



HARFORD COUNTY

PUBLIC WORKS
DIVISION
OF
WATER AND SEWER

STANDARD SPECIFICATIONS AND DETAILS

GENERAL RULES
AND
REGULATIONS
PART 14

January 1, 2026

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PART 14-1 GENERAL REQUIREMENTS

DIVISION 1 GENERAL REQUIREMENTS

SECTION 01000 GENERAL PROVISIONS

1.0 DEFINITIONS

Whenever the words defined in this section, or pronouns used in their stead occur in the contract, they shall have the meanings here given:

- A. Whenever the words APPROVED, ACCEPTABLE, or words of like import are used in the drawings or specifications, it shall be understood that "Approved by or Acceptable to" the Director is intended, unless otherwise stated.
- B. BID - The offer of the bidder submitted on the prescribed bid form to perform the prescribed work and to furnish the prescribed labor and materials in accordance with a set of Contract Specifications and/or Documents, for the consideration of payment at the unit and/or lump sum price stated and submitted on the prescribed forms.
- C. BID ITEM - An item of work specifically described and for which a price, either unit or lump sum, is provided. It includes the performance of all work and furnishing of all labor, equipment and materials, described herein or described in any supplemental specifications or Special Provisions.
- D. BID SECURITY - The security designated in the Bid, to be furnished by the bidder as a guarantee of good faith to enter into a Contract with the OWNER, if the work of constructing the improvement is awarded. The Bid Security may be a bid bond or certified check.
- E. BIDDER - Any individual, firm or corporation submitting a bid for the prescribed work contemplated, acting directly or through a duly authorized representative.
- F. CHANGE ORDER - A written order to the Contractor, signed by the Director of Procurement on behalf of the Owner, ordering a change in the work from that originally shown by the plans and specifications that has been found necessary. If the work is of a nature involving an adjustment of unit price, a Supplemental Agreement shall be executed. Change Orders duly signed and executed by the Contractor and County constitute authorized modifications of the Contract.
- G. CLOSED WATER FIRE SPRINKLER SYSTEM - A water service has a fire control system that utilizes sprinkler heads without the use of any type of pumping apparatus. In addition, this system has no fire hydrants or fire hose connection points.
- H. CONDITIONAL ACCEPTANCE – the date the operational certificate is executed and the one-year maintenance period begins.
- I. CONSTRUCTION EASEMENT - The area secured for temporary use and or modification for the purpose of facilitating work to be accomplished during construction.

- J. **CONTRACT** - The written agreement executed between the Owner and the successful bidder, covering the performance of the work and the furnishing of labor and materials, by which the Contractor is bound to perform the work and furnish the labor and materials, and by which the Owner is obligated to compensate them therefore at the mutually established and accepted rate or price.
- K. **CONTRACT BOND** - The approved form of security executed by the Contractor and their Surety or Sureties, guaranteeing complete execution of the Contract and all supplemental agreements and changes pertaining thereto. Harford County Government will accept insurance company Performance, Payment and/or Maintenance Bonds only from companies holding certificates of authority as acceptable sureties as published annually in the Federal Register, Department of the Treasurer, Fiscal Service, Department Circular 570.

EXCEPTION

Performance Bonds can be accepted from Harford Mutual Insurance Company up to a total aggregate amount of \$500,000. Maintenance Bonds can be accepted from Harford Mutual Insurance Company with no amount limit.

- L. **CONTRACT DOCUMENTS** shall include the invitation for bids, instructions to bidders, bid contract and contract bond, these specifications, supplemental specifications, all general or special provisions, general and detailed plans, and notice to proceed; also, any written change orders, written mutual understandings and agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof.
- M. **CONTRACT DRAWINGS** show the location, dimensions and sizes of the materials on the lines and slopes, at the depths with the connections and the manner in which they are to be placed as called for by the Specifications outlining the work and the materials to be provided for and placed under the contract, or in accordance with such changes as may be approved from time to time during the progress of work, as hereinafter provided.
- N. **CONTRACT ITEM** - The obligation of the Contractor, including the performance of all work and furnishing of all labor and the materials described in the respective articles or sections of the Specifications and Contract or in the Special Provision which are made a part thereof.
- O. **CONTRACT TIME** - The number of working days or calendar days shown in the bid, indicating the time allowed for the completion of the work contemplated in the contract and any modification thereto.
- P. **CONTRACTOR** shall mean the party of the second part, or the agent appointed to act for the said party, entering into the contract for the performance of the work required by it.
- Q. **COUNTY** - See OWNER
- R. **DIRECTOR** shall mean the Director of the Harford County Department of Public Works, acting for the Department or its duly authorized agents, said agent acting severally within the scope of the Particular duties entrusted to him/her.

- S. ENGINEER shall mean the Registered Professional Engineer or a duly authorized agent thereof, contracted by Harford County to provide any engineering services that the County may require or authorize.
- T. ESTABLISHED GRADE - The profile grade as anticipated and approved for future construction in order to meet geometric criteria approved by established standards of construction.
- U. FINAL ACCEPTANCE – the date certified by the Director when the work is totally complete in accordance with the Contract Documents and the Contractor has fulfilled all obligations thereunder, including, but not limited to all punch list work related to the one-year maintenance period and fulfillment of the warranty.
- V. FIXED-PRICE ITEMS - These unit prices are established and prescribed by the County to compensate for the cost of work and materials that may be necessary for the proper completion of the contract, and the quantities of which are not amendable to reliable quantitative estimation prior to the construction. The fixed-price items are shown on the bid sheets with estimated quantities, fixed price, and the estimated total cost imprinted prior to the issuance of the contract documents to bidders.
- W. NOTICE TO PROCEED - A written notice to the Contractor of the date on which the contract period begins.
- X. OPEN WATER FIRE SPRINKLER SYSTEM - A water service that has a fire control system that utilizes hoses, hose connection points, or any type of pumping apparatus.
- Y. OPERATIONAL CERTIFICATE: A form signed by the Developer and all responsible agents of the Director which states all of the work is complete in accordance with the contract documents and that all punch list work has been completed which may have been identified in the operational walkthrough. The operational certificate will not be fully executed until all punch list work has been completed, the one-year maintenance bond has been submitted and approved, (Capital Projects) a release of liens document has been submitted (Capital Projects) and all necessary as-built drawings have been submitted and approved.
- Z. OWNER shall mean the Harford County Department of Public Works, Bel Air, Maryland. Also referred to as County or Department.
- AA. PERPETUAL EASEMENT - The area secured and reserved by the Owner for right-of-use in constructing and maintaining proposed work and appurtenances thereto.
- BB. SPECIAL PROVISIONS - Special clauses supplemental to these specifications, setting forth requirements peculiar to the specific work included in the contract documents and right-of-way agreements.
- CC. SPECIFICATIONS - The direction, provisions and requirements contained in these Standard Specifications, together with all written agreements made and/or to be made, pertaining to the method and manner of performing the work, or to the quantities and qualities of the materials to be furnished under the contract.

- DD. SUB-CONTRACTOR - Any individual firm or corporation undertaking the engineering or construction of a part of the work under the terms of the contract, by virtue of an agreement with the contractor, who, prior to such undertaking, received the consent of the Surety and the approval of the Owner.
- EE. SURETY - The corporate body approved by the Owner which is bound with and for the Contractor who is primarily liable and which engages to be responsible for their payment of all debts pertaining to and for their acceptable performance of the work for which they have contracted.

2.0 PROPOSAL REQUIREMENTS AND CONDITIONS

A. Preparation of Bid

In completing bid forms bidders shall be governed by the following provisions:

1. Bids must be made on the blank forms provided by the Owner. The blank spaces in the bid form, except as otherwise noted, must be filled in, and no change shall be made in the phraseology of, or in the items mentioned in the bid form. Any such change shall be cause for rejection of the bid.
2. Bids must be signed in ink by the bidder with the signature in full. When an unincorporated business is a bidder, the agent who signs the business name to the bid shall state, in addition, the names and addresses of the individuals composing the firm. When a corporation is a bidder, the person signing shall state under the laws of what State the corporation is chartered and the names and titles of the officers having authority under the bylaws to sign contracts. The bid shall also bear the seal of the corporation, attested by its secretary. Anyone signing the bid as agent must file with it legal evidence of their authority to do so. Post Office address, county and state, and telephone number must be given after the signature of the person signing the bid.
3. Each bid shall specify a unit price or lump sum price, written with ink in both words and figures, for each of the separate items as called for. In case of discrepancy between the written words and figures, the sum denoted by written words shall be accepted.

The bid may contain certain fixed price items which have been included merely for purpose of obtaining a contract price in the case that these items may be needed.

B. Pre-Bid Conference

Bidders are not required, but are strongly encouraged to attend the Pre-Bid Conference but are invited to do so voluntarily.

C. Interpretation of Approximate Estimate

Bidders are cautioned that the estimate of quantities contained in the bid will serve, as far as the Contract is concerned, only for the purpose of comparing bids. The basis of payment will be actual quantities of material supplied and of work performed and accepted, and if, upon the completion of the project the

actual quantities should show either increase or decrease from the quantities shown in the approximate estimate, the unit prices bid in the Bid will still prevail.

D. Bid Security

No bid will be considered unless accompanied by a "Bid Security" of the character and amount indicated in the Bid Form, made payable to the Owner.

E. Public Opening of Bids

Bids will be opened publicly and read at the hour and on the date set in the "Advertisement for Bids" or Notice to Contractors," in the office of the Owner. Bidders or their authorized agents are invited to be present.

F. Examination of Plans, Specifications and Site

It shall be the bidders responsibility to make a personal examination of the location of the proposed work and of the surroundings thereof, and their responsibility to thoroughly acquaint themselves with the details of the work to be done and all the conditions and obstacles likely to be encountered in the performance and completion of the work. It shall be the bidders further responsibility to inform themselves as to the facilities for the transportation, handling and storage of equipment and materials, and their responsibility to carefully study the plans, specifications and other contract documents and thoroughly satisfy themselves as to the conditions under which the work is to be done and as to the character, qualities and quantities of work to be performed and materials to be furnished, and be prepared to execute a finished job in every particular without any extra charge whatever, except as may be specifically provided for elsewhere in these contract documents. Test borings, rock profiles, rock classification, pipe or other underground objects where shown on the Contract drawings are approximation only and are not representations of the conditions that are actually present in the construction sites. Should the Contractor encounter quicksand, springs or any other materials or conditions not shown in the Contract Documents it shall be understood that the Owner has not warranted that such condition is or is not present. Therefore, claims arising from increase or decrease quantities, or otherwise, shall be disposed of in accordance with the requirements of the Specifications governing the particular question at issue.

G. Disqualification of Bidders

In addition to the causes stated in the County's Procurement Law, the following causes will be considered sufficient to disqualify any bidder:

1. Interest by the same person in more than one bid.
2. Collusion among or between bidders.
3. Unbalanced bids: That is, bids in which the prices bid for some items are out of all proportions to those bid for others. Whether or not such bid is the lowest submitted.
4. Lack of responsibility on the part of bidders.

H. Rejection of Irregular Bids

Any Bid that has any omission, addition or item not called for in the Bid Form or that has irregularities of any kind, may be rejected. Any bid that does not contain prices set opposite each of the several items for which there is a quantity indicated or required in the Bid Form, or any bid which shall in any manner fail to conform to the conditions of the published notice inviting bids may be rejected.

3.0 AWARD AND EXECUTION OF CONTRACT

A. Consideration of Bids

Following the public opening of the Bids, they will be audited and studied for compliance with the Specifications. In the event of a discrepancy between the unit bid prices and the extensions (product of quantity and unit price), the unit price will govern.

B. Award of Contract

1. Contracts shall be awarded in accordance with the County Code in effect at the time of the award. The County reserves the right to waive or excuse any irregularities in awarding of contracts by taking curative action.
2. The Owner will hold bid securities submitted with the bids of the three (3) lowest responsible bidders until the execution and delivery of the contract documents, whereupon they shall be returned. All other bid securities will be returned following the opening and evaluation of bids.

C. Contract Bond

The successful bidder will be required to be bonded to the Owner for a sum equal to 100% of the amount of their bid according to the form of bond attached to the Bid Form. All Contract Bonds submitted will be deemed to include all of the Conditions and Covenants stated in the Bond Forms provided by the County.

D. Execution of Contract

The contract shall be signed by the Contractor and satisfactory contract Bonds furnished within ten (10) days after they have received notice of award. In case of failure on the part of the Contractor to enter into a contract and furnish the Contract Bonds as required, the guarantee accompanying their Bid will be forfeited to the Owner. Award may then be made to the next lowest responsible bidder, or the work readvertised, or the Owner may proceed in any lawful manner it deems advisable to secure the accomplishment of the work.

E. Service of Notice

The mailing, in a United States post office box, of a written communication, notice or order, addressed to the Contractor at the business address filed with the Owner, or to this office at the site of the work, shall be considered as sufficient service upon the Contract of such communication, notice or order, and the date of service shall be the date of such mailing.

4.0 SCOPE OF WORK

A. Intent of Work to be Done

Any stated intent as to work or improvement is to prescribe that complete work or improvement which the contractor undertakes to do in full compliance with the Contract Documents, together with any authorized alteration, special provisions and supplemental agreements. The Contractor shall perform all items of work covered and stipulated in the Contract Documents, together with any authorized alterations, special provisions, extra work and supplemental agreements, all in accordance with the lines, grades, cross sections and dimensions shown on the plans in accordance with these Specifications.

B. Schedule of Work to be Done

Within fifteen (15) days after the award of the Contract, or as specified in the contract documents, the Contractor shall submit to the Director for approval a complete progress schedule for the work to be done in the form required by the Contract Documents. As a minimum, the schedule shall show the Notice to Proceed, the number of locations where work is proposed to be done concurrently, the kind of work so scheduled, and the dates the different kinds of work are scheduled to begin and to be completed. Allowance in the schedule shall be made for normal interruptions to operations due to repairs and maintenance of equipment and delays which are likely to be encountered due to weather conditions, material deliveries, and other similar interruptions that would affect the schedule. The schedule shall demonstrate that the Contractor will complete the work within the time specified, and the Contractor shall, if required, give evidence of their ability to carry out the work in accordance with the schedule.

The schedule shall be used to monitor the Contractor's progress and shall be updated by the Contractor monthly as required by the Engineer.

C. Material to be Furnished by the Contractor

1. The Contractor shall do all the work and provide all labor tools, tackle, apparatus, machinery, equipment, transportation, pumping, insurance (both compensation and public liability) and materials, except as otherwise provided for, necessary to complete the work in all its parts, as shown or called for in, or as may be reasonably implied from, the Plans and Specifications. The Contractor shall complete the entire work, together with such extra work as may be required, at the prices fixed therefore, to the satisfaction of the Owner and in accordance with the contract documents.
2. Contractor shall submit for approval, shop drawings and/or materials specifications/certifications of all materials used in the project to the Owner, except for materials included in the current Approved List of Supplies and Materials for Water and Sewer Construction.
3. Within fifteen (15) days after the contract is awarded, the Bidder shall be required to furnish on forms provided by the Department of Public Works a complete statement of the origin, composition and manufacture of any or all materials to be used in the work, together with samples, as designated by

the Owner, which samples may be subjected to the tests provided for in these specifications to determine their qualities and fitness for the work. All materials must be approved by the Director in writing before their delivery to the job site.

4. The Owner reserves the right to inspect pipe, joining material and all other material to be incorporated in the project at place of manufacture. Notice shall be given to the Director in sufficient time to allow for inspection of such materials at the place of manufacture.
5. If the Contractor makes claims regarding unavailability of material which would delay the progress of work, then the Contractor shall furnish satisfactory evidence to the Owner that all efforts have been made by him/her to procure the material on time.
6. Where any article is specified by proprietary name, trade name, and/or name of manufacturer, with or without the addition of such expressions as "or equal" or "or approved equal", it is to be understood that the article named and the quality thereof is intended to represent the minimum acceptable standard, which is subject to the approval of the Director; and it is distinctly understood; (1) that the Director is to use his/her own judgment in determining from time to time, whether or not any article or thing proposed to be substituted is the equal of any article or thing so specified; (2) that the decision of the Director on all questions of equality shall be final; (3) that, in the event of any adverse decision of the Director no claim of any sort shall be made or allowed against the County.

D. Contract Drawings

1. The contract drawings show the location, dimensions and sizes of the materials, on the lines and slopes, at the depths, with the connections and the manner in which they are to be placed as called for by the Specifications outlining the work and the materials to be provided for and placed under the contract, or in accordance with such changes as may be approved from time to time during the progress of the work, as hereinafter provided.
2. The ground profiles shown on the drawings represent the grade elevations along the centerline of the structure or utility. Should the actual elevations of the profile over the structure differ from those shown in the drawings the Contractor shall be entitled to no additional compensation over the unit price bid for the actual depth classification encountered in the linear foot of pipe trenches, or the actual number of cubic yards excavated unless such difference exceeds two (2) feet. No additional payment, unless negotiated, will be made on lump sum bids where the actual elevations of the ground or surface over the structure differ from those shown on the profiles.

E. Existing Utilities Shown on Drawings

1. Water mains, storm drains, sanitary sewers, gas mains, and other utilities are shown on the drawings in accordance with the best information available for the information of the Contractor. The Owner assumes no responsibility for accuracy or completeness of information shown. It is the responsibility of the Contractor to verify the actual location of existing utilities prior to beginning

work, and to maintain any utility location markings at no additional cost to the County.

2. Existing mains, services and their connections shall be carefully protected and any damage to them caused by the work, shall be immediately repaired using materials of the kinds damaged to the satisfaction of the Director by the Contractor at their expense.

F. Removal and Disposal of Structures and Obstructions

1. All structures, materials, or resources within the right-of-way or construction area, which are not to remain in place or have not been designated for use in the construction, shall remain the property of the Owner, and shall be salvaged and stored or otherwise disposed of by the Contractor as hereinafter specified, indicated on the plans, or approved by the Director.
2. Materials resulting from work performed by the Contractor within the limits of construction and designated by the Director as unwanted will become the property of the Contractor and will be disposed of at the Contractor's expense off the job site.

G. Making Connections to Existing Structures

The Contractor shall, at their own expense and as part of their work under the contract, furnish all labor, materials, tools and appliances, and do all work required for making connections to existing water or sewer structures, and the cost of making such connections shall be included in the prices bid for excavation and refill and refurnishing and laying pipe, unless otherwise specified in the Bid or Special Provisions. Connections to existing structures shall be made only after all new lines are satisfactorily tested and approved by the Director. Actual dates and times of connection shall be approved by the Director.

H. Construction in Easements and Right-of-Ways

Perpetual easements or rights-of-way will be secured by the County without cost to the Contractor. The County will also obtain permission from the owners of property to be occupied during construction, temporary construction easements outside the limits of these perpetual easements or rights-of-way until authorized to do so by the Director. The Contractor shall confine their operations strictly within the limits of the perpetual easements and rights-of-way and construction easements, unless they have written permission of the owner of the adjacent property to occupy additional ground. A copy of the written permission shall be furnished to the Director prior to the start of work. The Contractor must complete all the work required by the Forest Conservation Plan developed for the project. All trees located within the Maryland State Highway Administration Right-of-Way must be protected and saved from harm in accordance with the regulations of the Maryland State Department of Forestry (See Section 1000(6.0).J).

The Contractor shall so conduct their work in the easements and rights-of-way that there will be a minimum of disturbance of the properties crossed. Fences shall be disturbed as little as possible and if damaged or removed shall be replaced or restored at least equal to their original condition at the expense of the Contractor.

Upon completion of the work, the Contractor shall, at their own expense, clean up within the easements and rights-of-way and shall restore them at least to their original condition as part of the original Bid Contract Price. Any damage to property outside the limits of the easements or rights-of-way shall be repaired or replaced by the Contractor at their own expense.

No arrangements will be made for any means of access to the perpetual easements, rights-of-way or construction easements by the County; the Contractor shall therefore be required to make their own arrangements for access to the work within these points. Contractors are cautioned that only those areas designated on the Plans have been obtained for their Construction operations by the County. If they feel that these areas are insufficient for their needs they must account for the cost of additional easements or rights-of-way and/or special construction methods in their bidding of the work. Notification to the Director is required in writing of any additional easement acquired by the Contractor.

I. Owner May Increase or Decrease Quantities

1. The Owner reserves the right to increase or decrease the quantity of material to be furnished or work to be done under a unit price contract by not more than ten (10) percent of the original bid quantity of any item, except where items of indeterminate quantity are involved such as Fixed Price Items in which a 25% increase, decrease or complete elimination of the original bid quantities shall be allowed. Such increase or decrease shall be allowed wherever the Director deems it advisable or necessary and such increase or decrease shall in no way violate the contract.
2. The Contractor will be paid for the actual quantity of authorized work done or material furnished under each item of the Bid, at the unit price stipulated for such item. In case the quantity of any item is increased as above provided, the Contractor shall not be entitled to compensation over and above the unit price bid for such item; and in case the quantity of any item is decreased as above provided, the Contractor shall have no claim for damages on account of loss of anticipated profits because of such decrease.

J. Additional Work

In instances where additional quantities of items noted in the Bid Form are required, the Contractor shall provide the necessary additional work, to fully complete the project regardless of the estimated quantities on the Bid Forms, and shall receive payment in full for such work at the prices shown in the Bid or supplemental agreement for similar classes of work in the same manner as if the quantities had been included in the original estimate of quantities.

K. Extra Work

1. The Contractor shall do such extra work as may be ordered by the Director, in writing. No claim for extra work shall be considered or allowed unless the work has been ordered in writing by the Director. The Director and Contractor shall make every effort to come to a mutually agreed upon unit or lump sum price for the extra work. If a mutual agreement cannot be reached,

the Director may require the Contractor to do such work on a force account basis to be compensated in accordance with the following:

Separate itemized statements and itemized bills, covering the extra work, shall be delivered to the Director before the fifteenth (15th) day of the following month. To all such bills shall be attached vouchers showing the cost of materials supplied by the Contractor that have actually been incorporated into such extra work. The Contractor shall permit such examination of their books, vouchers and accounts as the Director may require in checking bills for extra work. The amount to be paid the Contractor for extra work shall be made up of the following items:

- a. Wages of necessary day laborers and foreman actually employed on extra work, for such time as they are so employed plus forty-five (45) percent. This 45% shall include and cover all overhead, insurance, Worker's Compensation, etc. Superintendent's time will not be allowed.
- b. Actual purchase price, as paid by the Contractor, for materials actually incorporated into the extra work, to which costs shall be added an amount of equal to fifteen (15) percent plus the prevailing Maryland State Sales Tax.
- c. Rental for vehicles, or heavy equipment or machinery while actually and actively used on the extra work. Rental rates shall be 100% of the current rates recommended by the Rental Rate Blue Book for Construction Equipment based on the following schedule:

If time of use is 3 days or less, figure hourly rates from the schedule of rates per day.

If time of use is more than 3 days and less than 3 weeks figure the hourly rate from the schedule of rates per week. If time of use is 3 weeks or more, figure the hourly rate from the schedule of rates per month.

To compute hourly rate use 8 hours per day, 40 hours per week, 176 hours per month.

- d. Cost of work performed by an authorized subcontractor on extra work plus ten (10) percent.
2. Payment for extra work shall not include any allowance for the time of superintendents, timekeepers, or any workers or foremen not employed upon the extra work in question for a definitely and easily ascertainable period, nor for insurance of employees or for damage to the public, nor the use, maintenance or repair of tools, nor for the administrative expenses, nor for any rent, transportation, interest, depreciation or bonding cost or any other overhead, collateral or estimated expense, nor for any profit, all of which costs shall be deemed to be, and shall be, included in the allowance of forty-five (45) percent, and fifteen (15) percent, on labor and material items respectively.
 3. All extra work shall be done as economically and expeditiously as possible, and under sufficient but not disproportionate supervision. Labor shall be

furnished at the current rates and materials shall be charged at the lowest market prices. The Owner may, at its option, furnish any materials required for extra work and the Contractor shall not be entitled to any allowance or percentage on materials so furnished; and likewise the Owner may supply any necessary machinery or equipment, and the Contractor shall not be entitled to any allowance thereupon.

4. The decision of the Director shall be final and binding upon all questions relating to extra work. If he/she deems that any extra work bill is unreasonable or improperly made up in any particular, he/she shall be empowered to require its revision and adjustment in accordance with such terms as he/she judges to be fair and reasonable.
5. The Director will certify for payment, proper bills made out as above provided and submitted before the prescribed date, upon each written order for extra work. Payment, as approved, for the work done under each extra work order completed under the contract during that month, and shall be subject to all the provisions of the contract relating to the payment of current estimates. Should the work under any extra work order remain uncompleted during any month, payment thereupon shall not be made until the current estimate is paid for the month during which the work under said extra work order is completed. The Contractor shall not be entitled to any claim for interest on any bill for extra work on account of delay in its approval.
6. All extra work shall be considered a part of the Contractor's responsibility to perform any required extra work, or to make satisfactory progress in its execution, the Contractor shall not interfere with the prosecution of such work by the Owners.
7. During the progress of extra work the Contractor shall continue with any or all parts of the work under the contract, or shall suspend any part of the work that may be necessary or required; and no claim by the contractor for extra compensation shall thereby be allowed. The Contractor, however, shall be entitled to an extension of time, to the extent that the Director shall certify that the work under the contract has been delayed by the performance of said extra work, provided that a request for such extension shall be submitted within the time prescribed for requests of this nature.

L. Omitted Items

In accordance with Section 01000(4.0).I, should any items contained in the bid be found unnecessary for the proper completion of the work contracted, the Director may, upon written order to the Contractor, eliminate such items from the contract and such action shall in no way invalidate the contract, and no allowance in payment to the contractor will be made for items so eliminated in making final payment to the Contractor except for such actual work as may have been done, materials actually purchased, and actual equipment costs prior to notification of the elimination of these items. However, material purchased but not used shall become the property of Harford County, if payment is made under this subsection for such material.

M. Unauthorized Work

1. Work done without lines and grades being given, work done without field stakeout and cut sheets, work done beyond the lines and grades shown on the plans or as given, except as herein provided, or any extra work done without written approval, will be considered as unauthorized and at the expense of the Contractor and will not be measured or paid for by the Owner. Work so done may be ordered removed and replaced at the Contractor's expense.
2. Borrow or any other materials shall not be obtained from areas adjacent to the work for incorporation therein without written approval by the Director, and in no event shall the removal of materials be such as to detract from the uniformity and neatness of the improvements.
3. All materials obtained contrary to the above restriction shall be considered unauthorized and shall not be measured or paid for, and further, upon order of the Director, in writing, all such materials shall be removed from within the limits of the work.
4. Where and when the Contractor requests and/or elects to perform work beyond the payment limits as specified, the Contractor will perform such work at their own expense.

N. Rights in and Use of Materials Found on the Work Site

Except as provided in the preceding section, the Contractor, with the approval of the Director, may use in the proposed construction, suitable stone, gravel, top soil or sand found in the excavation, in accordance with Section 02250 of these Standard Specifications. The contractor shall replace, at their own expense, with other suitable material all of that portion of the material removed and used as was contemplated for use in the embankment, backfills, approaches or otherwise. No charge for material used will be made against the Contractor except the replacement herein provided for, which item when deductible shall be made from the respective item of excavation used for its replacement. The Contractor shall not excavate or remove any material from within the limits of work which is not within the excavation, as indicated by the slope and grade lines, without written authorization from the Director.

O. Pipe Lines to be Kept Clean

During the progress of the work and until the completion and final acceptance thereof, pipe lines and their appurtenances shall be kept thoroughly clean throughout. Obstructions or deposits, at any time discovered, shall be removed at once by the Contractor without extra compensation. After the completion of the work, the pipe lines and their appurtenances shall be left clean, free and in good order.

P. Cleaning Up

1. The Contractor shall, at their own expense, keep the site of their operations clean during the construction and remove all rubbish as it accumulates.
2. On or before the completion of the work, the Contractor shall, without charge therefore, tear down and remove all temporary structures built by them, shall

remove rubbish of any kind from any grounds which they have occupied, and shall restore site of the work, curbs, drains, gutters, sidewalks, roadways and other surfaces to a clean and neat condition.

Q. Water Supply

The Contractor shall provide, at their cost and expense, such quantities of clean water as may be required for any and all purposes under the Contract. The Contractor shall take particular care to furnish their employees with potable drinking water. All sources of water supply shall be subject to the approval of the Director, and shall be indicated to the Director by the Contractor five (5) days before beginning work, so that examinations of said supplies can be made.

R. Sanitary Arrangements

Approved sanitary conveniences for the use of laborers and others employed on the work, properly secluded from public observation, shall be constructed and maintained by the Contractor, at their own cost and expense, in such manner and at such points as shall be approved or directed and their use shall be strictly enforced. The collections in the same shall be disinfected and removed when and as directed.

S. Care and Protection of Work

From the commencement of the work until its completion and acceptance by the Owner, the Contractor shall be solely responsible for the care of the work, and all injury or damage to the same, from whatever cause, shall be repaired or replaced at the Contractor's expense, before the final estimate is made. The County reserves the right to direct the Contractor to repair or replace. The Contractor shall provide suitable means of protection for all materials intended to be used in the work in progress, as well as for completed work.

T. Rock Shown on Drawings

1. Where rock is shown on the plans or in boring logs it has been so shown from the best information available and it is shown for the information of all parties concerned; however, the Owner assumes no responsibility for the accuracy of such information and should any Bidder or Contractor rely on such information in preparing their bid or in the performance of the work, they do so at their own risk.
2. Whether or not rock is shown on the plans, the Contractor is not relieved of the responsibility of making their own investigations to determine if rock is present. Where the bid is at unit prices, the presence or absence of rock or the increase or decrease in quantities of rock shall not entitle the Contractor to additional compensation beyond the unit prices stipulated or bid for rock excavation.

5.0 CONTROL OF WORK AND MATERIALS

A. Supervision and Direction of Work

1. The contractor shall supervise and direct the work efficiently using their best skill and attention. They shall be solely responsible for the techniques and sequences of construction. The work shall be prosecuted by the Contractor in such a manner, and with sufficient materials, equipment and labor, as is considered necessary to insure completion on or before the time specified.
2. The contractor shall keep a competent supervisory staff that is fluent in the English language, on the work site at all times during its progress that is acceptable to the Director. The superintendent shall not be changed except with the consent of the Director, unless the superintendent proves to be unsatisfactory to the Contractor and ceases to be their employee.
3. The Director shall not be responsible for the acts or omissions of the Contractor, or any subcontractor, or any of his/her or their superintendents, or employees.
4. The Contractor shall maintain a local telephone at which a competent representative can be reached at all times, 7 days a week, 24 hours a day. This authorized representative shall have the capability of responding with positive corrective action to emergency calls from local officials (Sheriff's Dept., State Police and Department of Public Works personnel) within 2 hours of the calls.

B. Notices to Superintendents

All notices and instructions to the superintendent shall be given by the Director. Important instructions and notices shall be confirmed in writing to the Contractor.

C. Construction State-Out

1. Stake-out is defined as the installation of oak stakes in the ground with sledgehammer, identifying station, offset, cut, manhole number, valves, fittings, structures, roadways and other appurtenances. Stakes shall be at locations which will not be disturbed from construction activities. All reference shall match those shown on the construction drawings. All markings on stakes shall be with indelible marker.
2. Survey benchmarks are provided on the construction drawings with the corresponding coordinates and elevations. The construction drawings also provide location information of the proposed utilities. The Contractor shall utilize the benchmark information in conjunction with the proposed utility location information to perform a field stake-out to accurately construct the proposed facilities to the necessary lines, grades and elevations shown of the construction drawings. All field stake-out and re-stake-out must be performed by a Land Surveyor, registered in the State of Maryland. Any disturbed stakes shall be re-surveyed and located.
3. The party which performed the construction stakeout shall submit cut sheets to the County Inspector. The Contractor may not begin construction until the Inspector is in possession of the cut sheets. Cut sheets shall be signed and sealed by the registered Land Surveyor. Cut sheets shall indicate station number (with same reference as that shown on the construction drawings) of

manholes, valves, fittings, structures or other appurtenances. At a minimum, the following information shall be shown on the cut sheet:

- a. Surveyors Name, Address, Phone Number
 - b. Project Name and Contract Number
 - c. Location with the Project that cut sheets pertains to (s.a.: type & size of utility and sheet number)
 - d. Pipe materials and stations ID, if material is measured
 - e. Size/type of proposed utility
 - f. Off-set hub distance from centerline
 - g. Station
 - h. Hub elevation of perpendicular offset
 - i. Grade elevation (invert) of proposed utility
 - j. Hub Cut (vertical) distance from off-set hub to pipe invert
 - k. Remarks column for indicating special conditions or other noted
4. On straight pipeline alignments, stake-out and cutsheets shall be provided at intervals not to exceed 50-feet. On curved pipeline alignments, the stake-out interval shall not exceed 25-feet. The cutsheets and stake-out shall also be provided for every manhole, valve, cleanout, water meter, curb stop, horizontal and vertical bend, continuity test stations, concrete encasement, sleeves and tunnels and other features, if requested by the County.
 5. The Contractor shall preserve and maintain in proper position all stakes, grade-boards, and lines until authorized to remove them. In case any are disturbed, they shall be immediately re-set in accordance with the requirements in paragraph 1. above. Any portions of the proposed utility which are connected without the stakeout described above or with damaged or missing stakeout will not be approved and accepted.

D. Inspection

1. The Director will appoint such persons as they may deem necessary to inspect the materials furnished or to be furnished, and the work done under the Contract and to see that the same is proceeding in accordance with the Contract Documents. Materials and workmanship shall be always subject to the approval of the Director, but no inspection, approval or acceptance of any part of the work contracted for, or of the materials used or any payment on account thereof, shall prevent the rejection of said work or materials at any time thereafter during the existence of the contract, should said work or materials be subsequently found to be defective, or not in accordance with the requirements of the contract.

2. Work and material will be inspected promptly, but, if for any reason, delay should occur, the Contractor shall have thereby no claim for damages or extra compensation.
3. The Contractor shall furnish the Director with every reasonable facility for ascertaining whether or not the work performed and materials used are in accordance with the requirements and intent of the Specifications and Contract. If the Director requests it, the Contractor shall, at any time before acceptance of the work, remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the Specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed shall be paid for as extra work, but should the work so exposed or examined prove unacceptable, the uncovering or removing, the replacing of the covering or making good of the parts removed, shall be at the Contractor's expense. No rework under this provision shall be done nor materials used without inspection by the Owner.
4. The Contractor shall pay for all inspection costs necessary to complete the work that are incurred by any other agency than the Owner or its duly authorized representatives, such as any railroad, or any public service utility company, or any governmental agency or any other agency whose jurisdiction affects the work in any manner unless otherwise specified herein, or in the Contract.
5. For privately funded projects or developer projects, the Developer shall pay the cost of all inspection costs necessary to complete the work.
6. For County capital projects, the Contractor shall notify the Director in writing of their intended working hours and will obtain approval of the Director before revising these hours. The inspector will be paid for all work hours other than during normal County working hours. The billing rate will be noted in the contract documents or at a rate of one and a half (1 1/2) times the current inspection fee, and this payment will be subtracted from the monthly payment due the Contractor. The following times are to be considered hours other than normal working hours.
 - a. Contractor work performed on Saturday and Sunday; and
 - b. County Holidays; and
 - c. Special No-work Days as designated by the County; and
 - d. Hours of a Contractor's work day in which the work is excess of eight (8) hrs.

E. Authority and Duties of Inspectors

1. Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. The Inspector is not authorized to revoke, alter or waiver any requirements of the

Contract, nor are they authorized to approve or accept any portion of the complete project. They are authorized to call the attention of the Contractor to any failure of the work or materials to conform to the Specifications and Contract. The Inspector shall have the authority to reject materials or suspend the work until any questions at issue can be referred to and decided by the Director. Inspectors shall perform their duties at such times and in such manner as will not unnecessarily impede progress under the contract.

2. The Inspector shall in no case act as foreman or perform other duties for the Contractor, nor interfere with the management of the work by the Contractor. Any advice which the Inspector may give the Contractor shall not be construed as binding the Director in any way, or releasing the Contractor from fulfilling all of the terms of the Contract, or complying with these regulations or other applicable laws.
3. Where there is disagreement between the Contractor (or their representative) and the Inspector, such as, refusal by the Contractor to use properly approved materials; for performing work not in compliance with Plans and Specifications; and/or refusing to suspend work until problems at issue can be referred to and decided by the Director, the Inspector will immediately notify the Director as to the issue of disagreement and if the Contractor still refuses to make corrections, comply or suspend work, the Director will prepare and deliver in writing to the Contractor, by mail or otherwise, a written order suspending the work and explaining the reason for such shutdown. As soon as the Inspector is advised of the delivery of the shutdown order, the Inspector shall immediately leave the site of the work and any work performed during the Inspector's absence will not be accepted or paid for.

F. Office Space for Inspector

1. When required by the Director, the Contractor shall provide a suitable field office in an approved location in the immediate vicinity of the site for the exclusive use of the Resident Inspector. The office shall be a trailer or suitable building set up, equipped and made ready for use (including all utilities) prior to the beginning of work on the project and shall remain operative until all field records pertinent to the project have been completed. It shall be separated from any buildings used by the Contractor. The Contractor shall, within the price bid and without extra cost to the Owner, pay all costs of providing, operating and maintaining the field office including but not limited to charges for electrical and local telephone service (excluding long distance telephone calls), sanitary facilities, heating, fuel oil, etc.
2. The office shall be weather-tight, secured, heated or air conditioned as the season requires, adequately lighted by 110 volt 60 cycle electric lights, and as a minimum, have the following furnishings: desk, chair, plan rack, telephone, and file cabinet with an approved lock.

G. Defective Work and Defective Materials

1. No inspection and no failure to inspect, nor the presence of any employees of the Owner during the execution of the work, and no approval or acceptance of any part of the work herein contracted for or of the materials and equipment used therein shall relieve the Contractor of any of their obligations

to fulfill their Contract, or shall prevent the rejection of said work, materials and equipment, in whole or in part, at any time thereafter, should said work, materials and equipment be subsequently found by the Director to be defective or not in accordance with the requirements of the contract documents.

2. All materials not conforming to the requirements of the Contract Documents shall be considered as defective and all such materials, whether in place or not, shall be rejected and shall be removed immediately from the site of the work, unless otherwise permitted by the Director. No rejected material, the defects of which having been subsequently corrected, shall be used until approval has been given. Upon failure on the part of the Contractor to comply with any order of the Director made under the provisions of this article, the Director shall have authority to remove and replace defective materials and to deduct the cost of removal and replacement from any monies due the Contractor.
3. The Contractor shall furnish the Director with adequate documentation to show that the work performed and materials used are in accordance with the requirements and intent of the Contract Documents. At the request of the Director, the Contractor shall, at any time before acceptance of the work, remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the Contract Documents. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed shall be paid for as extra work, but should the work so exposed or examined prove unacceptable to the Director, the uncovering or removing, the replacing of the covering or making good of the parts removed, shall be at the Contractor's expense. No rework under this provision shall be done nor materials used without inspection by the Owner.

H. Failure to Remove and Renew Defective Materials and Work

1. Should the Contractor fail or refuse to remove and renew any defective materials used, or work performed previously, or to make any necessary repairs in an acceptable manner and in accordance with the requirements of these Specifications within the time indicated in writing, the Director shall have authority to cause the unacceptable or defective materials or work to be removed and renewed or such repairs to be made or defects corrected at the Contractor's expense.
2. Failure or refusal on the part of the Contractor to make any or all necessary repairs promptly, fully and in an acceptable manner, shall be sufficient cause for the Owner to declare the contract forfeited, in which case the Owner may purchase materials, tools and equipment, and employ labor, or may contract with any other individual, firm or corporation to perform the work. Any and all cost or expense incurred by the Owner in making these removals, renewals or repairs, which the Contractor has failed or refused to make, shall be charged against the defaulting Contractor and the amount thereof deducted from any monies due or which may become due under the contract. Any work performed, as described in this paragraph, shall not relieve the Contractor of their responsibility for the work performed by them.

I. Suspension of Work

The Owner may suspend the whole or any part of the work under the Contract, if in its judgment such action is necessary or advisable. Any claim for damages from such action shall be subject to the terms of Section 01000(6.0).E of these Standard Specifications. No allowances, however, will be made for minor interruptions to the work, from whatever cause.

J. Interpretations by Director

1. The Director shall make all necessary interpretations as to the meaning and intent of the specifications and drawings, and shall give all advice and assistance as contemplated therein or thereby, or in every case in which a difficult or unforeseen condition arises during the prosecution of the work. Should there be any discrepancies in or between, or should any misunderstanding arise as to the import of anything contained in the drawings and specifications, the interpretation of the Director shall be final and binding. Any errors or omissions on the drawings or in the specifications may be corrected by the Director when such corrections are necessary for the proper fulfillment of their intent.
2. The Director shall in all cases determine the amount, quality and acceptability of the work to be paid for under the contract, and shall decide all questions in relation to said work. Their decision and estimate shall be final and conclusive, and in case any question shall arise between the parties touching the contract, such decision and estimate shall be a condition precedent to the right of the Contractor to receive payment under that part of the contract which is in dispute.
3. Interpretations will be rendered by the Director as promptly as possible but should delay occur for any reason, the Contractor shall have thereby no claim for damages or extra compensation.

K. Alterations of Plans or of Character of Work

1. The Director reserves the right to change the alignment, elevation, grade, form, length, dimensions or materials of the work under the contract, whenever any conditions or obstructions are met that render such changes desirable or necessary. All such alterations shall be paid for at a unit price bid for these items of work, except as follows:
 - a. In case such alterations make the work less expensive to the Contractor, a proper deduction shall be made from the contract prices and the Contractor shall have no claim on this account for damages or for anticipated profits on the work that may be dispensed with.
 - b. In case such alterations make the work more expensive, a proper addition shall be made to contract prices. Any such deduction or addition shall be subject to the approval of the Director.
2. Any changes and/or alteration to the approved contract documents shall be submitted and approved by the Director prior to beginning work on that item.

Minor alterations may be noted on the as-built drawings if approved by the Director.

L. Coordination of Plans, Specifications and Special Provisions

These specifications, the accompanying Plans, Special Provisions and all supplementary documents are essential parts of the Contract. They are intended as to be mutually supplementary and to describe and provide for a complete work. In case of discrepancy, figure dimensions shall govern over scale dimensions. Plans shall govern over Specifications. Special Provisions shall govern over both Specifications and Plans.

M. Cooperation of Contractor Required

The Contractor will be supplied by the Director with five copies of the Plans and of the Specifications, and the Contractor shall have available at the site of work at all times, during the prosecution of the work, one copy each of said plans and specifications. The Contractor shall give the work his/her constant attention to facilitate the progress thereof and shall cooperate with the Owner in every way possible. The Contractor shall at all times have a competent English-speaking representative on the work site, authorized to receive orders and act accordingly.

N. Other Contractors

1. The Contractor shall cooperate with and so conduct their operations as not to interfere with or injure the work of other contractors or staff employed by the Owner. The Contractor shall promptly make good, at their own expense, any injury or damage which may be done by them or their employees or agents on the work.
2. The Contractor shall suspend such part of the work herein specified, or shall carry on the same in such manner as may be ordered by the Director, when necessary to facilitate the work of such other contractors or staff.

O. Source of Supply and Quality of Materials

1. In conjunction with Section 01000(4.0).C of these Standard Specifications, the source of supply of each of the material shall be approved in writing by the Director before the delivery is started. Representative preliminary samples of the character and quantity prescribed shall be submitted by the Contractor or producer, said samples being taken under the observation of the Director, for examination, and tested in accordance with the methods referred to herein. Only materials conforming to the requirements of these specifications and approved by the Director shall be used in the work. No materials which, after approval, have in any way become unfit for use shall be used.
2. Unless a material has a satisfactory record of performance, the Director reserves the right to withhold approval of a new source of supply, even though it meets the specification requirements, until its qualities have been verified and proved in actual service.

3. Tests of all materials specified will be made in accordance with the latest official approved methods effective as of the date of Contract as described in the Special Provisions, on the Contract Drawings or in these Standard Specifications, for the specified material. When ASTM, AASHTO, ASA, AWWA, or Federal Specification standard specifications and serial numbers are stipulated, the reference shall be construed to be the latest effective specification. If material previously certified is subsequently declared substandard or unfit for the intended use by the certifying agency, the Director may declare the unused materials unsatisfactorily or unfit for use under the Contract.
4. The Contractor shall furnish every facility for the verification of all scales, measures and other devices which they operate.

P. Storage of Materials

1. Materials shall be stored so as to insure the preservation of their quality and fitness of the work.
2. The portion of the easement or right-of-way not required for public travel may be used for storage purposes and for the placing of the Contractor's plant and equipment, and any additional space required, unless otherwise stipulated, shall be provided by the Contractor at their expense.
3. Unless directed or noted otherwise in the Contract documents, there will be no payment for stored material.

Q. Conditional Acceptance (Capital Projects Only)

Whenever, in the course of performance of a Contract, the Contractor shall consider the work to have been properly completed and ready to be accepted by the County, the Contractor shall make a written application for conditional acceptance for the Contract, and payment based upon the Contractor's final estimate of the value of authorized work done under the terms of the Contract. The Contractor shall also certify to the County the completion of the work, the amount of their final estimate, and the total amount due to be paid the Contractor pursuant to the Contract. Prior monthly estimates are subject to correction in the Contractor's final estimate. Such application and final estimate shall be submitted to the Director for verification and approval prior to payment. Upon receipt of such application and the Contractor's final estimate, the County will make an inspection of the work. Upon completion of all repairs or replacements by the Contractor which may appear at that time in the judgment of the County to be necessary, the County will process the Contractor's final estimate for Conditional Estimate Payment.

If, at the conclusion of the conditional acceptance inspection requested by the Contractor as described above, additional tests, testing, and/or reinspection is required because of failures or defects due to improper or faulty construction, materials, and/or equipment furnished and/or installed by the Contractor, or for other reason(s) attributable to the Contractor's performance of work under the terms of this Contract, or because of lack of preparation for delivery of documentation required by this Contract as a condition to conditional acceptance, all costs of County personnel, equipment, utilities, and services

associated with the reinspection(s) and/or retest(s) will be deducted from amounts retained or to be paid to the Contractor.

The date of this conditional acceptance certification will be the beginning of a one year guarantee period (unless noted otherwise), during which the Contractor shall at their own cost and expense, make all repairs and replacements which, in the judgment of the County, may become necessary during the guarantee period on account of any failures or defects due to improper construction or materials furnished by the Contractor. During the guarantee period, the Contractor shall return phone calls or respond, within 2 hours. If not, Harford County will perform emergency work and back charge the Contractor for the work performed. For non-emergency work, the Contractor shall respond within 2 days and perform the repair within 7 days. Should the Contractor fail to make needed repairs and replacements within the time frame noted above, the County shall be empowered to make any repairs or replacements and the cost of the required repairs or replacements shall be the financial responsibility of the Contractor. To insure the County against the nonpayment of such costs, the County will either require the retainage of 10 percent of the total value of the Contract plus the value of work remaining at the time of Conditional Acceptance or require the Contractor to post an equivalent Maintenance Bond.

R. Final Acceptance

Upon expiration of the aforesaid guarantee period, the County will make a final inspection of the work under the Contract, and if at such inspection all construction provided for and contemplated by the Contract is found completed, such inspection shall constitute the final inspection and the County shall make the final acceptance as of that date and the Contractor shall be notified of such acceptance. After final acceptance, the County will assume responsibility for maintenance, repairs, and/or replacement except where otherwise provided by the Contract.

6.0 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

A. Laws to be Observed

The Contractor shall at all times observe and comply with all Federal, State and/or local law ordinances, rules and regulations in any manner affecting the conduct of the work, and all such orders or decrees as exist at present and those which may be enacted later, by bodies or tribunals that have jurisdiction or authority over the work, and shall indemnify and save harmless the Owner, its agents or servants against any claims or liability arising from or based on violations of any such law, ordinance, regulation, order or decree, whether by themselves or by their employees.

B. Contractor's and Subcontractor's Insurance

1. Compensation and Employer's Liability Insurance

The Contractor shall procure and maintain during the life of the Contract statutory Workers' Compensation and Employer's Liability Insurance for all of their employees to be engaged in work on the project under the contract and,

in case any such work is sublet, the Contractor shall require and the Subcontractor is similarly required to provide Workers' Compensation and Employer's Liability Insurance for all of the latter's employees to be engaged in such work in an amount of not less than One Million Dollars (\$1,000,000.00).

2. Bodily Injury Liability and Property Damage Liability Insurance

The Contractor shall procure and maintain during the life of the contract Bodily Injury Liability and Property Damage Liability Insurance to protect themselves and any Subcontractor performing work covered by the contract from claims for damages for personal injury, including accidental death, as well as from any claims for property damage, which may arise from operations under the contract, whether such operations be by the Contractor or by any Subcontractor or by anyone directly or indirectly employed by either of them, and the amount of such insurance should not be less than:

- a. Bodily Injury Liability Insurance in an amount not less than One Million Dollars (\$1,000,000.00) for injuries including wrongful death to any one person, and subject to the same limits for each person in an amount not less than One Million Dollars (\$1,000,000.00) on account of one accident.
- b. Property Damage Insurance in an amount not less than that specified to fully and completely insure said property.
- c. Fire Insurance: The Contractor shall have adequate fire and standard extended coverage insurance with a company acceptable to the Owner that covers the project under Contract. The insurance shall provide protection at all times against loss by the Owner and Contractor until final acceptance of the work.

3. The Contractor shall file insurance certificates with the Owner prior to execution of the contract.

4. Written in the body of the certificate shall be:

- a. "In the event of cancellation of the insurance, the Owner shall be given ten (10) days prior written NOTICE BY THE INSURANCE COMPANY".
- b. "This certificate covers Contract(s) Number(s) _____; Name of job _____ (i.e.: "Joppa Area Water").

C. Patent Fees, Royalties and Licenses

Whenever any materials, process, composition or thing used in the work done or materials furnished, under the contract are covered by Letters Patent, the Contractor, before using or employing such material process, composition or thing, must secure the assent in writing of the Owner or licensee of such letters Patent and file same with the Director. In the event that the Contractor shall fail to obtain such prior consent, he/she and their surety Bond given for the faithful performance of their work under the Contract, shall be liable to the Owner for any and every claim, suit or demand brought against the Owner by reason of any default or neglect of the Contractor to obtain the assent in writing of such owners

or licensees of such letter Patent.

D. Permits and Licenses

1. Such permits, licenses, insurance policies, etc., as may be necessary in order to comply with Federal, State or local laws in conducting the work, shall be provided by the Contractor/Developer at their own expenses, except as otherwise provided.
2. The Owner has or will obtain a permit for any work within the State, County or Municipal Rights-of-Way, Railroad Rights-of-Way, and the Contractor shall perform all work in accordance with the requirements of this permit and to the satisfaction of the Director. Copies of any permit obtained by the Owner will be included with the bid forms at the time of bidding.

E. Claims for Damages

1. If the Contractor claims compensation for any damage sustained by reason of the acts of the Owner, or any official or agent thereof, the Contractor shall within ten (10) days after sustaining such damage make a written statement to the Director of the nature of the damage sustained, and shall, on or before the fifteenth (15th) day of the month succeeding that in which they allege that such damage has been sustained, file with the Director an itemized statement of the details and amount of the details and amount of such damage.
2. Whenever it shall appear to the Contractor that, due to the exigencies of the work, they are about to incur damage, owing to the neglect or refusal of the Director to issue an extra-work order or to any other cause whatever, they shall at once notify the Director or their representative in writing, of such fact and state the nature of their possible claim, in order that the Director may obtain necessary and authentic information to guide future consideration and action on such claim and unless the Contractor shall comply with this requirement their claim for damage shall be fortified and invalidated. Such notifications shall not take the place of, but shall be in addition to, written statement herein above required to be submitted within ten (10) days after the occurrence of and alleged cause of damage.
3. In any case where the Contractor deems extra compensation is due for work or materials not clearly covered in the contract, or not ordered by the Director as an extra, as defined herein, the Contractor shall notify the Director in writing of their claim for such extra compensation and receive the approval of the Director before they begin the work on which they base the claim. If such notification is not given, or the Director is not afforded proper facilities by the Contractor for keeping strict account of actual cost, then the Contractor is deemed to have waived the claim for such extra compensation and or not have had a valid claim initially. In case the claim is found to be just, it shall be allowed and paid as an extra as provided for herein for extra work under Section 01000(4.0).K of these Standard Specifications.

F. Public Convenience and Safety

1. The Contractor at all times shall conduct the work in such a manner as to ensure the least obstruction to traffic practicable. The convenience and

services of the general public and of the residents along and adjacent to the improvement shall be provided for in an adequate and satisfactory manner. Material stored along the improvement shall be placed so as to cause as little obstruction to the travelling public as is considered necessary. The Contractor shall, unless otherwise specified, provide and maintain in passable condition such temporary highways and bridges as may be necessary to accommodate the traffic diverted from the roadbed affected by the construction, and they shall provide and maintain in a safe condition temporary approaches to, and crossing of, intersecting highways. On highways occupied by a railway, vehicle access shall be provided and maintained by the Contractor in an approved manner. Fire hydrants on or adjacent to the improvement shall be kept accessible at all times to fire fighting personnel and equipment.

2. In the performance of their work, all contractors shall comply with all applicable Local, State, and Federal safety and health laws and regulations.

G. Use of Explosives

1. The use of explosives will not be permitted unless authorized in writing by the Director. When use of explosives is permitted, the Contractor shall use the utmost care so as not to endanger life or property; and whenever necessary the number of charges and size of the charge shall be reduced. The Contractor's attention is directed to the necessity of safeguarding the public during dynamiting operations, and a sufficient number of watchmen, flagmen, signs, etc. shall be used to warn motorists during periods of blasting. All explosives shall be stored in a secure manner, and all such storage places shall be marked clearly, "Dangerous Explosives" and shall be in care of competent watchmen at all times. Explosives shall be stored and handled in conformity with provisions of the statutes of the State of Maryland and local laws and ordinances.
2. The Contractor shall fully inspect the interior and exterior of foundations, and homes prior to and after blasting operations. In each case, the Contractor shall report the findings, with photo documentation, to the County within two working days. The Contractor shall be responsible to install seismographs at locations to document the forces resulting from blasting.
3. The Contractor shall notify each property owner/resident and public utility company having structures in proximity to the site of the work of their intention to use explosives, and such notice shall be given sufficiently in advance to enable the property owners/residents and companies to take steps as they may deem necessary to protect their property from injury. Such notice shall not relieve the Contractor of any responsibility for damages which may occur as a result of their operations.
4. Expert powder men licensed by the State Fire Marshal shall be employed by the Contractor for handling and use of explosives, and all their work shall conform to these requirements.
5. The Contractor shall notify the Harford County Fire Marshal's Office of their intention to use explosives, at least 48 hours in advance so the Fire Marshal's office can schedule their operations.

6. The authorization by the Director for use of explosives shall not relieve the Contractor of their full responsibility for damages which may occur or for obtaining all necessary permits.
7. The Contractor must file a copy of the blasting permit with the Director prior to the use of any explosives. The cost of the blasting permit shall be borne by the Contractor.

H. Maintenance of Traffic

Unless otherwise noted in the Special Provisions, it shall be the responsibility of the Contractor to maintain highway and pedestrian traffic safely, adequately, and continuously on all portions of the project. Traffic control shall be in accordance with the Harford County or Maryland State Highway Administration approved traffic control plan. Where it has previously been established that traffic cannot be maintained, specific information relative to the use of detour routes and working restriction, if any, will be included in the Contract Documents. If, during the conduct of the work, conditions are such that traffic cannot be maintained and other routes are available, the Contractor may with the approval of the Director request that the Division of Engineering and Transportation establish a detour route.

The Contractor shall, at their own cost and expense, furnish all watchmen, detour signs, road closure signs, and barricades in accordance with the approved traffic control plans and erect them at locations designated by the Director prior to the initiation of any work.

The cost of maintaining traffic as noted above shall be considered as incidental to other items and included in the price bid for them except when a special item for "Maintenance of Traffic" is provided in the Bid Form.

I. Preservation and Restoration of Property, Trees, Monuments, Etc.

The Contractor shall not enter upon private property for any purpose without obtaining permission, and shall be responsible for the preservation of all public and private property, trees, monuments, etc., along and adjacent to the work and shall use every precaution necessary to prevent damage or injury thereto. They shall use adequate precautions to prevent damage to tracks or pipes, conduits and other underground structures, and shall protect carefully from disturbance or damage all land monuments and property marks until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed, and replacement of same shall be borne by the Contractor. The Contractor shall not willfully or maliciously injure or destroy trees or shrubs and they shall not remove or cut them without proper authority. The Contractor shall be responsible for all damage or injury to property of any character, during the prosecution of the work, resulting from any act, omission or misconduct in their manner or method of executing said work or due to the non-execution thereof on the part of the Contractor. The Contractor shall restore, at their own expense, such property to a condition at least equal to that existing before such damage or injury was done, by repairing, rebuilding or otherwise restoring, as may be directed, or they shall make good such damage or injury, in an acceptable manner. In case of the failure on the part of the Contractor to restore such property, or make good such damage or injury, the Director may, upon forty-eight

(48) hours notice, proceed to repair, rebuild or otherwise restore such property as may be deemed necessary, and the cost thereof will be deducted from the monies due or which may become due the Contractor under their contract. Mail service shall be maintained at all times.

J. Requirements of the Maryland Department of State Forests and Parks

1. In conjunction with Section 01000(4.0).H, the attention of the Contractor is called to the fact that they will be required to protect and save from harm those trees which have been designated on the Contract drawings.
2. It will be required that the Engineer secure a permit from the Maryland Department of State Forest and Parks, which will be made part of the Bid Documents.
3. The Contractor must assume all expenses incurred by inspection and supervision service required by the Maryland Department of State Forest and Parks, and it is, therefore, necessary for the Contractor to contact the Maryland Department of State Forest and Parks' local District Office for further information.

K. Indemnification of the Owner

1. The Contractor shall indemnify and save harmless (including, but not limited to, compensation of attorney fees) the Owner and its officers, agents, and employees from all suits, actions, or claims of any character, name and description brought for or on behalf of persons or property due to any neglect in safeguarding the work, the use of unacceptable or defective material in the construction of the work, or on account of any act or omission, neglect, or misconduct of the Contractor, its agents, employees, or subcontractors.
2. The Owner may retain as much of the monies due the Contractor as shall be considered necessary by the Owner to assure settlement of said suits, actions or claims. In case no monies are due, the Contractor's bond shall be held until all suits, actions, or claims thereon have been settled and suitable evidence to that effect furnished to the Owner.

L. No Waiver of Legal Rights

The Owner shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work and payment therefore, from showing the true amount and character of the work performed and materials furnished by the Contractor, from showing that any such measurement, estimate, or certificate is untrue or is incorrectly made, nor from showing that the work or material does not in fact conform to the Contract. The Owner shall not be precluded or stopped, notwithstanding any such measurement, estimate, or certificate, any payment in accordance therewith, from recovering from the Contractor or its sureties, or both, such damage as it may sustain by reason of its failure to comply with the terms of the Contract. Neither the acceptance by the Owner or any representative of the Owner, nor any payment for the whole or any part of the work, nor any extension of time, nor any possession taken by the Owner, shall operate as a waiver or any portion of the Contract or of any power herein reserved, or any right to damages.

The waiver of any breach of the Contract shall not be held to be a waiver of any other or subsequent breach.

M. Waiver of Contract

Neither the acceptance of the whole or any part of the work by the Director nor any order by the Owner for the payment of money, nor any payment by the Owner for the whole or any part of the work, nor any extension of time, nor any possession taken by the Owner or its employees, shall operate as a waiver or any portion of the Contract or of any power therein reserved to the Owner, or any right to damage therein provided, nor shall any waiver of any breach of the Contract be held to be a waiver of any other or subsequent breach.

N. Prequalification Requirements

All Contractors constructing, replacing, modifying or altering water and sewer facilities under the jurisdiction of Harford County, must be pre-qualified under Category D-1 (Sewer Mains) and/or Category D-2 (Water Mains) and/or Category M (Pump Stations) in accordance with the Harford County Department of Procurement pre-qualification procedures. For Developer projects, pre-qualification shall occur prior to the pre-construction meeting.

O. Sanitary Sewage Overflow Prevention

1. **Sewage overflows are strictly prohibited.** The Contractor shall take every reasonable precaution to prevent overflows and spills during construction, startup and testing of projects.
2. Prior to construction, if applicable, the Contractor shall submit a plan of action to the County for review and approval that addresses the handling of existing wastewater flows. It is essential to the operation of the existing sewage system that there is no interruption in the flow of sewage throughout the duration of the project. The Contractor shall provide, maintain and operate all temporary facilities such as plugs, pipe, pumping equipment (both primary and back-up units), all necessary power, and all other labor and equipment necessary to maintain sewage flow around the work area in a manner that will not cause damage to sewers and that will protect public and private property from damage and flooding.
3. In the event of an emergency or special hazard (i.e., sewage spills, sewage overflows, unsafe working conditions, release of toxic chemicals, and other emergencies and hazards) that may occur during the performance of the work under the contract and/or that is the result of the Contractor's operations, the Contractor shall take immediate and appropriate action to halt the spillage or release and clean and disinfect the area to the satisfaction of the County. The Contractor shall immediately notify Harford County's Division of Water & Sewer at (410) 612-1612. All project work shall cease until this notification has been made and the appropriate corrective actions have been taken.
4. The Contractor shall be solely responsible for all fines, clean-up costs, public notifications, posting of signs, bacterial sampling and testing, written reports,

and five year record retention resulting from emergencies and hazards that are the result of Contractor operations.

5. Any regulatory agency fines that are levied against Harford County as a result of the Contractor's actions or negligence shall be paid by the Contractor.

7.0 PROSECUTION AND PROCESS

A. Time of Beginning and Completion

1. The Contractor shall accept a Contract with the understanding and intention to perform fully, entirely and in an acceptable manner the work contracted for within the Contract time stipulated in the Bid, accounting from the date provided in the Notice to Proceed. Time is of the essence in all Contracts.
2. The Contractor shall attend and participate in a Pre-Construction Meeting at a time and place indicated by the Owner. The Contractor's Superintendent must attend such meeting, as well as any other key personnel from the Contractor's work force deemed necessary by the Owner.
3. In connection with the improvement, the right is reserved to award any work not included in the Contract to another Contractor for performance during the progress of the Contract, or to perform such work by Owner's forces, and the Contractor for this Contract shall cooperate and conduct their operations as to minimize the interference therewith.
4. When the Contract time is on a calendar day basis, it shall consist of the number of consecutive calendar days stated in the Contract, including all Sundays, holidays, and non-work days, but excluding all calendar days elapsing between the effective dates of any orders of the Director to suspend and resume operations. If, however, the prosecution of the work shall be delayed or suspended in consequence of the Contractor's inability to obtain the necessary materials, or in consequence of any act or omission of the County and not by any fault of the Contractor, then the time for completion of the work shall be increased by a period of time equal to the aggregate time expressed in calendar days, and parts of days, during which the prosecution of the work has been so delayed or suspended.
5. No allowance shall be made for delay or suspension of the prosecution of the work due to the fault of the Contractor. The Contractor, under certain conditions, may be ordered or after written application to the Director, be granted permission, in writing to suspend operations in whole or in part. During such periods if, the Contractor elects, and is permitted in writing, by the Director, to do any work, the time charged shall bear the same ratio to the total time allowed for completion of the work as the value of work performed bears to the total value of the Contract. Work of an emergency nature ordered by the Director for the convenience of the traveling public or for the production or delivery of materials for storage, if performed during such periods of suspension, shall not be charged to the Contract time.
6. Following the date on which all work has been completed except those landscaping items on which work is restricted to specified seasons and when

final inspection and acceptance is being deferred pending completion of those landscaping items on which work is not permissible at the time because such work is currently out of season, and for no other reason, no time shall be charged against the Contractor until such time as it is again permissible to proceed with such work. However, time shall be charged during any extensions of the specified season which may be granted the Contractor.

7. If the satisfactory execution and completion of the Contract, as awarded and exclusive of extra work thereafter authorized, shall require work or material in greater amounts or quantities than those set forth in the Contract, then the number of days allowed for completion shall be increased in the same proportion as the additional work bears to the original work contracted for, figured at the Contract prices.
8. The Director shall compile a statement showing the date the Contractor was required to complete all the work, in accordance with all the terms and provisions of the Contract, as compared with the time actually consumed by the Contractor in so completing said work, and also showing the recommendations of the Director as to the number of days, if any, for which the Contractor shall pay liquidated damages.
9. The above statement, after being compiled by the Director, shall be certified by him/her and forwarded with their recommendations to the Director of Procurement.

B. Sub-Letting and Assignment

1. The Contractor shall give their personal attention constantly to the faithful performance of the work, shall keep the same under their own control, and shall not assign the Contract by power of attorney or otherwise, nor sublet the work or any part thereof, without the previous written consent of the Director. The Contractor shall state to the Director, in writing, the name of each subcontractor they intend to employ, the portion of the work which they are to do, or the materials which they are to furnish, their place of business and such other information as the Director may require in order to know whether such subcontractors are reputable and reliable, and able to perform the work or to furnish the materials as called for in the Specifications. A subcontractor may not sublet work assigned to them.
2. The Contractor shall perform with their own organization work amounting to not less than 50 percent of the remainder obtained by subtracting from the total original Contract value the sum of any items designated in the Contract Special Provisions as "Specialty Items." Only complete items may be sublet.
3. The Contractor shall not, either legally or equitably, assign any of the moneys payable under the Contract, or their claims thereto, unless by and with the like consent of the Director.
4. The Contractor shall not be released from any of their liabilities or obligations under their Contract should any subcontractors fail to perform in a satisfactory manner the work undertaken by them.

5. The Contractor shall be as fully responsible to the County for the acts and omissions of their subcontractors, and of persons either directly or indirectly employed by them, as they are for the acts and omissions of persons directly employed by them.
6. Nothing contained in the Contract Documents shall create any contractual relation between any subcontractor and the County.

C. Workmanship

All work shall be performed and all materials furnished in carrying out the Contract shall be of the character and quality required by the Contract documents. Where no standard is specified for such work or materials, they shall be the best of their respective kinds. Any unsatisfactory work done or materials furnished, at whatever time they may be discovered, shall be immediately removed and satisfactorily replaced by the Contractor, when notified to do so by the Director. If the Contractor shall neglect or refuse to remove such unsatisfactory work or material within forty-eight (48) hours after the receipt of the above mentioned notice, or if they do not make satisfactory progress in doing so, the Director may cause said work or material to be removed and satisfactorily replaced, by contract, or otherwise, and the expense thereof shall be charged to the Contractor. Such expense shall be deducted from any moneys due or to become due the Contractor under the Contract. Upon the completion of the Contract, the entire work shall be delivered to the Owner in a condition equal to or better than the industry standard, complete, and in a satisfactory working condition.

D. Competence of Labor

Only competent labor shall be used. Any employee of the Contractor who shall use profane or abusive language to the Inspector or other employees of the Owner, or is otherwise disorderly and interferes with them in the performance of their duties, or who is careless and incompetent, shall be discharged on the request of the Director and shall not again be employed on the Contract Job except with the Director's consent.

E. Abandonment of or Delay in Work

If the work under the Contract shall be abandoned by the Contractor, or if at any time the Director shall be of the opinion, and shall so certify in writing to the Owner, that the performance of the Contract is unnecessarily or unreasonably delayed, or that the Contractor is violating any of the provisions of the Contract or is executing the same in bad faith, or if the work be not fully completed within the time named for its completion, together with such extension of time as may have been granted, the Owner, by written notice, may order the Contractor to discontinue all work thereunder, or any part thereof; and thereupon the Contractor shall discontinue the work, or such part thereof, and the Owner shall have the power, by contract, or otherwise, to complete said work and deduct the entire cost thereof from any moneys due or to become due the Contractor under the Contract. For such completion of the work, the Owner may for itself or its contractors, take possession of and use or cause to be used any or all materials, tools, machinery and appliances found on the line of said work. When any part of the Contract is being carried on by the Owner as herein provided, the

Contractor shall continue the remainder of the work in conformity with the terms of the Contract, and in such manner as not to interfere with the workers employed by the Owner.

F. Default or Failure to Complete Work on Time

Should the Contractor fail to fully complete the work in accordance with the Contract Documents and within the time specified, the Director shall determine the number of days that the Contractor is in default in completing the work under the Contract and shall certify the same in writing. For each day so certified, the Contractor shall pay to the Owner the sum stipulated in the Bid and the Contract for each and every day thereafter, until and including the day when the said work shall be completed to all intent and purposes, as set forth in the Bid under the Contract and the specifications, in an acceptable manner and to the satisfaction of the Director, which sum is agreed upon, not as a penalty, but as liquidated damages which the Owner shall suffer by reason of such default: However, the Owner may, as hereinafter provided, extend the time for the completion of the work authorized and is empowered to deduct and retain the amount of any damages determined, as hereinbefore provided for, each day that the Contractor shall be in default in completing the work after the time fixed under the Contract, or for any later date to which the time of completion may have been extended, from any moneys due or to become due the Contractor under the Contract, at any time after such damages are so incurred, provided, however, that the Owner may extend the time for the completion of the work beyond the Contract time. The permitting of the Contractor to finish the work after the time fixed for its completion or after the date to which the time fixed for its completion or after the date to which the time for completion may have been extended, shall not in any way operate as a waiver on the part of the Owners or any of their rights under the Contract.

8.0 MEASUREMENT AND PAYMENT

A. General

1. Lump Sum Contracts - Lump sum payment shall include clearing and grubbing, removal and replacement of existing sidewalks, shrubbery, driveways, poles, mail boxes, signs, fences, or any other existing objects which are required to be restored to complete the work, and all new work such as trench excavation and backfill, sheeting and shoring, dewatering, furnishing and laying pipe, furnishing of materials and construction of manholes, vaults, headwalls, bends wye branches, and any other structures incidental to the work, and all other operations and materials required to complete the work. Lump sum contracts shall include, for the bid price, all costs of materials and services for which the Contractor shall be paid under the Contract, plus profit. No further or additional compensation is due and owing the Contractor except as the Contract may be modified to provide for.
2. Unit Price Contracts
 - a. Unit prices where directed shall be paid for by measurements of all quantities of work and material by the Director according to the specifications and drawings and the working-lines that may be given. No

allowance will be made for any excess above the quantities required by the specifications, drawings and lines on any part of the work, except where such excess material has been supplied or work done by written order of the Director and in the absence of default or negligence on the part of the Contractor. Should the dimensions of any part of the work or of the materials be less than those required by the drawings or the directions of the Director, only the actual quantities placed will be allowed in the measurements. The County reserves the right to withhold payment of particular items or portions thereof until the item(s) in question has proven conformance by the Director's inspection and satisfactorily passing the applicable testing requirements stipulated in the Contract documents.

- b. When a mobilization item has been established in the bid it shall consist of the furnishing of all work, materials, and operations required for the assembling and setting up for the project, including, but not limited, to the following:
 - i. Initial movement of personnel to the project site.
 - ii. Establishment of the Contractor's office.
 - iii. Establishment of the Engineer's field office.
 - iv. Establishment of shops and plants.
 - v. Construction of sanitary and other facilities required by the Specifications and state or local regulations.
 - vi. Clearing and grubbing, moving on and offsite all construction, hauling units, concrete mixers, hoisting equipment, compressors, and tools required to complete the work.
 - vii. Establishment of storage area.

Mobilization shall also include all other work and operations which must be performed prior to beginning work on compensable items of work at the project site.

The cost of required insurance and bonds and/or any other initial expense required for the start of work shall be included in this item.

Payment will be made at 50 percent of the lump sum price bid for "MOBILIZATION" of the Bid payable on the first monthly estimate subsequent to the Contractor's moving in all facilities required as indicated in the foregoing. The remaining 50 percent will be paid in equal monthly payments based on the specified construction term, during the progress of the contract. Payment as directed will be full compensation for all labor, materials, equipment, tools, and incidentals required to complete this item, regardless of the fact that the Contractor may have, for any reason, shut down the work on the project and moved equipment away from the project and then back again.

Where unit price contracts are directed, following the completion of the work and before final payment is made therefore the Director shall make final measurements to determine the quantities of various items of work performed as the basis for final settlement. The Contractor, in case of unit price items, will be paid for the actual amount of work performed and for the actual amount of materials in place, in accordance with these specifications as shown by the final measurements. All work contemplated under the Contract shall be measured by the Director according to the standards of weight and measures recognized by the National Bureau of Standards.

Measurements of items paid for on the basis of linear or surface area shall be along and parallel to the actual lines and surfaces on the roadway surfacing having an area of nine (9) square feet or less. In computing volumes, the method of average end areas will be used for excavation, embankments and removal of existing masonry. The pay weight for all items to be paid for by weight, certified shipping weight or by computed weight as hereinafter specified and no allowance for overrun, other than designated herein, shall be made.

Materials specified for measurement by tallying of vehicles having pre-determined carrying capacity shall be hauled only in approved units, struck off at the top of the carrying unit or to permanent lines at the loading point and tallied at the point of delivery. Unless all vehicles have uniform carrying capacity, each hauling unit shall be marked identifying the approved capacity.

In the volumetric measurements of the "Tamped Fill" over pipe, "Masonry" and "Stone Backfill" around pipe, deduction shall be made for the volume occupied by the pipe.

In the measurement of pipe whenever special fittings are used, for which a separate item price is set up, the accumulative linear measurement occupied by these fittings shall be deducted from the total linear measurement of pipe placed.

B. Monthly Estimates

1. The Contractor shall submit in writing on a date specified by the Director, and on forms provided by the Department of Public Works, an estimate, they believe to be just and fair, of the amount of work done under each item of the contract during the estimate period. Such estimate shall not be required to be made by strict measurements, but may be approximate only, and shall be subject to correction in later estimates. Monthly estimates shall not contain any allowance for materials delivered upon the site of the work but not incorporated therein, and the Contractor shall not be entitled to receive any payment therefore, except where specifically permitted by the Director. The estimate shall be submitted to the Director for confirmation that the work for which payment is claimed has been performed.
2. Upon the Owner's approval of each monthly estimate, the Owner will retain a portion of the amount due the Contractor, in accordance with the following:

- a. Withholding of 10 percent (10%) of the payment claimed for projects \$200,000 or less for the entirety of the project;
- b. For projects over \$200,000:
 - i. Withholding of 10 percent (10%) of the payment claimed until Work is 50 percent (50%) complete;
 - ii. When the work is 50 percent (50%) complete, and at the sole discretion of the Director, the withholding may be stopped or lowered to a lower percentage of the payment claimed for all remaining work satisfactorily completed to date, provided that the Contractor is making satisfactory progress and there is no specific cause for greater withholding.
 - iii. The County may reinstate up to 10 percent (10%) withholding of the total payment for the work completed to date, if the Contractor is not making satisfactory progress or there is other specific cause for such withholding.
 - iv. The County may accept securities negotiable without recourse, condition or restrictions; a release of retainage bond; or an irrevocable letter of credit provided by the Contractor, instead of all or part of the cash retainage.
 - v. In no case shall the withheld amount be less than 5 percent (5%) of the dollar value of the Work completed to date.

Director may retain out of such payment any or all sums which, by the terms of these specifications, the Contract, or of any law of the State of Maryland in force at the date of the signing of the Contract, it is authorized to retain. Payments on monthly estimates may be withheld if, in the judgment of the Director, the Contractor is not complying with the terms of the Contract.

3. In the instance of lump sum items, the Director shall estimate the percentage of the lump sum item satisfactorily performed during the preceding month. The percentage of the lump sum items shall be computed from the approved Contractor's breakdown.

C. Final Estimate

1. Upon completion of the work, the Contractor shall make a written final estimate, based upon the Director's measurement of the whole amount of authorized work done by the Contractor, and the value thereof under the terms of the Contract, and shall certify to the Owner the completion of the work and the amount of the final estimate. The Director's measurements, upon which the final estimate is based, shall be final and conclusive. The estimate shall be submitted to the Director for confirmation that the work for which payment is claimed has been performed. Following their review, the Director will submit the estimate for payment.

2. Upon approval of the final estimate, the Owner will notify the Contractor, in writing, of the conditional acceptance of the work. Out of the amount representing the total of the final estimate, the Owner will deduct ten (10) percent, which shall be in addition to any and all other amounts which under the Contract is entitled or required to retain, and shall hold said sum for a period of twelve (12) months from and after the date of payment of the final estimate, as herein below stipulated. Such part as may be necessary, or all, of said retained sum shall be applied to any expense to which the Owner may be subjected, during the said period of twelve (12) months, in repairing any defects found in the work under the Contract which may be deemed to have been caused by failure of the Contractor to comply with the terms of the Contract, or to any breach of the Contract whatsoever on the part of the Contractor. The Owner shall be empowered to make any required repairs or renewals during said period, without notice to the Contractor, if they shall judge such action to be necessary, or if, after notice, the Contractor shall refuse or neglect to do said required work or make satisfactory progress thereon within such period as the Director shall consider necessary or reasonable. Where such emergency repairs have been made without prior notice to the Contractor, they shall be advised as soon as possible thereafter. The right of expenditure of any retainage as provided for above shall be in addition to the Owner's right to proceed against any and all bonds posted or security by the Contractor.
3. Within fifteen (15) days after the approval of the final estimate, the Owner will pay to the Contractor the amount remaining after deducting from the total amount of the final estimate all such sums as have heretofore been paid to the Contractor under the provisions of the Contract, and also such amounts as the Owner has or may be authorized by these specifications or under the Contract to reserve or retain.

D. Final Acceptance and Payment

Prior to expiration of the aforesaid period of twelve (12) months succeeding the payment of the conditional acceptance the Owner will pay the Contractor all sums reserved or retained, less such amounts as it may be empowered under the provision of the Contract permanently to retain.

E. Evidence of Payment

The Contractor shall furnish the Owner with a release of liens within ten (10) days after the final completion and acceptance of the whole work under the Contract from each person, partnership and corporation who has done work or furnished materials under the Contract, or in or about the work contracted for. In the event a release of lien is not furnished by the Contractor, the Director may withhold an amount from monies retained or due to the Contractor under the Contract as it deems necessary to cover the cost of materials or labor provided until a release of lien is received by the Director.

F. Maintenance Bond

At any time after the approval of the final estimate the Contractor may be permitted to furnish a Maintenance Bond in favor of the Owner in the amount which would otherwise be retained by the Owner. Such bond shall be in a form

and with a surety approved by the Owner, binding the Contractor as principal and the surety to promptly and properly replace any improper work or materials that may become apparent within a period of twelve (12) months following the conditional acceptance of the work. Upon acceptance by the Owner of such a bond, the sum retained by the Owner will be paid to the Contractor.

G. Termination of the Owner's Liability

The acceptance by the Contractor of the final payment made as aforesaid shall operate as and be a release to the Owner and every officer and agent thereof, for all claims by and liabilities to the Contractor and/or any other person, corporation or association for anything done or furnished for or relating to or affecting or affected by the work under the Contract.

PART 14-2 STANDARD SPECIFICATIONS

DIVISION 2 SITE WORK

SECTION 02012 TEST PITS

1.0 GENERAL

A. Description

1. Prior to construction it shall be the Contractor's responsibility to establish the location and/or elevation of existing utilities and structures that may affect the proposed work. The Contractor shall test pit all mainline utilities as required to perform the work (including but not limited to water mains, gas mains, electric, telecommunication and others which may conflict with the construction) prior to the excavation of the proposed utility and submit copies of the results to the Director within 1 working day. The Contractor shall immediately notify the Engineer if the horizontal or vertical location of the test-pitted utility will conflict with the proposed construction. The proposed construction may not occur until the Engineer has revised the construction drawings and the revised construction drawings have been approved by the County.
2. Test pits shall include, but not necessarily be limited to, excavation to determine the exact horizontal location and/or elevation of underground structures, utilities, and other obstructions; the backfill and compaction of the excavation; and the stabilization of the surface, in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Restoration: Section 02800

C. Quality Assurance

It is intended that all suitable materials removed from the test pit excavation, exclusive of paving materials, be used for backfill. The County has the right to inspect all material used as backfill to determine the material's suitability for use as backfill.

2.0 MATERIALS

A. Materials Furnished by the County

None

B. Contractor's Options

1. Use of Excavated Material

All suitable material excavated from test pits shall be used, as far as practicable, for backfill. The Contractor shall properly store or stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at their own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project site without permission of the County. All unsuitable material shall be removed from the excavation and disposed of off-site in accordance with local, state and federal regulations by and at the expense of the Contractor.

2. Borrow

Borrow material for test pit backfill shall meet the requirements of Section 02250 of these Standard Specifications.

3. Graded Aggregate Subbase

Graded aggregate subbase for test pit backfill shall meet the gradation requirements specified in Section 02240 of these Standard Specifications.

3.0 EXECUTION

A. General

It shall be the Contractor's responsibility to determine the location and/or elevation of underground structures and utilities by the use of test pit excavation prior to initiating excavation operations for the installation of the proposed facility. Test pits shall be of the size, depth and location as approved by the County. Should the location and/or elevation thus determined be different from that shown on the Plans, the Contractor shall promptly furnish the correct information to the County so that the impact on the project may be determined.

B. Test Pits

1. The Contractor shall provide all necessary traffic control in accordance with the applicable regulations.
2. Surface preparation, excavation, backfill, compaction, and maintenance of the backfilled excavation shall be as specified in Section 02250 of these Standard Specifications for trenches, except that the limits of the work shall be as approved by the County.
3. Restoration shall be as specified in Section 02800 of these Standard Specifications unless otherwise specified or directed by the County.

4.0 METHOD OF MEASUREMENT

Unless otherwise shown on the drawings, identified by "Miss Utility", or specified in the Contract Documents, test pits will not be measured but shall be incidental to the proposed utility work. If directed by the Owner, measurement for test pits will be made on the basis of the volume of material actually removed from within the limits

specified by the County.

5.0 BASIS OF PAYMENT

Payment for test pit excavation performed to establish the location of existing utilities shown on the Plans shall not be paid as it is considered incidental to the proposed work.

If directed by the Owner, payment for test pits will be made at contingent prices established in the bid proposal. The price bid shall include furnishing all labor, material, equipment, and incidentals necessary to perform the traffic control, excavation, backfill, compaction and surface restoration or pavement patch for the test pit.

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SECTION 02050 REMOVAL OR ABANDONMENT OF EXISTING UTILITIES

1.0 GENERAL

A. Description

1. Removal or abandonment of existing utilities and underground structures shall include, but not necessarily be limited to, the removal, salvage, demolition in place, abandonment, or other disposition of existing utilities, underground structures, or other facilities shown on the plans, encountered in the course of the work, and/or as directed by the County and in accordance with the Contract Documents.
2. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the Contractors property. Salvaged materials specified to remain the property of the County shall be transported to another location designated by the County.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Gravity Sanitary Sewer and House Connections: Section 02700
4. Sanitary Sewer Manholes: Section 02710
5. Cast-in-Place Concrete: Section 03300
6. Mortar: Section 04100
7. Brick Masonry: Section 04200

C. Quality Assurance

The County will inspect all materials and work to insure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

Not Applicable.

C. Contractor's Options

None

D. Detailed Material Requirements

1. Borrow material for backfilling the space left by removal of facilities or backfilling abandoned structures shall meet the requirements specified in Section 02250 of these Standard Specifications.
2. Pipe plugs and caps for water main abandonment shall be as specified in Section 02660 of these Standard Specifications.
3. Pipe plugs for sewer main abandonment shall be a heavy-duty, conical-shaped, cast iron body sewer pipe plug with expandable rubber diaphragm with malleable iron wing nut.
4. Portland cement concrete for abandonment of utilities shall be Mix No. 1 as specified in Section 03300 of these Standard Specifications.
5. Mortar shall be as specified in Section 04100 of these Standard Specifications.
6. Brick for pipeline and structure bulkheads shall be sewer brick as specified in Section 04200 of these Standard Specifications.

3.0 EXECUTION

A. General

1. Utilities to be abandoned or removed shall not be abandoned or removed until all required proposed utility work is installed and tested to the complete satisfaction of the Director. Furthermore, the Contractor shall notify the Director at least three (3) days prior to beginning the abandonment or removal.
2. The area over the existing facility to be removed shall be excavated and, after removal or abandonment as specified, backfilled and compacted in accordance with Section 02250 of these Standard Specifications.
3. Brick construction shall be as specified in Section 04200 of these Standard Specifications and as specified herein.
4. Rubbish and debris shall be removed from the site unless otherwise directed so as to not allow accumulations inside or outside the project site. Materials that cannot be removed daily shall be stored in areas approved by the County.

B. Removal

Where indicated on the Plans, or directed by the County, existing utility pipelines and/or appurtenances shall be removed by the Contractor.

C. Abandonment

1. Sanitary Sewers 18-inch Diameter and Smaller

- a. All open ends of abandoned sewer pipe shall be sealed by setting the mechanical plug in the pipe followed by concrete fill as shown in the standard detail. Existing manhole channels and benches shall be reconstructed as necessary with brick and mortar to provide a smooth transition within the manhole.
- b. Abandon sewer services by removing the vertical stack to a minimum depth of 4 feet below finish grade. The stack shall be detached by saw cutting. A sewer plug shall be installed on the abandoned vertical stack and encased in concrete a minimum of 12-inches around all sides of the stack. Backfill shall be as specified in Section 02250 of these Standard Specifications.

2. Sanitary Sewers 18-inch Diameter and Larger

- a. All open ends of abandoned sewer pipe shall be sealed by constructing a minimum 20-inch thick brick and mortar or concrete bulkhead.
- b. Where a sewer is to be abandoned while the adjacent manhole is to remain active the Contractor shall seal (watertight) the pipeline opening in the manhole with a minimum 20-inch thick brick and mortar or concrete bulkhead. Existing manhole channels and benches shall be reconstructed as necessary with brick and mortar to provide a smooth transition within the manhole.

3. Sanitary Manholes

- a. Frames and covers of abandoned manholes will remain the property of Harford County. They shall be removed from the structure and transported to a designated location.
- b. The Contractor shall remove the structure to at least two feet (3'-0") below finished grade in accordance with the standard detail.
- c. Pipe openings within the manhole shall be sealed in accordance with the Standard Details.

4. Water Mains and Appurtenances

Where indicated on the Plans, or directed by the County, the Contractor shall abandon existing water mains and/or appurtenances as follows:

- a. The section water main remaining in service shall be capped or plugged and strapped and/or buttressed in accordance with the Contract Documents.
- b. When abandoning water mains 20-inches in diameter and larger, construct a 20-inch thick brick and mortar or concrete bulkhead, or plug, or cap each end of the abandoned sections. All open ends of abandoned water pipe shall be sealed.

- c. For water mains small than 20-inch diameter, install plugs or caps at each end of the abandoned sections.
- d. Abandon water services by exposing the corporation stop at the main, turning stop off, disconnecting the service line from the corporation stop, inserting a plug or cap on the exposed end of the corporation stop, encasing corporation in 6-inches of concrete, and backfill excavation to finished grade. Water services larger than two inches in diameter shall have the valve at the main removed, the service capped, and encased in 12-inches of concrete.
- e. The Contractor shall remove all structures to a minimum depth of two feet below finished grade, break or drill holes in the bottom of the structure to provide drainage, and backfill the structure as specified in Section 02250 of these Standard Specifications.
- f. Fire hydrants shall be returned to the Division of Water and Sewer Maintenance office at 3111 Philadelphia Road, Abingdon, Maryland.

4.0 METHOD OF MEASUREMENT

A. Removal

Measurement for removal of existing utilities and appurtenances will be made horizontally along the centerline of the pipe for each size and type of pipe removed without deduction for valves or fittings. Measurement for removal of existing structures will be made on the basis of the count or number of structures removed.

B. Abandonment

Measurement for abandonment of existing utilities and underground structures will be made on the basis of the count or number of pipeline sections and/or structures abandoned.

5.0 BASIS OF PAYMENT

A. General

- 1. Payment will be made at the unit prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.
- 2. The price bid for removal or abandonment of existing utilities and underground structures shall include the following:
 - a. Excavation, backfill, and compaction as specified in Section 02250 of these Standard Specifications.
 - b. Furnishing and installing borrow material for backfilling the space left by removed facilities, initial excavation, and/or abandoned structures as required by the Contract Documents.

- c. Storage of materials to be retained by the County, and disposal of those materials which the County does not want to retain.
- d. Furnishing materials for and constructing or installing caps, plugs, and/or bulkheads and appropriate concrete blocking on pressurized mains.
- e. Furnishing materials for and reconstructing channels or benches in existing manholes and/or structures.

3. Payment will be made for contingent items when approved by the County.

B. Removal

Payment for removal of existing utilities will be made at the unit price bid per linear foot for each size and type of pipe removed. Payment for removal of existing structures will be made at the unit price bid per each structure removed. The price bid shall include all traffic control, surface restoration and incidental items to remove the existing utility or underground structure.

C. Abandonment

Payment for abandonment of existing utilities and underground structures will be made at the unit price bid per each section of utility and/or structure abandoned. The price bid shall include all traffic control, surface restoration, and incidental items to abandon the exiting utility or underground structure.

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SECTION 02110 CLEARING AND GRUBBING

1.0 GENERAL

A. Description

1. Clearing and grubbing shall include, but not necessarily be limited to, clearing areas of trees, brush, shrubs, down timber, rotten wood, other vegetation, debris and rubbish, as well as removal of fences and incidental structures; and grubbing or removing from the ground all stumps, roots and stubs, brush, organic materials, and debris, as shown and as specified in the Contract Documents and within the limits of disturbance.
2. For developer projects, the Contractor shall be responsible for acquiring all required permits associated with tree removal and tree trimming. For capital projects, the Contractor shall obtain a permit for any tree clearing outside of the L.O.D. and within the State Highway Administration right-of-way from the Maryland Department of Natural Resources prior to construction.

B. Related Work Included Elsewhere

None

C. Quality Assurance

The County will inspect the work to insure that it is performed in accordance with the Contract Documents.

2.0 MATERIALS

Not applicable.

3.0 EXECUTION

A. Limits

1. General

- a. Unless otherwise indicated in the Contract Documents, all trees and other growth within the drainage and utility easement or rights-of-way shall be removed. In certain situations, designated trees may be required to be saved and shall be designated on the construction drawings.
- b. Within the limits indicated on the Contract Documents to be cleared and grubbed, the County has the right to designate trees and other growth which the County may desire to leave standing. Unless otherwise shown or specified, the entire width and length of easements shall be cleared and grubbed.
- c. The clearing and grubbing operation shall be completed in its entirety within 100 linear feet in advance of any water and sewer utility construction.

B. Unsuitable Materials

Note that after the clearing and grubbing operations are completed, unsuitable materials such as unstable formations, root mat, or swamp muck encountered below the surface of the ground must also be removed and properly disposed.

C. Salvaged Materials

When indicated, such materials as leaf mold or other organic materials above the surface of the ground and suitable for use as mulch or topsoil shall be salvaged and stockpiled.

D. Trees, Shrubbery and Plants

On County capital projects, the Contractor shall schedule a meeting with the County project manager and inspector to review which trees, shrubs, and vegetation shall not be disturbed. The County will discuss which trees, shrubbery, and plants which are not to be removed, and the Contractor shall protect them from any damage, as outlined in the "General Provisions." Where trees which are left standing are trimmed or become scarred by the Contractor's operations, the cuts or scars shall be repaired by the Contractor. All trimming and repairs shall be done by skilled workers and in accordance with good tree surgery practices under the supervision of a tree expert licensed by the State of Maryland.

E. Burning

If allowed, the Contractor shall obtain the appropriate permits to allow the burning of trees, brush, trash, or other perishable materials. If burning is prohibited by the Fire Marshall, the Contractor shall remove these materials and dispose of them off-site in permitted disposal facilities.

F. Disposal Locations

Perishable materials and debris shall be removed from the site easement or right-of-way and disposed of at locations off the project and outside the limits of view from the project by the Contractor. The Contractor shall make all necessary arrangements with property owners, in writing, for obtaining suitable disposal locations, and furnish the County with a copy of the agreement. The cost involved shall be included in the price bid. The Contractor shall be responsible for obtaining all State and local permits for the disposal locations and furnish the County with evidence indicating the sites are approved for disposal.

G. Fences

All fences within the easement or right-of-way that are identified to remain shall be removed as carefully as practicable and replaced so that it remains in a condition equal to or better than what existed prior to construction.

H. Excavation Areas

Within areas to be excavated, all imbedded stumps, root mats, etc., shall be removed to a depth of not less than 1-foot below the subgrade or slope surfaces. All depressions made below the subgrade or slope surfaces by the removal of

stumps or roots shall be refilled with materials suitable for embankment and shall be compacted in accordance with the requirements in Section 02250 of these Standard Specifications.

4.0 METHOD OF MEASUREMENT

The amount of clearing and grubbing will not be measured.

5.0 BASIS OF PAYMENT

Payment for clearing and grubbing will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.

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SECTION 02240 AGGREGATE BACKFILL

1.0 GENERAL

A. Description

Aggregate backfill shall include, but not necessarily be limited to, furnishing and placing granular material for the installation of pipes, fire hydrants, manholes, vaults, and other structures as directed by Harford County, indicated on the plans, and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Water Services and Appurtenances: Section 02664
4. Fire Hydrants: Section 02666
5. Gravity Sanitary Sewer and House Connections: Section 02700
6. Sanitary Sewer Manholes: Section 02710
7. Sanitary Sewer Force Mains: Section 02720

C. Quality Assurance

All aggregate fill material will be subject to test by the County to determine the materials compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish aggregate fill material.

B. Contractor's Options

When properly compacted, sand that meets the Maryland SHA requirements for fine aggregate may be used for PVC water mains and sanitary force mains in lieu of Size 57 as shown on the Standard Details.

C. Detailed Material Requirements

1. Aggregate fill material for the installation of pipes, hydrants, manholes, vaults and miscellaneous structures as noted in the Standard Details shall meet the requirements of AASHTO M43, Size 57.
2. Aggregate fill material for subgrade stabilization shall meet the requirements of AASHTO M 43, Size 3.

3. Aggregate backfill material that meets the Maryland SHA requirements for graded aggregate subbase may be used with the approval of Harford County.

3.0 EXECUTION

- A. If areas of the foundation are soft, composed of mud, or are, in the County's judgement, unfit to receive the pipe, structure, concrete, or masonry, then such unacceptable material shall be removed and replaced with aggregate fill material as directed by Harford County
- B. The aggregate backfill material shall be carefully placed to the dimensions indicated on the plans or directed by Harford County.
- C. Except for Size 57 or 3, all aggregate backfill material shall be compacted.
- D. Aggregate fill shall not be dropped from heights in excess of 5 feet above utility.

4.0 METHOD OF MEASUREMENT

- A. Except when used as a contingent item or noted otherwise, measurement for aggregate fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
- B. When used as a contingent item or noted otherwise, measurement for furnishing and installing aggregate fill will be made on the basis of the volume of material accepted and satisfactorily placed to the lines, grades, and dimensions shown in the Contract Documents.

5.0 BASIS OF PAYMENT

- A. General
 1. Except when used as a contingent item or noted otherwise, payment for aggregate fill will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
 2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
 3. Payment will be made for contingent items when approved by the County.
- B. Aggregate Fill
 1. Payment for furnishing and installing aggregate fill complete and in place will be made at the contingent prices established in the bid proposal. The price shall include all traffic control, and incidental items to complete excavation and placement.
 2. Payment for removal of unacceptable foundation material will be made under the pertinent contingent item.

3. No payment will be made for any aggregate fill which is used because of any error in the Contractor's operations, such as excavating beyond specified lines or grades, etc.

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SECTION 02250 TRENCH EXCAVATION, BACKFILL AND COMPACTION

1.0 GENERAL

A. Description

Trench excavation, backfill and compaction shall include, but not necessarily be limited to, the excavation, backfill, and compaction of trenches for pipelines, fire hydrants, valves, manholes, vaults and other structures shown on the Plans, and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Test Pits: Section 02012
2. Removal and Abandonment of Existing Utilities: Section 02050
3. Aggregate Backfill: Section 02240
4. Boring and/or Jacking Pipe: Section 02300
5. Tunneling: Section 02400
6. Water Mains: Section 02660
7. Water Valves and Appurtenances: Section 02662
8. Water Services, Water Meter Settings and Vaults: Section 02664
9. Fire Hydrants: Section 02666
10. Gravity Sanitary Sewer and House Connections: Section 02700
11. Sanitary Sewer Manholes: Section 02710
12. Sanitary Sewer Force Mains: Section 02720

C. Quality Assurance

All materials removed from trench excavations and used for backfill will be subject to test by the County to determine the material's suitability for use as backfill.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for trench backfill other than those materials which are available from the trench excavation limits as shown on the Standard Details and the Contract Documents.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Material for backfills may be from on-site excavations (if of proper quality) or from borrow sources. The material shall be free from organic material, sludge, grit, trash, muck, roots, logs, stumps or frozen material and other deleterious substances. Except as otherwise specified or approved, the material shall not contain rocks or lumps larger than six inches in greatest dimension. The material shall not contain mica in quantities which, in the judgment of the County are sufficient to affect compaction characteristics. The use of any soil additive that in the judgment of the Director may adversely affect the proposed utility is strictly prohibited.

2. Material for Backfill shall be as follows:

a. Select Material - Within public right-of-way, private roads and parking lots within drainage and utility easement, business, commercial, and industrially-zoned properties, areas supporting vehicular loads, and as specified herein or noted in the Contract Documents.

AASHTO Soil Classification Sieve Analysis (% passing)	A-1	A-2	A-3
No. 10 (2.0 mm)	50 max.	- - -	- - -
No. 40 (0.425 mm)	50 max.	- - -	51 min.
No. 200 (0.075 mm)	25 max	35 max.	10 max.
Typical Material	Stone fragment, gravel and sand	Silty or clayey gravel and sand	Fine sand

Additionally, the following material is allowable under the Unified Soil Classification System: GW and SW, or a well graded aggregate meeting the Maryland State Highway Administration requirements for roadway sub-base.

The maximum dry density shall be 105 lb./ft³ or greater as measured by AASHTO T-180, Method C. The liquid limit and plasticity index for the portion of material passing the No. 40 size shall not exceed 41 and 10 respectively.

b. Suitable Material – All other areas not required under paragraph a. above.

The maximum dry density shall be 100 lb./ft³ or greater as measured by AASHTO T-180, Method C, unless the material has more than 35 percent retained on the No. 4 sieve in which case Method D shall be used. Suitable Material shall include all material designated as Select Material as well as material classified in the Unified Soil Classification System (USCS) as ML, CL, MH and CH.

- c. Structural Fill – Structural fill shall be placed and compacted against cast-in-place concrete structures in accordance with the requirements specified in the Contract Documents.

3. Use and Ownership of Excavated Material

- a. All Suitable Material excavated from utility trenches shall be used, as far as practicable, for backfill in trenches.
 - b. The Contractor shall properly store, stockpile and protect all materials that are to be reused in the work. The Contractor shall replace, at their own expense, material that was suitable when excavated, which has subsequently become unsuitable because of careless, neglectful, wasteful, or unprotected storage. The Contractor shall have no property right in any material taken from any excavation and no excavated material shall be wasted or otherwise removed from the project site without permission of the County. All unsuitable and surplus Suitable Material, as determined by the County, shall be removed from the excavation and disposed of off-site by and at the expense of the Contractor in accordance with all applicable Federal, State, and local regulations.
 - c. If insufficient suitable soils are available from excavation on the contract project, the Contractor may obtain suitable soils from sources designated in the Special Provisions, or from such sources within 300 yards of the site as may be approved by the County. If these sources do not supply sufficient suitable soils, the Contractor shall submit for inspection and test by the County borrow excavation sites from which such soils as may be required to complete the construction of excavation backfill on the contract project. Borrow Excavation shall be supplied and placed at the contract unit price or when not provided for in the contract at a negotiated price for "Extra Work".
4. Aggregate backfill for pipe and structure installation, bedding and trench backfill shall meet the gradation requirements specified herein and Section 02240 of these Standard Specifications.

3.0 EXECUTION

A. Surface Preparation

1. Sediment Control

The Contractor shall install all required sediment control devices in accordance with permits and all applicable Federal, State and local regulations.

2. Clearing and Grubbing

The Contractor shall clear and grub the surface over the line of the trench in accordance with the requirements of Section 02110 of these Standard Specifications.

3. Removing Pavement, Sidewalk, Curb, etc.

- a. Prior to removal, the Contractor shall saw-cut all existing pavement, sidewalk and curb. Jack hammering edges of pavement, sidewalk and curb removal is prohibited.
- b. The Contractor shall remove paving only to the width shown on the Standard Details, noted in the Special Provisions, or as directed by the County. When the Contractor removes paving for a greater width than is deemed necessary or disturbs paving, sidewalk, curbs, etc. due to settlement, slides, or cave-ins, or in making excavation outside the limits of the trench without written order of the County, the County will require the Contractor to replace the excess damaged area and may retain from payments due the Contractor such amounts required to permanently replace the excess material removed. The Contractor shall be responsible for repaving or surfacing roadbeds or replacing sidewalk, curbs, etc. that have failed, settled, or have been damaged at any time before expiration of the Contract maintenance period due to work or any other activities by the Contractor, their subcontractors, or suppliers.

4. Maintaining Traffic

The Contractor shall furnish all labor, tools, equipment, and materials required for the maintenance of traffic during construction in accordance with the traffic control plan or permits.

B. Trench Excavation

1. General

- a. Excavation for the installation of utilities shall be unclassified and shall consist of the excavation removal and/or disposition of all material encountered to the lines, grades, and sections shown on the Plans and/or the Standard Details, as specified, or as directed by the County.
- b. Unless otherwise indicated, excavation shall be by open cut, except that short sections of a trench may be tunneled, or the pipeline jacked, if, in the opinion of the County, the pipe can be safely and properly installed.
- c. Trenches shall be excavated and backfilled either by hand or by machinery. The Contractor shall have no claims, nor will extra compensation be allowed, for hand excavation or backfill which may be required by these Specifications or by the County for protection of existing utilities or structures.

2. Protection of Property and Structures

- a. The Contractor shall, at their own expense, sustain in place and protect from direct or indirect injury all existing facilities in the vicinity of the excavation, whether above or below the ground, or that may appear in the trench. The Contractor shall be responsible for the implementation of protective measures associated with the presence or proximity of pipes, poles, tracks, walls, buildings, property markers, and other structures and property of every kind and description in or over their trenches or in the vicinity of their work whether above or below the surface of the ground. The Contractor shall repair or replace damaged facilities at their expense.
- b. The Contractor shall be responsible to obtain any applicable local, State and Federal permits associated with dewatering. Dewatering means and methods shall be the responsibility of the Contractor.

3. Utility Adjustments

- a. All adjustments to utilities other than those owned by the County shall be performed by the utility owner.
- b. Adjustments to water services between the property line and the water main shall be performed by Harford County pre-qualified utility contractors. Adjustments between the property line and the house shall be performed in accordance with Harford County Plumbing Code. It shall be the Contractor's responsibility to obtain all permits necessary for the performance of this work.
- c. Adjustments to sanitary sewers within the County Easement or right-of-way shall be accomplished by a Harford County pre-qualified utility contractor. Adjustments to sanitary sewers outside the County Easement or right-of-way shall be performed in accordance with the Harford County Plumbing Code. It shall be the Contractor's responsibility to obtain all permits necessary for the performance of this work.

4. Obstructions Shown on Plans

- a. Certain information regarding the reputed presence, size, character, and location of existing underground utilities and structures has been shown on the Plans based upon available records. There is no certainty of the accuracy of this information, and it shall be considered by the Contractor in this light. If test pit data is not shown on the Plans, the Contractor shall excavate test pits in advance of their work in accordance with Section 02012 of these Standard Specifications to locate existing utilities. The Contractor shall hereby distinctly understand that the County is not responsible for the correctness or sufficiency of the information given. The Contractor shall have no claim for delay or extra compensation on account of incorrectness of information given, or on account of the insufficiency or absence of information regarding obstructions. The Contractor shall have no claim for relief from any obligation or responsibility under the Contract in case the location, size, or character of any underground facility is encountered that is not shown on the Plans.
- b. It shall be the responsibility of the Contractor to notify "MISS UTILITY," all municipal utilities, all utility line owners, and any other parties affected

prior to the beginning of work. It is the Contractor's responsibility to reference and maintain the location markings during the construction of the project. In the event that a utility location needs to be re-established by Harford County, the cost to provide this shall be borne by the Contractor.

5. Removing Obstruction

- a. Should the position of any pipe, conduit, or other structure above or below ground be such as, in the opinion of the County, to require its removal, realignment, or change due to the work to be done under the Contract, the work of removal, realignment, or change will be done as extra work, or will be done by the owner of the obstructions without cost to the Contractor; but the Contractor shall uncover and support the structures in the limits of the trench at their own expense before such removal, and before and after such realignment or change. Whether the obstruction is shown on the Plans or not, the Contractor shall not be entitled to any claim for damage or extra compensation on account of the presence of said structure or on account of any delay in the removal or rearrangement of the same; however, if said structure is not shown on the Plans, time extension will be allowed if deemed to be warranted by the County.
- b. In the event that obstructions would delay the work of pipe installation, the Contractor may, with prior written County approval, be permitted to leave a gap in the work and return to fill the gap after the obstructions have been removed. The installation shall be completed by laying full pipe lengths and appropriate closure pieces.
- c. The Contractor shall not interfere with any persons, firms, or corporations or with the County in protecting, removing, changing or replacing pipes, conduits, poles, or other structures.
- d. In the event that the County has entered into any agreement with an affected utility owner or owners which will have an effect on the operations or financial responsibilities of the Contractor, the requirements of these agreements will be included in the Special Provisions of the Contract.

6. Change of Trench Location

- a. In the event the County directs that the location of a trench be changed to a reasonable extent from that proposed on the drawing on account of the presence of an obstruction, or from other cause, or if a changed location shall be authorized upon the Contractor's request, the Contractor shall not be entitled to extra compensation or to a claim for damages; provided that the change is made before the excavation is begun. If, however, such change, made at the direction of the County involves the abandonment of excavation already made, such abandoned excavation together with the necessary backfill, will be considered extra work and the Contractor shall be compensated accordingly. In the event that the trench is abandoned in favor of a new location, at the Contractor's request, the abandoned excavation and backfill shall be at the Contractor's expense.

- b. If an obstruction shall lie within the trench in such manner that the trench has to be excavated to extra width in order that sheeting or bracing may be properly placed, or in order that a structure to be placed in the trench may be properly built, such extra width of trench shall be classed as miscellaneous excavation. No sloping of sides of excavation, however, for the purpose of avoiding the necessity of placing sheeting or bracing, either in the presence or absence of obstructions, will be considered as excavation beyond pay limits.

7. Trench Width and Depth

- a. Trenches shall be excavated to the necessary width and depth as may be shown on the Plans or Standard Details, as specified in the Special Provisions, or as directed. The trench subgrade shall be such as to provide a uniform and continuous bearing and support for the pipe on solid undisturbed earth for the full length of each pipe, except for that portion at the bell hole. Any part of the bottom of the trench excavated below subgrade shall be backfilled with approved material and compacted in accordance with Contract Documents.
- b. Subgrade, in the case of pipe lines, shall be six (6) inches below the underside of the pipe barrel, where the pipe is laid on granular bedding. Where the pipe is laid on a natural foundation, subgrade shall be four (4) inches below the underside of the pipe barrel.
- c. The sides of the trenches shall be practically plumb and under no circumstances will they be permitted to be sloped except with the written approval of the County. Should the Contractor elect to slope or cut-back the sides of the trench, no additional payment will be made for extra excavation, backfill, restoration, or contingent items beyond the limits indicated on the Standard Details.
- d. Bell holes shall be excavated in the bottom of the trench to ensure that pipe has continuous bearing.
- e. Where sheeting or trench boxes are used, the maximum width shall be as noted in the Standard Details.

8. Length of Open Trench

- a. The Contractor shall keep the backfill operation to the top of trench for offsite and existing areas and to road subgrade in areas of new construction, within 100 feet of excavation and pipe laying operations. The County reserves the right to require the backfilling of open trenches over completed pipe lines if, in their judgment, such action is necessary; and the Contractor shall thereby have no claim for extra compensation, even though to accomplish said backfilling, they are compelled temporarily to stop excavation or other work at any place.
- b. All trenches shall be closed at the end of each work day.
- c. The excavation of all trenches shall be fully completed at least one full pipe length in advance of pipe installation, unless otherwise authorized.

9. Responsibility for Condition of Excavation

The Contractor shall be responsible for the condition of all excavations made by them.

10. Trench Support

- a. The support of the trench shall be the sole responsibility of the Contractor.
- b. The Contractor shall support the sides and ends of all excavations wherever necessary with braces, sheeting, shoring or stringers, trench boxes, or other acceptable excavation support systems. All trench support systems shall be installed by men skilled in such work and shall be so arranged that it may be withdrawn as backfilling proceeds, without injury to the utility or structure constructed or to any roadbed, adjacent structure or property.
- c. All timbering in excavations, trench boxes, or excavation support systems shall be withdrawn as the backfilling is being done, except where and to such extent as the County shall order in writing that said timbering or excavation support system be left in place or where the County permits the trench support to be left in place at the Contractor's expense and upon their request. The Contractor shall cut off any sheeting left in place 2 feet below finished grade and shall remove the material cut off without compensation therefore.
- d. Wherever necessary, in running sand, or soft ground, or for the protection of any structure or property, sheeting shall be driven without extra compensation to such a depth below the bottom of the trench as may be required or directed. Where directed by the County to leave sheeting in place, payment will be made under the appropriate contingent item.
- e. All work shall be performed in accordance with the latest applicable Federal, State, and local safety and health regulations.

11. Drainage and Dewatering

- a. The Contractor shall grade the site as necessary to prevent surface water ponding or from flowing into the trench or other utility excavations and shall provide all necessary temporary surface drainage and keep the same operating to the satisfaction of the County until permanent drainage or finished grading and permanent surface stabilization has been completed.
- b. It shall be the Contractor's responsibility to adequately control water that may be present in the excavation. The Contractor shall provide for the disposal of water removed from excavations in such a manner not to cause damage to public or private property or to any portion of the work completed or in progress or cause any impediment to the use of any area by the public; nor shall the Contractor discharge any flushing or ground water or any material of any nature into existing sanitary sewer system during the construction of the facilities. All water shall be discharged

through an approved sediment control device. The costs of dewatering trench excavations will not be paid for directly, but will be included in prices bid for other related items.

12. Excavation Below Subgrade

- a. The Contractor shall, without additional compensation, before any pipe or appurtenance is installed, fill all unauthorized depressions or irregularities in the bottom of the trench or tunnel with aggregate fill.
- b. Where the bottom of the trench, at subgrade, is in unstable or unsuitable material, excavation shall be carried to such depth as ordered by the County. The trench bottom shall be restored to subgrade with aggregate fill. Excavation and backfill for removal of unsuitable material will be paid for under the appropriate contingent item.

C. Backfill

1. The Contractor shall backfill all trenches as rapidly as practicable after the installation of the utility therein, or after the excavation has served its purpose.
2. Subgrade to 2'-0" above top of pipe: Unless otherwise noted in the Construction Drawings, Specifications or Permits, backfill material shall be carefully placed around and to a depth of two feet over the pipe. These initial lifts shall be carefully placed and hand-tamped in four inch layers. Care should be exercised in this operation to insure that the alignment of the utility is not disturbed.
3. 2'-0" above top of pipe to top of trench: The remainder of the trench may be backfilled in layers not exceeding the specified compaction lift depths. However, if lift thickness is followed and the specified compaction is not obtained based on the testing during backfilling, the Contractor shall, at their own expense, remove, replace, and retest as many times as is required to obtain the specified compactions. In backfilling the remainder of the trench, stones of not more than 6 inches in largest dimension which have been taken out in excavating may be mixed with earth in an amount not exceeding 25% of the backfill volume. Stones of larger size or in greater quantities shall not be used, unless directed by the County. The Contractor shall not permit excavations to be used for the disposal of refuse.
4. In paved areas, the Contractor shall furnish and backfill the trench as per the requirements of the governing regulatory agency, and/or Contract Documents.
5. Should additional material be required for backfilling in excess of that obtained from excavation, the Contractor shall obtain Borrow material from off-site sources, to complete the trench backfill.
6. Use of frozen backfill material is prohibited.
7. Pipe, structures, appurtenances and backfill material shall not be laid upon frozen soil or aggregate.

D. Compaction

1. In unimproved areas (areas not identified in paragraph 2 below), compaction shall be accomplished as follows for the remaining depth of trench: Suitable Material shall be placed in maximum 2 foot layers or as approved by the County and compacted in such a manner that a completely dense refill is obtained which is free of voids and not susceptible to undue settlement or depression.
2. Soil compaction, certified by a soils testing company will be required under the following conditions, unless otherwise shown on the Construction Drawings, noted in the Specifications or required in the permit:

- a. Road Right-of-Ways, Roadways, driveways, parking lots, sidewalks and other easement areas with vehicular loads; and all business, commercial or industrial property.

The remaining trench depth up to a depth of two feet below sub-base shall be backfilled with Suitable Material and mechanically tamped in layers not to exceed twelve inches to not less than 92% of the maximum density at optimum moisture content as determined by the Modified Proctor Method, AASHTO Designation T-180. The remaining trench shall be backfilled with Select Material (top 1-foot) shall be compacted to not less than 97 percent of the maximum dry density determined as noted above. All compaction must comply with the aforementioned or the latest edition of the governing applicable road code or permit whichever is most stringent. In some circumstances, lawn and landscaped areas may require the above compaction standards.

- b. Residentially Zoned Property (Maintained lawn and landscaped areas)

The remaining trench depth shall be backfilled with Suitable Material and mechanically tamped in layers not to exceed twelve inches to not less than 85% of the maximum density at optimum moisture content as determined by the Modified Proctor Method, AASHTO Designation T-180.

3. Insofar as the specifications for mechanical tamping equipment or methods are concerned, no specific requirements are included in these Specifications other than that the use of any particular type of equipment is subject to the approval of the County and that the County has the right to judge if equipment is unsuitable for the uses intended. The Contractor shall be cognizant that use of hand-tamping equipment may be required around existing utilities.
4. For developer projects, the developer or contractor shall inspect and test the soil compaction utilizing a County-approved soils testing company to ensure the requirements are met in paragraph 2 above. A full-time soils testing technician shall be on-site performing compaction tests during all backfilling operations. The following shall be required of the soils testing company:
 - a. Prior to construction, perform modified Proctor Test T-180 on bag samples of proposed backfill material for the purpose of obtaining moisture-density relationship curves (Proctor curves). The soils

technicians inspecting the backfilling operations shall have the proctor curves with them at all times.

- b. Monitor and document all backfill operations that are subject to compaction certification.
- c. The soils technicians shall assure each lift meets the compaction requirements noted on the construction drawings. Testing shall occur at least once each day on every lift, with the spacing of the tests not to exceed 100 feet. The moisture and density of the soil shall be tested by either the sand cone method or by nuclear density gauge. The soils technician shall notify the contractor if any lift does not meet the compaction requirements. The contractor shall then re-compact the backfill as necessary until the minimum compaction has been achieved. The soils technician shall note the station and depth of each test and re-test with results. The contractor shall not proceed until the minimum compaction requirements have been met.
- d. The soils technician shall provide the County Inspector with copies of the reports on a daily basis on the day the testing occurred.
- e. The soils technician shall take moisture tests of the backfill material a minimum of twice daily. If the tested soil moisture will prevent the required density, the technician shall immediately notify the Contractor. The Contractor shall then take the necessary steps to modify the soil moisture to acceptable levels that will achieve the minimum compaction requirements without the use of additives.
- f. The soils technician shall determine if the backfill material meets the requirements of the Standard Specifications.

For capital projects, Harford County will retain the services of a soils testing company at the County's expense.

E. Maintenance of Backfilled Trench

- 1. All backfilled trenches shall be maintained in an acceptable condition by and at the expense of the Contractor for a period of twelve (12) months following the date of conditional acceptance of the work.
- 2. If the Contractor fails to fill depressions in the backfilled trench within 24 hours after the receipt of notice from the County, the County may refill said depressions and the cost thereof shall be retained from any monies due the Contractor, under the Contract. In case of emergency, the County may refill any dangerous depression or protect with lights wherever necessary without giving previous notice to the Contractor; and the cost of so doing shall be retained from any monies due to become due the Contractor under the contract.
- 3. The Contractor shall be responsible for any injury or damage that may result from lack of maintenance of any refilled excavation at any time prior to final acceptance of the Project.

4.0 METHOD OF MEASUREMENT

A. Trench Excavation, Backfill and Compaction

Trench excavation, backfill, and compaction will not be measured as a separate item, but will be included with other items of work contained in the Bid Documents.

5.0 BASIS OF PAYMENT

A. General

1. No separate payment will be made for trench excavation, backfill, and compaction. The cost shall be included in the price bid for installing pipe, or constructing the various appurtenances included in the Contract. The bid prices shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.

B. Trench Excavation, Backfill and Compaction

In addition to the work listed above, trench excavation, backfill, and compaction shall also include the traffic control, removing, storing, and rehandling of surface materials over the trench, including paving; the scoring of existing paving in a straight and uniform line; the excavation of all materials encountered in the trench including excavation at manholes, structures, vaults, and other appurtenances that may be shown or required, and any extra excavation necessary for sheeting or bracing or installation of other excavation support systems; the backfilling and compaction of trenches; the removal and disposal of unsuitable and/or surplus material; and all other incidental items to complete the work.

SECTION 02300 BORING AND/OR JACK PIPE

1.0 GENERAL

A. Description

Boring and/or jacking pipe shall include, but not necessarily be limited to, furnishing and installing carrier pipe and/or casing pipe beneath railways, roadways, or other locations indicated on the Plans and in accordance with the Contract Documents. The work consists of the furnishing of a trenchless installation which serves as a casing for utilities. The trenchless excavation shall be installed to the lines and grades shown on the Construction Drawings. The Contractor shall be responsible for selecting a method suitable for the conditions to be encountered and to assure no disturbance to the existing surface.

B. Related Work Included Elsewhere

1. Aggregate Backfill: Section 02240
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Water Mains: Section 02660
4. Water Services and Appurtenances: Section 02664
5. Gravity Sanitary Sewer and House Connections: Section 02700
6. Sanitary Sewer Force Mains: Section 02720

C. Quality Assurance

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

D. Railroad Crossings

No work shall begin without a fully executed Agreement between the County and the Railroad. The Contractor is required to read and adhere to all terms and conditions of the Agreement. The Contractor shall furnish and install all materials specified in the Agreement.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for boring and/or jacking pipe.

B. Detailed Material Requirements

1. Portland Cement Concrete

Portland cement concrete for inverts or cradles shall be Mix No. 1 as specified in Section 03300 of these Standard Specifications.

2. Mortar for Grout

- a. Mortar used for grouting voids outside the casing pipe shall conform to the requirements of Section 04100 of these Standard Specifications except that it shall be composed of one part Portland cement and three parts sand.
- b. Mortar used for bulkheading sleeve ends shall conform to the requirements of Section 04100 of these Standard Specifications.

3. Brick Masonry

Brick Masonry for bulkheading sleeve ends shall conform to the requirements of Section 04200 of these Standard Specifications.

4. Steel Casing Pipe

- a. Steel casing pipe shall be smooth walled and have a minimum yield strength of 36,000 psi (ASTM A-570, Grade 36). Minimum wall thickness shall be as noted herein or as specified in the Contract Documents. Pipe shall conform to AWWA C-200.

Casing Pipe

<u>Nominal Pipe Size (inches)</u>	<u>Wall Thickness (inches)</u>
12	0.375
16	0.375
20	0.375
24	0.375
30	0.500
36	0.500
48	0.500

- b. The pipe shall be fabricated and field connected in accordance with Section 02660 of these Standard Specifications. Joints shall be fully welded around the circumference of the pipe.
- c. The exterior of the pipe shall have a factory applied bituminous coating. The field connection shall also be bituminous coated before installation. Bituminous coating shall meet the requirements of AWWA C210.

5. Carrier Pipe

Carrier pipe shall be as specified in the Contract Documents and meet the requirements specified in Sections 02660, 02700, or 02720 of these Standard Specifications as appropriate.

6. Casing Spacer/Insulators

- a. Casing spacer/insulators shall be fabricated items capable of providing position, support and separation of carrier pipes inside casing pipes. Spacer/insulators shall be virtually corrosion-proof and resistant to sodium chloride and acids.
- b. Spacer/insulators shall provide the ability to position the carrier pipe within the casing. Unless otherwise approved by the Division of Water and Sewer, the concentric centering method shall be utilized. Spacer/insulators shall be capable of grade adjustment to position a gravity sewer to its required grade alignment within a casing pipe and to maintain the required carrier pipe alignment due to irregularities in the casing pipe alignment.
- c. Spacing/insulators shall be injection molded high density virgin polyethylene or an ultra high molecular weight polymer. The carrier pipe shall be capable of sliding within the casing pipe with minimal pushing force. The bearing surfaces of runners shall have a high resistance to wear and abrasion, high impact strength, low deflection under compression, and low coefficient of friction.

3.0 EXECUTION

A. Preparation

1. Bored and/or jacked pipe greater than 4 inches in diameter shall receive a casing pipe unless directed otherwise by the Director.
2. Preliminary work shall consist of excavating and sheeting a suitable shaft on the lower side of the crossing and installation of a backstop and guide rails. The guide rails shall be long enough to hold at least two lengths of pipe and shall be carefully checked for line and grade before any pipe is placed on them.
3. Design, construction, maintenance and removal of the jacking pit and receiving pits, including damage attributed to the construction of the pits shall be the responsibility of the Contractor. The Contractor shall be responsible for any necessary support or protection of utilities related to the jacking and receiving pit construction. Utility support and protections, for those utilities shown on the construction drawings shall be at no additional cost to the County.
4. The Contractor shall provide, operate and maintain for the duration of the construction, a ventilation system, lighting, and other health and safety measures suitable for meeting local, State and Federal health and safety requirements.

B. Boring and/or Jacking

1. 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 arrangement shall be removable from within the pipe in the event an obstruction is

encountered. The excavation by the cutting head shall not exceed the outside diameter of the pipe by more than 2 inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft material.

2. If an obstruction is encountered during installation that stops the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations shall cease and the pipe abandoned in place and filled completely with flowable fly ash.
3. 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 County shall be employed to fill such voids.
4. When groundwater is encountered in the excavation, pumps of sufficient capacity to handle the flow shall be maintained at the site. The pumps shall be in constantly attended operation on a 24 hour basis until their operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of surface facilities. Should settlement or displacement be detected, the Contractor shall notify the County immediately and take such action as necessary to maintain safe conditions and prevent any further damage. Discharge of groundwater shall meet all local, State, and Federal regulations and shall be borne by the Contractor at their expense.
5. All operations shall be conducted so as not to interface with, interrupt, or endanger the operation of traffic, or damage, destroy, or endanger the integrity of any surface facilities.
6. Carrier pipe will be tested in accordance with Section 02660 or Section 02700 of these Standard Specifications as applicable.
7. Each end of the sleeve will be bulkheaded in accordance with Section 02050 of these Standard Specifications.

C. Installation of Carrier Pipe

1. Carrier pipe shall be installed within the casing pipe as shown in the Contract Documents and as specified in Sections 02660, 02700, and 02720 of these Standard Specifications.
2. There shall be no direct contact between carrier pipe and casing pipe. There shall be no less than three pipe spacer/insulators per segment of pipe. The first spacer shall be placed not more than two feet from each end of the casing pipe. Spacer placement intervals shall be set to maintain joint stability during and after installation, to maintain separation distance between casing and carrier pipe and to maintain required grade adjustments. Interval between spacers shall be seven to nine feet however, manufacturer recommendations shall be adhered to for type, size, and live load of carrier pipe.

4.0 METHOD OF MEASUREMENT

A. Casing Pipe

Measurement for bore and/or jacked casing pipe will be made of the length of casing pipe satisfactorily installed. Measurement will be made horizontally along the centerline of the pipe between the ends of the casing pipe.

B. Carrier Pipe

Carrier pipe will not be measured as it will be incidental to the casing pipe installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.
3. Should a contractor elect to make a boring and/or jacking pipe under trees, sidewalks, curbs, pipelines, or similar obstructions that are not specifically noted as a boring and/or jacking operation in the Contract Documents it shall be done at no additional cost to the County.

B. Casing Pipe

Payment for bored and/or jacked casing pipe will be made per linear foot for the various diameters of casing pipe furnished and installed by boring and/or jacking. The price(s) bid shall include the traffic control, compaction, excavation, support, and restoration of the boring and receiving pits; removal and disposal of excess excavated material; dewatering, settlement monitoring; carrier pipe, fittings, jointing material, joint restraint, testing, disinfection (if applicable), and incidental items to complete the installation.

C. Carrier Pipe

Payment for bored and/or jacked carrier pipe will not be made as it will be incidental to the casing pipe installation.

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SECTION 02310 DIRECTIONAL BORING OR PRESSURE SEWER

1.0 GENERAL

A. Description

The pressure sewer shall be located within the easement and within 1 foot horizontally and within 2-inches vertically of the alignment shown on the contract plans and shall be installed by directional boring. Directional boring shall be conducted so as to minimize the number and size of excavation holes.

B. Operating Expertise

The Contractor or their Subcontractor must demonstrate expertise in trenchless methods by providing the County a list of ten utility references for whom similar work has been performed within the last three years prior to the pre-construction meeting. The references should include a name and telephone number where contact can be made to verify the contractor capability. The Contractor must provide documentation showing successful completion of the projects used for reference. The pre-construction meeting may not be scheduled until after the County approves of the above expertise. Conventional trenching experience will not be considered applicable.

C. Submittals

1. The Contractor shall submit technical data for equipment, method of installation, and proposed sequence of construction for approval by the County. The submittal shall include information pertaining to working and receiving shaft, dewatering, method of spoils removal, size and capacity of equipment capabilities for installing pipes on a curve, type of cutter head, drilling fluid type, method of monitoring line and grade, and detection of surface movement.
2. Prior to the pre-construction meeting and County approval to perform the directional boring, the Contractor must submit the names of supervisory field personnel and historical information of directional boring experience. In addition, the Contractor must submit for approval the name plate data for the drilling equipment and mobile spoils removal unit and MSDS information for the drilling slurry compounds.

D. Related Work Specified Elsewhere

1. Clearing and grubbing: Section 02110
2. Trench Excavation, Backfill and Compaction: Section 02250
3. Low Pressure Sewer: Section 02731
4. Sewage Grinder Pumping Units: Section 11307

E. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

Materials shall be in accordance with Section 02731 of these Standard Specifications.

3.0 EXECUTION

A. Installation

1. Unless otherwise prohibited by specific wetland permit requirements or otherwise shown on the construction drawings or specified, prior to installation, the entire drainage and utility easement and/or right-of-way shall be cleared and grubbed in accordance with Section 02110 of these Standard Specifications.
2. Installation shall be in trenchless manner producing a continuous bore. The number of access pits shall be kept to a minimum.
3. The drilling system shall be remotely steerable and permit electronic monitoring of tunnel depth and location. Accurate placement of pipe at up to eight feet deep, within a \pm 2-inch window is required. The drilling device shall be capable of drilling a 90 degree, 35-foot radius curve.
4. The equipment must be capable of boring the following lengths in single bores, and successive boring pits will not be allowed to be any closer than the following distances:

<u>Pipe Size</u>	<u>Boring Distance</u>
1 in. to 1 2 in.	400 feet
2 in. to 2 2 in.	350 feet
3 in. to 6 in.	300 feet

5. Drilling must be performed by a fluid cutting process (high pressure/low volume), utilizing a liquid/clay slurry, i.e. bentonite. The clay slurry must be totally inert vacuum spoils recovery vehicle on site to remove the drilling spoils from the access pits. The spoils must then be transported from the job site and be properly disposed of. Under no circumstance will the drilling spoils be permitted to be disposed of into sanitary, storm, or other public or private drainage systems.
6. Mechanical, pneumatic, or water jetting methods will be considered unacceptable due to the possibility of surface subsidence.
7. Upon Owner request, the Contractor shall prove the accuracy of the electronic monitor every fifty (50) feet of directional bore in the presence of the Owner during directional drilling operations via test pit every 50' of bore. If the above accuracy is not met, the Contractor shall adjust or provide the necessary equipment which will meet the accuracy requirements. All such calibration costs shall be at no cost to the Owner.

8. After an initial bore has been completed, a reamer head shall be installed at the termination pit, and the pipe and reamer head shall be pulled back to the starting pit. The reamer must also be capable of discharging liquid clay to facilitate the installation of the pipe into a stabilized and lubricated tunnel. Reaming diameter shall not exceed 1.5 times the outside diameter of the pipe being installed.
9. The pipe being pulled into the tunnel will be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.
10. Pullback forces shall not exceed the manufacturers recommended allowable pulling force for the product pipe.
11. The Contractor shall allow sufficient lengths of pipe to extend past the termination point to allow connections to adjacent pipe sections. Pulled pipe shall be allowed a minimum of twenty-four (24) hours of stabilization prior to making tie-ins. The extra length of pipe shall be sufficient to make all necessary connections and tests.
12. Upon completion of boring and pipe installation, the Contractor will remove all spoils from the starting and termination pits. All pits will be compacted as per County and contract documents and be restored to their original condition.

B. Safety

1. Because the directional boring may encounter existing buried electrical lines, the following safety requirements must be met.
 - a. All drilling equipment must have a permanent inherent alarm system capable of detecting an electrical current. The ground system shall be equipped with an audible alarm to warn the operator when the drill head nears electrified cable.
 - b. All crews shall be provided with grounded safety mats, heavy gauge ground cables with connectors, and hot boots and gloves.
 - c. All supervisory personnel must be adequately trained and have direct supervisory experience in directional boring.

C. Obstruction/Alignment

1. The bore shall not deviate from the horizontal alignment shown on the drawings by more than one (1) foot. If obstructions are encountered during the drilling operation, the Owner shall be notified immediately. With approval of the Owner, the Contractor shall attempt to go around the obstruction. If a deviation of more than three (3) feet from the horizontal alignment is required to bypass the obstruction, the Owner shall be immediately consulted to determine if adjustments in the alignment are required. At no time shall the alignment be allowed to exit the sewer easement or right-of-way. To prevent dips and high points in the pipeline profile, a vertical deviation in the pipeline profile may not exceed two (2) inches.

2. The Contractor shall employ all means necessary to complete the pipe installation as specified at no additional cost to the Owner. Any deviation from the previously approved means and methods shall be approved by the Owner prior to the implementation.
3. The Contractor shall mark the location and depth of the alignment with spray paint on paved surfaces and wooden stakes on non-paved surfaces at twenty-five (25) foot intervals. The Contractor shall record the depth of the sewer at the twenty-five (25) foot intervals and provide a copy of the record to the Owner upon completion of the installation of each bore. The Contractor shall measure or survey locations where the horizontal alignment deviates from the proposed alignment and incorporate the changes in the as-built drawings.
4. If the bore pipe installation has deviated beyond the specified tolerances, it shall be the Owners option to require the Contractor to abandon the bore, or remove the installed pipe, and rebore or reinstall the pipe on the correct alignment at no additional cost to the Owner.

D. Detection

1. Tracer Wire: All non-metallic pipe shall have tracer wire secured with duct tape to the top of the pipe. The wire shall be continuous for the full length of the pipeline. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.
2. Detector wire shall be terminated from each pipe run in each structure along the system, i.e. flushing connection vaults, air release vaults, service valve assembly vaults, etc. Allow adequate length of each wire in the structure, so it may be pulled one (1) foot out of the top of the structure for connection of detection equipment.
3. The detection wire shall be tested for continuity for each bored installation before acceptance by the Owner.
4. Detection tape is not required for pipe installed by directional boring.

4.0 METHOD OF MEASUREMENT

The amount of directional boring of pressure sewer shall be measured in accordance with Section 02731 of these Standard Specifications.

5.0 BASIS OF PAYMENT

Payment for directional boring of pressure sewer will not be made, as it shall be included in the unit price item for low pressure sewer Section 02731 of these Standard Specifications. Payment shall include clearing and grubbing.

SECTION 02400 TUNNELING

1.0 GENERAL

A. Description

Tunneling shall include, but not necessarily be limited to, furnishing and installing tunnel liners beneath railways, roadways, or other locations indicated on the Plans and in accordance with the Contract Documents. The work consists of the furnishing of a trenchless installation which serves as a liner for utilities. The trenchless excavation shall be installed to the lines and grades shown on the construction drawings. The Contractor shall be responsible for selecting a method suitable for the conditions to be encountered and to assure no disturbance to the existing surface.

B. Related Work Include Elsewhere

1. Aggregate Backfill: Section 02240
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Water Mains: Section 02660
4. Gravity Sanitary Sewer and House Connections: Section 02700
5. Sanitary Sewer Force Mains: Section 02720

C. Quality Assurance

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

D. Railroad Crossings

No work shall begin without a fully executed Agreement between the County and the Railroad. The Contractor is required to read and adhere to all terms and conditions of the Agreement. The Contractor shall furnish and install all materials specified in the Agreement.

E. Design

The trenchless excavation method shall be designed for the earth, construction, and other loads present plus AASHTO HS25 Highway Live Load increased 30 percent for impact. If the tunnel crosses a railway, it shall meet the design standards of the Railway Company. The Contractor's engineer, or appropriate design professional, who must be registered in the State of Maryland, shall prepare the design for review by the Engineer. Steel Tunnel Liner Plates, if used, shall be designed in accordance with the latest edition of the Standard Specifications for Highway Bridges adopted by the American Association of State Highway and Transportation Officials. All design shall be in accordance with OSHA, MOSH and all federal, state and local regulations.

F. Working Drawings

The Contractor shall submit working drawings for review by the Engineer on the trenchless excavation method itself and on any required launching/jacking and receiving pits. The Working Drawings shall be signed and sealed by the Contractor's engineer, or appropriate design professional. The Contractor shall submit six copies of drawings showing typical sections and details of the trenchless excavation method to be used, and any grouting procedures. Working Drawings shall contain certification by the Contractor's engineer that the proposed trenchless excavation method and the proposed construction of any launching/jacking and receiving pits have been designed in accordance with these Specifications. County review of the working drawings shall not relieve the Contractor of the responsibility and liability for the adequacy and accuracy of the working drawings when implemented in the field.

G. Preconstruction Survey

The Contractor shall survey, photograph, and videotape all buildings, structures, and roadways within a horizontal distance of the centerline of the trenchless excavation that is three times the vertical distance from the invert of the trenchless excavation to the finished grade over the trenchless excavation. This survey shall be performed by a company that can show acceptable previous experience to the County. The Survey shall be prepared and submitted to the County and shall be sufficient to document the existing condition of any cracks, settlement, upheaval, spalls, or other existing deficiencies in existing buildings, structures, or roadways. If the trenchless excavation is under wetlands or other surface, the complete condition of the wetlands or other surface which is over the proposed trenchless excavation shall be documented. The Preconstruction Survey shall be submitted, reviewed, and approved by the County before any activity related to the trenchless excavation begins.

H. Submittals

The Contractor shall submit the following to the Engineer for review:

1. Working Drawings, Trenchless Excavation Plan, and Preconstruction Survey, describing in detail the proposed methods, procedures and the entire operation to be used, shall include but not be limited to the following:

General

- a. size, capacity and arrangement of equipment
- b. method of dewatering and drainage
- c. method of ground stabilization and materials, if proposed, and evidence of experience and competency
- d. method of detection of ground movement
- e. method of monitoring and controlling line and grade

Tunneling

- a. launching and receiving pits

- b. method of excavation and removing soils materials
 - c. method of support of tunnel face and initial supports
 - d. method of erecting, placing and operating the tunnel shield
 - e. grout and concrete design mix specifications
 - f. method and procedure for the placement of gravel pack or grout between the tunnel liner plates and the excavation
 - g. method and procedure for installing the carrier pipe, and casing spacer/insulators, or supports and anchors, to prevent flotation and surge pressure buckling
 - h. method of bulkheading the tunnel ends
2. Certified test reports for liner plates and connectors, and shop drawings and specifications showing sizes, shapes, methods of attachment, connection details and grout hole details, shall be submitted for conformance with the specifications and approved by the Engineer before delivery of materials. Certifications for liner plates shall be in accordance with AASHTO M167, Paragraph 18.
 3. Certified test reports for casing pipe, and shop drawings and specifications showing sizes, joint welds, and coatings, shall be submitted for conformance with the specifications and approved by the Engineer before delivery of materials.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for tunneling.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Portland Cement Concrete

Portland cement concrete for invert cradles shall be Mix No. 1 as specified in Section 03300 of these Standard Specifications.

2. Mortar for Grout

For filling voids outside the liner plate, the grout shall conform to the requirements of Section 04100 of these Standard Specifications and the following. The mortar shall be composed on one (1) part Portland Cement (Type 1) and three (3) parts sand with only enough water to permit the material to flow properly. The grout shall remain fluid long enough to be

injected through the lining and to fill the voids and shall set promptly enough to avoid grout flowing into the new annular space after the next advance.

3. Liner Plate

- a. All materials shall be new and unused. Steel liner plates shall conform to the requirements of ASTM A569 and AASHTO M167. Steel liner plates shall have the minimum mechanical properties of flat plate before cold forming as follows:

Tensile strength	=	42,000 psi
Yield strength	=	28,000 psi
Elongation, 2 inches	=	30%

The liner plate thickness provided shall be no less than that shown in the Contract Documents. If the proposed tunneling method includes jacking operations, liner plate thickness shall be increased to withstand the jacking pressure to be imposed.

Tunnel liner plate segments shall be fabricated with such accuracy and uniformity in dimensions that segments shall be entirely interchangeable, not only with individual rings but with similar segments of other rings. All plates shall be punched for bolts on both longitudinal and circumferential seams and shall be so fabricated as to permit complete erection from the inside of the tunnel. In 2-flange plates, the longitudinal lapped seams shall have four bolts per foot. To provide four bolts per foot, holes along the edge of the plates that will form the longitudinal seams in the finished structure shall be staggered in rows two inches apart with holes in one row in the valleys and holes in the other row in the crests of the corrugations. The tolerance of hole diameter shall be plus or minus 0.02 inches. Liner plate grouting rings shall be located longitudinally at 48-inch or 54-inch intervals, depending on plate size. Liner plate grouting rings shall have a minimum of four grout holes in each grouting ring with one hole each at 2:00, 4:00, 8:00 and 10:00 positions. Grout holes shall be 1 ½ or 2-inch diameter pipe half couplings welded to the liner plate.

- b. The liner plates shall be coated on both sides as follows:
- i. Liner plates shall be hot-dipped galvanized using prime westerns spelter, or equal in accordance with AASHTO M167. In no case shall the coating application be less than 2 oz/sq. ft. Spelter coating shall be of first class commercial-quality, free from defects such as blisters, flux, and uncoated spots.
 - ii. Liner plates shall be bituminous coated on all sides in accordance with AASHTO M190, Type A pipe.
- c. Bolts and nuts used with 4-flange plates shall be not less than ½ inch in diameter for plate thicknesses less than or equal to 0.179 inch (7 gauge) and not less than 5/8 inch in diameter for plate thicknesses greater than 0.179 inch. Bolts shall have quick-acting coarse threads meeting the

requirements of ASTM A307. Nuts shall have quick-acting course threads meeting the requirements of ASTM A307, grade A. Bolts and nuts shall be hot-dip galvanized in accordance with ASTM A153.

4. Carrier Pipe

Carrier pipe shall be as specified in the Contract Documents and meet the requirements specified in Sections 02660, 02700, or 02720 of these Standard Specifications as appropriate.

5. Surface Settlement Markers

- a. Surface settlement markers within pavement areas shall be P.K. nails.
- b. Surface settlement markers within non-paved areas shall be wooden hubs.

6. Casing Spacer/Insulators

- a. Casing spacer/insulators shall be fabricated items capable of providing position, support and separation of carrier pipes inside casing pipes. Spacer/insulators shall be virtually corrosion-proof and resistant to sodium chloride and acids.
- b. Spacer/insulators shall provide the ability to position the carrier pipe within the casing. Unless otherwise approved by the Division of Water and Sewer, the concentric centering method shall be utilized. Spacer/insulators shall be capable of grade adjustment to position a gravity sewer to its required grade alignment within a casing pipe and to maintain the required carrier pipe alignment due to irregularities in the casing pipe alignment.
- c. Spacing/insulators shall be injection molded high density virgin polyethylene or an ultra high molecular weight polymer. The carrier pipe shall be capable of sliding within the casing pipe with minimal pushing force. The bearing surfaces of runners shall have a high resistance to wear and abrasion, high impact strength, low deflection under compression, and low coefficient of friction.

3.0 EXECUTION

A. Line and Grade

The Contractor shall be responsible for extending the line, grade, and elevation in the tunnel/casing from the launching/jacking pit. The Contractor shall submit to the Engineer for approval the method it proposes to use for extending controls within the tunnel/casing. No work in these areas will be allowed to be performed prior to such approval. The Engineer may make periodic checks on the lines, grade elevation, etc., established by the Contractor. The Contractor shall maintain line and grade to within plus or minus 2 inches of that indicated on the Contract Documents.

B. Job Conditions

Blasting is prohibited without the explicit written approval of the County.

Tunneling, or jack and bore construction shall be performed so as not to interfere with, interrupt or endanger surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the casing pipe. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the casing pipe, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from trenchless operations and shall repair and restore damaged property to its condition prior to being disturbed at no cost to the County or Owner of property or additional cost to the Contract.

The Contractor shall comply with applicable ordinances codes, statues, rules and regulations of the State of Maryland, MDSHA, applicable County building codes, and applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Caissons".

C. Excavation Support Systems and Dewatering Systems

Excavation Support Systems and Dewatering Systems shall meet the requirements of Section 2250 of these Standard Specifications, and the following:

1. Dewatering – When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Discharge from dewatering operations shall be directed into approved receiving basins in accordance with all applicable regulatory requirements. When dewatering, the Contractor shall maintain close observation of the highway or railroad to detect any settlement or displacement of the embankment, tracks or other facilities.

Methods of dewatering shall be at the option and responsibility of the Contractor with prior County approval. The Contractor shall maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, the Contractor shall notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

2. Protection of Drainage Facilities – If it becomes necessary during construction to block a ditch, pipe or other drainage facility, the Contractor shall install temporary ditches, pipes or other drainage facilities to maintain adequate drainage as approved by the Engineer, or the property owner. The temporary facilities shall be removed and the permanent facilities restored upon completion of the work.

The Contractor shall use soil erosion attenuation methods and materials to protect ditches and other drainage facilities during construction.

3. Construction of Launching and Receiving Pits – Design, construction, maintenance and removal, including any damage attributed to the

construction of launching and receiving pits, is the responsibility of the Contractor.

Launching and receiving pits shall be constructed in accordance with approved working drawings sealed by a professional engineer registered in the State of Maryland.

Excavation, backfill and grading shall be performed in accordance with Section 2250 of these Standard Specifications and to the requirements specified herein.

The Contractor is responsible for any necessary utility relocations or the supporting of utilities for launching/jacking and receiving pits during construction. Utility support and relocations, for those utilities shown on the construction drawings, shall be at no additional cost to the County.

D. Ground Movement Monitoring

The Contractor shall carry out operations to minimize horizontal displacement, settlement and/or heave of the ground, and shall be responsible for all damage due to displacement, settlement consolidation or heave from any construction related activities.

No horizontal displacement, settlement or heave will be permitted at property structures.

The Contractor shall install and maintain a system of instrumentation to monitor the underground excavation operation and to detect movement in the soil, adjacent structures and utilities.

Installation of the instrumentation by the Contractor shall not preclude the Engineer, through an independent Contractor or consultant, from installing instrumentation to monitor ground movement in or adjacent to the construction work.

Survey benchmarks used for ground movement monitoring shall be a sufficient distance away from the construction to avoid errors in readings due to ground movement.

The Contractor shall cooperate fully with the agency which has rights to the right-of-way. Settlement detected shall be corrected by the Contractor at no additional cost to the Contract.

The contractor shall report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action, at no additional cost to the Contract.

In the event of movement of the ground surface, structure or utility being detected or damage recorded, the Engineer may order that the work be stopped and secured. Before proceeding, the contractor shall correct any problems causing or resulting from such movement at no additional cost to the Contract. If ground settlement or heave occurs which might affect the accuracy of temporary

or permanent benchmarks, it is the Contractor's responsibility to monitor and report such movements to the Engineer.

E. Power Supply

Provide temporary electric lights to properly and safely illuminate all parts of the tunnel construction area including special illumination at the working face. Lighting circuits shall be thoroughly insulated and separated from power circuits, and lights shall be enclosed in wire cages. The Contractor shall secure all necessary electrical permits to prosecute the Work.

Power machinery and tools within the tunnel shall be operated by either electricity, compressed air, diesel with approved scrubber or other approved power. Electrical tools and equipment shall be grounded in accordance with the latest requirements of the National Electrical Code.

F. Ventilation and Air Quality

The Contractor shall provide, operate, and maintain for the duration of the trenchless project a ventilation system suitable for meeting applicable local, state and federal safety requirements for the health of the workers.

G. Tunneling Operations

Tunneling equipment shall be of U.S. Bureau of Mines approved types.

The tunnel face shall be controlled using such support procedures as breasting, poling plates, face jacks, sliding tables, either singly or in combination, spaced as required.

Excavate in such a manner that voids behind liner plates are held to a minimum. Immediately after each increment of excavation, install one ring of liner plates. Completely fill voids with grout, or gravel pack followed by grout, placed under pressure as specified in this Section.

The use of water or other liquids to facilitate liner plate installation and/or spoil removal is prohibited.

Whenever the tunneling operation is suspended, the face or heading shall be completely bulkheaded or supported by positive means and all completed liner plate rings shall be grouted. The dewatering system shall remain operating. Qualified personnel shall periodically check conditions that might threaten the stability of the work.

Spoil from the work shall be disposed of off-site at a permitted facility or location.

1. Tunnel Shield – The shield shall be of steel construction, designed to support railroad loading in addition to the other loadings that it must sustain. The advancing face shall be provided with a hood extending no less than twenty (20) inches beyond the face, and extending around no less than the upper 240° of the total circumference. It shall be of sufficient length to permit the installation of at least one complete ring of liner plates within the shield before it is advanced for the installation of the next ring of liner plates. The shield

shall conform to, and not exceed, the outside diameter of the liner plate tunnel being installed by more than one (1) inch at any point on its periphery unless otherwise approved by the Engineer.

The shield shall be adequately braced and provided with the necessary appurtenances for completely bulkheading the face with horizontal breast boards, and arranged so that the excavation can be benched as necessary. Excavation shall not be advanced beyond the edge of the hood, except in rock.

2. Installation of Tunnel Lining – The Contractor shall construct tunnel to the line and grade shown on the Contract Documents.

The inside dimensions of the tunnel liner plate ring, measured along the diameter at any location, shall not vary more than three percent of the liner plate diameter.

Liner plates shall be installed in a manner that will not damage the liner plates or coating. Damaged liner plates shall be replaced at no additional cost to the Contract. Coating damage shall be repaired to the satisfaction of the Engineer.

Flanges which will be in contact with each other shall be cleaned of foreign matter, taking care not to damage the coating in the cleaning process. Such surfaces shall be free from material that could interfere with proper bearing and water tightness.

Bolt liner plates in accordance with liner plate manufacturer's recommendations. Retighten or replace bolts as required.

3. Grouting – Cement grout shall be placed under pressure through the grout holes to fill any voids that exist between the liner plates and the undisturbed earth.

Grouting shall be kept as close to the heading as possible, using grout stops behind the liner plates, if necessary. In no case shall more than six (6) lineal feet of tunnel be progressed beyond the grouting. Grouting shall be done:

- a. At more frequent intervals than six (6) feet if conditions warrant;
- b. At the end of the work shift, or when work is interrupted for any reason; or
- c. Progressively with each adjacent set of grout holes.

In general, grouting shall proceed progressively upward from the lowest grout holes of each ring. When going from lower to higher grout holes, do not make connection to the higher holes until grout has completely filled the space below. Continue grouting until grout appears in the next set of grout holes, which shall be kept open during grouting to permit escape of air and water.

A threaded plug shall be installed in each grout hole as the grouting is completed at that hole.

The grout pump and injection system shall be of a type that will deliver the grout in a smooth even flow without surge. The grouting circuit shall contain a return line to allow return of the grout from the nozzle to the supply tanks. The grouting equipment shall be capable of development a uniform pressure at the grout hole connection sufficient to fill voids without disturbing the liner plates, adjacent utilities, structures or roadways. The equipment shall be equipped with hoses having a minimum inside diameter of 1 ½ inches and have a minimum capacity of ½ cubic yard per minute.

4. Placement of Invert Concrete – Place concrete fill in invert of tunnels even with edges of liner plate flanges, and to the limits shown on the Contract Documents, to facilitate skidding carrier pipe into tunnel. Concrete fill shall not be poured as a level floor.

4.0 METHOD OF MEASUREMENT

A. Tunneling

Measurement for earth tunneling and liners will be made horizontally along the centerline of the tunnel satisfactorily installed between the ends of the tunnel.

B. Carrier Pipe

Carrier pipe will not be measured as it will be incidental to the tunnel liner installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum price bid. The price bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.
3. Should a contractor elect to install a tunnel in lieu of a bore and jack under roads trees, sidewalks, curbs, pipelines, or similar obstructions that are not specifically noted as a tunneling operation in the Contract Documents it shall be done at no additional cost to the County.

B. Liner Plate

Payment for liner plate will be made per linear foot for the various diameters of liner plate furnished and installed by the tunneling operations. The price(s) bid shall include the traffic control, excavation, support, grouting, backfill, compaction, and restoration; removal and disposal of excess excavated material; dewatering, settlement monitoring; furnishing and placing grout within the tunnel liner plate; carrier pipe, fittings, jointing material, joint restraint, testing, disinfection (if applicable), and incidental items to complete the installation.

C. Carrier Pipe

Payment for carrier pipe will not be made as it will be incidental to the tunnel installation.

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SECTION 02660 WATER MAINS

1.0 GENERAL

A. Description

Water main installation shall include, but not necessarily be limited to, furnishing and installing water pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on a firm foundation true to line and grade in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02662
3. Water Services and Appurtenances: Section 02664
4. Fire Hydrants: Section 02666
5. Cast-In-Place Concrete: Section 03300
6. Miscellaneous Metals: Section 05500

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all water mains unless otherwise indicated on the Plans, or as approved by the County.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

DIP - Ductile Iron Pipe

PVC - Polyvinyl Chloride Pipe

C. Materials Furnished by the County

1. The County will not furnish any materials for water main construction.
2. Unless otherwise noted in the "Special Provisions," the County will make water available from its potable water system for pipeline testing at no charge to the Contractor for one attempt at a test cycle. Test cycle shall include initial flushing, filling, chlorination, hydrostatic testing, and flushing with dechlorination. If any portion of the cycle fails, the Contractor will be responsible for water. The Contractor shall contact the Division of Water and Sewer to coordinate its use. If subsequent testing is required, the Contractor shall purchase additional water from the County's system.

D. Contractor's Options

1. The Contractor may furnish Polyvinyl chloride plastic water pipe (PVC) and compatible specified fittings for water mains equal to or smaller than 12-inches in diameter unless specified otherwise by the County.
2. The Contractor may furnish ductile iron pipe (DIP) and compatible specified fittings for water mains 3-inches in diameter and greater unless specified otherwise by the County.

E. Detailed Material Requirements

1. Portland cement concrete for pipe fitting buttresses and anchorages shall be as specified in Section 03300 of these Standard Specifications.
2. Polyvinyl Chloride Plastic Water Pipe 4 inch through 12 inch shall be Class 200 (DR14) and shall meet the requirements of AWWA C900. PVC Water Pipe 3 inch and smaller shall be PVC 1120 (SDR21) and shall meet the requirements of ASTM D 2241. The outside diameters of DR14 shall be equivalent to cast-iron pipe. PVC Water Pipe shall have an integral bell with a rubber gasketed joint as listed in the AWWA C900 standard. Pipe and couplings shall be marked and factory tested in accordance with AWWA C900.
3. Ductile Iron Pipe and Fittings
 - a. Pipe
 - i. Pipe shall be designed and manufactured in accordance with ANSI/AWWA C151/A21.51 unless directed in writing by the County.
 - ii. All pipe and fittings shall be designed and constructed to withstand all external pressure caused by overburden as indicated on the profile and traffic loads to which the pipe may be subjected.
 - iii. Pipe shall be double thickness cement mortar lined in accordance with AWWA C104 with an interior seal coat of bituminous material. The outside surface shall also be bituminous coated.
 - iv. The minimum special standard thickness class shall be as noted

herein or as shown on the plans or specified in the "Special Provisions".

Size (In.)	Class	Max. Cover (Ft.)
3	52	100+
4	52	100+
6	52	86
8	52	49
10	52	38
12	52	33
14	52	24
16	52	21
20	52	18
24	52	17
30	52	14
36	52	13
42	52	13
48	52	12
54	52	12

b. Joints

Joints may be mechanical or rubber gasketed push-on type. Unless otherwise noted, all joints shall be in accordance with ANSI/AWWA C111/A21.11 Standard.

c. Fittings

- i. All fittings shall have mechanical joints.
- ii. All fittings 3-inches through 24-inches shall be manufactured in accordance with the ANSI/AWWA C153/A21.53 Standard. All fittings 30-inches through 48-inches shall be manufactured in accordance with the ANSI/AWWA C110/A21.10 standard for a working pressure of 250 psi unless specified or directed otherwise by the County.

4. Joint Restraint

- a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design for ductile iron, and fittings.
- b. Mechanical joint restraining systems for ductile iron pipe may be used at fittings, valves, fire hydrant leads, vault bypasses and when connecting to existing utilities unless noted otherwise by the Water and Sewer Engineering office. The mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which when actuated imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to

ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53 of the latest revision. Twist-off nuts shall be used to insure proper actuating of the restraining devices. The 3 inch through 16 inch mechanical joint restraining device shall have a working pressure of at least 350 psi with a minimum safety factor of 2:1. The 18 inch through 48 inch mechanical joint restraining device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1. Restrained joints on straight lengths of pipe shall be as manufactured by the pipe manufacturer and the restraining mechanisms shall be an integral part of the bell and spigot.

- c. Rod for tie rod assemblies shall meet the material requirements of ASTM A 193, Grade B7, and shall be threaded for at least 4 inches on both ends. Rod shall be 3/4 inch diameter unless otherwise noted. Nuts shall meet the requirements of ASTM A 194. Manufactured tie rod and accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.

5. Detector Tape

Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in black graphics.

6. Tracer Wire for Non Metallic Pipelines

Tracer wire shall be 8 gage, 7 strand continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

7. Continuity Test Station

- a. The continuity test station aside a fire hydrant shall be a 2 1/2" shaft cathodic test box constructed of ABS plastic with cast iron rim and lid. The minimum box length shall be 24" and the body shall be flared or squared at the base to prevent pull out or settling. Lid shall be locking, blue in color and have raised custom lettering noting "test". Test station shall be complete with an inset removable terminal board with three (3) terminals.
- b. The continuity test station that is located over the water main shall be a 4 1/4" valve box with blue locking lid. Test station shall be complete with an inset removable terminal board with three (3) terminals.

3.0 EXECUTION

A. Preparation

- 1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250 of these Standard Specifications.
- 2. Prior to start of utility installation, all rights-of-way shall be graded to within +/-

0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.

3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.
4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.
5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the County and in accordance with the Standard Details. Bedding shall be installed to insure that joints are properly made and the pipe is firmly supported the full length of the barrel. Aggregate bedding shall be installed to grade prior to laying pipe.

B. Pipe Installation

1. All pipe shall be installed in accordance with the approved manufacturers written instructions, Harford County Standards, and as specified herein. These recommendations, if more restrictive than that shown in the Standard Details shall include: maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:
 - a. Polyvinyl chloride water pipe (PVC) shall be installed in accordance with the Standard Details and the recommendations of Uni-Bell.
 - b. Ductile iron pipe (DIP) shall be installed in accordance with the Standard Details and the recommendations of the Ductile Iron Pipe Research Association.
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.
3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to insure that each joint is watertight, has met the required manufacturers insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the County.
4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.

5. Cleaning Pipe: The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall remain in place at all times when installation is not in progress.
6. Cutting Pipe: Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.

7. Jointing Pipe

- a. General

Before any joints are made in the trench, the Contractor shall demonstrate to the County by making a sample joint that methods they will employ conform with the Specifications, will secure a watertight joint, and that the workers whom the Contractor intends to use are familiar with the requirements for making proper joints.

- b. Push-On Gasketed Joints

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the County. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. In all cases, the spigot shall be inserted into the previously laid and seated bell, in order to minimize the potential of gasket roll, to prevent the bell dragging and pushing soil into the joint, and to prevent the need to undercut the pipe to lay the bell.

- c. Mechanical Joints

Mechanical joints shall be joined in accordance with the manufacturers recommendations as approved by the County. All nuts shall be tightened uniformly with a torque of not less than 75 or more than 90 foot-pounds.

- d. Other methods of jointing pipe will be given consideration by the County, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.
 - e. All jointing material and workmanship shall be in accordance with the manufacturer's recommendations as approved by the County.

8. Tracer Wire: All non-metallic water mains shall have tracer wire secured with duct tape to the top of the pipe at ten (10) foot centers. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.
9. Detector Tape: Install visual detection tape 18 inches above all mains.
10. Restrained joints and joint restraint systems shall be assembled in accordance with the manufacturer's recommendations. Tie rod nuts shall be uniformly tightened and double nutted to prevent movement. Joint restraint systems shall be field protective coated with two coats of a bituminous coating after assembly.
11. Connections to existing work shall be made by the Contractor in the presence of the County at such a time and in such manner as directed and approved by the County. The Contractor shall notify the consumers in the area to be affected by the shut-off a minimum of 3 working days prior to the work. Notification shall include at a minimum knocking on all doors and placing type-written flyers in doorways. All valves necessary for making connections will be operated by the County. The Contractor shall complete the connections with the greatest possible speed and all work shall proceed without interruption until the existing system is returned to operation, so that the public will be inconvenienced as little as possible.
12. Buttresses and anchors shall be installed at all caps, horizontal bends, tees, branches and vertical bends as required in the Contract Documents, Standard Details, and as directed by the County.

C. Field Tests

1. General

- a. All portions of water mains and appurtenances shall be tested prior to connection to the existing water system. The County shall have the final decision as to the methods used.
- b. During installation water mains will be visually inspected for compliance with these specifications and the contract documents by the County with the assistance of the Contractor. Further inspections and tests will be conducted by both parties after the section of pipeline being inspected and tested has been backfilled and has had ample time for the curing of buttresses.
- c. The Contractor shall schedule all tests with the County at least 2 County working days in advance of the test, and shall conduct all tests in the presence of the County. On County Capital Projects, the County will witness one test at no cost to the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required.

- d. Prior to performing any test and filling operations, the pipeline shall be flushed free of all debris, silt, earth, gravel, rock or other foreign material. It shall be done in a manner to prevent debris or flushing water from entering the existing water mains.
- e. Any defective work which shows up while conducting tests shall be replaced or repaired as approved by the County by the Contractor at their expense.
- f. Water mains shall be tested in sections dictated by the operational breaks noted on the Contract Documents or as approved by the County.
- g. No water mains shall be connected to existing mains, except through 3/4" loading line, at any point until they have been tested and chlorinated.
- h. All stub valves shall be open and testing will be through caps or blow-offs at buttress.
- i. After these tests have passed, the Contractor will drain the line and connect to existing mains.
- j. After tying into existing mains the Contractor will refill and flush the lines and a representative of the County Water and Sewer Maintenance Department will check to see that the chlorine residual is back to acceptable levels before any water services are installed.
- k. Once the line is permanently tied into the County system the line shall remain charged unless directed otherwise by the County.
- l. Chlorination, testing and dechlorination is required to be performed by a professional chlorination and testing company which has received prior written approval by the Division of Water and Sewer Maintenance Department.
- m. All water used for testing procedures must be accounted for and documented by the Contractor. Certification reports prepared by the testing company shall be provided to the maintenance department and along with pipe size, length, and number of times pipe was filled to the maintenance department prior to the permanent tie-in.

2. Disinfection and Hydrostatic Testing Procedures

a. General

- i. When mains are completed, they shall be flushed, chlorinated, tested and dechlorinated. Chlorination and hydrostatic testing is performed simultaneously. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the procedures specified.
- ii. Testing and tying-in will be coordinated through the Resident County Inspector on the job. Under no circumstances will any existing valves or fire hydrants be operated by the Contractor without prior approval of the Resident County Inspector, and the Water and Sewer

Maintenance Department.

- iii. The section of water main being tested shall be filled from an existing fire hydrant or main as designated by the County. The Contractor shall furnish an approved backflow preventer and meter at the point of supply. When charging and testing water mains which are not sufficiently close to existing water mains, the Contractor may use an approved and sanitized potable water truck to haul water from an existing water main as pre-approved by the Water and Sewer Maintenance Department.

b. Initial Flushing

- i. Prior to the simultaneous chlorination and hydrostatic testing, the Contractor shall flush the water main from all debris and particulate matter adhering to the pipe interior with a minimum scouring velocity of 2.5 feet per second in accordance with AWWA C651. The purpose of this initial flush is to eliminate foreign matter which may significantly reduce the effectiveness of the disinfectant. The following table presents the flow rates necessary to properly flush the main.

<u>Pipe Diameter (inches)</u>	<u>Minimum Flow Rate (gallons per minute)</u>	<u>Flushing duration per every 100 ft. of pipe (seconds)</u>
4	100	40
6	200	40
8	400	40
12	900	40
16	1,600	40
20	2,200	40
24	3,200	40
30	4,800	40
36	7,200	40

The Contractor shall measure and County shall witness the flow rate provided using their meter to ensure the minimum rate has been achieved.

- ii. The Contractor shall provide the County Inspector a minimum of 1 working day advanced written notice of flushing. The Contractor shall provide the County Inspector with size and linear feet of pipe, proposed discharge point, diameter of drain (if applicable), chlorine concentration, time and date flushing will commence, and anticipated time duration of flushing. The County Inspector will in-turn notify the Division of Water and Sewer Maintenance Superintendent.

c. Disinfection and Hydrostatic Testing

- i. Following the initial flush, the testing company shall simultaneously disinfect and hydrostatically test the main.
- ii. Disinfection – Continuous Feed Method

- a) The continuous feed method, in accordance with AWWA C651, may be utilized for disinfection and as specified herein.
- b) Approved forms of chlorine include liquid or gaseous chlorine, sodium hypochlorite solution, and calcium hypochlorite.
- c) At a cap and fill pipe in the new main, the water and chlorine solution shall be introduced at a constant rate to provide a uniform minimum concentration of 25 ppm available free chlorine. Air within the line shall be fully evacuated in the filling process.
- d) The following table from AWWA C651 provides a reference for the amount of chlorine required to achieve the minimum chlorine dosage.

Chlorine required to produce minimum 25 ppm concentration in 100 feet of pipe

<u>Pipe Diameter (inches)</u>	<u>100% Chlorine (pounds)</u>	<u>1% Chlorine Solution (gallons)</u>
4	0.13	0.16
6	0.30	0.36
8	0.54	0.65
12	1.20	1.44
16	2.17	2.60
20	3.42	4.21
24	4.80	5.91

Note: Solutions of 1% percent chlorine shall be prepared with sodium hypochlorite or calcium hypochlorite. Sodium hypochlorite requires 1 lb. of chlorine with (8) gallons of water.

The chlorine residual shall be tested by the testing company and verified by Harford County no less than 24 hours after the main was completely full of chlorinated water. Valves and fire hydrants shall be operated to ensure full contact with the chlorinated solution, during the filling operations.

iii. Disinfection – Slug Method (Superchlorination Method)

- a) The slug method, in accordance with AWWA C651, may be utilized for disinfection
- b) Approved forms of chlorine include liquid or gaseous chlorine, sodium hypochlorite solution, and calcium hypochlorite.
- c) At a cap and fill pipe in the new main, the water and chlorine solution shall be introduced at a constant rate such that the water will not have less than 100 ppm free chlorine. Air within the line shall be fully evacuated in the filling process.
- d) The chlorine residual shall be tested by the testing company and

verified by Harford County no less than 3 hours after the main was completely full of chlorinated water. Valves and fire hydrants shall be operated to ensure full contact with the chlorinated solution, during the filling operations.

iv. Hydrostatic Testing

- a) Hydrostatic testing shall be performed in accordance with AWWA C600.
- b) After filling the main during the disinfection process, the main shall be hydrostatic tested by piping potable water into the main up to 200 psi measured at the highest elevation of the main in accordance with the pipeline profile shown on the contract documents. If pressure readings cannot be taken at the highest elevation, the pressure shall be increased to accommodate the difference between the highest elevation and test elevation. An additional 0.43 psi shall be added to every additional foot in elevation change.
- c) The test pressure shall be maintained and shall not drop for a minimum fifteen (15) minutes.
- d) If the test did not pass, the Contractor shall remedy such defects and repeat the disinfection and hydrostatic test until approved by the County at the Contractor's expense for additional water.
- e) Hydrostatic testing against closed valves is prohibited.

d. Final Flushing

Upon completion of the disinfection and hydrostatic testing, the main shall be flushed to remove the chlorinated water. Flushing procedures shall be as follows:

- i. The Contractor shall provide the County Inspector a minimum of 1 working day advanced written notice of flushing. The Contractor shall provide the County Inspector with size and linear feet of pipe, proposed discharge point, diameter of drain (if applicable), chlorine concentration, time and date flushing will commence, and anticipated time duration of flushing. The County Inspector will in-turn notify the Division of Water and Sewer Maintenance Superintendent.
- ii. The discharge of chlorinated or dechlorinated water into the wastewater collection system is strictly prohibited.
- iii. In accordance with the Maryland Code of Regulations, the discharge of chlorinated water onto the ground surface or into storm drains is prohibited. In such cases, the water shall first be dechlorinated to achieve no more than 0.1 ppm free chlorine residual before disposal.
- iv. The main shall be considered flushed once the free chlorine residual has matched the chlorine residual in the water main from which the

flushed water originated.

e. Bacteriological Testing

- i. After final flushing, but before the main is tied into the existing system bacteriological tests shall be performed. The Contractor shall obtain the services of a Maryland-Certified water testing company to perform bacteriological testing. All test samples shall be collected in the presence of the Division of Water and Sewer Maintenance personnel. A minimum 2-working day, advanced notification shall be made to the Maintenance office. Bacteriological tests shall be performed in accordance with AWWA C651 and as specified herein. Prior to testing the free chlorine residual shall be between 0.5 mg/l and 1.5 mg/l.
- ii. Two consecutive sets of acceptable samples, taken at least 24 hours apart shall be collected.
- iii. At a minimum, one set of samples shall be taken at the beginning of the main, one set every 1200 feet, one set at every branch, and one set at the end of the main.
- iv. A technician employed by the certified testing company shall collect all samples no less than 24 hours after the final flush. Samples shall be taken from a corporation stop with a copper-tube gooseneck assembly located at or near the end of the main. A blow-off drain, if provided as part of the testing apparatus may also be utilized. Samples may not be taken from fire hydrants.
- v. Samples shall be tested by the certified testing company for bacteriological quality in accordance with "The Standard Methods for the Examination of Water and Wastewater".
- vi. The sample results must be submitted to the Water and Sewer Maintenance Department within 24-hours of receipt. These results shall indicate free chlorine residual, concentration, the presence or absence of coliform organisms and a standard plate count. The samples shall pass if there is no presence of coliform organisms and the plate count is 500 cfu per ml or less.
- vii. If acceptable, the main may be put into service.
- viii. If the results are not acceptable, the main shall be flushed and re-sampled. If the results of the second sampling are not acceptable, the Contractor shall repeat the disinfection and final flushing procedures and re-test for bacteriological quality until two consecutive successful tests taken at least 24 hours apart have been performed.

f. Hydrostatic Testing

These results must be submitted to the Water and Sewer Maintenance Department within 24 hours of receipt.

g. Continuity Testing for Non-Metallic Pipe

- i. After backfilling, the County shall test at the Contractor's/Developer's expense, the tracer wire to demonstrate electrical continuity between valve boxes and through the length of the non-metallic pipeline installed. The Contractor shall schedule all tests with the County at least 48 hours in advance. Any discontinuity shall be located, repaired, and retested at the Contractor's expense until continuity is demonstrated.
- ii. On Capital Projects, the County will perform one continuity test at no cost to the Contractor. Should the continuity test fail, the Contractor shall reimburse the County for all costs resulting from such additional test so required until the continuity test passes.

4.0 METHOD OF MEASUREMENT

A. Water Mains

Measurement for furnishing and installing water mains will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for fittings or valves less than 8-inches in diameter.

B. Fire Hydrant Leads

Measurement for furnishing and installing fire hydrant leads will not be made as it will be incidental to fire hydrant installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
2. The prices bid for furnishing and installing water mains shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250 of these Standard Specifications.
 - b. Furnishing and installing granular pipe bedding materials and concrete for pipe fitting anchorages and buttresses as shown on the Standard Details and as required elsewhere in the Contract Documents.
 - c. Furnishing and installing restrained joints and/or joint restraint systems where required by the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Water Mains

Payment for furnishing and installing water mains, complete and in place, will be made per linear foot of the size and type of pipe installed and/or lump sum price bid. The price(s) bid shall include traffic control, furnishing and installing all pipe valves (less than 8-inches in diameter), fittings, jointing materials, tracer wire and test stations where required, and buttresses, providing an approved spoil site, and disposing of all spoil or excess materials; bedding materials between top of pipe and subgrade, all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, removing existing buttresses when necessary, and connecting to existing pipelines, structures; testing and disinfecting the water main, and incidental items to complete the water main.

C. Fire Hydrant Leads

Payment for furnishing and installing fire hydrant leads, will not be made as it will be incidental to fire hydrant installation.

D. Valves and Fire Hydrants

Payment for furnishing and installing valves and fire hydrants will be made as specified in Section 02662 and Section 02666 of these Standard Specifications

SECTION 02662 WATER VALVES AND APPURTENANCES

1.0 GENERAL

A. Description

Water valve and appurtenance installation shall include, but not necessarily be limited to, furnishing and installing gate, butterfly, air release, vacuum, combination air valves or assemblies with appurtenant valve vaults, roadway valve boxes and accessories in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Cast-In-Place Concrete: Section 03300
4. Precast Concrete: Section 03400
5. Brickwork, Unit Masonry: Section 04200
6. Miscellaneous Metals: Section 05500

C. Quality Assurance

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

The County will not furnish any water valves or appurtenances.

C. Contractor's Options

None

D. Detailed Material Requirements

1. Aggregate for bedding, leveling, and drainage shall meet the gradation requirements of AASHTO M 43, Size Number 57.
2. Water mains and appurtenances shall be as specified in Section 02660 of these Standard Specifications.

3. Tapping saddles and corporation stops shall be as specified in Section 02664 of these Standard Specifications.
4. Portland cement concrete for miscellaneous valve appurtenances and cast-in-place vaults shall be the mix number indicated on the Standard Details and as specified in Section 03300 of these Standard Specifications.
5. Precast concrete vaults, manhole sections and grade rings shall be as indicated on the Standard Details and as specified in Section 03400 of these Standard Specifications.
6. Brick for valve support and miscellaneous valve appurtenances shall be sewer brick as specified in Section 04200 of these Standard Specifications.
7. Mortar for brickwork shall be as specified in Section 04100 of these Standard Specifications.
8. Frames, covers, and steps shall be as indicated on the Standard Details and as specified in Section 05500 of these Standard Specifications.
9. Valves 16" and greater shall not have less than 2 feet from top of operating nut to finish grade. All vertical adjustment shall be at no additional cost to the County.

10. Gate Valves

a. General

Gate valves shall be iron body, resilient-seated, non-rising stem, 2-inch square operating nut which shall turn left (counter-clockwise) to open, with ample strength to withstand and operate under a working pressure of 150 psi, unless otherwise noted. The thrust collar shall be effective for both opening and closing. Valves up to and including 12" shall be manufactured in accordance with AWWA C 509. Valves greater than 12" shall be manufactured in accordance with AWWA C 509 or C 515. Valves shall be furnished with mechanical joint ends unless flanged or other type ends are indicated in the Contract Documents.

- b. Gate valves through 20-inch diameter shall be vertical type with O-ring stem seals. Gate valves 20-inches and greater shall have gearing as approved by Harford County.
- c. Gate valves shall be coated in accordance with AWWA C550. Both the inside and outside surfaces of the body and bonnet shall be epoxy coated.
- d. Buried valves shall be furnished with an extension in accordance with the Standard Details.
- e. Wedge rubber shall be molded in place and bonded to the ductile iron portion, and shall not be mechanically attached with screws, rivets, or similar fasteners.

- f. Waterway shall be smooth and shall have no depressions or cavities in seat area where foreign material can lodge and prevent closure or sealing.
- g. Wedge shall be constructed of gray or ductile iron, fully encapsulated in synthetic rubber except for guide and wedge nut areas.

11. Tapping Valves and Sleeves

Valves for tapping service shall meet all the requirements for gate valves. In addition, the body seat rings shall have a clear opening equal to the nominal size of the tapping valve. Tapping sleeves shall be iron body mechanical joint type, or as approved by the County. Tapping valves for ductile iron pipe shall have flange by mechanical type ends unless otherwise shown on the Plans. All tapping sleeves shall be furnished with an outlet for testing. Tapping sleeves for prestressed concrete pipe shall be furnished and installed in accordance with the pipe manufacturer's recommendations.

12. Butterfly Valves

- a. Butterfly valves shall be manufactured in accordance with AWWA C504 as modified herein. Valves shall be Class 150B, and designed for a differential pressure across the valve of 150 psi and a minimum flow of 16 feet per second for opening and closing.
- b. Valves shall be furnished with mechanical joint ends unless otherwise noted in the Contract Documents. When flanged ends are specified, valves shall be of the short lay length configuration.
- c. Valves shall be furnished with a rubber seat, either in the body or on the disc, and a seat mating surface of alloy cast iron conforming to ASTM A 436, Type I, or 18-8 stainless steel, Type 304 or 316. Valves 24-inch diameter and larger shall have adjustable seats of a design that permits replacement in the field without removal of the valve from the line.
- d. Valve shafts shall be stainless steel or monel, and shall be horizontal when the valve is installed in the water main.
- e. Valve actuators may be worm gear or traveling nut type with a 2-inch square operating nut which shall turn left (counter-clockwise) to open. Operators shall be fully enclosed in a gasketed grease-filled enclosure, and shall withstand an input of 350 foot pounds to the nut at extreme operator position without damage.
- f. Valves shall be furnished with an extension stem terminating a maximum of 6-inches below finished grade. The operating nut shall be located in a standard valve box and shall include a sealed valve position indicator which shows a valve position, and direction and number of turns to open or close the valve.

13. Air and/or Vacuum Release Valve

- a. Air-release, air/vacuum, and combination air valves shall be

manufactured in accordance with AWWA C512 as modified herein. Valves shall be furnished with threaded ends unless otherwise noted in the Contract Documents.

- b. The air/vacuum valve shall have a cast iron body and cast iron cover. The internal compound level mechanism shall be stainless steel and all other internals including float shall be stainless steel to avoid galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

<u>PART</u>	<u>MATERIAL</u>	<u>SPECIFICATION</u>
Body and Cover	Cast Iron	ASTM A48, Class 35
Internal Linkage	Stainless Steel	Series 300
Float and Internals	Stainless Steel	Series 302
Seat	Buna-N	
Exterior Paint	Phenolic Primer Red Oxide	FDA approved for potable water

- d. All internals shall be easily removed through the top cover without removing the main valve from the lines.
- e. An isolating valve shall be installed between main and air/vacuum release valve for maintenance.
- f. Air/vacuum release valve shall be installed in an easily accessible vault. Vault shall be adequately vented to meet air/vacuum release valve requirement.
- g. The valve manufacturer shall furnish installation and maintenance instruction manuals with each valve.

14. Roadway Boxes

Screw type roadway valve boxes and covers shall be made of cast iron conforming to the requirements of ASTM A 48, Class 30 B and shall meet the dimensional and marking requirements indicated on the Standard Details and Section 05500 of these Standard Specifications.

3.0 EXECUTION

A. General

- 1. Excavation, foundation preparation, backfill, and compaction shall be as specified in the Standard Details and Section 02250 of these Standard

Specifications.

2. Valves shall be restrained, supported, and strapped and/or anchored in accordance with the Standard Details.

B. Gate and Butterfly Valves

1. Gate and butterfly valves shall be installed in accordance with the Standard Details and at the locations shown on the Plans or as directed by the County.
2. Roadway valve boxes shall be centered and plumb over the valve operating nut. Backfill shall be compacted under and around valve boxes to insure that no vertical loads are transmitted to the valve operators.

C. Valves in Vaults or Manholes

Dewatering and air release, vacuum, and combination air valves shall be installed in manholes in accordance with the Standard Details.

D. Field Tests

1. Water valves and appurtenances installed at the same time as a new water main shall be tested, after installation, by the Contractor along with the water main in accordance with Section 02660 of these Standard Specifications.
2. Water valves and appurtenances installed in an existing water main will be visually inspected for leakage by the County at the existing water main line pressure before the excavation is backfilled. The valve and joints shall be leak free under line pressure.
3. Tapping sleeves and valves shall be tested after assembly on the existing water main but prior to making the tap. The Contractor shall pressurize the complete assembly to 150 psi for 15 minutes with zero leakage, unless otherwise noted, and the County will visually inspect the tapping sleeve and valve for leakage. No leakage will be permitted.

4.0 METHOD OF MEASUREMENT

A. Water Valves

Measurement for furnishing and installing water valves (gate, tapping valves and sleeves, and butterfly) 8-inches in diameter and greater and appurtenances will be made of the number of each size and type installed complete.

B. Air and/or Vacuum and Combination Air Valves

Measurement for furnishing and installing air and/or vacuum and combination air valves and appurtenances will be made of the number of each size and type installed complete.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown and specified in strict accordance with the Contract Documents.
2. Payment for furnishing and installing water valves and appurtenances will include the following:
 - a. Excavation, backfill, compaction, and incidental items as specified in Section 02250 of these Standard Specifications.
 - b. Furnishing and installing aggregate, tie rods, retainer glands, and concrete valve support and restraint as shown on the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Water Valves

Payment for furnishing and installing water valves (gate, tapping valves and sleeves, and butterfly) 8-inches in diameter and greater and appurtenances will be made for each size and type of valve installed. The price(s) bid shall include traffic control, furnishing and installing all valves, vaults, manholes, roadway valve boxes, jointing materials and buttresses, strapping, restoration; testing of the complete installation; and incidental items to complete the valve installation.

C. Air and/or Vacuum and Combination Air Valves

Payment for furnishing and installing air and/or vacuum and combination air valves and appurtenances will be made for each size and type installed. The price(s) bid shall include traffic control, furnishing and installing all valves, saddles, vaults, manholes, pipe supports, angle valves, corporation stops, extensions, restoration; testing of the completion installation; and incidental items to complete the valve installation.

Payment for furnishing and installing valves on water service connections will be made as specified in Section 02664 of these Standard Specifications.

SECTION 02664 WATER SERVICES AND APPURTENANCES

1.0 GENERAL

A. Description

Water services and appurtenances shall include, but not necessarily be limited to, furnishing and placing water services with appurtenant meter housings and connection to the water main in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Mains: Section 02660
3. Water Valves and Appurtenances: Section 02662
4. Cast-In-Place Concrete: Section 03300
5. Precast Concrete: Section 03400

C. Quality Assurance

The County will inspect all materials before and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all water services unless otherwise indicated on the Plans, or as approved by the County.

B. Materials Furnished by the County

The County will furnish and install 5/8-inch and 3/4-inch water meters and remote readouts for water service connections.

C. Contractor's Options

Refer to Standard Details and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

D. Detailed Material Requirements

1. Water Meters

- a. Water meters shall be as shown on the Standard Details and the Construction Documents.
 - b. Water meters shall meet the requirements of AWWA C700, C701, C702 and C703 (proportional type only). The mainline case shall be bronze or epoxy coated cast iron. Registers shall be permanently sealed, straight reading and read in U.S. gallons.
2. Water Service
- a. Water services less than 3-inches in diameter shall be Type K, annealed copper tubing and shall meet the material, chemical and mechanical requirements of ASTM B 88 or SDR 21 gasketed PVC water pipe that meets the requirements of ASTM D 2241 and ASTM D 1784: PVC 1120. The pipe is to have an integral bell that utilizes a gasket for sealing that meets the requirements of ASTM F477.
 - b. Water services 3-inches in diameter and larger shall be as specified in Section 02660 of these Standard Specifications.
3. Meter fittings, yokes, lids, covers, and appurtenances shall be as noted in the Approved List of Suppliers and Materials for Water Main Construction.
 4. Tubing Couplings - Copper tube couplings shall be as noted in the Approved List of Suppliers and Materials for Water Main Construction.
 5. Corporation stops with compression type fittings shall be as noted in the most recent Approved List of Suppliers and Materials for Water Main Construction.
 6. Gate valves, roadway valve boxes, curb boxes and tapping sleeves for water services shall be as specified in the Standard Details and Section 02662 of these Standard Specifications.
 7. All service line valves and fittings shall be manufactured in accordance with AWWA C800. Connection to service lines shall be compression type.
 8. Meter vaults for 12-inch or larger service lines shall have aluminum access hatches designed to withstand an H-20 wheel load. Door leaf shall be 3-inch aluminum diamond or safety tread pattern plate. Channel frame shall be 3-inch aluminum with concrete anchor flange around the perimeter, bituminous coated where in contact with concrete, and a 12-inch drainage coupling. Doors shall be equipped with stainless steel hinges and an automatic hold-open arm with release handle. The door shall have a locking mechanism and snap lock with a removable handle. The door shall be operable by a force not to exceed 30 pounds. Fixed ladders shall be equipped with an aluminum LadderUp safety post or approved equal.
 9. Tapping saddles shall be manufactured of high strength ductile iron, ASTM A536, protected with a fusion applied epoxy or nylon fused (10-12 mil) coating. Saddles shall be furnished with Type 304 stainless steel straps with a minimum 2 inch wide bearing area and a rubber gasket suitable for potable water.

10. Pipe wall penetrations shall be as specified in the Standard Details.
11. Meter vaults shall be precast concrete vaults of the size indicated on the Standard Details furnished and installed as specified in Section 03400 of these Standard Specifications.
12. All water services and/or fire service lines shall be equipped with approved backflow prevention devices.
13. Detector Tape

Visual Detection Tape shall be 3 inches wide (minimum) nonmetallic blue plastic tape lettered "water" in black graphics.

14. Location Lumber

Lumber for marking house connection locations shall be minimum 2-inch x 6-inch boards of sufficient length to extend from the plug at the end of the house connection to a height of 4 feet, more or less, above finished grade, painted blue above finished grade.

15. Tracer Wire for Nonmetallic Pipelines

Tracer wire shall be 8 gage, 7 strand continuous copper wire with a 45 mil polyethylene insulation. The wire shall be blue, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connectors with a water proof binder and underground electrical tape.

16. Continuity Test Station

- a. The continuity test station aside a fire hydrant shall be a 2 1/2" shaft cathodic test box constructed of ABS plastic with cast iron rim and lid. The minimum box length shall be 24" and the body shall be flared or squared at the base to prevent pull out or settlement. Lid shall be locking, blue in color, and have raised custom lettering noting "test". Test station shall be complete with an inset removable terminal board with three (3) terminals.
- b. The continuity test station that is located over the water main shall be a 4 1/4" valve box with blue locking lid. Test station shall be complete with an inset removable terminal board with three (3) terminals.

3.0 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, bedding and haunching shall be as specified in Section 02250 of these Standard Specifications.
2. Prior to start of utility installation, all rights-of-way shall be graded to within ± 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.

3. Trench Water: The service trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.
4. Laying Service in Freezing Weather: No service shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the service has been installed.
5. Pipe Bedding: Each service shall be bedded on a solid foundation acceptable to the County and in accordance with the Standard Details. When aggregate bedding is required, bedding shall be installed to grade prior to laying pipe.

B. Water Services and Appurtenances

1. Water services and appurtenances shall be installed in accordance with the approved manufacturers written instructions, County Standards, Contract Documents, and as specified herein:
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used. Bending of copper tubing shall be accomplished by the use of a tubing bender to eliminate kinking unless otherwise approved by the inspector.
3. Water services shall be jacked or driven under paving unless otherwise directed by the County. In case jacking or driving house services under any type of paving cannot be made, the County with approval of the pertinent agency may permit the Contractor to open cut. In the case of an open cut in paving, trench widths shall not exceed 18 inches or the requirements noted in the utility permit, whichever is most stringent.
4. House services installed in areas other than paving areas shall be open cut or driven at the Contractor's option.
5. All services shall be laid to the grade and lines in accordance with the Contract Documents or as directed by the County. Special care shall be taken to insure that the services are well-bedded. Any defects resulting from settlement shall be repaired by the Contractor at their expense.
6. Copper service pipe shall be cut square to the run of the pipe and free from burrs. 3/4-inch to 1-inch pipe can be cut with a disc-type pipe cutter or hacksaw. An abrasive wheel will not be allowed. Care must be taken not to deform pipe end.
7. All services shall be thoroughly flushed with potable water at the time the main is tapped. All PVC services and services larger than 3-inch diameter shall be installed, chlorinated and tested as specified in Section 02660 of these Standard Specifications.
8. The pipe and fittings shall be thoroughly cleaned before being installed, and shall be kept clean until the acceptance of the completed work.

9. All meter vaults 24-inch in diameter and smaller shall be set at a minimum depth of two feet, eight inches (2' - 8"). They shall be set on brick or precast concrete rings and bedded on firm undisturbed earth.
10. Tracer Wire: All nonmetallic water services shall have tracer wire secured with duct tape to the top of the pipe at ten (10) foot centers. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped.
11. Detector Tape: Install visual detection tape 18-inches above all water service pipe.

C. Connections to Water Mains

1. The following table provides types of allowable taps for different pipe sizes and materials.

Pipe Material	Main Size (inches)	Service Size (inches)	Allowable Tap Type			
			Direct	Service Saddle	Tapped Tee w/Boss	Tapping Sleeve and Valve
DIP	≤ 4	All	NO	YES	YES	NO
DIP	> 4	≤ 1	YES	-	-	-
DIP	6 thru 10	>1	NO	YES	YES	YES
DIP	≥12	≤ 2	YES	-	-	-
DIP	>12	>2	NO	YES	YES	YES
PVC	≤ 4	All	NO	YES	YES	NO
PVC	>4	≤1	YES	-	-	-
PVC	6 thru 10	>1	NO	YES	YES	YES
PVC	12	≤1	YES	-	-	-
PVC	12	>1	NO	YES	YES	YES

2. Corporation taps or tapping sleeves shall be installed on new water mains under operating pressure after the water mains have been chlorinated, tested, and tied in, in accordance with the Contract Documents.
3. Service connections to existing water mains shall be made as noted in this section only where authorized by the County.
4. The County reserves the right to require a saddle on any water main service connection where the integrity of the connection or appurtenances is in question.

4.0 METHOD OF MEASUREMENT

- A. Measurement for water services will be made per each type and size of service installed.

- B. Measurement for meter settings and vaults or curb stops will not be made for it will be incidental to water service installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown and specified in strict accordance with the Contract Documents.
2. The prices bid for furnishing and installing water services shall included the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250 of these Standard Specifications.
 - b. Tapping the main or furnishing and inserting saddles or fittings in the main with appropriate buttresses, and furnishing and installing corporation stops or valves at the main.
 - c. Furnishing and installing cast-in-place or precast concrete or plastic meter vaults with frames and covers and access hatches as per the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Water Services

Payment for furnishing and installing water services will be made per each type and size of service installed. The price(s) bid shall include traffic control furnishing and installing the pipe or tubing, fittings, driving sleeves, curb stops, curb stop valve boxes, meter yoke/meter setting, bypass lines, temporary paving, and incidental items to complete the work.

C. Meter Settings and Vaults

Payment for furnishing and installing meter settings and vaults will not be made for it will be incidental to water service installation.

SECTION 02666 FIRE HYDRANTS

1.0 GENERAL

A. Description

Fire hydrant installation shall include, but not necessarily be limited to furnishing and installing fire hydrants or relocating fire hydrants in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Main Installation and Chlorination: Section 02660
3. Water Valves and Appurtenances: Section 02662
4. Cast-In-Place Concrete: Section 03300
5. Unit Masonry: Section 04200

C. Quality Assurance

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

The County will not furnish any materials for fire hydrant installation or relocation.

C. Contractor's Options

None.

D. Detailed Material Requirements

1. Washed gravel for hydrant foundation shall meet the gradation requirements of AASHTO M 43, Size Number 57.
2. Fire Hydrants
 - a. Hydrant valve opening shall be at least 5 1/4-inch diameter net. Inlet connection shall be 6-inch mechanical joint

- b. Hose connections shall consist of two 2 1/2-inch diameter hose connections and one 4 1/2-inch diameter steamer or pumper connection. Hose and pumper nozzle threads shall conform to ANSI Specifications B26 for "National (American) Standard Fire-Hose Coupling Screw Thread."
- c. Operating nut shall be 5-sided, 1 1/2 inches from point to flat, and shall turn left (counterclockwise) to open.
- d. The inlet connection to hydrants shall be six (6) inch mechanical joint.
- e. Hydrant design shall be such that when the barrel is broken, it may be replaced without excavating or breaking adjacent pavement; that the entire barrel, including all working parts along with the main and drain valve seats, may be removed for inspection or repair without excavating or disturbing the ground.
- f. The groundline lugs and valve rod shall be frangible so that in the event of accident, damage or breaking of the hydrant above or near the grade level, the main valve will remain closed and reasonably tight against leakage. Breakaway lugs are required, breakaway bolts will not be accepted.
- g. The main valve seal shall be compression type sealing against a bronze seat and the valve shall open against pressure. The main valve shall be removed by use of a short-stemmed wrench.
- h. Minimum bury depth shall be three and a half (3 1/2) feet measured from the top of the connecting pipe to the ground level at the hydrant.
- i. Bonnet shall have cast on the top an arrow and the word "open" indicating the direction for opening.
- j. Fire hydrants shall meet the requirements of the "AWWA" Standard for fire hydrants for ordinary water works service C502. All lug bolts shall conform to ASTM A307, Grade B.
- k. Interior of shoe shall be epoxy coated.

3.0 EXECUTION

A. General

- 1. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250 of these Standard Specifications.
- 2. Construction methods shall be in accordance with Section 02660 of these Standard Specifications.

B. Fire Hydrant Installation

- 1. Fire hydrants shall be installed and restrained in accordance with the Standard Details, at the locations shown, and to elevations directed by the

County. Hydrants shall be set within an aggregate drainage well extending the full width of the trench, from the center of the hydrant to a length equal to the width in a direction towards the main line, and from the bottom of the trench to a point 6-inches above the drip opening.

2. Hydrant leads shall be laid level on a firm foundation to insure that the hydrant is set plumb. Backfill around the hydrant shall be compacted so as to obtain a density of at least 92% of maximum when measured in accordance with AASHTO T180, Method D.
3. Where hydrants are to be relocated, the Contractor shall ascertain whether or not the hydrant valve has been restrained before removing the hydrant to be relocated.
4. Where the existing lead is to be abandoned the lead shall be capped and blocked at the main by removing the hydrant valve and installing the cap or plug. All caps and plugs shall be buttressed and strapped to the main or restrained in accordance with County Standards.
5. The outside of all fire hydrants above the breakaway flange shall be painted with two coats of paint as noted in the County Approved List of Suppliers and Materials for Water Main Construction.
6. Main port of fire hydrant shall be directed towards the curb or roadway.
7. There shall be no obstruction within a three foot radius of the hydrant.

C. Field Test

1. Fire hydrants installed at the same time as a new water main shall be tested after installation by the Contractor, along with the water main, in accordance with Section 02660 of these Standard Specifications.
2. Fire hydrants installed on an existing water main will be visually inspected for leakage by the County at the existing water main line pressure before the excavation is backfilled. The hydrant, valve, and connecting pipe shall be leak-free under line pressure.

4.0 METHOD OF MEASUREMENT

- A. Measurement for fire hydrant installations or relocations will be made of the number of hydrants satisfactorily installed or relocated as shown on the Plans or directed by the County.
- B. Fire hydrant lead pipe, fittings, valves and appurtenances will not be measured for it will be incidental to fire hydrant installation.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily

complete the work as shown as specified in strict accordance with the Contract Documents.

2. The price(s) bid for furnishing and installing or relocating fire hydrants shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250 of these Standard Specifications.
 - b. Furnishing and installing aggregate fill and bedding, tie rods, retainer glands, and concrete thrust blocking as shown on the Standard Details or elsewhere in the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Fire Hydrants

1. New

Payment for furnishing and installing fire hydrants complete and in place will be made per hydrant for the total number placed. The price bid shall include all traffic control, removal and disposal of spoil materials; furnishing and placing washed gravel under and around the hydrant; tee, hydrant lead, hydrant lead valve, hydrant, all hydrant and/or valve extensions (if required), bracing, testing and painting of the complete installation; and for incidental items to complete the hydrant installation.

2. Relocations

Payment for removing and reinstalling existing fire hydrants complete and in place will be made per hydrant for the total number placed. The price bid shall include all traffic control, removal and disposal of spoil materials, investigation of existing restraint system, all required lead modifications (including valve), the removal and reinstallation of the existing hydrant, all hydrant or valve extensions (if required), the capping or plugging of the existing lead line (if required), re-tapping the existing water main (if required); furnishing and placing washed gravel under and around the relocated hydrant, testing and painting of the complete installation; and incidental items to complete the hydrant relocation.

C. Fire Hydrant Lead Pipes

Payment for furnishing and installing fire hydrant lead pipe, fittings, valves and appurtenances, including strapping the valve to the water main fitting, will not be made for it will be incidental to the fire hydrant installation.

SECTION 02700 GRAVITY SANITARY SEWER AND HOUSE CONNECTIONS

1.0 GENERAL

A. Description

Sanitary sewer installation shall include, but not necessarily be limited to furnishing all labor, materials, and services necessary to install pipe, fittings, miscellaneous structures of concrete or brick masonry, and appurtenances for gravity sewer and house connections, of the size and type shown, in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill and Compaction: Section 02250
2. Sanitary Sewer Manholes: Section 02710
3. Precast Concrete Structures: Section 03400
4. Mortar and Masonry Grout: Section 04100
5. Unit Masonry: Section 04200
6. Miscellaneous Metals: Section 05500

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all sanitary sewer mains and house connections unless otherwise indicated on the Plans, or as approved by the County.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the following symbols:

CISP -	Cast iron soil pipe
DIP -	Ductile iron pipe
PVC -	Polyvinyl chloride pipe

C. Materials Furnished by the County

1. The County will not furnish any materials for gravity sanitary sewer and house connections.
2. Unless otherwise noted in the "Special Provisions", the County will make water available from its potable water system for pipeline testing at no charge to the contractor for one test only. The Contractor shall contact the Division of Water and Sewer to coordinate its use. If subsequent testing is required, the Contractor will purchase additional water from the County's system.

D. Contractor's Options

1. The Contractor may furnish Polyvinyl chloride (PVC), or ductile iron pipe (DIP) for sewers equal to or smaller than 24-inch diameter unless specified otherwise in writing by the County.
2. The Contractor shall furnish ductile iron pipe (DIP) for sewers greater than 24-inch diameter unless specified otherwise in writing by the County.
3. The Contractor may furnish precast, cast-in-place, or masonry construction for miscellaneous sanitary sewer structures unless specified otherwise in writing by the County.

E. Detailed Material Requirements

1. Polyvinyl Chloride Sewer Pipe (PVC) and Fittings

- a. Polyvinyl chloride (PVC) pipe and fittings 4-inch and 6-inch diameter must comply with ASTM D 3034 and F1336 and have a minimum wall thickness of SDR 26. Pipe and fittings 8-inch through 15-inch diameter must comply with ASTM D 3034 and F1336 and have a minimum wall thickness of SDR 35. Pipe and fittings 18-inch through 24-inch diameter shall meet the material requirements of ASTM F679 and F1336 and have a minimum pipe stiffness of 115 psi. All PVC compounds for all sizes shall comply with ASTM D 1784 and have a minimum cell classification of 12454B.
- b. All pipe and fittings must be manufactured with a locked-in gasket.
- c. All pipe and fittings for standard sewer house connections shall be heavy wall having a wall thickness of SDR 26.
- d. All pipe and fittings for drop sewer house connections shall be PVC with a wall thickness of SDR 26, including 450 wye fitting on the main.
- e. Alternatively, the drop sewer house connection may be constructed of ductile iron pipe, in which case the entire run of sewer main to which the drop connects must constructed of either ductile iron pipe or PVC C900 pipe meeting the detailed material requirements of Section 02660 of these Standard Specifications.

2. Ductile Iron Pipe (DIP) and Fittings and Cast Iron Fittings

a. Pipe

- i. Ductile iron pipe (DIP) and fittings shall conform to ANSI/AWWA C150/A21.50 in matters of design and ANSI/AWWA C151/A21.51 for materials. Pipe thickness shall conform to the Special Thickness Class 52 minimum or as shown on the Plans. The outside surfaces shall be bituminous coated.
- ii. The Contractor shall be cognizant of available ductile iron fittings which adapt to PVC SDR-35.

b. Interior Linings

Ductile iron pipe, ductile iron fittings and cast iron fittings shall be cement-lined in accordance with AWWA C104, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surfaces shall be bituminous coated.

3. Cast Iron Soil Pipe and Fittings

Cast iron soil pipe and fittings for sanitary house connections outside the public right-of-way or on risers shall meet material requirements of ASTM A74, service weight or heavier with mechanical, or gasketed joints.

4. Pipeline Plugs for Testing

Pipeline plugs shall be rubber gasketed or ribbed, watertight, airtight to the extent required by air testing requirements of this Section, cannot be dislodged by testing pressure (internal or external), and of an approved design.

5. Detector Tape

Detector Tape shall be 3 inches wide (minimum) nonmetallic green plastic tape lettered "sewer" in black graphics.

3.0 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250 of these Standard Specifications.
2. Prior to start of utility installation, all rights-of-way shall be graded to within ± 0.2 feet of the proposed subgrade in paved areas and finished grade in unpaved areas.
3. Trench Water: The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water. In the event significant groundwater is encountered during construction, the Director may require the Owner and/or Contractor to prepare a corrective plan of action for review and approval by the County.

4. Laying Pipe in Freezing Weather: No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe had been installed.
5. Pipe Bedding: Each pipe shall be bedded on a solid foundation acceptable to the County and in accordance with the Standard Details. Bedding shall be installed to insure that joints are properly made and the pipe is firmly supported the full length of the barrel. All sewer mains and services shall be installed with a minimum of six inches of aggregate bedding below the pipe invert, meeting the gradation requirements of AASHTO M43, size number 57. Aggregate bedding shall be installed to grade prior to laying of pipe sections.

B. Pipe Installation

1. All pipe shall be installed in accordance with the approved manufacturers written instructions, Harford County Standards, and as specified herein. These recommendations, if more restrictive than that shown in the Standard Details shall include maximum trench width, bedding requirements, backfill material, and compaction, where applicable. In addition, the following shall apply unless otherwise noted:
 - a. Polyvinyl chloride sewer pipe (PVC) shall be installed in accordance with the Standard Details and the recommendations of Uni-Bell.
 - b. Ductile iron pipe (DIP) and cast iron soil pipe shall be installed in accordance with the Standard Details and the recommendations of the Ductile Iron Pipe Research Associations.
2. Equipment for Handling Pipe: Proper and suitable tools and appliances as approved for safe and convenient handling and joining of pipes shall be used.
3. Pipe Installation: Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to insure that each joint is watertight, has met the required manufacturer's insertion depth, and has no shoulder or unevenness of any kind along the inside of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the County.
4. Pipe Setting and Protection: No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure water tightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.
5. Cleaning Pipe: The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall remain in place at all times when installation is not in progress.

6. Cutting Pipe: Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be performed by an approved method that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.
7. Alignment of Pipe: A calibrated, precise sewer pipe laser shall be used to align the pipe to the proper grade. The Contractor is responsible to continuously monitor the line and grade in each pipe run between structures. It is the Contractor's responsibility to maintain proper calibration of the equipment throughout the duration of the project.
8. Jointing Pipe
 - a. General

Before any joints are made in the trench, the Contractor shall demonstrate to the County by making a sample joint that methods they will employ conform with the Specifications, will secure a watertight joint, and that the workers whom the Contractor intends to use are familiar with the requirements for making proper joints.
 - b. Push-On Gasketed Joints

Prior to making gasketed joints, both mating pipe ends and the gasket shall be cleaned of all foreign material. The gasket shall then be inserted in or stretched over the cleaned gasket seat and lubricant applied as recommended by the manufacturer and approved by the County. The pipe ends shall be carefully aligned and pushed together to meet the required manufacturer's insertion depth. There shall be no shoulder or unevenness of any kind along the inside of the pipeline. In all cases, the spigot shall be inserted into the previously laid and seated bell, in order to minimize the potential of gasket roll, to prevent the bell dragging and pushing soil into the joint, and to prevent the need to undercut the pipe to lay the bell. All bells shall be laid uphill.
 - c. Other methods of jointing pipe will be given consideration by the County, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.
 - d. All jointing and workmanship shall be in accordance with the manufacturer's recommendations as approved by the County.
9. Detector Tape: Install visual detection tape 18 inches above all mains.
10. Connections to existing work shall be made by the Contractor in the presence of the County at such a time and in such manner as directed and approved by the County. Shut-off operations will not be allowed. The Contractor shall complete the connections with the greatest possible speed and all work will

proceed without interruption until the connection operation is complete. When specified in the "Special Provisions", the Contractor shall make connections at night.

C. Sanitary House Connections

1. Sanitary house connection branch fittings shall be located where designated by the contract documents and/or the County. Short pieces of sewer pipe shall be field-cut to meet this condition as approved. The Contractor shall have available at the construction site factory approved equipment to machine and adapt the field-cut end to standard couplings and jointing materials.
2. Sanitary Sewer Taps: All taps made into sanitary sewer lines shall be made by an approved hole-cutting method in accordance with the manufacturer's recommendations. Every effort shall be made to prevent entrance of foreign matter into the pipe during the tapping procedure.
3. Backfill for the support of Y-branches and bends shall be placed as shown in the Standard Details, or as directed.

D. Field Tests

1. General
 - a. All portions of the sewers and appurtenances shall be tested. The County shall have the final decision as to the method or methods used, i.e. water infiltration, water exfiltration, air, mirror, or combination of these.
 - b. After installation, sanitary sewers and sanitary house connections will be inspected by the County with the assistance of the Contractor for compliance with these specifications. Inspections and tests will not be conducted until the section of pipeline being inspected and tested has been backfilled, dewatering pumps have been removed from the area, and the ground water has stabilized.
 - c. The Contractor shall schedule all tests with the County at least 2 working days in advance of the test, and shall conduct all tests in the presence of the County. On County Capital Projects, the County will witness one test at no cost the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required.
 - d. Sewer mains may not contain any debris, silt, earth, gravel, rock, or other foreign material prior to field testing. Each manhole run shall be flushed by the Contractor with sufficient quantities of potable water to flush all material within the sewer main prior to performing any tests. The downstream manhole shall be plugged and the flushing water and debris shall be collected within this manhole. The Contractor shall completely remove the water and all stones, silt, sediment, debris and foreign

material from the manhole. The flush water and debris may not extend beyond one or more manhole runs which collectively add up to 400 feet. Flush water may not be re-used for subsequent manhole runs. Potable water from the county water system shall be quantified in gallons by the Contractor and provided to the Division of Water and Sewer Maintenance personnel at the time of testing. At no time may flush water or debris be introduced into the existing County sewage collection system. The Contractor shall be responsible for all labor, material, equipment and other associated costs of cleaning the sewer mains to the satisfaction of the County.

- e. Control and/or treatment of the discharge of chlorinated water used for flushing, cleaning, or testing operations shall comply with all current applicable local, state, and federal regulations. Costs associated with the control or treatment procedures shall be the Contractor's responsibility.
- f. Harford County Water and Sewer will allow repairs to sewer mains on a very limited basis, if the main does not pass the pressure test. Repairs to sewer mains will be allowed with gasketed PVC couplings only. There shall be no more than one repair within any running 125 feet section in any given manhole run. If the number of identified air leaks exceed the above requirement, then new pipe shall be laid instead of additional PVC couplings. Upon completion of construction and successful testing, there shall be no more than one repair within any running 125 feet section in any given manhole run.

2. Materials

- a. When specific test of materials are called for in the referenced standards and specifications, the County has the option of requiring that any or all of these tests be performed.
- b. Polyvinyl chloride (PVC) pipe and couplings shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts or scrapes on inside or outside surfaces or other imperfections which may impair the performance or life of the pipe. Each pipe shall be straight-to-within 1 1/4 inch per 20-foot length of pipe when uniformly supported along its entire length, and shall have a true circular cross-section to within $\pm 1/64$ inch.
- c. Cast iron soil pipe, ductile iron pipe (DIP), and ductile iron and cast iron fittings shall be sound and without defects that might impair its service.

3. Visual Inspection

- a. All equipment necessary for the inspection will be furnished by the County, however, the Contractor shall provide assistance as may be required to enable the County to perform the inspection.
- b. The County will inspect all sanitary sewers for alignment, grade, leakage, and condition. The inspection may be conducted by crawling or walking through the pipeline, using mirrors to reflect light through the pipeline, or closed circuit television equipment.

- i. If a mirror test is used, the pipe alignment will be acceptable if it is sufficiently true and straight to allow passage of the reflected light with an image of a "full moon".
- ii. The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line.
- iii. No visible infiltration will be allowed. Any water leakage into the system sufficient to constitute any noticeable trickle or dribble shall be corrected.

4. Acceptance Testing

a. General

- i. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests. Testing shall be conducted only after the section of sewer has passed the visual inspection.
- ii. Generally sewers will be tested from manhole to manhole or from manhole to terminus of the pipeline if there is no manhole at the other extremity. Sewers shall only be tested after the brick channel and bench have been installed. Testing shall be by low pressure air and/or infiltration/exfiltration as specified herein and/or as determined by the County.
- iii. If the sanitary sewer or sanitary house connection fails any test specified herein, the Contractor shall, at their own expense, repair or replace any defective component and retest the failed section or component until all requirements are met. Defective material shall be replaced.
- iv. All equipment used for testing shall be approved by the County.

b. Low Pressure Air Test

Sanitary sewers 24-inch diameter and smaller and attached sanitary house connections shall be tested with low pressure air in accordance with the following procedures. Testing may only occur after the brick channel and bench have been completed.

- i. Test plugs shall be supplied and installed by the Contractor within the pipeline at each manhole. Each plug shall be securely braced.
- ii. If the pipeline to be tested is expected to be below the ground water table, the County may visually inspect the trench prior to backfilling to determine the elevation of the groundwater table. All gauge pressures for the test shall be increased by an amount to provide 4 psig above the back pressure due to ground water submergence over the end of the probe to a maximum of 6 psi in the pipe system to be tested.

- iii. If the air pressure required for the test is greater than 6 psig, the pipeline shall not be air tested, but shall be tested for infiltration in accordance with method indicated in Paragraph C, which follows.
- iv. The Contractor shall add air slowly to the portion of the pipeline under test until the internal pressure is raised to 4.0 psig greater than the average back pressure of any groundwater above the pipe's invert.
- v. The Contractor shall not allow personnel in manholes after the air pressure is increased in the sewer. If the test plug is suspected of leaking, the Contractor shall first relieve the pressure before any adjustments are made to eliminate air leakage at the plug. The Contractor may pre-coat the plug with a soap solution to check for leakage.
- vi. The Contractor shall allow the air temperature to stabilize for at least 2 minutes by adding only the amount of air required to maintain 4.0 psig above groundwater back pressure. After this 2 minute period, the Contractor shall completely disconnect the hose and compressor from the section being tested to assure no additional air is added to the pipeline.
- vii. The time required for the pressure to drop 1 psig will be observed and recorded. Pipelines which fail to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the table at the end of this Section shall be deemed to have failed the low pressure air test and will not be accepted by the County.
- viii. The portion of the line being tested will be acceptable if the time required in minutes for the pressure to decrease from 4.0 to 3.0 psig shall not be less than the time shown for the given diameters in the following table:

Pipe Diameter in Inches	Minutes
6	3.0
8	4.0
10	5.0
12	5.5
15	7.5
18	8.5
21	10.0
24	11.5

- ix. Air testing may be required for pipe diameters greater than 24 inch when specified by the Engineer and approved by Harford County.
- c. Infiltration/Exfiltration Tests
- i. Sanitary sewers 24-inch in diameter and larger and sewers in which air testing is not specified or required shall be subjected to either infiltration or exfiltration tests as determined by the County. Testing may be conducted from manhole to manhole, or between more than

two manholes, however, the length to be tested shall not exceed 700 feet. Minimum test duration shall be 24 hours unless otherwise directed by the County. Testing shall be conducted in accordance with ASTM C 969 as modified herein.

- a) Infiltration test shall be made by measuring the amount of water infiltrating into the pipeline section at the lower end of the section being tested by means of a weir installed in the pipe or by other measurement method approved by the County.
- b) Exfiltration test shall be made by plugging the lower manhole, filling the pipeline section with water to a level of at least 2 feet above the crown of the pipe at the upstream end of the section being tested or 2 feet above groundwater level whichever is greater and measuring the water level drop in the manhole at the end of the specified test period. Pipelines shall be filled with water for at least 24 hours immediately before the test.

c) Test Criteria

The maximum leakage allowance in the completed sewer lines shall not be greater than 25 gallons per inch diameter per mile per twenty-four hours. Note that this is a rate and does not in any way prescribe or infer the length of the line to be included in each test section.

d. Deflection Testing

In addition to other tests detailed in this Section, PVC sanitary sewers may be tested for deflection (reduction in vertical inside diameter). Testing shall be performed by passing a 5% undersized GO/NO-GO mandrel or sewer ball through the pipeline or measuring deflection continuously by using a deflectometer. Maximum allowable deflection shall be 5%.

e. Closed-Circuit Television Inspection

The County retains the right to inspect sewer mains by means of robotically controlled closed circuit television cameras.

4.0 METHOD OF MEASUREMENT

A. Sanitary Sewers

Measurement for furnishing and installing sanitary sewers will be made horizontally along the center line of the pipe for each size and type of pipe without deduction for wye or drop connections. The inside lengths of manholes and junction chambers will be deducted.

B. Sanitary House Connections

Measurements for furnishing and installing sanitary house connections will be made horizontally along the center line of pipe for each size and type of pipe

from the center line of the sewer to the end of the house connection without deduction for wyes, bends, cleanouts, plugs, or other fittings.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified, in strict accordance with the Contract Documents.
2. The price(s) bid for furnishing and installing sanitary sewers and sanitary house connections shall include trench excavation, backfill, compaction, and incidental items as specified in Section 02250 of these Standard Specifications.
3. Payment will be made for contingent items when approved by the County.

B. Sanitary Sewers

Payment for furnishing and installing sanitary sewers, complete and in place, will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include traffic control, furnishing and installing of all pipe, fittings, plugs, stoppers, and jointing materials; connection to existing pipelines, structures, or manholes; testing; providing an approved spoil site, and disposing of all spoil or excess materials, aggregate bedding, and backfill shown on Standard Detail S-1; all environmental and erosion or sediment control; restoration of all disturbed areas; and incidental items to complete the sanitary sewers.

C. Sanitary House Connections

Payment for furnishing and installing sanitary house connections complete and in place will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, vertical riser, cleanout, cap, plugs, precast concrete blocks where required, jointing materials; connection to sewer branch fittings; testing; providing an approved spoil site, and disposing of all spoil or excess materials; aggregate bedding, and backfill shown on Standard Detail S-22; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas; and incidental items to complete the sanitary house connection.

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SECTION 02710 SANITARY SEWER MANHOLES

1.0 GENERAL

A. Description

Sanitary sewer manhole installation shall include, but not necessarily be limited to, furnishing and installing sanitary sewer manholes and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Sanitary Sewers: Section 02700
3. Cast-in-Place Concrete: Section 03300
4. Precast Concrete Structures: Section 03400
5. Mortar: Section 04100
6. Brick Masonry: Section 04200

C. Quality Assurance

The County will inspect all materials delivered to the job-site. Any pre-cast concrete sections which are not in compliance with the required dimensions; which are not true, square, plumb, symmetrical; which have honey-combing; cracks, chips; which do not have smooth surfaces; or otherwise have visible material defects shall be rejected and removed from the project site. Rejected materials may not be repaired but shall be replaced with new products.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

The County will not furnish any materials for sanitary manholes.

C. Contractor's Options

1. The Contractor may furnish polypropylene, or plastic-coated steel for manhole steps.
2. Standard sanitary manholes shall be precast construction; however, the Contractor may furnish cast-in-place, or masonry construction for

miscellaneous sanitary sewer structures with the approval of the County.

D. Detailed Material Requirements

1. Granular bedding beneath manhole bases shall meet the gradation requirements of AASHTO M43, Size Number 57, as specified in Section 02240 of these Standard Specifications .
2. Portland cement concrete for cast-in-place structures shall be as specified in Section 03300 of these Standard Specifications, mix number as indicated on the Standard Details or the Plans.
3. Precast manhole bases, risers, cone sections, grade rings, and precast utility structures shall be as specified in Section 03400 of these Standard Specifications.
4. Joints shall be "O" ring compression type meeting the requirements of ASTM C-443.
5. Non-shrink grout shall be as specified in Section 04100 of these Standard Specifications.
6. Mortar for brickwork and grade rings shall be as specified in Section 04100 of these Standard Specifications.
7. Brick for manhole inverts and miscellaneous structures shall be sewer brick as specified in Section 04200 of these Standard Specifications.
8. Frames and covers shall be as shown in the Standard Details and as specified in Section 05500 of these Standard Specifications.
9. Manhole steps shall be as per the Standard Details. The plastic coated type shall be manufactured using a minimum 3/8-inch diameter steel reinforcing rod meeting the requirements of ASTM A 615, as a core. The plastic coating shall meet the requirements of ASTM 2146, Type II, Grade 4375B.
10. Force main discharge manholes and above grade manholes shall be seal-coated to the limits noted on the Standard Details with 16 mils of a coal tar polyamide epoxy.
11. Manhole-to-Pipeline Connectors
 - a. Cast-in-place type connectors shall be:
 - i. A Banded-boot type for sewer grades greater than 18% and less than 46.5%.
 - ii. A compression type for sewer grades less than 18%.
 - b. For doghouse type manhole applications a banded-boot type connector shall be used.
 - c. Mechanically wedge-in-place type connectors shall be used for cored

openings.

12. Manholes shall have sealant between the manhole and the manhole frame. The sealant shall be mastic rope, type B, 3/4 inch minimum diameter, butyl based, meeting requirements of AASHTO M 198.
13. The stainless steel insert dish for manholes shall be manufactured of materials resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid. The insert body shall be 18 GA, 304 stainless steel. The manufacturer must furnish a load test verification showing a load test failure in excess of 3,000 lbs. The insert shall contain gas relief valves designed to release a pressure of .5 to 2.0 psi and have a water leakdown rate no greater than 5 gallons per 24 hours. The handle shall be able to withstand a pull of 500 lbs. without breakage.

3.0 EXECUTION

A. General

1. Precast sections shall be transported and handled with proper equipment to protect the units from damage. Sections shall be handled by means of lifting inserts embedded in the concrete. All pre-cast concrete unit construction shall consist of new and unused products, free from defects. Repairs to pre-cast concrete units shall be strictly prohibited, before, and after shipment. Pre-cast concrete units damaged as a result of installation shall be removed and disposed of by the Contractor at no cost to the County and not returned to the project site. Damaged pre-cast units shall be replaced with new unused pre-cast units from the same manufacturer. Injection of grout sealant in the surrounding soils to correct joint leakage is prohibited.
2. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250 of these Standard Specifications.
3. Manholes and drop connections shall be installed in accordance with the Standard Details and as specified herein.
4. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the County.
 - a. Cast-in-place concrete construction shall be as specified in Section 03300 of these Standard Specifications.
 - b. Brick construction shall be as specified in Section 04200 of these Standard Specifications.
5. Pipelines connected to manholes and other structures shall have a pipe joint between 3 and 7 feet from the exterior wall of the structure.
6. All new openings in existing manholes shall be core drilled in a manner acceptable to the manhole manufacturer and the County.
7. A stainless steel insert dish shall be installed within all manholes where the edge of the cover is five (5) feet or less to the face of the curb. They shall

also be installed in manholes that lie within the vertical sumps of roadways, swales, or ditches and as directed by the County.

B. Manhole Installation

1. Manholes, frames and covers shall be installed as pipeline installation progresses. The manhole vertical axis shall be plumb and directly over the centerline of the pipeline unless otherwise shown or directed.
2. Manhole joints shall be watertight. The exterior of all joints below grade on new manholes shall be fully wrapped with a minimum 12-inch wide wrapping product specifically designed to prevent ground water infiltration at manhole joints. The wrapping product shall be designed for adhesion to concrete surfaces and shall meet the approved materials list. Installation of the wrap shall be in accordance with the manufacturer instructions. The wrap shall be centered over the manhole joint.
3. Grade rings shall be set on a full bed of mortar.
4. Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. All such channels shall be lined with sewer brick. Channels shall slope smoothly and evenly and a channel bench constructed to the height of the crown of the highest pipe. Channels and a watertight plug shall be installed in the manhole for future extensions where shown on the Plans or directed by the County.
5. Pipes shall be cut flush with the inside wall of the manhole.
6. The frame and cover shall be installed in accordance with the Standard Details.
7. Parging of the interior brick surfaces will not be permitted.

C. Curing

1. Manhole channels and benches shall receive a minimum twenty-four (24) hour cure time prior to being subjected to sewage flow. The County reserves the right to adjust this curing period if deemed necessary.

D. Tests

The construction of new manholes shall provide for a watertight interior, free of infiltration of groundwater and inflow of surface storm water runoff. After construction and during the one-year maintenance period there shall be no leakage or seepage of water into the manhole from defects related to materials and workmanship. All new manholes shall be vacuum tested as follows:

1. Vacuum Testing of New Manholes

Vacuum testing procedures shall be performed in accordance with ASTM C1244 with the following clarifications and modifications.

- a. Vacuum testing shall be performed by a utility testing company approved

by Harford County Water and Sewer Maintenance Department. The vacuum tests shall be performed after subgrade is within plus or minus 0.2 feet. Harford County retains the right to require additional vacuum tests if it believes other construction activities have damaged the integrity of the manhole.

- b. The brick bench and channel does not have to be installed at the time of vacuum testing.
- c. The manhole shall be fully backfilled prior to performing the vacuum test.
- d. Prior to testing, all lift holes shall be plugged with mortar. All pipes and pipe stubs entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
- e. The test head shall be placed at the top of the manhole in accordance with the recommendation of the testing apparatus manufacturer. A vacuum of 10 inches of mercury shall be drawn on the manhole. Then the valve on the vacuum line of the test head shall be closed and the time measured to drop the vacuum to 9 inches of mercury. The manhole is acceptable if the time for the vacuum to drop from 10 to 9 inches of mercury is equal to or greater than that shown in the following table:

Manhole Depth	Manhole Diameter (ft.)				
	4	5	6	7	8
	Time (Seconds)				
<4	10	13	16	19	23
6	15	20	25	29	34
8	20	26	33	38	45
10	25	33	41	48	56
12	30	39	49	57	67
14	35	46	57	67	78
16	40	52	67	76	89
18	45	59	73	86	100
20	50	65	81	95	111
22	55	72	89	105	122
23	59	78	97	114	133

- f. If the vacuum test does not pass, the manhole shall be excavated and the joints examined for source(s) of the failure. The joints shall be properly cleared of foreign matter and gaskets checked. The manhole sections shall be re-set as necessary until the passing of the vacuum tests.

E. Protection During Pavement Operations

The Contractor shall provide whatever means necessary to prevent damage to manholes during paving operations and to prevent soil, gravel, asphalt and construction debris from entering sanitary manholes and sewer mains during paving operations.

The County reserves the right to require the Contractor to perform additional vacuum tests if it believes the manhole was damaged from paving or other construction activities. All damaged manhole sections shall be replaced and re-tested at the Contractor's expense. Any frames and covers and brick work damaged or pushed off-center from paving or other construction activities shall be re-set to the satisfaction of the County at no expense to the County.

The Contractor shall recognize that any debris entering sanitary manholes from sewer, road or other construction is strictly prohibited. Prior to the operational walkthrough, all soil, gravel, asphalt and other construction debris shall be completely removed from the manhole and sanitary sewer.

4.0 METHOD OF MEASUREMENT

A. Sanitary Sewer Manholes

Measurement for furnishing and installing sanitary sewer manholes will be made per vertical foot for the number of each type constructed, as shown on the Standard Details. Measurement will be made from the lowest point in the manhole invert to the highest external point on the top of the manhole frame and cover.

B. Drop Connections

Measurement for drop connections will be made for the number and type constructed. The manhole on which the drop structure is constructed will be measured and paid for separately as described above.

C. Miscellaneous Structures

Measurement for miscellaneous structures will be made for the number of each type of unit constructed in accordance with the Contract Documents or as directed.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.
2. The price(s) bid for furnishing and installing sanitary sewer manholes shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250 of these Standard Specifications.
 - b. Furnishing and installing granular bedding for manhole foundation as shown on the Standard Details and as required elsewhere in the Contract Documents.

3. Payment will be made for contingent items when approved by the County.

B. Sanitary Sewer Manholes

Payment for sanitary sewer manholes will be made per each type and size (diameter) of manhole installed. The price(s) bid shall include traffic control, furnishing and installing all precast, masonry, or cast-in-place concrete units, waterproofing, reinforcing bars, ladder rungs, metal frames and covers; all testing; providing an approved spoil site, and disposing of all spoil and excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and incidental items to complete the manholes.

C. Manhole Drop Connections

Payment for drop connections will be made per type and size constructed as shown, specified, and directed. The price(s) bid shall include furnishing and installing all pipe, fittings, precast concrete, concrete encasement, aggregate and incidental items to complete the drop connection.

D. Miscellaneous Structures

Payment for miscellaneous structures will be made for each structure constructed to limits shown on the Contract Documents and shall be full compensation for furnishing all items necessary to satisfactorily complete the work.

E. Waterproofing

No separate payment will be made for waterproofing, but will be considered incidental to unit prices bid.

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SECTION 02720 SANITARY SEWER FORCE MAINS

1.0 GENERAL

A. Description

Sanitary sewer force main installation shall include, but not necessarily be limited to, furnishing and installing pressure rated pipe, fittings, and appurtenances of size and type shown on the Plans, installed on firm foundation true to line and grade and in accordance with the Contract Documents.

B. Related Work Specified Elsewhere

1. Trench Excavation, Backfill, and Compaction; Section 02250.
2. Precast Concrete Utility Structures; Section 03400.

C. Quality Assurance

1. Materials

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.
2. To minimize the number of joints, only standard manufacturers length of pipe shall be furnished and installed for all sanitary sewer mains and house connections unless otherwise indicated on the plans, or as approved by the County.

B. Pipe Symbols

For convenience and standardization, the various types of pipe are designated on the plans by the symbols noted in Section 02660 of these Standard Specifications.

C. Materials Furnished by the County

1. The County will not furnish any materials for sanitary sewer force main construction.
2. Unless otherwise noted in the "Special Provisions", the County will make water available from its potable water system for pipeline testing at no charge to the Contractor for one test only. The Contractor shall contact the Division of Water and Sewer to coordinate its use. If subsequent testing is required, the Contractor will purchase additional water from the County's system.

D. Contractor's Options

The Contractor shall only furnish ductile iron pipe and fittings, for sanitary sewer force mains unless otherwise noted.

E. Detailed Material Requirements

1. Portland cement concrete for pipe buttresses and anchorages shall be Mix No. 1, as specified in Section 03300 of these Standard Specifications.
2. Ductile iron pipe and fittings, shall be as specified in Section 02660 of these Standard Specifications. Pressure rating or class shall be as noted in the Contract Documents. Cement lining and coatings shall be as required on ductile iron pipe (DIP) and fittings.

Pipe shall be ductile iron pipe meeting the minimum material requirements for water main in Section 02660 of these Standard Specifications. Pipe shall be special thickness class 52; however, the specified thickness shall be noted on the construction drawings or project manual and shall account for expected operating pressures, surge pressures and a factor of safety.

3. Joint Restraint

- a. Restrained joint pipe and fittings shall be of the pipe manufacturer's standard design.
- b. Ductile iron retainer glands for use with mechanical type joints shall be as approved.
- c. Rod for tie rod assemblies shall meet the material requirements of ASTM A193, Grade B7, and shall be threaded for at least 8 inches on both ends. Rod shall be 3/4 inch diameter unless otherwise noted.
- d. Nuts shall meet the requirements of ASTM A194. Manufactured tie rod and accessories shall result in the completed restrained joint assembly having a minimum working pressure rating of 200 psi.

4. Resilient Seat Gate Valves

Resilient seat gate valves shall be as specified in Section 2662 of these Standard Specifications.

5. Valve Boxes

Valve boxes shall be as specified in Section 02660 of these Standard Specifications, except the covers shall be labeled "SEWER".

6. Sewage Air Release and Combination Air/Vacuum Valves

- a. Sewage air and vacuum valves shall be of the type that automatically releases air, gas or vapor under pressure, automatically exhausts large quantities of air during the filling of a system, and allows air to reenter during draining or when a vacuum occurs.

- b. Sewage air and vacuum valves shall have an elongated cast iron body and cast iron cover. The internal compound lever mechanism shall be stainless steel and all other internals, including float, stainless steel to positively prevent a galvanic action. The stainless steel float shall withstand a minimum pressure of 1,000 psi.
- c. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

PART	MATERIAL	SPECIFICATION
Body and Cover	Cast Iron	ASTM A48, Class 30
Internals	Stainless Steel	Series 300
Float	Stainless Steel	Series 300
Seat	Buna-N	
Exterior Paint	Phenolic Primer Red Oxide	FDA approved for potable water

- d. The valve manufacturer shall furnish installation and maintenance instruction manuals with each valve.
- e. Isolating valve shall be installed between force main and air and vacuum valve.
- f. Sewage air and vacuum valves shall be installed in an easily accessible vault. Vault shall be adequately vented to meet air and vacuum valve requirements.
- g. All internals shall be easily removed through the top cover without removing the main valve from the lines.

7. Detector Tape

Visual detection tape shall be 3 inches wide (minimum) nonmetallic green plastic tape, lettered "SEWER" in black graphics.

3.0 EXECUTION

A. General

1. Trench excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250 of these Standard Specifications.
2. Force main installation shall be as specified in Section 02660 of these Standard Specifications, except chlorination is not required.
3. Pipe bedding, thrust and anchor blocks, and force main appurtenances shall be installed in accordance with the Standard Details for Water.
4. Resilient Seat gate valve installation shall be as specified in Section 02662 of these Standard Specifications.
5. Sewage air release and combination air release/vacuum valves shall be

installed in accordance with the Standard Details.

B. Field Test

1. The force main and appurtenances shall be tested in accordance with Section 02660 of these Standard Specifications, except as modified herein.
2. Chlorination will not be required.

4.0 METHOD OF MEASUREMENT

A. Force Main

Measurement for furnishing and installing force main pipe and fittings will be per linear foot made horizontally along the centerline of the pipe through all fittings and appurtenances.

B. Isolation, Sewage Air Release and Combination Air/Vacuum Valves

Measurement for isolation, sewage air release and combination air/vacuum valves will be made of the number of each size and type of valves installed complete.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment and materials necessary to complete the work as shown, specified, and in strict accordance with the Contract Documents.
2. Payment for furnishing and installing force main pipelines and appurtenances will include the following:
 - a. Trench excavation, backfill, compaction and incidental items as specified in Section 02250 of these Standard Specifications.
 - b. Furnishing and installing bedding material for air release and vacuum valve manhole fill as per the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Force Main

Payment for furnishing and installing force main pipelines, complete and in place, will be made per linear foot of the size and type installed. The price(s) bid shall include traffic control, furnishing and installing all pipe, fittings, and jointing materials, removing existing buttresses when necessary, joint restraint, tracer wire and test stations where required, furnishing materials for and constructing all concrete anchorages and buttresses; strapping of fittings, connecting to existing pipelines or structures, testing; all aggregate bedding, and backfill shown on Standard Detail W-1; providing an approved spoil site, and disposing of all spoil

or excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and for all appurtenances, and incidental items to complete the force main.

C. Isolation, Sewage Air Release and Combination Air/Vacuum Valves

Payment for furnishing and installing isolation, sewage air release and combination air/vacuum valves, complete and in place, will be made for each size and type of valve installed. The price(s) bid shall include traffic control, furnishing and installing all valves, saddles, vaults or manholes, lids or frames and covers, pipe supports, angle valves, corporation stops, extension bar, restoration; testing of the complete installation; and incidental items to complete the valve installation.

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SECTION 02731 LOW PRESSURE SEWER

1.0 GENERAL

A. Description

Low pressure system installation shall include, but not necessarily be limited to, furnishing and installing pressure sewer pipe, valves, fittings, and appurtenances of the size and type shown on the Contract Plans and in accordance with the Contract Documents and approved installation details.

B. Related Work Specified Elsewhere

1. Clearing and Grubbing: Section 02110
2. Trench Excavation, Backfill, and Compaction: Section 02250
3. Water Valves and Appurtenances: Section 02662
4. Water Services and Appurtenances: Section 02664
5. Cast-in-Place Concrete: Section 03300
6. Miscellaneous Metals: Section 05500
7. Sewage Grinder Pumping units: Section 11307

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Construction.
2. To minimize the number of joints, only standard manufacturer's length of pipe shall be furnished and installed for all low pressure sewers unless otherwise indicated on the plans or approved by the County.

B. Materials

1. Pressure Sewer Piping, Fittings and Valves
 - a. All low pressure sewer pipe, valves and fittings 4-inches and larger shall be in accordance with Section 02720 of these Standard Specifications.
 - b. HDPE Pipe

- i. High density polyethylene pipe and fittings (HDPE) shall have a standard thermoplastic material designation code of PE 3408, comply with all requirements for a Grade PE34 according to ASTM D 3350, and have a PPI recommended designation of PE 3408.
 - ii. Pipe and fittings shall be manufactured from identical material. The manufacturer shall provide certification that samples of the manufacturer's production pipe have been tested in-house, in accordance with ASTM D 2837, and validated in accordance with the latest revision of PPI TR-3. Under these procedures, the minimum hydrostatic design basis shall be certified by the manufacturer to be 1600 psi at 73.40 F and 800 psi at 1400F.
 - iii. Pipe shall be DR 11, pressure rated for 160 psi.
 - iv. Pipe and fittings shall be butt fusible at 4400 F or 5000 F, and shall be socket or sidewall fusible at 5000 F.
 - v. Pipe shall be manufactured in accordance with ASTM F 714.
 - vi. Fittings and transition pieces shall be butt fusion type, meeting the requirements of ASTM D 3261 and this specification. All fittings shall be pressure rated to match the system piping to which they are fused. At the point of fusion, the outside diameter and minimum wall thickness shall meet the outside diameter and minimum wall thickness of ASTM F 714 for the same size of pipe.
- c. PVC Pipe
- i. Pipe shall be push-on type, SDR-21, rated for 200 psi, and meet requirements of ASTM D-2241.
 - ii. The pipe shall be plainly marked with manufacturers name, size, material type and grade, NSF seal, and pressure rating.
 - iii. The material shall consist of Grade 1 PVC compound material in accordance with ASTM D-1784.
 - iv. Rubber gaskets shall meet the requirements of ASTM D-1869.
 - v. Impact strength shall meet the requirements of ASTM D-2444.
- d. All valves 2" and smaller shall be Ball Valve Curb Stop with Female Iron Pipe Thread - (NPT) end connections. The valve size shall be same as the pipeline size. Connection to force main shall be packed joint with stainless steel insert, push-on joint or approved equal. Valves shall open left, counter-clockwise and be suitable for the conveyance of wastewater.

The ball valves shall turn one-quarter (1/4) turn, ninety degrees to open and shall have a minimum working pressure rating of 200 psi. The ball valve shall be suitable for buried service and shall be manufactured in accordance with AWWA C-500.

Valve extension stems shall be manufactured with cold rolled steel and have a centering ring when depth of ball valve is greater than 6' - 0". Top of stem shall be compatible with a standard tee-head wrench and extend to a maximum of 3-feet below finished grade. Bottom of stem shall be compatible with the ball valve tee-head and pinned to top of valve.

All valves 3" and larger shall be resilient seal gate valves, as specified in accordance with Sections 02660 and 02664 of these Standard Specifications.

- e. Roadway valve boxes shall be as specified in Section 02660 of these Standard Specifications except the covers shall be labeled "SEWER".

- f. Detector Tape

Visual detection tape shall be 3 inches wide (minimum) non-metallic green plastic tape lettered "sewer" in black graphics.

- g. Tracer Wire for Non Metallic Pipelines

Tracer wire shall be 8-gage, 7 strand continuous copper wire with 45 mil polyethylene insulation. The wire shall be green, have "UL" markings and suitable for direct bury applications. All underground splicing shall be with butt splice connectors and shrink tubing or split bolt connections with a water proof binder and underground electrical tape.

- h. Tapping Saddle

Tapping saddle shall be specifically designed to tap a live HDPE low pressure sewer main and shall be capable of being clamped to the main with stainless steel bolts. The tapping tee shall contain a full wrap-around saddle. The tapping tee shall contain an integral brass cutter and sleeve with lower and upper "cutter stops" which shall also function as a cut-off valve. Tapping tee shall be rated for a minimum 160 psi.

- i. Small Diameter Ductile Iron Pipe – Iron Pipe Size (IPS)

Small diameter ductile iron pipe and fittings shall meet the requirements of ASTM A-536. Grade 65-45-12 with a minimum wall thickness of 0.25 inches. Threads shall be NPT per ANSI B.120-1.

- j. 24-inch Frame and Cover Adjustment Riser

Adjustment riser shall be a multi-purpose rubber composite which enables the cast iron frame to be easily adjusted to the finished pavement surface. The adjustment riser shall be specifically manufactured for standard sanitary manholes and frames and shall withstand vehicular traffic conditions.

- k. Continuity Test Station

- i. The continuity test station adjacent to a fire hydrant shall be a 2 1/2" shaft cathodic test box constructed of ABS plastic with cast iron rim

and lid. The minimum box length shall be 24" and the body shall be flared or squared at the base to prevent pull out or settling. Lid shall be locking, green in color and have raised custom lettering noting "test". Test station shall be complete with an inset removable terminal board with three (3) terminals.

- ii. The continuity test station that is located over the low pressure sewer shall be a 4 1/4" valve box with blue locking lid. Test station shall be complete with an inset removable terminal board with three (3) terminals.

3.0 EXECUTION

A. Pressure Sewer, Fittings and Valves

1. The pressure sewer main shall be installed by either directional boring or open cut methods. In either case, unless otherwise prohibited by specific wetland permit requirements or otherwise shown on the construction drawings or specified, the entire drainage and utility easement and/or right-of-way shall be cleared and grubbed prior to the pipeline construction in accordance with Section 02110 of these Standard Specifications.
2. For open cut methods, the installation of pressure sewer pipe shall be in accordance with Section 02660 of these Standard Specifications. For directional drilling methods, the installation of pressure sewer pipe shall be in accordance with Section 02310 of these Standard Specifications.
3. Service valve assemblies (SVA) subjected to test pressure or system operating pressure prior to completion of service pipe installation and backfill shall be provided with adequate temporary bracing or anchorage to prevent valve separation from pipe.
4. HDPE pipe and fittings shall be installed in strict accordance with the manufacturer's recommendations.

B. Pressure Sewer House Service Connections and Appurtenances

1. Service connections from sewage grinder pump connections or pressure sewer mains shall be installed using service saddles as the pressure sewer main is being installed or with installation of the service valve assemblies as approved by the Owner.
2. Intersection, Flushing Connections, Terminal Flushing Connections and In-Line Cleanouts and Valves: Flushing connections and in-line cleanouts and valves shall be provided where indicated on the Drawings and in accordance with the Construction Details.

C. Concrete Thrust Blocks

The Contractor shall provide concrete thrust blocks on all pressure sewer bends, tees, plugs and caps in accordance with the drawings and Standard Details. The entire face of earth against which the thrust block will bear shall be undisturbed earth or soil that meets all required compaction requirements, flat, and at the

proper angle to counteract the thrust. Concrete thrust blocks shall be cured for a minimum of 48 hours before testing. Wood for temporary blocking and valve box installation shall be pressure treated southern yellow pine suitable for a buried application. Wood for blocking shall be solid, a minimum of one inch thick. No wood buttressing shall be used except as a temporary restraining measure until remaining work is completed.

D. Tracer Wire

All non-metallic mains shall have a tracer wire secured with duct tape to the top of the pipe. The tracer wire shall be continuous for the full length of the pipeline. Continuous conductivity shall be maintained and tested. Underground splice connections shall be made with solderless split bolt connectors and taped to pipe.

E. Detector Tape

Install visual detection tape 18 inches above all mains.

F. Inspection and Field Tests

1. The Owner will inspect all materials before and after installation to ensure compliance with these Contract Documents. When specific material tests are called for in the referenced standards and specifications, the County shall have the option of requiring that any or all these tests be performed for materials furnished for a specified project.
2. After installation, pressure piping and appurtenances, shall be tested by the Contractor for compliance with the Contract Documents. The Contractor shall furnish all labor, tools, materials, and equipment necessary to perform the specified tests.
3. All tests shall be witnessed by the County. The Contractor shall schedule all tests with the Owner at least 2 working days in advance.
4. If any section of the pressure sewer system fails the inspection and/or tests, the Contractor shall, at their own expense, replace, repair, adjust, seal, or reseal the personnel, to witness tests once only for each section tested. If additional tests are required, all costs of County personnel and equipment will be deducted from amounts to be paid the Contractor.
5. Inspection and testing of the various components of the low pressure sewer system shall be tested in accordance with Section 02660 of these Standard Specifications. Specified test pressure shall be 80 psi as measured at the high point of the low pressure sewer.
6. At the Contractor's expense and risk, they may elect to test against closed curb stops. If test pressures do not hold, the Contractor shall follow the procedure in item 8 below.
7. Testing shall include the entire low pressure system as one whole and complete system. With the exception of the ball valve curb stops on the service valve assemblies, and on the flushing connection risers, all valves

shall be in the open position during testing.

8. Normal test procedures include the installation of a temporary capped and buttressed pipe stub extending from the ball valve curb stop at each service valve assembly as shown on the Standard Details. However, at the Contractor's risk and expense, they may elect to test against closed ball valve curb stops at the service valve assemblies. If the ball valve curb stops are unable to hold the test pressure, the Contractor shall, at their expense, install the temporary capped and buttressed pipe stub as described above. In all cases, there must be a physical break between the ball valve curb stop and grinder pump basin during testing. This physical break must remain until the entire low pressure system has been tested and approved. The pipe and fittings between the ball valve curb stop and grinder pump basin will not be tested.

G. Continuity Testing for Non-Metallic Pipe

1. After backfilling, the County shall test at the Contractor's/Developer's expense, the tracer wire to demonstrate electrical continuity between valve boxes and through the length of the non-metallic pipeline installed. The Contractor shall schedule all tests with the County at least 2 working days in advance. Any discontinuity shall be located, repaired, and retested at the Contractor's expense until continuity is demonstrated.
2. On Capital Projects, the County will perform one continuity test at no cost to the Contractor. Should the continuity test fail, the Contractor shall reimburse the County for all costs resulting from such additional test so required until the continuity test passes.

H. Service Taps on Low Pressure Sewer

Service connections on live low pressure sewers shall be made with tapping saddles specifically designed for HDPE pipe. Tapping saddle shall be secured to the low pressure sewer by tightening the supplied bolts in strict accordance with the pipe and fitting manufacturers' recommendations. Plastic stiffener shall be inserted into the service connection end of tap. HDPE service line shall connect to HDPE adaptor.

4.0 METHOD OF MEASUREMENT

Measurement for furnishing and installing low pressure sewer, including appurtenances, flushing connections and service valve assemblies will be made horizontally along the centerline of the pipe for each size and type of pipe.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices shall include furnishing all labor, tools, equipment and materials necessary to complete the work as shown, and in strict accordance with the Contract Documents.

2. Payment for furnishing and installing low pressure sewer and appurtenances will include the following:
 - a. Clearing and Grubbing: Section 02110
 - b. Aggregate Backfill: Section 02240
 - c. Trench Excavation, Backfill and Compaction: Section 02250
 - d. Directional boring of pressure sewer: Section 02310
 - e. Restoration: Section 02800
 - f. Turf Establishment: Section 02820
 - g. Pre-cast Concrete Utility Services: Section 03400
3. Payment will be made for contingent items when approved by the County.

B. Low Pressure Sewer

Payment for furnishing and installing low pressure sewer, complete in place, will be made per linear foot of the size and type installed. The price(s) bid shall include clearing and grubbing, sediment and erosion control, traffic control, furnishing and installing pipe, fittings and jointing materials, joint restraint, buttresses, connection to existing pipelines or structures, testing, aggregate, excavation and backfill, disposing of spoil material, restoration of all disturbed areas and all other incidental items to complete the work.

C. Air/Vacuum Valves

Payment for air/vacuum valves shall be in accordance with Section 02720 of these Standard Specifications.

D. In-line Flushing Connections, Terminal Flushing Connections and Service Valve Assemblies.

Payment for furnishing and installing in-line flushing connections, terminal flushing connections and service valve assemblies complete in place, will be made for each unit installed. The price(s) bid shall include clearing and grubbing, sediment and erosion control, excavation and backfill, furnishing and installing all valves, pipe and fittings, furnishing and installing all vaults and manhole frames and covers, restoration and testing for the complete installation and all incidental items necessary to complete the work.

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SECTION 02800 RESTORATION

1.0 GENERAL

A. Description

Restoration shall include, but not necessarily be limited to all clean up and disposal of waste materials and the restabilization of disturbed areas including paved areas, non-paved areas, concrete improvements, street signs, mail boxes, fences, trees, shrubs and other improvements whether shown in the Contract Documents or not.

B. Related Work Included Elsewhere

1. Test Pits: Section 02012
2. Removal or Abandonment of Existing Utilities: Section 02050
3. Clearing and Grubbing: Section 02110
4. Aggregate Backfill: Section 02240
5. Trench Excavation, Backfill and Compaction: Section 02250
6. Boring and/or Jacking Pipe: Section 02300
7. Tunneling: Section 02400
8. Turf Establishment: Section 02820
9. Sodding: Section 02830
10. Soil Stabilization Matting: Section 02850
11. Cast-In-Place Concrete: Section 03300

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. General

Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

The County will not furnish any materials for restoration other than those acceptable materials which are available from the trench excavation limits as shown on the Contract Documents.

C. Contractor's Options

Not applicable.

D. Detailed Material Requirements

Not applicable.

3.0 EXECUTION

A. General

After the completion of backfilling, all materials not used therein shall be removed and disposed of in such a manner and at such point or points as shall be approved or directed by the County; and all roads, sidewalks, and other places on the line of the work shall be left free of debris, clean, and in good order. Said cleaning-up shall be done by the Contractor without extra compensation; and if they fail to do such work within twenty four hours after receipt of notice, the County may arrange to have the cleaning-up done by others; and the cost shall be retained out of the monies due or to become due to the Contractor under the Contract. In case of emergency, the County may restore or remove and dispose of materials wherever necessary without giving previous notice to the Contractor, and the cost of doing so shall be retained from any monies due to become due the Contractor under the contract.

B. Paved Areas

1. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall provide graded aggregate subbase, temporary bituminous surfacing material as per the Contract Documents and/or direction of the governing regulatory agency.
2. Weather permitting, the Contractor shall remove and dispose of the temporary surfacing materials, cut-back the edge of the existing pavement as per the Contract Documents, and permanently patch-pave the area as specified in the Contract Documents and/or governing agency direction. This shall be done within 30 calendar days after backfilling and compacting the trench as described in the paragraph above or within the time period specified by the governing agency.

C. Concrete Improvements

Sidewalks, curbs, combination curb and gutter, drive aprons, and other concrete improvements removed, soiled, or damaged by the Contractor's activities shall be cleaned or replaced by the Contractor in kind, or as directed by the County and/or Contract Documents without extra compensation.

D. Non-paved Areas

1. Immediately upon completion of the trench backfill and compaction as previously specified, the Contractor shall temporarily stabilize the area in accordance with the Contract Documents.
2. Weather permitting, within 14 days after the completion of trench backfill and compaction, the Contractor shall permanently stabilize the area with seeding and mulching or sodding, as noted in the Contract Documents.

E. Street Signs, Mail Boxes, Fences, Shrubs, Trees, and Other Improvements

1. Existing street signs and traffic control devices stored or relocated by the Contractor will be reset by the Contractor after construction in the area is complete and the work approved by the County.
2. In case of emergency, the County may reset street signs and traffic control devices wherever necessary without giving previous notice to the contractor; and the cost of doing so shall be retained from any monies due to become due the contractor under the contract.
3. Mail boxes shall be carefully removed by the Contractor to the extent required to permit construction operations and as directed by the Postal Service. It shall be the Contractor's responsibility to temporarily reset mail boxes during construction to maintain service until the boxes are permanently reset in their original locations or at locations designated by the Postal Service. The Contractor shall comply with all Postal Service regulations regarding the location and height of all mail boxes disturbed by their activities.
4. Existing fences, paper boxes, signs, property markers, and other similar items shall be carefully removed by the Contractor to the extent required to permit construction operations and as directed by the County. The Contractor shall safely store all items during the time that they are down and when possible, re-erect them in the original locations or at locations designated by the County.
5. Shrubs, hedges, and other plantings shall be transplanted with sufficient earth to insure that no damage to their major root system occurs. After transplanting has been accomplished, it shall be the Contractor's responsibility to water all plants until their growth is established.

4.0 METHOD OF MEASUREMENT

Restoration will not be measured.

5.0 BASIS OF PAYMENT

Restoration will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

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SECTION 02820 TURF ESTABLISHMENT

1.0 GENERAL

A. Description

Lawn Restoration shall include, but not necessarily be limited to, topsoil, soil preparation, seeding, fertilizing, mulching, liming as required, over seeding, and re-fertilizing all areas disturbed by construction and where designated for lawn restoration in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Clearing and Grubbing: Section 02110
2. Sodding: Section 02830
3. Soil Stabilization Matting: Section 02850

C. Quality Assurance

The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.

D. Establishment of Vegetation within Wetland Areas

Permanent soil stabilization measures within wetland and wetland buffers, and other environmentally sensitive areas shall be performed in strict accordance with the Maryland Department of the Environment and/or Army Corps of Engineers Wetlands and Waterways Permit. The turf establishment requirements herein do not pertain to special conditions associated with wetland areas.

E. Turf Establishment

Turf establishment shall be performed by a professional landscape contractor in which over fifty percent of their business is landscape work. The Contractor shall provide evidence of landscapers work history and references for Harford County review and approval prior to the work being performed.

The Contractor and landscape subcontractor shall obtain and file at the work site a copy of the Maryland Turf Grass Law and Regulations and Maryland Seed Law and Regulations available from the Maryland Department of Agriculture.

2.0 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for lawn restoration.
2. The Contractor may purchase water for hydroseeding or turf irrigation from the County's potable water system. The Contractor shall contact the Division of Water and Sewer to coordinate its use.

B. Contractor's Options

1. Fertilizer may be furnished in either dry or liquid form unless otherwise noted.
2. Mulch may consist of straw, hay, salt hay, or wood cellulose fiber unless otherwise noted.

C. Detailed Material Requirements

1. Ground Limestone

Ground limestone shall contain not less than 80% calcium and magnesium carbonates. Dolomitic or magnesium limestone shall contain at least 10% magnesium as magnesium oxide. The limestone shall be ground to meet the following size gradation:

<u>Sieve Sizes</u> <u>U.S. Standard</u>	<u>Percent Passing</u> <u>by Weight</u>
No. 10	100
No. 20	98
No. 100	50

2. Fertilizer

- a. Fertilizer analysis shall be 10-10-10 for temporary seeding and 10-20-20 for permanent seeding. It shall be a standard commercial grade fertilizer meeting the requirements of all State. Commercial fertilizer shall provide the minimum percentage of available nutrients specified.
- b. Fertilizer shall be furnished in bulk or new, clean, sealed, and properly labeled bags. Fertilizer failing to meet the specified analysis may be used as determined by the County providing sufficient materials are applied to comply with the specified nutrients per unit of measure without additional cost to the County.

3. Seed

- a. Seed lots must be state certified and blended under the supervision of the Maryland Department of Agriculture (MDA), Turf and Seed Section.
- b. All seed and labeling must fully comply with the Maryland Seed Law and these Specifications.
- c. Each container shall have permanently affixed to it an accurate analysis tag and a certification tag.
- d. All seed lots to be used in this mixture shall have been pretested by the Maryland Seed Laboratory to insure compliance with Specifications.
- e. A quality control sample of the delivered mixture may be submitted to the Maryland Seed Laboratory for testing prior to payment and any lots found not to comply with the Specifications shall be returned at the Contractor's

expense.

f. The Engineer's representative shall collect all seed certification tags and/or sod certification prior to the beginning of any seed or sod work.

g. No seed shall be used after date of expiration.

h. Seed type and application rates

i. For sunny and partly shaded improved areas which are mowed regularly: sow the following mixtures at 195 pounds per acre or 4.5 pounds per 1,000 square feet between March 1 and May 31 and between August 15 and October 31:

<u>Grass Type</u>	<u>Percent</u>	<u>Certified Grass Species</u>
Tall Fescue	90-100	Adventure, Apache, Arid, Falcon, Finelawn I or Rebel II
Kentucky Bluegrass	0-10	Common, Kenblue, Vica, Ram 1 or Monopoly

ii. For heavily shaded improved areas which are mowed regularly: sow the following mixtures at 175 pounds per acre or 4 pounds per 1,000 square feet between March 1 and May 31 and between August 15 and October 31:

<u>Grass Type</u>	<u>Percent</u>	<u>Certified Grass Species</u>
Tall Fescue	65	Adventure, Apache, Arid, Falcon, Finelawn I or Rebel II
Perennial Ryegrass	10	All Star, Blazer, Manhattan, Palmer, Pennant, Pennfine, Premier, Prelude, Regal or Repell
Creeping Red Fescue and/or Chewings Fescue	25	Penlawn, Flyer, Longfellow Victory or Jamestown

iii. For unimproved areas not to be mowed: sow mixture at 175 pounds per acre or 4 pounds per 1,000 square feet between March 1 and May 31 and between August 15 and October 31:

<u>Grass Type</u>	<u>Percent</u>	<u>Certified Grass Species</u>
Tall Fescue	80	Kentucky 31 (K-31)
Perennial Ryegrass	20	Common

iv. All seed varieties shall meet the following minimum specifications:

- | | |
|------------------------|-----|
| a) Minimum Purity | 98% |
| b) Minimum Germination | 85% |

- c) Maximum Other Crop 0.1%
- d) Maximum Weed Seed 0.1%
- e) Noxious Weeds None

* Must be free of ryegrass, timothy, orchard grass, bentgrass, Canada bluegrass, clover, or any other contaminant which shall be unsightly and uncontrollable.

** Must be free of dock, cheat, chess, chickweed, crabgrass, plantain, and black magic.

*** Must be free of all Maryland prohibited and restricted noxious weeds.

4. Mulch

- a. Mulches shall be free of clay, stones, foreign substances, plant parts of Canada Thistle and Johnsongrass, and reasonably free of other weed seeds. Mulches containing Canada Thistle and Johnsongrass shall not be used for any purposes.
- b. Straw, hay, and salt mulches shall not contain sticks larger than 1/4-inch in diameter or other materials which would prevent matting down during application. No straw, hay, or salt hay mulches shall be used within 48 hours after cutting. Straw, hay, and salt hay shall be free from mold and other objectionable material and shall be in an air-dry condition suitable for placing with mulch blower equipment.
- c. The following mulches may be acceptable by visual inspection provided they meet the above and following requirements:
 - i. Straw: Straw shall consist of thoroughly threshed wheat, rye, or oat straw.
 - ii. Hay: Hay shall consist of native grasses or other plant material approved by the County. Hay shall be free of noxious weed seeds as specified in the Maryland Seed Law.
 - iii. Salt Hay: Salt hay shall consist of well cured beach grasses or other approved material.
 - iv. Wood Cellulose Fiber: Wood cellulose fiber shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose fiber shall contain a green dye that will provide easy visual inspection for uniformity of the slurry spread. The wood cellulose fiber, including dye, shall contain no germination or growth inhibiting properties. The material shall be manufactured and processed in a manner that the wood cellulose fiber will blend with seed, fertilizer, and other additives to form a homogeneous slurry. The wood cellulose fiber shall perform satisfactorily in hydraulic seeding equipment without clogging or damaging the equipment.

The manufacturer shall certify that wood cellulose fiber meets the following requirements:

<u>Requirements</u>	<u>Specification Limits</u>
Particle Length	Approximately 3/8 inch
Particle Thickness	Approximately 3/64 inch
Net Dry Weight Content	Minimum stated on bag
ph, ASTM D778	4.0 to 8.5
Ash Content, ASTM D586	1.6% maximum
Water Holding Capacity	90% minimum

The material shall be delivered in packages of uniform weight not exceeding 75 pounds net weight and bear the name of the manufacturer, the net weight, and a supplemental statement of net weight content.

v. Mulch Binder

Mulch binder shall be emulsified asphalts or wood cellulose fiber meeting the requirements of Section 02820(2.0).C.4.c.iv of these Standard Specifications.

vi. Water

Water used in the planting or care of vegetation shall be free from oil, acids, alkalis, salts, or any substance injurious to plant life. Water from streams, lakes, ponds, or similar sources shall not be used unless the source is approved by the County.

5. Topsoil

- a. Topsoil shall consist of natural surface agricultural soil capable of sustaining vigorous plant growth. Topsoil shall be free of stones, roots, rubbish and other objectionable materials including Bermuda grass, poison ivy and other items harmful to plant life. Organic matter, as determined by AASHTO Test T-194, shall be 1.5 to 10 percent by weight. The pH shall range between 5.0 and 7.5. The soil analyses shall meet the following in accordance with AASHTO M146: Sand (20 to 75% by weight), Silt (10 to 60% by weight), Clay (5 to 30% by weight).
- b. Topsoil on site may be salvaged for re-use provided that it meets the above specified requirements.
- c. The source of off-site manufactured topsoil shall originate from reputable local supplier with prior Harford County approval.

3.0 EXECUTION

A. Seeding Seasons

Seed shall be sown from March 1 to May 31 and from August 15 to October 15 inclusive as soon as the soil is dry enough to allow proper penetration of a

seedbed. Extensions beyond these time periods may be granted by the County, depending upon weather conditions for the period in question. Any planting outside of these seasons shall be solely at the Contractor's risk and shall not be subject to compensation until stabilization has been accomplished in accordance with these Specifications. No seeding shall be done on frozen ground or when the temperature is 32 degrees F or lower.

B. Schedule of Procedure

The Contractor shall begin their work at a point or points approved by the County. When topsoil is required for areas to be seeded, all topsoiling shall be completed before seeding operations are started.

C. Soil Preparation

1. For unimproved areas which will not be mowed regularly: Areas of disturbance shall be graded to match the original condition. Soil shall be scarified to a depth of 2-inches. Remove all stones greater than 1-inch in diameter by means of manual or mechanical landscape rakes. Seed and mulch as specified below.
2. For improved areas which will be mowed regularly: Soil shall be lightly scarified if compacted. Remove all stones greater than 1-inch by means of manual or mechanical landscape rakes. Topsoil shall be placed to a uniform compacted depth of 2-inches, and shall be graded to match original conditions.

D. Seeding

Seeding shall consist of soil preparation as specified above and application of seed, fertilizer, and mulch as specified below. Seed application shall be by either of the following application methods as the Contractor may elect:

1. Dry Application Method

- a. Ground Limestone: Ground limestone, shall be applied, at rates as determined by soil test or no less than 50 pounds per 1000 square feet, separately before the application of any fertilizer or seed on seedbeds which have previously been prepared. Where ground limestone is required to be worked in, the seedbed shall again be properly graded and dressed for seeding. Limestone shall be worked into the full depth of topsoil. Limestone shall not be applied to unimproved areas.
- b. Fertilizer: Fertilizer of the analysis 10-20-20 shall be applied at a rate of 1,000 pounds per acre.
- c. Seed Application: Application rates shall be in accordance with Section 2.0 above. After seeding, the areas shall be lightly raked and rolled. Areas which do not "catch" shall be re-seeded at an interval of fourteen (14) days, which shall continue until a satisfactory growth of grass is established over the entire area.

2. Wet Application Method

- a. General: Apply seed and fertilizer (ground limestone, if required) by spraying the material on previously prepared seedbeds in the form of an aqueous mixture using the methods and equipment described herein. The rates of application shall be the same as those specified for the Dry Application Method.
- b. Spraying Equipment: The spraying equipment shall have a water tank equipped with a bar or liquid level gage calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity. The gage shall be mounted to be visible to the nozzle operator. The tank shall also be equipped with an agitation system capable of keeping all the solids in the mixture in complete suspension at all times until used.
- c. Ground Limestone
 - 1) Ground limestone, if required, shall be sprayed separately from mixtures of seed and fertilizer on areas flatter than 3:1. The water-limestone mixture shall contain a maximum of 600 pounds per 100 gallons. The water limestone mixture shall be applied at a minimum rate of 1000 gallons per acre. The water-limestone mixture shall be worked into the topsoil. After working the ground limestone into the topsoil, the seedbed shall again be properly graded and dressed.
 - 2) Ground limestone shall not be required to be applied separately on slope areas 3:1 and steeper. The water-seed-fertilizer and limestone mixture shall be applied at a minimum rate of 1000 gallons per acre in the relative proportions specified so that these combined solids do not exceed 600 pounds per 100 gallons.
- d. Application
 - 1) Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which ground limestone, if required, has been incorporated. Seed and/or fertilizer shall be mixed together with water in the relative proportions specified so that these combined solids do not exceed 300 pounds/100 gallons. The water-seed-fertilizer mixture shall be applied at a minimum rate of 1000 gallons/acre.
 - 2) All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All seed mixtures in aqueous agitation shall be used within eight hours after mixing, except for leguminous seed which shall be used within one hour after mixing. Seed mixtures not utilized within the time limits shall be wasted and disposed of at locations acceptable to the County.
 - 3) The mixtures shall be applied by high pressure spray equipment which shall always be directed upward into the air so the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in a manner to produce erosion or runoff.

- 4) Particular care shall be exercised to insure that application is made uniformly at the prescribed rate and to guard against misses and overlaps. Proper predetermined quantities of the mixture, as specified, shall be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or collecting containers over the area at intervals and observing the quantity of material deposited thereon.
- 5) The spray method shall not be used during periods of high winds which prohibit satisfactory spray patterns.
- 6) Seed and fertilizer applied by the spray method need not be raked into the soil.
- 7) Any spray or residual which disfigures or otherwise damages existing structures or vegetation shall be thoroughly cleaned from the damaged surface.

E. Mulch Application

1. Mulch materials shall be furnished, hauled, and evenly applied on the area shown in the Contract Documents and/or as directed by the County. All mulch shall be immediately applied after seeding. Mulch applied by hand shall provide a loose depth of not less than 1.5 inches nor more than 3 inches. Mulch applied by the blowing method shall provide a loose depth of not less than 1 inch nor more than 2 inches, and 95% of the mulch shall be 6 inches or more in length. Mulch applied by the above methods shall achieve a uniform distribution and depth so no more than 10% of the soil surface is exposed. Mulch applied either by hand or the blowing method shall be spread evenly over all seeded areas at the rate of 2.0 tons per acre.
2. If the mulch is to be secured with a mulch anchoring tool, the rate shall be 2.5 tons per acre. If the tracking method is used, the rate of mulch shall be 1.5 tons per acre.

F. Securing Mulch

Mulch may be secured by any of the following methods.

Where mulch has been secured with a wood cellulose fiber binder, it will not be permissible to walk on the slopes after the binder has been applied. The Contractor will be required to place temporary protective covers over existing signs just before seeding and mulching. The covering shall be immediately removed after seeding and mulching operations are completed.

1. Peg and String Method

If the peg and string method is used, the mulch shall be secured by stakes or wire pins driven into the ground on 5-foot centers or less. Binder twine shall be strung between adjacent stakes in straight lines and crisscrossed diagonally over the mulch, after which the stakes shall be driven nearly flush to the ground to draw the twine down tight onto the mulch.

2. Spray Method

If the spray method is used, all mulched surfaces shall be sprayed with the selected binder material so the surface has a uniform appearance. Mulch binder may be sprayed on the mulched slope areas from either the top or the bottom of the slope. A spray nozzle of approved design must be used. The nozzle shall be operated at a distance of not less than 4 feet from the surface of the mulch. Uniform distribution of the binder material will be required. A pump or an air compressor of adequate capacity shall be used to insure the uniform distribution of binder material.

a. Chemical Binder

Wood cellulose fiber used as a binder shall be applied at a net dry weight of 750 pounds per acre.

The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 pounds of wood cellulose fiber per 100 gallons.

3. Mix Method

If the mix method is used, the mulch shall be blown onto the area by a mulch blower; and the binder material shall be sprayed into the mulch as it leaves the mulch blower. For rates of application, see Spray Method above.

G. Wood Cellulose Fiber

Wood cellulose fiber used as a mulch shall be applied at a net dry weight of 1,500 pounds per acre. The wood cellulose fiber shall be mixed with water at a maximum rate of 50 pounds of wood cellulose fiber per 100 gallons. This wood cellulose fiber will be permitted to be used in the following areas when approved, and as directed, by the County:

1. Narrow disturbed areas up to 8 feet wide adjacent to pavement where traffic created gusts of wind could cause problems with straw.
2. Deep or high slope areas inaccessible to straw application by a mulching machine.

H. Repair of Defective Areas

1. The responsibility for maintaining treated areas shall be as follows. Until the Project is finally accepted, the Contractor will be required to repair or replace any seeding or mulching that is defective or damaged. When, in the judgment of the County, such defects or damages are the result of poor workmanship or failure to meet the requirements of the Contract Documents, the cost of necessary repairs or replacement shall be borne by the Contractor. However, once the Contractor has completed the seeding and mulching of any area in accordance with the provisions of the Contract Documents and to the satisfaction of the County, no additional work at their expense will be required. Subsequent repairs and replacements deemed necessary shall be made by the Contractor and will be paid for as additional work or extra work.

2. When either the Dry or Wet Application Method is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density. If, when the Contract has been completed, it is not possible to make an adequate determination of color, density and uniformity of such stand of grass, payment for the unaccepted portions of the areas will be withheld until these requirements have been met.

4.0 METHOD OF MEASUREMENT

A. General

1. Except when used as a contingent item or noted otherwise, measurement for turf establishment will not be made, as it shall be included in the unit quantity item for utility installation.
2. When used as a contingent item or noted otherwise, measurement for turf establishment will be made on the surface area, measured in place, acceptably established.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for turf establishment will not be made, as it shall be included in the unit quantity item for utility installation.
2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Turf Establishment

1. Payment for turf establishment will be made per square yard at the contingent prices established in the bid form. The price shall include all traffic control and incidental items to complete the turf establishment.

SECTION 02830 SODDING

1.0 GENERAL

A. Description

Sodding shall include, but not necessarily be limited to, furnishing, hauling, and placing grass sod on prepared areas in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Clearing and Grubbing: Section 02110
2. Turf Establishment: Section 02820
3. Soil Stabilization Matting: Section 02850

C. Quality Assurance

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for sodding.
2. The Contractor may purchase water from the County's potable water system. The Contractor shall contact the Division of Water and Sewer to coordinate its use.

B. Contractor's Options

Fertilizer may be furnished in either dry or liquid form unless otherwise noted.

C. Detailed Material Requirement

1. Grass Sod

Grass sod shall be well rooted and produced in the State of Maryland. It shall, when placed, be live growing grass not less than 3-years old, of which not less than 96% shall be improved tall fescue (Rebel II, Rebel Falcon, Olympic) and not more than 4% Kentucky Bluegrass (Victa, Nassau) at the time of installation. It shall, when placed, have been cut and rolled (stored) not longer than 48 hours. It shall be cut in strips not less than 12-inches nor more than 18-inches wide and have 3/4 inches of soil firmly attached to the roots. The sod thickness shall not be deficient more than 1/4-inch from the required thickness at or just before placement. This 1/4-inch tolerance does not relieve the Contractor of the responsibility of cutting the sod a full 3/4-inches thick. The thickness of sod is measured by the thickness of soil firmly attached to the root system. The height of grass or thickness of thatch has

no bearing on the determination of sod thickness. The sod and attached soil shall be free from noxious weeds: Common Bermudagrass, Nutsedge, Quackgrass, Garlic, Johnsongrass, Poison Ivy or Poison Oak, and Canada Thistle. Any lot of sod containing the following weeds either individually or collectively exceeding one percent of the total plant population by plant count or surface area covered shall be rejected as follows: Orchard-grass, Nimblewill, Annual Bluegrass, Crabgrass, Goosegrass and Foxtail. It shall not contain substances deleterious to growth or which might affect the survival or hardiness of the sod when transplanted.

2. Fertilizer shall be as specified in Section 02820 of these Standard Specifications.
3. Ground limestone shall be as specified in Section 02820 of these Standard Specifications.
4. Water shall be as specified in Section 02820 of these Standard Specifications.
5. Pegs shall be wooden wedges 2-inch x 1-inch x 6-inch to 2-inch x 1-inch x 12-inch.
6. Staples shall be made from No.11 or heavier steel wire bent to form a U. The staples shall average 1 to 1-1/2-inches wide. The staple shall be at least 6 inches long from top to bottom after bending.

3.0 EXECUTION

A. General

Sod sections or strips shall be of a length as may be readily lifted without breaking, tearing or loss of soil.

Sections or strips shall be cut by approved sod cutters, hauled or carried to storage piles or the point of installation without breaking, and set in final place as indicated on the Contract Documents and as directed by the County. All sod in stacks shall be kept moist and protected from exposure to the air, sun and freezing. Any sod permitted by the Contractor to dry out may be rejected whenever, in the judgement of the County, its survival after placing is rendered doubtful. No payment will be made for rejected sod.

In no event shall more than 48 hours elapse between the cutting and placement of sod.

During wet weather, sod shall be allowed to dry sufficiently to prevent tearing as a result of handling and placing. During dry weather it shall be watered before cutting and lifting to insure its vitality and prevent the dropping off of soil in handling.

B. Ground Preparation

Before placing sod upon any topsoiled surfaces, all shaping and dressing of such surfaces shall be completed. The completed areas to be sodded shall present a

smooth, uniform, well tilled surface true to line and cross-section. Any raking required to accomplish this shall be done immediately before placing the sod.

All areas to be sodded shall be fertilized and limed in accordance with Section 02820 of these Standard Specifications. The lime and fertilizer shall be worked into the top 2 inches of soil before placing sod.

C. Sod Placement

No sod shall be placed between the dates of June 1st and August 15th inclusive unless adequate irrigation is available to establish the sod nor any time when the temperature is below 32 degrees F. No frozen sod shall be used. No sod shall be placed upon frozen soil.

Sod shall be lifted from trucks or storage piles and placed by approved methods with close joints and no overlapping. All cracks between blocks of sod shall be closed with small pieces of sod. All sod shall be tamped or rolled after laying to close the seams between the pieces and press the sod tight against the ground. A hand tamper shall weigh approximately 15 pounds and have a flat surface of approximately 100 square inches. A roller shall weigh 40 pounds per foot of width. Any slipping of sod is to be corrected by the Contractor without additional compensation.

D. Watering

The sod shall be watered a minimum of 3 times after placement. The sod and soil directly beneath the sod shall be kept moist, by additional waterings if necessary, until acceptance or it has become established. The first watering shall be immediately after laying the sod. The second and third waterings shall be as necessary within 2 weeks of the first watering. No sod will be accepted until the water requirements have been satisfied, and the sod appears in good health.

E. Sodded Slopes and Drainage Ditches

On slopes 2:1 and steeper, sod shall be laid with the long edges parallel to the contour starting at the bottom of the slope. Successive strips shall be neatly matched and all joints staggered or broken. When placing sod in drainage ditches, the length of the strip shall be laid perpendicular to the direction of the flow of the water. Where the sod may be displaced during sodding operations, the workers, when replacing it, shall work from ladders or treaded planks to prevent further displacement.

Each strip or section of sod placed on slopes 2:1 and steeper and surface drainage V-shaped or flat bottom ditches or gutters shall be staked securely with at least 2 wooden pegs spaced not more than 2-feet apart with the flat side against the slope and driven flush with the top of sod.

F. Repair of Defective Areas

Until the project is conditionally accepted, the Contractor will be required to repair or replace any sod that is defective or damaged.

G. Contractor's Responsibility

Before final acceptance of the Project, it shall be the responsibility of the Contractor to remove all heaved staples, which have been in place a minimum of six months, from areas to be mowed, or as directed by the County.

4.0 METHOD OF MEASUREMENT

A. General

1. Except when used as a contingent item or noted otherwise, measurement for sodding will not be made, as it shall be included in the unit quantity item for utility installation.
2. When used as a contingent item or noted otherwise, measurement for furnishing and installing sodding will be made on the surface area, measured in place, acceptably installed.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for sodding will not be made, as it shall be included in the unit quantity item for utility work.
2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Sodding

Payment for furnishing and installing sodding complete and in place will be made per square yard at the contingent prices established in the bid form. The price shall include all pegging, irrigation, traffic control, and incidental items to complete the sodding.

SECTION 02850 SOIL STABILIZATION MATTING

1.0 GENERAL

A. Description

Soil stabilization matting shall include, but not necessarily be limited to, furnishing and placing excelsior matting over seeded areas, and securing with wire staples on seeded areas in accordance with the Contract Documents. Soil stabilization matting shall only be furnished and installed if required by the Contract Documents or if directed by the Engineer.

B. Related Work Included Elsewhere

Turf Establishment: Section 02820.

C. Quality Assurance

The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for soil stabilization matting.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Excelsior Matting

- a. Excelsior matting shall be machine produced from wood which has been properly cured to achieve adequately curled and barbed fibers. A maximum of 20% of the fibers may be less than 6 inches in length.
- b. The excelsior matting shall have a uniform thickness and distribution of fibers throughout. The top and bottom of the excelsior matting shall be covered with a biodegradable extruded plastic netting having a maximum mesh opening of 2 inches x 2 inches. The average break strength of any two strands running lengthwise shall be 5 pounds minimum. The net shall be entwined with the excelsior to aid handling and provide sufficient reinforcement against damage during handling and placement.
- c. The excelsior matting shall be smolder resistant. A chemical treatment may be applied to the matting to make it smolder resistant. The chemical treatment, if used, shall be non-leaching, nontoxic to vegetation and germination of seed, and non-injurious to human skin. Rolls of the excelsior matting shall meet the following requirements: width - 48 + 1 inch; weight - 0.60 pounds per square yard minimum at 0% moisture;

nominal roll length - 180 feet.

2. Staples shall be as specified in Section 02830 of these Standard Specifications.
3. "T"- Pin staples shall be made of No. 8 wire with an 8-inch leg, 4" head and a 1-inch secondary leg.
4. Materials required for seeding shall meet the requirements of Section 02820 of these Standard Specifications, except mulch binder will not be required.

3.0 EXECUTION

A. General

When topsoil is specified for areas where matting is being placed, topsoil placement shall be completed before the soil stabilization matting operations are started.

B. Seeding

Seeding shall be performed in accordance with the provisions of Section 02820 of these Standard Specifications, except that Fall season installation of soil stabilization matting shall end on September 30, and the rolling operation shall be omitted. The seed mixture shall be the same as in the areas immediately adjacent to the area where matting is to be placed.

C. Placing and Securing

The matting shall be placed prior to the first rain event or within 48 hours after seeding operations have been completed in the work areas, whichever is less. Matting shall be rolled on in the direction of the flow of water. Where more than one width of matting is required, the strips shall overlap at least 4 inches. Ends shall overlap at least 6 inches. The upgrade end of each strip of matting shall be turned down and buried to a depth of not less than 6 inches with the soil firmly tamped against it. Overlapping shall be done with the upgrade section on top. The County may require any other edge exposed to more than normal flow of water be buried in a similar manner. Edges of matting must be similarly buried around the edges of catch basins and other structures. Disturbed areas shall be fertilized and reseeded with the specified seed mixture for the area.

Matting shall be laid smoothly upon the seeded surface, and stretching shall be avoided. Matting shall be securely fastened with staples driven vertically into the soil, flush with the surface. Matting shall be in firm contact with the soil in its entirety. Staples shall be placed 2 feet apart along the edges and center of the matting. On all overlapping edges, staples shall be placed 18 inches apart. At all ends of the matting, staples shall be placed 6 inches apart.

D. Contractor's Responsibility

Before final acceptance of the Project, it shall be the responsibility of the Contractor to remove all heaved staples, which have been in place a minimum of 6 months, from areas to be mowed, or as directed by the County.

4.0 METHOD OF MEASUREMENT

A. General

1. Except when used as a contingent item or noted otherwise, measurement for soil stabilization matting will not be made, as it shall be included in the unit quantity item for all pipe and structures installed.
2. When used as a contingent item or noted otherwise, measurement for furnishing and installing soil stabilization matting will be made of the surface area, measured in place, acceptably installed.

5.0 BASIS OF PAYMENT

A. General

1. Except when used as a contingent item or noted otherwise, payment for soil stabilization matting will not be made, as it shall be included in the unit quantity item for pipe and structures installed.
2. When used as a contingent item or noted otherwise, payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict accordance with the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Stabilization Matting

Payment for stabilization matting will be made per square yard at the contingent prices established in the bid form. The price bid shall include all traffic control, and incidental items to complete the soil stabilization matting.

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SECTION 02860 TREE PROTECTION

1.0 GENERAL

A. Description

Tree protection shall consist of measures necessary for the survival of existing trees to remain in the vicinity of the proposed work, and where designated in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Clearing and Grubbing: Section 02110
2. Trench Excavation, Backfill, and Compaction: Section 02250

2.0 MATERIALS

A. Materials Furnished by the County

Not Applicable

B. Contractor's Options

Not Applicable

C. Detailed Material Requirements

1. Orange Safety Fence

Orange safety fencing shall be 4-foot high blaze orange polyethylene plastic with 5-foot metal stakes, staked at maximum 10-foot intervals.

3.0 EXECUTION

A. General

1. The Contractor shall engage the services of a subcontractor, licensed as a Tree Expert by the Maryland Department of Natural Resources to perform the following:
 - a. Prior to commencing any construction activities, recommend procedures to compensate for loss of roots (if any) and perform initial pruning of branches and stimulation of root growth where removed.
 - b. Inspect all trees to be saved at the completion of construction and perform follow-up care for any damage incurred.
 - c. Submit a written Tree Protection Certificate that trees have been protected during the course of construction in conformance with recognized standards in the industry. Certify that damaged trees were promptly and properly treated.

B. Establishment of Tree Protection Areas

Prior to commencing construction activities, the Contractor shall meet with the Engineer and Owner to establish Tree Protection Areas. Prior to commencing construction activities, the Contractor shall install orange safety fencing around all tree protection areas. The orange safety fence shall encompass all trees to be saved within and along the designated work area. At a minimum, the orange safety fencing shall extend to the edge of the tree dripline.

C. Root Protection Measures

1. The Contractor shall protect tree root systems throughout the contract duration. Tree roots shall be protected from smothering, flooding, excessive wetting, from dewatering operations, off-site run-off, spillage and other activities which could be hazardous to tree roots. Removal of topsoil within the tree protection area is prohibited.
2. The Contractor is prohibited from parking any construction equipment, or from storing or stockpiling materials within the tree protection areas. Foot and vehicular traffic within the tree protection area is prohibited.
3. If any excavation will occur beneath the dripline of any tree to be saved, the Contractor shall first prune the tree roots along the proposed outside edge of trench. Root pruning shall consist of using a trenching machine, vibrating knife, or rock saw to a depth of 18-inches. When a trenching machine is used, the trench shall be immediately backfilled. Root pruning shall immediately be followed by fertilization.

D. Tree Pruning

1. All tree pruning shall be in accordance with the current edition of the National Arborist Association Standard for Pruning Shade Trees. All pruning tools and methods employed shall be in conformance with accepted arboricultural practices under the direct on-site supervision of the tree expert. Climbing spurs are prohibited.
2. Injuries to bark, trunk and limbs resulting from the construction shall be repaired by properly cutting, smoothing the wood if necessary, tracing the bark to the proper shape to ensure proper healing, and only using approved tools, materials and methods.
3. All pruned material and debris from the pruning operations shall be removed and disposed of at an approved waste disposal facility.

E. Damaged Tree Replacement

Existing trees that have been designated to be saved but which are damaged beyond repair due to the construction operations, as determined by the tree expert shall be removed and replaced at no additional cost to the County. Replacement trees shall be the same genus, species, variety and size as the removed tree, except those trees having a caliper greater than 4-inches. The tree caliper shall be the diameter measured 4 ½ feet above the ground. For

trees with a caliper greater than 4-inches shall have a minimum of two smaller caliper trees with a minimum 3-inch caliper.

4.0 METHOD OF MEASUREMENT

Tree protection will not be measured as it is considered incidental to the unit quantity item for utility installation.

5.0 BASIS OF PAYMENT

Payment for Tree Protection will not be made, as it shall be included in the unit quantity item for utility installation.

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SECTION 02865 TREE AND SHRUBS

1.0 GENERAL

A. Description

This Section includes requirements for tree and shrub planting at locations indicated and approved by the Engineer in accordance with the Contract Documents.

B. Submittals

1. In accordance with the General Conditions, submit itemized list showing sources of all plant items.
2. Submit samples of additional landscape materials incorporated into the work, except the plants specified under this Section.
3. With each shipment submit invoice or stock order giving name of plants, date plants were dug for shipment and certification that plants are free from disease.

C. Reference Documents

1. Plant measurement size and grading shall be in accordance with the current edition of American Standard for Nursery Stock as approved by the American Nursery and Landscape Association (ANLA).
2. The current edition of Standardized Plant Names as adopted by the American Joint Committee on Horticulture Nomenclature, shall be the authority for all plant names.

D. Inspection and Acceptance of Plant Materials

1. Plants will be subject to inspection and approval at the place of growth or upon delivery for conformity to specification requirements as to quality, size and variety. Such approval shall not impair the right of inspection during the progress of work or right of rejection due to damage suffered in handling, transportation, or the planting process.
2. Rejected plants shall be removed immediately from the site by the Contractor.
3. All plants shall be labeled as to genus, species and size and shall bear an inspection certificate from the Board of the Department of Agriculture, or other State agency of the State within which the nursery, where the plants were grown, is located.

E. Guarantee

The guarantee for trees and shrubs shall be one year from the conditional acceptance date.

F. Plant Replacements

1. Replace dead, weak, diseased, improperly sized and improperly marked plants.
2. Replacement plants shall be of the same type and size as specified on the Drawings and shall carry the same guarantee as the original stock.
3. If plant rejection occurs during the planting season, the plants shall be replaced at once. If not, they shall be replaced during the next appropriate planting season. However, the Contractor may elect to allow the rejected plant to remain through the next complete growing season at which time, if found to be dead, in an unhealthy or badly impaired condition, the rejected plant shall be replaced by the Contractor at no cost to the County. When making plant replacements, replace planting mulch to its initial specified depth and follow all procedures outlined in Planting Procedures.

G. Licensing

All trees and shrubs shall be installed by a Maryland licensed Landscape Contractor with previous successful experience in the planting and survival of trees and shrubs.

2.0 MATERIALS

A. Topsoil

1. Topsoil shall meet requirements of topsoil as specified in Section 02820 of these Standard Specifications.
2. Topsoil shall be protected from the elements and shall not be handled or installed in a frozen or muddy condition.

B. Fertilizers and Additives

1. Fertilizer for trees and shrubs shall be an organic form such as cottonseed meal or bone meal, inorganic such as Super Phosphate. Do not use inorganic nitrite or nitrate fertilizers for starter solution in tree or shrub pits.
 - a. Super Phosphate shall be composed of finely ground phosphate rock as commonly used for agricultural purposes, containing not less than 18 percent available phosphoric acid.
 - b. Bone Meal shall be commercial raw bone meal finely ground and shall be a minimum analysis of one percent nitrogen and 18 percent phosphoric acid.
2. Peat moss shall be a sphagnum peat moss and shall be free from woody substances.
3. Manure shall be dehydrated, well-rotted cow manure.
4. Anti-desiccant shall be "Wilt Pruf" or equal, delivered in manufacturer's

containers and used according to the manufacturer's instructions.

C. Soil Mixes

1. Soil mix for all plants, except ericaceous plants shall consist of 200 pounds of manure and 36 cubic feet of peat moss of 12 cubic yards of topsoil.
(Ericaceous plants include azaleas, rhododendron, pieres and other broad-leaved evergreens)
2. Soil mix for ericaceous plants shall consist of 50 cubic feet of peat moss to 12 cubic yards of topsoil, to which no lime has been added.
3. Soil mixtures shall be thoroughly mixed before using.

D. Mulch

1. All mulch shall be free of toxic substances or foreign materials that may harm plant life.
2. Mulch for tree, shrub planting and mulch bed preparation shall be ground bark or shredded bark.
 - a. Ground bark shall be 100 percent true pine-bark with organic content of not less than 90 percent, with a white wood content not to exceed eight percent and shall be of a good uniform brown color. Note more than 50 percent shall be capable of passing through a 3/4 inch sieve.
 - b. Shredded bark shall be 100 percent true pine-bark peelings with organic content of not less than 90 percent. It shall be fibrous material of a good uniform brown color. Not more than 25 percent shall be able to pass through a 3/4 inch sieve.

E. Plant Material

1. Unless otherwise approved, plants shall be nursery grown.
2. Plants shall be hardy, grown under climatic conditions similar to those in the locality of the project.
3. Plants shall be typical of their species or variety and shall have a normal habit of growth. They shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of diseases and insect pests, eggs or larvae. They shall have healthy, well-developed root systems. Plants that are weak or which have been cut back from larger grades to meet specifications will be rejected.
4. Plants shall conform to the measurements specified on the Drawings with the following exceptions:
 - a. Plants larger than specified may be used, if approved by the engineer, at no additional cost to the County. If the use of larger plants is approved, the spread of roots or ball of earth shall be increased in proportion to the size of the plant.

- b. Up to ten percent of undersize plants in any one variety or grade may be used provided that there are sufficient plants above size to make the average equal to or above specified grade and provided that undersized plants are larger than the average size of the next smaller grade.

5. Digging and Preparation of Shipment

- a. Bare root shrubs shall be dug with adequate fibrous roots retained and shall be delivered to the site of the project prior to the plant material coming into leaf. Pack roots of these plants in moist straw or peat moss immediately after digging.
- b. Balled and burlapped plants shall be dug with firm natural balls of earth, of sufficient diameter and depth to include most of fibrous roots.
- c. Container grown stock shall have been grown in a container large enough for the root system to develop sufficiently to hold its soil together firmly. No plants shall be loose in the container.

F. Planting Stakes and Appurtenances

- 1. Vertical stakes shall be rough-sawn straight grain oak, reasonably free of knot holes, bark, wane, warp, or splits.
- 2. Stake dimensions shall be 2-inch by 2-inch by 8 feet.
- 3. Stakes for guy wires shall be 1 3/4 inch by 1 3/4 inch by 30 inch.
- 4. Guy wire shall be pliable number 12 or 14 gauge galvanized wire.
- 5. Tree ties shall be 5/8-inch or 3/4 inch reinforced corded garden hose.
- 6. Tree wrapping shall be first quality commercial paper tree wrap, in four inch to six inch strips, or clean new burlap, seven or eight ounce weight per square yard, treated with a solution containing a bactericide, fungicide and insecticide.

3.0 EXECUTION

A. Seasons for Planting

Trees and shrubs shall be planted between October 1st and May 15th only. No plants shall be planted during periods of freezing temperatures nor during frozen ground conditions. Preparations for planting may begin earlier than the specified season, provided the locations have been approved by the Engineer.

B. Handling and Protection of Delivered Plants

- 1. Roots or balls of plants shall be adequately protected at all times from sun and drying winds or frosts.
- 2. Balled and burlapped plants which cannot be planted immediately upon delivery shall be set on the ground and shall be well protected from soil, wet

straw, peat moss or other acceptable material. Bare root plants that cannot be planted immediately shall be temporarily planted or heeled-in in trenches upon delivery.

3. Bundles of plants shall be opened and the plants separated before the roots are covered. Care shall be taken to prevent voids among the roots. During planting operations, bare roots shall be covered with canvas, straw or other suitable material. No plant shall be bound with wire or rope at any time so as to damage the bark or break the branches.

C. Planting Procedures

1. Excavation for Planting

- a. Notify the Engineer prior to beginning operations.
- b. Provide stakes and stake out the locations for plant excavations as shown on the Drawings and as approved by the Engineer. Do not change locations without the approval of the Engineer.
- c. Plant in individual excavations with vertical sides and horizontal bottom.
- d. Excavations for trees shall be two feet greater in diameter than the ball of earth or spread of roots of the tree and sufficiently deep to allow for a layer of compacted soil mix beneath the ball or roots a minimum of six inches thick.
- e. Excavations for shrubs shall be twelve inches greater than the spread of the roots and a minimum of eighteen inches below finished grade, or as necessary to allow a layer of compacted soil mix beneath the ball or roots a minimum of six inches thick.
- f. Allow a tolerance of one inch for the above dimensions.
- g. If excavations are made in advance of planting, backfill to grade with the specified soil mix, mark locations and record on the Drawings.

2. Planting

- a. Remove seals and tags only after inspection and acceptance of plants by the Engineer.
- b. After setting balled and burlapped plants, compact soil mix around base of balls, to fill all voids, up to one-half the depth of the balls, tamp and thoroughly water. Loosen burlap around the top half of the balls and spread out away from the ball. If too bulky, cut burlap away and remove. Remove balling and tying materials or containers, other than burlap and jute twine, from the excavation without damage to the soil ball. Cover all burlap and twine with at least two inches of soil mix. Then fill the remainder of the excavation with soil mix, tamp and again water, all within the same day of planting.
- c. When container-grown plants are planted, remove the plant from the

container, so as not to damage the root ball, and plant as outlined for balled and burlapped plants.

- d. When bare root plants are set, spread the roots of the plant carefully in their natural positions and work soil mix around the roots, thoroughly tamp into place and water, all within the same day of planting.
- e. Watering shall mean full and thorough saturation of backfill in the excavations the day the plants are planted. Apply water by container or open-end hose under low pressure only.
- f. When planted, watered, and fully settled, the plants shall be vertical and the back fill shall be flush with the surrounding surface.
- g. Form a soil shoulder at least three inches high around the outside of the excavation above finished grade, to entrap water.
- h. Wrap trees over 1 ½ inch caliper with the specified wrapping material. Wrap spirally from the ground line up to the lowest main branches and overlay approximately two inches. Secure wrapping material, at the bottom, middle and top with ties spaced a maximum of two feet apart.
- i. Mulch completed plantings with the specified mulching material. Spread mulch evenly to a minimum thickness of three inches over the entire area of the filled excavation and for shrub in beds, the entire area of the shrub bed. Apply mulch within four days after planting.
- j. Prune each tree and shrub in accordance with the American Association of Nurseryman Standards to reserve the natural appearance and character of the plant. Do not cut leaders of shade trees. Remove dead wood, broken or badly bruised branches, or suckers using clean, sharp pruning tools. Treat surface of cuts over one inch diameter with specified tree wound dressing covering all exposed cambium.

3. Clean Up After Planting

- a. Remove waste materials continuously and promptly.
- b. Regrade and restore existing turf areas damaged and seed or sod when so directed, at no cost to the County.

D. Maintenance

- 1. Maintenance of planting material shall commence immediately after each plant is planted and shall continue until final acceptance. During such time, the Contractor shall perform all work necessary to establish and maintain the plants in a live, health condition. Maintenance shall include the following:
 - a. Water at the end of each 14 day period, if less than one inch of precipitation is recorded by the National Weather Service in the Metropolitan Area for that period. Each tree shall receive at least five gallons of water and each shrub shall receive at least two gallons.

- b. Clearing plant mulched area of weeds and grasses. Remove weeds when they have attained a height of four inches. The use of herbicides to control weeds and grasses will be acceptable only if all Maryland Department of Agriculture regulations are followed.
- c. Pruning of dead material and removal of succoring growth.
- d. Resetting settled plants to proper grade.
- e. Reshaping and re-mulching of washed out planting saucers.
- f. Tightening and repairing of guying and staking.
- g. Fertilizing of nutrient deficient plants.
- h. Replacing of dead, weak, or diseased plants.

E. Final Inspection and Acceptance

- 1. Within twenty days of the end of the one-year guarantee period as described herein, the Engineer will inspect planting material. This inspection will be scheduled within ten days after the Contractor submits a written notice requesting such inspection.
- 2. If any tree or shrub must be replaced as determined by the County, the Contractor shall replace as described hereinbefore. The warranty period shall be extended for one additional growing season until all trees and shrubs have successfully survived.

4.0 METHOD OF MEASUREMENT

Measurement for furnishing and installing trees and shrubs will be made on the basis of each tree and shrub installed at the locations and spacing depicted in the Contract Documents, and accepted by the Owner.

5.0 BASIS OF PAYMENT

Payment for the tree and shrub installation will be made at the unit price bid per each tree or shrub. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified in strict adherence with the Contract Documents.

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SECTION 02870 FENCES

1.0 GENERAL

A. Description

This work will include, but not necessarily be limited to, the construction of fence and gates in accordance with, and in reasonably close conformance to, the lines and grades shown on the Contract Documents.

B. Related Work Included Elsewhere

Clearing and Grubbing: Section 02110

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for fence installation.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. All fencing shall consist of chain link fabric topped with three strands of barbed wire mounted on extension arms projecting outward at 45 degrees.

2. Barbed Wire

The barbed wire shall consist of three lines of aluminum coated steel barbed wire which is to be of the four point pattern composed of two strands of 12-1/2 gage line wires with 14 gage aluminum barbs spaced on approximately 5 inch centers. Minimum weights of aluminum coating shall be 0.30 ounces per square foot of wire surface.

3. Chain Link Fabric

- a. Fabric shall be aluminum coated steel chain link, No. 9 gage wire woven in a 2 inch mesh. Top and bottom selvages shall be barbed. The fabric shall conform to ASTM Designation A491-74 in its entirety.
- b. The aluminum coating shall be a minimum of 0.4 ounces per square foot of wire surface for #6 and #9 gage fabric and 0.35 ounces per square foot for #11 gage. The weight of coating shall be determined by the strip test as defined in ASTM Specifications A428-68.

4. Fabric Connections

The chain link fabric shall be securely fastened to all terminal posts using 3/16" x 3/4" stretcher bars and heavy 11 gage tension bands. The fabric shall be fastened to all intermediate posts and top rails with #11 gage tie wires.

5. Tension Wire

The top and bottom tension wire shall be No. 7 gage aluminum coated spring coil or crimped wire. Minimum weight of aluminum coating shall be 0.40 ounce per square foot of wire surface.

6. Framework

- a. All posts and framework (including gates) shall be hot dipped zinc coated with a minimum of 1.8 ounces per square foot of surface and shall conform to ASTM A120-78.
- b. Terminal and corner posts shall be nominal 3-inches outside diameter, nominal weight 5.79 pounds per linear foot.
- c. Line posts shall be nominal 2 2-inches outside diameter, nominal weight 3.65 pounds per linear foot.
- d. The top rail and brace pipes shall be nominal 1-5/8-inches outside diameter standard weight pipe, wt. 2.27 pounds per linear foot.

7. Gates

- a. Posts for swing gates shall be 4-inch O.D. standard weight pipe, wt. 9.1 pounds per linear foot.
- b. Gate posts shall be equipped with top cap so designed to prevent moisture from entering the post.
- c. Gate frames shall be nominal 2-inches outside diameter standard weight pipe, wt. 2.72 pounds per linear foot. Gates may be fabricated using welded construction or heavy pressed steel or malleable corner fittings securely riveted. Hinges shall be of sufficient strength and design to permit easy and trouble-free operation. Gates shall have center plunger rod to positively hold gates in open or closed positions. Gates shall have barb wire. All gates shall be equipped with a positive type latching device with a means for padlocking. An approved padlock with three keys shall be provided for each gate. Locks shall be keyed to the Harford County system.

8. Portland Cement Concrete

Portland cement concrete for fence post encasement shall be Mix No. 1 as specified in Section 03300 of these Standard Specifications.

3.0 EXECUTION

A. General

1. The fence shall be erected at locations shown on the Plans to grades conforming to existing ground contours by experienced fence erectors. The bottom of the fabric shall be placed a normal distance of 1-inch above the finished grade, however, over irregular ground, a minimum clearance of 1-inch and a maximum clearance of 6-inches will be permitted for a horizontal distance not to exceed 8 feet.
2. Any excavation or backfill required in order to comply with these provisions shall be made as approved by the County. The fence shall be true to line, taut, and shall comply with the best practice for chain link fence construction. For site fencing projects, the fence fabric shall be placed on the outside of the posts.
3. All posts shall be plumbed and placed at the specified spacing shown on the Contract Documents. Spacing of posts shall be as uniform as practicable under local conditions. The distance between line posts shall not exceed 10 feet.
4. Terminal posts shall be installed at all ends, abrupt changes in grade, and at changes in the horizontal alignment greater than 10 degrees. In no case shall the distance between terminal posts exceed 500 feet.
5. Post lengths must be adequate in all cases to accommodate the fabricated width of the fence fabric without stretching or compressing the fabric and to obtain, as a minimum, the distance required below the bottom of the fabric.
6. Horizontal brace rails shall be installed at all gate, pull, and corner posts. Horizontal brace rails with diagonal truss rods and turn buckle shall be installed at all terminal posts. Sufficient braces shall be supplied to allow complete bracing from each terminal post to all adjacent line posts. Braces shall be securely fastened to posts by heavy pressed steel and malleable fittings.
7. Fabric shall be tied to brace and top rails at 2-foot intervals maximum. Stretcher bars shall be attached to terminal posts by connectors equally spaced at 12-inch centers maximum. The fabric shall be fastened to all intermediate post at a spacing not to exceed 14-inches.
8. Tension wire shall be stretched taut and run continuously between terminal post near the top and bottom of the fabric and securely fastened to each intermediate post.
9. Gates shall be installed so as to be easily opened and closed by one person and shall be capable of being swung back parallel with the fence unless otherwise noted. Gates must be properly braced to eliminate any possible sagging condition.

B. Concrete

1. Concrete footings shall be constructed in accordance with dimensions shown on the Standard Details. Posts shall be centered in cylindrical concrete

footings. The concrete shall be thoroughly compacted around the post by tamping or vibrating. The finish top surface shall be a smooth finish, slightly above the ground line, and uniformly sloped to drain away from the post. The post shall not be disturbed in any manner within 72 hours after the individual post footing is completed.

2. Hand mixed concrete shall not be used without written permission of the County. If permitted, the hand mixed batch shall not exceed 2 cubic yard.

4.0 METHOD OF MEASUREMENT

A. Chain Link Fence

Measurement for chain link fence will be made of the length of fence of various sizes installed complete and accepted. Measurement will be made to the centers of end posts.

B. Terminal Posts

No measurement of terminal posts will be made.

C. Line Posts

No measurement of line posts will be made.

D. Gates

No measurement of gates will be made.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit prices bid. The prices bid shall include and cover furnishing all labor, tools, equipment, and materials necessary to complete the work as shown and specified, in strict accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.

B. Chain Link Fence

Payment for chain link fence will be made at the price bid per linear foot for fence of the size and type specified and shall include traffic control and the furnishing and installation of all terminal posts, line posts, gates, chain line fabric, bracing, fittings, locks, and incidental items to complete the fence installation.

C. Terminal Posts

Payment for furnishing and installing terminal posts will not be made, for it will be incidental to chain link fence installation.

D. Line Posts

Payment for furnishing and installing line posts will not be made, for it will be incidental to chain link fence installation.

E. Gates

Payment for furnishing and installing gates will not be made, for it will be incidental to chain link fence installation.

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DIVISION 3 CONCRETE

SECTION 03200 CONCRETE REINFORCEMENT

1.0 GENERAL

A. Description

Concrete reinforcement shall include, but not necessarily be limited to, furnishing and placing various types and/or sizes of steel reinforcing for embedment in Portland cement concrete as specified in the Contract Documents.

B. Related Work Included Elsewhere

1. Cast-In-Place Concrete: Section 03300
2. Pre-Cast Concrete: Section 03400

C. Quality Assurance

The County will inspect all materials before, during and after placement to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for concrete reinforcement.

B. Contractor's Options

Substitution of smaller size bars will be permitted only upon specific authorization by the County. Substituted bars shall provide a steel area equal to or larger than that called for by the design provided the spacing is not reduced to a point where the clear distance between the bars is less than one and one-half times the nominal diameter of the bars, nor one and one-half times the maximum size of the course aggregate, nor 1 1/2 inches, and further provided that the planned cover is maintained. No additional compensation will be allowed because of the substitution of larger areas of steel.

C. Detailed Material Requirements

1. General

Reinforcing steel shall conform to the requirements of ACI 318.

2. Bar Reinforcement

Bar reinforcement shall consist of deformed bars meeting the requirements of AASHTO M 31, Grade 60. Grade 40 may be used for #5 and smaller bars where indicated on the Plans.

3. Tie or Dowel Bars

Tie or dowel bars shall be round steel bars meeting the requirements of AASHTO M 31, Grade 40 or ASTM A 36.

4. Welded Steel Wire Fabric

Welded steel wire fabric shall meet the requirements of AASHTO M 55. When galvanizing is specified, the fabric shall be galvanized after fabrication.

5. Welded Deformed Steel Wire Fabric

Welded deformed steel wire fabric shall meet the requirements of AASHTO M 221.

6. Galvanizing

Galvanizing for deformed steel bars shall be in accordance with ASTM A 153.

3.0 EXECUTION

A. Fabrication

1. General

After bar lists and bending diagrams have been approved, fabricate each unit of reinforcement to the type, shape, size, grade, and dimensions shown on the approved shop drawings.

2. Cutting and Bending

Perform cutting and bending of reinforcing bars before shipment to the site. Bend all bars cold in a manner that will not injure the material and in accordance with the Manual of Standard Practice of the Concrete Reinforcing Steel Institute.

B. Shipping, Handling, and Protection of Material

Reinforcing steel bars shall be shipped in standard bundles and tagged and marked in accordance with the provisions of the Code of Standard Practice of the Concrete Reinforcing Steel Institute. Bundles shall be kept intact and material undamaged and properly identified until ready for use.

Reinforcing steel bars shall be stored on blocking, racks, or platforms so as not to be in contact with the ground.

Bars shall be kept free from dirt, paint, oil, grease, loose or thick rust, detrimental mill scale, or other foreign substances. However, when steel has on this surface detrimental rust, mill scale, dust, or dirt, it shall be cleaned by a method approved by the County.

C. Placing and Fastening

The placing of bars shall conform to the recommended practices in "Placing Reinforcing Bars" as published by the Concrete Reinforcing Steel Institute.

Reinforcing steel shall be accurately placed in the position shown on the plans and firmly held during the depositing and setting of the concrete. Cover, or the distance between the external face of the bar and the face of the finished concrete, shall be as indicated on the Plans. Reinforcing steel bars embedded in concrete shall not be bent after they are in place. Bars shall be tied at all intersections with 16 2 gage black annealed wire except that where spacing is less than 1 foot each direction alternate intersections need not be tied. All intersections shall be tied in the top mat of reinforcement placed on the top slabs of box culverts. Abrupt bends shall be avoided except where one steel bar is bent around the other. Stirrups and ties shall always pass around the outside of main bars and be securely attached thereto. All reinforcing steel shall be securely held at the proper distance from the forms by means of plastic coated steel chains. Blocks for holding reinforcement away from contact with earth shall be precast concrete blocks of approved shape, mix, and dimensions and shall have tie wires embedded in them. Layers of bars shall be separated by approved plastic coated metal chairs or bolsters.

Any broken or damaged concrete spacer blocks shall be removed before concrete is placed. The use of pebbles, pieces of broken stone or brick, metal pipe, or wooden blocks as spacers will not be permitted. Reinforcing steel when placed in the work shall be free from flake rust, dirt, and foreign material before any concrete is placed. Any mortar which may be adhering to the reinforcing steel shall be removed. No concrete shall be deposited until the County has inspected the placing of the reinforcing steel and given permission to place the concrete. The Contractor shall allow the County ample time after the reinforcement and forms are in place to conduct the inspection. Any bars of incorrect size, length, or shape shall be removed and replaced with correct bars. Any bars located or spaced incorrectly shall be relocated or spaced correctly before approval is given to place concrete, and such replacements and corrections shall be at the Contractor's expense. All concrete placed in violation of these provisions shall be rejected and removed.

Contractor shall allow the County ample time after the reinforcement and forms are in place to conduct the inspection. Any bars of incorrect size, length, or shape shall be removed and replaced with correct bars. Any bars located or spaced incorrectly shall be relocated or spaced correctly before permission is given to place concrete, and such replacements and corrections shall be at the Contractor's expense. All concrete placed in violation of these provisions shall be rejected and removed.

D. Splicing

Reinforcement shall be furnished in full lengths as indicated on the Plans. Splicing, except where shown on the Plans, will not be permitted without written approval from the County and if additional splices are used, the additional weight occasioned by such splices shall be at the Contractor's expense.

All splices shall conform to Class "B" in ACI 318 or as shown on the Plans. Splices shall be well distributed where conditions permit. Except where otherwise shown on the Plans, lap splices shall be made with the bars placed in contact and wired together. Lapped splices for reinforcement shall not be used for bar sizes larger than No. 11.

No welding of reinforcing steel or attachments thereto will be permitted without written authorization by the County, unless so indicated on the Plans. Welding, if permitted, shall be in accordance with AWS D1.4.

4.0 METHOD OF MEASUREMENT

Measurement for concrete reinforcement consisting of deformed bars, or wire mesh will not be made, but shall be included in the unit or lump sum price bid for cast-in-place concrete.

5.0 BASIS OF PAYMENT

Payment for concrete reinforcement consisting of deformed bars, or wire mesh will not be made as such, but the cost thereof shall be included in the lump sum price bid for cast-in-place concrete.

SECTION 03300 CAST IN PLACE CONCRETE

1.0 GENERAL

A. Description

Cast-in-place concrete shall include, Portland cement concrete and the construction of small below grade Portland cement concrete structures constructed to the lines and dimensions and at the locations shown on the Plans and in accordance with the Contract Documents.

All concrete work and/or sealing work around built-in items and penetrations shall be performed as required to insure that groundwater and/or surface water does not intrude into any dry well, equipment rooms, pipe galleries, habitable areas or other generally dry areas.

B. Related Work Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Aggregate Backfill: Section 02240
3. Water Mains: Section 02660
4. Water Valves and Appurtenances: Section 02662
5. Fire Hydrants: Section 02666
6. Sanitary Sewer Force Mains: Section 02720
7. Concrete Reinforcement: Section 03200

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

All concrete structures shall be inspected to insure that there is no water entering the structure, including the dry well, equipment room, pipe gallery, habitable areas or other usually dry areas. It shall be the Contractor's responsibility to repair, renovate and replace concrete and/or foundation cracks, by crack injection or other means, as determined by field survey.

2.0 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for Portland cement concrete.
2. The Contractor may purchase water from the County's potable water system in accordance with the current County policies and procedures.

B. Contractor's Options

1. The Contractor may furnish higher strength concrete than specified.

C. Detailed Material Requirements

1. Portland Cement

Portland cement shall be in accordance with AASHTO M 85 with the fineness determined in accordance with AASHTO T 153 and the time of setting determined in accordance with AASHTO T 131.

2. Fine Aggregate

Fine aggregate shall meet the gradation requirements contained in Table 03300-1 and shall be in accordance with the quality requirements of AASHTO M 6.

3. Coarse Aggregate

Coarse aggregate shall be in accordance with the Class A quality requirements of AASHTO M 80 using sodium sulfate to determine the soundness. Grading of aggregate shall be in accordance with AASHTO M 43, size numbers 57, 67, or 7, Table 03300-1.

4. Aggregate Gradations

TABLE 03300-1
Mass Percent Passing

Sieves Sizes U.S. Standard	AASHTO M 43		
	No. 57	No. 67	No. 7
1 ½ inch	100	-	-
1 inch	95-100	100	-
¾ inch	-	90-100	100
½ inch	25-60	-	90-100
3/8 inch	-	20-25	40-70
No. 4	0-10	0-10	0-15
No. 8	0-5	0-5	0-5
No. 16	-	-	-
No. 50	-	-	-
No. 100	-	-	-

5. Water shall be Potable.

6. Admixtures

Admixtures to be used in concrete (except for air entrainment) shall be subject to written prior approval by the County. Admixtures for concrete shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610. The relative durability factor of

concrete with Admixtures shall be determined in accordance with ASTM C 666, Procedure B.

a. Air Entraining

Air entraining admixtures shall be in accordance with AASHTO M 154.

b. Admixtures

Admixtures shall be in accordance with AASHTO M 194.

c. High Range Water Reducing Admixtures

When specified, high range water reducing admixtures shall be liquid and meet the requirements of AASHTO M 194, Type F or G. When this material is used in patching, the admixture shall be liquid and meet the requirements of AASHTO M 194, Type F, for air entrained concrete with the following exceptions.

- i. The water content shall be a maximum of 85% of that of the control.
- ii. The relative durability factor shall be a minimum of 90 when tested in accordance with ASTM C 666, Procedure B.
- iii. The 12 hour compressive strength for Type F admixture shall be 180% of that of control.

Additionally, the admixture shall be nonfoaming when tested in accordance with ASTM D 1173. It shall not contribute more than 200 ppm of chlorides based on the cement content when tested in accordance with MSMT 610.

7. Fly Ash

Fly Ash may be used with written prior County approval.

Fly ash shall be in accordance with AASHTO M 295, pozzolan Class C or F.

8. Concrete Reinforcement

Concrete reinforcement shall be the size and type specified and shall be in accordance with the requirements of Section 03200 of these Standard Specifications.

9. Waterstops

Waterstops shall be made of rubber or polyvinyl chloride. The rubber type may be natural rubber, suitable synthetic rubber, or a combination of natural and suitable synthetic rubber. The polyvinyl chloride shall contain at least 90% virgin polyvinyl chloride. The remaining 10% may include one or more monomers copolymerized with vinyl chloride or consist of other resins mechanically blended with polyvinyl.

The waterstop shall be of the shape and dimensions shown on the plans. The cross section shall be uniform along the length and transversely symmetrical so that the thickness at any given distance from either edge of the waterstop shall be uniform. The waterstop shall be dense, homogeneous, and free from holes and other imperfections.

The waterstop shall meet the following requirements:

Tensile Strength, ASTM D 412, psi min.	2000
Elongation at Break, ASTM D 412, % min.	300
Hardness, Rubber, Type A Durometer, ASTM D 2240	55±5
Hardness, PVC, Type A Durometer, ASTM D 2240	75±5

10. Forms

Forms shall be constructed of wood, steel, or other approved material. Wall ties approved by the County shall be used where necessary. Surfaces of metal forms shall be free from irregularities, dents, and sags. Knot holes and broken places in wood forms shall be covered with metal patches. Lumber used in forms for exposed surfaces shall be smooth, uniform, and free from loose knots and other defects that would show defects in the finished concrete surfaces. For unexposed surfaces and rough work square-edge lumber may be used. By unexposed surfaces is meant any concrete surface not exposed to view on completion of the project. Interior and exterior corners shall have chamfer strips. The Contract may be required to submit details of forming to the County before work proceeds.

11. Form Release Compounds

Form release compounds shall effectively prevent the bonding of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete nor adversely affect the quality or rate of hardening at the interface of the forms. The compounds will be tested in accordance with MSMT 503.

12. Portland Cement Concrete Curing Materials

Curing materials shall be burlap cloth, sheet materials, or liquid membrane-forming compounds.

a. Burlap

Burlap cloth shall be made from jute or kenaf and shall be in accordance with AASHTO M 182, Class 1, 2, or 3.

b. Burlap Polyethylene Sheeting

Sheet material shall be in accordance with AASHTO M 171 except that tensile strength and elongation requirements are waived. White burlap

polyethylene sheeting shall give a finished product weight of not less than 10 ounces per square yard.

c. Liquid Membrane

Liquid membrane-forming compounds shall be in accordance with AASHTO M 148.

Field control testing of the white pigmented curing compounds will be on the basis of weight per gallon. The samples shall not deviate more than plus or minus 0.3 pounds per gallon from the original source sample.

13. Vapor Barrier

- a. Building paper shall be Sisal-Kraft building paper, conforming to requirements of FSS UUB 790A.
- b. Polyethylene sheeting shall be 0.006 inch thick, conforming to requirements of ASTM D 2103.

3.0 EXECUTION

A. General

- 1. Concrete shall be mixed as specified in this Section and shall be delivered to the site in accordance with ASTM C 94.
- 2. The Contractor will be required to use concrete equipment of sufficient capacity to complete any unit, as indicated on Contract Documents, in one continuous operation consistent with placement operations as approved by the County.
- 3. Hand mixing may be permitted with written approval of the County for small volumes of concrete. However, its intended use is for small isolated areas where structural integrity is not critical.
- 4. Before placing any concrete, the Contractor shall install all sleeves, anchors, fittings, pipes, conduits, or other special devices called for in the Contract Documents. No concrete shall be placed until this work has been approved by the County. The Contractor shall ascertain that all material to be installed in the concrete by other trades has been placed prior to pouring any concrete. Any concrete poured without prior provisions having been made for inclusion of the indicated inserts and materials will be subject to rejection by the County and/or correction at the Contractor's expense.
- 5. Coat aluminum accessories and embedded items with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.
- 6. Design loads may not be imposed on cast-in-place concrete until the concrete has cured to its design strength. This includes the pressurization of

pipelines. The concrete strength shall be verified by the sampling of fresh concrete and completion of concrete test cylinders, as indicated in paragraph B below.

B. Concrete Mixes

The concrete shall be proportioned by weight. Water and admixtures may be proportioned by volume or weight. The mix shall be homogeneous, placeable, and uniformly workable.

Coarse aggregate shall be maintained at a uniform moisture content at least equaling its absorbed moisture. Water, if used for wetting, shall meet the requirements of this Section.

Portland cement concrete mixtures shall conform to the Maryland SHA standard specifications for construction and materials (October 1993) and are noted below for your convenience.

Mix No.	28 Day Specified Compressive Strength psi (MPa)	Min. Cement Factor pounds per cubic yard (kg/m ³)	Coarse Aggregate M 43	Max. Water/Cement Ratio by wt	Slump Range In. (mm)	Total Air Content %
1	2500 (17.2)	455 (270)	57, 67	0.55	2-5 (50-125)	5-8
2	3000 (20.7)	530 (315)	57, 67	0.50	2-5 (50-125)	5-8
3	3500 (24.1)	580 (345)	57, 67	0.50	2-5 (50-125)	5-8
4	3500 (24.1)	615 (365)	57, 67	0.55	4-8 (100-200)	N/A
5	3500 (24.1)	580 (345)	7	0.50	2-5 (50-125)	5-8
6	4500 (31.0)	615 (365)	57, 67	0.45	2-5 (50-125)	5-8
7	350 (2.4) split tensile	580 (345)	57	0.50	1-1/2-3 (40-75), 2-1/2 max if slip-formed	5-8

Note 1: When concrete is exposed to sewage or water exceeding 15000 ppm sodium chloride content, Type II cement shall be used.

Note 2: When synthetic fibers are used, the slump shall not exceed 5 in.

C. Mixers and Agitators

1. All mixers shall display a current Maryland State Highway Administration approval stamp. Mixers and agitators and mixing and delivery of ready-mixed concrete shall meet the requirements of AASHTO M 157 with the following exceptions:
 - a. Transit mixed concrete will not be permitted. The following requirements shall apply when additional water is added on the job site:
 - i. No water shall be added after partial discharge of the batch.
 - ii. The water-cement ratio shall not be exceeded.
 - iii. Acceptance will be based upon a retest of the slump and air content.
 - b. All concrete shall be discharged within 1 hour after the mixing water is added or 1-1/2 hours after the addition of the cement to the aggregates, whichever is the lesser time.
 - c. No mixer or agitator containing free water in the drum shall be loaded.

D. Hand Mixing Portland Cement Concrete

1. No hand mixing of concrete shall be allowed without first obtaining permission from the County.
2. The amount of concrete shall be small enough in quantity that in the judgment of the County, the delivery of the same is impractical.
3. Scheduling of mixing and placing shall be coordinated with the resident County inspector so that all work by the contractor is under the supervision of the resident inspector.
4. Under no circumstances shall hand mixing of concrete be allowed for any permanent buttresses that will not be subject to the 200 pound plus pressure test.

E. Forms

1. Design Criteria

Design of the forms shall be the Contractor's responsibility. Forms shall be designed for strength and deflection to resist all loads and pressure of wet concrete. The design shall provide for rate of pour, effect of vibration, and use of retarders, etc. In addition, horizontal surfaces shall have applied to them a live load of 50 pounds per square foot. This load is to be used in the design of the forms for strength only and is not to be used in computing deflections. However, in the design of forms for horizontal slabs, in no case shall this loading be less than a total of 120 pounds per square foot. (This does not apply to form joists, form wales, etc.) No form member or support thereof shall have a deflection in excess of $L/240$ of its span length, and in no case shall said deflection exceed 1/4 inch.

2. Concrete forms shall be built true to line and grade, mortar-tight, and sufficiently rigid to prevent displacement or sagging between supports. All form work shall be provided with adequate clean out openings to permit inspection and easy cleaning after all reinforcement has been placed.

3. Forms at Construction Joints and Corners

At construction joints in concrete, ties or bolts shall be provided 3 to 6 inches from each side of the joint for tightening the forms against the hardened concrete (first pour) immediately prior to placing fresh concrete. At joints where forms have been removed and reconstructed, the form surface shall extend over the concrete already in place; and the forms shall be drawn tightly against the previously placed concrete immediately prior to placing the fresh concrete. Where forms have been extended, the forms shall be retightened against the concrete already in place immediately before placing fresh concrete.

Forms shall be filleted at all exposed sharp corners, except when otherwise indicated on the Plans and shall be given a bevel or draft in the case of all projections, such as girders, copings, etc., sufficient to insure easy removal.

4. Bracing and Maintenance

Special attention shall be paid to bracing; and where the forms appear to be insufficiently braced or unsatisfactorily built, either before or during the placing of concrete, the County will order work stopped until the defects have been corrected. All forms shall be so maintained as to eliminate the formation of joints due to the shrinkage of lumber. All forms shall be set and maintained true to the line designated until the concrete is sufficiently hardened. For narrow walls where access to the bottom of the forms is not readily attainable provide temporary openings and at such other locations as may be necessary to clean out all chips, dirt, sawdust, or other extraneous material immediately prior to placing concrete. Existing forms may be extended after the concrete in said forms has been placed for at least 12 hours, provided such form extension can be done without any damage to the previously placed concrete.

Unit stresses for forms, form supports, false work, and bracing shall not exceed the AASHTO Specification.

5. Form Removal

All forms for concrete work shall be removed and disposed of by the Contractor after form work requirements have been complied with, except those which are designated to remain in place.

Forms shall remain in place a sufficient time to allow the concrete to set properly and the Contractor shall assume all responsibility for removing same. In no case shall forms be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. The Director, however, may, when they deem it advisable, order the forms to remain for a longer time, but his/her acquiescence in permitting the removal of forms shall not relieve the Contractor of responsibility for same.

Forms for pipe end walls may be removed after the concrete has been in place for a period of 24 hours unless it is necessary to protect the concrete against cold weather, in which case the forms shall remain in place for the entire protection period.

Forms for vertical surfaces shall remain in place for a period of 48 hours. If, however, forms are removed before the concrete is 7 days old, the vertical surfaces shall be immediately covered with curing material and the concrete kept wet and so covered until the concrete is 7 days old. Horizontal form, and false work, carrying loads shall remain in place for a minimum of 7 days and until the concrete has attained a compressive strength of 3000 psi. Internal bulkheads used for forming construction joints, contraction joints, expansion joints, etc. may be removed after the concrete has been in place for 24 hours, if it is necessary to do so for the continuance of the work without interruption.

Special care shall be taken not to break concrete edges in taking down forms. Any portion of concrete damaged while stripping forms may be ordered torn down and recast at the discretion of the County. Upon removal of forms, the County shall be notified by the Contractor. The County after inspecting the surfaces newly stripped, will designate what honey-combed parts, if any, shall be pointed up and how the slightly damaged portions of concrete, if any, shall be repaired or replaced. No freshly stripped surfaces shall be pointed up or touched in any manner before having been inspected by the County.

In all cases, the Contractor shall assume all responsibility arising from the removal of forms and shall be sure that the concrete is properly cured to sustain loads before forms are removed.

F. Concreting

1. Before placing concrete, all sawdust, chips, and other construction debris and extraneous matter shall be removed from interior of forms. No struts, stays, and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, will be permitted.

All concrete shall be placed in the dry, unless Plans and/or "Special Provisions" require the placement of tremie concrete.

All concrete shall be placed in a continuous operation.

Concrete, after being placed in the forms, shall be thoroughly compacted and shall be spaded, tamped, or vibrated to the satisfaction of the County.

Chuting of concrete will be allowed only as approved by the County. No concrete shall have a free fall of over three (3) feet and if this height is exceeded, it shall be conveyed in place by approved spouts and chutes. Open troughs and chutes shall be metal or metal lined. Where steep slopes are required, the chute shall be equipped with baffles or be in short length that reverse the direction of movement. All chutes, troughs and pipes shall be kept clean and free from coatings or hardened concrete by thoroughly flushing with water after each run.

2. Retempering concrete by the addition of water shall not be permitted. The addition of water to the batch in the mixer, after ten (10) minutes have elapsed after the initial charging or the addition of water at any time after the concrete has been removed from the mixer shall be construed as retempering. Batches of concrete prepared contrary to these specifications shall be rejected and immediately removed from the project.

The concrete shall be mixed only in the quantity required for immediate use and concrete not in place within one hour from the time the ingredients were charged into the mixing drums, or that has developed initial set, shall not be used.

3. Cold Weather Specifications

Under no circumstances will concrete be permitted to be placed on frozen soil. Construction of plain and reinforced cement concrete pavements, curbs, gutters, combination curb and gutters, and sidewalks, except by specific written authorization and under very definite Special Provisions, shall not be continued when a descending air temperature in the shade and away from artificial heat falls below 45°F, or resumed until an ascending air temperature in the shade and away from artificial heat reaches 40°F.

If temperature is below 45°F then one or more of the following methods shall be used to obtain the required temperature all as approved by the County.

- a. When the method of heated mixing water is used, the water shall not be above 170°F when introduced into the mix.
- b. When the method of heated aggregates is used, aggregates containing frozen lumps, ice, or snow shall be allowed to enter the mixer. Aggregates may be heated by steam coils or other dry heat but not by discharging live steam or hot water into them. Heating by means of a flame thrower or any direct flame will not be permitted.

Adequate protection of concrete against damage by frost during the making and early curing period is absolutely essential whenever temperatures below 40°F are likely to occur within that period.

4. Construction Joints

Construction joints shall be kept to a minimum and will be permitted only where shown on the approved Plans and/or shop drawings.

In order to bond successive courses, suitable keys shall be formed at the top of the lift where construction joints are permitted and at other levels where work is interrupted. These keys shall be as indicated on the Plans. At horizontal construction joints, the pour shall be allowed to set for about 12 hours before placing concrete above same.

After concrete has been placed and before it has hardened, all laitance and foreign material shall be removed from the surface. Before placing fresh concrete adjacent to hardened concrete, the surface of the hardened concrete shall be cleaned thoroughly of any remaining laitance or foreign

material, scrubbed with wire brooms and clean water, and thoroughly drenched with water until saturated. It shall be kept saturated until the new concrete is placed.

Unless otherwise specified, the top surface of the concrete shall be leveled whenever a pour of concrete is stopped; and to insure a level, straight joint on exposed face, a strip of sheathing shall be attached to the form at the exposed face where the joint occurs. The concrete shall be carried not more than 2 inch above the underside of this strip. About 1 hour after concrete is placed, the strip shall be removed; and any irregularities in the joint line shall be leveled off with a wood float (use steel trowel at exposed face of joint). All laitance shall be removed. To avoid visible joints at chamfers, the top surface of the concrete shall be steel troweled adjacent to the chamfer using the top surface of the chamfer strip as a guide.

5. Consolidation

All concrete shall be internally vibrated unless herein noted otherwise. Vibration shall be in accordance with the following requirements:

- a. All concrete shall be deposited in the forms in its final position and shall be placed in layers of uniform thickness. All concrete shall be consolidated by vibratory methods, unless otherwise specified.

Vibration shall be internal and applied directly to the concrete, except when the use of other methods is authorized by the County or provided herein. The County will be the final judge as to which sections are unsuited for internal vibration.

The Contractor shall provide a sufficient number of vibrators to properly consolidate each batch immediately after it is placed in the forms and before the next batch is delivered, without delaying such delivery. The vibration shall be of sufficient intensity and duration to thoroughly consolidate the concrete, but it shall not be continued to such an extent as to cause segregation. Vibration shall not be continued at any one point to the extent that any localized areas of grout are formed.

Vibration shall be applied at points uniformly spaced not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be used to transport concrete in the forms or to make it flow in the forms over distances so great as to cause segregation. Vibration shall not be applied directly or through the reinforcement or forms to sections or layer of concrete which have hardened to such a degree that the concrete ceases to be plastic under vibration.

Vibration shall be supplemented by such spading, along form surfaces, in corners, and at locations impossible to reach with the vibrators, as is necessary to insure smooth surfaces and dense concrete.

The provisions of this section shall apply to precast concrete cribbing and other precast members or units, except that if approved by the County the manufacturer's methods of vibrating may be used.

- b. Internal vibrators shall be of a type and design approved by the County. They shall be capable of transmitting vibration to the concrete at frequencies of not less than 4500 impulses per minute. The intensity of application shall be such as to visibly affect a mass of concrete of 1 inch slumps over a radius of at least 18 inches.

Internal vibration shall be applied directly to the concrete at the point of deposit and in the area of freshly deposited concrete. Vibrators shall be inserted in and withdrawn from the concrete slowly. Internal vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms.

6. Concrete Surface

a. General

Concrete surfaces shall be finished in accordance with one of the following designations. Unless otherwise specified, all concrete work shall have a "Grout Finish" for vertical surfaces and "Toweled Finish" for horizontal surfaces. Strict compliance with the Specifications and the intent pertaining to finished surfaces will be enforced. Any concrete structure or concrete work which exhibits surfaces with defective finish will not be accepted until finishing has been completed in accordance with the Specifications. All concrete surfaces shall be finished within 24 hours after the forms are removed. If the concrete surfaces are not finished as specified within the time limit mentioned, all other work shall be suspended until the concrete surfaces required to be finished are completed.

<u>Application</u>	<u>Finished Designation</u>
Structures - For all concrete surfaces not exposed to public view and not to be waterproofed	Rough Form Finish
For all concrete wall surfaces exposed to public view	Grout Finish
Tops of footings	Float Finish
Horizontal construction joints	Left Rough
Slabs & Miscellaneous Paving	Floated Finish
Incidental Works Sidewalks, curb, combination curb and gutter, concrete paving, safety curb, median paving	Broom or Belt Finish

b. Rough Form Finish

Immediately following the removal of forms, all fins and irregular projections shall be removed from all surfaces except from those which are not exposed or not to be waterproofed. On all surfaces, the cavities produced by form ties and all other holes, honeycomb spots, broken corners or edges, and other defects shall be thoroughly cleaned and,

after having been kept saturated with water for a period of not less than 3 hours, shall be carefully pointed and trued with a mortar of cement and fine aggregate mixed in proportions used in the grade of the concrete being finished. Any excess mortar at the surface of the concrete due to filling form tie holes shall be struck off flush with a cloth. The mortar patches shall be cured as specified under Curing. All construction and expansion joints in the completed work shall be left carefully tooled and free of all mortar and concrete. The joint filler shall be left exposed for its length with clean and true edges.

The resulting surfaces shall be true and uniform. All surfaces shall be repaired to the satisfaction of the County.

c. Grout Finish

All fins, projections, etc. shall be removed to the satisfaction of, and by means approved by, the County (stone, chipping hammer, sandblasting, etc.). No cleaning operations shall be undertaken until all contiguous surfaces to be cleaned are completed and accepted. Cleaning as the work progresses will not be permitted. The surface of the concrete shall then be saturated with water and kept wet for at least 2 hours.

Proceeding by sections, a grout mix of 1 part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having the consistency of thick paint shall be thoroughly rubbed onto the surface using burlap pads or cork floats completely filling all voids, pits, and irregularities. While the grout is still plastic, remove all unnecessary grout by working the surface with a rubber float or burlap. After this grout has dried sufficiently so that it will not smear, the surface shall be wiped off with dry, clean burlap so as to leave a clean uniform surface. This surface shall then be cured as required, except that only colorless liquid curing compound will be permitted for this method.

d. Floated Finish

After the concrete has been placed, consolidated, struck off, and leveled, the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10 foot straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a smooth surface. The slab shall then be refloated immediately to a uniform sandy texture.

e. Broom or Belt Finish

Immediately after the concrete has received a float finish, it shall be given a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

7. Curing

Except for buttresses without steel reinforcement, provisions shall be made for curing all concrete. Curing shall start as soon as concrete has set sufficiently so that curing applications will not damage the surfaces. Curing will also be required while protecting concrete against cold weather.

The following are methods to be used for curing:

- a. Two layers of burlaps shall be used. Successive strips of each layer shall be overlapped a minimum of 6 inches. The second layer shall be placed not less than 45 degrees to the first layer; or the 6 inches overlap of the second layer may be placed midway (one-half width) of this first layer. The layers of burlap shall be kept thoroughly saturated with curing water for the full time specified for curing.
- b. The material for liquid membrane-forming compounds shall have a fugitive dye or be white pigmented. The materials shall be thoroughly agitated before use and applied by sprayers.
- c. When curing concrete structural slabs, etc., burlap-polyethylene mats or white polyethylene sheets may be used atop the wet burlap on unobstructed flat and reasonably level surfaces.

The burlap-polyethylene mats or white polyethylene sheets shall be placed only on unobstructed flat and reasonably level surfaces. They will not be permitted on vertical surfaces, such as walls, columns, abutments, etc.

Adjacent mats or sheets shall be lapped no less than 1 foot. The ends shall be brought down around the sides of the concrete being cured and securely fastened to the satisfaction of the County to make an airtight seal that will be unaffected by wind.

The burlap-polyethylene mats must be placed on no less than one layer of wet burlap with the burlap side of the mat facing down. White polyethylene sheets, if used, must be placed on no less than two layers of wet burlap.

The burlap-polyethylene mats or white polyethylene sheets must remain in place for the same length of time as required for burlap mats. These protective coverings need not be wetted down; however, the covered burlap or cotton mats must be kept wet for the time interval required by the Specifications.

- d. The burlap must be thoroughly saturated just prior to placement. The requirement for keeping the concrete surfaces saturated at all times during the curing period, regardless of the covering, will be strictly enforced. This saturation of the surfaces must be employed even in areas where there is no ready water supply. The Contractor must furnish, at their expense, sufficient water to satisfy this requirement.

All vertical surfaces may be cured by leaving forms in place for 7 days. If forms are removed after 48 hours, then the remainder of the 7 days of cure shall be by method B.

Immediately after the finishing operation for sidewalks and slabs, the areas of future construction joints shall be covered with two layers of wet burlap which shall extend 6 inches outside the joint area. The finished concrete surface shall then be sprayed with a liquid compound as specified in curing method b. The material shall be applied uniformly at the rate of 150 to 200 square feet per gallon, one half applied in a longitudinal direction and the second half in a transverse direction. After 1 day or as soon as the concrete may be walked upon without damage, the concrete shall be cured using method A or C for the remainder of the 7 day curing period.

All other horizontal surfaces shall be cured using either method A or C for a period of 7 days.

8. Prevention and Removal of Stains on Concrete

The Contractor shall prevent rust of unpainted structural steel, staining by bituminous materials, or any other substance from discoloring any portion of the concrete. The Contractor, therefore, shall devise and use construction procedures or methods that prevent staining of any of the concrete. If, however, any portion of the concrete is stained, the Contractor shall remove such stains and restore the concrete to its original color without damage to the concrete all at their expense and as approved by the County. No chemical solvents will be allowed unless previously approved by the County.

9. Defective Work

Concrete work will be considered defective if it is structurally unsound, not watertight, improperly finished and/or does not conform to the specified requirements. All concrete work and/or sealing work around built-in items and penetrations shall be performed as required to insure that groundwater, surface water or other substances does not enter into the dry well, equipment rooms, pipe galleries, habitable areas or other usually dry areas. It shall be the Contractor's responsibility to repair, renovate and replace concrete and/or foundation cracks, by crack injection or other means, as determined by field survey.

10. Field Quality Control

a. Inspection

- i. For developer projects, the Contractor or Developer shall arrange for the inspection and testing of cast-in-place concrete with reinforcement. For County capital projects, the County will arrange for and pay all costs associated with concrete sampling and testing.
- ii. When all rebar has been placed to the satisfaction of the inspector, and the Contractor is ready to place concrete, the Contractor shall notify the County inspector. No concrete shall be deposited before the County has reviewed the reinforcing and given permission to proceed. Such inspection and permission to proceed shall in no way release the Contractor of the responsibility for proper placement of

reinforcing and placement of concrete, and the responsibility for adherence to the requirements of the Contract Documents.

- iii. Contractor shall notify the County Inspector of concrete pour at least 1 working day in advance. Notification will not be considered without the County Inspector acknowledging receipt of prior notification.
- iv. The Contractor shall provide unobstructed access to work areas for the concrete inspector/technician, furnish a wheel barrow for concrete sampling and a suitable storage box for initial curing of cylinders, as specified in ASTM C31. They shall also make running water available at the testing site. The storage box shall be at a location in the vicinity of the cast-in-place concrete structure and shall be within heated and/or protected areas identical to the cast-in-place concrete.

b. Sampling

- i. Contractor shall provide and furnish concrete sample for testing.
- ii. Samples will be taken by the Concrete Inspection Agency in accordance with ASTM C 172 and cylinders molded in accordance with ASTM C 31.
- iii. A minimum of four test cylinders shall be made for every fifty (50) cubic yards of concrete (or fraction thereof) placed in one day.
- iv. Test cylinders shall be cured per ASTM C31.

c. Tests

- i. Slump tests in accordance with ASTM C 143. Make tests periodically, when cylinders are made and when a change in consistency of concrete is noted. Unless otherwise noted the slump shall be 2 inches minimum and 4 inches maximum. For slabs, the maximum slump shall be 3 ½ inches.
- ii. Test for air content in accordance with ASTM C231 or C138.
- iii. Compression and strength tests: Each test will consist of 4 standard 6" x 12" cylinders; 2 cylinders to be tested at the age of 7 days and 2 cylinders at the age of 28 days. Specimens made to check the adequacy of the design for strength of concrete or as a basis for acceptance of concrete will be made and laboratory cured in accordance with ASTM C31. Additional test of specimens cured entirely under field conditions will be utilized to check the adequacy of curing and protection of the concrete as directed. Make strength tests in accordance with ASTM C39.
- iv. The average of five consecutive strength tests shall be equal to or greater than the specified strength and not more than one test in ten shall have an average value less than 90% of the specified value. When the average of compressive tests for 5 consecutive cylinders falls below the specified strength adjust the design mix and water

content to produce the specified strength of concrete that is subsequently placed. In addition, the Engineer may order additional curing for that portion of the structure where the questionable concrete has been placed. In the event that such additional curing does not give the strength required as determined by load tests made in accordance with ACI 318 or cored cylinder tests, the Engineer may order defective parts removed and replaced, or reinforced, all at expense of Contractor.

- v. 5. The expense of any and all re-inspection and/or retesting required due to failure of concrete to meet requirements shall be borne by the Contractor and/or Developer.

- d. Reports

- i. Test reports shall include the following:
 - a) Exact mix, including quantities of admixtures, etc.
 - b) Date of pour
 - c) Exact location of pour in building
 - d) Slump
 - e) Truck number
 - f) Type of break
 - g) Air entrainment
 - h) Water content including aggregate moisture
- ii. Field inspection reports shall include the following:
 - a) Extent of reinforcement and formwork inspected
 - b) Date of inspection
 - c) Any problems encountered or instructions given to the Contractor

4.0 METHOD OF MEASUREMENT

Except for when used as a buttress, measurement for cast-in-place concrete of the mix number specified will be made on a unit area or volume, or a lump sum per structure basis. In establishing the breakdown between footing concrete and substructure concrete, the division line shall be the top of footing regardless of where the construction joint occurs.

- A. Unit Price

Measurement for cast-in-place concrete, when a unit price is provided for in the Proposal, will be made on an area or volume basis for the actual amount of

concrete satisfactorily placed and accepted.

B. Lump Sum

Measurement for cast-in-place concrete, when a lump sum price or prices per structure are provided for on the Proposal Form, will be made on the basis of a lump sum for all concrete included in the Project or on the basis of the number of structures satisfactorily placed and accepted.

C. Concrete for buttresses or any joint restraint will not be measured.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices shall include all materials, forms, reinforcing steel, curing materials, sealing, caulking, and dampproof or waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.

B. Unit Price

Payment for cast-in-place concrete will be made at the price bid per cubic yard for the various mix numbers specified.

C. Lump Sum

1. Payment for cast-in-place concrete will be made at the lump sum price bid for all concrete on the Project, or for all concrete in each structure or structural unit as indicated in the Contract Documents.
2. To provide for unforeseen changes in planned dimensions affecting concrete on a lump sum basis, the Contract Documents may include an item(s) for contingent concrete. This item(s) shall be used only upon written direction of the County and applied only to referenced structure(s). If necessary changes in the planned dimensions result in an enlargement, then the pertinent lump sum price shall be increased by an amount obtained from the product of the increase in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. Should, however, the necessary changes result in a smaller structure than planned, then the pertinent lump sum price shall be reduced by an amount obtained from the product of the reduction in volume times the unit price bid per cubic yard on the pertinent contingent concrete item. The unit price bid on the pertinent contingent concrete item shall include cost of all concrete, reinforcing steel, expansion material, dampproofing, membrane waterproofing, form work, incidental materials, etc. and work required to complete the structure(s) as revised.
3. Concrete will not be paid for when used for joint restraint unless approved.

SECTION 03400 PRECAST CONCRETE UTILITY STRUCTURES

1.0 GENERAL

A. Description

Precast concrete utility structures shall include, but not necessarily be limited to, furnishing and installing precast concrete structures, manholes, valve and meter vaults, grade rings, and other miscellaneous structures of the configuration and to the extent indicated and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Water Valves and Appurtenances: Section 02662
3. Water Services and Appurtenances: Section 02664
4. Sanitary Sewer Manholes: Section 02710

C. Quality Assurance

1. All manufacturers of pre-cast concrete utility structures shall possess a current certification from the National Pre-cast Concrete Associate Association (NPCA). The manufacturer shall submit the current certification to the County upon request.
2. The County will inspect all materials prior to installation. Any pre-cast concrete sections which are not in compliance with the required dimensions; which are not true, square, plumb, symmetrical; which have honey-combing; cracks, chips; which do not have smooth surfaces; or otherwise have visible material defects shall be rejected and removed from the project site. Rejected materials may not be repaired but shall be replaced with new products. Cosmetic defects, if in the opinion of the Division of Water and Sewer, Deputy Director, will not affect the integrity, longevity and water tightness of the structure, may be allowed in writing.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for precast concrete utility structures.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. General

a. Design Criteria

- i. Structural design for precast units shall be prepared by a Maryland registered Engineer for the precast concrete manufacturer. Units shall be designed for HS 20 load designation or 300 pounds per square foot live load, whichever is most critical for determining the concrete and steel stresses.
 - ii. Where more than one standard is referenced for any given unit, should there be a conflict, the more stringent requirement as determined by the County, shall apply.
 - iii. Unit configuration shall be as shown on the Plans and/or Standard Details.
 - iv. Distribution of earth loading and live load shall be in accordance with ASTM C 857 or ASTM C 890.
 - v. Walls shall be designed using an equivalent fluid pressure of 83 pounds per cubic foot and a 2 foot surcharge. The units shall also be designed to resist all stress encountered during casting, handling, and erection.
- b. Pre-cast Concrete Manholes and Vaults
- i. The precast units shall be factory cast. Job site casting will not be permitted. Concrete in the precast elements shall be continuously placed to prevent formation of seams. The finished units shall be free of voids and cracks. Exposed corners and edges shall be beveled. All inserts shall be securely attached or embedded in their proper location.
 - ii. Concrete strength of all precast units at 28 days shall be 4000 psi minimum, unless otherwise specified. It shall be the precast unit manufacturer's responsibility to insure that the specified concrete strength is maintained throughout production of the units. Mix design shall be those previously used by the manufacturer which has proven satisfactory for casting units similar to those specified and producing the required strength. All precast concrete shall be air entrained in accordance with AASHTO M154. Admixtures containing calcium chloride shall not be used.
 - iii. Vault wall sleeves or gaskets for piping, sumps, steps, access hatches, and other inserts as shown on the Plans and/or Standard Details shall be cast into the structure or inserted at the place of manufacture.
- c. Product Handling
- i. No precast unit shall be shipped in less than 7 days from date of manufacturer, unless the unit has been tested and is shown to be in full compliance with the Specifications. Date of manufacture shall be stamped on each unit.

- ii. Precast sections shall be transported and handled with proper equipment to protect the elements from damage. Sections shall be handled by means of lifting inserts embedded in the concrete. Damaged sections shall be replaced with new unused materials.

2. Pre-cast Concrete Manholes

- a. Pre-cast concrete manhole bases, risers, cone sections, and grade rings shall meet the material and manufacturing requirements of ASTM C478, except the minimum 28-day compressive strength of the concrete shall be 4000 psi. Joints shall meet the requirements of ASTM C443, shall be self-centering, and shall form a tight joint free from water leakage and seepage.
- b. Precast concrete manholes and grade rings shall meet the requirements of ASTM C 478 except that the minimum compressive strength of the concrete shall be 4000 psi. The maximum individual grade ring height shall be 3 inches. Grade rings shall include steel reinforcement.
- c. Each manhole section shall be clearly marked inside with the following:
 - i. ASTM Designation
 - ii. Date of Manufacturer
 - iii. Name or Trademark of Manufacturer
 - iv. Manhole No. which corresponds to the Contract Drawings
- d. All other manhole material components shall be in accordance with Section 02710 of these Standard Specifications and the Standard Details.

3. Pre-cast Concrete Vaults

- a. Pre-cast concrete utility vault bases, risers and top slabs shall meet the material and manufacturing requirements of ASTM C857 and C858, except the minimum 28-day compressive strength of the concrete shall be 4,000 psi. Joints shall meet the requirements of ASTM C443, shall be self-centering, and shall form a tight joint free from water leakage and seepage.
- b. Each section of the vault shall be clearly marked on the inside with the following:
 - i. ASTM Designation
 - ii. Vault Size
 - iii. Date of Manufacturer
 - iv. Name or Trademark of Manufacturer

4. Joints

- a. Joints shall be sealed with manufacturer-supplied gaskets or mastic sealing compound which meets the recommendation of the manufacturer. Joints shall provide a water-proof joint free from water leakage or seepage.

5. Steps

Steps shall be as specified in the Standard Details.

6. Granular Bedding

Granular bedding shall meet the requirements of AASHTO M 43, No. 57.

7. Pipe Penetrations

Pipe penetrations for pipe openings shall be cast into the pre-cast sections.

- a. A banded-boot type rubber gasket shall be provided for vertical pipeline alignments greater than 18% and less than 46.5% slopes.
- b. A compression type rubber gasket shall be provided for a vertical pipeline alignment less than 18% slope.
- c. A mechanically compressed rubberized gasket shall be used for cored openings.

3.0 EXECUTION

A. Installation

1. Precast sections shall be transported and handled with proper equipment to protect the units from damage. Sections shall be handled by means of lifting inserts embedded in the concrete. All pre-cast concrete unit construction shall consist of new and unused products, free from defects. Repairs to pre-cast concrete units shall be strictly prohibited, before, and after shipment. Pre-cast concrete units damaged as a result of installation shall be removed and disposed of by the Contractor at no cost to the County and not returned to the project site. Damaged pre-cast units shall be replaced with new unused pre-cast units from the same manufacturer. Injection of grout sealant in the surrounding soils to correct joint leakage is prohibited.
2. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250 of these Standard Specifications.
3. Precast units shall be installed where and as shown on the Contract Documents and Standard Details or as directed by the County.
4. Mating surfaces shall be cleaned of all foreign materials such as dirt, mud, stones, etc., and where appropriate, joint sealing materials applied prior to assembly of the units. If mastic is used as a joint sealant, it shall be re-applied with new material every time the pre-cast units are re-set, or re-positioned.

5. Grade rings shall be set on a full bed of mortar.

4.0 METHOD OF MEASUREMENT

Measurement for precast concrete utility structures will be made as specified in the "Contract Documents."

5.0 BASIS OF PAYMENT

A. General

1. Payment for precast concrete utility structures, complete and in place will be lump sum or as dictated by the appropriate section. The prices shall include all materials, sealing caulking, waterproofing, and all necessary equipment, tools, labor, and work incidental thereto in accordance with the Contract Documents.
2. Payment will be made for contingent items when approved by the County.

B. Lump Sum

1. Payment for precast concrete units will be made at the lump sum price bid for each structural unit as indicated in the Contract Documents.

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SECTION 03400 CONCRETE REPAIRS

1.0 GENERAL

A. Description

The Contractor shall furnish all materials, labor, equipment, tools, etc., required for the repair, renovation, and replacement of concrete and/or foundation cracks, by crack injection or other means, as determined by field survey.

The Contractor, in conjunction with the Engineer and Owner, shall determine the extent of cracked or deteriorated concrete to be repaired and/or replaced. A summary of the work to be performed shall be submitted to the Engineer for review, and such summary shall be approved by the Engineer prior to commencement of the Work.

B. Water Tightness of Structures

1. All concrete work, sealing work around built-in items and penetrations shall be performed as required to insure that groundwater and/or surface water infiltration does not intrude into any dry well, equipment rooms, pipe galleries, habitable areas or other generally dry areas.
2. The required water tightness shall be achieved by quality concrete construction, formwork and proper sealing of all joints and penetrations.
3. Penetrations: all pipe sleeves, built-in items and penetrations shall be sealed as required to ensure a continuous watertight seal.
4. Structures: all concrete structures and foundations shall be examined for leakage to insure there is no flowing or running infiltration of water or other substances.

C. Subcontractor/Applicator Qualifications

1. The Contractor shall furnish the names of all subcontractors/applicators which they propose to use for this work, including necessary evidence and/or experience records to ascertain their qualifications in the application of epoxy, urethane, polymer-modified, silica fume enhanced mortars and grouts, or other means.
2. A minimum of five (5) year experience in applying epoxy, urethane, polymer-modified and cement-based compounds.
3. A letter from the manufacturer of the specified materials, on the manufacturer's letterhead, signed by an officer of the company, stating that the subcontractor/applicator has been trained in the proper techniques for applying the product, including surface preparation and mixing, placing, curing, and caring for the manufacturer's products. This letter shall further state that the subcontractor/applicator is on the manufacturer's approved list of contractors.

D. Quality Assurance

1. The County shall inspect the structure for leakage. If moist spots become visible, indicating the existence of minor leaks, or if there is running/flowing water, then it shall be the Contractor's responsibility to furnish all materials and complete all work necessary to locate the leaks, and make the structure watertight to the complete satisfaction of the County. This includes the repair of cracks in wall, foundation, penetrations, etc. No additional compensation shall be allowed for such work.
2. Any defective or imperfect work or materials furnished by Contractor, which is discovered before the final acceptance of the work, as established by the Certificate of Substantial Completion, or during the subsequent guarantee period, shall correct by the Contractor.
3. The Contractor shall guarantee all repair work performed under this Contract against defects in workmanship resulting in leakage and/or failure of concrete bond for a period of two (2) years from the date of the Certificate of Substantial Completion.

E. Submittals

1. Material certifications and technical data sheets on all grouts, mortars, epoxy resins, aggregates and repair products.
2. Shop Drawings detailing specific details of proposed repairs including any planned deviation from the proposed construction sequence and/or method of repair.
3. The Contractor, based on their experience in their profession, may submit to the Engineer for approval, alternative materials and/or methods of work to assure the durability and watertight integrity of the repair work performed.

F. Additional Guarantee

The Contractor shall guarantee all repair work performed under this Contract against defects in workmanship resulting in leakage and/or failure of concrete bond for a period of two (2) years from the date of the Certificate of Substantial Completion.

2.0 MATERIALS

A. Performance & Design Requirements

Unless otherwise specified or authorized, repairs shall conform to the requirements specified herein. Types of repairs not specified herein or in the absences of any definite requirement, as recommended by the Manufacturer's representative and subject to the acceptance by the Engineer. The following types of repairs shall be performed as required.

1. Pressure-Inject Epoxy Resin: pressure-injected epoxy resin shall be used to seal cracks, construction joints and other repairs in concrete structures as required or as directed.
2. Pressure-Injected Foam Resin: pressure-injected foam resin shall be used to seal joints and cracks in concrete structures that will have movement as required or as directed.
3. Crack Sealant: crack sealant shall be used to seal cracks in structures prior to pressure injection of resin.
4. Waterproof Injection Grout: waterproof crack repair material shall be a one-component, water-activated polyurethane hydrophilic injection grout capable of 700% expansion.

B. Materials

All materials shall be as specified or as recommended by the manufacturer for temperature and moisture conditions encountered.

Pressure-Injected Epoxy Resin	ASTM C881, Type 1 or Type IV, moisture tolerant or moisture insensitive
Pressure-Injected Foam Resin	Hydrophilic polyurethane foam; Prime Resins "Prime-Flex 900 XLV", DeNeef "Hydro-Active Sealfoam" and/or "Hydro-Active Flex LV", Avanti "AV-333 Injectaflex" or approved equal.
Foam Resin Accelerator	As recommended by foam resin manufacturer
Crack Sealant	As recommended by the manufacturer of the pressure-injected resin product.
Water	Clean and free from delirious substances

3.0 EXECUTION

A. Inspection

Prior to the placement of the repair materials, the crack to be repaired shall be inspected by the material manufacturer to assure that preparation and conditions are correct for the type of repair and the product/material being used.

B. General Requirements

No repair work shall be undertaken when ambient temperatures are below

manufacturer's safe recommendations. No admixtures, except those required by the manufacturer, shall be used in the repairs specified herein. All products shall be applied in strict accordance with manufacturer's recommendations. The Contractor shall furnish and install safe scaffolding and ladders for the Engineer's prework inspection, the repair work activities, and the Engineer's final inspection.

C. Pressure-Injected Preparation

1. Preparation for injected epoxy and/or foam resin shall include drilling offset injection holes at an angle that will intersect the crack, joint or crack network at approximately one-half the thickness of the concrete up to a thickness of 36 inches and as recommended by the manufacturer. Holes drilled for injection ports shall not cut rebar. If rebar is encountered during drilling, the hole shall be abandoned and relocated, and the abandoned hole shall be patched immediately with non-shrink grout flush with the surface of the existing concrete. Spacing of injection ports shall be determined as recommended by the injection material manufacturer and as acceptable to the Engineer.
2. Once the surface sealing material has cured, inject crack with waterproof injection grout using standard pressure injection equipment as directed by the manufacturer.

D. Curing

All repair products shall be cured in strict accordance with manufacturer recommendations.

E. Cleaning

The work areas shall be cleaned each day in accordance with the project requirements. Upon completion of the final cleanup, the Contractor shall restore all areas affected by the repairs procedures to their original conditions, leaving no trace of materials or other waste materials.

DIVISION 4 MASONRY

SECTION 04100 MORTAR

1.0 GENERAL

A. Description

Mortar shall include, but not necessarily be limited to, furnishing site mixed mortar for masonry, pipe connections, grouting, and other uses as specified in the Contract Documents or as directed by the County.

B. Related Work Included Elsewhere

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Water Valves and Appurtenances: Section 02662
3. Water Services and Appurtenances: Section 02664
4. Sanitary Sewer Manholes: Section 02710
5. Brick Masonry: Section 04200

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for mortar.
2. The Contractor may purchase water from the County's potable water system in accordance with the current County policies and procedures.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

1. Water shall be potable.
2. Portland Cement

Portland cement shall meet the requirements of ASTM C150.

3. Mortar

a. Sewer and Water Main Construction

Proportions of mortar shall be 1 part Type II Portland Cement (ASTM C150) and 3 parts masonry sand meeting ASTM C144.

b. Mortar for Parging Masonry Walls below Grade

Proportions of mortar shall be 1 part Type I Portland Cement (ASTM C150), 1/4 part hydrated lime (ASTM C207, Type d), and 3 parts sand.

c. Mortar for laying Concrete Block Walls, Brick Walls and Unit Masonry Structures

i. Below grade mortar shall be ASTM C270 (Masonry Cement) or ASTM C91 (Portland/Lime Blend), Type M.

ii. Above grade, mortar shall be ASTM C270 (Masonry Cement) or ASTM C91 (Portland/Lime Blend), Type S (air-entrained).

4. Hydrated Lime for Masonry

Hydrated lime for masonry shall meet the chemical requirements of ASTM C 207, Type N.

5. Grout

Grout used for anchor bolts, pipe handrail posts and miscellaneous items shall be composed in accordance with one of the following:

a. one part Portland cement and one part mortar sand by dry loose volume.

b. an epoxy or polyester anchoring system may be used as approved by the County and in accordance with the manufacturer's recommendations. Strength values shall be as indicated on the Contract Documents.

c. non-shrink grout shall be used when specified. The grout shall have a minimum compressive strength of 5,000 psi in seven (7) days when tested with AASHTO T-106 except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The non-shrink grout shall have a minimum expansion of 0.0 percent after seven (7) days when tested in accordance with AASHTO T-160.

6. Rapid-set grout mix for brick manhole conversion – only

- a. Rapid-set mortar for use with the conversion of brick manhole sections to pre-cast concrete sections shall be a quick setting, high strength, self bonding and curing concrete patching and finishing compound. The mortar shall come from the manufacturer in bags, uniformly pre-mixed, consisting of Portland cements and graded washed silica aggregates with polymer modification to promote a lasting surface adhesion. The product shall meet the minimum properties: Compressive strength in accordance with ASTM C-109, air cure, 1 hour at 225 psi, 24 hours at 3340 psi, 7 days at 5050 psi and 28 days at 5800 psi; flexural strength in accordance with ASTM C-348, 28 days at 900 psi; Shear bond to concrete 28 days at 250 psi; Freeze Thaw Stability in accordance with ASTM C-290, compressive 300 cycles at 6,000 psi; Chemical resistance shall be "good" against de-icing salts and mild acids.

3.0 EXECUTION

A. Mixing

1. Mortar may be mixed in an approved mixing machine or manually in a tight box. The dry materials shall be mixed until the mixture assumes a uniform color and consistency. Water shall be added as the mixing continues until the proper consistency has been attained for the intended use.
2. Mortar shall be mixed only in quantities that satisfy immediate use. Retempering of mortar shall not be permitted.

B. Curing

1. Mortar within brickwork for manhole channels and benches shall cure a minimum of 24 hours before being exposed to sewage.

4.0 METHOD OF PAYMENT

Mortar will not be measured.

5.0 BASIS OF PAYMENT

Mortar will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

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SECTION 04200 BRICK MASONRY

1.0 GENERAL

A. Description

Brick masonry shall include, but not necessarily be limited to, furnishing and installing brick masonry above and below grade to the sizes and shapes and at the locations indicated in accordance with the Contract Documents or as directed by the County.

B. Related Work Included Elsewhere

1. Removal or Abandonment of Existing Utilities: Section 02050
2. Boring and/or Jacking Pipe: Section 02300
3. Tunneling: Section 02400
4. Water Valves and Appurtenances: Section 02662
5. Water Services and Appurtenances: Section 02664
6. Fire Hydrants: Section 02666
7. Sanitary Sewer Manholes: Section 02710

C. Quality Assurance

The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.

2.0 MATERIALS

A. Materials Furnished by the County

The County will not furnish any materials for brick masonry.

B. Contractor's Options

None.

C. Detailed Material Requirements

1. Sewer brick shall be grade SM, have dimensions not exceeding 2 1/4" x 3 3/4" x 8", and meet the requirements of ASTM Designation C32. The bricks shall have a fine-grained uniform, and dense structure, free from lumps of lime, laminations, cracks, checks, soluble salts or other defects which may in any way impair their strength, durability, appearance, or usefulness for the purpose intended. Bricks shall emit a clear, metallic ring when struck with a hammer.
2. Mortar shall be as specified in Section 04100 of these Standard

Specifications.

3.0 EXECUTION

A. Environmental Requirements

1. General

- a. Cover completed work each day to prevent rain or melting snow from penetrating the mortar of upper courses. Do not uncover until immediately before new work is to be laid. Protect new masonry for a period of not less than 72 hours immediately following laying. This time period may be extended by the County.
- b. Spray masonry laid during the period from April to November, inclusive, with sufficient water so as to be moist, but not saturated with water just prior to use.

2. Cold Weather Protection

- a. No brick masonry work or pointing shall be done when there is frost in the brick or when the air temperature is below 40 degrees F, unless the Contractor has on the project ready to use, if and when directed, suitable housing, covering, tarpaulins, etc. and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 40 degrees F.
- b. Protect work by heating and maintaining the temperature of the masonry materials at not less than 40 degrees F but not more than 160 degrees F and maintaining an air temperature above 40 degrees F on both sides of the masonry for not less than 72 hours. Work will not be permitted with or on frozen materials. When the temperature reaches or is above 40 degrees F proceed as under warm weather conditions.

3. Hot Weather Protection

- a. During hot weather, protect masonry from direct rays of sun. Cover, and/or wet all finished work for a period of 7 days after laying.
- b. Do not erect masonry when the ambient air is warmer than 99 degrees F in the shade and has a relative humidity of less than 40% unless the work is prevented from drying out for not less than 48 hours after having been installed.

B. General

1. Keep joints equal to the difference between the actual and nominal dimensions of the unit being installed.
2. Toothing of new work into existing work will not be permitted.

C. Preparation

1. Clean dirt, debris, oil, grease, and other foreign substances which would affect bond of mortar, from all surfaces to receive mortar.
2. Lay out brickwork to establish accurate spacing of bond pattern, to ensure uniform joint widths, and to locate openings, returns, and offsets. Arrange units in a manner which will result in few or no units to be cut.
3. Wetting Bricks
 - a. Brick having absorption rates in excess of 0.025 ounces per square inch per minute, when tested in accordance with ASTM C 67 shall be wetted, so that the rate of absorption does not exceed that rate.
 - b. Wetting methods shall ensure that each brick, immediately before being installed, is nearly saturated but brick surfaces are dry.

D. Erection

1. Workmanship
 - a. All brickwork shall be laid by competent brickmasons and any workers not deemed to be such by the County shall be removed from the work at once.
 - b. Lay masonry plumb, true to line, with level and accurately spaced courses. Where bricks are laid on their side for the manhole channel, the joint spacing shall not exceed 3/16-inch. On manhole benches where brick is laid flat, the joint spacing shall be no more than 1/2-inch.
 - c. Build in wood blocking, strips, grounds, wedges, pipe sleeves, frames, and similar items of material necessary to properly secure the work for other trades.
 - d. Remove mortar which has splashed or been smeared on finished surfaces with stiff bristle brushes as the work progresses.
 - e. Special care shall be taken in laying brick in inverts of manholes, transition sections, junction chambers, brick wyes and similar structures to insure a uniform flow of water through the sections. In such locations, joints shall not exceed three-sixteenths (3/16) inch thickness and each brick shall be laid in full mortar joints on bottom side and end performed in one operation; no grouting or working in of mortar after laying the brick will be permitted.
 - f. All brick work for manhole adjustments shall be installed flat in a radial pattern and not placed on edge in any course. The face of brick manhole interiors shall not be parged.
2. Parging
 - a. Parge exterior masonry in contact with the earth with two coats of Portland cement mortar, each 3/8 inch thick. The first coat shall be cross-scratched; the second coat shall be troweled smooth, beveled at the top,

and covered out at the edge of the footing. Extend parging not more than 4 inches above grade, unless otherwise, and keep damp for at least 3 days.

- b. Parging the interior surfaces of a manhole is not permitted without prior County approval.

3. Brick

- a. Lay brick work in common bond. Fill all joints between bricks completely with mortar. Form bed joints with a thick layer of mortar, which shall be smoothed. The practice of buttering at the corners of brick and then throwing mortar or scrapings into the empty joints will not be permitted. Lay closure brick with a bed joint and with head joints. Place the brick carefully without disturbing the joints. Place the brick carefully without disturbing the brick previously laid. Properly bond each course. Dry or butt joints will not be permitted. Provide grouting where indicated.
- b. Use sewer brick whenever brick construction is exposed to sewage flow. Lay sewer brick on edge so that the 2 1/4 by 8 inch side is exposed to the flow.
- c. Channel configurations shall be constructed as per the Standard Details.
- d. All manhole frame and cover adjustment brick work will be installed in a flat radial pattern.

4.0 METHOD OF MEASUREMENT

Unit masonry will not be measured.

5.0 BASIS OF PAYMENT

Unit masonry will not be paid for as a separate item but is considered incidental to other items of work. Payment will be included in other related items of work and will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

DIVISION 5 METALS

SECTION 05500 MISCELLANEOUS METALS

1.0 GENERAL

A. Description

Miscellaneous metals shall include, but not necessarily be limited to, furnishing and installing anchors, fasteners, hardware, castings, utility specialties, and other miscellaneous metal items in accordance with the Contract Documents or as directed by the County.

B. Related Work Included Elsewhere

1. Boring and/or Jacking Pipe: Section 02300
2. Tunneling: Section 02400
3. Water Mains: Section 02660
4. Water Valves and Appurtenances: Section 02662
5. Water Services, Water Meter Settings, and Vaults: Section 02664
6. Fire Hydrants: Section 02666
7. Sanitary Sewer Manholes: Section 02710

C. Quality Assurance

1. The County will inspect all materials before, during, and after installation to ensure compliance with the Contract Documents.
2. All miscellaneous metal items and fabrications shall be anchored firm and tight, in true alignment with neat fits, and without distortions, unsightly fastenings, raw edges, or protrusions.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

The County will not furnish any miscellaneous metals.

C. Contractor's Options

Not applicable.

D. Detailed Material Requirements

1. Whenever practicable, items shall be standard products, meeting the requirements specified herein, of a manufacturer regularly engaged in production of such items.
2. All fasteners, hangers, or other miscellaneous connections or accessories shall be of the same material or compatible with the item being fastened or hung.
3. Shapes and Bars
 - a. Mild steel shall conform to requirements of ASTM A 36.
 - b. Stainless steel shall conform to requirements of ASTM A 276, Type 304.
 - c. Aluminum shall conform to requirements of ASTM B 221, Alloy 6061-T6.
4. Plate, Sheet, Strip
 - a. Mild steel shall conform to requirements of ASTM A 36, or A 283, Grade C.
 - b. High strength steel shall conform to requirements of ASTM A 242.
 - c. Corrosion resistant steel shall conform to requirements ASTM A 242; 0.25 to 0.75 percent copper.
 - d. Stainless steel shall conform to requirements of ASTM A 240, Type 304.
 - e. Aluminum shall conform to requirements of ASTM B 209, Alloy 6061-T6.
5. Mild steel forgings shall conform to requirements of ASTM A 668, Class F.
6. Castings
 - a. Unless noted otherwise, gray iron shall conform to requirements of ASTM A48, and AASHTO Designation M306, Class 30 B.
 - b. Malleable iron shall conform to requirements of ASTM A 47, Grade 35018.
 - c. Ductile iron shall conform to requirements of ASTM A 536, Grade 60-40-18.
 - d. Nodular iron shall conform to requirements of ASTM A 220, Grade 45008.
 - e. Steel shall conform to requirements of ASTM A 27, Grade 65-35. The supplementary requirements of ASTM A 27 for tolerances and deviations shall also apply.
 - f. Chromium alloy-steel castings shall conform to the requirements of ASTM A 743, A 744, and A 297. The grade shall be as specified in the "Special

Provisions” for the particular use requirement of the casting.

- g. Aluminum shall conform to requirements of ASTM B 108, Alloy ANSI 356.0, T6.

7. Bolts, nuts, washers

a. General

- i. Provide galvanized for use with galvanized material.
- ii. Provide stainless for use with corrosion resistant metals.

b. Stainless

- i. Bolts shall conform to requirements of ASTM A 320, Type 316.
- ii. Nuts shall conform to requirements of ASTM A 194, Grade 8.
- iii. Washers shall be Type 316.

c. Expansion bolts shall be the metal shield type.

d. Steel drive bolts shall be the split shank type.

e. Headed steel anchors shall be fabricated from cold finished carbon steel conforming to requirements of ASTM A 108.

f. Cast washers, ogee washers and special cast washers shall meet the requirements of ASTM A 47. Cast washers shall be mechanically or hot-dip galvanized. The coating shall meet the thickness, adherence, and quality requirement of ASTM A 153.

g. Bronze bolts, nuts, and washer shall meet the requirements of ASTM B 21, UNS No. C46400.

8. Hardware

Spikes, wood screws, staples, brads, lag screws, carriage bolts, and other parts coming under the general heading of “Hardware” shall be composed of carbon steel and shall meet the requirements of FSS FF-N-105.

9. Checkered safety plate

Aluminum shall conform to requirements of ASTM B 221, Alloy 6063, T6.

3.0 EXECUTION

A. Fabrication

1. General

- a. Fabricate all work true to shape, size and tolerances as indicated in the

Contract Documents and on approved Shop Drawings; with straight lines, square corners, or smooth bends; free from twists, kinks, warps, dents, and other imperfections.

- b. Thickness of the metal and details of assembly and support shall provide sufficient strength and stiffness to resist distortion during shipment, handling, installation, and under severe service conditions. Dress exposed edges and ends of metal smooth, with no sharp edges and with corners slightly rounded. Construct connections and joints exposed to weather to exclude water.
- c. Provide sufficient quantity and size of anchors for the proper fastening of the work.

2. Fabricated Products

- a. Pipe wall sleeves in concrete construction shall be standard weight, black steel pipe, with anchors welded to exterior, size as required to accommodate passage of conduits, pipes, ducts, and similar items with proper clearance.

- b. Hatch Doors

Provide hatch doors that meet the requirements noted in the standard details and/or contract documents.

- c. Connections

- i. Shop connections in weldable materials, not designed for service removal, shall be welded. All welding shall conform to AWS D1.1 requirements. Grind all exposed welds smooth. Remove weld, brazing, and solder splatter, flux, slag, and oxides from finished surfaces. Use sheet metal lock seams only when indicated on the Plans or approved shop drawings.
- ii. Complete all provisions for bolted field connections in the shop unless otherwise indicated.
- iii. Match exposed work to produce continuity of line and design. Fabricate and fasten metal work so that the work will not be distorted, the finish impaired, nor the fasteners overstressed from the expansion and contraction of the metal. Conceal fastenings whenever practicable.

- d. Castings and Forgings

- i. Fabricate castings and forgings to the sizes and shapes indicated. Castings and forgings shall be uniform quality, true to pattern; strong, tough, of even grain; sound; smooth; without cold sheets, scabs, blisters and sand holes, cracks or other defects. Plugs, filled holes, and welding will not be allowed. Castings shall be of thickness and configurations shown on the Standard Details. Abrasive blast as required to remove scale and to achieve a uniform smooth clean

surface. Paint with asphaltum or coal tar paint meeting requirements of AWWA C 203, where indicated. Provide raised letters where indicated.

- ii. Valve boxes shall be Class 30B, round head, screw type consisting of snug fitting top, bottom sections, and screw type extension. Lid shall be removable only by lifting straight up from the shaft shoulder.
- iii. Meter setting fittings, yokes, and appurtenances for 3/4 through 2-inch metered water supplies, and meter pit frames, lids, and covers shall be as specified on the Standard Details.
- iv. Manhole frames and covers shall be cast from material meeting the requirements of ASTM A48, Class 30B. Weights, configuration, and lettering shall be as shown on the Standard Details.
- e. Miscellaneous anchors, strap anchors, clip angles, and plates, hangers, etc., and other items, together with all miscellaneous structural shapes required for construction of the work shown on the Plans, shall be furnished in accordance with the requirements of the Contract Documents.

B. Painting and Coatings

- 1. Where indicated, shop and/or field paint miscellaneous metal items according to the paint systems specified in the Contract Documents.
- 2. Galvanized touch up shall be zinc dust coating conforming to requirements of Military Specification P-26915.
- 3. Bituminous corrosion protection shall conform to requirements of Military Specification C-18480.
- 4. Coat aluminum accessories and items embedded in concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete.

C. Delivery, Handling, and Storage

- 1. Identify, and match mark if applicable, all materials, items, and fabrications; for installation and field assembly.
- 2. Wherever practicable, deliver items to job site as complete units, ready for installation or erection, with all anchors, hangers, fasteners, and miscellaneous metal items required for installation.
- 3. Provide adequate storage facilities at the job site for the protection and storage of all delivered materials. Handle and store in such a manner as to not damage factory finishes. The Contractor shall repair damaged finishes at no cost to the County.

D. Erection and Installation

1. Erection and installation of miscellaneous metal items shall be in accordance with requirements specified elsewhere in the Contract Documents.
2. Miscellaneous metal items and fabrication shall be installed in their proper locations as shown or directed and shall be anchored, rigid and secure, plumb and level unless otherwise shown, and in true alignment with related and adjoining work.
3. The Contractor shall provide shims, washers, anchors, and such additional work as necessary to achieve a satisfactory installation.

4.0 METHOD OF MEASUREMENT

Miscellaneous metals will not be measured.

5.0 BASIS OF PAYMENT

Miscellaneous metals will not be paid for as separate items. The materials and their installation are considered incidental to the work required in the construction of specific structures that will be paid for under various items indicated in the Contract Documents. Payment will constitute full compensation for all labor, equipment, tools, and incidentals necessary to complete the required work.

DIVISION 6 NOT USED

DIVISION 7 NOT USED

DIVISION 8 NOT USED

DIVISION 9 NOT USED

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DIVISION 11 EQUIPMENT

SECTION 11307 SEWAGE GRINDER PUMPING UNITS

1.0 GENERAL

A. Description

Sewage Grinder Pumping unit installation shall include but not necessarily be limited to furnishing and installing the sewage grinder pumping (SGP) units including accessway, tank, pumps and motors, check valves, and control and alarm panels of the size and type shown on the plans and in accordance with the Contract Documents.

B. Submittals

Shop drawings shall be furnished for review and approval to the Engineer with subsequent review and approval by the Harford County Division of Water and Sewer for the following items:

1. Sewage grinder pump units including accessway, tank, pumps and motors, check valves, controls and wiring.
2. An affidavit from the pump supplier that the required quantity of grinder pump cores, electrical cable, supply/control and control panels are stored and will be made available at the local pump suppliers warehouse until such time as the lots are developed and connected to public sewer.

C. Related Work Specified Elsewhere

1. Trench Excavation, Backfill and Compaction: Section 02250
2. Gravity Sanitary Sewer and House Connections: Section 02700
3. Low Pressure Sewer: Section 02731
4. Sanitary Sewer Force Mains: Section 02720
5. Cast-in-Place Concrete: Section 03300

D. Quality Assurance

1. The County will inspect all materials before, during and after installation to ensure compliance with the Contract Documents.
2. The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired Grinder Pump Station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use.
3. The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards,

and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer main construction.

B. Sewage Grinder Pump Units

1. The Contractor shall furnish new, factory-built sewage grinder pump units consisting of simplex or duplex grinder pump core units and all necessary parts and equipment installed in high density polyethylene tanks.
2. Sewage grinder pump units shall be as manufactured by the Environment/One Corp., 2772 Balltown Road, Niskayuna, New York 12309 or approved equal. The equipment specified shall be a product of a company experienced in the design and manufacture of sewage grinder pumps (progressive-cavity type) for specific use in low pressure sewer applications. The company shall submit detailed product specifications, submit evidence of an established service program (over 15 years of experience), and shall be responsible for maintaining a continuing inventory of grinder pump replacement parts.
3. Operating Conditions: The pumps shall be of a semi-positive displacement type. Each pump shall be capable of delivering 11 GPM against a normal rated total dynamic head of 92 feet. At zero head, the output shall be 15 GPM, minimum. The pumps shall be capable of intermittent (3 minutes minimum) operation at any head up to 185 feet total dynamic head with a minimum flow of 7.8 GPM. The electrical rating of each pump motor shall be 8 amperes, 1 phase, 240 volts, 60 Hertz.
4. Tanks
 - a. Sewage grinder pump basins (tanks) and integral accessway shall be manufactured by the Environment/One Corp., 2773 Balltown Road, Niskayuna, New York, 12309 or approved equal. The tank shall be of high density polyethylene (HDPE) corrugated double wall construction, minimum 3-inch thick. The internal wall shall be generally smooth with the outside wall having a minimum of 1 2 inch corrugations for stiffness. Tank bottom and all other construction seams shall be thermally welded and factory tested for lead tightness.
 - b. All tanks shall be furnished with inlet grommet(s) to accept a 6" nominal diameter PVC SDR 35 sewer house connection and comply with ASTM D 3034 and F1336.
5. Accessways: The accessways shall be of corrugated HDPE as specified for

the tank for the required Model unit(s). It shall have an access opening at the top with a lockable cover with skirt capable for supporting a 150 pound per square foot loading.

- a. The accessway shall be an integral extension of the tank and include a tamper-proof cover assembly with water-tight capability.
- b. The basin shall have all necessary penetrations molded in and factory sealed. Field penetrations will be prohibited.
- c. All discharge piping within and penetrating the basin shall be 340 stainless steel and terminate outside the basin with a 1 3 inch female NPT fitting. The discharge piping shall include a stainless steel ball valve rated for 200 psi. All penetrations shall be warranted to be watertight.
- d. The accessway shall include a single NEMA 6P electrical quick disconnect for all power and control functions, factory installed with accessway penetrations warranted to be water tight. The accessway shall also include a 2 inch PVC vent to prevent sewage gases from accumulating in the tank. Junction boxes within the basin are prohibited.

6. Pump Core Units

- a. The grinder pump shall have a cartridge type easily removable core assembly containing pump, motor, grinder, polypropylene rope, stainless steel valve actuator, controls, check valves, anti-siphon valve and wiring. The core unit shall have two lifting eyes provided in the top housing to facilitate easy removal of the core unit from the tank if necessary. The core mounting plate shall be equipped with captive mounting bolts which permit installation/removal of the cores from the surface without entering the accessway by means of a long-stem wrench.
- b. The watertight integrity of the core unit, including wiring and access cover, shall be established by 100% factory test at a minimum of 5 psi.
- c. The Contractor shall furnish the following additional spare pump core, identical to the approved pump cores, and deliver it to the Sod Run Wastewater Treatment Plant in Perryman, Maryland, Attention Maintenance Supervisor according to the following schedule:

<u>Number of Grinder Pumps</u>	<u>Number of Required Spare Cores</u>
2 - 20 units	1 core
21 - 50 units	2 cores
51 - 150 units	5 cores

7. Pumps: Each pump shall be an integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be through-hardened, high polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. The material shall be suitable for domestic wastewater service. its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature,

stability, and wear resistance. The pump shall have a two-bearing design including both upper and lower ball bearings. Sleeve bearings will not be acceptable.

8. Grinder

- a. The grinder shall be positioned immediately below the pumping element and shall be direct-driven by a single, one-piece, motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the impeller to the motor shaft. Attachment by pins or keys are prohibited. The grinder shall be a one-piece forged 4140 cutter wheel of the rotating type with inductively hardened cutter teeth (Rockwell 55-58c). The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time. This assembly shall operate without objectionable noise or vibration over the entire range of recommended operating procedures.
- b. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following items in conjunction with the grinder pump tank.
 - i. The grinder shall be positioned in such a way that solids are fed in an up-flow direction.
 - ii. At maximum flow rate through the cutting mechanism must not exceed 4 feet per second.
 - iii. The impeller must rotate a nominal speed of no greater than 1800 rpm.

9. Electric Motor

- a. The motor shall be 1HP, minimum, 1725 rpm, 240 volt, 60 hz, single phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and a high starting torque of 8.4 foot pounds.
- b. The motor shall have inherent protection against overloads or locked rotor conditions by the use of a UL-listed, automatic-reset, integral thermal overload protector incorporated into the motor. Non-capacitor start motors or permanent split capacitor motors shall be prohibited.

10. Seal

- a. The pump core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in place with a stainless steel spring.

11. Check Valve

The pump discharge shall be equipped with a factory installed, check valve that is built into the discharge pipe. The valve shall be constructed with a HDPE housing and stainless steel interior components. The valve will provide a full-port passageway when open and shall produce a friction loss of less than 6-inches of water at maximum rated flow. Working parts shall be made of 300 series stainless steel. The valve operation shall provide maximum seating capability, even at very low back pressure. The check valve will provide a full-ported passageway when open. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer. Ball-type check valves shall be prohibited.

12. Controls

- a. All necessary controls shall be located in the top housing of the core unit. The top housing will be attached with stainless steel fasteners. All controls shall be wired.
- b. Non-fouling waste water level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the waste water. High-level sensing will be accomplished in the manner detailed above by a separate air-bell sensor and pressure switch of the same type. Float switches are not acceptable.
- c. To assure reliable operation of the pressure sensitive switches, each core shall be equipped with an equalizer diaphragm that compensates for atmospheric pressure or temperature changes.
- d. The grinder pump will be furnished with a length of 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements. This cable shall be installed in a 1 1/2" PVC conduit that runs from the control cabinet to the grinder pump.
- e. The Contractor and home builder shall coordinate the ordered length of control/power cable between the grinder pump location and the control panel. Unless the houses and proposed control panel locations are shown on the construction drawings or otherwise specified, the Contractor shall order a minimum 100' feet of control/power cable for each pump core. The control/power cable between the grinder pump disconnect and the pump control panel shall be one piece with no splices. The maximum length shall not exceed 150' feet unless approved modifications are made by the grinder pump manufacturer.

13. Pump Control Panel

- a. The pump control panel shall be Simplex Sentry as manufactured by the Environment/One Corporation, 2773 Balltown Road, Niskayuna, New York or approved equal. The entire pump control panel as specified shall be listed by Underwriters Laboratories, Inc.
- b. Each sewage grinder pumping unit shall include a NEMA 4x, UL listed pump control panel suitable for mounting on the exterior of a residential

dwelling. The NEMA 4x enclosure shall be manufactured of UV-stabilized thermal plastic. The enclosure shall include a hinged, pad-lockable cover secured dead front (protection from exposed wires), and component knockouts.

- c. For each pump core, the control panel shall contain one (1) 15 amp dedicated double pole circuit breaker for the power circuit and one (1) 15 amp dedicated single pole circuit breaker for the alarm circuit. The control panel shall also contain one (1) 15 amp dedicated single pole circuit breaker for a 120 VAC, 15 amp rating, service with integral GFC outlet.

The outlet shall only be accessible by opening the control panel cover. The control panel shall contain at least but not be limited to terminal blocks, integral power bus, push to run feature, and a complete alarm circuit.

- d. The visual alarm lamp shall be inside a red fluted lens at least 2 5/8" inches diameter and 1 11/16" inches height. The visual alarm shall be mounted to the top of the pump control in such a manner as to maintain NEMA 4X rating.
- e. The audio alarm shall be a printed circuit board in conjunction with an 93-dB buzzer with a quick mounting terminal strip mounted in the interior of the enclosure. The audio alarm shall be capable of being de-activated by depressing a push-type switch which is encapsulated in a weather proof silicone boot and mounted on the bottom of the enclosure.

14. Interior Piping

All discharge piping and fittings shall be 300 series stainless steel.

15. Warranty

The grinder pump manufacturer shall provide a parts and labor warranty on the entire sewage grinder pumping unit and accessories including but not limited to control panel, electrical parts, pump core, tank basin and integral accessway, cabling and internal piping, valves and appurtenances for a period of 24 months after pump core is placed into service. All service calls during this 24-month period will be deemed necessary as warranty work unless the repairs are due to non-equipment related failures or damage such as vandalism, damage to vehicular traffic, etc. When the Division of Water and Sewer receives a service call request from the customer, they will report to the site and restore the service as soon as possible. If the failure or damage is of no fault of the Division of Water and Sewer or the customer, the Division will back charge the Developer or Contractor as per the Public Works Utility Agreement or the Contract Documents. If the core unit is deemed defective, the County will contact the manufacturer/supplier and have it picked up from the Sod Run Wastewater Treatment Plant located at 1212 Chelsea Road for repair or replacement. The repaired or replacement core must be returned to the Sod Run Wastewater Treatment Plant within three (3) working days after the notification. Harford County shall not be responsible for any labor, freight, transportation, taxes or any other costs associated with

service deemed as warranty work.

The Contractor shall supply the Division of Water and Sewer with the 24-hour telephone number of the pump manufacturer/supplier representative who will be responding to warranty service calls.

16. Level Sensor

Non-fouling wastewater level detection for controlling the grinder pump and alarm operation shall be accomplished by use of a detection mechanism specifically designed for use in a sewage grinder pump basin. Level detection shall not require any regular maintenance. The control assembly shall be specifically approved by Underwriters Laboratories. Conventional mercury, mechanical or swing arm floats will not be acceptable. All electrical wires to the level detection shall have electrical quick disconnects. (NEMA 6P).

17. Shut-off Valve

The grinder pump discharge piping shall be equipped with a factory-installed, full port, stainless steel manual ball valve with a minimum rated pressure of 235 psi. The valve shall be equipped with a stainless steel valve wrench terminating within 18-inches of the accessway. Each valve wrench shall be stored within the upper confines of the accessway.

18. Anti-Siphon Capability

The pump shall be constructed with a positively primed flooded suction configuration. As added assurance that the pump cannot lose prime even under negative pressure conditions in the discharge piping system, the design shall provide protection against siphoning. This device will automatically close when the pump is running and open to atmosphere when the pump is off. Use of small-diameter orifices in the discharge piping between the pump and check valve for anti-siphoning purposes is not acceptable. The anti-siphon valve shall be a gravity-operated, flapper-type valve built into the discharge piping. Moving parts shall be made of 300 stainless steel and fabric-reinforced synthetic elastomer.

19. Padlocks

The Contractor shall provide one padlock each for the breaker panel, control panel and grinder pump basin. The padlock shall be Masterlock with rubberized weatherproof coating and keyed to Harford County Standard.

3.0 EXECUTION

A. Factory Test

1. All components for the sewage grinder pumping unit shall be factory tested and certified. Certified test results shall be available upon request by the Division of Water and Sewer. The Division of Water and Sewer reserves the right to inspect such testing procedures with representatives of the grinder pump manufacturer at the manufacturer's facilities and at their expense.

2. All completed stations shall be factory leak tested to assure the integrity of all joints, seams and penetrations. All necessary penetrations such as inlets, discharge fittings, and cable connections shall be included in this test along with their respective sealing means (grommets, gaskets, etc.).

B. Delivery

1. All grinder pump tanks, including ball valve, quick disconnect, and watertight penetrations, shall be delivered to the job site 100% complete assembled including testing, ready for installation. Grinder pump tanks shall be individually mounted on wooden pallets.

C. Installation

1. Earth excavation and backfill shall be specified in accordance with the Standard Specifications and/or these Specifications and the Drawings, are also are to be done as a part of the work under this section including any necessary sheeting and bracing. The contractor shall be responsible for control of groundwater to provide a firm, dry subgrade for the structure and shall guard against flotation or other damage resulting from general water or flooding. The grinder pump stations shall not be set into the excavation until the installation procedures are excavation have been approved by the Inspector.
2. Remove packing material. Users instruction MUST be given to the Inspector. Hardware supplied with the unit, if required, will be used at time of installation. The basin will be supplied within one (1) flexible inlet grommet for simplex pump and two (2) flexible inlet grommets for duplex pumps for connecting the incoming sewer line. Appropriate inlet piping must be used. When moving tank, it should be lifted using all four (4) lifting eyes provided at the lower end of the basin. Do not use these eyes if a concrete collar has been attached to the tank. The basin may not be dropped, rolled, or laid on its side for any reason.
3. A 6-inch layer (minimum) of washed No. 57 stone shall be used as bedding material under each unit. A concrete anti-flotation collar, as detailed on the drawings and details and sized according to the manufacturer's instructions, shall be required and shall be precast to the grinder pump basin or poured in place. Each grinder pump basin with its precast anti-flotation collar shall have a minimum of three (3) lifting eyes for loading and unloading purposes. The unit shall be leveled and filled with water to the bottom of the inlet to help prevent the unit from shifting while the concrete is being poured. The concrete must be manually vibrated to ensure there are no voids. The concrete may not extend any higher than the invert of the inlet piping. The contractor may not construct pre-cast concrete "blocks" which are fastened to the grinder pump basin by means of bolts. All anti-flotation concrete collars must be cast-in place integrally with the pump basin, either above or below ground. If precast below ground, the concrete shall be allowed to cure a minimum of 24-hours prior to backfill.
4. The contractor shall provide and install grinder pump house connection piping as shown on the Drawings.

5. Backfill with wash no. 57 stone from top of concrete anti-flotation collar to six inches (6") minimum above grinder pump discharge pipe, then backfill in accordance with the Contract Documents. Improper backfilling may result in damaged accessways.
6. Upon completion of backfilling, Contractor shall place the stainless steel valve actuators within each grinder pump basin and re-secure the pump basin lid.
7. It is extremely important that the finished grade shall slope away from the surface of the grinder pump.
8. All restoration will be the responsibility of the contractor. Per unit costs for this item shall be included in the contractor's bid price for the individual grinder pump stations. All properties shall be restored to their original condition in all respects including, but not limited to, curb and sidewalk replacement, landscaping, topsoil and seeding, and restoration of the traveled ways as directed by the Inspector.
9. Any pre-purchased control wire and control panels which are not required to be installed at the time of the grinder pump installation shall be kept in the suppliers inventory and not stored within the grinder basins.

D. Commissioning Procedures Post-Utility Construction for Developer Projects

For Developer projects, the following procedures have been established on installing the plumbing and electrical connections to the grinder pumps as well as start-up and testing. These procedures are primarily aimed at the homebuilder.

1. The grinder pump basin and cleanouts shall be protected from damage during the construction of the home(s). Protection shall at a minimum consist of 4 foot high orange safety fence installed a minimum of 5 feet beyond the grinder pump basin and cleanouts. These facilities have been inspected and approved as part of the operational process. Any damage to these facilities from the homebuilder or their subcontractors shall be repaired or replaced if necessary by a Harford County approved licensed utility contractor at the homebuilder's expense.
2. Under an electrical permit, the homebuilder shall have a licensed electrician install the electrical service and control panel in conformance with the standard details. Homebuilder is responsible for acquiring the control panel, controls, alarm system and control/power cable from the pump supplier. These components shall have been pre-purchased by the utility contractor. For duplex grinder pumps, each house will have electrical power and controls that only operate the pump for that house.
3. Under a plumbing connection permit, the homebuilder shall have a licensed plumber install the sewer service between the house and existing cleanout.
4. The ground around the grinder basin must be graded to the finished grades for inspection at start-up. The start-up test will be cancelled if the ground is not properly graded. At no time shall the grinder pump basin be within a sump area. The site drainage shall freely drain stormwater away from the grinder basin. If this cannot be achieved, the homebuilder shall contact the

pump supplier to have an extension piece installed by the pump supplier, at the homebuilder's cost. There must be a minimum of 6-inches from the top of the grinder basin lid and finished grade (including sod). If the 6-inch clearance cannot be met the homebuilder shall have the pump manufacturer install a riser section, at the homeowner's cost.

5. Once the electrical and plumbing work is complete, the homebuilder shall schedule for a pump start-up with a minimum (1) week advance notice. Notification shall be to the pump supplier with:

- a. The test date and time
- b. Property address
- c. Homebuilder contact name and phone number

The same notification shall also be to Harford County Water and Sewer Pump Station Operations Maintenance Superintendent.

6. Just prior to the start-up test, the homebuilder shall have a septic hauler with vacuum capabilities on-site to thoroughly clean all stones and debris from the bottom of the pump basin.
7. At the day of the start-up, water must be available by the homebuilder to fill the basin, as needed, to test the pump.
8. The following people must be present at the start-up test: Homebuilder, homebuilder's electrician, pump supplier technician, and Harford County Operations Maintenance Superintendent.
9. The pump supplier technician will then test all of the electrical connections and inspect the installation. If all is acceptable to the pump supplier and Harford County, the pump supplier technician will install the pump core and check its operation. If all operations are successful the pump may be put into service.
10. Upon satisfactory start-up the grinder pump, the homebuilder shall provide a copy of the grinder pump notification information to the new homeowner at settlement or sooner.
11. Submit affidavit described in Section 1.0.

E. Commissioning Procedures Post-Utility Construction for Capital Projects

1. Under an electrical permit, the Contractor shall have a licensed electrician install the electrical service, circuit breaker, control panel, and all required wiring and conduit in accordance with the Contract Documents. The licensed electrician shall be responsible to contact BGE for coordination of a separate service into the BGE meter.
2. The ground around the grinder basin must be graded to the finished grades with seed and mulch for inspection at start-up. At no time shall the grinder pump basin be within a sump area. The site drainage shall freely drain

stormwater away from the grinder basin.

3. Once the electrical work and grading is complete, the Contractor shall schedule for a pump start-up and test with a minimum (1) week advance notice. Notification shall be to the pump supplier with:

- a. The test date and time
- b. Property address.

The same notification shall be made to the Harford County project manager, inspector and the Division of Water and Sewer, Maintenance Supervisor, or their designated representative. The Contractor, pump supplier, Harford County project manager, inspector, and Harford County Maintenance Superintendent must all be present at the start-up and test.

4. Just prior to the test, the Contractor shall have a septic hauler with vacuum capabilities on-site to thoroughly clean all stones and debris from the bottom of the pump basin.

At the day of the start-up, the Contractor shall have clean potable water in tanks available to fill the grinder pump basin. It is prohibited to utilize water from the homeowner.

5. The pump supplier shall provide the services of a qualified factory-trained technician who shall inspect the placement and wiring of each installation and perform tests below:
 - a. Check electrical continuity of all circuits.
 - b. Determine if proper voltage is provided to the unit.
 - c. Check entire site for proper installation.
 - d. Install test-pump and open all discharge piping.
 - e. After contractor fills basin with water, verify high level alarm.
 - f. Initiate pump operation to verify automatic controls are functioning properly.
6. Once the sewage pumping unit is accepted by the factory-trained manufacturer's representative, the technician shall complete the start-up completion report. The test-pump shall then be removed from the pump basin. The discharge valves shall be in the closed position. All new pump cores shall be retained in inventory with the local pump supplier until notified that the homeowner is ready for connection to the system.
7. For Vacant Lots – The Contractor is not responsible to perform procedures 1 through 7 above. At the time of site development, the homebuilder will be required to follow the Commissioning Procedures for developer projects.
8. Submit affidavit described in Section 1.0

4.0 METHOD OF MEASUREMENT

Measurement for Sewage Grinder Pumping unit installations will be made of the number of Sewage Grinder Pumping units satisfactorily installed as shown on the plans or directed by the County.

5.0 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit price bid. The price bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown as specified in strict accordance with the Contract Documents.
2. The price (s) bid for furnishing and installing Sewage Grinder Pumping units shall include the following:
 - a. Trench excavation, backfill, compaction and incidental items specified in Section 02250 of these Standard Specifications and elsewhere.
 - b. Cast-in-Place concrete, Section 03300 of these Standard Specifications.

B. Sewage Grinder Pumping Units

Payment for furnishing and installing Sewage Grinder Pumping units, complete, in-place, will be made per each Sewage Grinder Pumping unit placed. The price bid shall include all sediment and erosion control, traffic control, excavation, removal and disposal of spoil materials; furnishing and placing cast-in-place concrete, furnishing and placing washed gravel beneath unit and around basin, backfill and compaction, restoration, warranty and for incidental items to complete the installation.

PART 14-3 STANDARD DETAILS

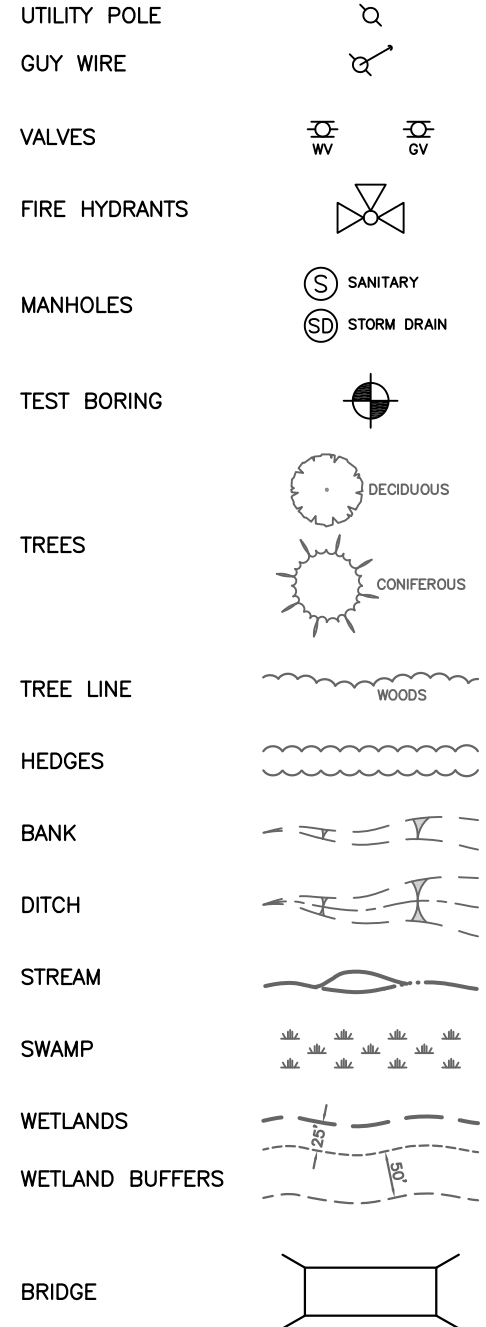
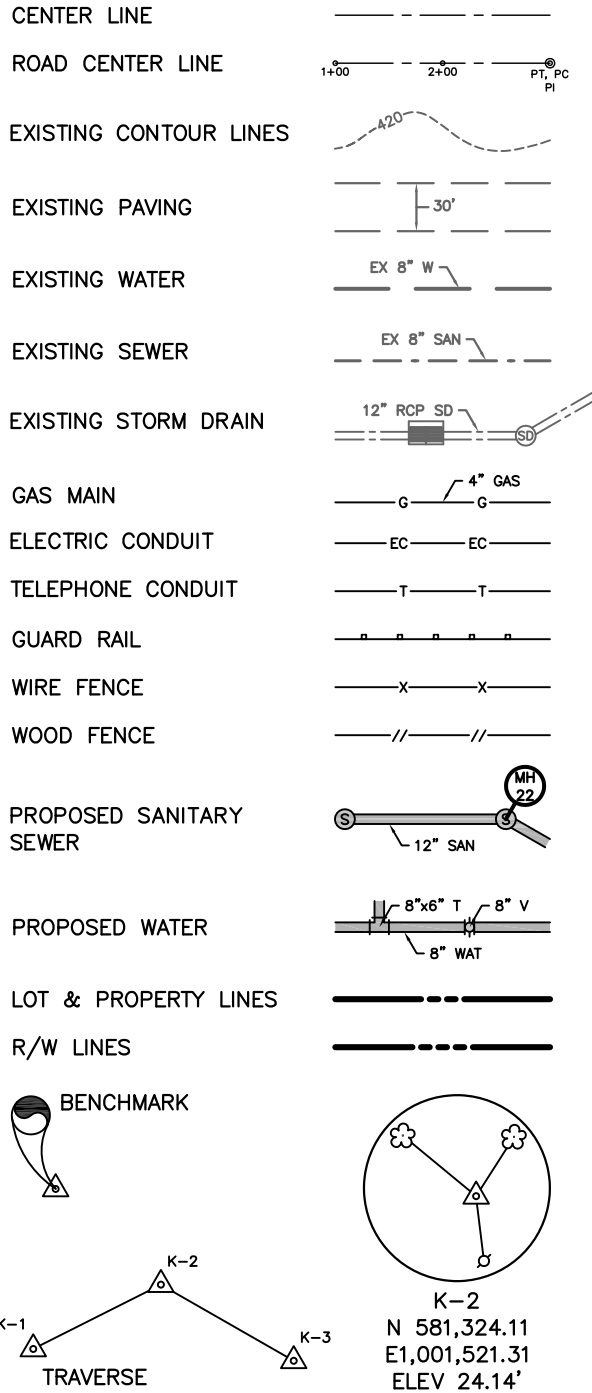
STANDARD GENERAL DETAILS

ISSUED 1/1/2026

G1	Standard Symbols
G2	Standard Legend
G3	Water and Sewer Services for Single Family Lots
G4	Water and Sewer Services for Townhouse Lots without Driveways
G5	Water and Sewer Services for Townhouse Lots with 7' or Less Between Driveways
G6	Water and Sewer Services for Two Panhandle Lots
G7	Water and Sewer Services for Three Panhandle Lots
G8	Water and Sewer Services for Four Panhandle Lots
G9	Clearances for Water and Sewer Service Connections and Mains
G10	Trench Payment Widths
G11	Jacking or Boring
G12	Tunneling
G13	Project Sign
G14	Security Fence
G15	Continuity Test Station
G16	Concrete Encasement and Cradles
G17	Access Drive
G18	Access Drive Barrier
G19	Method of Strapping Flexible Couplings in Vaults and Facilities
G20	DIP to HDPE Transition Connection
G21	Method of Connecting DIP to Existing Water Main Requiring Shutdown
G22	Tree and Shrub Planting Detail

1. ALL EXISTING FEATURES (SCREENED)
2. CONTOURS AND GRADES ALONG DRAINAGE AND UTILITY EASEMENTS (SCREENED)
3. ALL EXISTING UTILITIES (SCREENED)
4. PROPERTY LINES AND DISTANCES
5. PARCEL AND HOUSE NUMBERS
7. LOT NUMBERS, OWNERS AND RECORDINGS

8. UTILITY POLES – TYPE AND NUMBER
9. RIGHT-OF-WAY AND PAVING WIDTHS
10. C/L STATION ON ROADS
11. BANKS AND DITCHES
12. SUBDIVISION NAME AND RECORDING
13. ROAD NAMES AND ADDRESSES
14. PIPE SIZE AND TYPE



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STANDARD GENERAL DETAILS

STANDARD SYMBOLS

ISSUED
01/01/26

PLATE
G-1

*ALL SYMBOLS LABELED AS 'FUTURE' SHOULD ALSO APPLY TO 'PROPOSED (BY OTHERS)'

LEGEND

x(50.0)	EXISTING SPOT ELEVATION (Screened 50%–65%)
x50.0	PROPOSED SPOT ELEVATION
—50—	EXISTING CONTOUR (Screened 50%–65%)
—50—	*FUTURE CONTOUR (Screened 50%–65%)
—50—	PROPOSED CONTOUR
— . . . —	EXISTING STREAM (Screened 50%–65%)
— wavy —	EXISTING WOODS LINE (Screened 50%–65%)
— wavy —	EXISTING WETLAND (Screened 50%–65%)
— dashed —	EXISTING 25' WETLAND BUFFER (Screened 50%–65%)
— dashed —	EXISTING 75' WETLAND BUFFER (Screened 50%–65%)
— thick —	LIMIT OF FOREST RETENTION (Screened 40%–60%)
— dashed —	EXISTING PROPERTY LINE
— dashed —	EXISTING RIGHT-OF-WAY LINE
— thick dashed —	PROPOSED PROPERTY LINE
— thick dashed —	PROPOSED RIGHT-OF-WAY LINE
==	EXISTING CURB AND GUTTER (Screened 50%–65%)
==	*FUTURE CURB AND GUTTER (Screened 50%–65%)
==	PROPOSED CURB AND GUTTER
— G —	EXISTING GAS LINE (Screened 50%–65%)
— OH —	EXISTING OVERHEAD ELECTRIC (Screened 50%–65%)
— UG —	EXISTING UNDERGROUND ELECTRIC (Screened 50%–65%)
— S —	EXISTING STORM DRAIN (Screened 50%–65%)
— S —	PROPOSED STORM DRAIN (Screened 50%–65%)
— S —	EXISTING SANITARY SEWER (Screened 50%–65%)
— S —	*FUTURE SANITARY SEWER (Screened 50%–65%)
— S —	PROPOSED SANITARY SEWER (NO SCREENING)
— S —	W/SHADING (Screened 20%–40%)
— S —	EXISTING WATER MAIN (Screened 50%–65%)
— S —	*FUTURE WATER MAIN (Screened 50%–65%)
— S —	PROPOSED WATER MAIN (NO SCREENING)
— S —	W/SHADING (Screened 20%–40%)

NOTE: THE SCREENED PERCENTAGES LISTED ARE SUGGESTIONS ONLY AND VARY FROM PRINTER TO PRINTER. VERIFY THAT THE SCREENING PERCENTAGE SELECTED CAN BE VIEWED WHEN MAKING COPIES OF THE ORIGINAL DRAWINGS.



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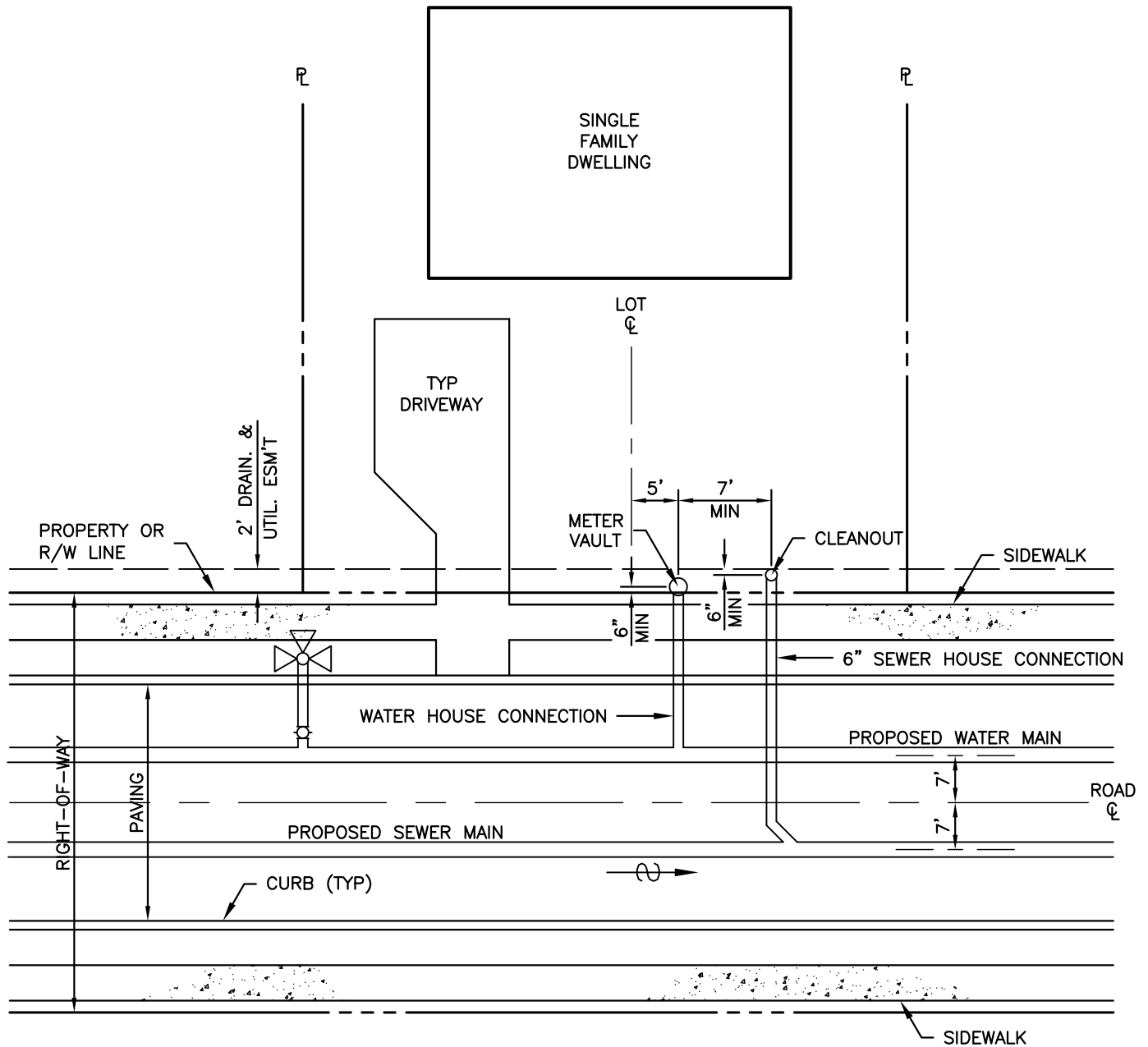
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STANDARD GENERAL DETAILS

STANDARD LEGEND

ISSUED
01/01/26

PLATE
G-2



NOTES:

1. METER VAULT AND CLEANOUT SHALL NOT BE LOCATED IN DRIVEWAY, SIDEWALKS OR STEPS.
2. PLACE UTILITIES ON LOW SIDE OF LOT.
3. MINIMUM SEPARATION BETWEEN WATER AND SEWER SERVICES IS SEVEN (7) FEET.
4. REFER TO THE APPROVED CONSTRUCTION DRAWINGS FOR SPECIFIC SERVICE LOCATIONS. IN CASE OF CONFLICT BETWEEN THIS DETAIL AND THE APPROVED CONSTRUCTION DRAWINGS, THE APPROVED CONSTRUCTION DRAWINGS SHALL GOVERN.



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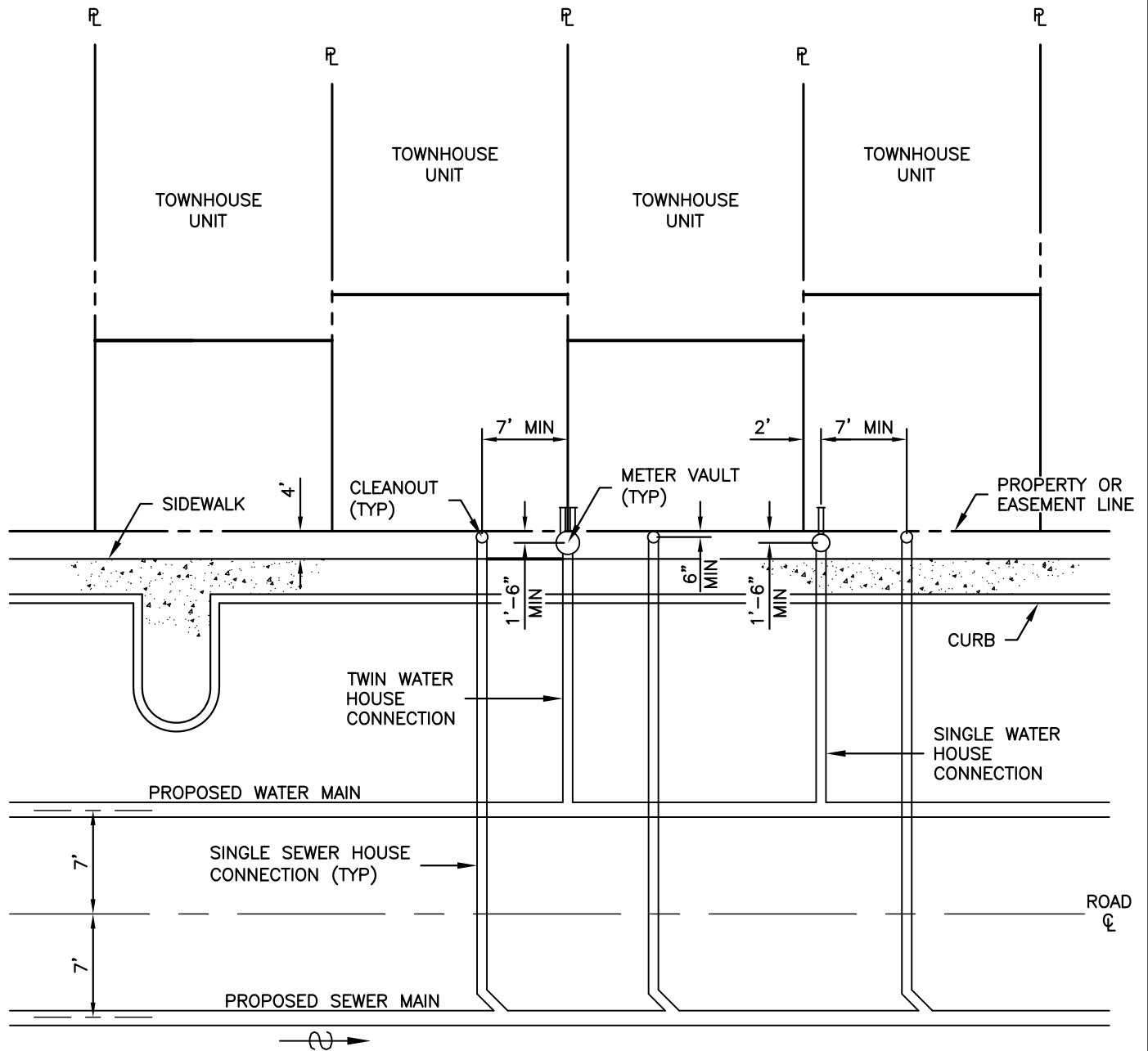
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STANDARD GENERAL DETAILS

WATER AND SEWER SERVICES
FOR SINGLE FAMILY LOTS

ISSUED
01/01/26

PLATE
G-3



NOTES:

1. METER VAULTS AND CLEANOUTS SHALL NOT BE LOCATED IN DRIVEWAYS, SIDEWALKS OR STEPS.
2. IN TOWNHOUSE UNITS WITHOUT PERPENDICULAR PARKING, AN ADDITIONAL TWO (2) FOOT DRAINAGE AND UTILITY EASEMENT IS REQUIRED. METER VAULTS AND CLEANOUTS SHALL BE LOCATED AS SHOWN ON STANDARD DETAIL G-3.
3. PLACE UTILITIES ON LOW SIDE OF LOT.
4. MINIMUM SEPARATION BETWEEN WATER AND SEWER SERVICES IS SEVEN (7) FEET.



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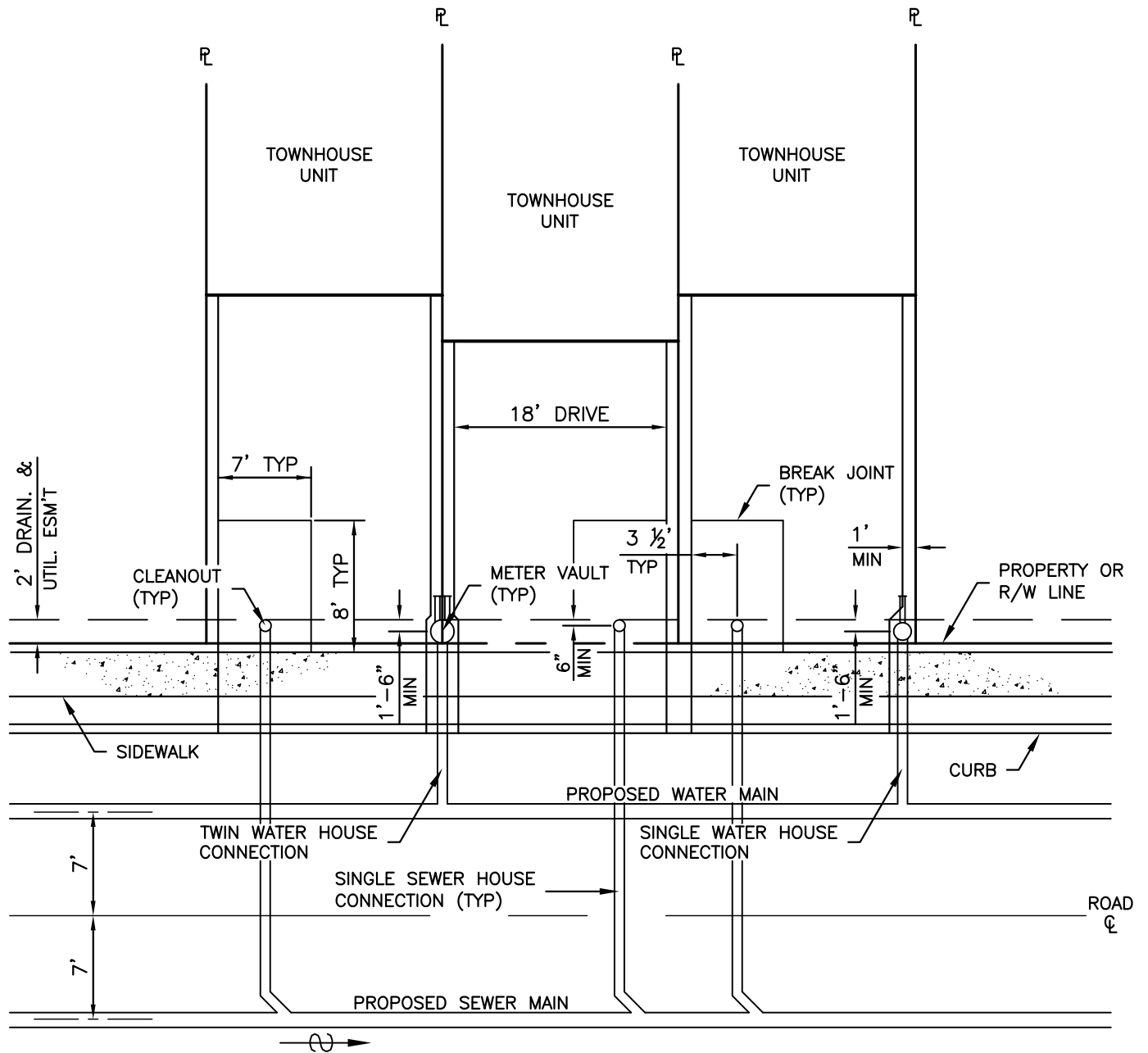
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STANDARD GENERAL DETAILS

WATER AND SEWER SERVICES
FOR TOWNHOUSE LOTS
WITHOUT DRIVEWAYS

ISSUED
01/01/26

PLATE
G-4



NOTES:

1. METER VAULTS SHALL NOT BE LOCATED IN DRIVEWAYS, SIDEWALKS OR STEPS. DRIVEWAYS SHALL BE TAPERED AS REQUIRED.
2. ALL CLEANOUTS SHALL USE TRAFFIC BEARING FRAME & COVER PER STANDARD DETAIL S-28.
3. MINIMUM SEPARATION BETWEEN WATER AND SEWER SERVICES IS SEVEN (7) FEET.



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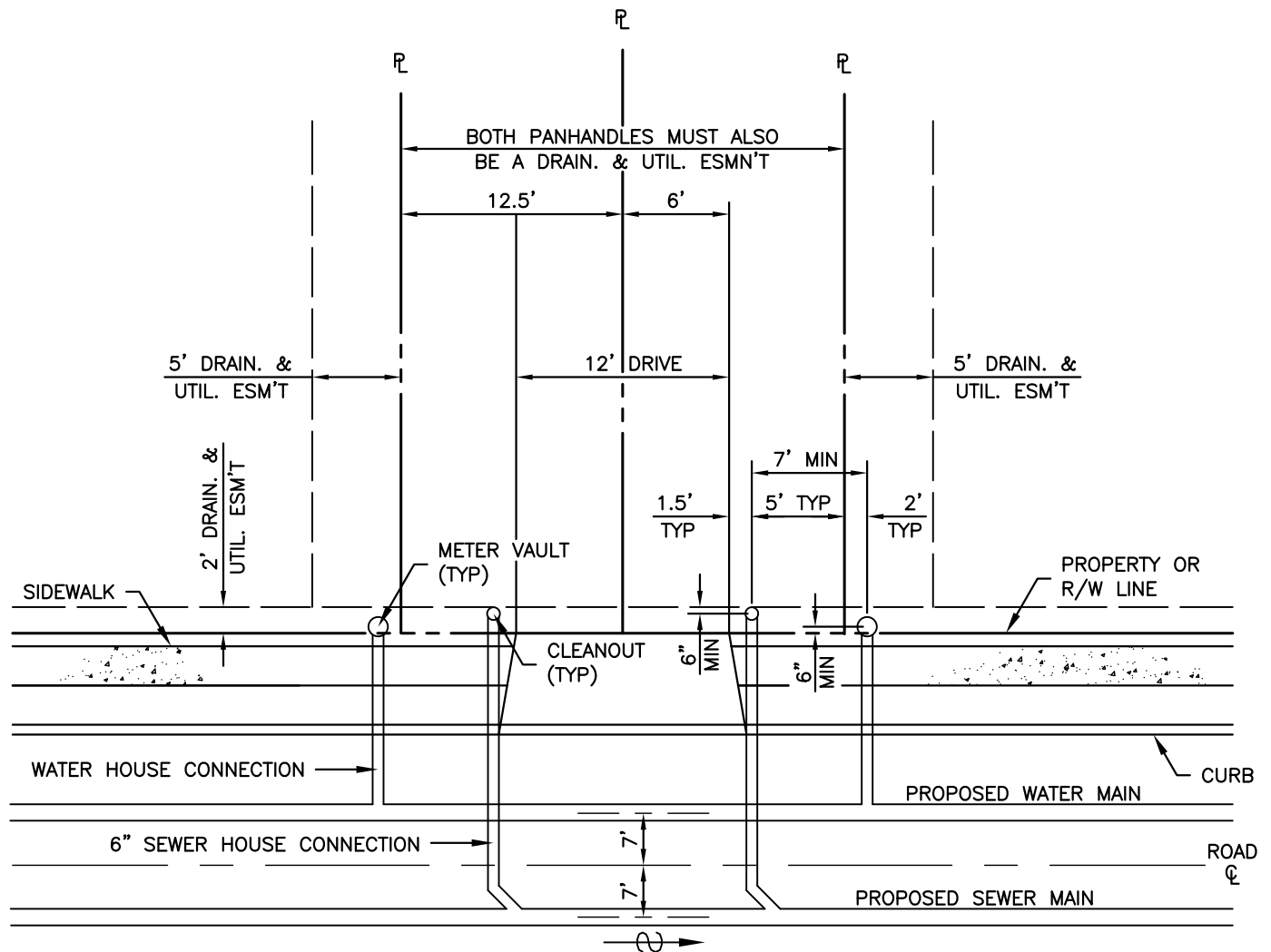
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STANDARD GENERAL DETAILS

WATER AND SEWER SERVICES
FOR TOWNHOUSE LOTS WITH 7'
OR LESS BETWEEN DRIVEWAYS

ISSUED
01/01/26

PLATE
G-5



NOTES:

1. METER VAULTS AND CLEANOUTS SHALL NOT BE LOCATED IN DRIVEWAYS, SIDEWALKS OR STEPS.
2. MINIMUM SEPARATION BETWEEN WATER AND SEWER SERVICES IS SEVEN (7) FEET.



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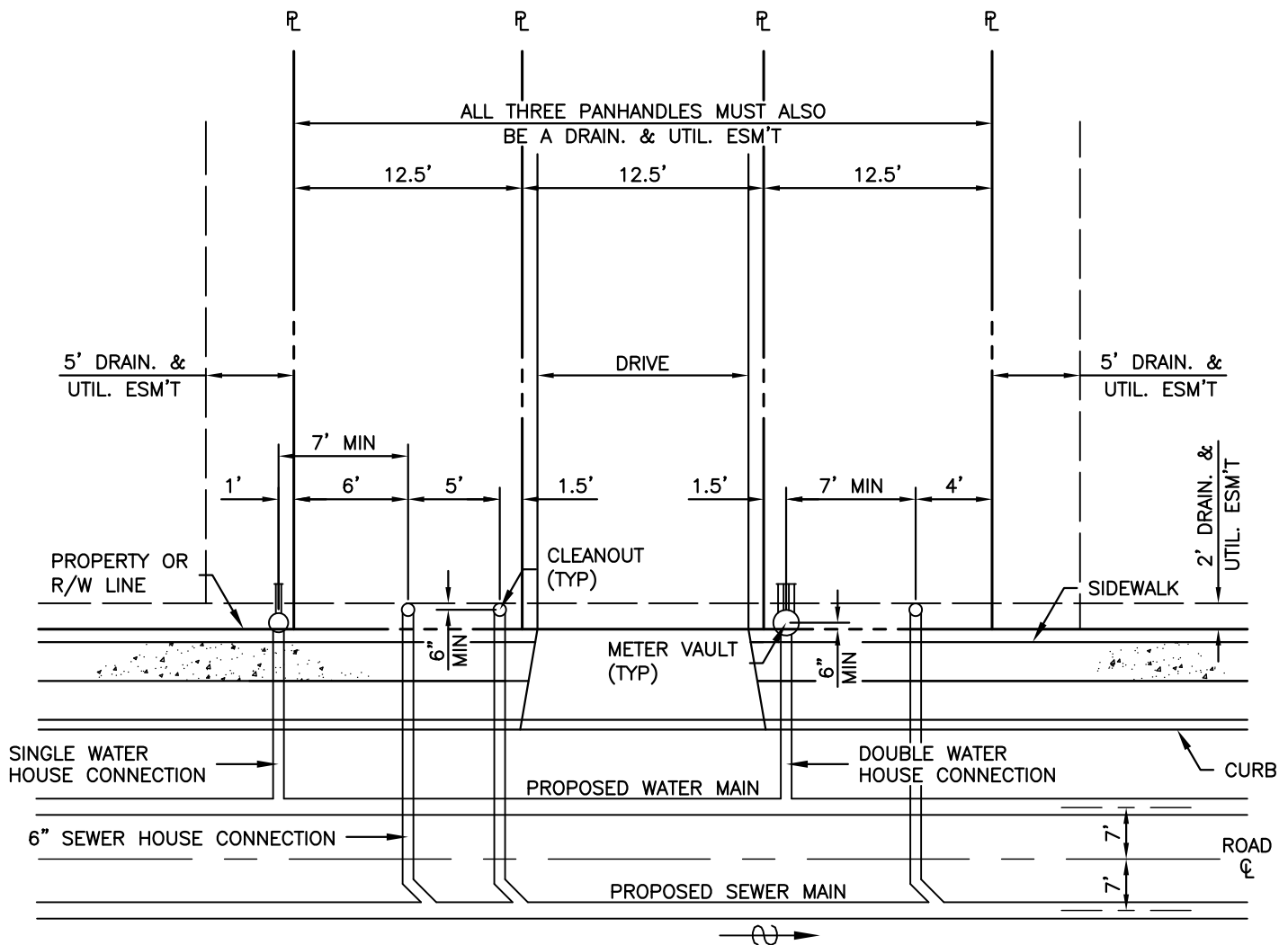
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STANDARD GENERAL DETAILS

WATER AND SEWER SERVICES
FOR TWO PANHANDLE LOTS

ISSUED
01/01/26

PLATE
G-6



NOTES:

1. METER VAULTS AND CLEANOUTS SHALL NOT BE LOCATED IN DRIVEWAYS, SIDEWALKS OR STEPS.
2. MINIMUM SEPARATION BETWEEN WATER AND SEWER SERVICES IS SEVEN (7) FEET.



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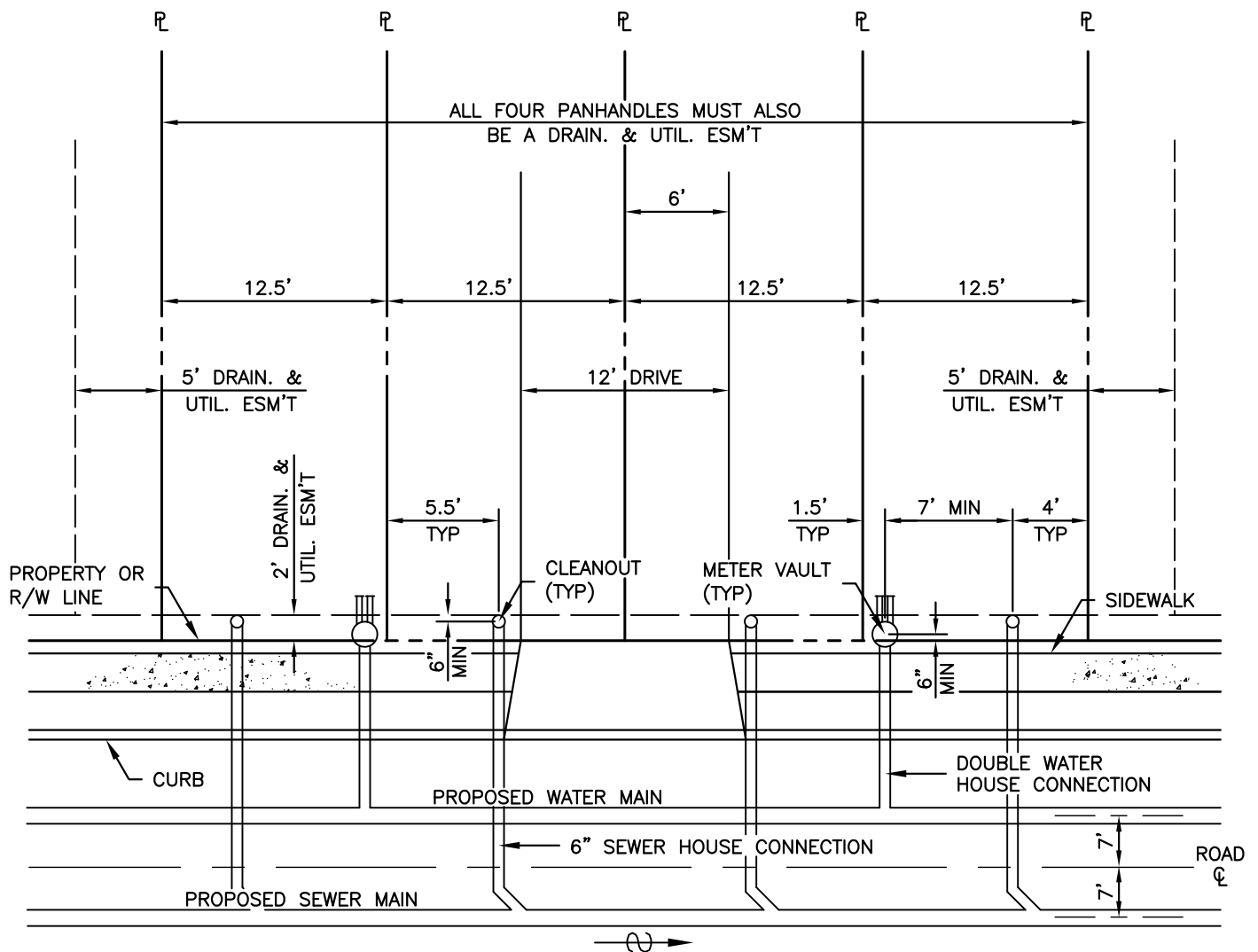
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STANDARD GENERAL DETAILS

WATER AND SEWER SERVICES
FOR THREE PANHANDLE LOTS

ISSUED
01/01/26

PLATE
G-7



NOTES:

1. METER VAULTS AND CLEANOUTS SHALL NOT BE LOCATED IN DRIVEWAYS, SIDEWALKS OR STEPS.
2. MINIMUM SEPARATION BETWEEN WATER AND SEWER SERVICES IS SEVEN (7) FEET.



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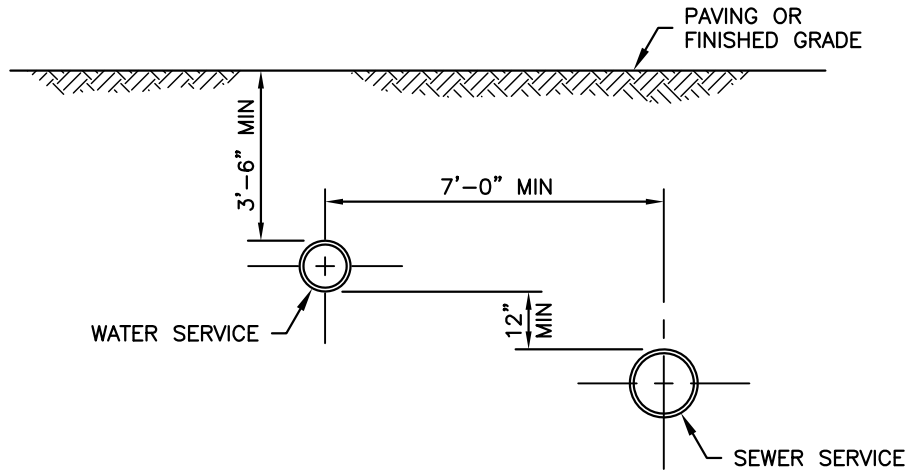
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STANDARD GENERAL DETAILS

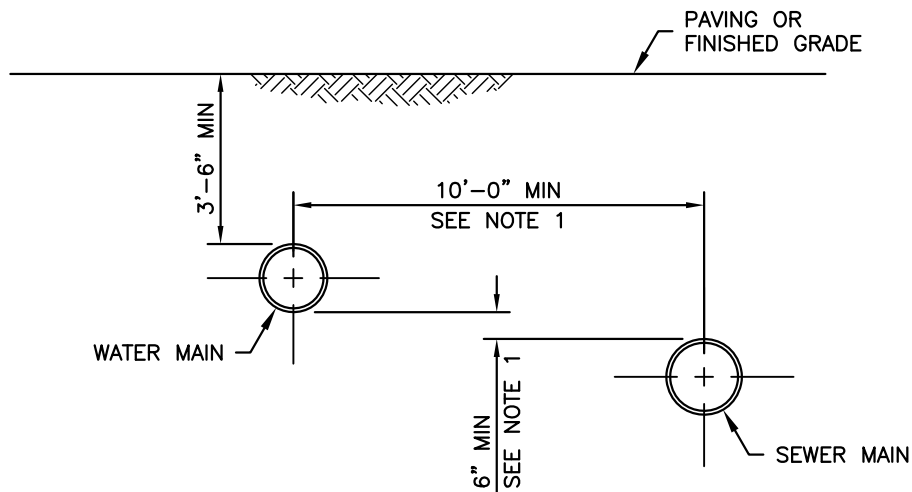
WATER AND SEWER SERVICES
FOR FOUR PANHANDLE LOTS

ISSUED
01/01/26

PLATE
G-8



WATER & SEWER HOUSE SERVICES



WATER & SEWER MAINS

NOTES: (PERTAINS TO BOTH DETAILS UNLESS NOTED OTHERWISE)

1. WHERE WATER AND SEWER MAINS HAVE A HORIZONTAL SEPARATION LESS THAN 10'-0", THE WATER MAIN SHALL BE 6'-0" MIN ABOVE THE SEWER.
2. WHERE WATER CROSSES ABOVE SEWER, A MINIMUM CLEARANCE OF 1'-0" IS REQUIRED. IF CLEARANCE IS LESS THAN 1'-0", ONE FULL LENGTH OF WATER PIPE SHALL BE INSTALLED OVER SEWER MAIN SO THAT THE JOINTS ARE EQUIDISTANT FROM THE CROSSING.
3. WHERE SEWER CROSSES ABOVE WATER, SEWER PIPE MATERIAL SHALL BE CHANGED TO AWWA C900 BETWEEN THE ASSOCIATED MANHOLES AND INSTALLED SO THAT ONE FULL LENGTH OF PIPE IS CENTERED OVER THE WATER MAIN.



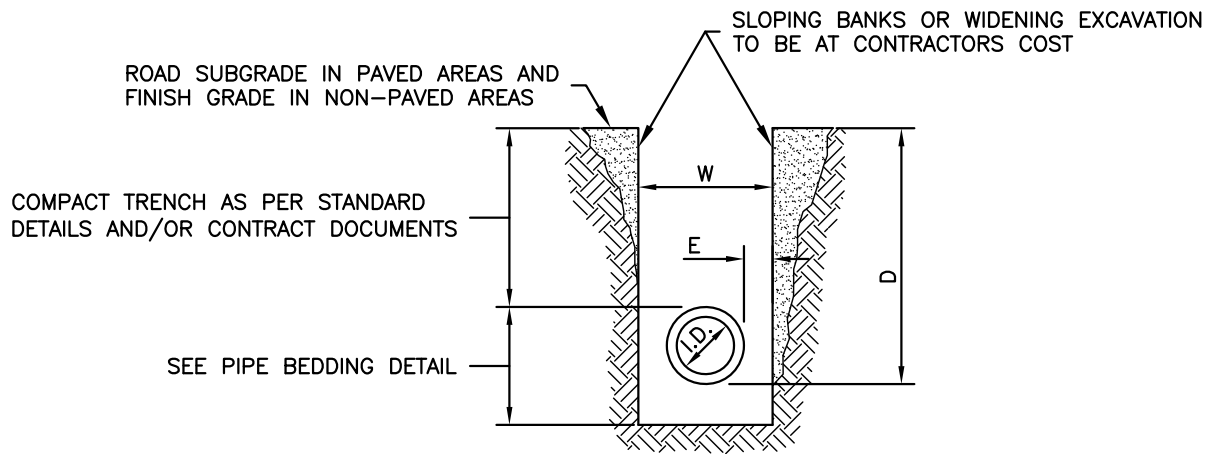
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STANDARD GENERAL DETAILS

CLEARANCES FOR WATER
AND SEWER SERVICE
CONNECTIONS AND MAINS

ISSUED
01/01/26

PLATE
G-9



STANDARD TRENCH

PIPE I.D. (IN.)	W (IN.) 0' < D ≤ 5'	W (IN.) 5' < D ≤ 15'	W (IN.) 15' < D
6	36	60	66
8	36	60	66
10	36	60	66
12	36	60	66
15	37	61	67
16	38	62	68

PIPE I.D. (IN.)	W (IN.) 0' < D ≤ 5'	W (IN.) 5' < D ≤ 15'	W (IN.) 15' < D
18	40	64	70
20	42	66	72
24	46	70	76
27	56	80	86
30	59	83	89
36	66	90	96

NOTES:

- W = PAYMENT WIDTH FOR CONTINGENT ITEMS IN NORMAL TRENCHES.
- THE ABOVE CHART PERTAINS TO CAST IRON, DUCTILE IRON AND PVC PIPE. FOR OTHER PIPE MATERIALS THE MAXIMUM TRENCH WIDTH (W) FOR TRENCH DEPTHS UP TO 5'-0" WILL BE O.D. OF BELL + 2E (36" MIN)
 - FOR 6" TO 24" PIPE, E = 9"
 - FOR 27" TO 36" PIPE, E = 12"
 - FOR 42" TO 72" PIPE, E = 15"

ADD 24" TO THE ABOVE CALCULATED 'W' FOR TRENCH DEPTHS GREATER THAN 5'-0" AND LESS THAN 15'-0".
ADD 30" TO THE ABOVE CALCULATED 'W' FOR TRENCH DEPTHS GREATER THAN 15'-0".
- TRENCHES TO BE SHEETED OR BRACED AS REQUIRED TO MEET ALL GOVERNING SAFETY CODES. ALL ASSOCIATED COST WILL BE BORNE BY THE CONTRACTOR.
- ROADWAY PATCH/REPAIR SHALL BE MADE TO THE LIMITS NOTED IN THE HIGHWAY PERMIT, STANDARD DETAILS OR CONTRACT DOCUMENTS AS DIRECTED BY THE COUNTY. THE TRENCH WIDTHS ABOVE SHALL BE USED FOR PAVEMENT PAYMENT PURPOSES.



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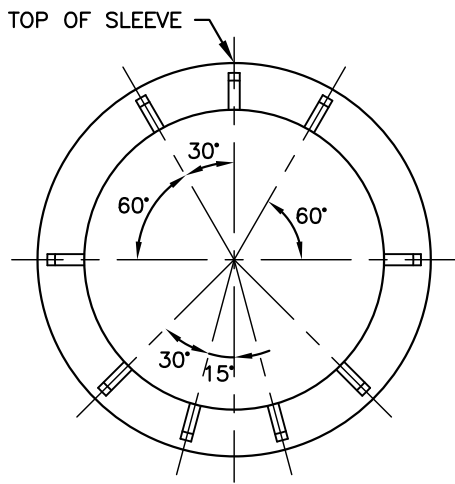
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STANDARD GENERAL DETAILS

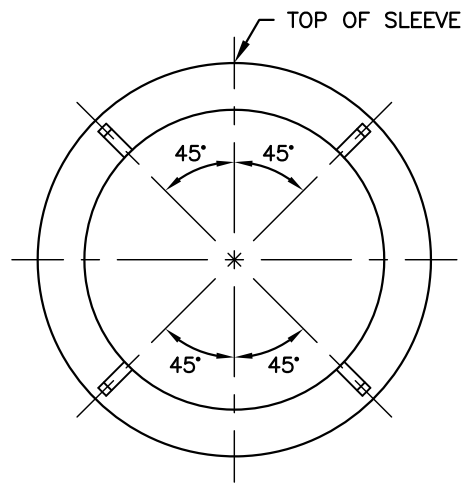
TRENCH PAYMENT WIDTHS

ISSUED
01/01/26

PLATE
G-10

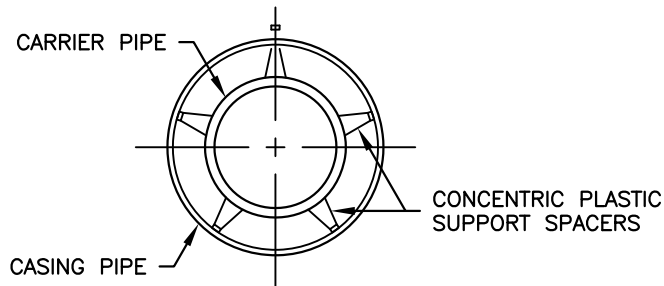


SPACER LOCATION
FOR 16" THRU 36" DIA.
CARRIER PIPE

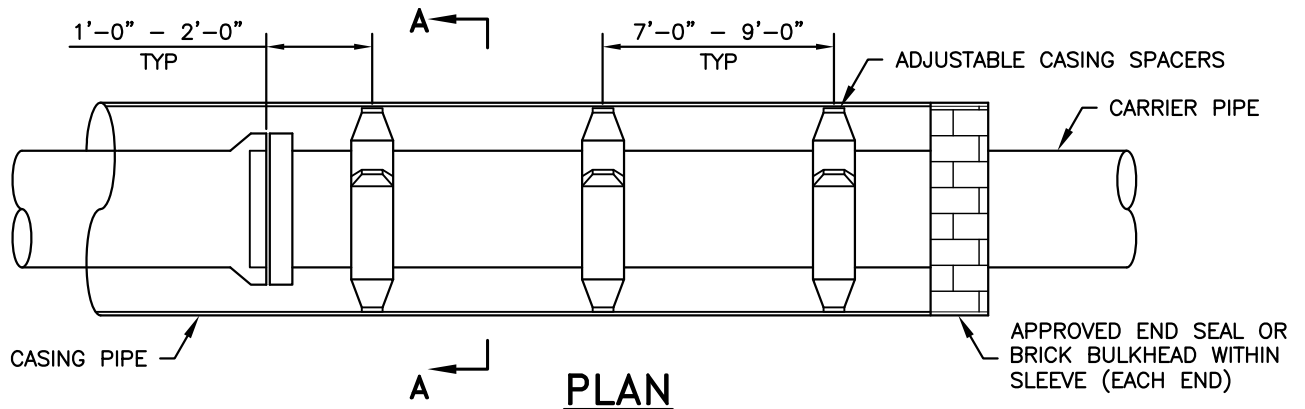


SPACER LOCATION
FOR 12" DIA. &
LESS CARRIER PIPE

PIPE SIZE	CASING PIPE SIZE (MIN.)
6"	18"
8"	20"
10"	22"
12"	24"
14"	26"
16"	30"
18"	30"
20"	32"
24"	36"
30"	48"



SECTION A-A



NOTES:

1. ALL CARRIER PIPES SHALL BE RESTRAINED JOINT DUCTILE IRON PIPE (CLASS 52 MIN.).
2. CASING SIZE MAY BE INCREASED WITH PRIOR WRITTEN APPROVAL FROM THE DIVISION OF WATER AND SEWER.
3. FOR GRAVITY SEWER, CASING PIPE SHALL BE FILLED COMPLETELY WITH A UNIFORM MIXTURE OF 1:3 GROUT.
4. THE EXTERIOR OF THE CASING PIPE SHALL HAVE A FACTORY APPLIED BITUMINOUS COATING. THE FIELD CONNECTION SHALL ALSO BE BITUMINOUS COATED BEFORE INSTALLATION. BITUMINOUS COATING SHALL MEET THE REQUIREMENTS OF AWWA C210.



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[Signature]

STANDARD GENERAL DETAILS

JACKING OR BORING

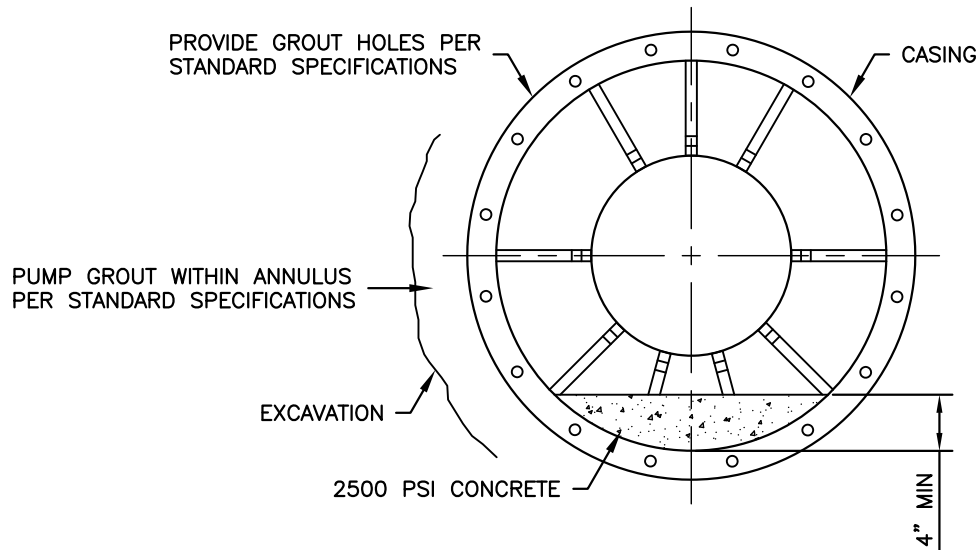
ISSUED
01/01/26

PLATE
G-11

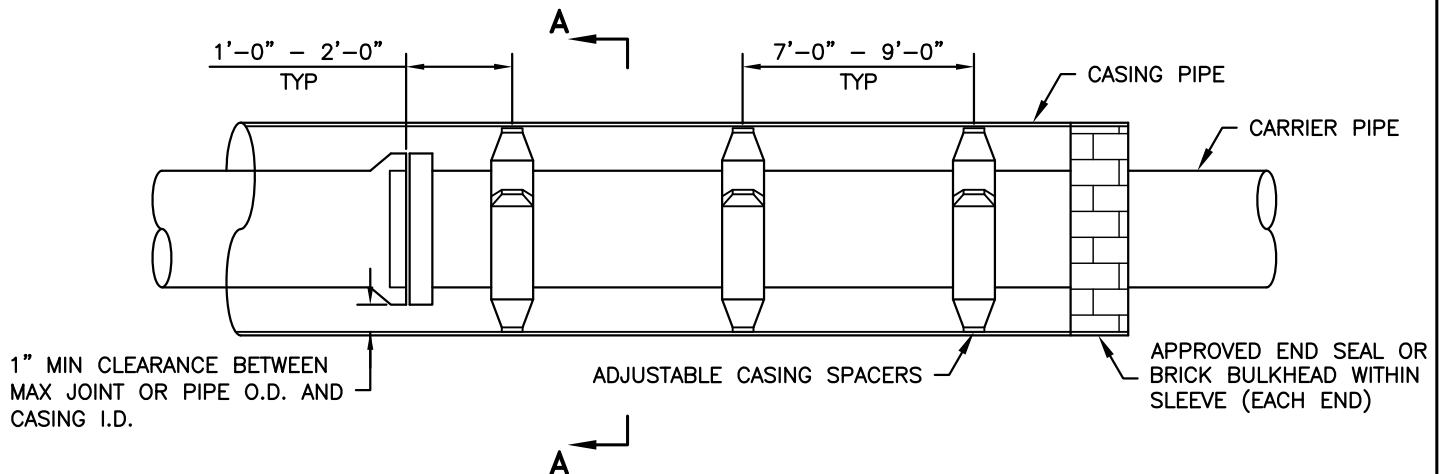
NOTES:

1. SEE STANDARD DETAIL G-9 FOR LOCATIONS OF CONCENTRIC SPACERS.
2. GROUT HOLES STAGGERED - MAXIMUM SPACING 3'-6" O.C.
3. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS SHOWING SPECIFIC MATERIALS AND METHODS.

PIPE I.D. INCHES	CASING MIN. O.D. INCHES
8-12	48
14-16	48
20	48
24	54
30	60
36	66



SECTION A-A



PLAN



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STANDARD GENERAL DETAILS

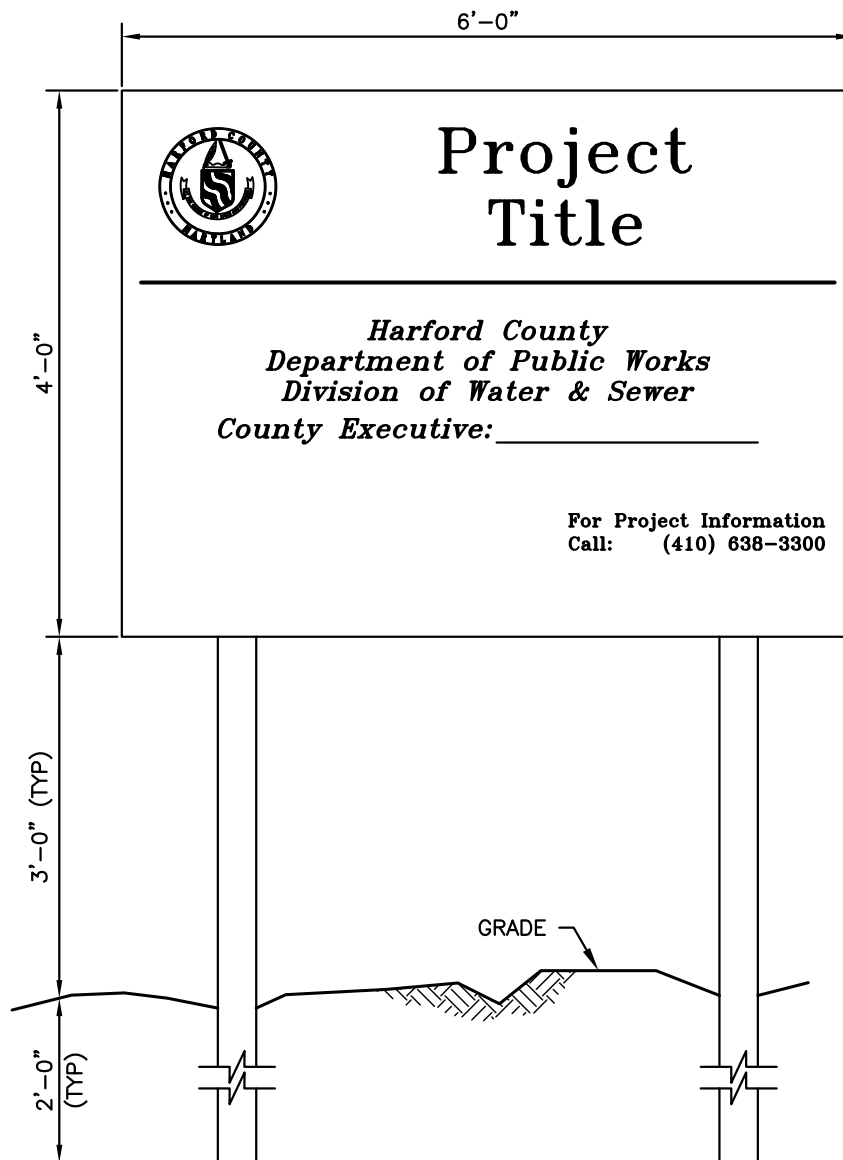
TUNNELING

ISSUED
01/01/26

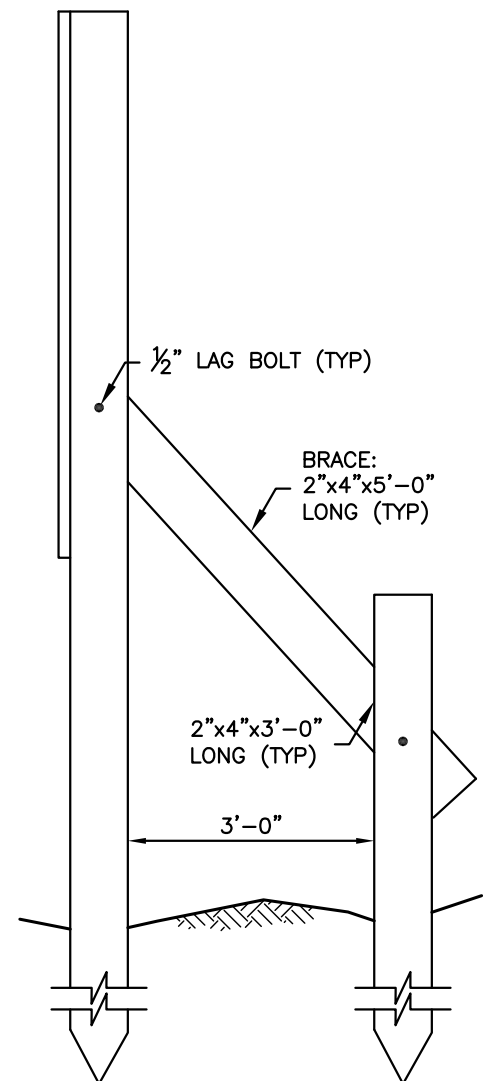
PLATE
G-12

NOTES:

1. A 1 FOOT DIAMETER HARFORD COUNTY SEAL DECAL WILL BE PROVIDED BY THE COUNTY.
2. SIGN SHALL BE 4'x6' ON $\frac{1}{2}$ " EXTERIOR GRADE PLYWOOD AND SUPPORTED BY 2"x4" PRESSURE TREATED POSTS.
3. PROVIDE ROYAL BLUE LETTERING ON A NON-REFLECTIVE WHITE BACKGROUND. THE LETTERING AND LAYOUT SHALL BE COMPUTER GENERATED.
4. LETTERING SHALL BE PROPORTIONAL IN SIZE AND OF THE SAME OR SIMILAR STYLES TO THAT SHOWN.
5. SIGN SHALL BE ERECTED LEVEL AND MAINTAINED DURING THE CONSTRUCTION PERIOD. SIGN SHALL BE REMOVED IN GOOD CONDITION.



FRONT VIEW



SIDE VIEW



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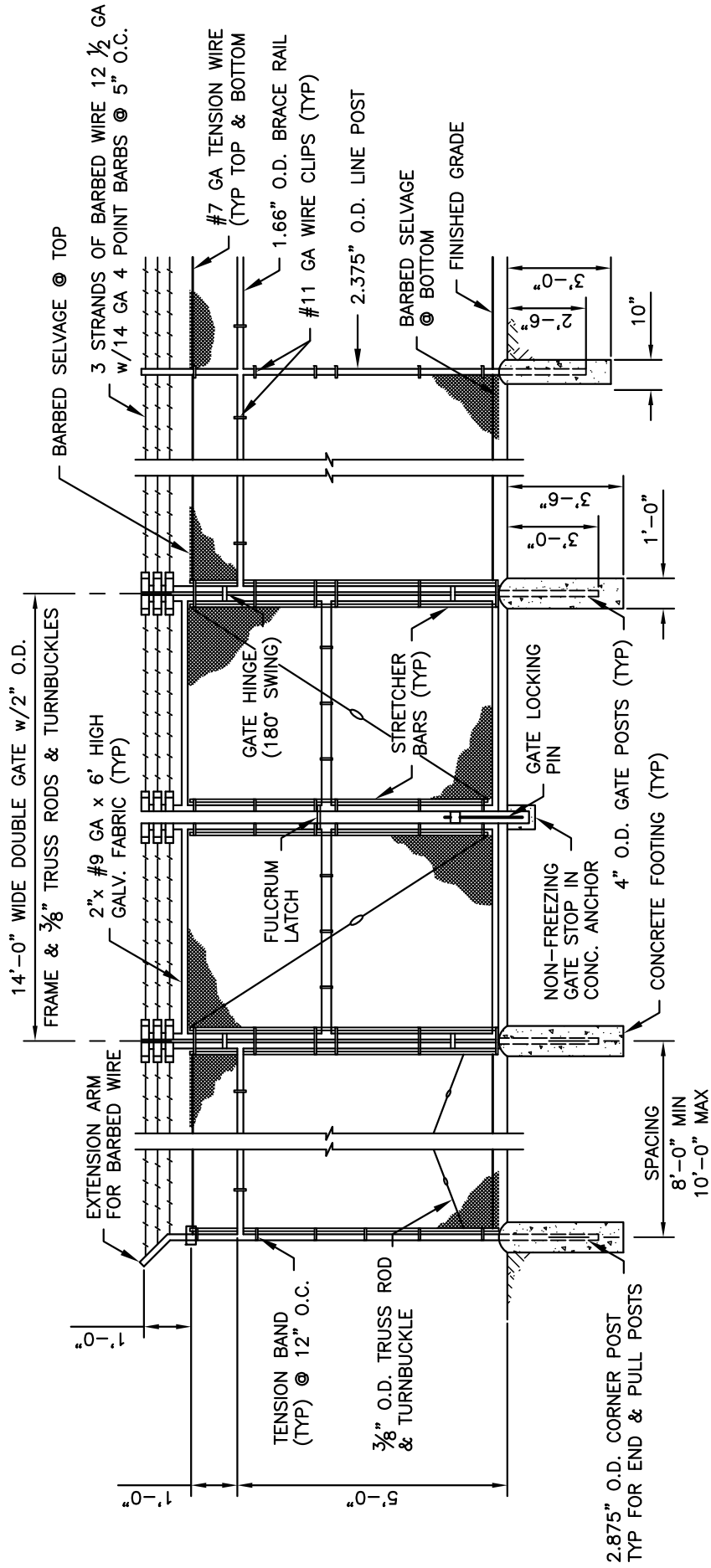
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STANDARD GENERAL DETAILS

PROJECT SIGN

ISSUED
01/01/26

PLATE
G-13



NOTES:

1. TERMINAL OR PULL POSTS SHALL BE INSTALLED AT SHARP BREAKS IN VERTICAL ALIGNMENT & HAVE 3/8" O.D. TRUSS ROD AND TURNBUCKLE BRACING.
2. GATE SHALL OPEN INWARD.
3. SEE TECHNICAL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.



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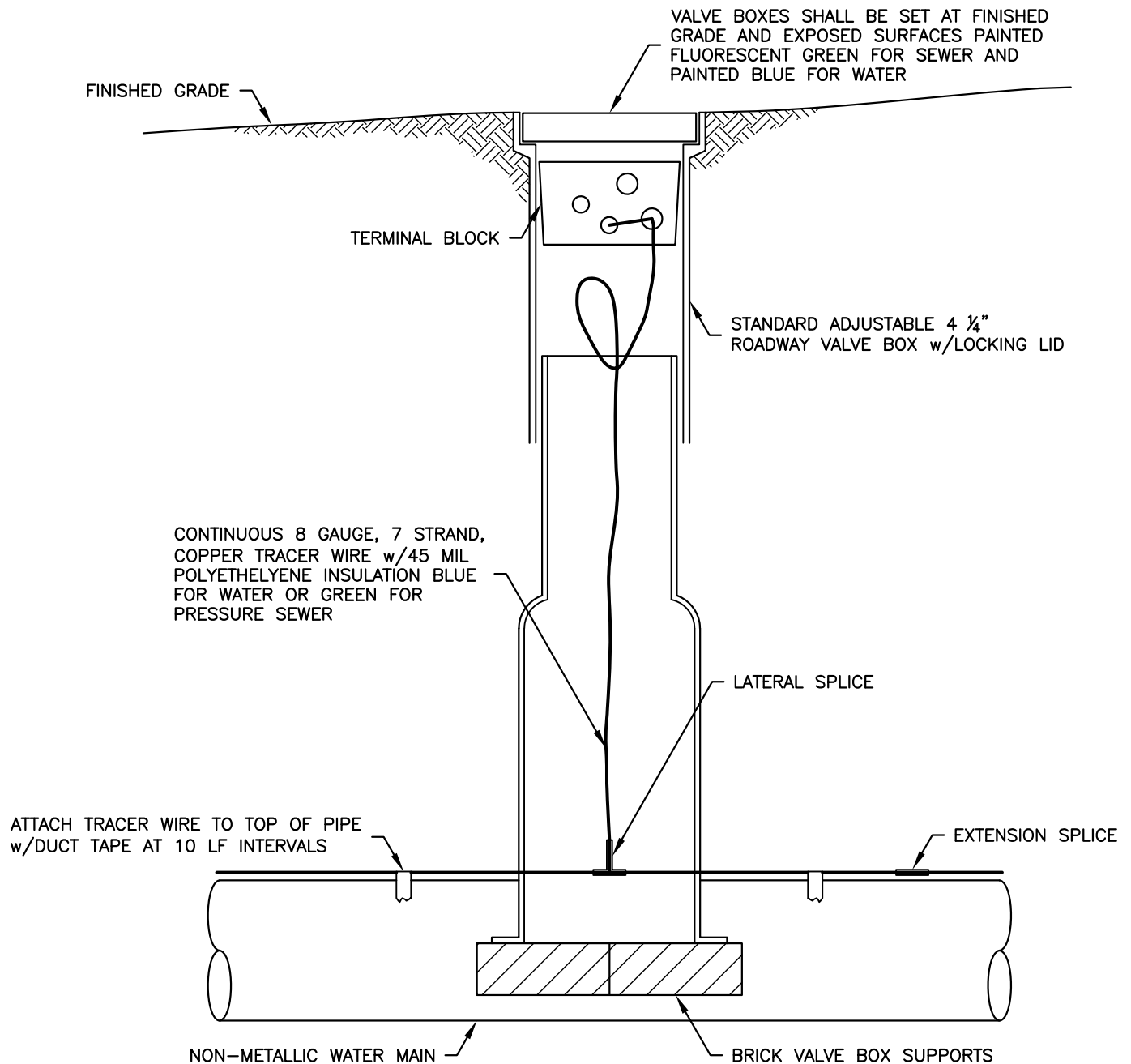
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STANDARD GENERAL DETAILS

SECURITY FENCE

ISSUED
01/01/26

PLATE
G-14



NOTES:

1. TRACER WIRE SHALL EXTEND 12 INCHES ABOVE THE TOP OF THE ROADWAY BOX. AFTER THE TOP OF THE ROADWAY BOX IS ADJUSTED FLUSH WITH FINAL GRADE, STRIP THE INSULATION FROM THE LAST 3/8" OF TRACER WIRE AND SECURE TO TERMINAL BLOCK.
2. LATERAL SPLICING SHALL BE MADE USING A BRASS COMPRESSION NUT, WATERPROOF BINDER AND UNDERGROUND ELECTRICAL TAPE. EXTENSION SPLICING SHALL BE MADE USING A CRIMP CONNECTOR AND SHRINK TUBING.



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STANDARD GENERAL DETAILS

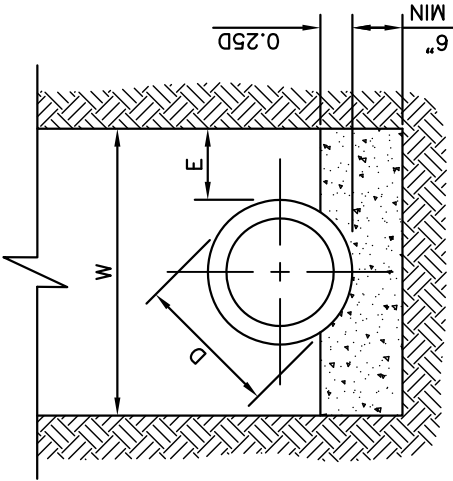
CONTINUITY TEST STATION

ISSUED
01/01/26

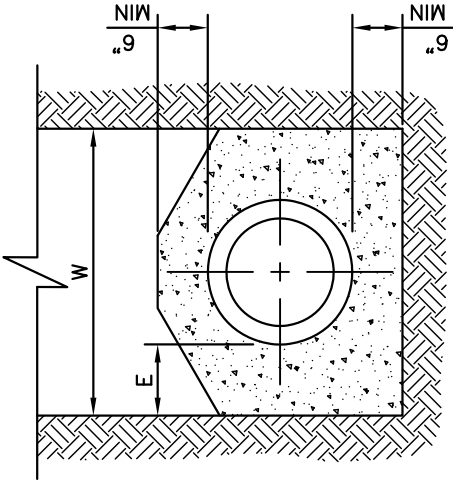
PLATE
G-15

LEGEND

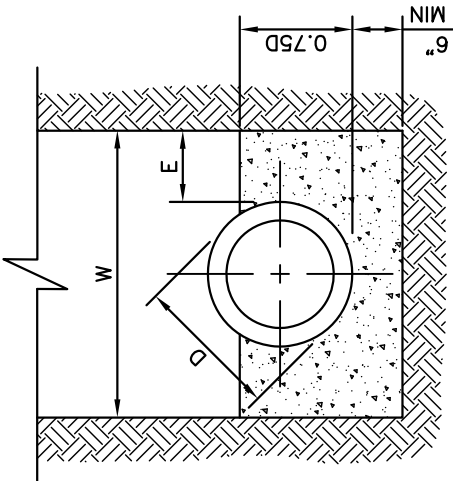
- W = O.D. + 2 E
- E = 9" FOR 6" TO 24" PIPES
- E = 12" FOR 27" TO 36" PIPES
- E = 15" FOR 42" TO 72" PIPES



CONCRETE LOW CRADLE



CONCRETE ENCASUREMENT



CONCRETE HIGH CRADLE



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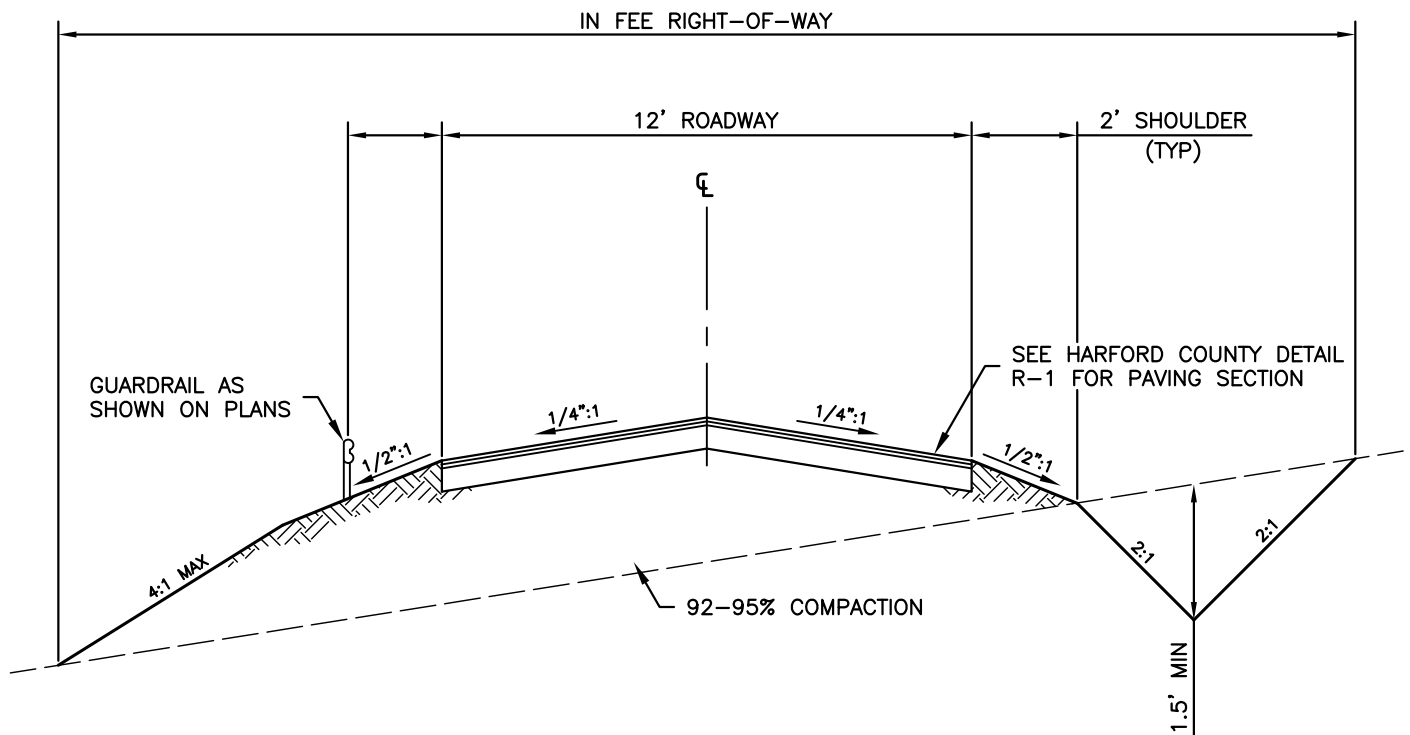
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STANDARD GENERAL DETAILS

CONCRETE ENCASUREMENT AND CRADLES

ISSUED
01/01/26

PLATE
G-16



NOTES:

1. CROSS-SLOPE DRIVES ARE ACCEPTABLE.
2. IF GUARDRAILS ARE REQUIRED AS SHOWN ON THE CONSTRUCTION DRAWINGS, GUARDRAIL MATERIALS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE MARYLAND STATE HIGHWAY ADMINISTRATION STANDARD SPECIFICATIONS.



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STANDARD GENERAL DETAILS

ACCESS DRIVE

ISSUED
01/01/26

PLATE
G-17

16'-0"

3/8" - 16 DROP FORGED THREADED
STAINLESS STEEL EYE BOLT w/SHOULDER.
SECURE w/STAINLESS STEEL NUT AND
LOCK WASHER IN PIPE (TYP 2)

SECURE CABLE TO ONE EYE BOLT
w/OPEN LINK. COUNTY TO PROVIDE
MASTER LOCK FOR ONE END

3/8" STAINLESS STEEL PLASTIC
COATED CABLE w/STAINLESS
STEEL THIMBLE SETS

4" DIA PIPE @ 11#/LF MIN. FILL PIPE
w/CONCRETE (TYP 2). COVER w/YELLOW PLASTIC
SLEEVE & PLASTIC TOP CAP

NO
TRESPASSING

12"x24" REFLECTIVE SIGN

4'-0"

2'-0"
TYP

FINISHED GRADE

12' ACCESS DRIVE

3'-6"

4'-0"

CONCRETE FOOTING,
3000 P.S.I. MIN (TYP 2)

1'-6"

ELEVATION



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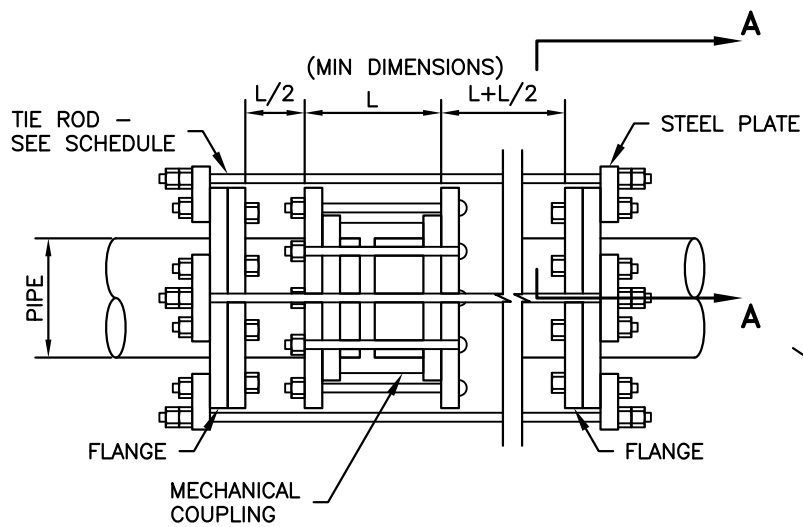
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STANDARD GENERAL DETAILS

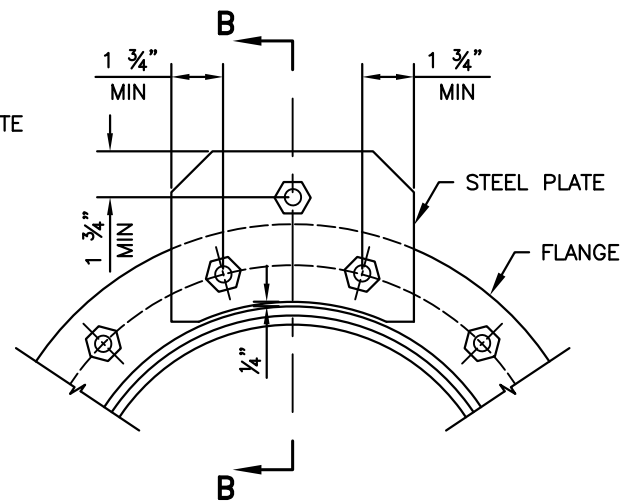
ACCESS DRIVE BARRIER

ISSUED
01/01/26

PLATE
G-18

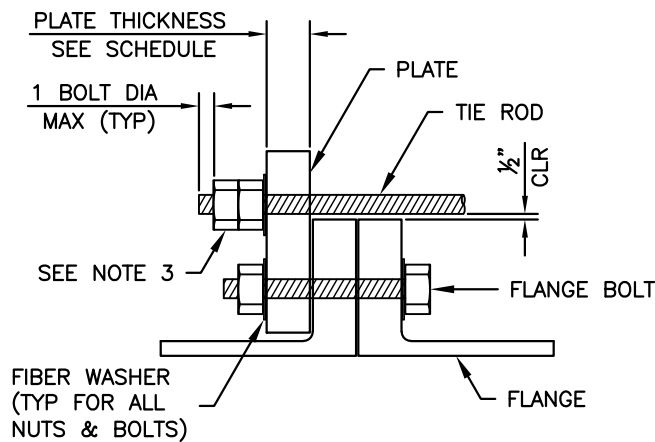


PLAN



SECTION A-A

STRAPPING HARNESS DETAIL



SECTION B-B

PIPE DIAM.	No. OF RODS	DIAM. OF RODS	PLATE THICKNESS

NOTES:

1. TIE RODS SHALL BE STAINLESS STEEL.
2. STEEL PLATE SHALL CONFORM TO ASTM A-36 SPECIFICATIONS.
3. INSIDE NUT TO BE HAND TIGHT, AND TWO NUTS SHALL BE TIGHTENED AGAINST EACH OTHER.
4. STRAPPING DESIGN SHALL INCLUDE SURGE PRESSURE ADDED TO OPERATION PRESSURE IN P.S.I.
5. FIBER WASHERS SHALL BE INSTALLED BETWEEN FLANGES/STEEL PLATES AND NUTS/BOLT HEADS.
6. WHEN STRAPPING ASSEMBLY IS LOCATED NEAR THE FLANGED VALVE, PROVIDE A FLANGED SPOOL PIECE (1' MINIMUM LENGTH) BETWEEN THE VALVE AND ASSEMBLY IN ORDER TO AVOID STRAPPING DIRECTLY TO THE VALVE.
7. DESIGN ENGINEER SHALL COMPLETE TABLE AS PART OF DESIGN.
8. ALL PIPE AND APPURTENANCES SHALL RECEIVE COATINGS IN ACCORDANCE WITH THE SPECIFICATIONS.



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STANDARD GENERAL DETAILS

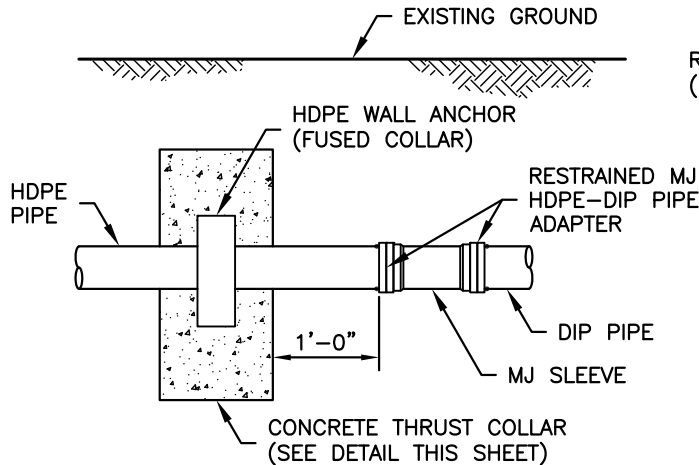
**METHOD OF STRAPPING
FLEXIBLE COUPLINGS IN
VAULTS AND FACILITIES**

ISSUED
01/01/26

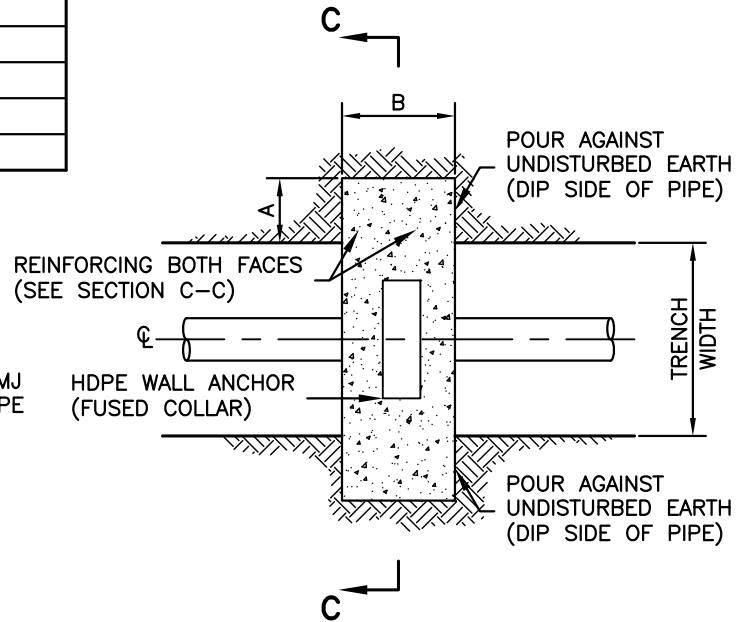
**PLATE
G-19**

BUTTRESS DIMENSIONS (SEE NOTE 3)					
DIMENSIONS	PIPE SIZE (INCHES)				
	4	6	8	12	16
A					
B					
C					
D					
RE-BAR SIZE					

* THIS BLANK TABLE IS TO BE COMPLETED BY THE ENGINEER FOR INCLUSION IN THE CONTRACT DOCUMENTS.

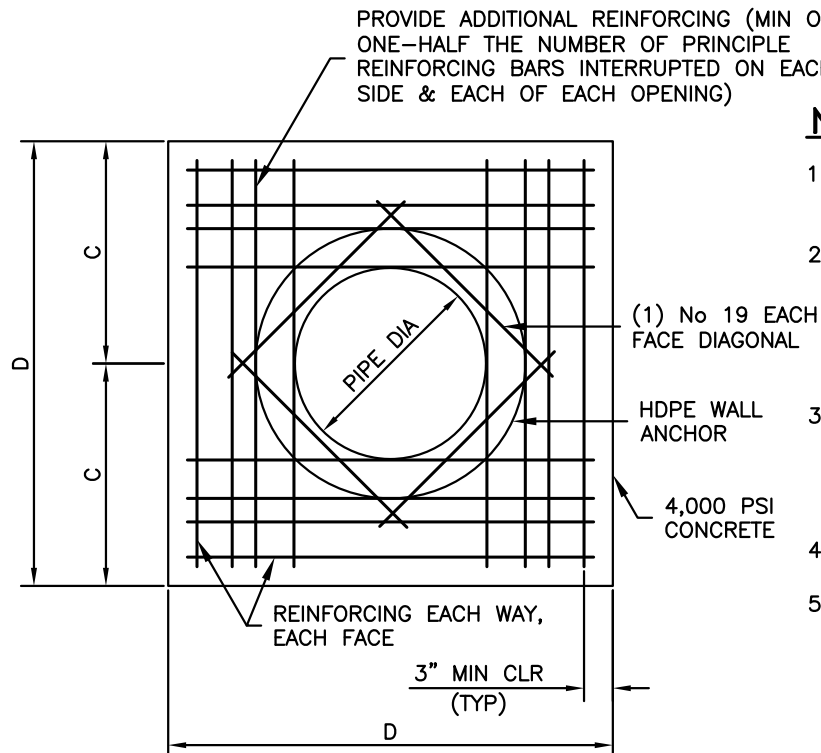


CONNECTION



PLAN

CONCRETE THRUST COLLAR



SECTION C-C

CONCRETE THRUST COLLAR

NOTES:

1. PROVIDE 3" MINIMUM CONCRETE COVER OVER ALL REINFORCEMENT.
2. ADEQUATE CURING TIME OR USE OF HIGH EARLY CONCRETE TO OBTAIN THE REQUIRED 4,000 PSI STRENGTH SHALL BE PROVIDED FOR ALL THRUST COLLARS PRIOR TO TESTING FORCE MAIN.
3. ALL CONCRETE THRUST COLLARS MUST BE DESIGNED FOR THE SITE SPECIFIC SOILS, GROUNDWATER AND SYSTEMS PRESSURE CONDITIONS.
4. ALL HARDWARE SHALL BE STAINLESS STEEL.
5. FOR DIRECTIONAL DRILLING, A MINIMUM OF 48 HOURS TIME SHALL BE PROVIDED AFTER DRILL IS COMPLETE PRIOR TO CONSTRUCTING AND INSTALLING THE THRUST COLLARS, TO ALLOW HDPE PIPE TO ADJUST TO GROUND TEMPERATURE.
6. DESIGN ENGINEER SHALL COMPLETE TABLE AS PART OF THE DESIGN.



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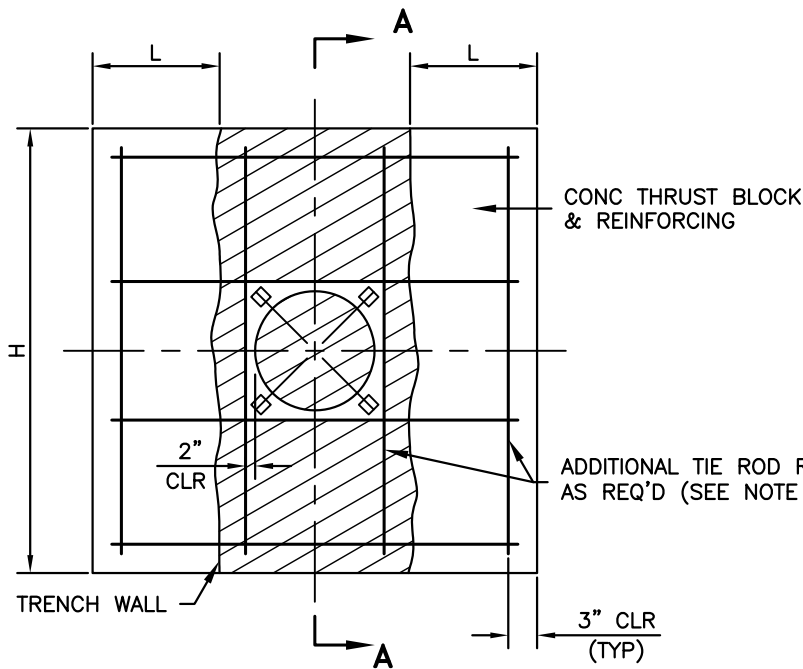
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STANDARD GENERAL DETAILS

DIP TO HDPE
TRANSITION CONNECTION

ISSUED
01/01/26

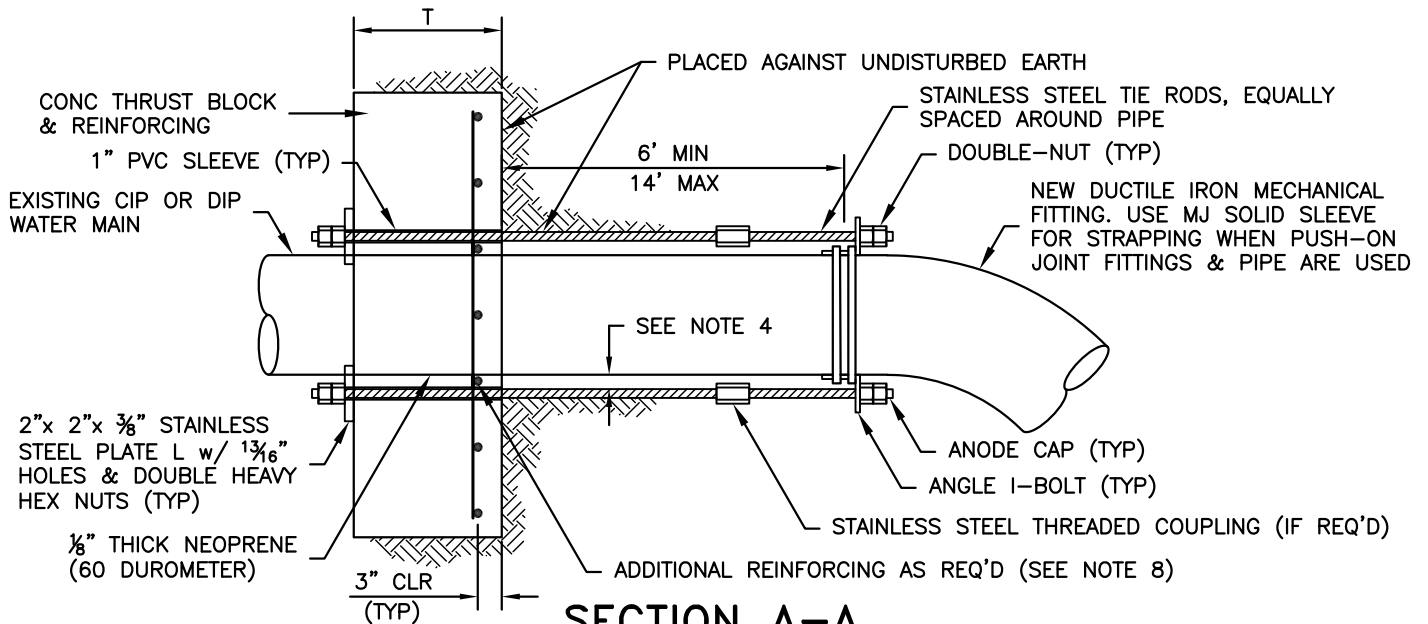
PLATE
G-20



DIMENSIONS (INCHES)	
L	
H	
T	
No. OF TIE RODS	
TIE RODS DIA.	
TIE ROD SPACING	

THE DESIGN ENGINEER SHALL COMPLETE THE ABOVE INFORMATION AS PART OF THE DESIGN.

ELEVATION



SECTION A-A

NOTES:

1. ALL CONCRETE SHALL BE 4,000 PSI. PIPELINE SHALL NOT BE PRESSURIZED UNTIL CONCRETE STRENGTH REACHES 4,000 PSI AS CONFIRMED BY THE TESTING OF CONCRETE CYLINDER.
2. ALL REBAR SHALL BE ASTM A615 GRADE 60.
3. STEEL PLATES SHALL BE STAINLESS STEEL.
4. MAINTAIN 2" MINIMUM CLEAR BETWEEN ALL REBAR AND PIPE.
5. BOLT CIRCLE FOR 3/4" TIE RODS AT THRUST COLLAR SHALL EQUAL BOLT CIRCLE AT TIE BOLTS.
6. ALL TIE RODS SHALL BE PARALLEL TO AXIS OF PIPE.
7. ALL THRUST BLOCKS SHALL BE DESIGNED BASED ON ACTUAL SOIL, GROUNDWATER, AND PIPE DEPTH CONDITIONS.
8. (4) TIE RODS SHOWN ON ELEVATION VIEW ARE FOR CLARITY ONLY (DESIGN IS REQUIRED).
9. MAXIMUM CLEARANCE BETWEEN EDGE OF PIPE AND TRENCH WALL SHALL BE 15".
10. PROVIDE EQUAL TORQUE TO NUTS AND ALL TIE RODS.
11. DESIGN ENGINEER SHALL COMPLETE TABLE AS PART OF THE DESIGN.



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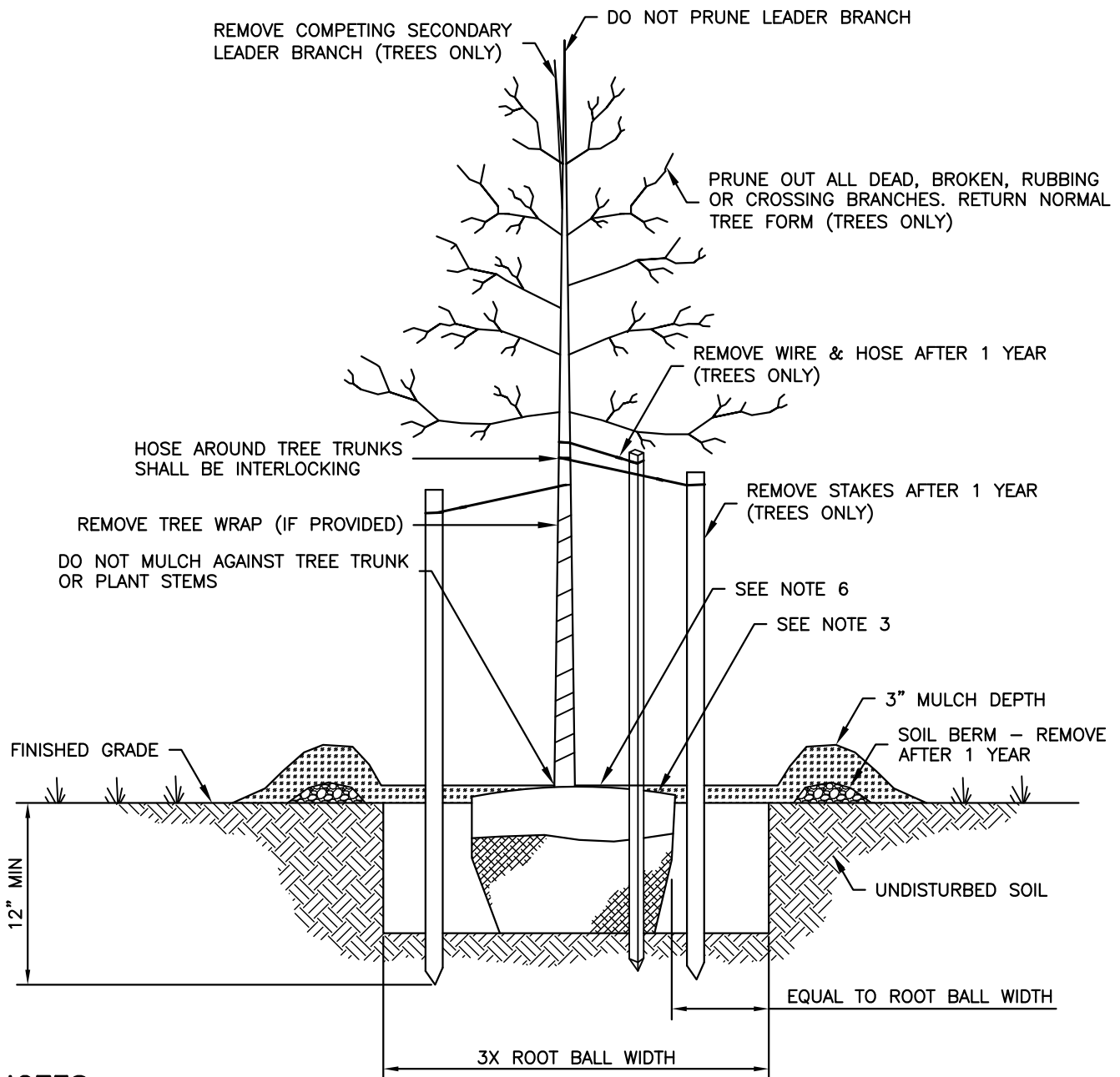
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STANDARD GENERAL DETAILS

METHOD OF CONNECTING DIP TO
EXISTING WATER MAIN
REQUIRING A SHUTDOWN

ISSUED
01/01/26

PLATE
G-21



NOTES:

1. FOR PICTORIAL PURPOSES THE DETAIL SHOWN ABOVE DEPICTS A TREE PLANTING. HOWEVER, THE NOTES SHOWN BELOW AND ON THE DETAIL, REFERENCE SPECIFIC DIFFERENCES WITH SHRUB PLANTING.
2. FLOOD PLANTS TWICE DURING THE FIRST 24 HOURS AFTER PLANTING.
3. TOP OF ROOT BALLS OF TREES SHALL BE FLUSH WITH FINISHED GRADE. TOP OF ROOT BALLS OF SHRUBS SHALL EXTEND $\frac{1}{8}$ OF THE ROOT BALL HEIGHT ABOVE FINISHED GRADE.
4. MULCH SHALL NOT BE PLACED DIRECTLY AGAINST TREE TRUNKS OR PLANT STEMS.
5. SOIL BERMS AND SUPPORT SYSTEMS SHALL BE FULLY REMOVED ONE YEAR FROM THE PLANTING DATE.
6. PLANTS IN POTTED CONTAINERS SHALL BE REMOVED FROM THE POTS. BALLED AND BURLAPPED PLANTS SHALL HAVE THE WIRE OR STRING CUT AND BURLAP FOLDED DOWN OR CUTOFF TO HALF THE HEIGHT OF THE ROOT BALL.
7. TREES OR SHRUBS SHALL NOT BE PLANTED WITHIN 15 FEET OF WATER OR SEWER UTILITIES IN RIGHTS-OF-WAY OR DRAINAGE AND UTILITY EASEMENTS.



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STANDARD GENERAL DETAILS

TREE AND SHRUB
PLANTING DETAIL

ISSUED
01/01/26

PLATE
G-22

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STANDARD WATER DETAILS

ISSUED 1/1/2026

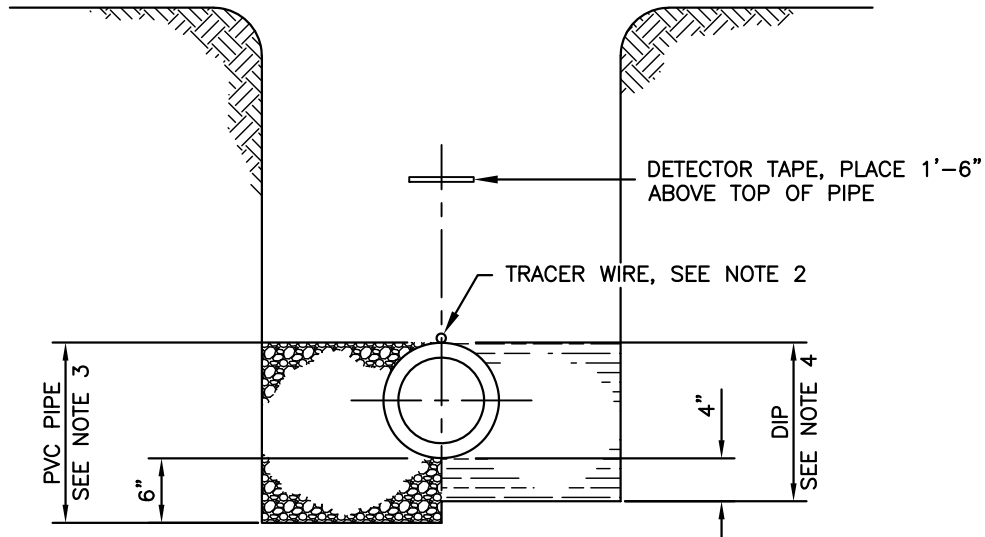
W1	Pipe Bedding
W2	Continuity Test Station at Fire Hydrant
W3	Typical Fire Hydrant Settings
W4	Restraining Fire Hydrant and Valve to Main
W5	Fire Hydrant Well
W6	Buttress for Tees
W7	Buttress for Horizontal 1/4 Bends
W8	Buttress and Anchorages for Vertical Bends
W9	Water Main Valve w/Roadway Box
W10	Buttress for Caps and Horizontal Bends
W11	Anchorages for Valves with PVC Pipe
W12	Water Main Valve Key Extension
W13	Cap and Blow-Off for 4" Mains and Larger
W14	Standard Water Meter Frame and Cover
W15	Standard Frames and Covers
W16	Standard Service Connection with Curb Box
W17	Standard Service Connection with Meter Vault
W18	Outside Setting 3/4" Supply with 5/8" Meter (Domestic Service without Sprinkler Service)
W19	Outside Setting 1" Supply with 3/4" Meter (Domestic Service with Sprinkler Service)
W20	Outside Setting 1-1/2" Supply with Twin 3/4" Meter for Townhomes (Domestic Service with Sprinkler Service)
W21	Outside Setting 1-1/2" Supply with 1" Meter
W22	Outside Setting 1-1/2" and 2" Metered Service
W23	Open System Domestic Water Service with Fire Supply
W23a	Open System Domestic Water Service with Fire Supply Notes
W24	Closed System Domestic Water Service with Fire Supply
W24a	Closed System Domestic Water Service with Fire Supply Notes
W25	Standard Installation for 3" thru 10" Combined Fire and Domestic Service
W25a	Standard Installation for 3" thru 10" Combined Fire and Domestic Service Notes
W26	"Conceptual" Reverse Flow Meter

STANDARD WATER DETAILS (CONTINUED)

ISSUED 1/1/2026

W27	Inside Setting Combined Domestic and Sprinkler Service (Single Family and Townhouse Units)
W28	Inside Setting Domestic Service (Single Family without Sprinkler)
W29	Air Release Valve or Combination Air Valve and Vault for 20" Pipe and Smaller
W30	Mechanical Joint Solid Sleeve and Spacer
W31	Transmission Line Dewatering/Blowoff
W32	Water Main Crossing Storm Drain
W33	Water Valve Location in Intersections
W34	5-1/4" Valve Box
W35	4-1/4" Valve Box with Lock Lid
W36	Sewage Pumping Station Water Meter with Backflow Preventer

NOTE: TRENCH TO BE COMPACTED
AS PER SPECIFICATIONS.



SECTION

NOTES:

1. UNLESS NOTED OTHERWISE, ALL ROAD REPAIR SHALL BE DONE IN ACCORDANCE WITH THE LATEST REVISION OF THE HARFORD COUNTY OR MARYLAND STATE ROAD CODE.
2. PROVIDE TRACER WIRE FOR ALL NON-METALLIC WATER MAINS, SEWER FORCE MAINS AND SERVICES, SEE STANDARD DETAILS W-2, W-13 AND G-15.
3. PVC PIPE SHALL BE BACKFILLED WITH AASHTO M43, No. 57 AGGREGATE TO TOP OF PIPE.
4. DUCTILE IRON PIPE SHALL BE BEDDED IN LOOSE SOIL (4" MIN) AND HAVE APPROVED COMPACTED BACKFILL MATERIAL CONSOLIDATED TO TOP OF PIPE.
5. ALL PIPE SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PIPE MANUFACTURER AND COUNTY APPROVAL.
6. PROVIDE CONTINUOUS BEARING FOR FULL LENGTH OF PIPE.



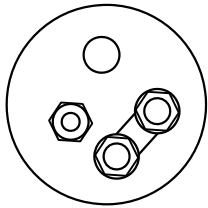
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STANDARD WATER DETAILS

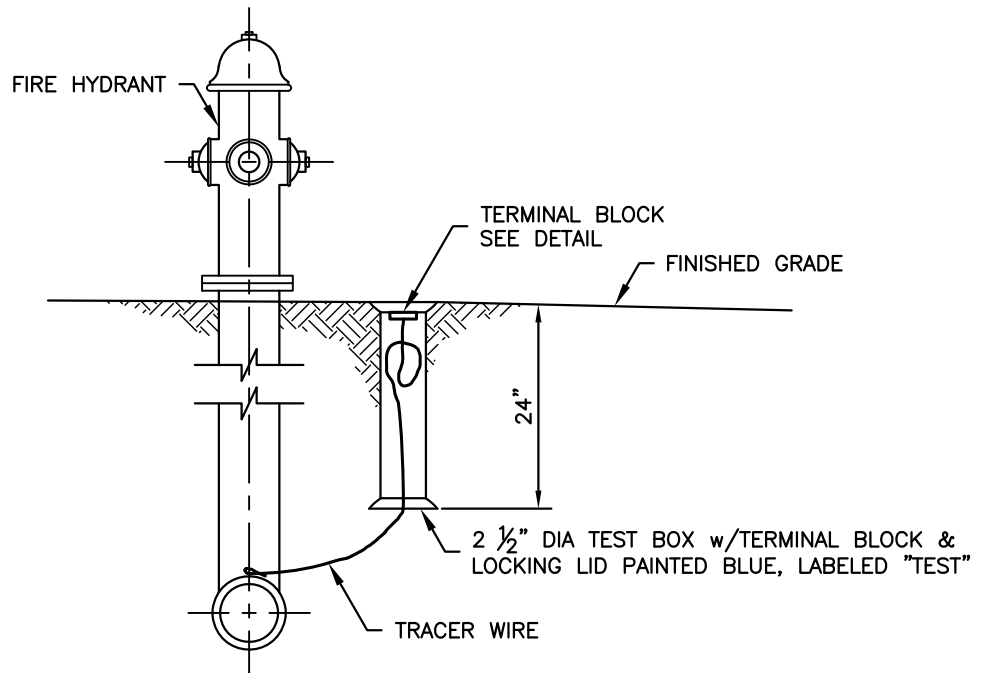
PIPE BEDDING

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01/01/26

PLATE
W-1

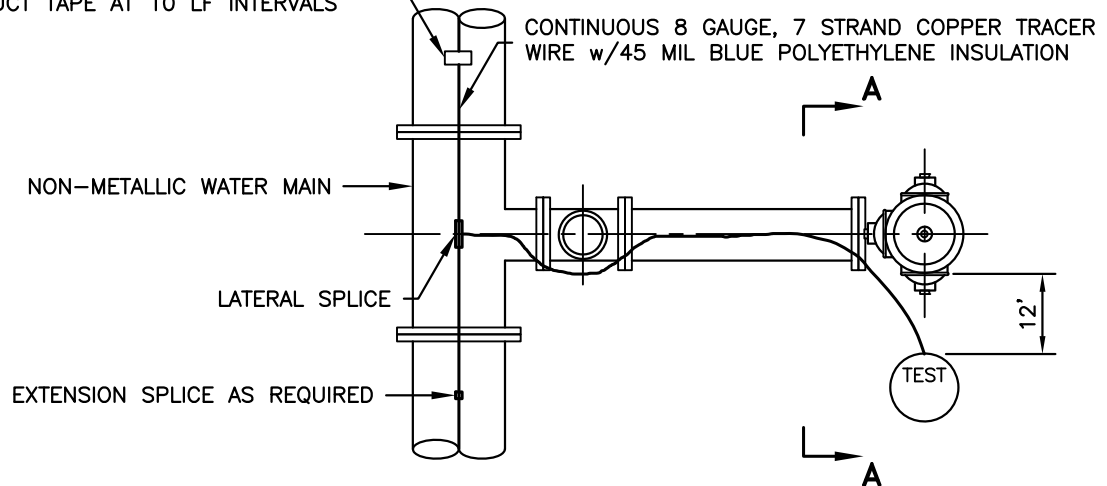


TERMINAL BLOCK



SECTION A-A

ATTACH TRACER WIRE TO TOP OF PIPE
w/DUCT TAPE AT 10 LF INTERVALS



PLAN

NOTES:

1. THE TRACER WIRE SHALL EXTEND 12 INCHES ABOVE THE TOP OF THE TEST BOX. AFTER THE TEST BOX IS ADJUSTED FLUSH WITH FINAL GRADE, STRIP THE INSULATION FROM THE LAST 3/8" OF TRACER WIRE AND SECURE TO TERMINAL BLOCK.
2. LATERAL SPLICING SHALL BE MADE USING A BRASS COMPRESSION NUT, A WATER PROOF BINDER AND UNDERGROUND ELECTRICAL TAPE. EXTENSION SPLICING SHALL BE MADE USING A CRIMP CONNECTOR AND SHRINK TUBING.
3. BUTTRESSES AND JOINT RESTRAINTS NOT SHOWN FOR CLARITY.
4. TEST STATION MUST BE PLACED TO THE RIGHT OR LEFT SIDE OF THE FIRE HYDRANT.



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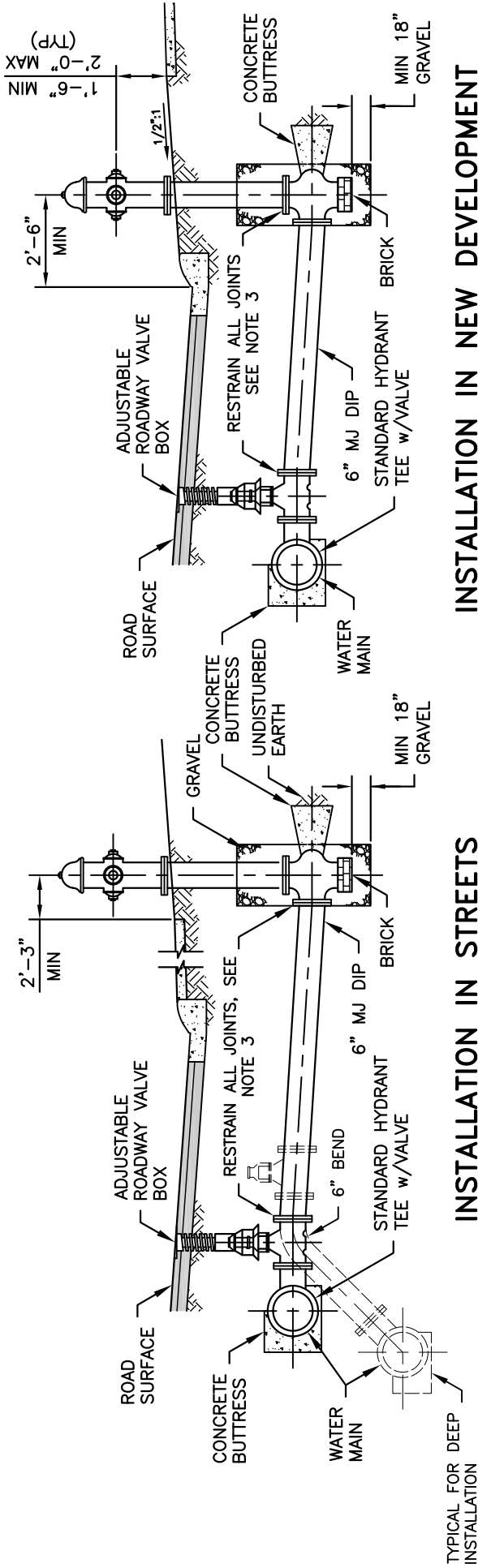
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STANDARD WATER DETAILS

CONTINUITY TEST STATION
AT FIRE HYDRANT

ISSUED
01/01/26

PLATE
W-2



TYPICAL FOR DEEP INSTALLATION

INSTALLATION IN STREETS

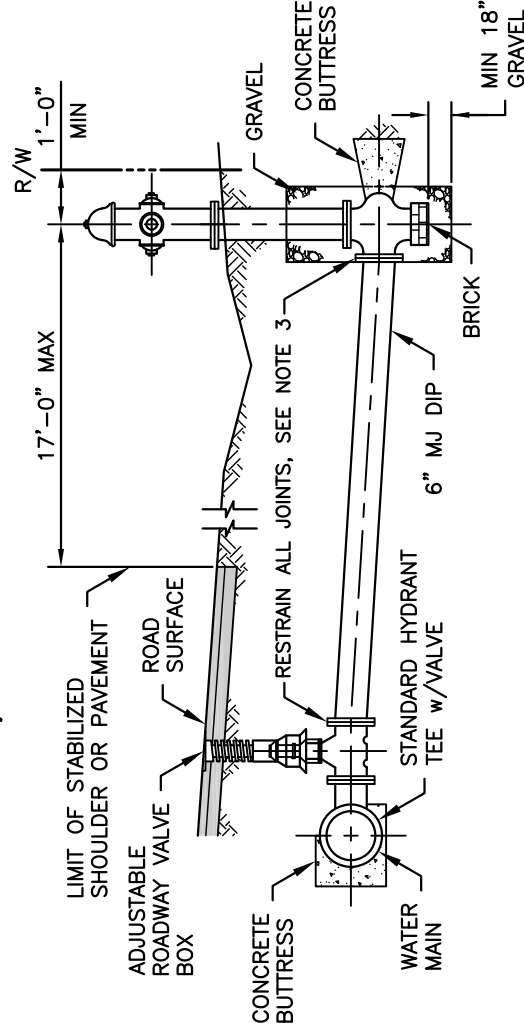
w/SIDEWALK ADJACENT TO CURB

INSTALLATION IN NEW DEVELOPMENT

WITH CURB AND GUTTER

NOTES:

1. FOR PRESSURES ABOVE 200 PSI A SPECIAL DESIGN SHALL BE SUBMITTED AND APPROVED.
2. AFTER ASSEMBLY, PAINT ALL EXPOSED UNDERGROUND STEEL WITH AN APPROVED BITUMINOUS COATING.
3. MECHANICAL JOINT RESTRAINT REQUIRED ON ALL JOINTS FROM MAIN TO HYDRANT.
4. PROVIDE 3'-6" (MIN) COVER OVER WATER MAIN AND FIRE HYDRANT LEAD.
5. LARGEST OUTLET SHALL FACE PAVED AREA.
6. WHEN DETERMINING BURY ELEVATION, HYDRANT HEIGHT SHALL ACCOMMODATE THE RISE OF GRADE 1/2 INCH PER FOOT FROM BACK OF CURB.
7. THE FIRE HYDRANT FLANGE SHALL NOT BE BURIED AND SHALL BE NO MORE THAN 6 INCHES ABOVE FINISHED GRADE.



INSTALLATION IN STREETS WITHOUT CURB AND GUTTER



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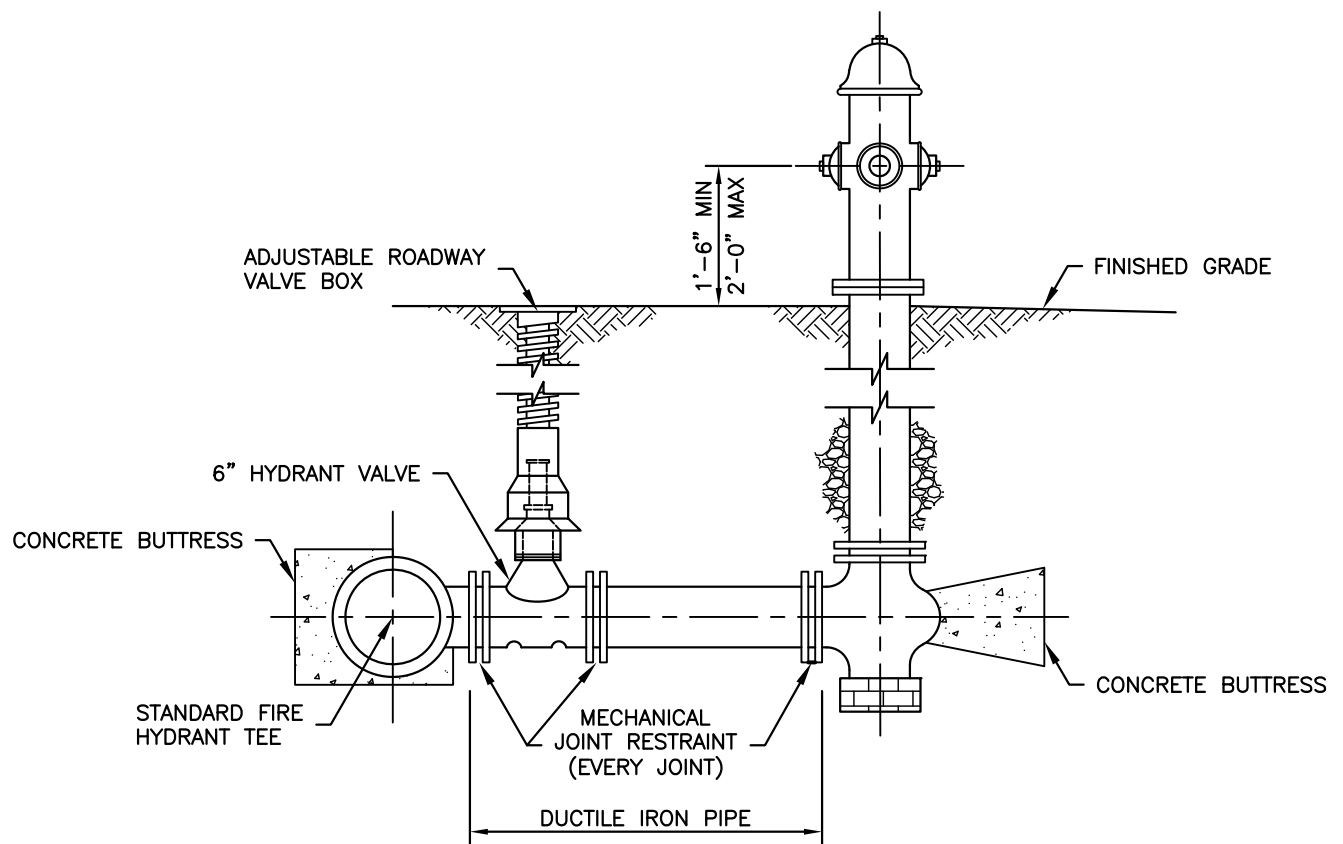
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STANDARD WATER DETAILS

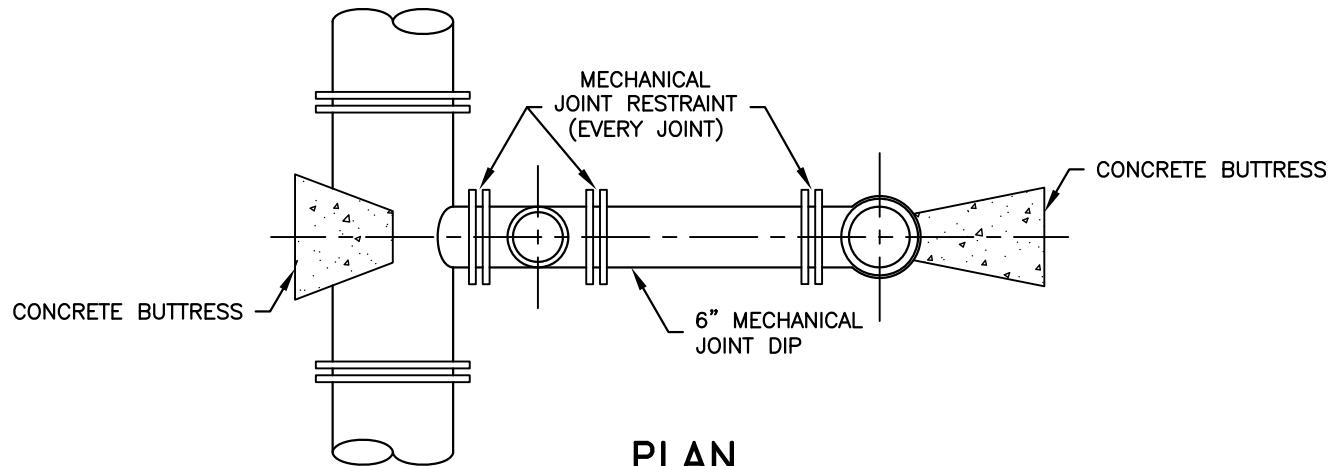
ISSUED
01/01/26

TYPICAL FIRE HYDRANT SETTINGS

PLATE
W-3



ELEVATION



PLAN

NOTES:

1. FOR PRESSURES ABOVE 200 PSI A SPECIAL DESIGN SHALL BE SUBMITTED AND APPROVED.
2. PROVIDE 3'-6" (MIN) COVER OVER WATER MAIN AND FIRE HYDRANT LEAD.
3. SEE STANDARD DETAIL W-3 FOR TYPICAL FIRE HYDRANT SETTINGS.
4. PROVIDE 4 MIL PLASTIC SHEETING BETWEEN CONCRETE BUTTRESS AND ALL PIPE AND FITTINGS.



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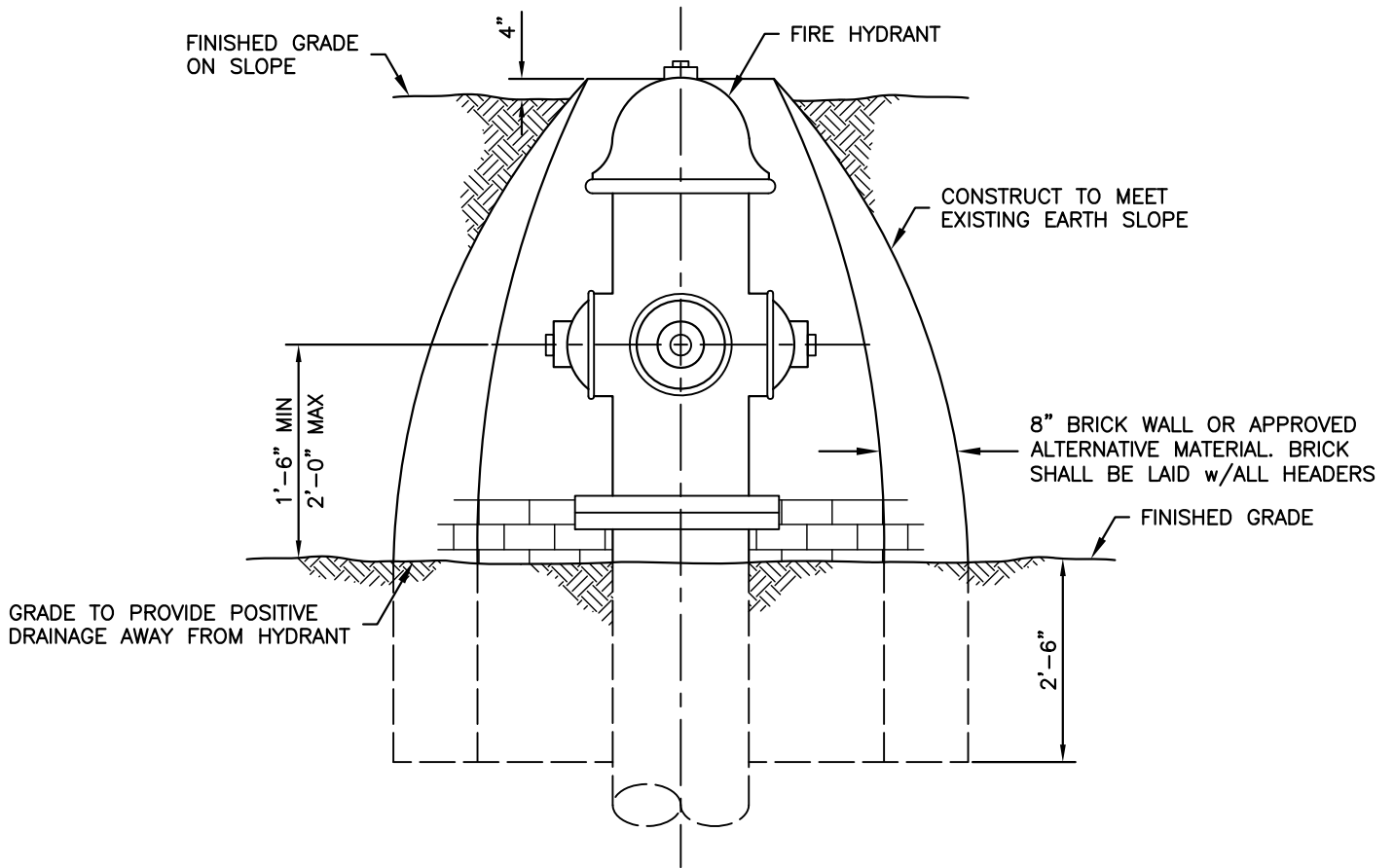
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STANDARD WATER DETAILS

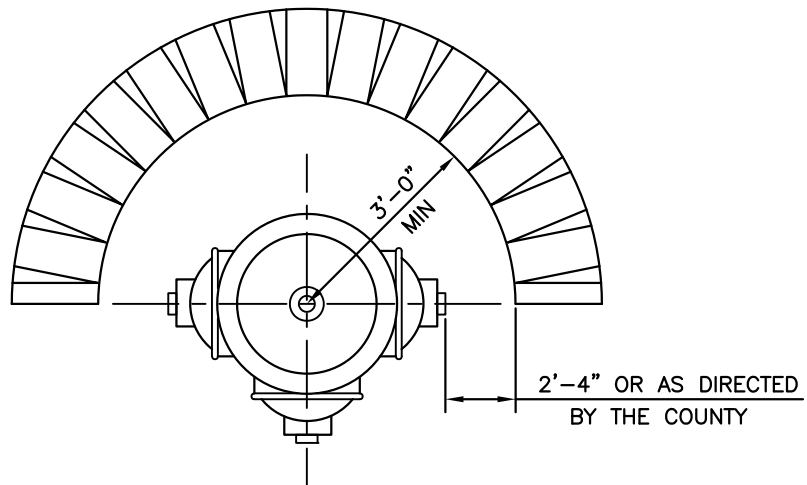
RESTRAINING FIRE HYDRANT
AND VALVE TO MAIN

ISSUED
01/01/26

PLATE
W-4



ELEVATION



PLAN

NOTE:

THIS DETAIL SHALL BE USED WHEN THE FINISHED GRADE
EXCEEDS A 2:1 SLOPE AT THE FIRE HYDRANT CENTERLINE.



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STANDARD WATER DETAILS

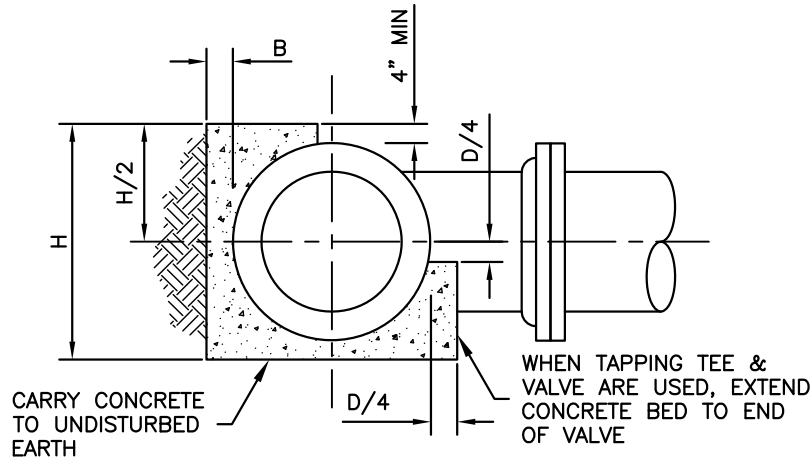
FIRE HYDRANT WELL

ISSUED
01/01/26

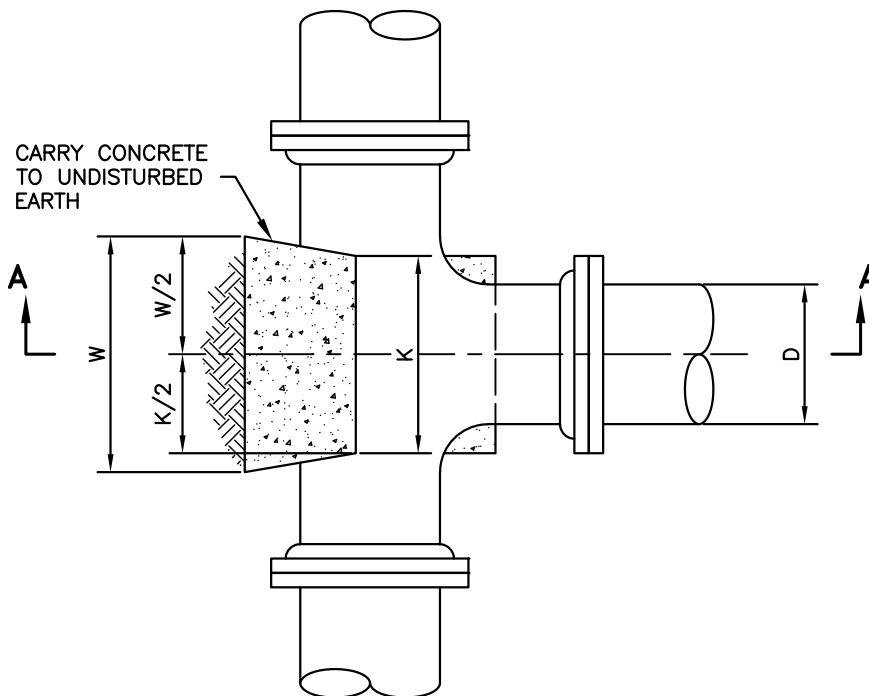
**PLATE
W-5**

NOTES:

1. ALL CONCRETE TO BE MIX No. 2.
2. BUTTRESS DIMENSIONS SHOWN ARE BASED UPON SOIL BEARING PRESSURE OF 3000 PSF AND STATIC WATER PRESSURE OF 200 PSI. WHERE WATER MAIN PRESSURE EXCEEDS 200 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3000 PSF SPECIAL BUTTRESS DESIGN IS REQUIRED.
3. MINOR VARIATIONS IN BUTTRESS SHAPE WILL BE PERMITTED, PROVIDED THE MINIMUM BEARING AREA AGAINST SOLID GROUND IS MAINTAINED.
4. A SPECIAL DESIGN WILL BE REQUIRED FOR PIPELINES GREATER THAN 16 INCH IN DIAMETER.
5. PROVIDE 4 MIL PLASTIC SHEETING BETWEEN CONCRETE BUTTRESS AND ALL PIPE AND FITTINGS.



SECTION A-A



PLAN

BUTTRESS DIMENSIONS FOR TEES (INCHES)

SIZE OF BRANCH (D)

D	6	8	12	16
B	8	9	12	12
H	19	25	38	50
W	15	20	30.5	40
K	12	16	16	20



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

[Signature]

STANDARD WATER DETAILS

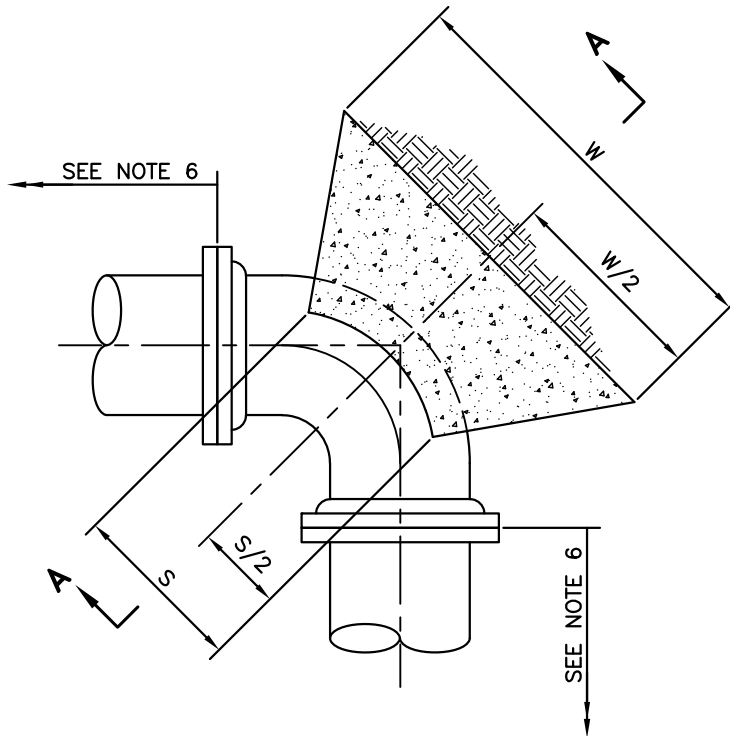
BUTTRESS FOR TEES

ISSUED
01/01/26

PLATE
W-6

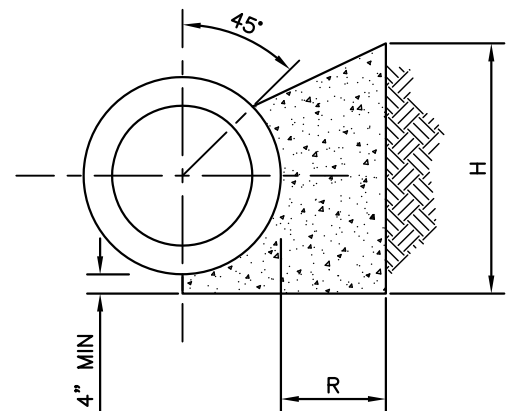
BUTTRESS DIMENSIONS (INCHES)

PIPE DIAMETER	W	H	R	S	DISTANCE FROM BEND THAT ALL JOINTS SHALL BE RESTRAINED (FT)
6	26	21	20	10	40
8	33	27	20	12	50
12	48	39	20	14	72
16	64	51	20	20	92



PLAN

MINOR VARIATIONS IN BUTTRESS SHAPE WILL BE PERMITTED PROVIDED THE MINIMUM BEARING AGAINST UNDISTURBED EARTH IS MAINTAINED.



SECTION A-A

NOTES:

1. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH.
2. THIS DETAIL TO BE USED FOR HORIZONTAL 1/4 BENDS ONLY.
3. ALL CONCRETE TO BE MIX No. 2.
4. BUTTRESS DIMENSIONS SHOWN ARE BASED UPON SOIL BEARING PRESSURE OF 3000 PSF AND STATIC WATER PRESSURE OF 200 PSI. WHERE WATER MAIN PRESSURE EXCEEDS 200 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3000 PSF SPECIAL BUTTRESS DESIGN IS REQUIRED.
5. A SPECIAL DESIGN WILL BE REQUIRED FOR PIPELINES GREATER THAN 16 INCH IN DIAMETER.
6. ALL JOINTS SHALL BE RESTRAINED A DISTANCE FROM THE BEND AS SHOWN IN THE ABOVE TABLE USING DUCTILE IRON PIPE.
7. PROVIDE 4 MIL PLASTIC SHEETING BETWEEN CONCRETE BUTTRESS AND ALL PIPE AND FITTINGS.



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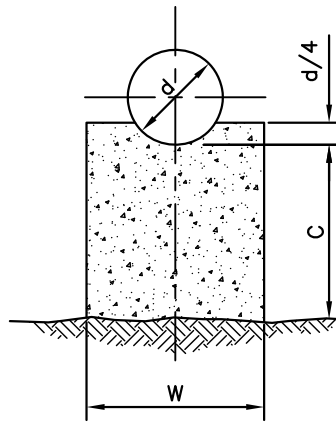
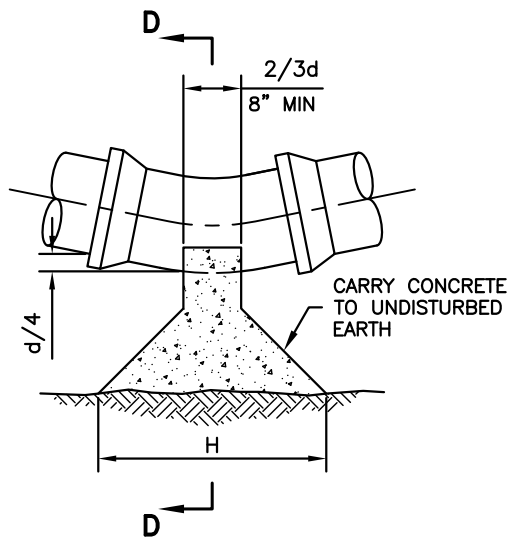
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STANDARD WATER DETAILS

BUTTRESS FOR
HORIZONTAL 1/4 BENDS

ISSUED
01/01/26

PLATE
W-7

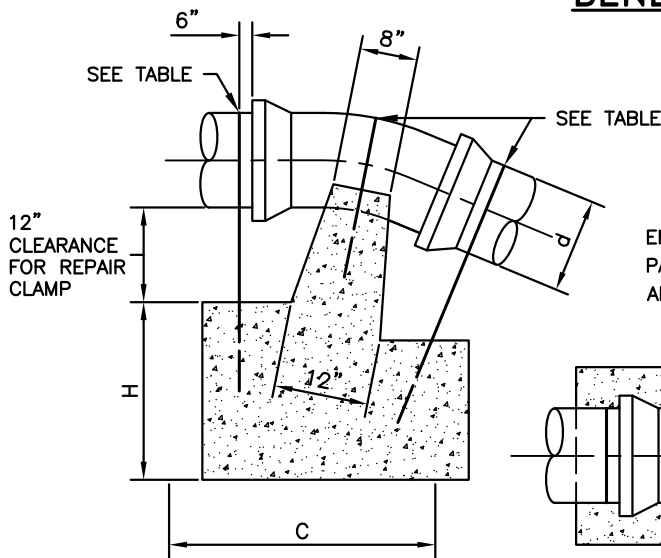


SECTION D-D

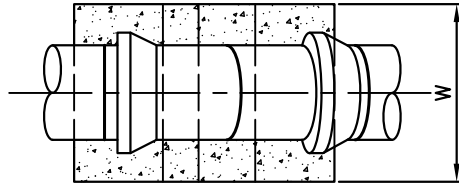
ELEVATION

BUTTRESS FOR VERTICAL BENDS

BUTTRESS DIMENSIONS FOR LOWER VERTICAL BENDS (INCHES)					
BEND	SIZE	6	8	12	16
1/8 (45°)	W	15	25	36	47
	H	12	20	29	38
	C	8	9	11	14
1/16 (22 1/2°)	W	13	18	26	33
	H	11	14	21	27
	C	8	9	11	14
1/32 (11 1/4°)	W	10	13	19	24
	H	8	10	15	19
	C	7	7	8	9



EMBED BARS 30 DIAMETERS.
PAINT EXPOSED BARS w/AN
APPROVED BITUMINOUS COATING.



ELEVATION

PLAN

ANCHORAGE FOR VERTICAL BENDS

REINFORCING BARS (INCHES)				
SIZE BEND	6	8	10	12
1/8	3 #5	3 #5	4 #5	4 #5
1/16	3 #5	3 #5	4 #5	4 #5
1/32	3 #5	3 #5	4 #5	4 #5

ANCHORAGES FOR UPPER VERTICAL BENDS (INCHES)				
BEND	SIZE	6	8	12
1/8 (45°)	W	36	48	66
	H	36	42	54
	C	48	54	66
1/16 (22 1/2°)	W	36	45	60
	H	30	32	36
	C	36	42	60
1/32 (11 1/4°)	W	24	30	45
	H	21	30	32
	C	36	36	45

NOTES:

- ALL CONCRETE TO BE MIX No. 2.
- BUTTRESS DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3000 PSF AND STATIC WATER PRESSURE OF 200 PSI. WHERE PRESSURE EXCEEDS 200 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3000 PSF, A SPECIAL BUTTRESS DESIGN IS REQUIRED.
- MINOR VARIATIONS IN BUTTRESS SHAPE WILL BE PERMITTED, PROVIDED THE MINIMUM BEARING AGAINST UNDISTURBED EARTH IS MAINTAINED.
- ANCHORING BARS TO CONFORM TO PIPE O.D. PROVIDE A CONTINUOUS BEARING SURFACE FOR ONE HALF THE PIPE PERIMETER.
- WHEN ANCHORING PVC PIPE, THE STRAPPING IN CONTACT WITH THE PIPE SURFACE SHALL BE 1" WIDE x 1/4" THICK STEEL (NOT SHOWN). THE REMAINING PORTION OF THE STRAP SHALL BE A REINFORCING BAR SIZED IN ACCORDANCE WITH THE PERTINENT CHART.
- A SPECIAL DESIGN WILL BE REQUIRED FOR WATER MAINS 16 INCHES IN DIAMETER OR LARGER AND ALL 90° BENDS.
- PROVIDE 4 MIL PLASTIC SHEETING BETWEEN CONCRETE BUTTRESS AND ALL PIPE AND FITTINGS.



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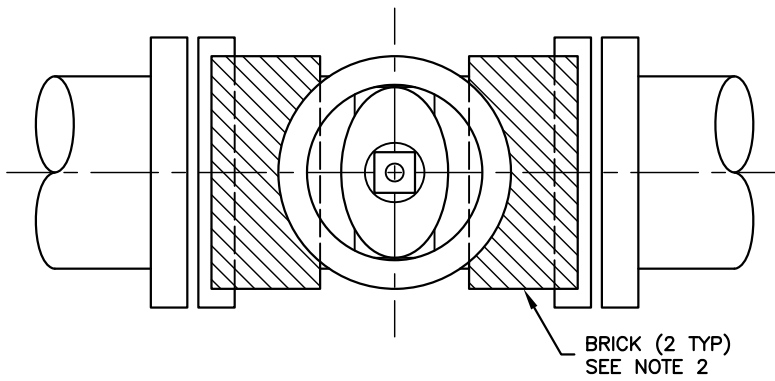
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STANDARD WATER DETAILS

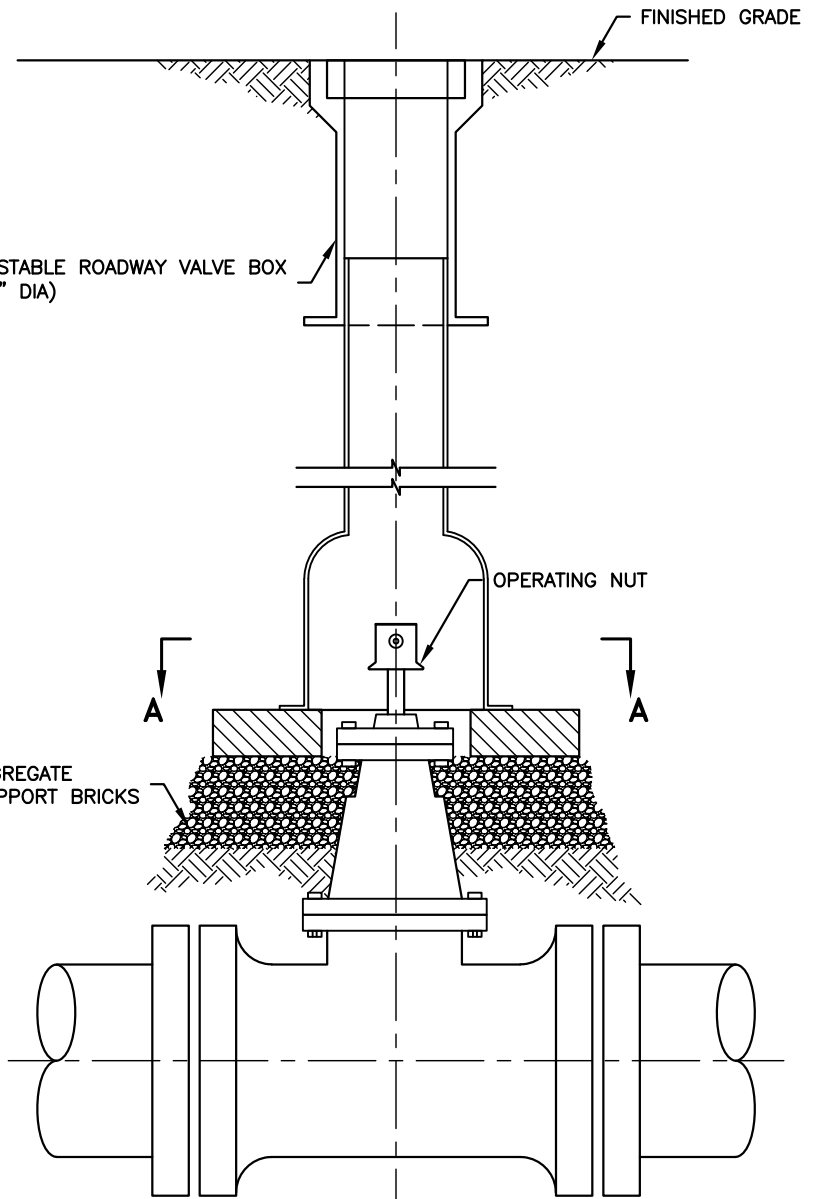
BUTTRESSES AND ANCHORAGES
FOR VERTICAL BENDS

ISSUED
01/01/26

PLATE
W-8



SECTION A-A



ELEVATION

NOTES:

1. PROVIDE VALVE KEY EXTENSION WHEN DEPTH OF VALVE OPERATING NUT EXCEEDS 6'-0", SEE STANDARD DETAIL W-12.
2. SUPPORT VALVE BOX WITH TWO BRICKS LAID PARALLEL TO VALVE BONNETT.



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

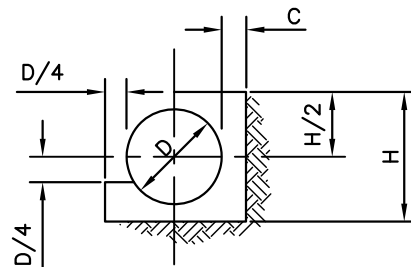
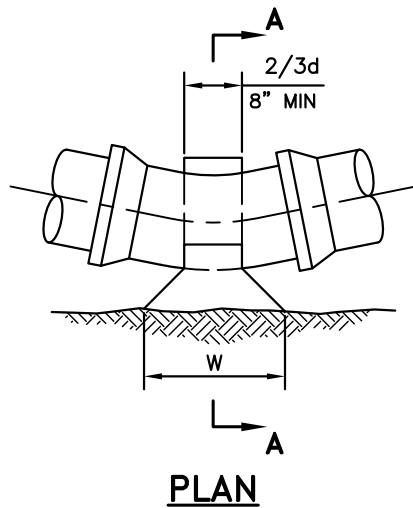
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STANDARD WATER DETAILS

**WATER MAIN VALVE
w/ROADWAY BOX**

ISSUED
01/01/26

**PLATE
W-9**



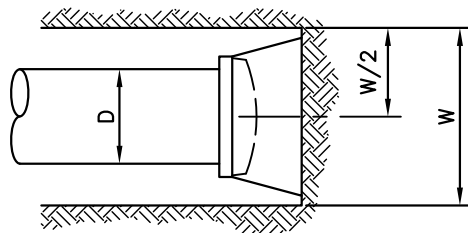
SECTION A-A

BUTTRESS FOR HORIZONTAL BENDS

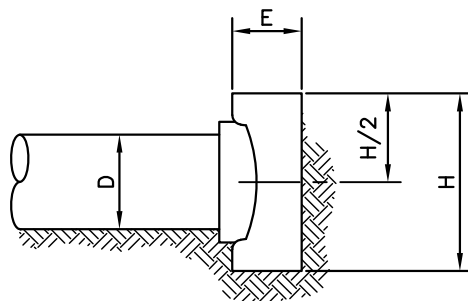
BUTTRESS DIMENSIONS FOR HORIZONTAL BENDS (INCHES)					
BEND	D	6	8	12	16
1/8 (45°)	W	15	25	36	47
	H	12	20	29	38
	C	8	9	11	14
1/16 (22 1/2°)	W	13	18	26	33
	H	11	14	21	27
	C	8	9	11	14
1/32 (11 1/4°)	W	10	13	19	24
	H	8	10	15	19
	C	7	7	8	9

NOTE:

1. CARRY CONCRETE TO UNDISTURBED EARTH.



PLAN



SECTION

BUTTRESS FOR CAPS

BUTTRESS DIMENSIONS FOR CAPS (INCHES)				
D	6	8	12	16
E	6	8	10	12
H	19	25	38	50
W	15	20	30.5	40

NOTES:

1. ALL CONCRETE TO BE MIX No. 2.
2. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3000 PSF AND STATIC PRESSURE OF 200 PSI. WHERE PRESSURE EXCEEDS 200 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3000 PSF SPECIAL BUTTRESS DESIGN IS REQUIRED.
3. MINOR VARIATION IN BUTTRESS SHAPE WILL BE PERMITTED, PROVIDED THE MINIMUM BEARING AGAINST SOLID GROUND IS MAINTAINED.
4. A SPECIAL DESIGN WILL BE REQUIRED FOR PIPELINES GREATER THAN 16 INCH IN DIAMETER AND ALL 90° BENDS.
5. PROVIDE 4 MIL PLASTIC SHEETING BETWEEN CONCRETE BUTTRESS AND ALL PIPE AND FITTINGS.



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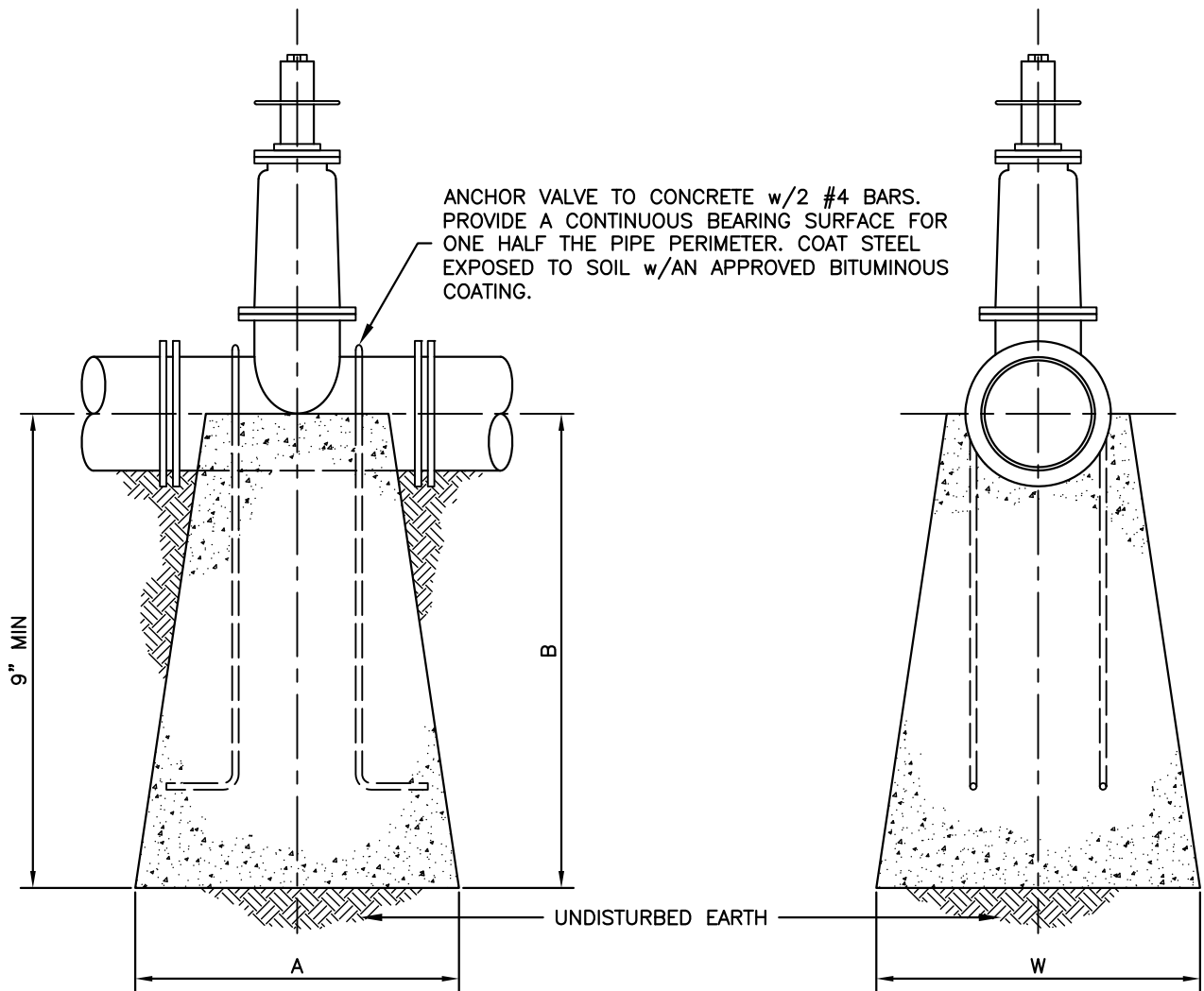
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STANDARD WATER DETAILS

BUTTRESSES FOR CAPS
AND HORIZONTAL BENDS

ISSUED
01/01/26

PLATE
W-10



NOTES:

1. ALL CONCRETE TO BE MIX No. 2.
2. BUTTRESS DIMENSIONS SHOWN ARE MINIMUM. DIMENSIONS ARE BASED UPON SOIL BEARING PRESSURE OF 3000 PSF AND STATIC PRESSURE OF 200 PSI. WHERE PRESSURE EXCEEDS 200 PSI OR WHERE SOIL BEARING PRESSURE IS LESS THAN 3000 PSF SPECIAL BUTTRESS DESIGN IS REQUIRED.
3. PROVIDE VALVE KEY EXTENSION WHEN DEPTH OF VALVE OPERATING NUT EXCEEDS 6'-0", SEE STANDARD DETAIL W-12
4. A SPECIAL DESIGN WILL BE REQUIRED FOR VALVES GREATER THAN 12 INCHES.
5. PROVIDE 4 MIL PLASTIC SHEETING BETWEEN CONCRETE BUTTRESS AND ALL PIPE AND FITTINGS.

PIPE SIZE	A	B	W
4"	9"	1'-0"	1'-0"
6"	10"	1'-6"	1'-0"
8"	1'-0"	2'-0"	2'-0"
12"	1'-0"	2'-0"	3'-0"



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[Signature]

STANDARD WATER DETAILS

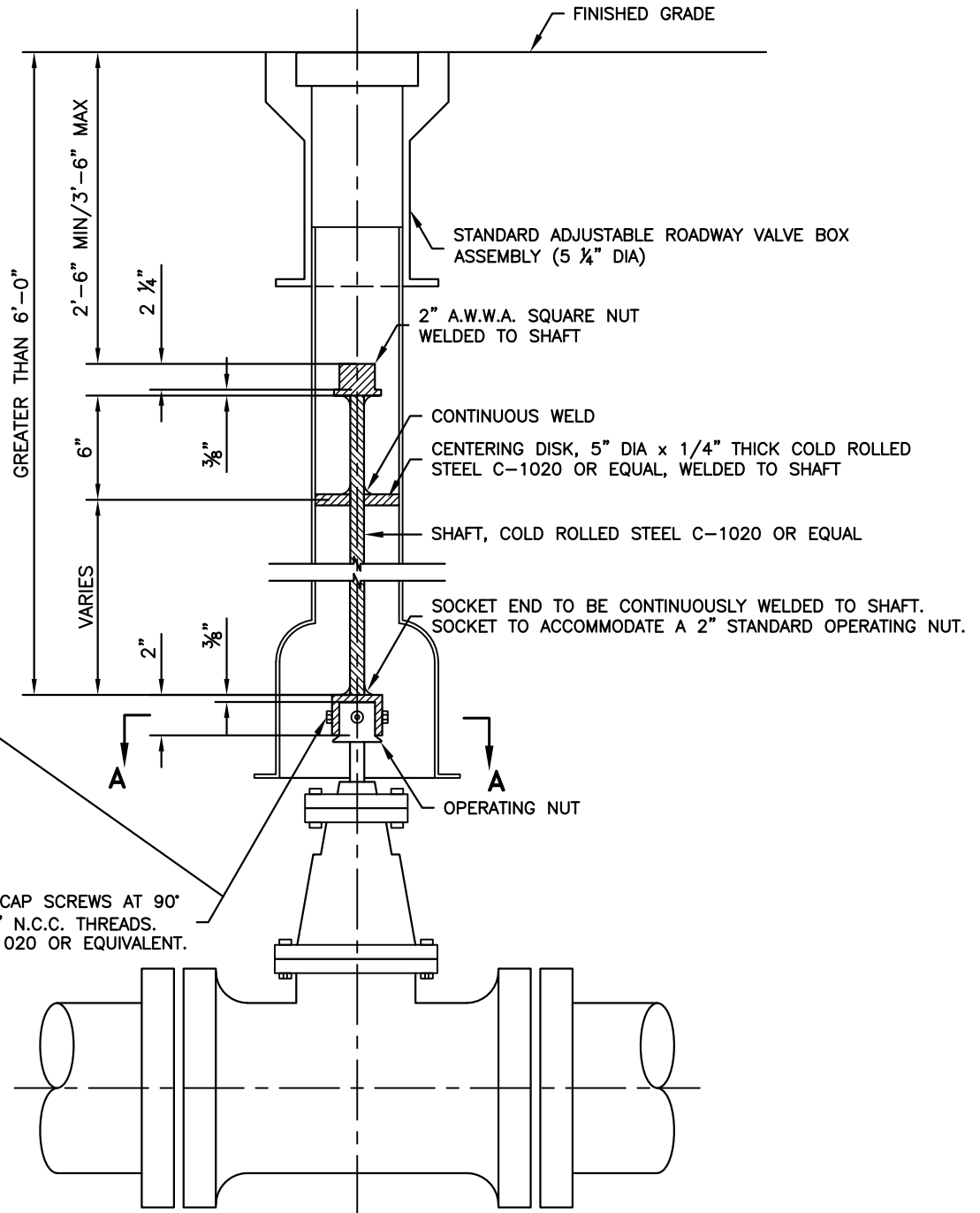
ANCHORAGES FOR VALVES
w/PVC PIPE

ISSUED
01/01/26

PLATE
W-11

SECTION A-A

SECURE w/4 HEX HEAD CAP SCREWS AT 90°
PLACEMENT. $\frac{3}{8}$ " DIA x $\frac{3}{4}$ " N.C.C. THREADS.
COLD ROLLED STEEL C-1020 OR EQUIVALENT.



ELEVATION

NOTES:

1. PROVIDE VALVE KEY EXTENSION WHEN DEPTH OF VALVE OPERATING NUT EXCEEDS 6'-0".
2. ALL EXPOSED METAL TO BE BITUMINOUS COATED.
3. OVERALL LENGTH OF VALVE KEY EXTENSION TO BE DETERMINED BY FIELD MEASUREMENT TO PROVIDE 2'-6" TO 3'-6" DEPTH FROM GRADE LEVEL.

SHAFT EXTENSION DIAMETER	
VALVE SIZE	INCHES
8" OR LESS	1"
10" TO 12"	1 1/4"
16" AND UP	1 1/2"



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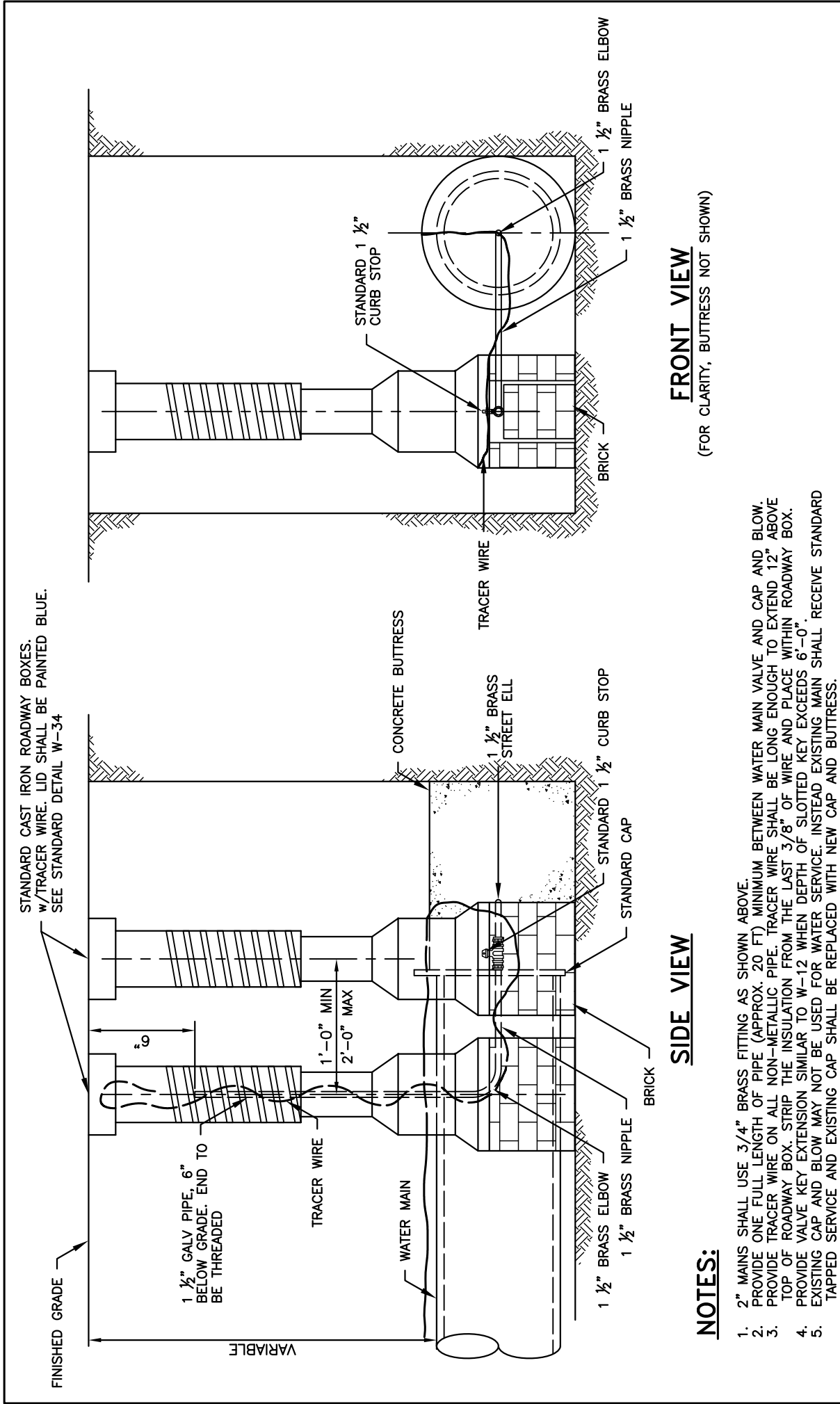
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STANDARD WATER DETAILS

WATER MAIN VALVE
KEY EXTENSION

ISSUED
01/01/26

PLATE
W-12





FRONT VIEW
(FOR CLARITY, BUTTRESS NOT SHOWN)

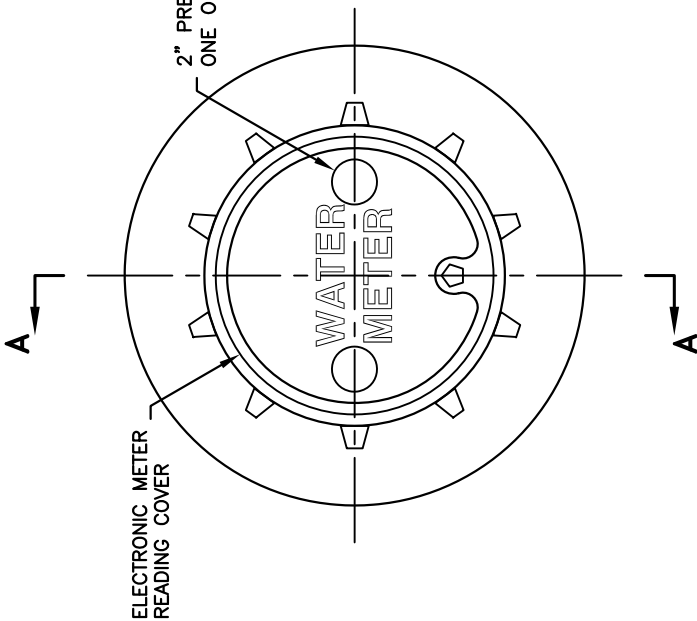
SIDE VIEW

NOTES:

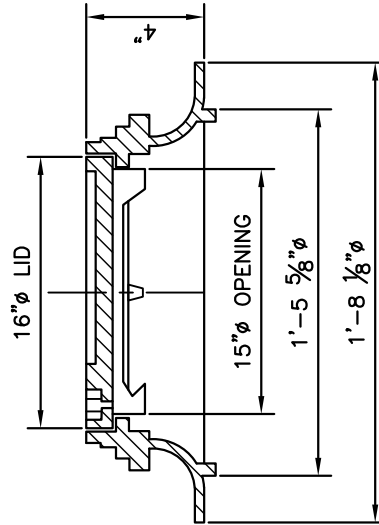
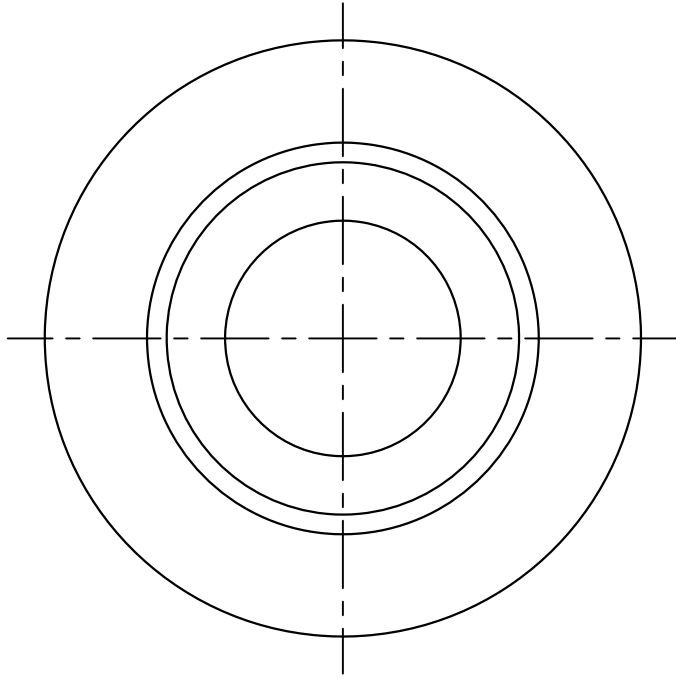
1. 2" MAINS SHALL USE 3/4" BRASS FITTING AS SHOWN ABOVE.
2. PROVIDE ONE FULL LENGTH OF PIPE (APPROX. 20 FT) MINIMUM BETWEEN WATER MAIN VALVE AND CAP AND BLOW.
3. PROVIDE TRACER WIRE ON ALL NON-METALLIC PIPE. TRACER WIRE SHALL BE LONG ENOUGH TO EXTEND 12" ABOVE TOP OF ROADWAY BOX. STRIP THE INSULATION FROM THE LAST 3/8" OF WIRE AND PLACE WITHIN ROADWAY BOX.
4. PROVIDE VALVE KEY EXTENSION SIMILAR TO W-12 WHEN DEPTH OF SLOTTED KEY EXCEEDS 6'-0".
5. EXISTING CAP AND BLOW MAY NOT BE USED FOR WATER SERVICE. INSTEAD EXISTING MAIN SHALL RECEIVE STANDARD TAPPED SERVICE AND EXISTING CAP SHALL BE REPLACED WITH NEW CAP AND BUTTRESS.

	DIRECTOR, DEPARTMENT OF PUBLIC WORKS 		STANDARD WATER DETAILS CAP AND BLOWOFF (4" MAINS AND LARGER)		ISSUED 01/01/26 PLATE W-13
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MATERIAL:
 CAST GREY IRON
 ASTM A48-92 CLASS 30



FRAME AND COVER MUST
 SIT SECURELY ON VAULT



SECTION A-A
METER BOX COVER

18" TO 24" OR 18" TO 30"
EXTENSION RING



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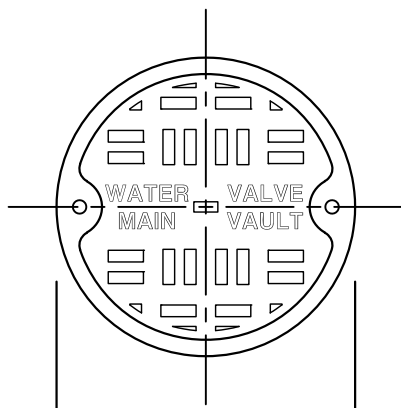
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STANDARD WATER DETAILS

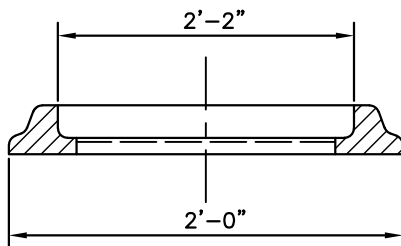
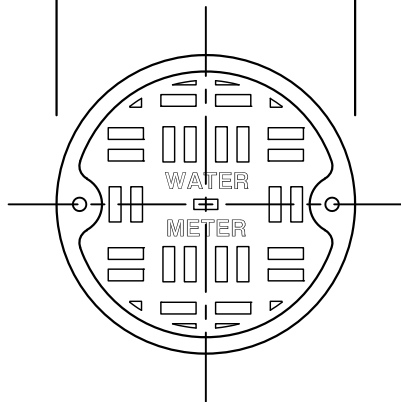
STANDARD WATER METER
 FRAME & COVER

ISSUED
 01/01/26

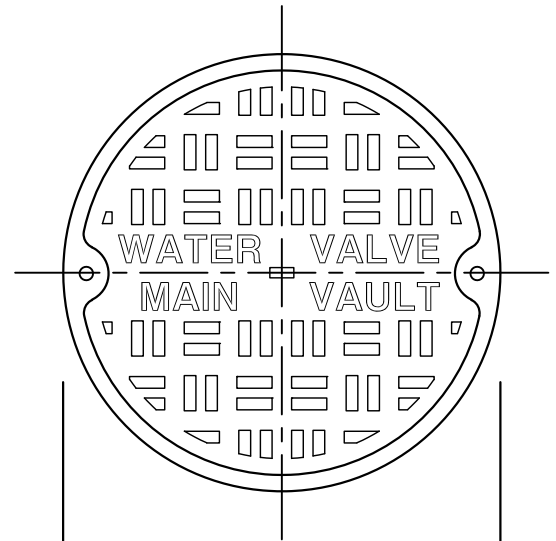
PLATE
 W-14



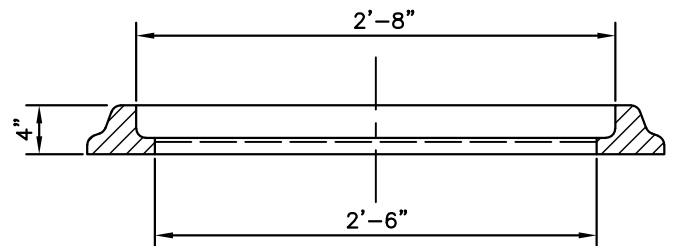
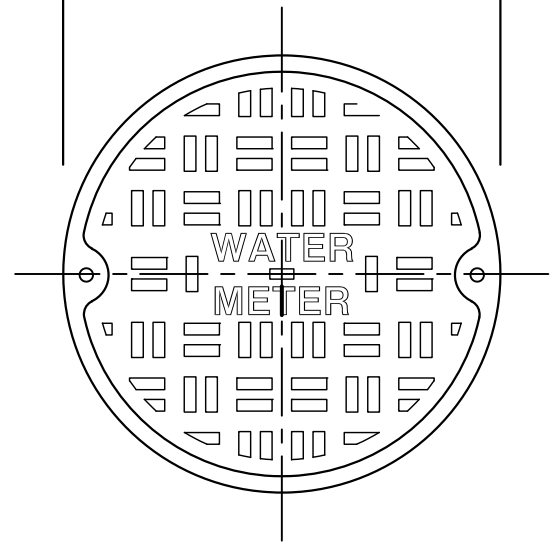
2'-1 $\frac{3}{4}$ "



**24" VAULT
FRAME & COVER**



2'-7 $\frac{3}{4}$ "



**30" VAULT
FRAME & COVER**



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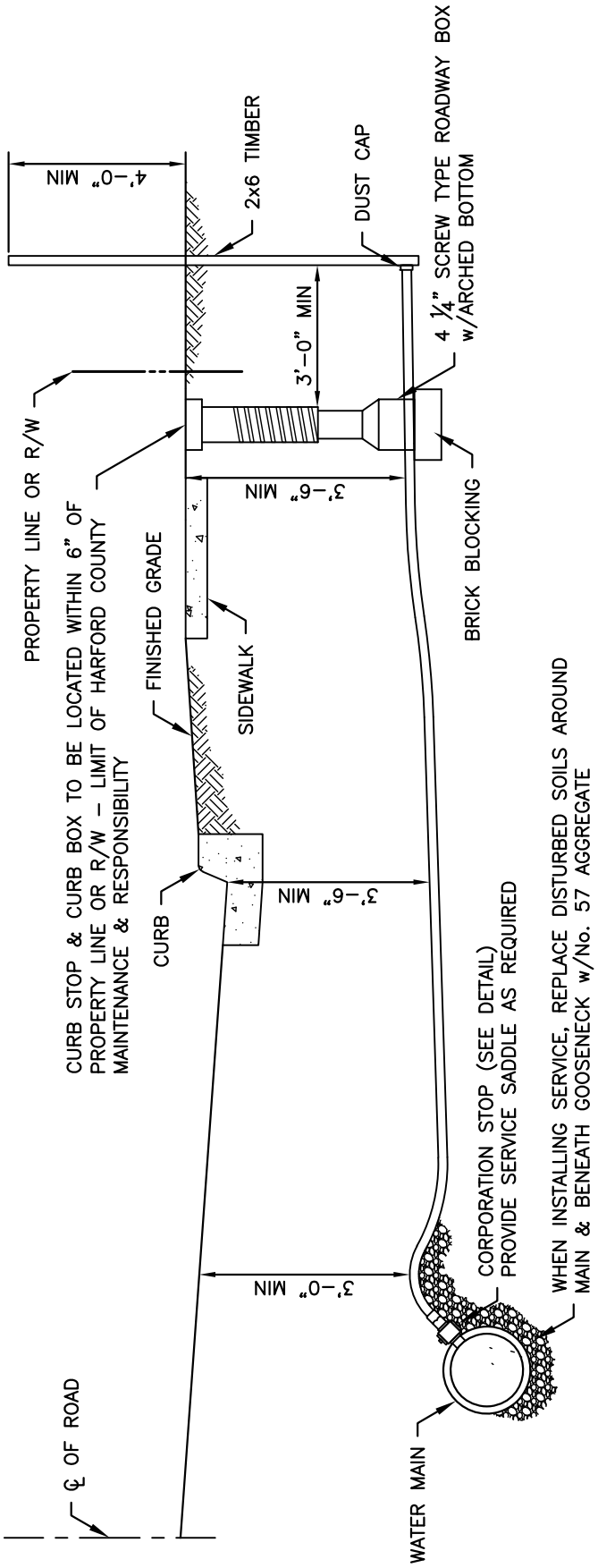
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STANDARD WATER DETAILS

STANDARD FRAMES
& COVERS

ISSUED
01/01/26

PLATE
W-15



NOTES:

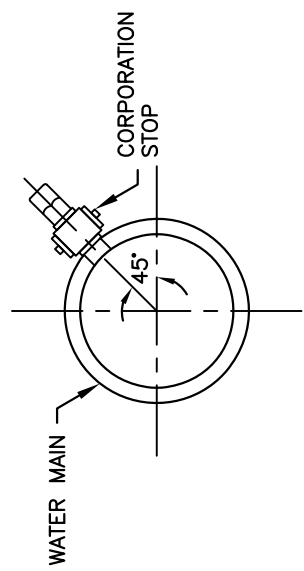
1. MINIMUM PIPE SIZES ARE SPECIFIED.
2. ALL BRASS FITTINGS TO BE COMPRESSION TYPE ONLY.
3. IF DIRECT TAP INTO PVC PIPE: 3-4 WRAPS OF TEFLON TAPE ON THREADS IS REQUIRED.
4. CURB BOX SHALL NOT BE PLACED IN DRIVEWAYS, STEPS OR SIDEWALKS.
5. SERVICE LINE FROM MAIN TO CURB BOX SHALL BE ONE CONTINUOUS PIECE (NO JOINTS).
6. PROVIDE VALVE KEY EXTENSION SIMILAR TO STANDARD DETAIL W-12, WHEN DEPTH OF SLOTTED KEY EXCEEDS 6'-0".

WATER SERVICES FOR TOWNHOUSES

- 1 1/2" COPPER TUBING FOR TWIN HOUSE CONNECTIONS
- 1" COPPER TUBING FOR SINGLE HOUSE CONNECTIONS

WATER SERVICES FOR SINGLE FAMILY LOTS

- 1" COPPER TUBING FOR HOUSE CONNECTIONS w/FIRE SPRINKLER SYSTEMS



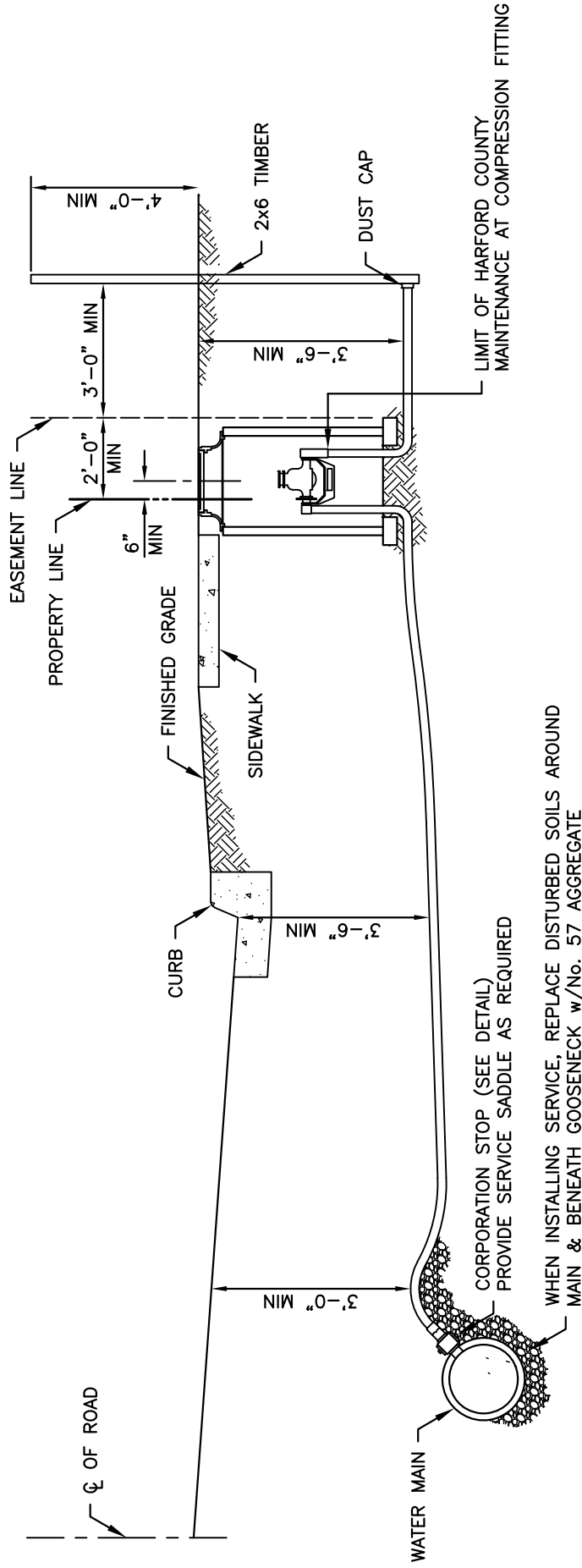
DETAIL



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

[Signature]

STANDARD WATER DETAILS		ISSUED 01/01/26
STANDARD SERVICE CONNECTION w/CURB BOX		PLATE W-16



NOTES:

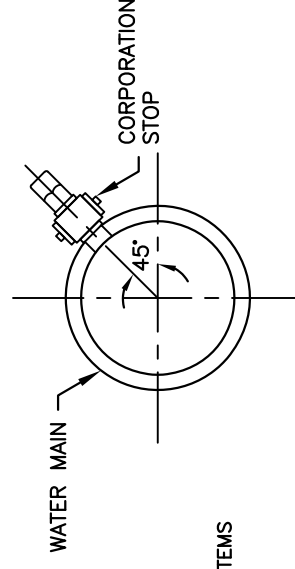
1. MINIMUM PIPE SIZES ARE SPECIFIED.
2. ALL BRASS FITTINGS TO BE COMPRESSION TYPE ONLY.
3. IF DIRECT TAP INTO PVC PIPE: 3-4 WRAPS OF TEFLON TAPE ON THREADS IS REQUIRED.
4. METER VAULT SHALL NOT BE PLACED IN DRIVEWAYS, STEPS OR SIDEWALKS.
5. SERVICE LINE FROM MAIN TO METER VAULT SHALL BE ONE CONTINUOUS PIECE (NO JOINTS).

WATER SERVICES FOR TOWNHOUSES

- 1 1/2" COPPER TUBING FOR TWIN HOUSE CONNECTIONS
- 1" COPPER TUBING FOR SINGLE HOUSE CONNECTIONS

WATER SERVICES FOR SINGLE FAMILY LOTS

- 1" COPPER TUBING FOR HOUSE CONNECTIONS w/SPRINKLER SYSTEMS



DETAIL



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

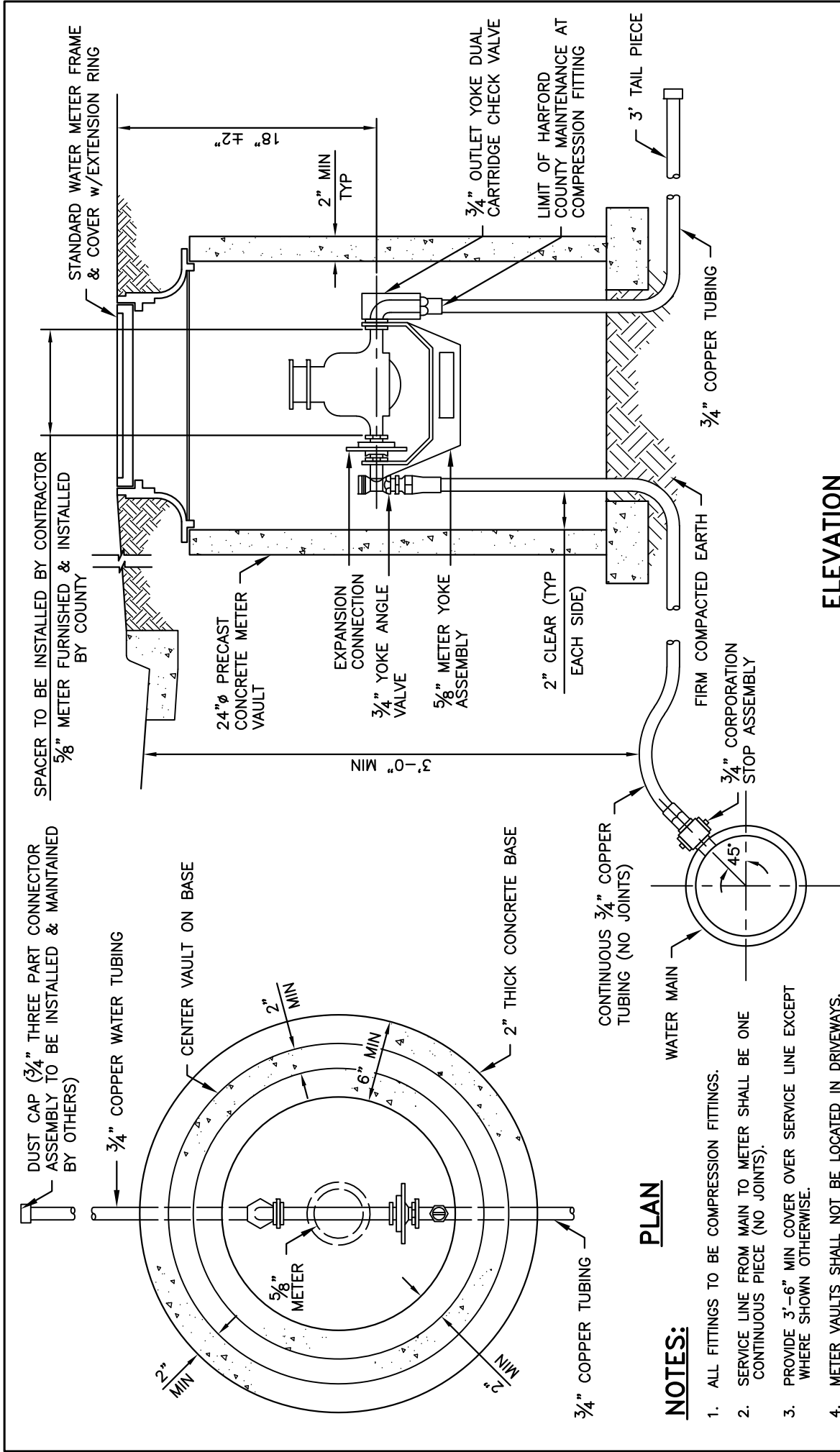
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STANDARD WATER DETAILS

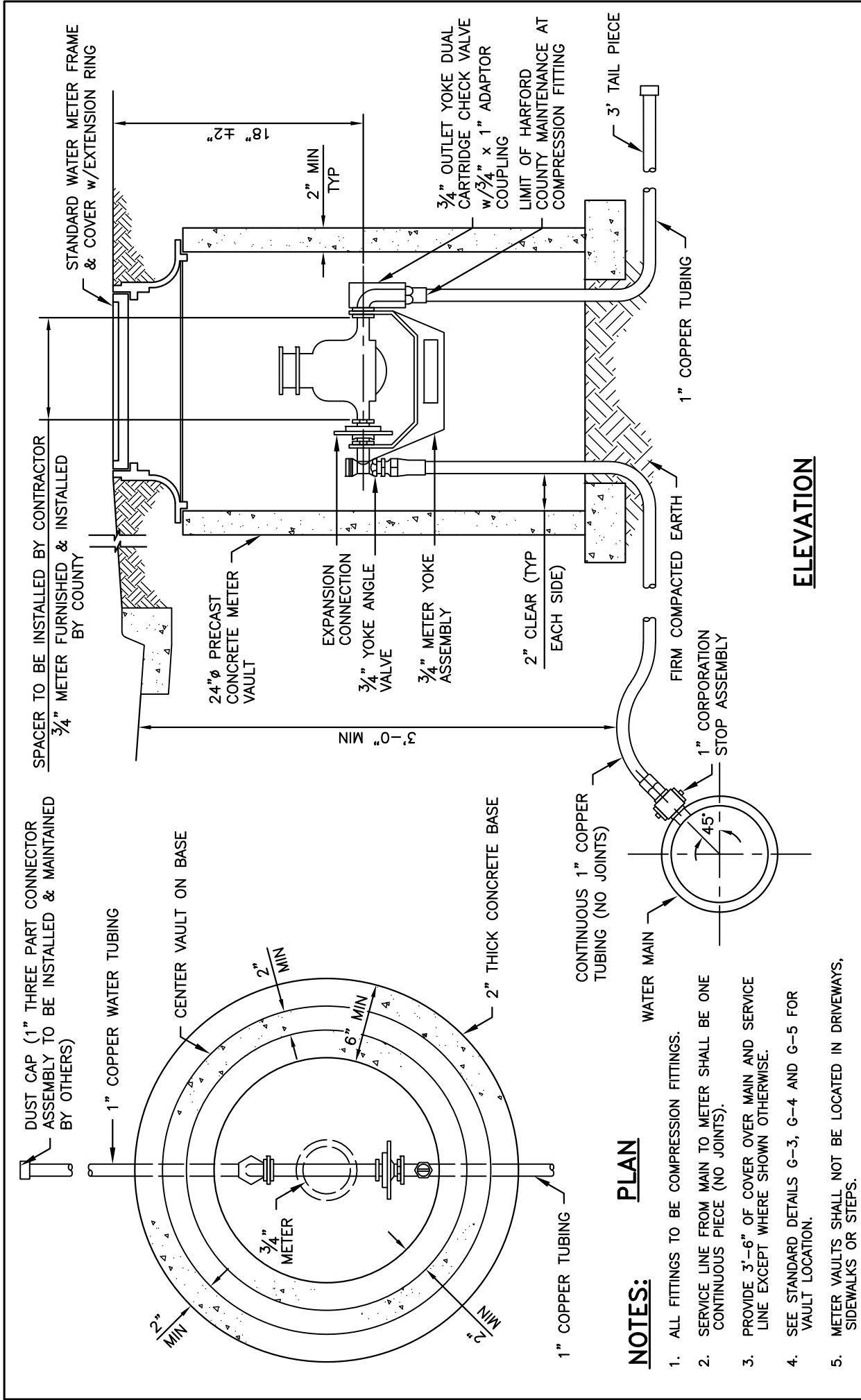
ISSUED
01/01/26


STANDARD SERVICE CONNECTION w/METER VAULT

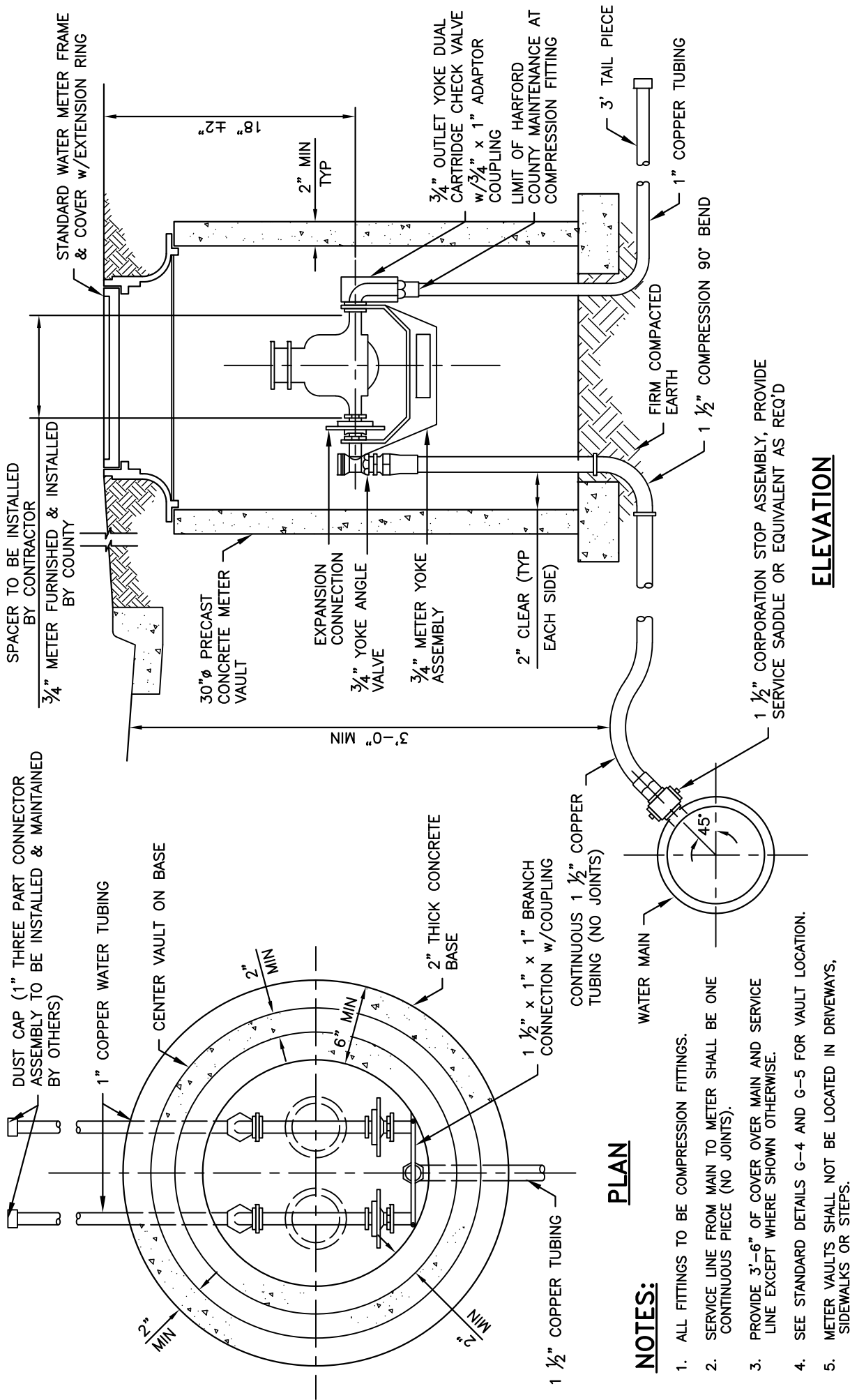
PLATE
W-17



	<p>DIRECTOR, DEPARTMENT OF PUBLIC WORKS</p> <p><i>[Signature]</i></p>	<p>STANDARD WATER DETAILS</p> <p>OUTSIDE SETTING</p> <p>3/4" SUPPLY WITH 5/8" METER</p> <p>(DOMESTIC SERVICE WITHOUT SPRINKLER SERVICE)</p>	<p>ISSUED 01/01/26</p> <p>PLATE W-18</p>
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	STANDARD WATER DETAILS		ISSUED 01/01/26
	OUTSIDE SETTING 1" SUPPLY WITH 3/4" METER (DOMESTIC SERVICE WITH SPRINKLER SERVICE)		PLATE W-19



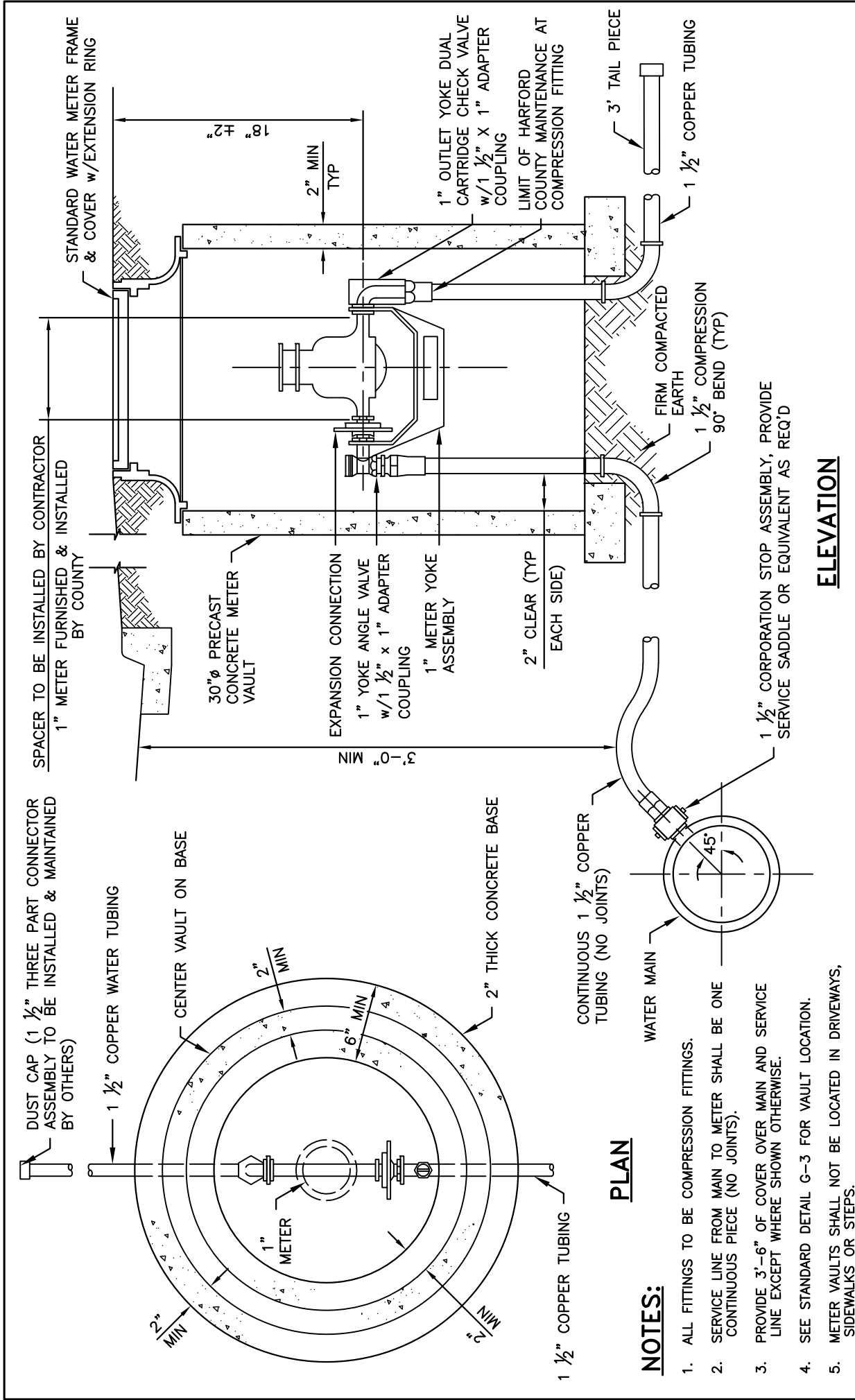
DIRECTOR, DEPARTMENT OF PUBLIC WORKS

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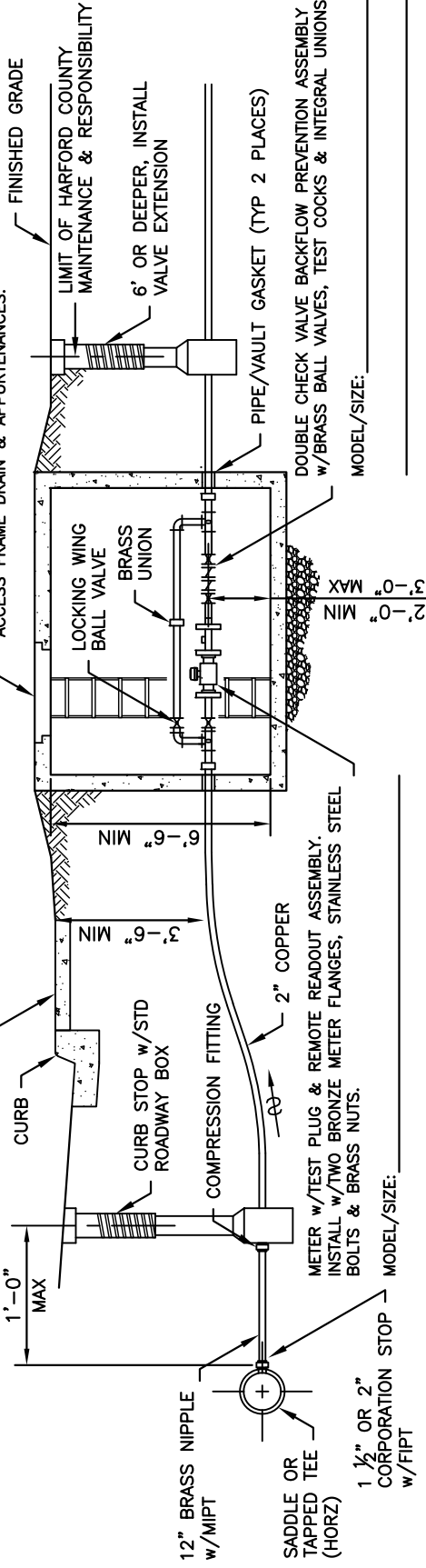
STANDARD WATER DETAILS

OUTSIDE SETTING

1 1/2" SUPPLY WITH TWIN 3/4" METERS FOR TOWNHOMES (DOMESTIC SERVICE WITH SPRINKLER SERVICE)



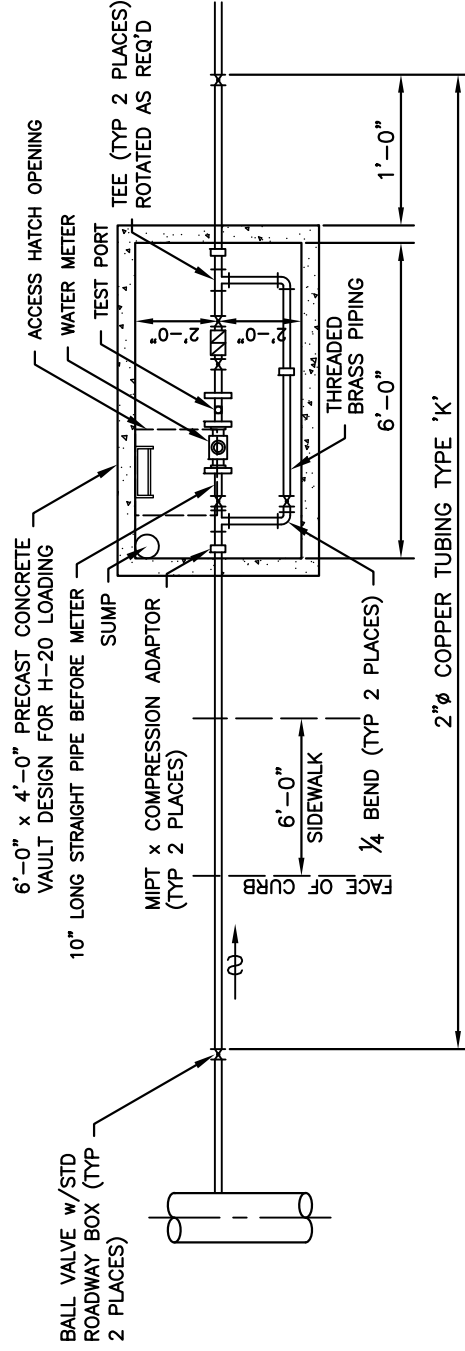
30" SQUARE ACCESS HATCH(DESIGNED FOR H-20 LOADING) w/BUILT-IN PNEUMATIC CYLINDER TO KEEP HATCH OPEN UNDER RESISTANCE. HATCH SHALL ALSO HAVE 18" WIDTH MIN NON-CORROSIVE OSHA APPROVED LADDER, EXTENSION SAFETY POST, ACCESS FRAME DRAIN & APPURTENANCES.



NOTES:

1. PERMANENT BRICK, CONCRETE OR APPROVED PRECAST PIPE SUPPORTS (NOT SHOWN) TO BE PLACED UNDER ALL FLANGED FITTINGS AND AS DIRECTED BY THE COUNTY.
2. ALL FITTINGS AND NIPPLES SHALL BE BRASS WITH APPROPRIATE ADAPTORS.
3. SET VAULT ON A 6" LEVELING COURSE OF AASHTO M43 SIZE 57 AGGREGATE.
4. PROVIDE POSITIVE DRAINAGE AWAY FROM VAULT. SIMILAR DESIGN OF PIPING AND EQUIPMENT FOR COMMERCIAL INTERIOR BUILDING INSTALLATIONS.
5. TYPE 'K' COPPER TUBING SHALL BE CONTINUOUS BETWEEN VALVE UP TO SPECIFICALLY ORDERED MAXIMUM AVAILABLE LENGTHS.
6. SUMP SHALL HAVE A 8" MINIMUM DIAMETER AND A 4" MINIMUM DEPTH.
7. SOLDERED COPPER JOINTS ARE PROHIBITED. THE EXTERIOR OF THE CONCRETE VAULT SHALL HAVE A FACTORY APPLIED BITUMINOUS COATING.

ELEVATION



PLAN



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

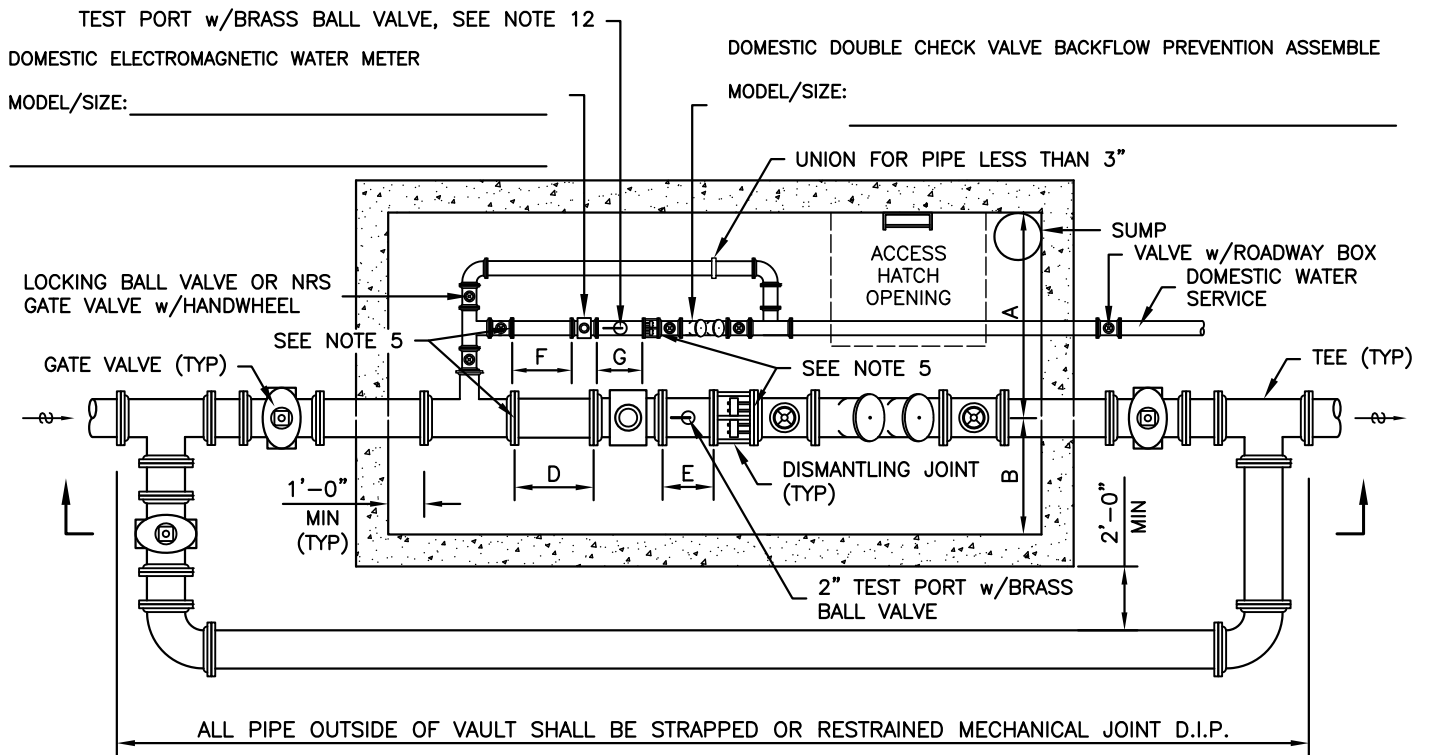
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STANDARD WATER DETAILS

ISSUED
01/01/26

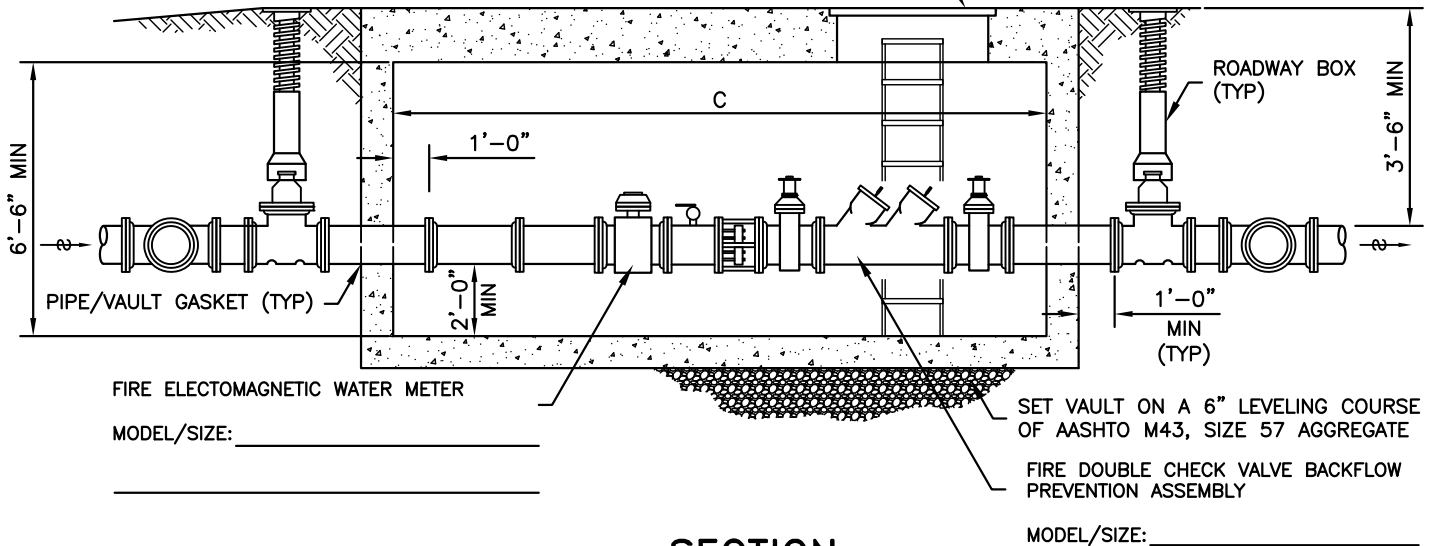
OUTSIDE SETTING
1 1/2" AND 2" METERED SERVICE

PLATE
W-22



PLAN

FOR FIRE SUPPLY SERVICE LESS THAN 6" PROVIDE 4'-0" x 4'-0" ACCESS HATCH w/H-20 LOAD DESIGN, w/BUILT IN PNEUMATIC CYLINDER TO KEEP HATCH OPEN UNDER RESISTANCE. HATCH SHALL ALSO HAVE 18" WIDTH MIN NON-CORROSIVE OSHA APPROVED LADDER, EXTENSION SAFETY POST & FRAME DRAIN. HATCH SIZES FOR LARGER FIRE SUPPLY SERVICES SHALL BE 5'-0" x 5'-0"



SECTION

(SEE PLATE W-23a FOR TABLE & NOTES)



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

[Signature]

STANDARD WATER DETAILS

OPEN SYSTEM
DOMESTIC WATER SERVICE
w/FIRE SUPPLY

ISSUED
01/01/26

PLATE
W-23

NOTES:

1. PERMANENT BRICK, CONCRETE OR APPROVED PRECAST PIPE SUPPORTS (NOT SHOWN) TO BE PLACED UNDER ALL FLANGED FITTINGS AND AS DIRECTED BY THE COUNTY.
2. LOADS: L.L. = AASHTO H-20, D.L. = EARTH @ 110 LBS PER CU FT AND 42 LBS PER CU FT EQUIVALENT FLUID PRESSURE.
3. CONCRETE AND REINFORCING SHALL CONFORM TO STANDARD SPECIFICATIONS.
4. PROVIDE POSITIVE DRAINAGE AWAY FROM VAULT.
5. PROVIDE A REDUCER AT THESE LOCATIONS WHEN THE METER SIZE IS SMALLER THAN THE BACKFLOW PREVENTER.
6. ALL PIPE WITHIN THE VAULT SHALL BE FLANGED.
7. ALL FLANGES AND METERS SHALL RECEIVE STAINLESS STEEL BOLTS AND BRASS NUTS.
8. ALL FITTINGS TO BE BRASS OR DUCTILE IRON.
9. SUMP SHALL HAVE AN 8" MIN DIA AND A 4" MIN DEPTH.
10. PRIOR TO ORDERING THE VAULT, METER SETTING AND BACKFLOW PREVENTER, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE DIVISION OF WATER AND SEWER FOR APPROVAL.
11. THE EXTERIOR OF THE CONCRETE VAULT SHALL HAVE A FACTORY APPLIED BITUMINOUS COATING.
12. FOR METER SIZES LESS THAN 6", PROVIDE 2" DIAMETER TEST PORT. FOR METER SIZES 6" AND LARGER, PROVIDE 3" DIAMETER TEST PORT.

FIRE METER SIZE	FIRE BACKFLOW PREVENTER SIZE	A	B	C	D (STRAIGHT PIPE SPOOL)	E (TEST PORT SPOOL)
3"	3"	48"	24"	132"	12"	12"
3"	4"	48"	24"	144"	12"	12"
4"	4"	72"	24"	168"	16"	14"
4"	6"	72"	24"	168"	16"	14"
6"	6"	78"	30"	192"	25"	21"
6"	8"	78"	30"	192"	25"	21"
8"	8"	90"	30"	228"	34"	26"
8"	10"	90"	30"	228"	34"	26"
10"	10"	90"	30"	252"	42"	30"
10"	12"	90"	30"	252"	42"	30"

DOMESTIC METER SIZE	DOMESTIC BACKFLOW PREVENTER SIZE	F	G
1 1/2"	1 1/2"	6"	7"
1 1/2"	2"	6"	7"
2"	2"	6"	7"
2"	3"	6"	7"
3"	3"	12"	12"
3"	4"	12"	12"
4"	4"	16"	14"
4"	6"	16"	14"
6"	6"	25"	21"
6"	8"	25"	21"



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STANDARD WATER DETAILS

OPEN SYSTEM
DOMESTIC WATER SERVICE
w/FIRE SUPPLY NOTES

ISSUED
01/01/26

PLATE
W-23a

NOTES:

1. PERMANENT BRICK, CONCRETE OR APPROVED PRECAST PIPE SUPPORTS (NOT SHOWN) TO BE PLACED UNDER ALL FLANGED FITTINGS AND AS DIRECTED BY THE COUNTY.
2. LOADS: L.L. = AASHTO H-20, D.L. = EARTH @ 110 LBS PER CU FT AND 42 LBS PER CU FT EQUIVALENT FLUID PRESSURE.
3. CONCRETE AND REINFORCING SHALL CONFORM TO STANDARD SPECIFICATIONS.
4. PROVIDE POSITIVE DRAINAGE AWAY FROM VAULT.
5. PROVIDE A REDUCER AT THESE LOCATIONS WHEN THE METER SIZE IS SMALLER THAN THE BACKFLOW PREVENTER.
6. ALL PIPE WITHIN THE VAULT SHALL BE FLANGED.
7. ALL FLANGES AND METERS SHALL RECEIVE STAINLESS STEEL BOLTS AND BRASS NUTS.
8. ALL FITTINGS TO BE BRASS OR DUCTILE IRON.
9. SUMP SHALL HAVE AN 8" MIN DIA AND A 4" MIN DEPTH.
10. PRIOR TO ORDERING THE VAULT, METER SETTING AND BACKFLOW PREVENTER, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE DIVISION OF WATER AND SEWER FOR APPROVAL.
11. THE EXTERIOR OF THE CONCRETE VAULT SHALL HAVE A FACTORY APPLIED BITUMINOUS COATING.
12. FOR METER SIZES LESS THAN 6", PROVIDE 2" DIAMETER TEST PORT. FOR METER SIZES 6" AND LARGER, PROVIDE 3" DIAMETER TEST PORT.

FIRE BACKFLOW PREVENTER SIZE	A	B	C
3"	48"	24"	120"
4"	72"	24"	168"
6"	78"	30"	192"
8"	90"	30"	216"
10"	90"	30"	240"

DOMESTIC METER SIZE	DOMESTIC BACKFLOW PREVENTER SIZE	D	E
1 1/2"	1 1/2"	6"	7"
1 1/2"	2"	6"	7"
2"	2"	6"	7"
2"	3"	6"	7"
3"	3"	12"	12"
3"	4"	12"	12"
4"	4"	16"	14"
4"	6"	16"	14"
6"	6"	25"	21"
6"	8"	25"	21"



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STANDARD WATER DETAILS

CLOSED SYSTEM
DOMESTIC WATER SERVICE
w/FIRE SUPPLY NOTES

ISSUED
01/01/26

PLATE
W-24a

NOTES:

1. PERMANENT BRICK, CONCRETE OR APPROVED PRECAST PIPE SUPPORTS (NOT SHOWN) TO BE PLACED UNDER ALL FLANGED FITTINGS AND AS DIRECTED BY THE COUNTY.
2. LOADS: L.L. = AASHTO H-20, D.L. = EARTH @ 110 LBS PER CU FT AND 42 LBS PER CU FT EQUIVALENT FLUID PRESSURE.
3. CONCRETE AND REINFORCING SHALL CONFORM TO STANDARD SPECIFICATIONS.
4. PROVIDE POSITIVE DRAINAGE AWAY FROM VAULT.
5. PROVIDE A REDUCER AT THESE LOCATIONS WHEN THE METER SIZE IS SMALLER THAN THE BACKFLOW PREVENTER.
6. ALL PIPE WITHIN THE VAULT SHALL BE FLANGED DUCTILE IRON.
7. ALL FLANGES AND METERS SHALL RECEIVE STAINLESS STEEL BOLTS AND BRASS NUTS.
8. SUMP SHALL HAVE AN 8" MIN DIA AND A 4" MIN DEPTH.
9. PRIOR TO ORDERING THE VAULT, METER SETTING AND BACKFLOW PREVENTER, THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE DIVISION OF WATER AND SEWER FOR APPROVAL.
10. THE EXTERIOR OF THE CONCRETE VAULT SHALL HAVE A FACTORY APPLIED BITUMINOUS COATING.
11. FOR METER SIZES LESS THAN 6", PROVIDE 2" DIAMETER TEST PORT. FOR METER SIZES 6" AND LARGER, PROVIDE 3" DIAMETER TEST PORT.

METER SIZE	BACKFLOW PREVENTER SIZE	A	B	C	D (STRAIGHT PIPE SPOOL)	E (TEST PORT SPOOL)
3"	3"	48"	24"	120"	12"	12"
3"	4"	48"	24"	132"	12"	12"
4"	4"	48"	24"	120"	16"	14"
4"	6"	48"	30"	144"	16"	14"
6"	6"	54"	30"	156"	25"	21"
6"	8"	54"	30"	180"	25"	21"
8"	8"	54"	30"	180"	34"	26"
8"	10"	54"	30"	216"	34"	26"
10"	10"	54"	30"	192"	42"	30"
10"	12"	54"	30"	228"	42"	30"



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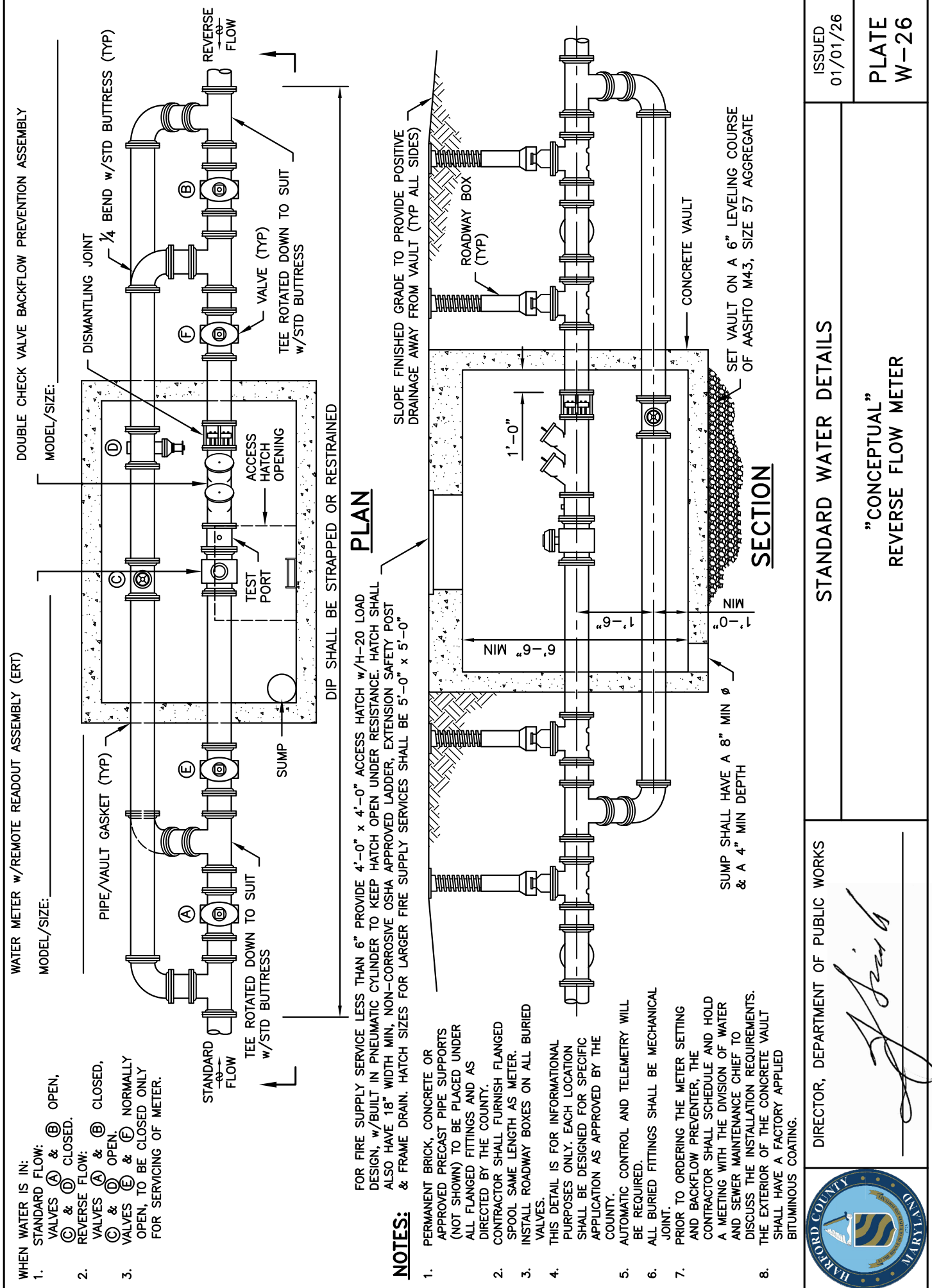
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STANDARD WATER DETAILS

STANDARD INSTALLATION FOR
3" THRU 10" COMBINED
FIRE AND DOMESTIC SERVICE NOTES

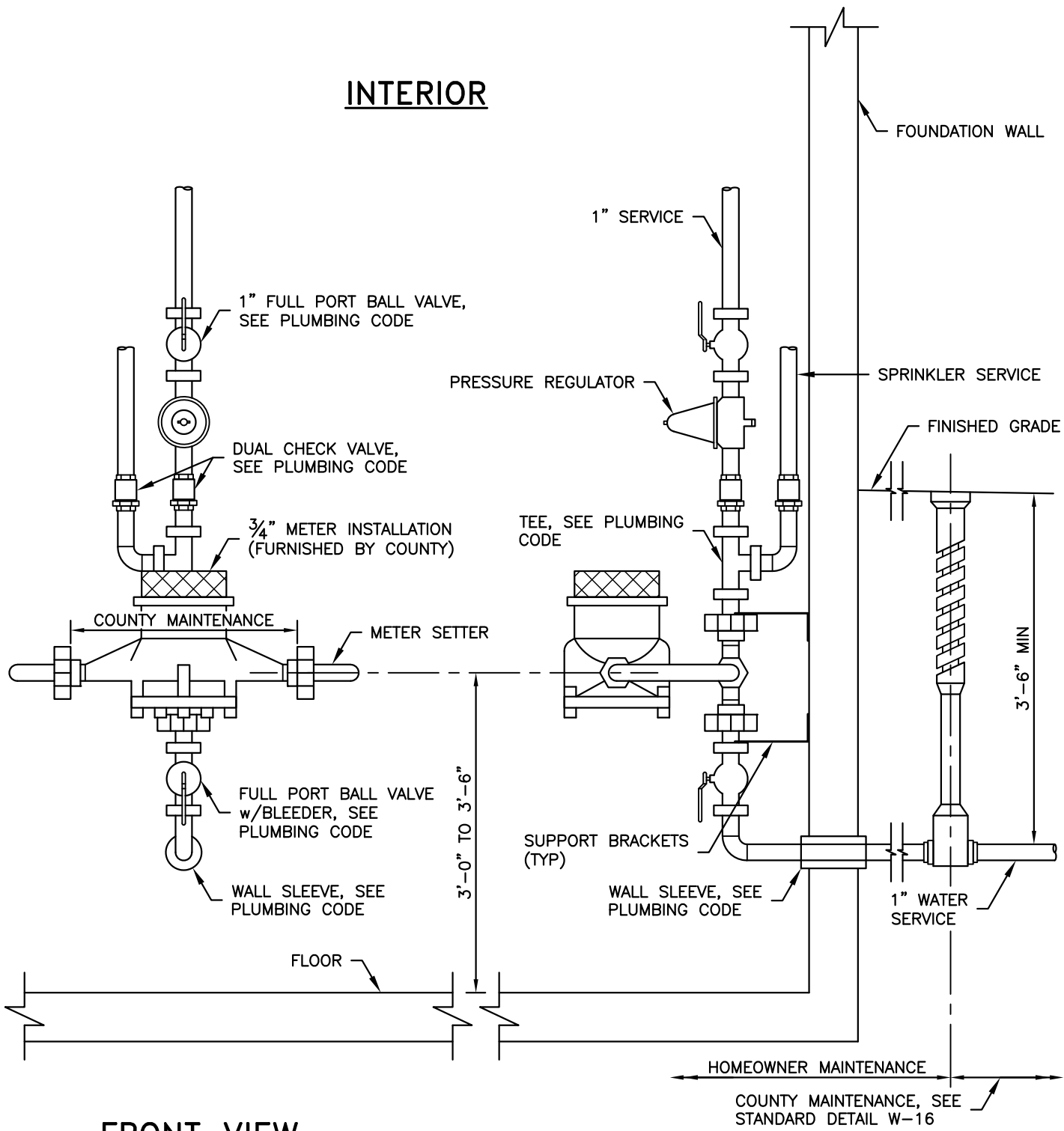
ISSUED
01/01/26

PLATE
W-25a



EXTERIOR

INTERIOR



FRONT VIEW

SIDE VIEW



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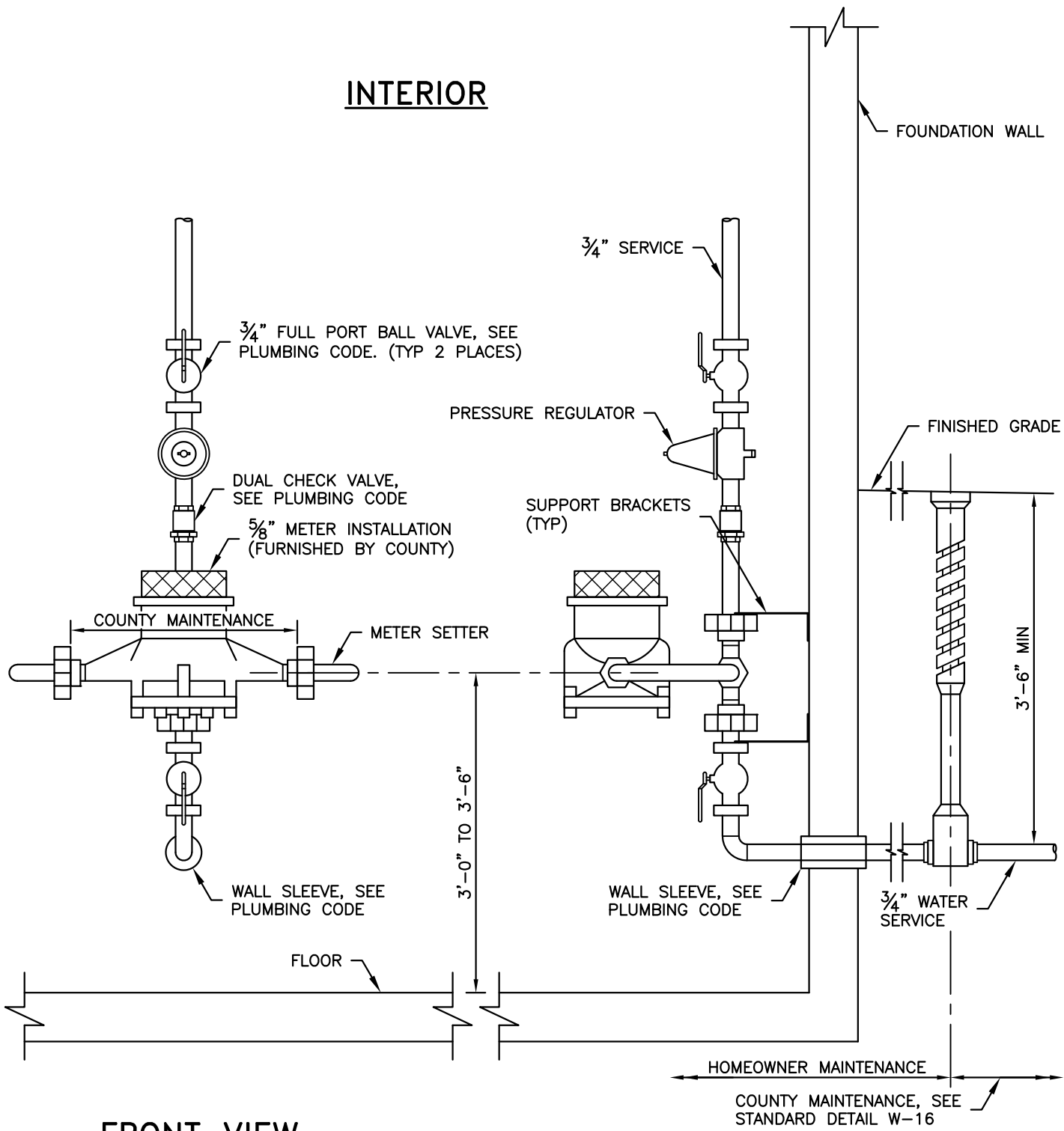
STANDARD WATER DETAILS
INSIDE SETTING
COMBINED DOMESTIC & SPRINKLER SERVICE
(SINGLE FAMILY & TOWNHOUSE UNITS)

ISSUED
01/01/26

**PLATE
W-27**

EXTERIOR

INTERIOR



FRONT VIEW

SIDE VIEW



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STANDARD WATER DETAILS

**INSIDE SETTING
DOMESTIC SERVICE
(SINGLE FAMILY WITHOUT SPRINKLER)**

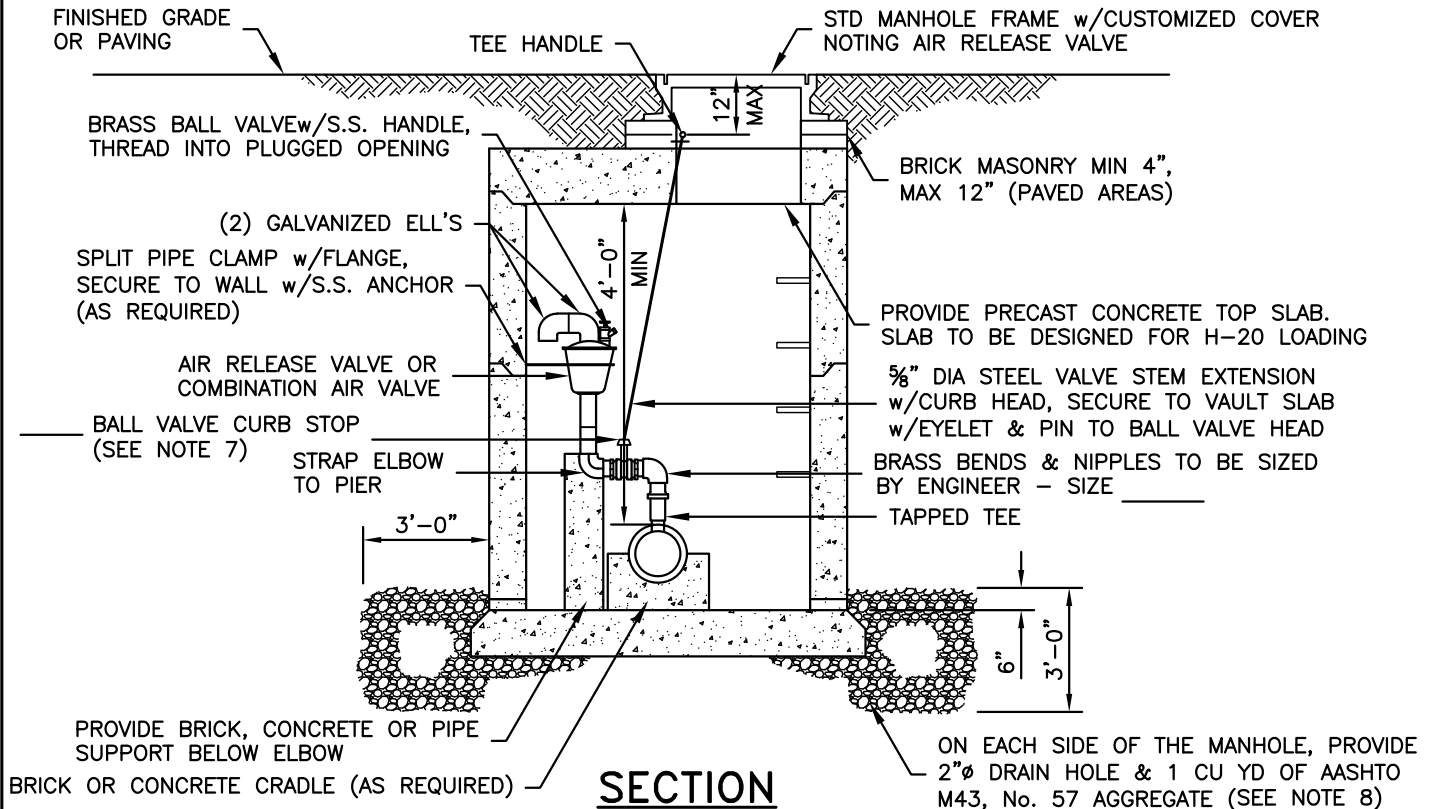
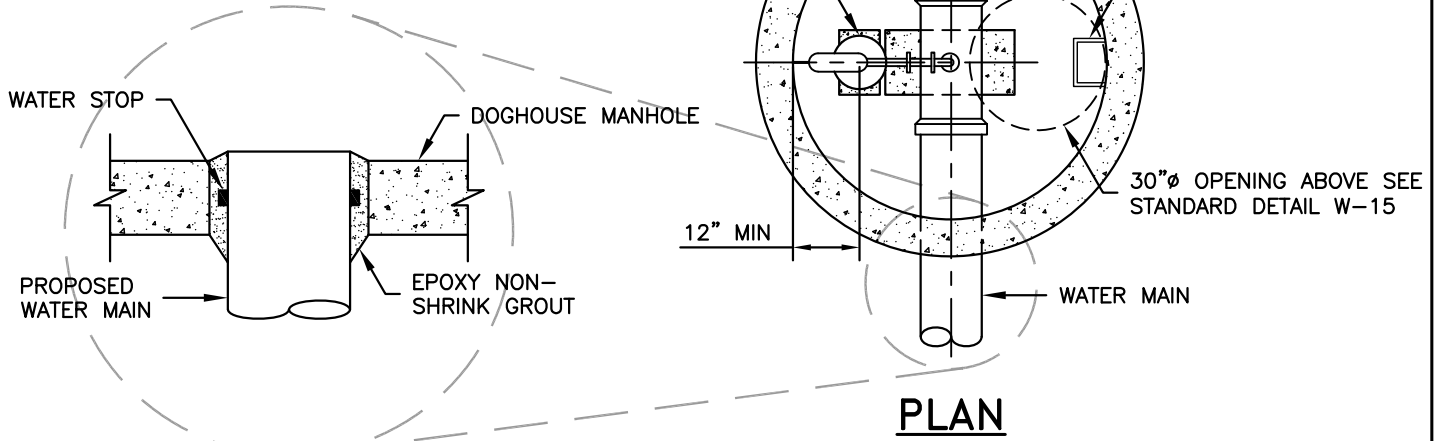
ISSUED
01/01/26

**PLATE
W-28**

TYPICAL 60" PRECAST MANHOLE, UNLESS NOTED OTHERWISE, SEE STANDARD DETAIL S-3

AIR RELEASE VALVE OR COMBINATION VALVE TO BE SIZED BY ENGINEER

MODEL/SIZE: _____



NOTES:

1. ALL FITTINGS BELOW AIR VALVE TO BE HEAVY DUTY THREADED, UNPOLISHED BRASS UNLESS NOTED OTHERWISE.
2. PIPE TAP AND ANGLE VALVE TO BE SIZED BY ENGINEER.
3. SET MANHOLE ON 6" LEVELING COURSE OF AASHTO M43, No. 57 AGGREGATE.
4. VAULTS IN HIGH WATER TABLE AREAS SHALL BE MODIFIED AS REQUIRED BY THE COUNTY.
5. CONTRACTOR MAY USE PRECAST DOGHOUSE TYPE MANHOLE RISER SECTION WITH CAST-IN-PLACE BASE AND SEALED OPENINGS PER INSET.
6. MINIMUM VAULT HEIGHT SHALL BE 6'-6" MEASURED FROM FLOOR TO CEILING.
7. AN ACCEPTABLE ALTERNATIVE TO THE 90° BEND AND BALL VALVE CURB STOP IS AN ANGLE BALL SERVICE VALVE.
8. THE DRAIN HOLES AND GRAVEL SHALL NOT BE INSTALLED IF GROUNDWATER IS ENCOUNTERED DURING CONSTRUCTION.



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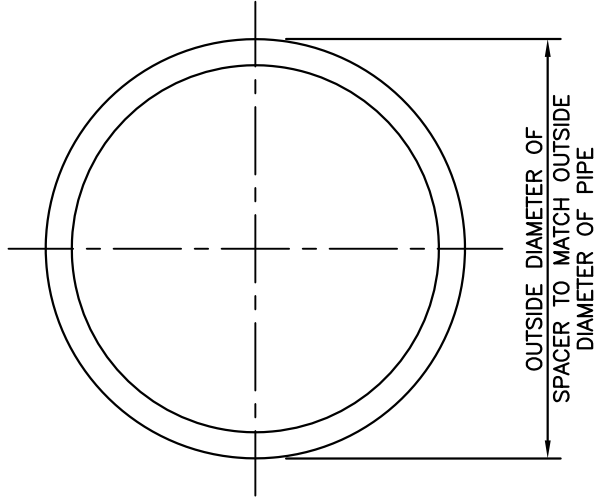
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STANDARD WATER DETAILS

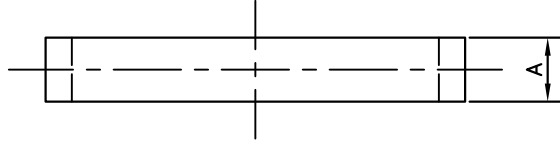
AIR RELEASE VALVE OR
COMBINATION AIR VALVE & VAULT
(20" PIPE AND SMALLER)

ISSUED
01/01/26

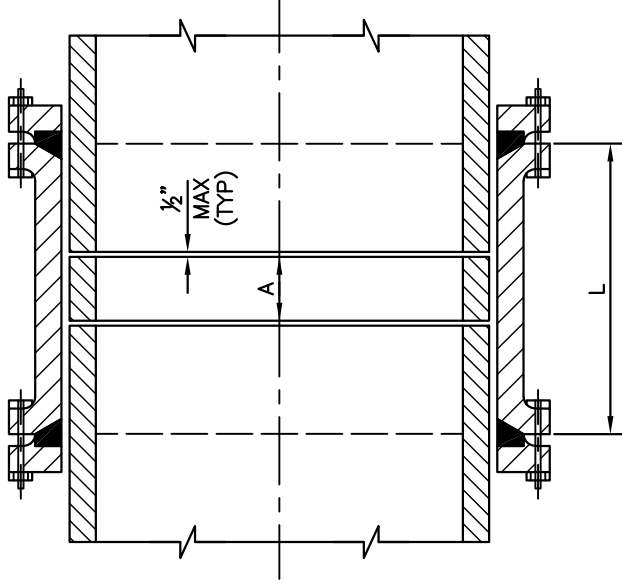
PLATE
W-29



SECTION



ELEVATION



METHOD OF INSTALLATION

SIZE	A(MAX)	L(MIN)
6"	3.25"	12"
8"	3.75"	12"
10"	3.75"	12"
12"	3.75"	12"
16"	3.75"	15"
20"	3.75"	15"
24"	3.75"	15"
30"	4.25"	24"
36"	4.25"	24"

NOTES:

1. SPACER SHALL BE INSTALLED IN ALL CASES WHERE ENDS OF PIPE DO NOT ABUT.
2. ALL SLEEVES SHALL BE LONG PATTERN.



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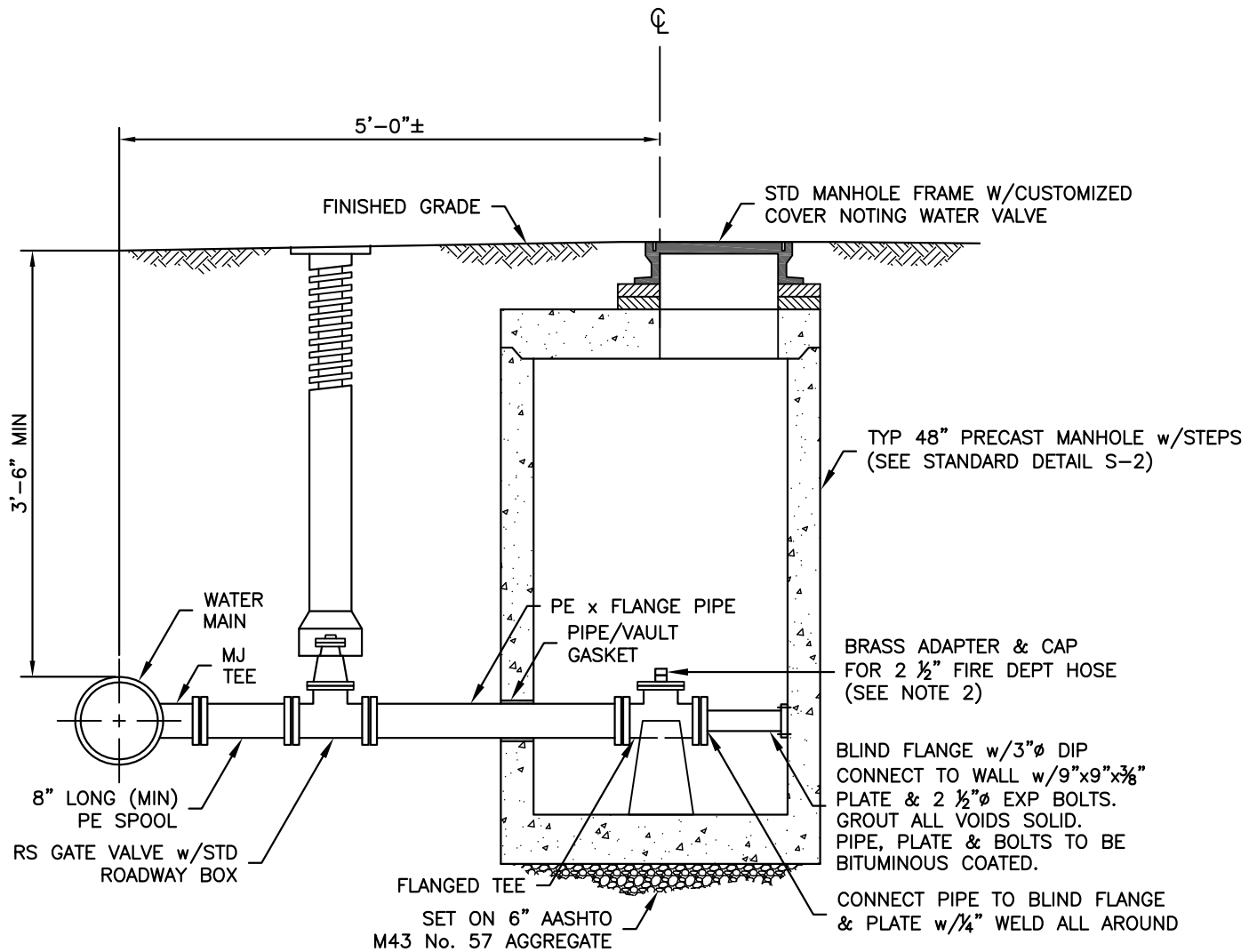
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STANDARD WATER DETAILS

MECHANICAL JOINT SLEEVE
AND SPACER

ISSUED
01/01/26

PLATE
W-30



SECTION

NOTES:

1. ALL PIPING SHALL BE RESTRAINED JOINT DUCTILE IRON PIPE UNLESS NOTED OTHERWISE.
2. HOSE CONNECTION AND CAP THREADS SHALL CONFORM TO ANSI SPECIFICATIONS B26 FOR "NATIONAL (AMERICAN) STANDARD FIRE-HOSE COUPLING SCREW THREAD".
3. MINIMUM VAULT HEIGHT SHALL BE 6'-6" FROM FLOOR TO CEILING.
4. ALL PIPING FROM THE MAIN SHALL BE 6" DIAMETER.
5. ALL JOINTS SHALL BE MECHANICALLY RESTRAINED.



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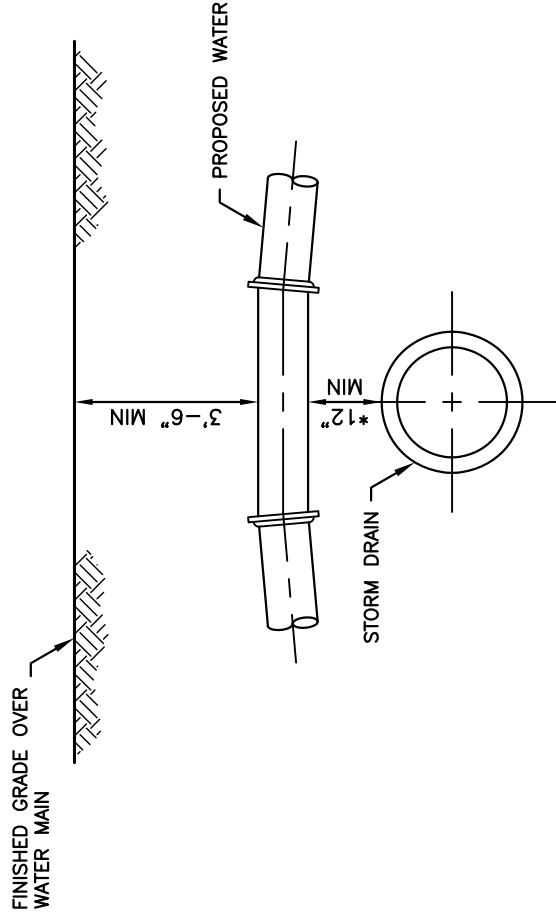
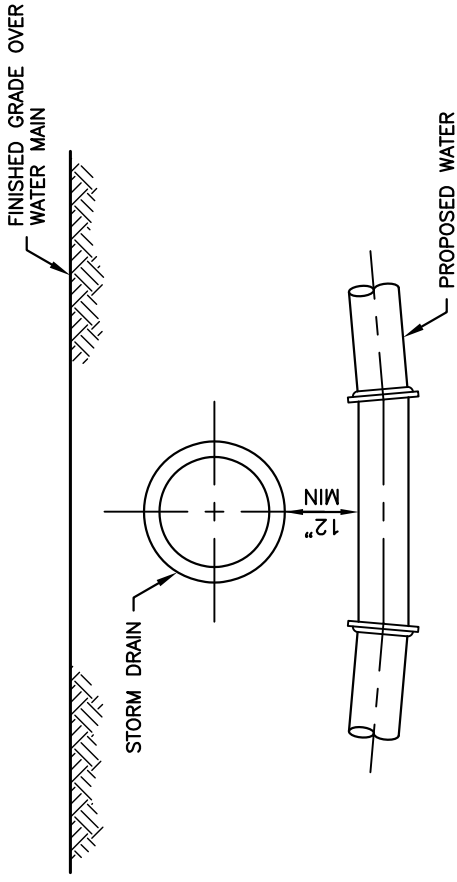
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STANDARD WATER DETAILS

TRANSMISSION LINE
DEWATERING/BLOWOFF

ISSUED
01/01/26

PLATE
W-31



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

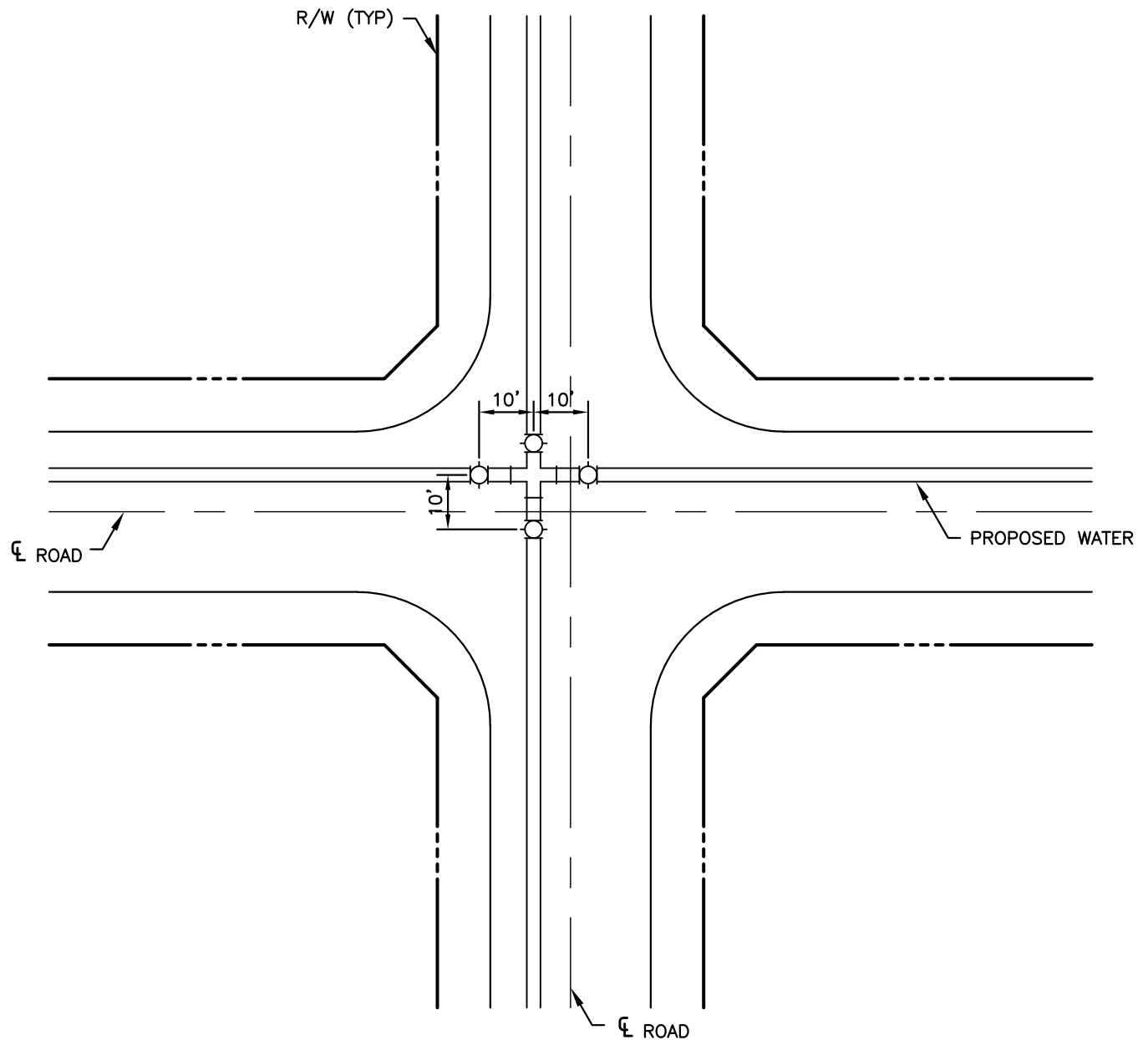
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STANDARD WATER DETAILS

WATER MAIN CROSSING
STORM DRAIN

ISSUED
01/01/26

PLATE
W-32



NOTES:

1. ONLY ONE VALVE MAY BE STRAPPED DIRECTLY TO A BRANCH FITTING. ADDITIONAL VALVES, IF REQUIRED, SHALL BE INSTALLED 10' FROM CROSS OR TEE.
2. THERE SHALL BE NO JOINTS BETWEEN THE CROSS/TEE AND THE VALVES.



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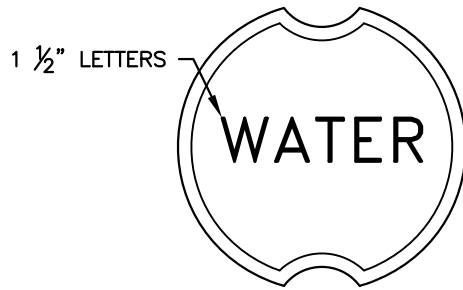
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STANDARD WATER DETAILS

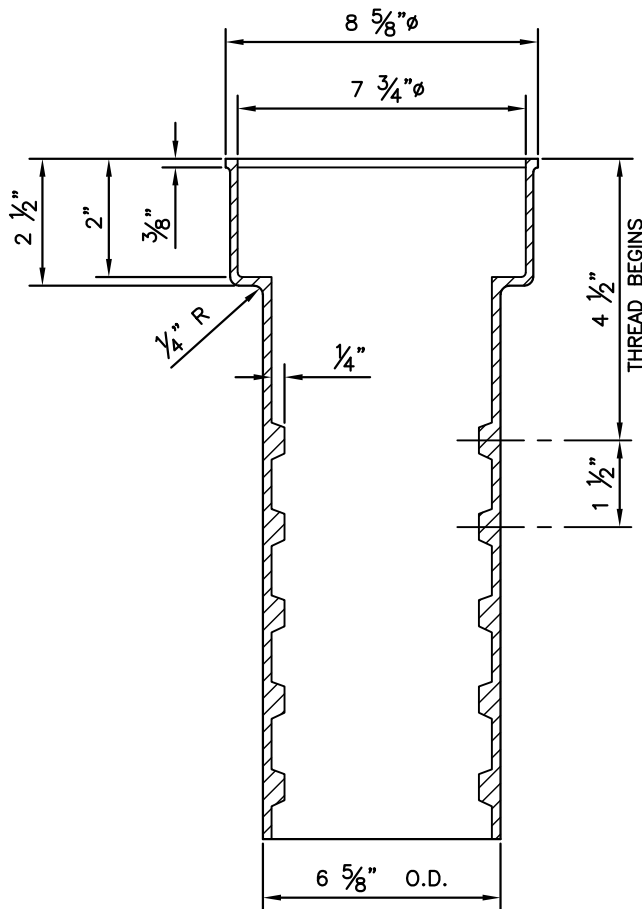
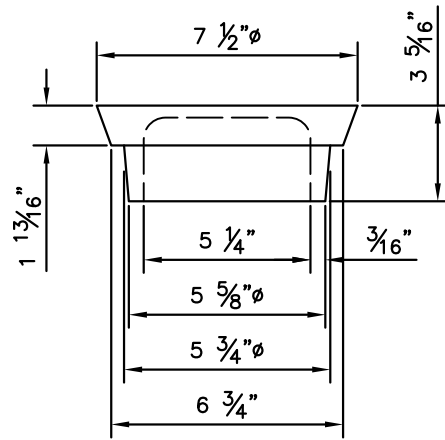
WATER VALVE LOCATION AT
INTERSECTIONS

ISSUED
01/01/25

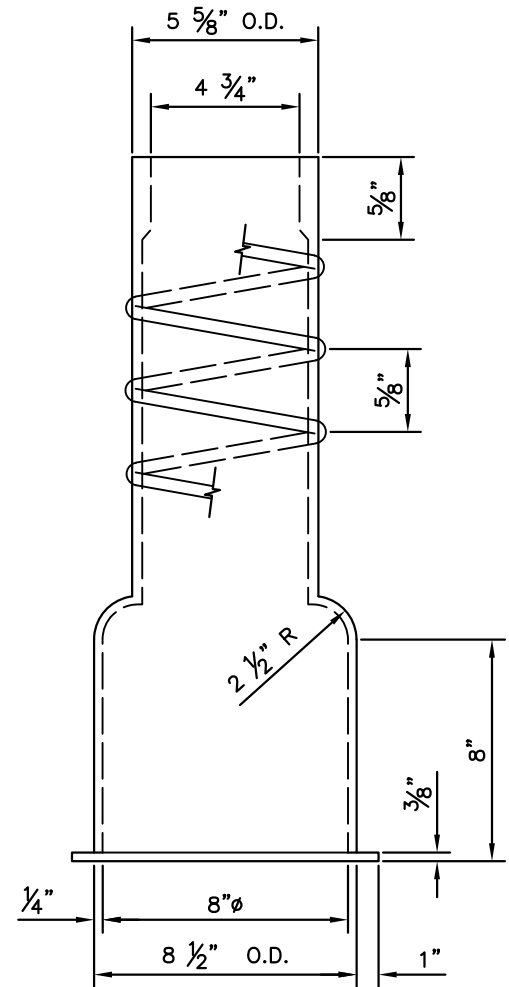
PLATE
W-33



LID



TOP SECTION



BOTTOM PROFILE

NOTES:

1. GRAY IRON SHALL CONFORM TO ASTM A48, CLASS 30 MIN.
2. THE MANUFACTURER IDENTIFICATION AND COUNTRY OF ORIGIN SHALL BE CAST INTO ALL PARTS.
3. SUPPORT VALVE BOX WITH TWO BRICKS LAID PARALLEL TO VALVE BONNETT.



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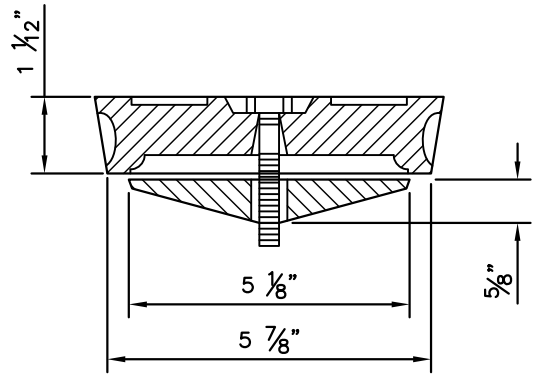
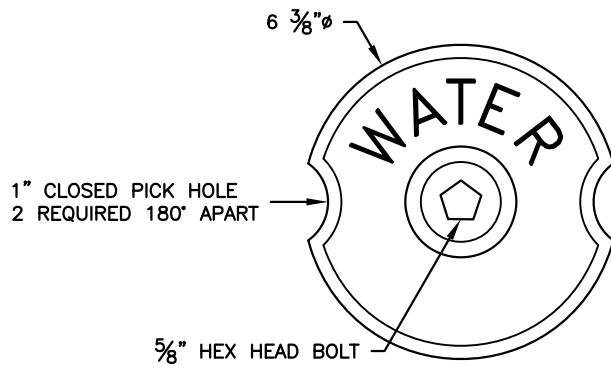
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STANDARD WATER DETAILS

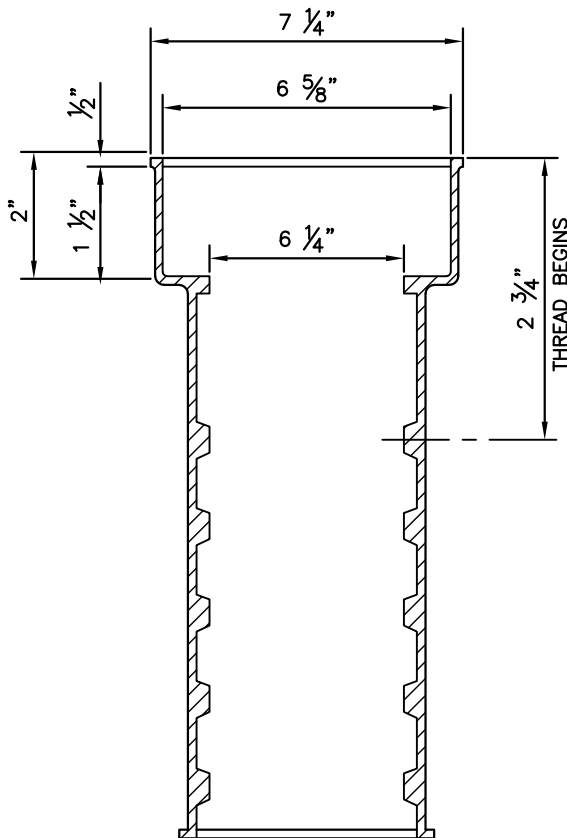
5 1/4" VALVE BOX

ISSUED
01/01/26

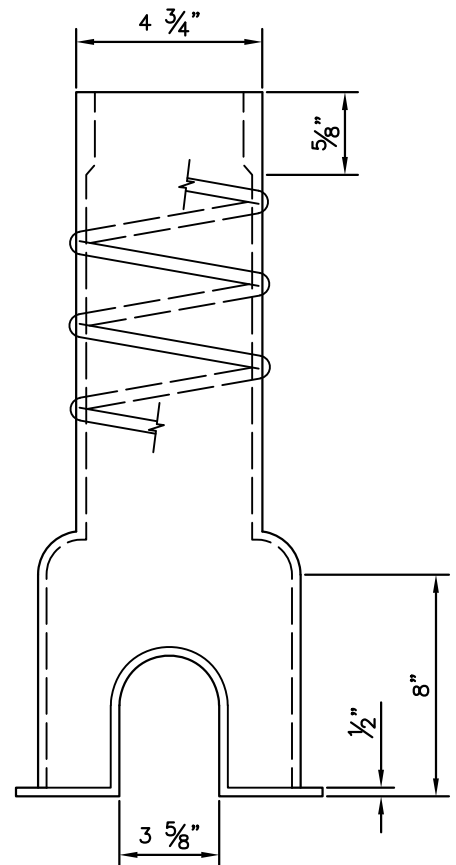
PLATE
W-34



LID



TOP SECTION



BOTTOM PROFILE

NOTES:

1. GRAY IRON SHALL CONFORM TO ASTM A48, CLASS 30 MIN.
2. THE MANUFACTURER IDENTIFICATION AND COUNTRY (IF OTHER THAN U.S.) OF ORIGIN SHALL BE CAST INTO ALL PARTS.
3. SUPPORT VALVE BOX WITH TWO BRICKS LAID PARALLEL TO VALVE BONNETT.



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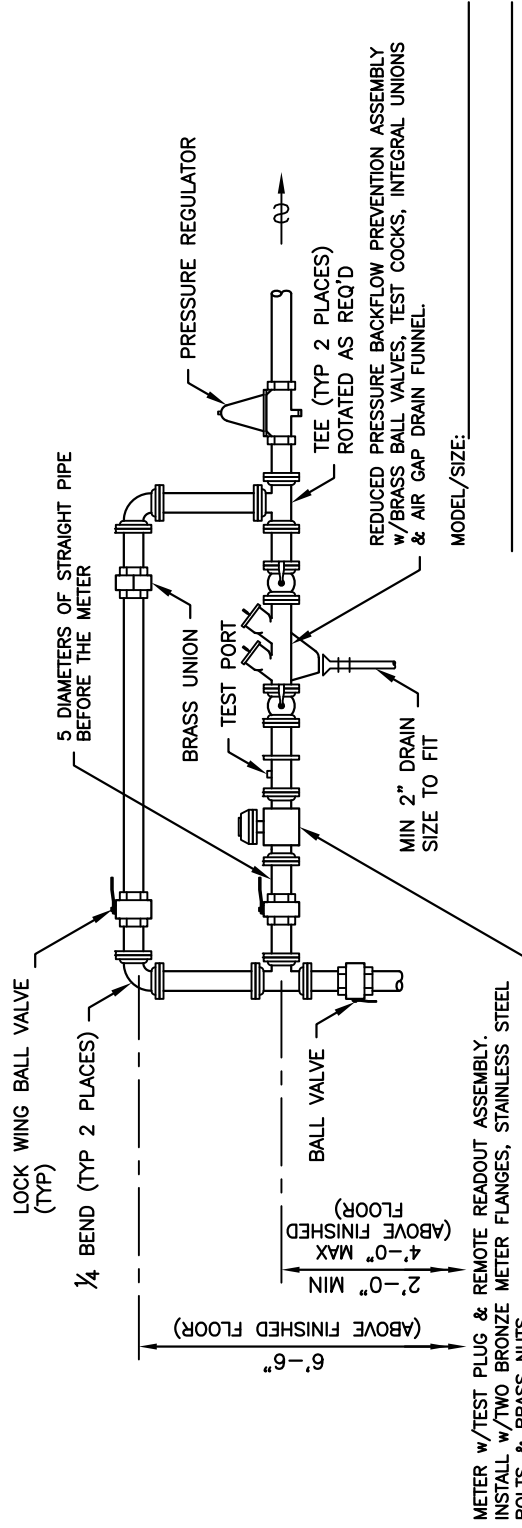
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STANDARD WATER DETAILS

4 $\frac{1}{4}$ " CURB BOX
WITH LOCK LID

ISSUED
01/01/26

PLATE
W-35



ELEVATION

NOTES:

1. INSTALL CORROSIVE RESISTANT WELDED CANTILEVERED WALL BRACKETS AS REQUIRED BY HARFORD COUNTY TO SUPPORT THE EQUIPMENT AND PIPING.
2. TYPE 'K' COPPER TUBING SHALL BE CONTINUOUS TO THE BALL VALVE.
3. BYPASS PIPING SHALL BE THREADED BRASS.
4. ALL FITTINGS AND NIPPLES SHALL BE BRASS WITH APPROPRIATE ADAPTERS.
5. ALL COMPONENTS SHALL BE LEAD FREE.



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[Signature]

STANDARD WATER DETAILS

SEWAGE PUMPING STATION WATER METER
w/BACKFLOW PREVENTER

ISSUED
01/01/26

PLATE
W-36

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STANDARD SEWER DETAILS

ISSUED 1/1/2026

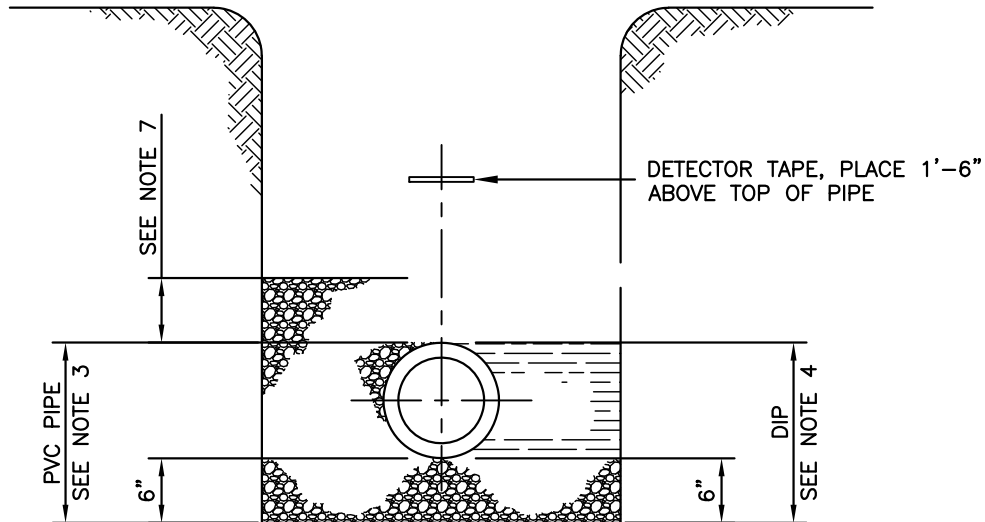
S1	Pipe Bedding
S2	48" Precast Manhole for 21" Pipe and Smaller
S3	60" Precast Manhole for 24" to 30" Pipe
S4	72" and Larger Manholes for 36" Pipe and Larger
S5	Round Shallow Manhole Brick Construction
S6	Square Shallow Manhole Brick Construction
S7	Offset Manhole
S8	Terminal Manhole
S9	Manhole with Offsite/Unimproved Area
S10	Built-in-Place Main Drop at Manhole Type "A" and "B"
S11	48" Manhole with Precast Collars for Main Drop Connection (8" Diameter Pipe)
S12	Method of Connection to Existing Manhole
S13	Plans for Manhole Channeling
S14	Standard Manhole Frame and Cover
S15	Locking Manhole Frame and Cover; Non-Watertight
S16	Watertight Manhole Frame and Cover
S17	Metal Step
S18	Plastic Step
S19	Sewer Service Connection at Main
S20	Ductile Iron Drop Sewer Service Connection at Main
S21	Sewer Service Connection Clean-out
S22	Concrete Anchors
S23	Lamphole
S24	Sewage Combination Air Valve in Manhole
S25	Pump Around
S26	Precast Manhole Setting within 5 LF of Face of Curb
S27	Sanitary Cleanout in Paving
S28	Force Main Discharge Manhole (4" Diameter Pipe and Greater)
S29	Manhole Vent
S30	Abandonment of Pipe at Manhole
S31	Complete Manhole Abandonment

STANDARD SEWER DETAILS (CONTINUED)

ISSUED 1/1/2026

- S32 Manhole Channel Detail
- S33 Brick Manhole Conversion to Precast Concrete

NOTE: TRENCH TO BE COMPACTED
AS PER SPECIFICATIONS.



SECTION

NOTES:

1. UNLESS NOTED OTHERWISE, ALL ROAD REPAIR SHALL BE DONE IN ACCORDANCE WITH THE LATEST REVISION OF THE HARFORD COUNTY OR MARYLAND STATE ROAD CODE.
2. ALL PIPE SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PIPE MANUFACTURER AND COUNTY APPROVAL.
3. PVC PIPE SHALL BE BACKFILLED WITH AASHTO M43, No. 57 AGGREGATE TO TOP OF PIPE.
4. DUCTILE IRON PIPE SHALL BE INSTALLED ON 6" AASHTO M43, No. 57 AGGREGATE AND HAVE APPROVED COMPACTED BACKFILL MATERIAL CONSOLIDATED TO TOP OF PIPE.
5. SANITARY SEWER FORCE MAINS SHALL BE INSTALLED AS PER STANDARD DETAIL W-1.
6. PROVIDE CONTINUOUS BEARING FOR FULL LENGTH OF PIPE.
7. AGGREGATE SHALL CONTINUE TO 6" ABOVE TOP OF PIPE WHEN USING PVC WITH DEPTHS OF COVER GREATER THAN 14'.



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STANDARD SEWER DETAILS

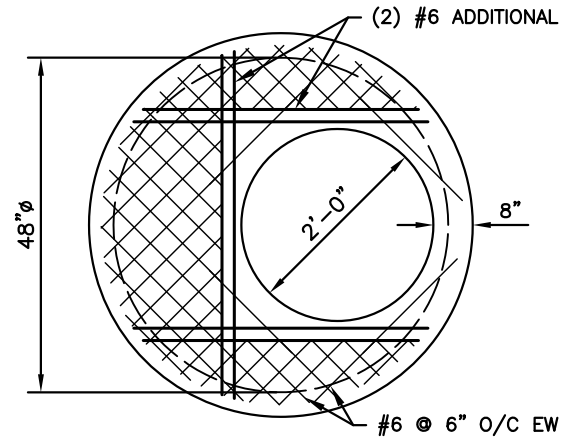
PIPE BEDDING

ISSUED
01/01/26

PLATE
S-1

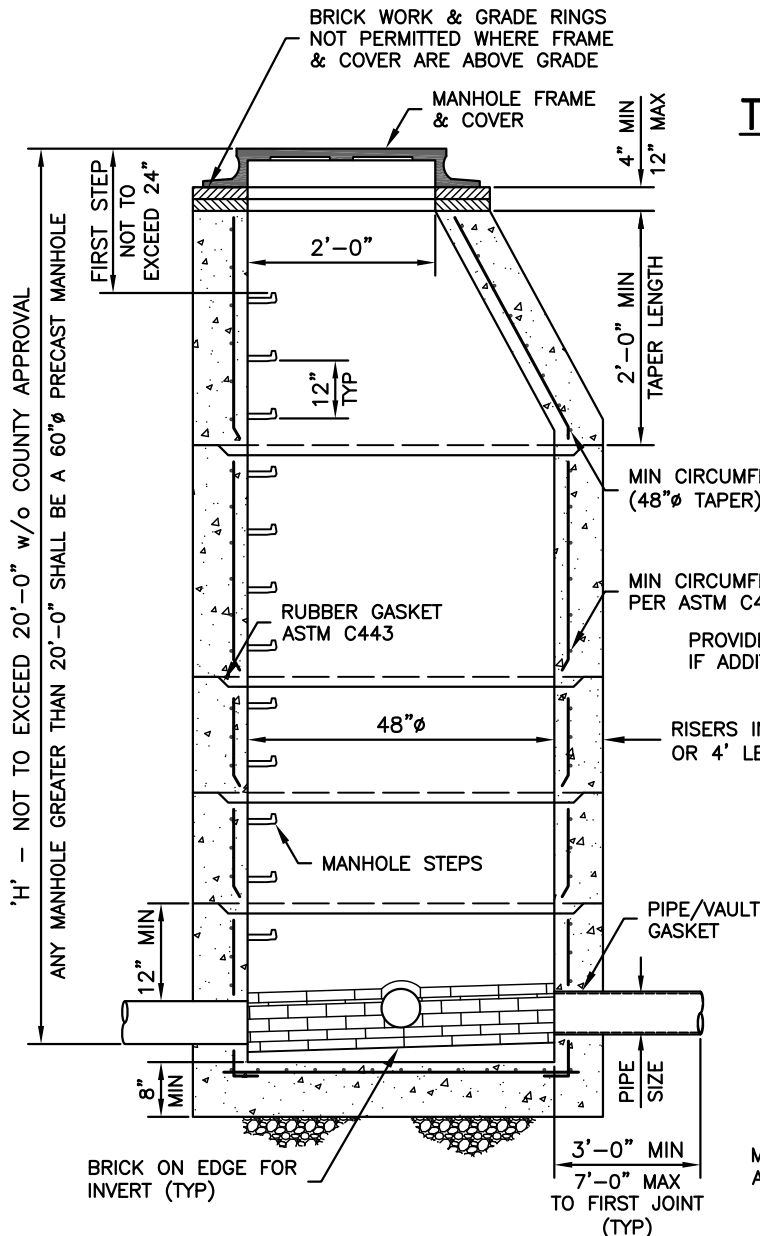
NOTES:

1. EXCEPT AS NOTED, MANHOLE TAPERS, RISERS AND BASES SHALL BE FURNISHED IN STRICT ACCORDANCE WITH ASTM DESIGNATION C478 (LATEST) FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".
2. CONCRETE FOR PRECAST CONSTRUCTION SHALL BE 4000 PSI MINIMUM.
3. REINFORCING FOR TYPE A-3 IS SAME AS TYPE A-2.
4. MANHOLE STEPS SHALL BE SPACED AS SHOWN IN A SINGLE VERTICAL ALIGNMENT. THE STEPS SHALL NOT BE STAGGERED.
5. TOP OF BENCH TO MATCH CROWN OF PIPE.
6. NO INTERIOR SURFACES SHALL RECEIVE PARGING WITHOUT COUNTY APPROVAL.
7. GRADE RINGS SHALL BE SET ON A FULL BED OF MORTAR.

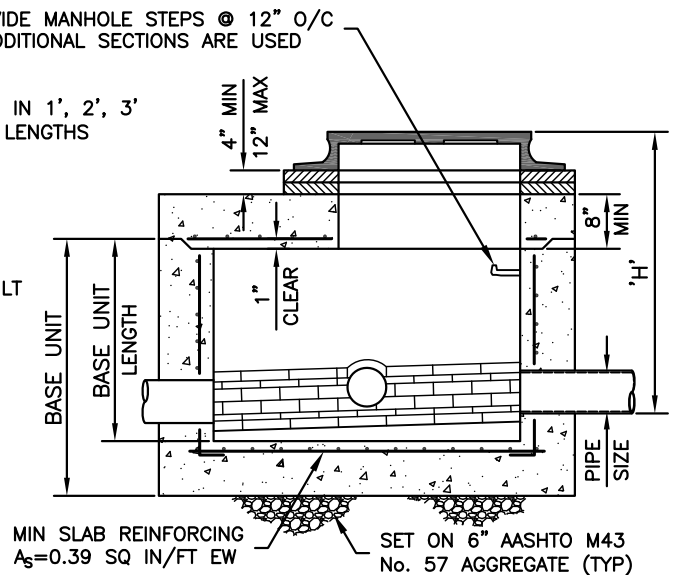


SLAB REINFORCING FOR TYPE A-3 PRECAST MANHOLE

PIPE SIZE	BASE UNIT LENGTH (MIN)	MIN 'H' FOR A-2 MAX 'H' FOR A-3
8"	2'-0"	5'-0"
12" TO 15"	3'-0"	6'-0"
18" TO 21"	4'-0"	7'-0"



48" TYPE A-2



SHALLOW PRECAST MANHOLE 48" TYPE A-3



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STANDARD SEWER DETAILS

48" PRECAST MANHOLE FOR
21" PIPE AND SMALLER

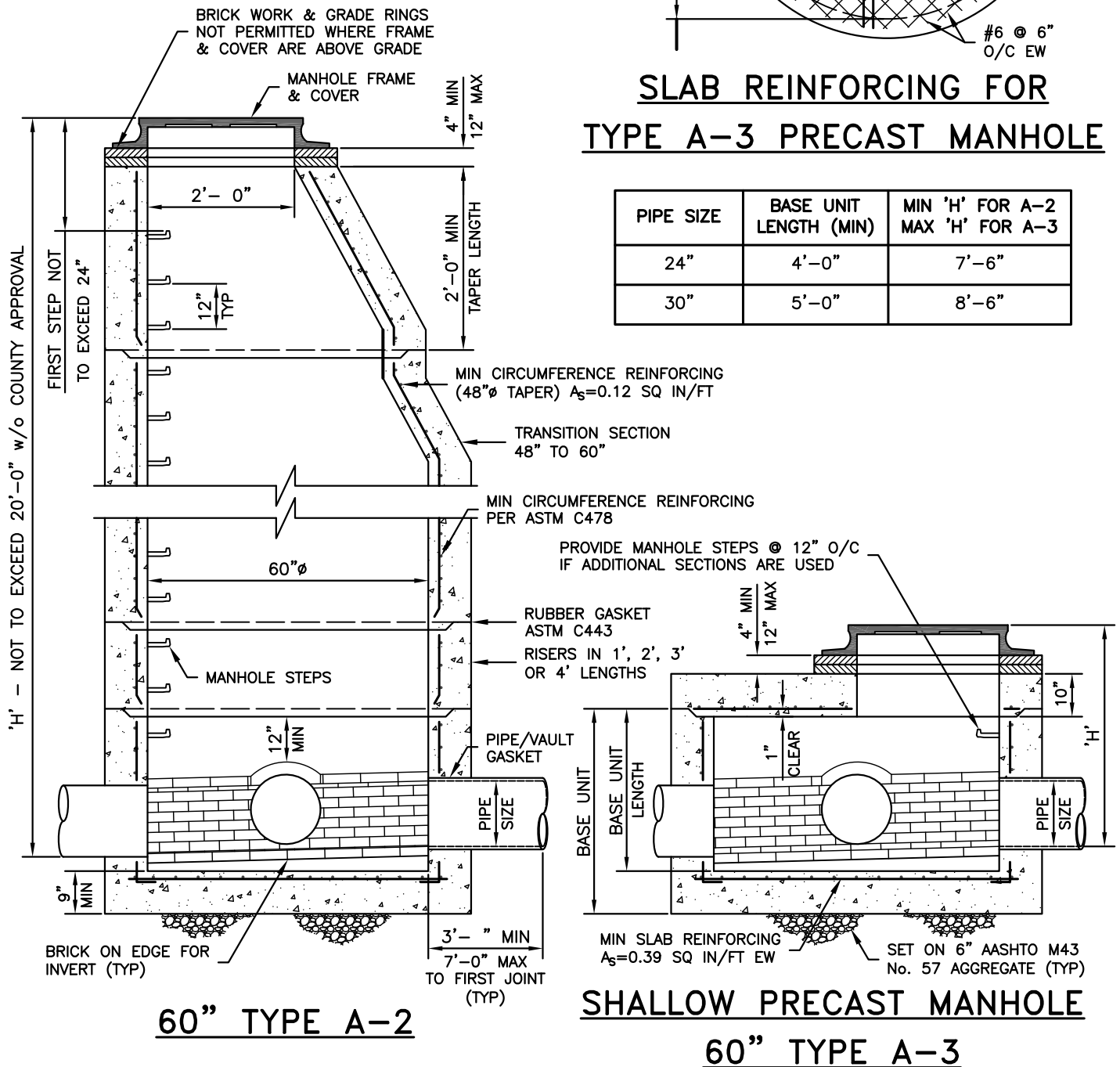
ISSUED
01/01/26

PLATE
S-2

1. EXCEPT AS NOTED, MANHOLE TAPERS, RISERS AND BASES SHALL BE FURNISHED IN STRICT ACCORDANCE WITH ASTM DESIGNATION C478 (LATEST) FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".
2. CONCRETE FOR PRECAST CONSTRUCTION SHALL BE 4000 PSI MINIMUM.
3. REINFORCING FOR TYPE A-3 IS SAME AS TYPE A-2.
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5. TOP OF BENCH TO MATCH CROWN OF PIPE.
6. NO INTERIOR SURFACES SHALL RECEIVE PARGING WITHOUT COUNTY APPROVAL.
7. GRADE RINGS SHALL BE SET ON A FULL BED OF MORTAR.



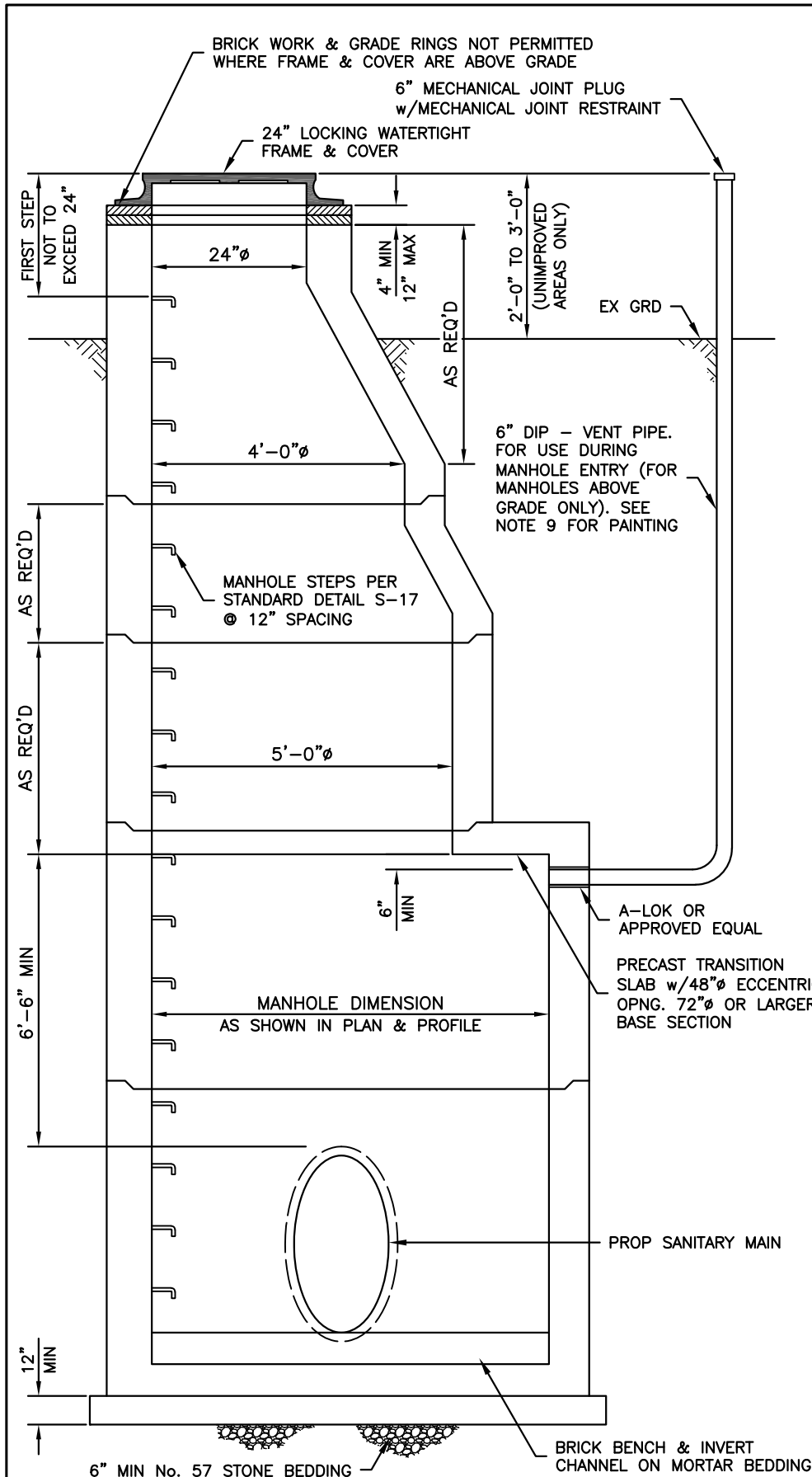
PIPE SIZE	BASE UNIT LENGTH (MIN)	MIN 'H' FOR A-2 MAX 'H' FOR A-3
24"	4'-0"	7'-6"
30"	5'-0"	8'-6"



J. Smith

60" PRECAST MANHOLE FOR
24" TO 30" PIPE

PLATE
S-3



NOTES:

1. MANHOLE SHALL MEET THE REQUIREMENTS OF ASTM C478 AND APPROVED HARFORD COUNTY STANDARD SPECIFICATIONS. CONCRETE SHALL BE 4000 PSI MIN.
2. CONE TRANSITION MAY BE USED IN PLACE OF TRANSITION SLAB WHERE SPACE ALLOWS.
3. BASE SECTION AND TRANSITION SLAB DESIGNS SHALL BE PREPARED AND CERTIFIED BY A MARYLAND LICENSED PROFESSIONAL ENGINEER.
4. MANHOLE FRAME AND COVER SHALL BE WATERTIGHT IN ACCORDANCE WITH HARFORD COUNTY STANDARD DETAIL S-17. INSTALLATION SHALL BE IN ACCORDANCE WITH HARFORD COUNTY STANDARD DETAIL S-8.
5. PROVIDE RUBBER COMPRESSION GASKET FOR PIPE CONNECTION TO CONCRETE BASE, A-LOK OR APPROVED EQUAL.
6. MANHOLE BENCHES AND INVERT CHANNELS SHALL BE CONSTRUCTED OF SEWER BRICK IN ACCORDANCE WITH HARFORD COUNTY STANDARD SPECIFICATIONS AND DETAILS. EDGE OF BENCH SHALL MATCH CROWN OF THE LARGEST PIPE. BENCH SHALL SLOPE TOWARD THE CHANNEL AT 1" PER FOOT.
7. PROVIDE PIPE JOINT WITHIN 5 FEET OF THE OUTSIDE WALL OF MANHOLE.
8. WHERE DEPTH OF COVER OVER THE PROPOSED TOP OF PIPE IS LESS THAN 6'-6" THERE SHALL BE NO TRANSITION SMALLER MANHOLE SECTION. THE MANHOLE WIDTH AT THE BASE SHALL EXTEND FULLY ABOVE GRADE TO PROVIDE A MINIMUM OF 6'-6" HEAD ROOM WITHIN THE MANHOLE. A TOP SLAB SHALL BE INSTALLED WITH THE MANHOLE FRAME CAST INTO THE TOP SLAB. IN ALL CASES THE TOP OF MANHOLE SHALL BE 2'-0" TO 3'-0" ABOVE GRADE.
9. VENT PIPE COATING TO BE THE SAME AS ON MANHOLE FRAME AND COVER.



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[Signature]

STANDARD SEWER DETAILS

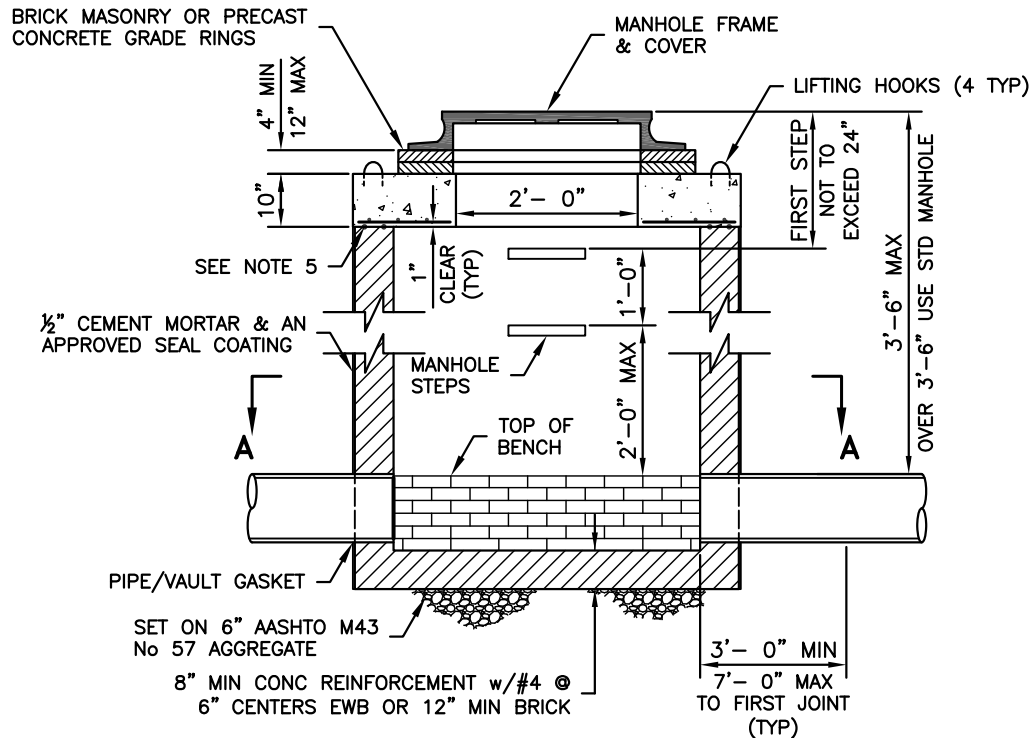
72" AND LARGER MANHOLES FOR
36" PIPE AND LARGER

ISSUED
01/01/26

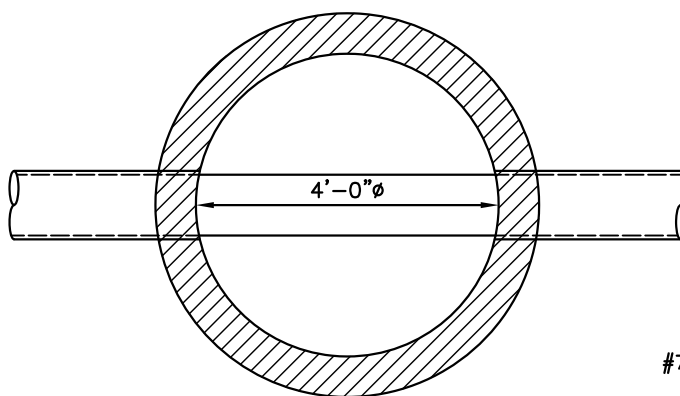
PLATE
S-4

NOTES:

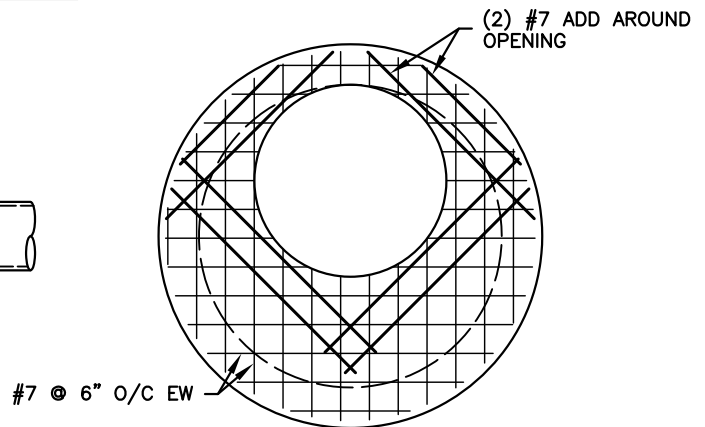
1. ALL CONCRETE SHALL BE MIX No 1.
2. WALLS SHALL BE 8" THICK THROUGHOUT, EXCEPT WHERE DIRECTED.
3. BENCH FULL HEIGHT OF PIPE AS SHOWN FOR MANHOLES.
4. SLABS SHALL HAVE HOOKS OR HOLES FOR LIFTING ON ALL BUILT-IN-PLACE SHALLOW MANHOLES.
5. IF SLAB IS PRECAST (FACTORY OR ONSITE) PROVIDE (2) 3/4" CONTINUOUS BANDS OF MASTIC ROPE.
6. GRADE RINGS SHALL BE SET ON A FULL BED OF MORTAR.



PLAN



SECTION A-A



TOP SLAB



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[Signature]

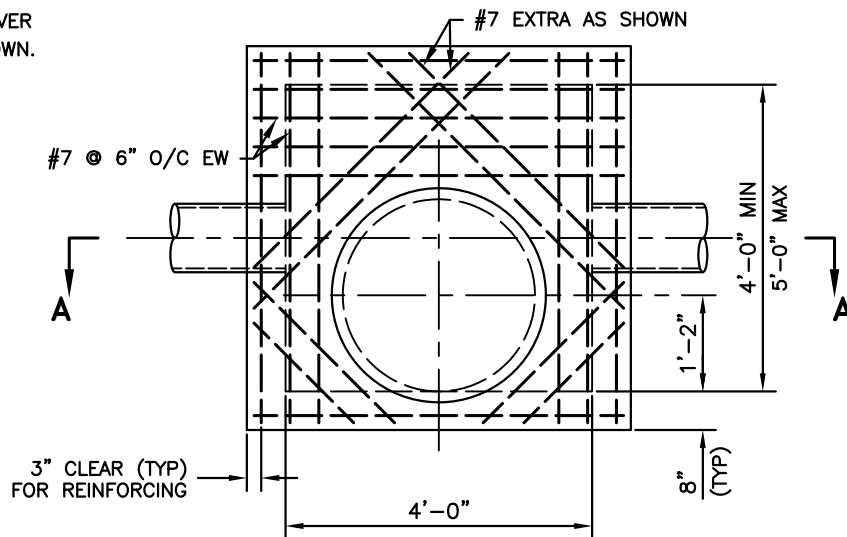
STANDARD SEWER DETAILS

ROUND SHALLOW MANHOLE
BRICK CONSTRUCTION

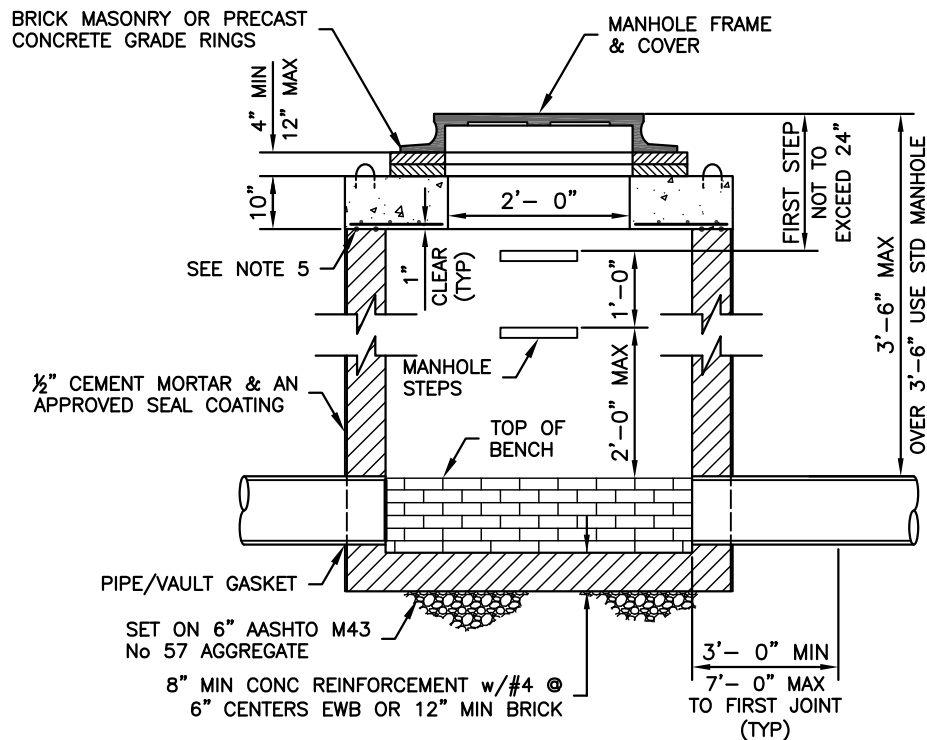
ISSUED
01/01/26

PLATE
S-5

MANHOLE FRAME & COVER
TO BE PLACED AS SHOWN.



PLAN



SECTION A-A

NOTES:

1. ALL CONCRETE SHALL BE MIX No 1.
2. WALLS SHALL BE 8" THICK THROUGHOUT, EXCEPT WHERE DIRECTED.
3. BENCH FULL HEIGHT OF PIPE AS SHOWN FOR MANHOLES.
4. SLABS SHALL HAVE HOOKS OR HOLES FOR LIFTING ON ALL BUILT-IN-PLACE SHALLOW MANHOLES.
5. IF SLAB IS PRECAST (FACTORY OR ONSITE) PROVIDE (2) 3/4" CONTINUOUS BANDS OF MASTIC ROPE.
6. GRADE RINGS SHALL BE SET ON A FULL BED OF MORTAR.



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J. Smith

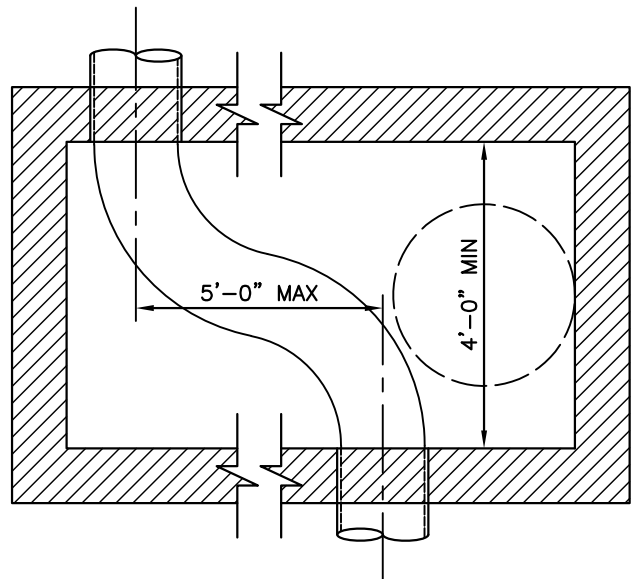
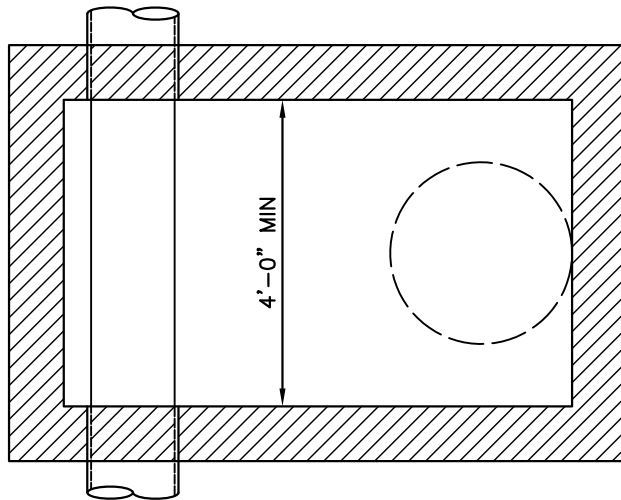
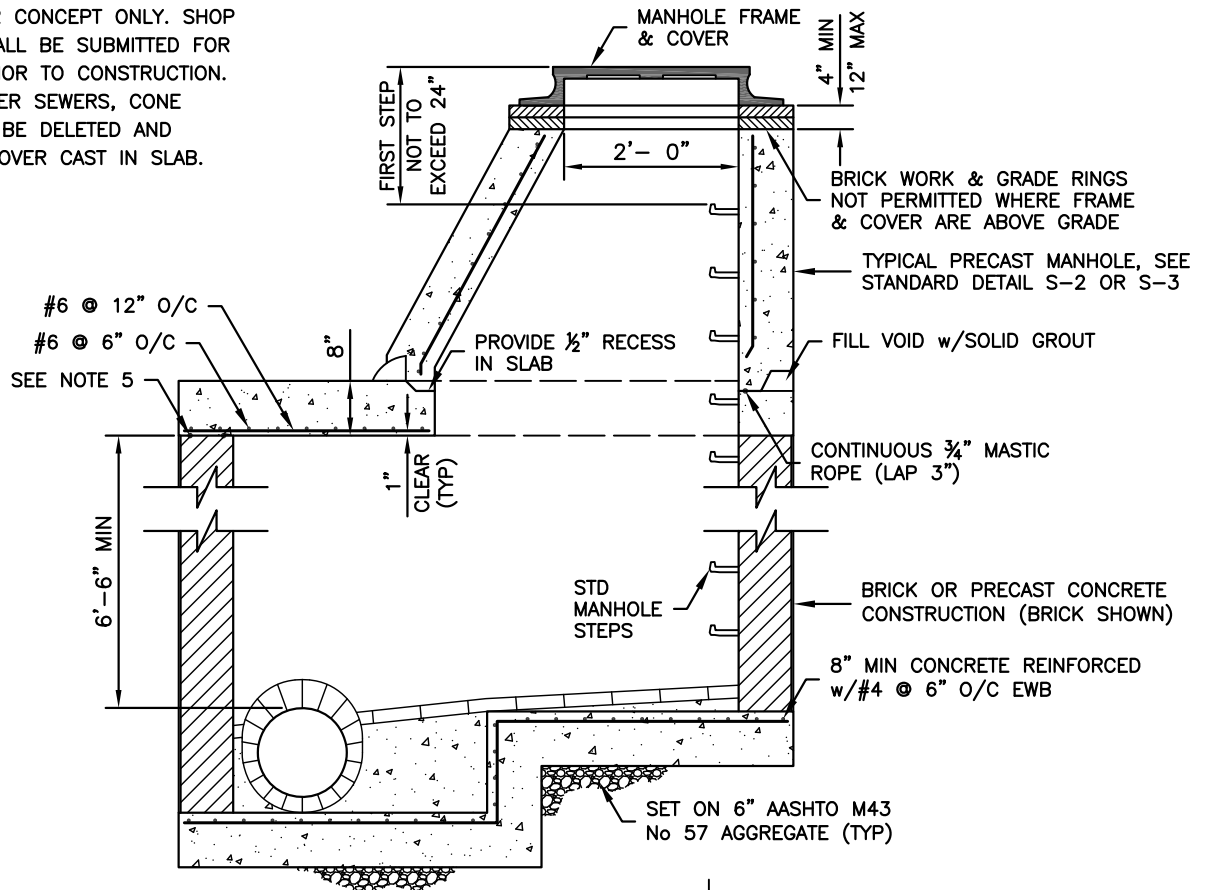
STANDARD SEWER DETAILS

SQUARE SHALLOW MANHOLE BRICK CONSTRUCTION

ISSUED
01/01/26

PLATE
S-6

DETAIL IS FOR CONCEPT ONLY. SHOP DRAWINGS SHALL BE SUBMITTED FOR APPROVAL PRIOR TO CONSTRUCTION. FOR SHALLOWER SEWERS, CONE SECTION MAY BE DELETED AND FRAME AND COVER CAST IN SLAB.



NOTES:

1. ALL CONCRETE SHALL BE MIX No 2.
2. THICKNESS OF WALLS TO BE INCREASED TO 12", 12'-0" BELOW UNDERSIDE OF FRAME (FOR BRICK MANHOLES ONLY).
3. WALLS SHALL BE 8" THICK THROUGHOUT EXCEPT WHERE DIRECTED (FOR BRICK MANHOLES ONLY).
4. APPROVED SEAL COATING TO BE APPLIED TO EXTERIOR CEMENT MORTAR (FOR BRICK MANHOLES ONLY).
5. IF SLAB IS PRECAST (FACTORY OR SITE) PROVIDE (2) 3/4" CONTINUOUS BANDS OF MASTIC ROPE.
6. GRADE RINGS SHALL BE SET ON A FULL BED OF MORTAR.



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

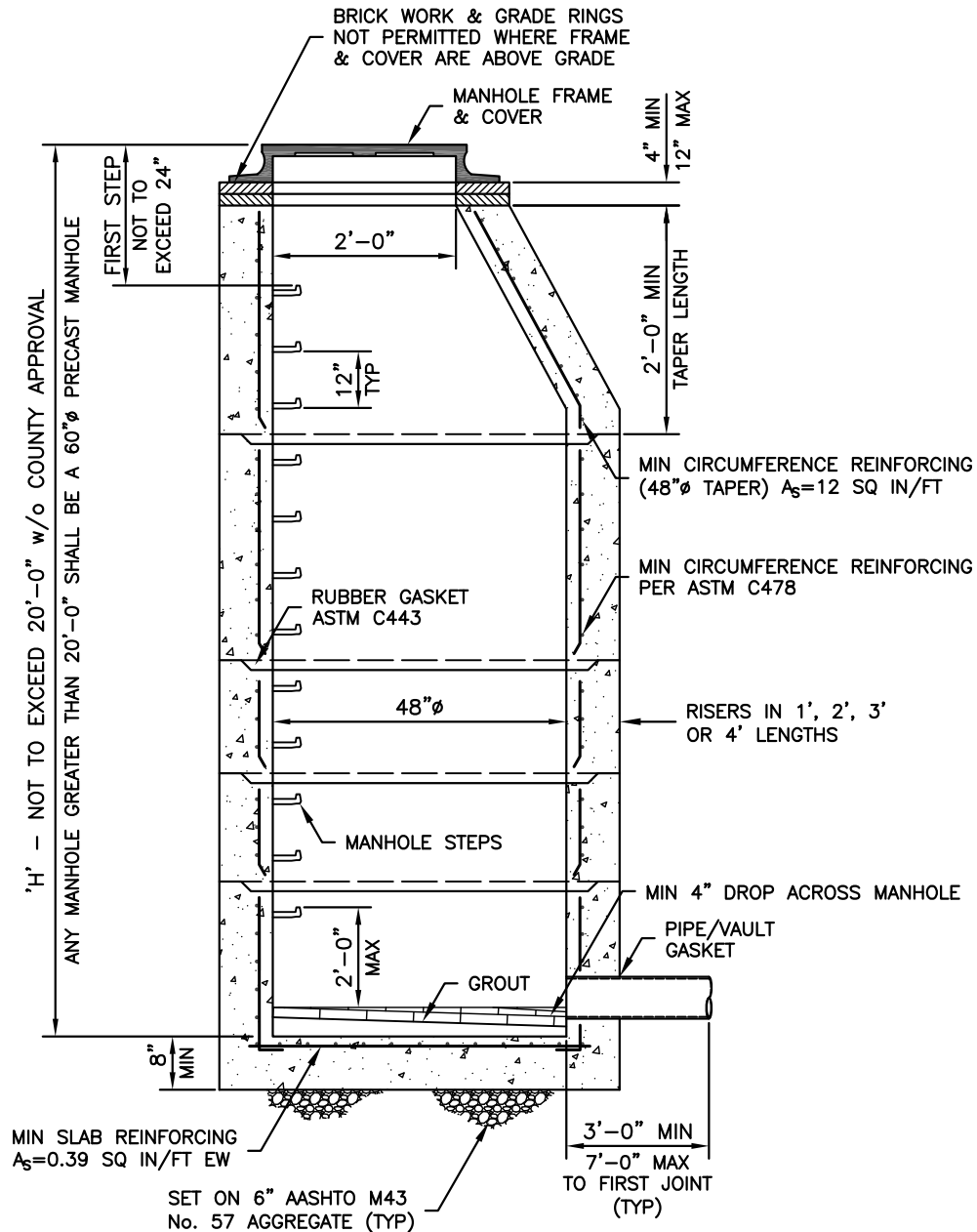
[Signature]

STANDARD SEWER DETAILS

OFFSET MANHOLE

ISSUED
01/01/26

PLATE
S-7



NOTES:

1. EXCEPT AS NOTED, MANHOLE TAPERS, RISERS AND BASES SHALL BE FURNISHED IN STRICT ACCORDANCE WITH ASTM DESIGNATION C478 (LATEST) FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".
2. CONCRETE FOR PRECAST CONSTRUCTION SHALL BE 4000 PSI MINIMUM.
3. MANHOLE STEPS SHALL BE SPACED AS SHOWN IN A SINGLE VERTICAL ALIGNMENT. THE STEPS SHALL NOT BE STAGGERED.
4. GRADE RINGS SHALL BE SET ON A FULL BED OF MORTAR.



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STANDARD SEWER DETAILS

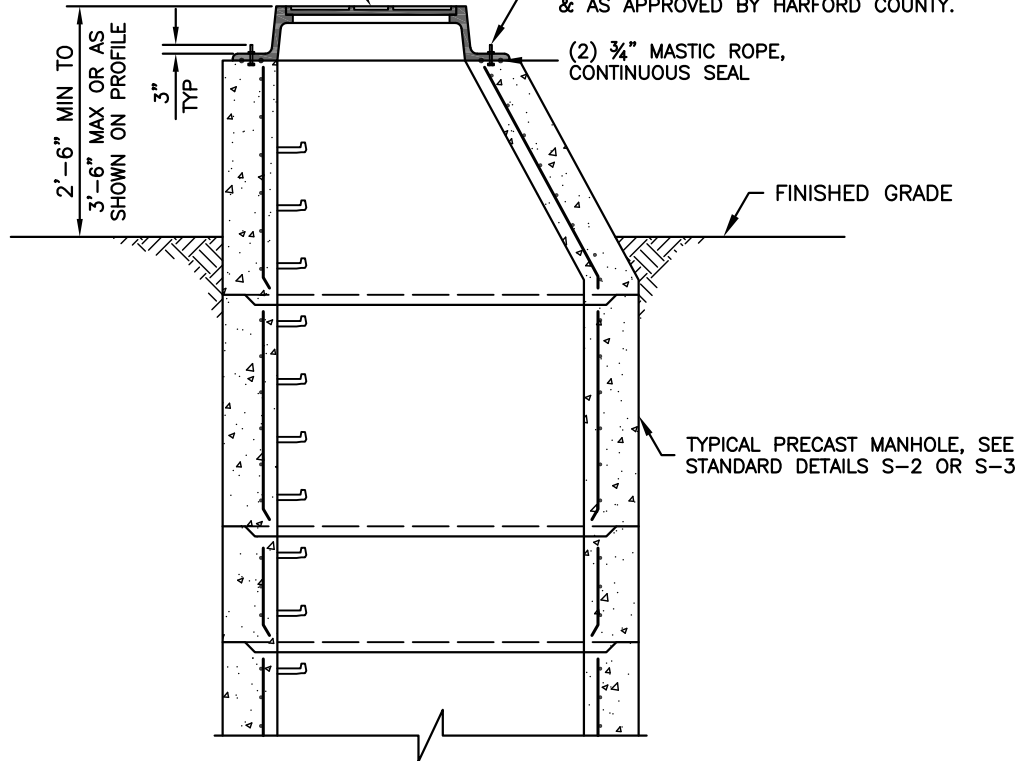
TERMINAL MANHOLE

ISSUED
01/01/26

PLATE
S-8

LOCKING NON-WATERTIGHT OR WATERTIGHT
MANHOLE FRAME & COVER AS APPROVED

FRAME TO BE SECURED TO CONE
w/GALVANIZED BOLTS, NUTS & WASHERS
AS PER MANUFACTURERS' RECOMMENDATIONS
& AS APPROVED BY HARFORD COUNTY.



NOTES:

1. FRAME AND COVER SHALL BE PAINTED WITH A METAL PRIMER COAT FOLLOWED BY A COAT OF FLUORESCENT GREEN INDUSTRIAL ENAMEL.
2. GRADE RINGS AND BRICK BENEATH THE FRAME ARE PROHIBITED.



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STANDARD SEWER DETAILS

MANHOLE WITHIN
OFFSITE/UNIMPROVED AREA

ISSUED
01/01/26

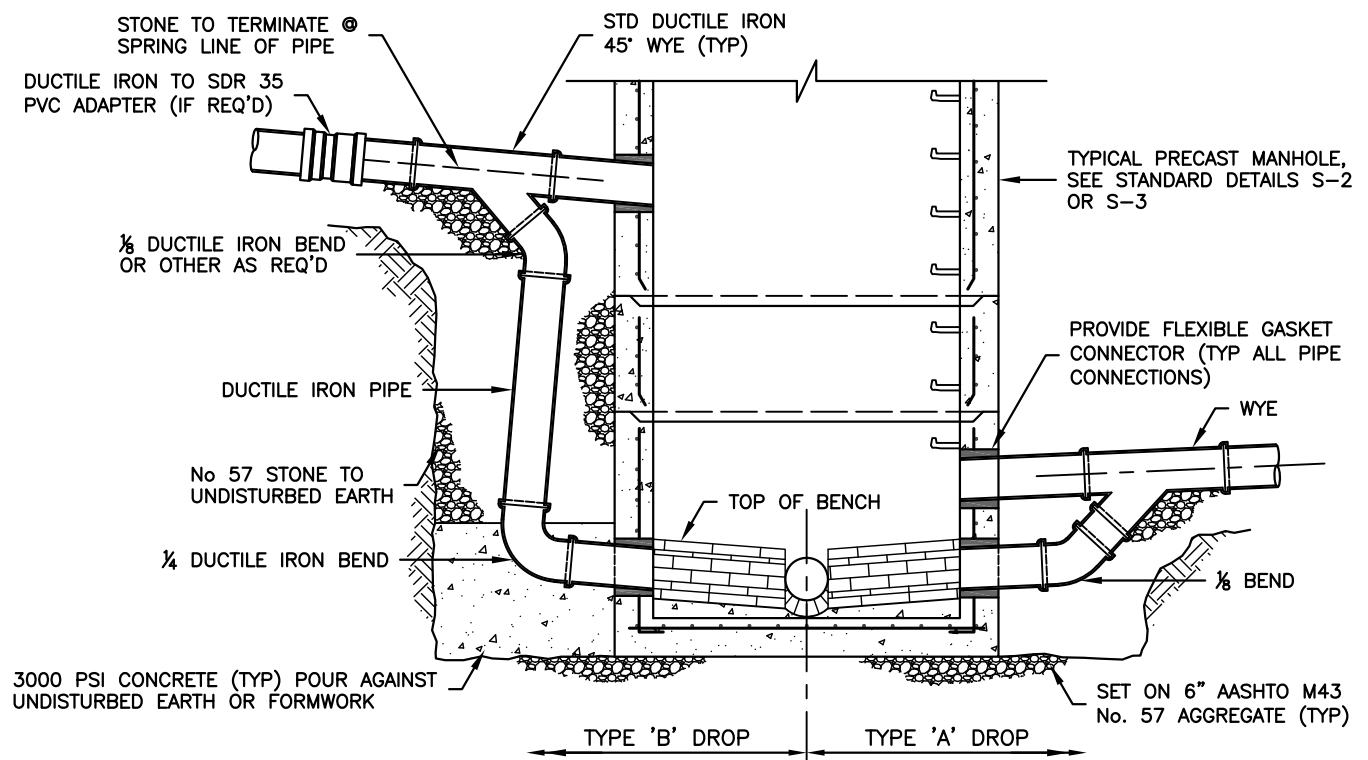
PLATE
S-9

DROP CONNECTIONS			
SIZE OF SEWER	TYPE A		TYPE B MIN DROP
	MAX DROP	MAX DROP	
8"	3'-9"	1'-4"	3'-9"
12"	6'-0"	1'-10"	4'-9"
15"	6'-0"	2'-8"	N/A
16"	N/A	N/A	5'-3"
18"	6'-0"	3'-6"	6'-0"

DROP CONNECTIONS	
TYPE B	
MAX SLOPE	MAX DROP
15%-20%	5'-0"
5%-15%	7'-0"
5% OR LESS	12'-0"

NOTES:

1. PIPE PENETRATIONS SHALL NOT BE LOCATED BETWEEN MANHOLE STEPS.
2. USE OF PRECAST COLLARS FOR MAIN DROPS AT MANHOLES ALLOWED ON INCOMING SEWER SLOPES UP TO 3% MAX.
3. TYPE B DROPS WITH SLOPES BETWEEN 3% AND 20% REQUIRE THE USE OF DUCTILE IRON PIPE AND FITTINGS BEYOND THE DUCTILE IRON TO PVC ADAPTER SHOWN.
4. TYPE B DROPS WITH SLOPES OVER 20% WILL REQUIRE SPECIAL DESIGN WITH ADDITIONAL FITTINGS.



SECTION



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STANDARD SEWER DETAILS

BUILT-IN-PLACE
MAIN DROP AT MANHOLE
TYPE 'A' AND TYPE 'B'

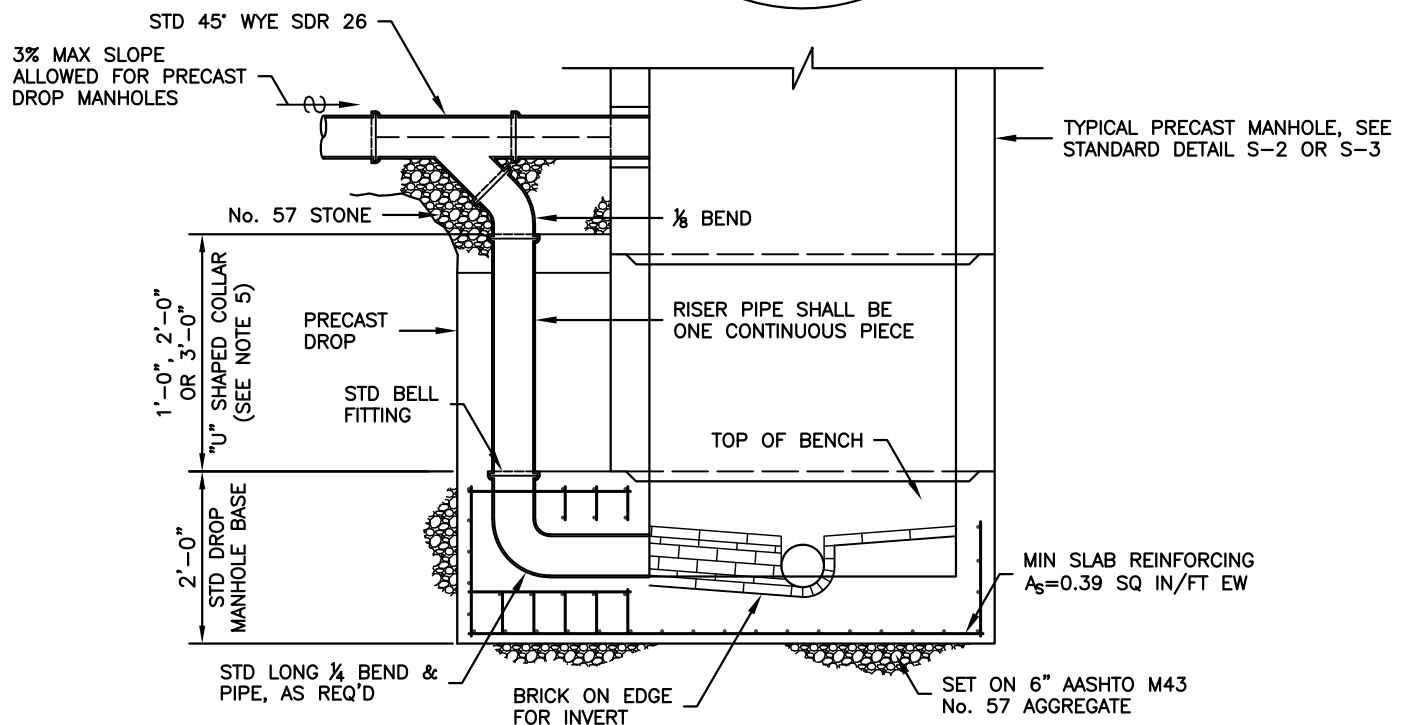
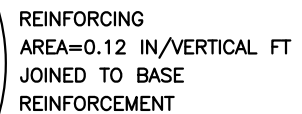
ISSUED
01/01/26

PLATE
S-10

1. ALL MANHOLE SECTIONS SHALL BE FURNISHED IN STRICT ACCORDANCE WITH ASTM DESIGNATION C478 (LATEST) FOR "PRECAST REINFORCED CONCRETE MANHOLE SECTIONS".
2. PRECAST CONCRETE SHALL BE 4000 PSI MIN.
3. MANHOLE STEPS AND CONCRETE REINFORCING NOT SHOWN FOR CLARITY.
4. CHANNEL AS PER STANDARD DETAIL.
5. CONTRACTOR SHALL INSTALL AASHTO M43 No. 57 AGGREGATE BETWEEN "U" COLLAR AND UNDISTURBED EARTH.
6. MAXIMUM ALLOWABLE INCOMING SEWER SLOPE FOR PRECAST DROP MANHOLE SHALL BE 3%.
7. THE PIPE MATERIAL FOR THE MAIN AND THE DROP CONNECTION SHALL BE THE SAME.



U SHAPED CONCRETE COLLAR



SECTION



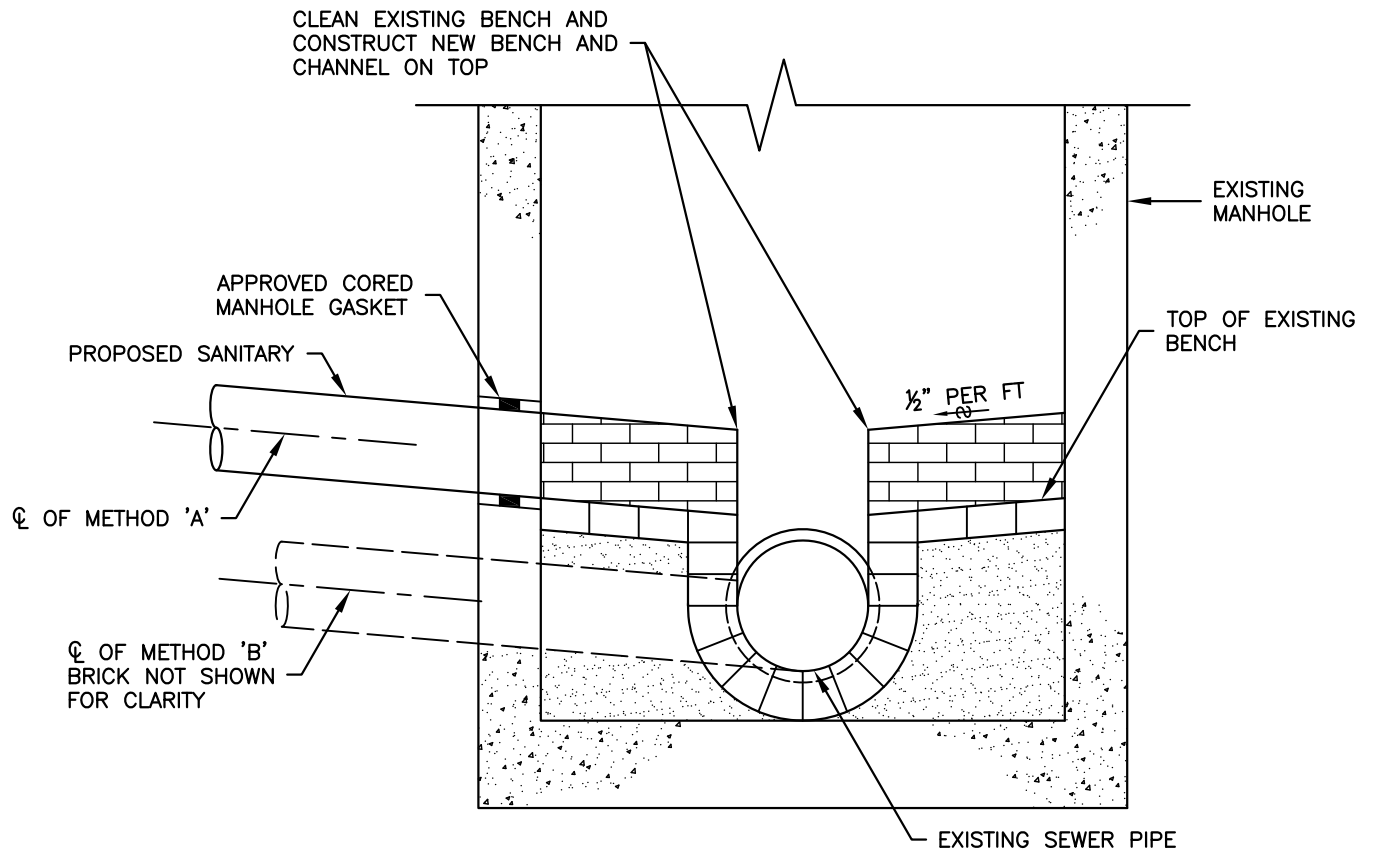
DIRECTOR, DEPARTMENT OF PUBLIC WORKS

STANDARD SEWER DETAILS

48" MANHOLE w/PRECAST COLLARS
FOR MAIN DROP CONNECTIONS
(8" DIA PIPE)

ISSUED
01/01/26

PLATE
S-11



NOTES:

1. PRIOR TO CONNECTING TO EXISTING MANHOLE, AN INSPECTION WILL BE PERFORMED BY COUNTY PERSONNEL TO DETERMINE WHETHER THE EXISTING MANHOLE REQUIRES ANY REHABILITATION.
2. INVERT OF PROPOSED SANITARY TO BE CHanneled AS PER STANDARD DETAILS.
3. NEW OPENING SHALL BE CORED AND SEALED.
4. METHOD 'B' IS DEFINED AS CONNECTING TO EXISTING MANHOLE BELOW EXISTING BENCH. WHEN USING METHOD 'B', THE ENTIRE BRICK CHANNEL AND BENCH SHALL BE REMOVED AND RE-CONSTRUCTED TO SUIT THE PROPOSED INCOMING SEWER. FLOW SHALL BE EITHER BYPASS PUMPED OR A FLEXIBLE SLEEVE INSTALLED DURING THE WORK. METHOD 'B' SHALL BE USED ONLY WHEN SPECIFICALLY APPROVED BY THE COUNTY.



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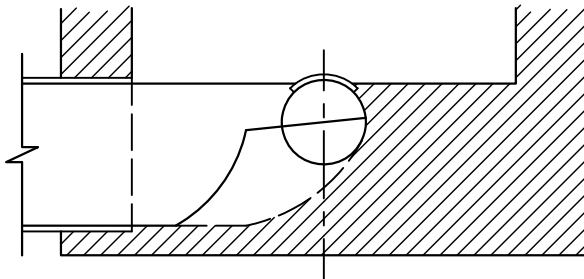
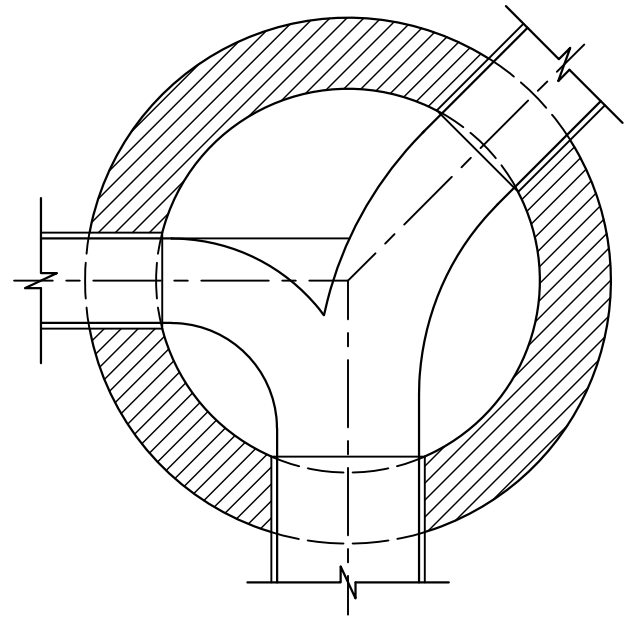
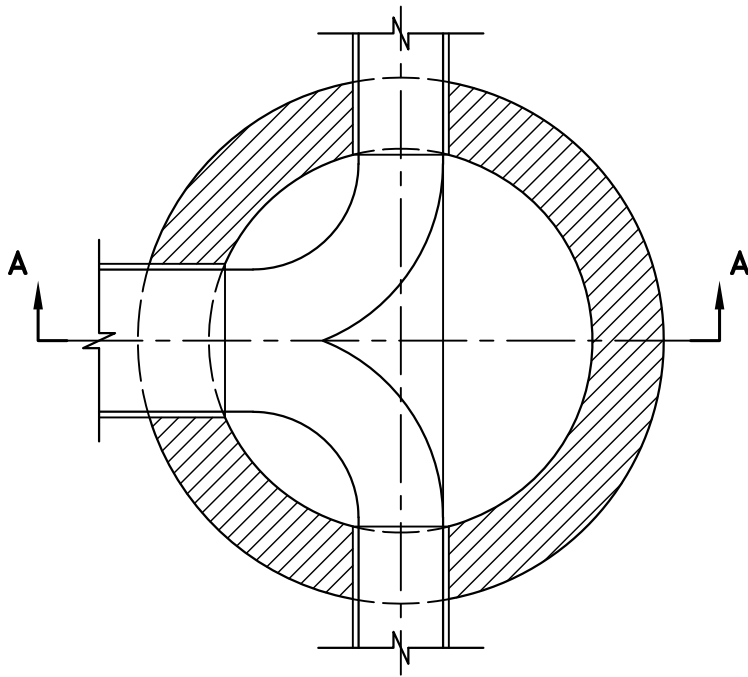
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STANDARD SEWER DETAILS

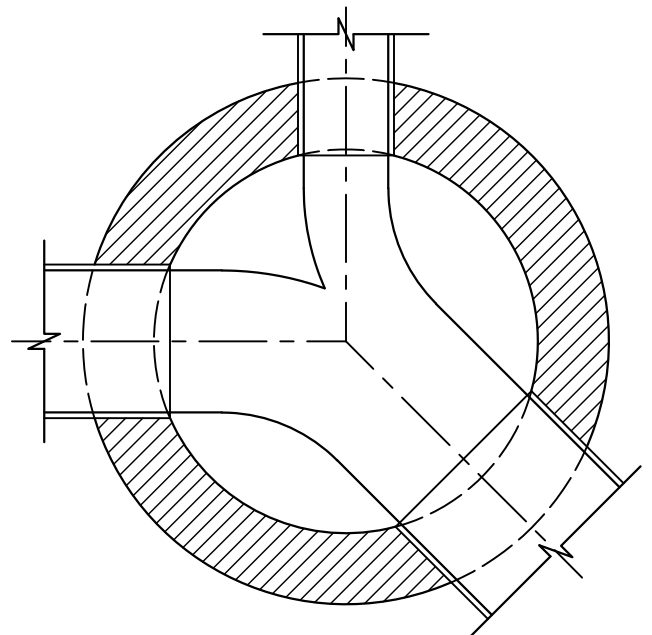
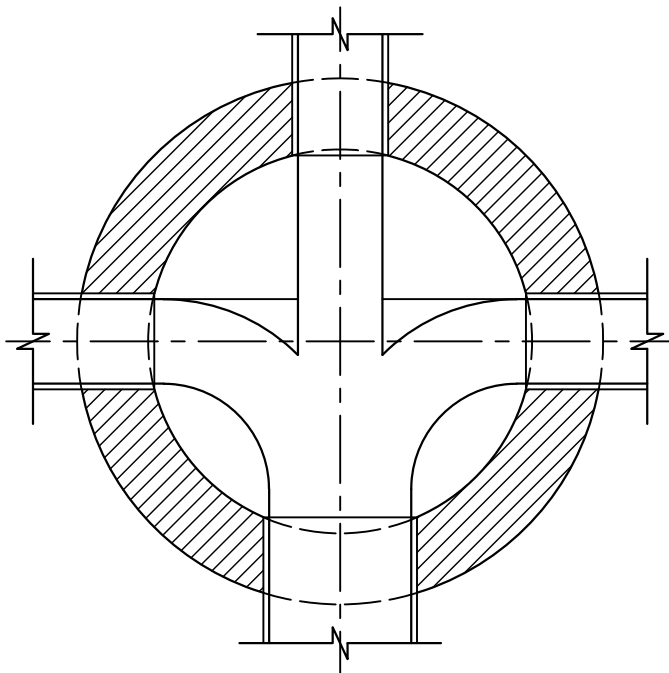
METHOD OF CONNECTION
TO EXISTING MANHOLE

ISSUED
01/01/26

PLATE
S-12



SECTION A-A



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

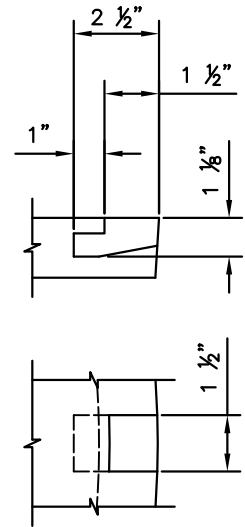
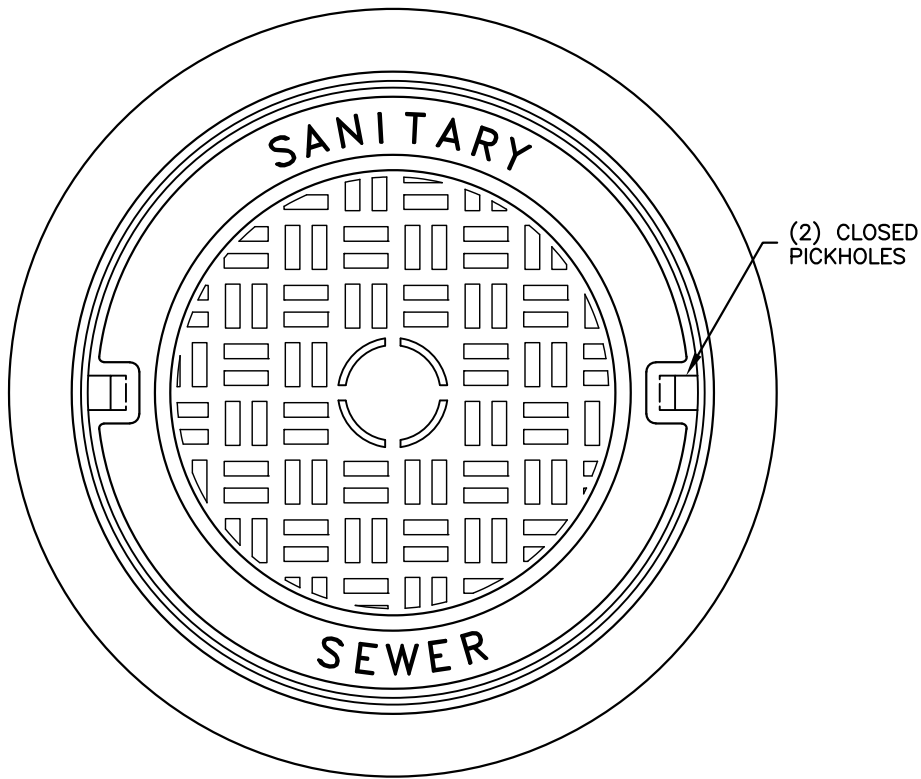
J. Smith

STANDARD SEWER DETAILS

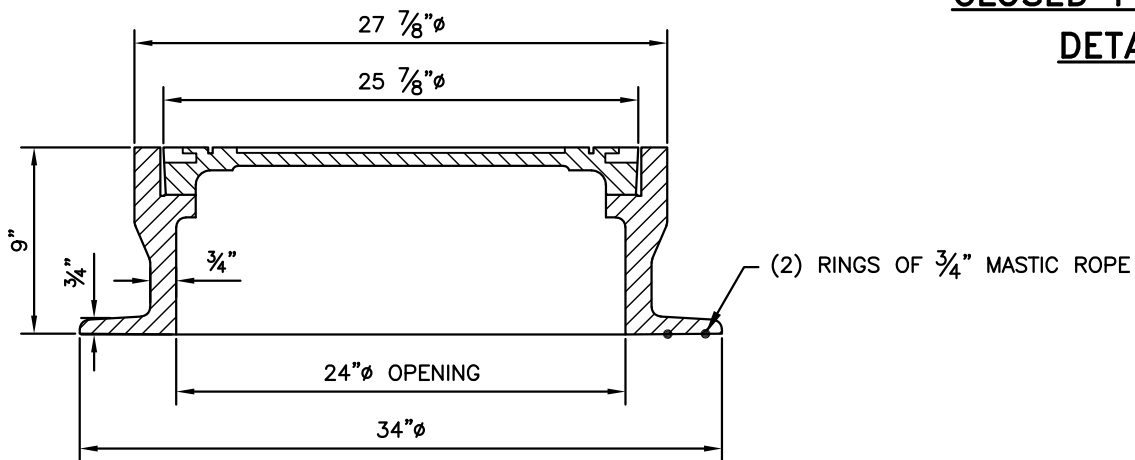
**PLANS FOR MANHOLE
CHANNELING**

ISSUED
01/01/26

**PLATE
S-13**



**CLOSED PICKHOLE
DETAIL**



- HEAVY DUTY
- MAT'L: ASTM A48 CL 30B

- MACHINED BEARING SURFACES
- MANUFACTURERS' MARKING
ON FRAME AND COVER

- COVER WEIGHT: 170 LBS
- FRAME WEIGHT: 250 LBS

NOTES:

1. MANHOLES LOCATED IN PAVED AND LAWN AREAS SHALL BE CONSTRUCTED TO PROPOSED FINISHED GRADE.



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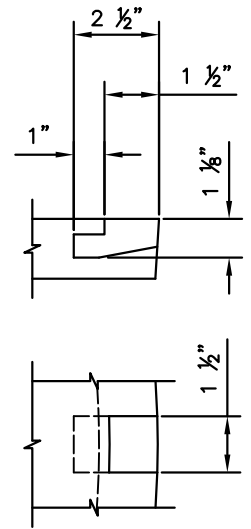
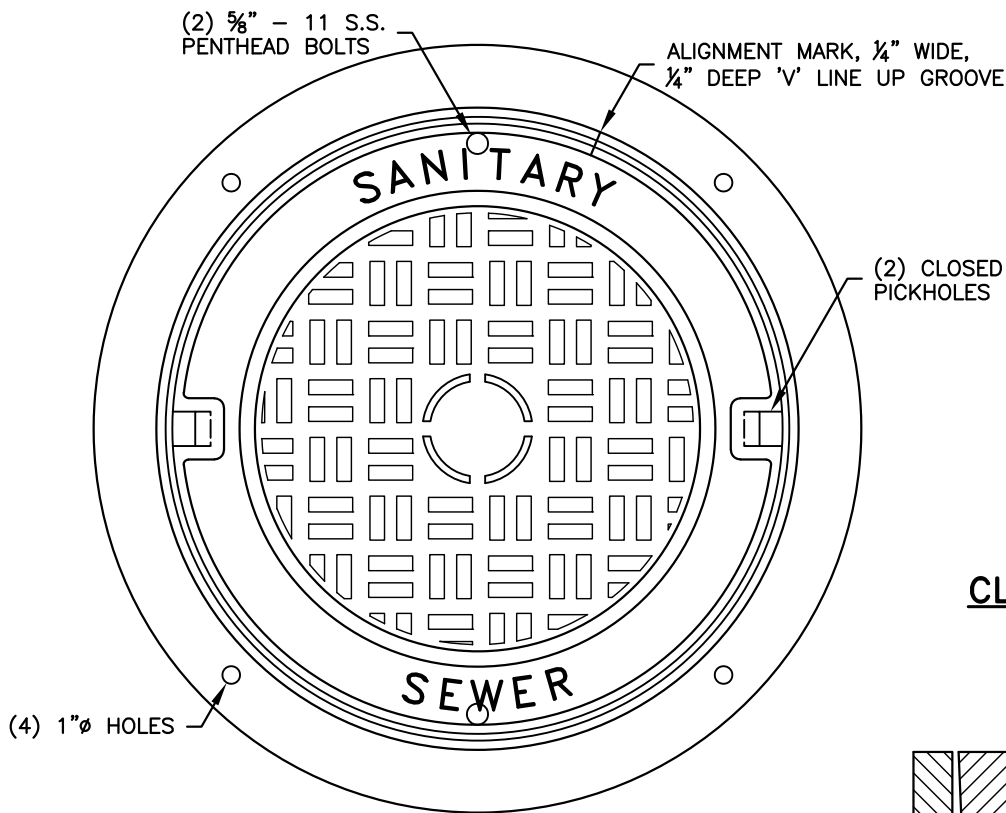
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STANDARD SEWER DETAILS

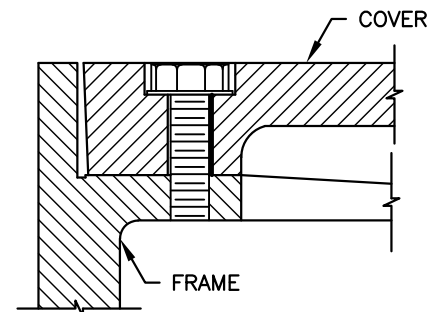
**STANDARD MANHOLE
FRAME & COVER**

ISSUED
01/01/26

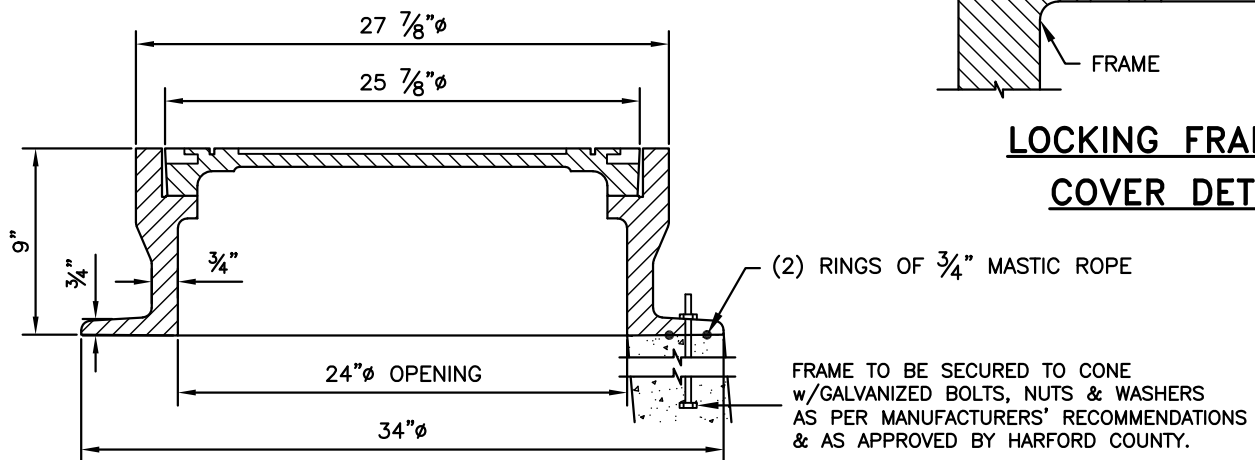
**PLATE
S-14**



**CLOSED PICKHOLE
DETAIL**



**LOCKING FRAME &
COVER DETAIL**



- HEAVY DUTY
- MAT'L: ASTM A48 CL 30B

- MACHINED BEARING SURFACES
- MANUFACTURERS' MARKING
ON FRAME AND COVER

- COVER WEIGHT: 170 LBS
- FRAME WEIGHT: 250 LBS

NOTES:

1. MANHOLES LOCATED IN PAVED AND LAWN AREAS SHALL BE CONSTRUCTED TO PROPOSED FINISHED GRADE.
2. MANHOLES LOCATED IN OTHER AREAS SHALL BE A MAXIMUM OF 3'-6" AND A MINIMUM OF 2'-6" ABOVE EXISTING GRADE AND THE FRAME AND COVER SHALL BE PAINTED WITH A METAL PRIMER COAT (WHITE) FOLLOWED BY A COAT OF FLUORESCENT GREEN INDUSTRIAL ENAMEL.
3. APPROVED FRAME AND COVERS WITH CAM LOCKING DEVICES MAY BE SUBSTITUTED.



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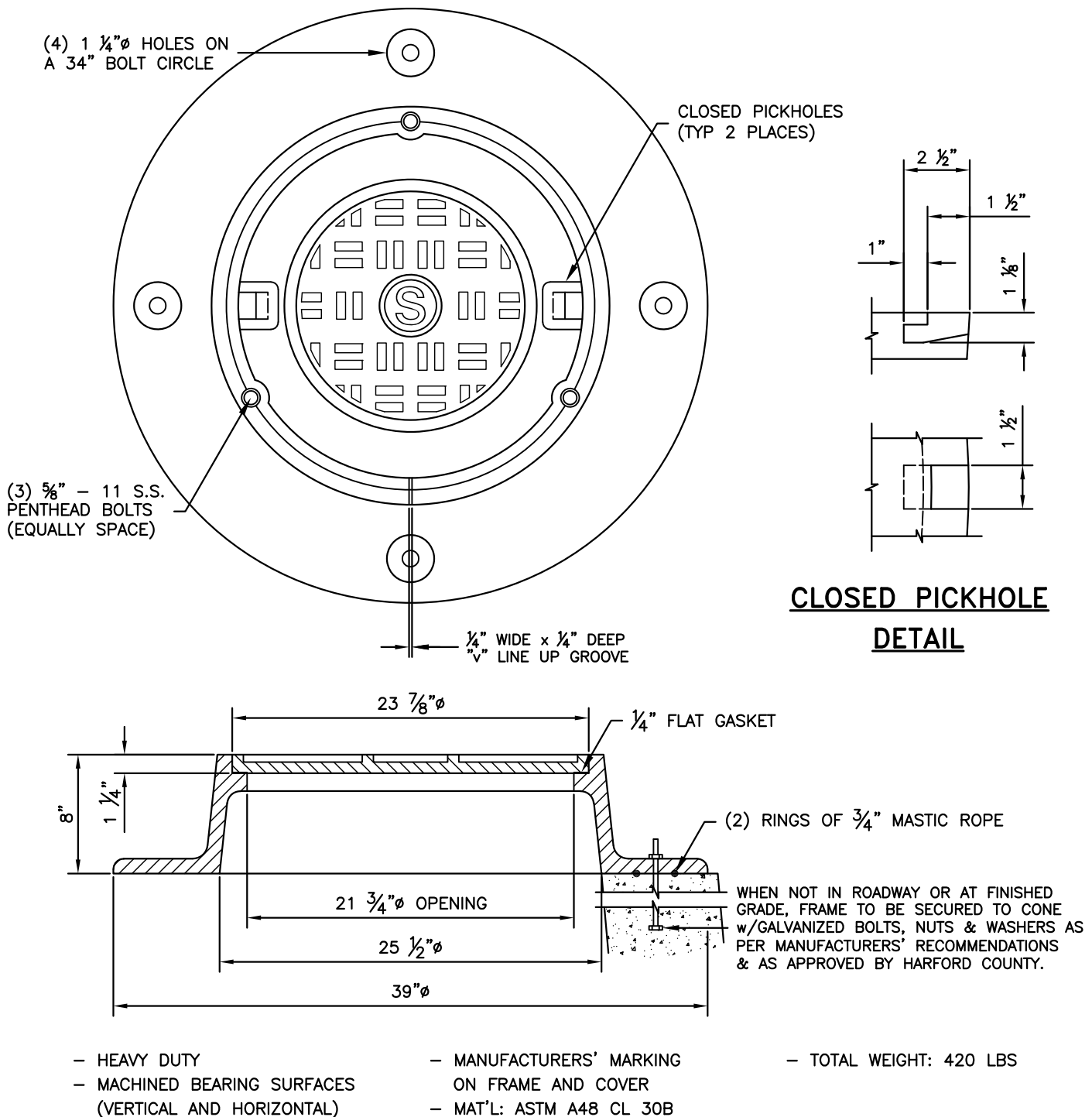
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STANDARD SEWER DETAILS

**LOCKING MANHOLE
FRAME & COVER
(NON-WATERTIGHT)**

ISSUED
01/01/26

**PLATE
S-15**



NOTES:

1. MANHOLES LOCATED IN PAVED AREAS THAT ARE REQUIRED TO BE WATERTIGHT, SHALL UTILIZE A STANDARD FRAME AND COVER WITH A STAINLESS STEEL INSERT DISH AND RUBBER GASKET.
2. MANHOLES LOCATED IN LAWN AREAS SHALL BE CONSTRUCTED TO PROPOSED FINISH GRADE.
3. MANHOLES LOCATED IN OTHER AREAS SHALL BE A MAXIMUM OF 3'-6" AND A MINIMUM OF 2'-6" ABOVE EXISTING GRADE AND THE FRAME AND COVER SHALL BE PAINTED WITH A METAL PRIMER COAT (WHITE) FOLLOWED BY A COAT OF FLUORESCENT GREEN INDUSTRIAL ENAMEL.
4. MANHOLES LOCATED WITHIN THE 100 YEAR FLOODPLAIN SHALL EXTEND 3'-0" ABOVE EXISTING GRADE.



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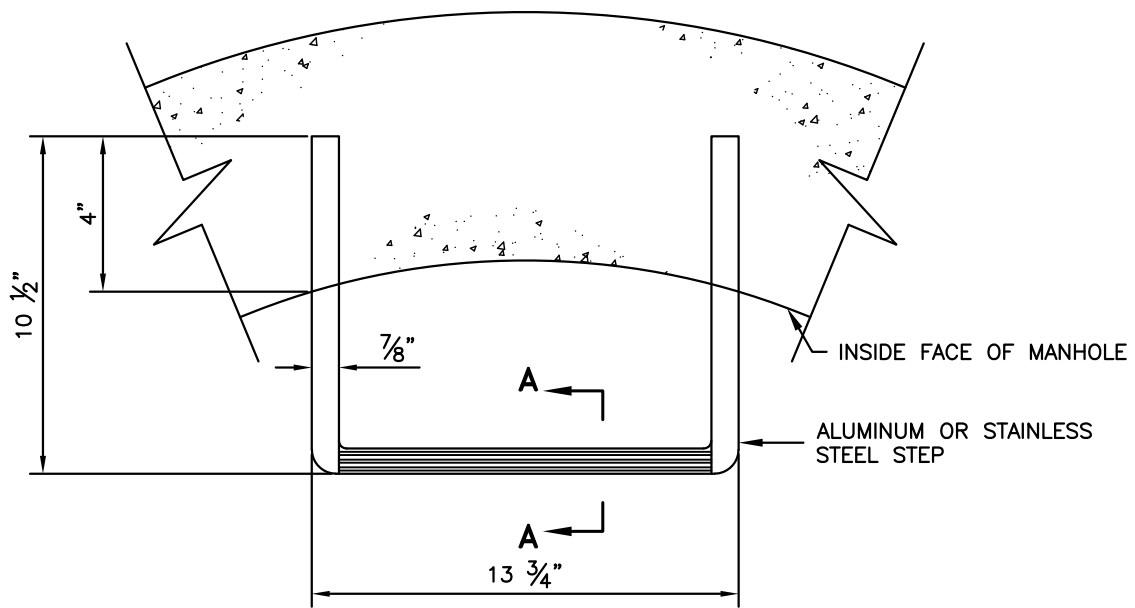
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STANDARD SEWER DETAILS

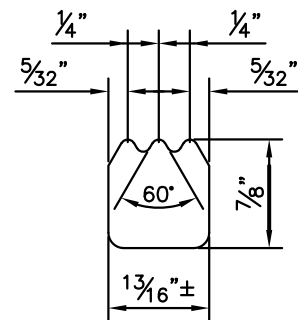
WATERTIGHT MANHOLE
FRAME & COVER

ISSUED
01/01/26

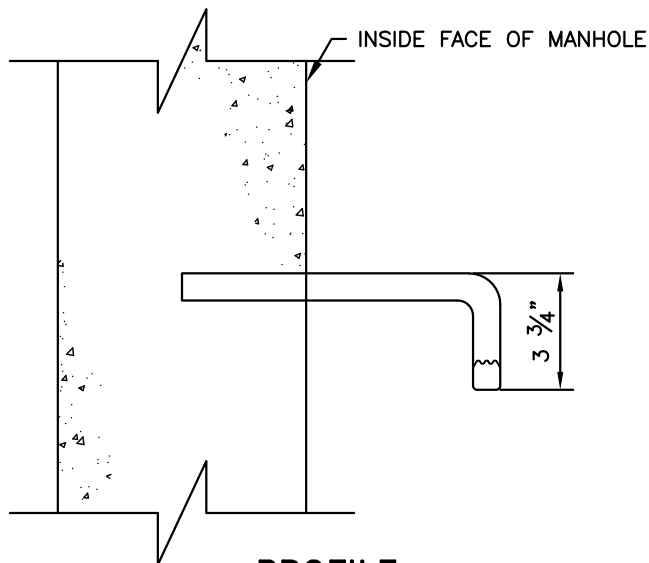
PLATE
S-16



PLAN



SECTION A-A



PROFILE

NOTE:

STEPS TO BE FABRICATED OF ALUMINUM ALLOY 6061-T6 OR TYPE 304 STAINLESS STEEL. PORTION OF STEP TO BE EMBEDDED IN MANHOLE WALL OR WALL INSERT SHALL BE DIPPED IN HEAVY BODIED BITUMINOUS COATING.



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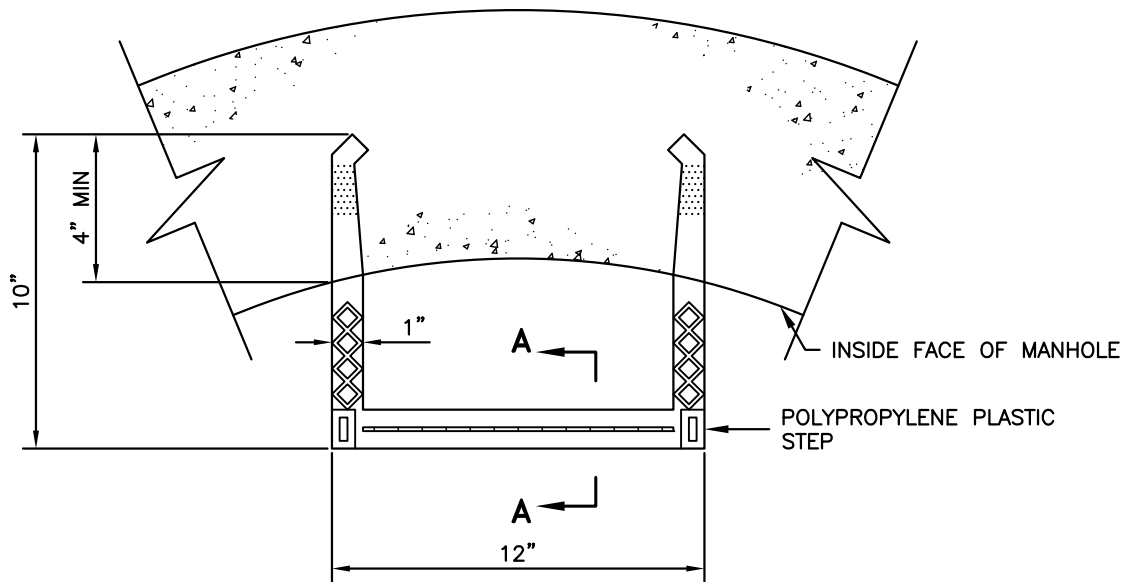
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STANDARD SEWER DETAILS

METAL STEP

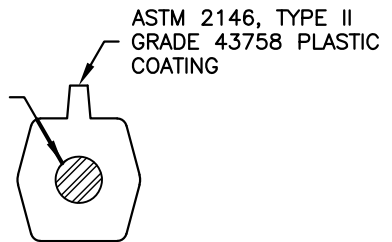
ISSUED
01/01/26

PLATE
S-17

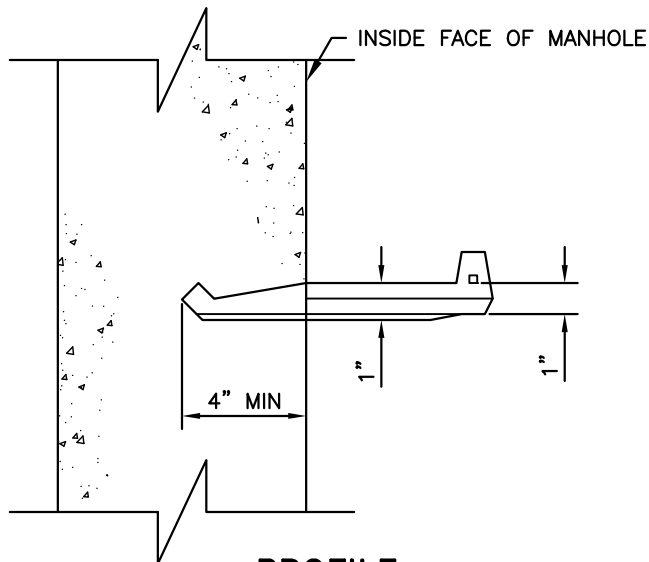


PLAN

$\frac{3}{8}$ " DIA ASTM A-615 STEEL
REINFORCING ROD



SECTION A-A



PROFILE

NOTE:

STEPS SHALL BE PLACED INTO WET
CONCRETE WALL DURING MANUFACTURE
OR MORTARED INTO HOLES AFTER
CONCRETE HAS SET.



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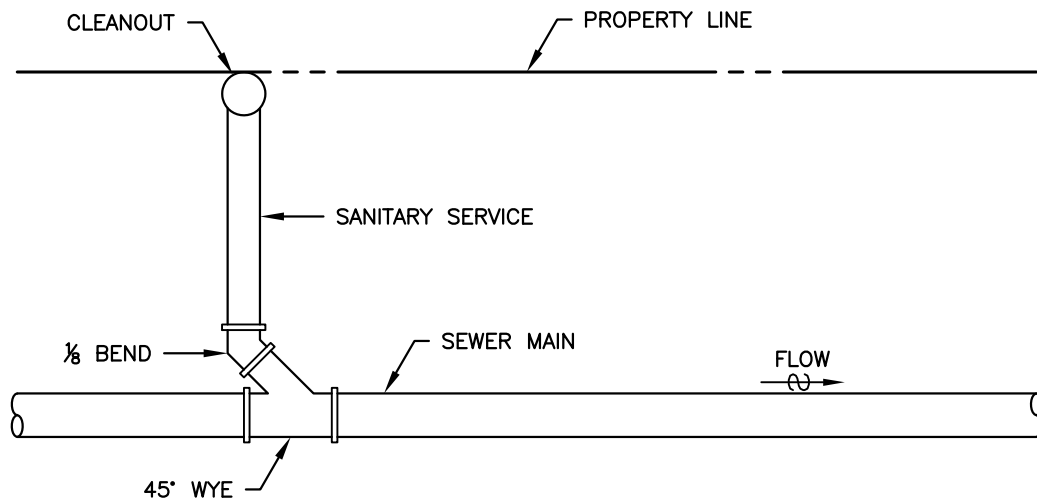
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STANDARD SEWER DETAILS

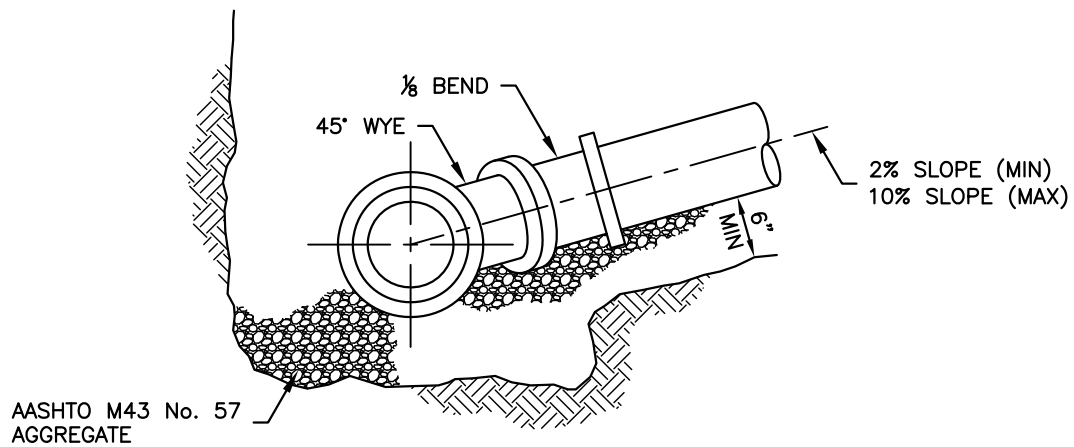
PLASTIC STEP

ISSUED
01/01/26

**PLATE
S-18**



PLAN



SECTION



DIRECTOR, DEPARTMENT OF PUBLIC WORKS

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STANDARD SEWER DETAILS

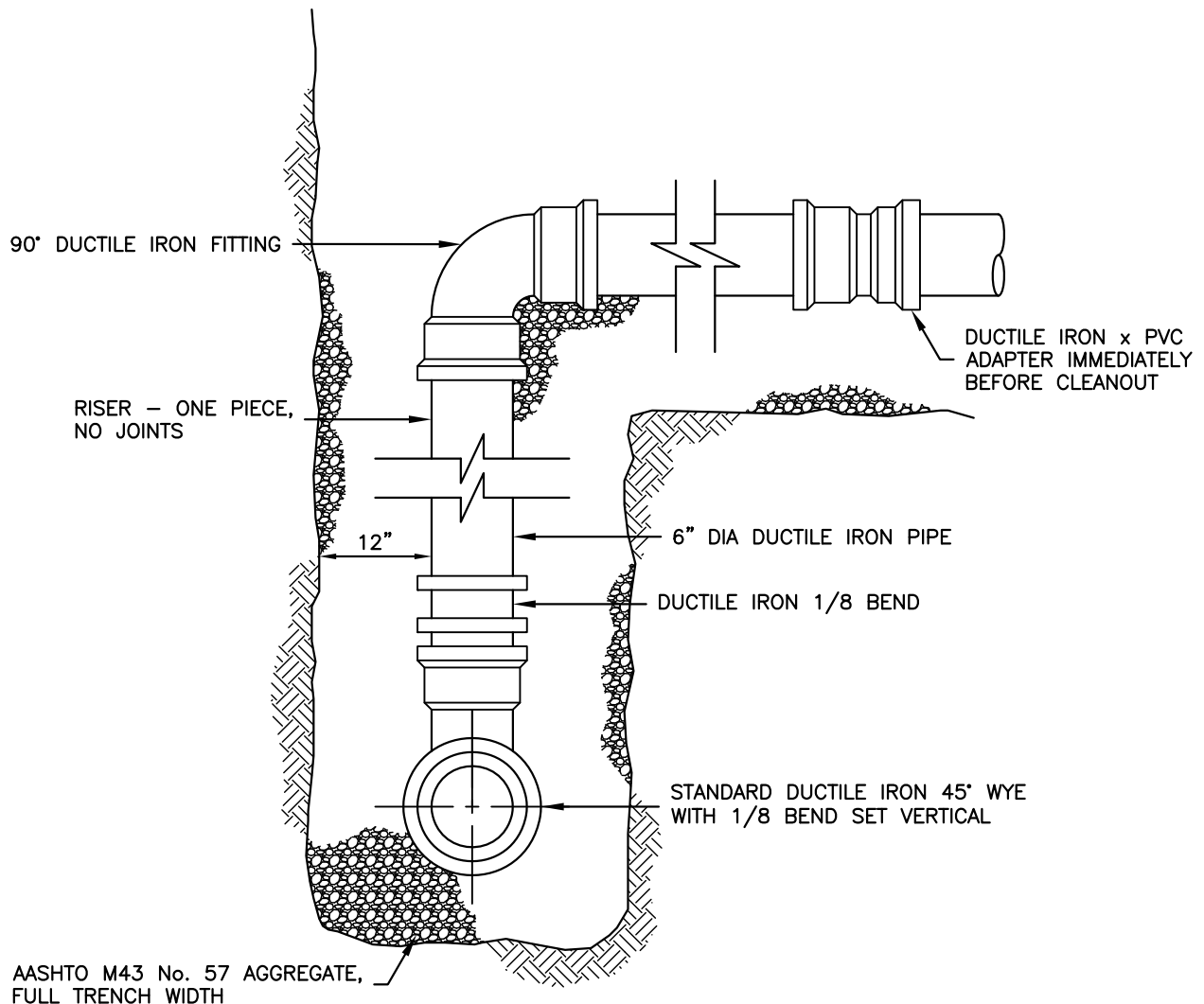
SEWER SERVICE CONNECTION
AT MAIN

ISSUED
01/01/26

PLATE
S-19

NOTES:

1. TRENCH TO BE COMPACTED IN ACCORDANCE WITH STANDARD SPECIFICATIONS.
2. ALL PIPES AND FITTINGS SHALL BE DUCTILE IRON FROM THE WYE ON THE MAIN TO THE CLEANOUT.
3. THE SEWER MAIN BETWEEN MANHOLES TO WHICH THIS CONNECTION IS MADE SHALL BE EITHER DUCTILE IRON OR C900 PVC PIPE.



SECTION



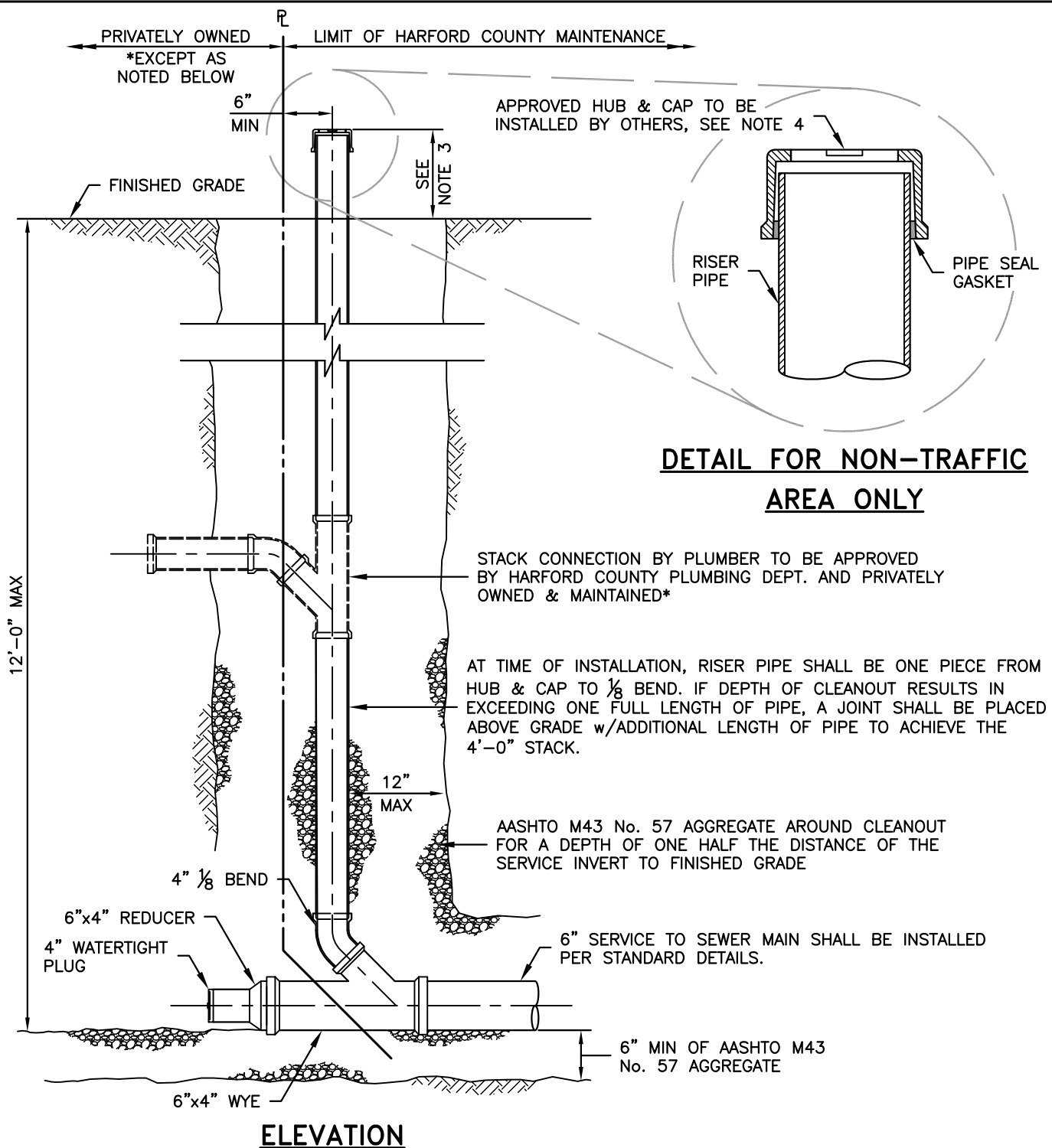
DIRECTOR, DEPARTMENT OF PUBLIC WORKS

STANDARD SEWER DETAILS

DUCTILE IRON DROP SEWER
SERVICE CONNECTION AT MAIN

ISSUED
01/01/26

PLATE
S-20



NOTES:

1. ALL PIPE AND FITTINGS SHALL BE HEAVY WALL SEWER PIPE, SDR 26.
2. CLEANOUTS ARE SUBJECT TO AIR TESTS. CONTRACTOR SHALL INSTALL APPROVED TEMPORARY AIR TIGHT CAP OR PLUG. TAPE ALONE IS NOT ALLOWED.
3. UTILITY CONTRACTOR SHALL EXTEND CLEANOUT A MINIMUM OF 4 FEET ABOVE GRADE. CLEANOUT TO BE ADJUSTED TO FINISH GRADE BY PLUMBER PRIOR TO FINAL ACCEPTANCE BY THE COUNTY. ON LOTS WITH EXISTING HOMES, CONTRACTOR SHALL INSTALL APPROVED HUBS AND CAPS FLUSH WITH FINISHED GRADE.
4. CLEANOUTS SHALL NOT BE LOCATED IN SIDEWALKS OR STEPS. CLEANOUTS MAY ONLY BE INSTALLED IN DRIVEWAYS WITH PRIOR APPROVAL FROM THE COUNTY.



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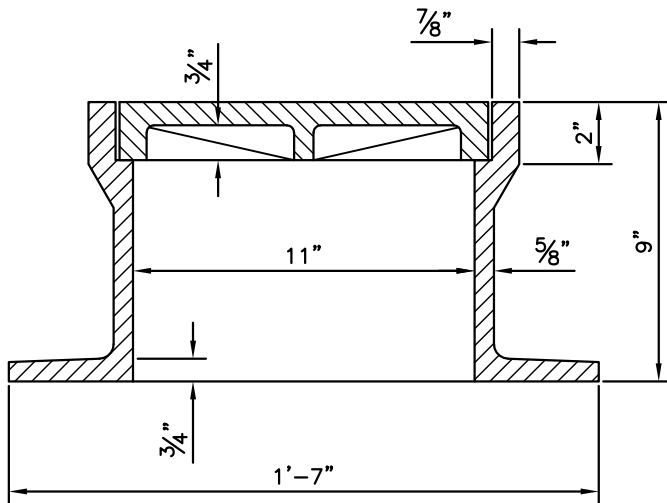
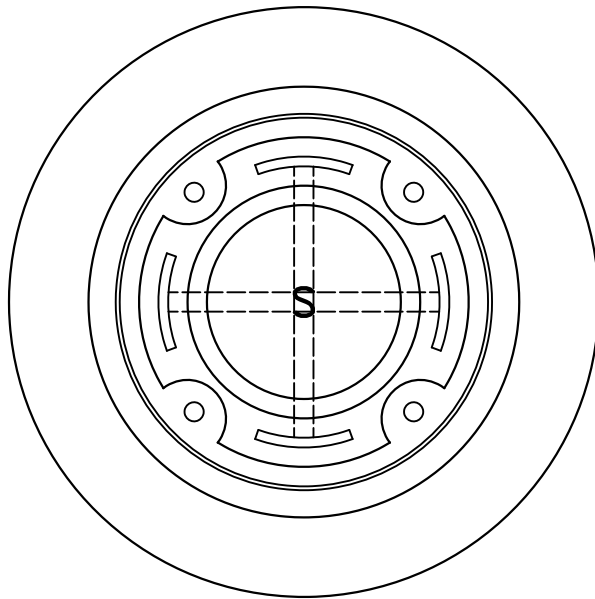
STANDARD SEWER DETAILS

SEWER SERVICE
CONNECTION CLEANOUT

ISSUED
01/01/26

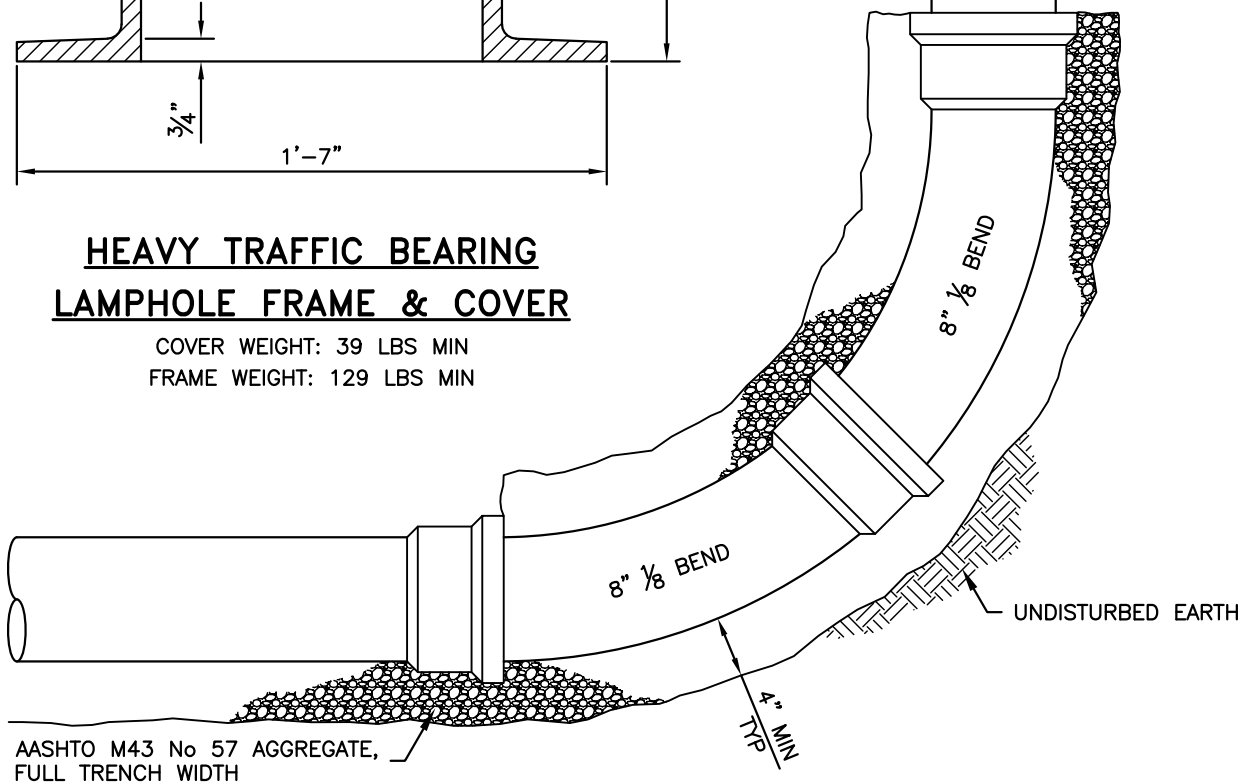
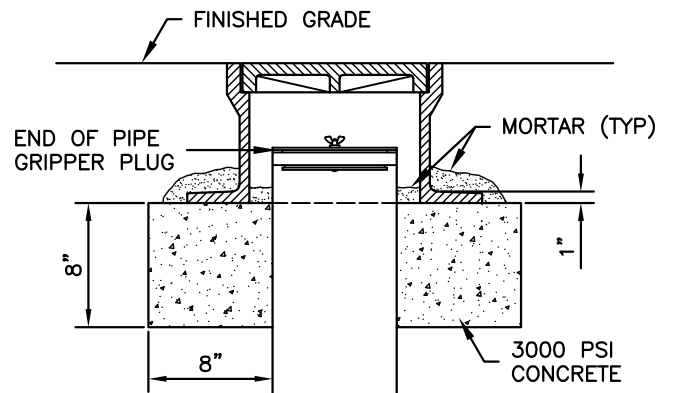
PLATE
S-21

PLATE
S-22



HEAVY TRAFFIC BEARING LAMPHOLE FRAME & COVER

COVER WEIGHT: 39 LBS MIN
FRAME WEIGHT: 129 LBS MIN



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[Signature]

STANDARD SEWER DETAILS

LAMPHOLE

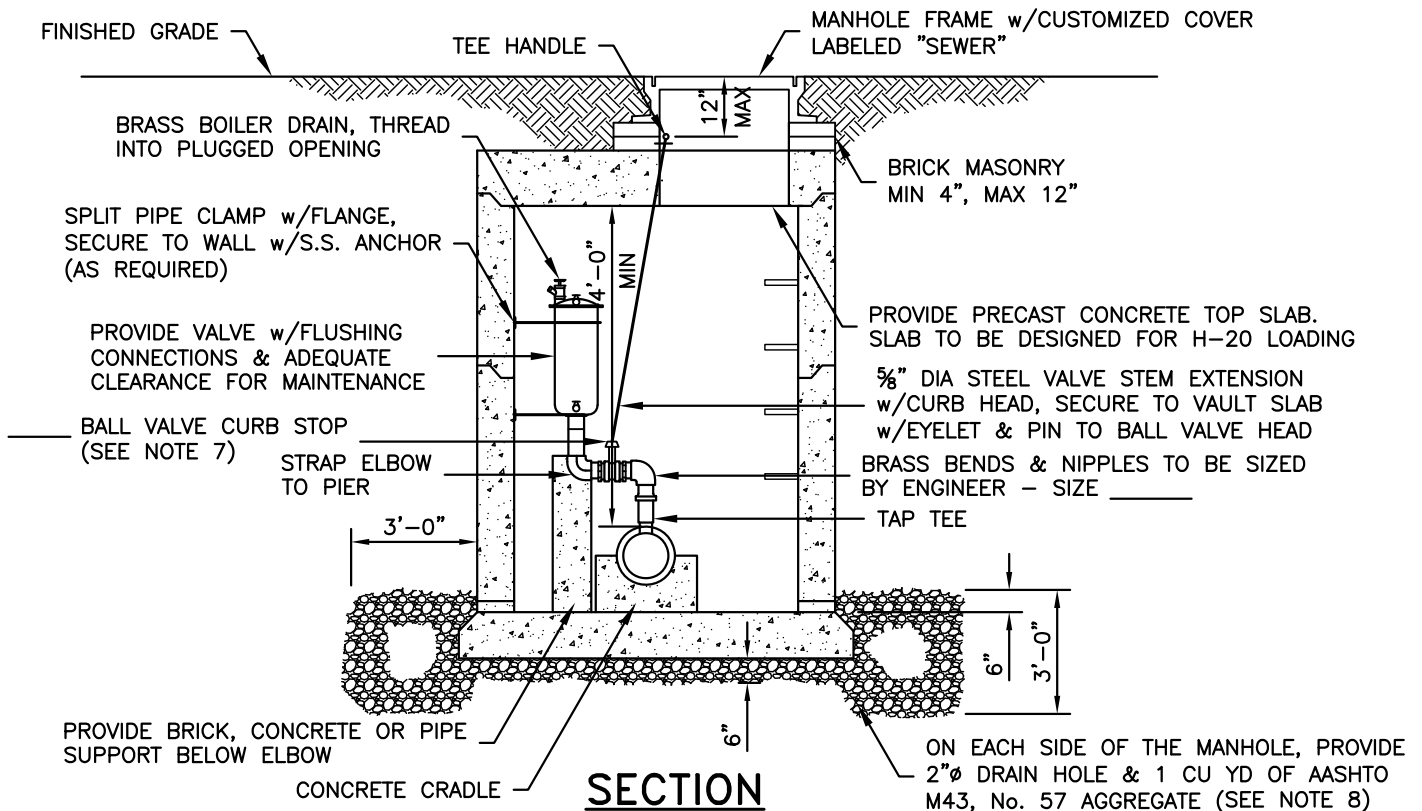
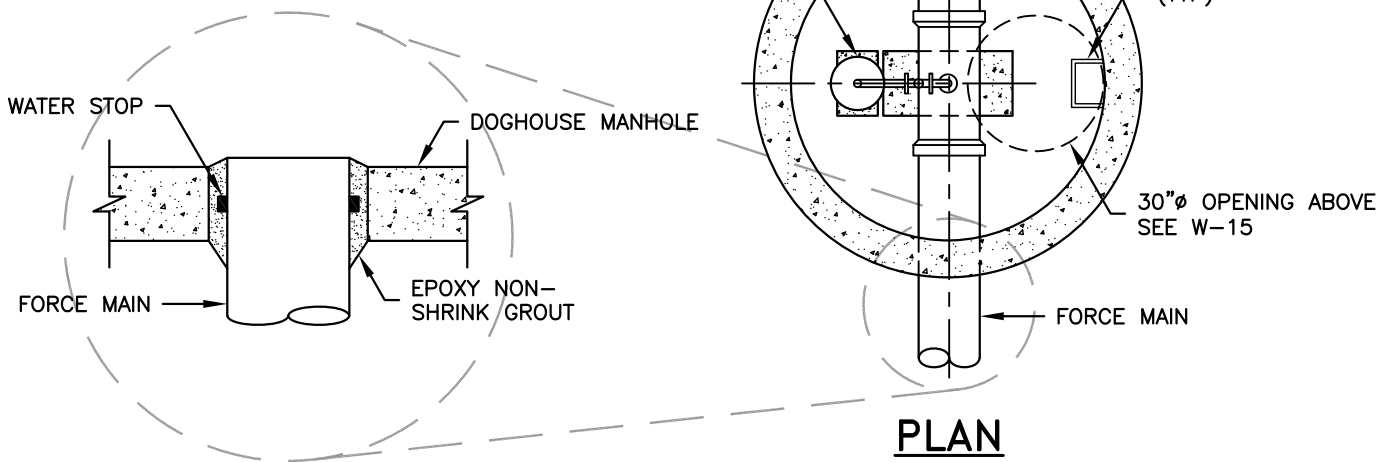
ISSUED
01/01/26

PLATE
S-23

TYPICAL 60" PRECAST MANHOLE, UNLESS NOTED OTHERWISE, SEE STD DTL S-3

AIR SEWAGE COMBINATION VALVE TO BE SIZED BY ENGINEER

MODEL/SIZE: _____



NOTES:

1. ALL FITTINGS BELOW AIR VALVE TO BE HEAVY DUTY THREADED, UNPOLISHED BRASS UNLESS NOTED OTHERWISE.
2. ALL PIPE SUPPORTS AND BRACING TO BE SIZED BY ENGINEER.
3. SET MANHOLE ON 6" LEVELING COURSE OF AASHTO M43, No. 57 AGGREGATE.
4. VAULTS IN HIGH WATER TABLE AREAS SHALL BE MODIFIED AS REQUIRED BY THE COUNTY.
5. CONTRACTOR MAY USE PRECAST DOGHOUSE TYPE MANHOLE RISER SECTION WITH APPROVED PIPE/VAULT GASKETS AND CAST-IN-PLACE BASE.
6. MINIMUM VAULT HEIGHT SHALL BE 6'-6" MEASURED FROM FLOOR TO CEILING.
7. AN ACCEPTABLE ALTERNATIVE TO THE 90° BEND AND BALL VALVE CURB STOP IS AN ANGLE BALL SERVICE VALVE.



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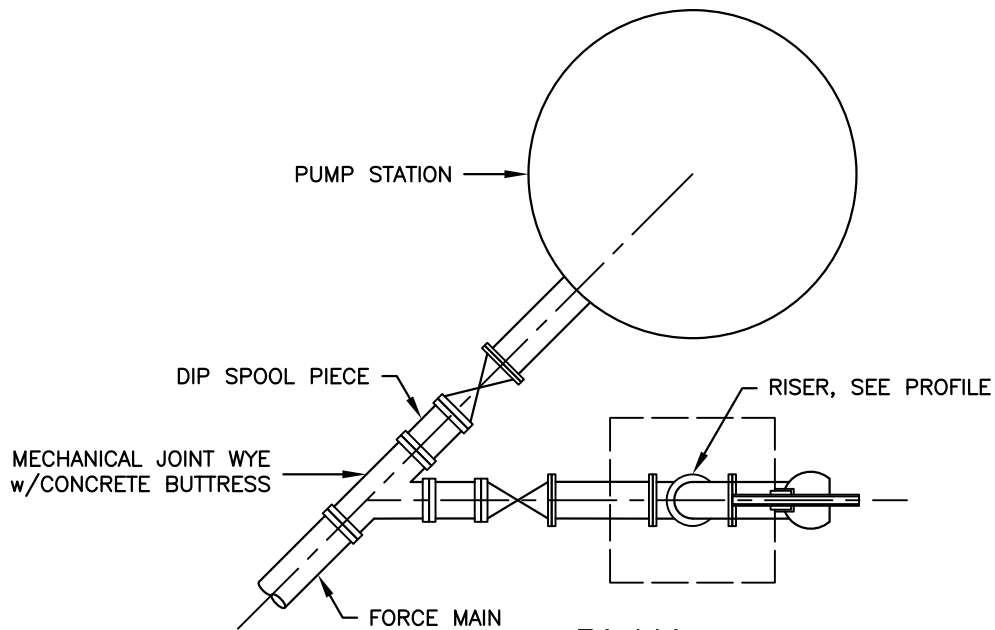
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STANDARD SEWER DETAILS

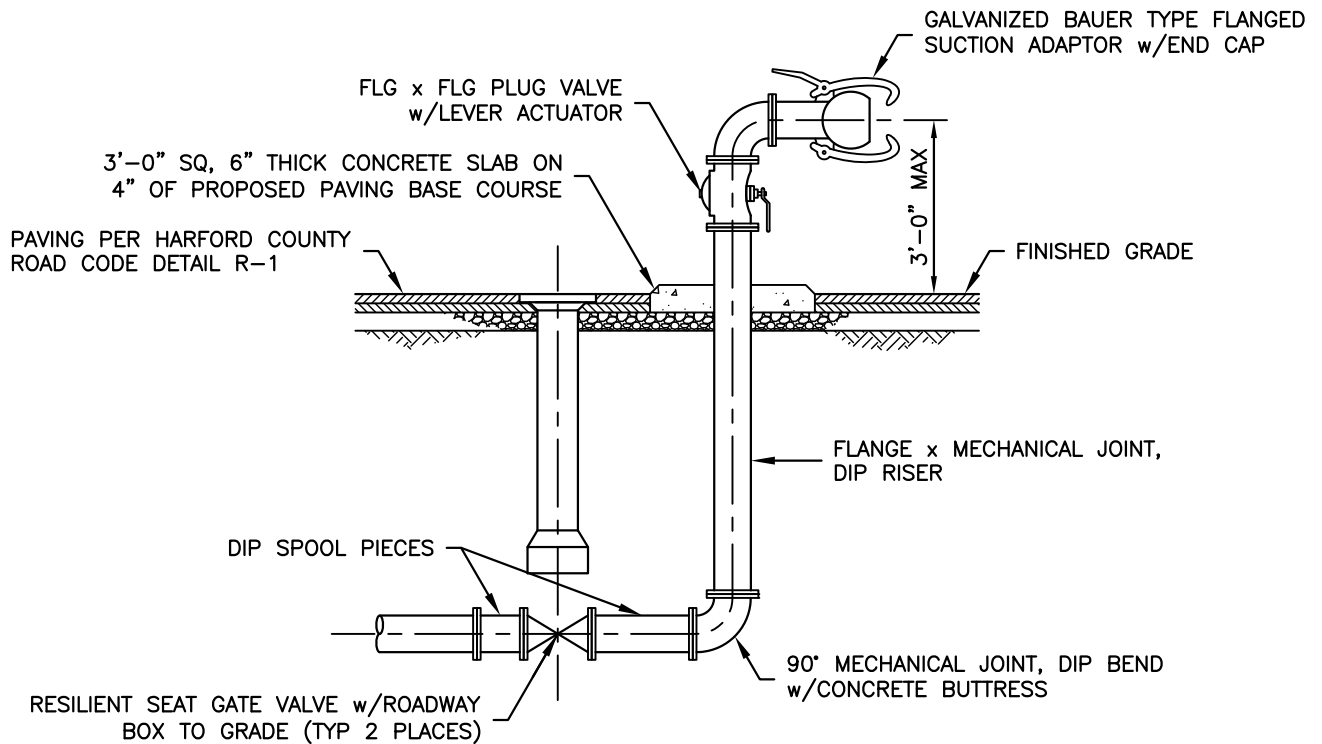
SEWAGE COMBINATION AIR
VALVE IN MANHOLE

ISSUED
01/01/26

PLATE
S-24



PLAN



PROFILE

NOTES:

1. THIS DETAIL IS FOR CONCEPT ONLY. PIPE LOCATION AND SIZES WILL BE AS DESIGNED BY THE ENGINEER AND APPROVED BY THE DIVISION OF WATER AND SEWER.
2. ALL BURIED JOINTS SHOWN IN THIS DETAIL SHALL HAVE MECHANICAL JOINT RESTRAINTS AND BUTTRESSES.



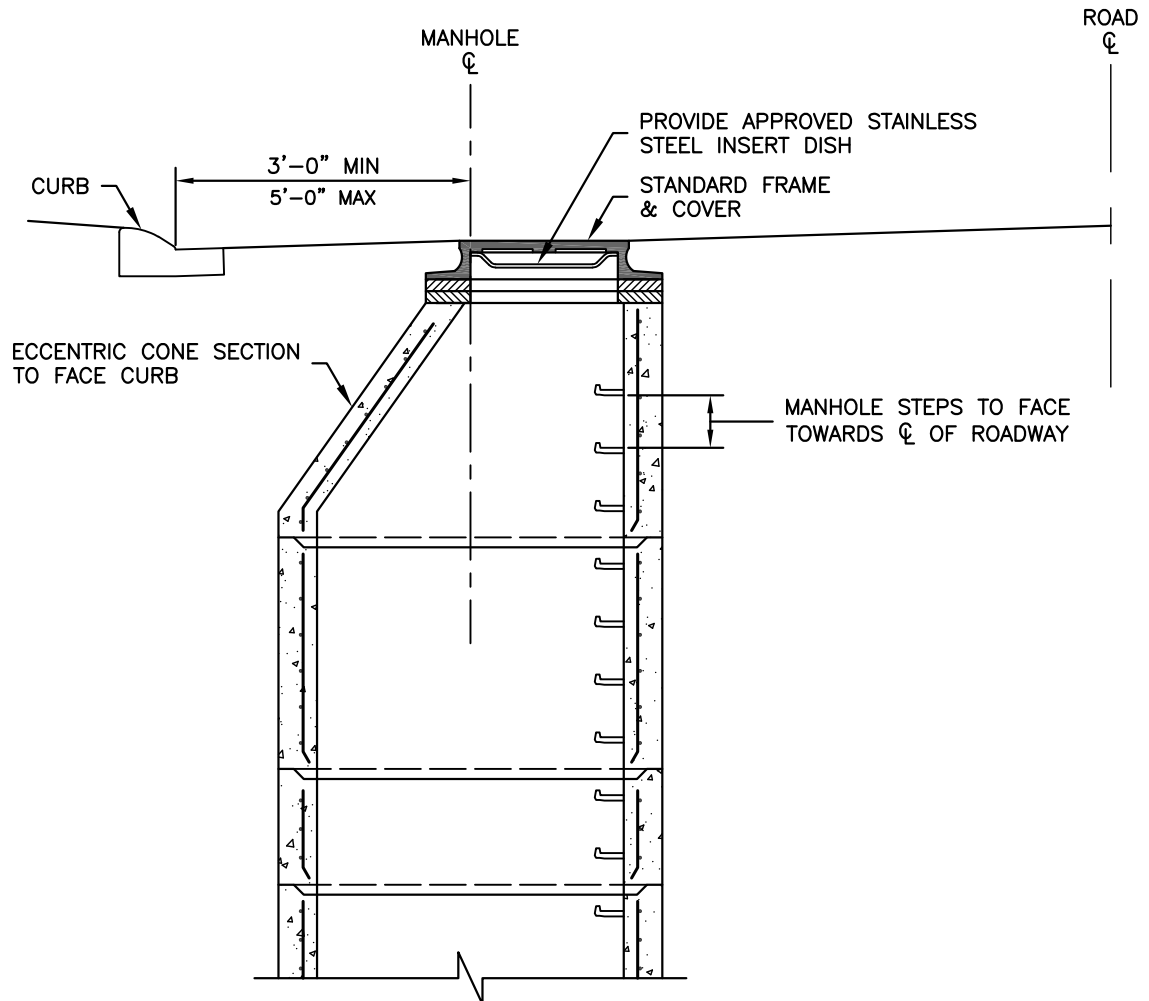
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STANDARD SEWER DETAILS

PUMP AROUND

ISSUED
01/01/26

**PLATE
S-25**



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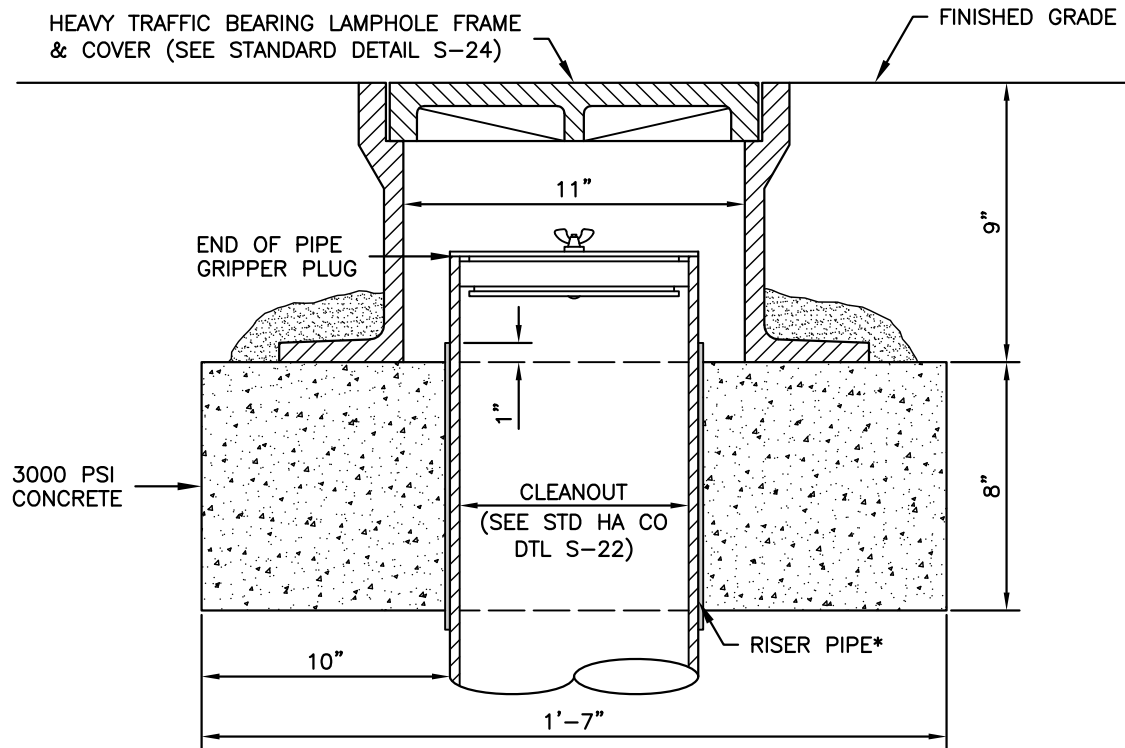
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STANDARD SEWER DETAILS

PRECAST MANHOLE SETTING
WITHIN 5 LF OF FACE OF CURB

ISSUED
01/01/26

PLATE
S-26



*ALL PIPE EXPOSED TO CONCRETE SHALL BE WRAPPED w/TWO LAYERS OF 8 oz NONWOVEN GEOTEXTILE FABRIC

NOTES:

1. THIS DETAIL PERTAINS TO BUSINESS, COMMERCIAL OR INDUSTRIAL APPLICATIONS AND AS OTHERWISE APPROVED. IF LOCATED IN PAVING, THE CLEANOUT SHALL BE ENCASED IN A 24"x24" CONCRETE SLAB BOXED OUT WITH EXPANSION JOINT MATERIAL.
2. IN RESIDENTIAL CONCRETE DRIVEWAYS, PROVIDE A 7'X8' SLAB, EITHER CUT-OUT OR BOXED OUT WITH EXPANSION JOINT MATERIAL. SEE STANDARD DETAIL G-5.



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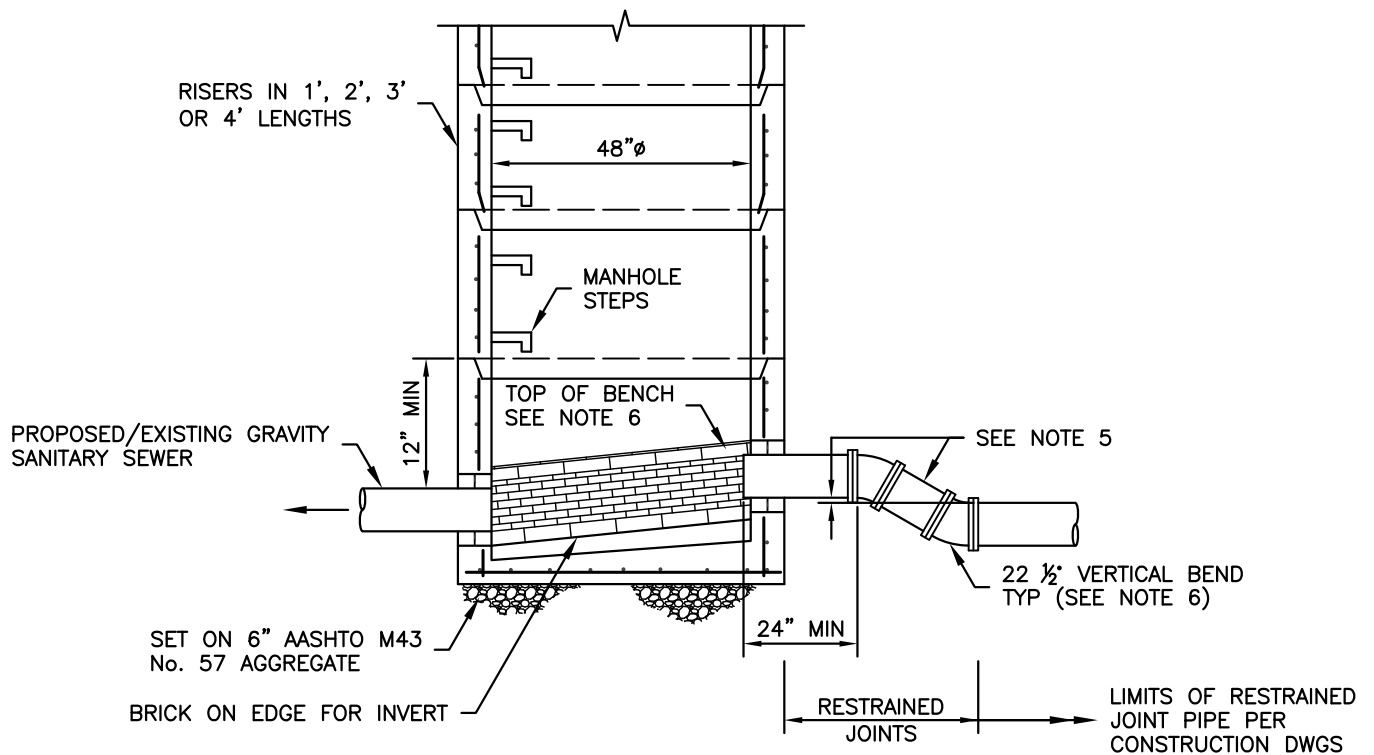
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STANDARD SEWER DETAILS

SANITARY CLEANOUT
IN PAVING

ISSUED
01/01/26

PLATE
S-27



48" TYPE A-2

NOTES:

1. WHEN CONNECTING TO AN EXISTING SEWER SYSTEM, A NEW DISCHARGE MANHOLE SHALL BE INSTALLED.
2. MANHOLE CONE, RISER AND BASE SECTIONS SHALL BE FURNISHED IN STRICT ACCORDANCE WITH ASTM DESIGNATION C478 (LATEST) FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS.
3. THE INTERIOR SURFACES OF THE MANHOLE SHALL BE COATED IN ACCORDANCE WITH THE APPROVED MATERIALS LIST.
4. PROVIDE CARBON ODOR CONTROL INSERT IN LID.
5. INVERT OF PIPE TERMINUS SHALL BE EQUAL TO OR HIGHER IN ELEVATION THAN FORCE MAIN PRIOR TO THE FIRST 22 1/2' BEND. THE LENGTH OF SPOOL PIECE BETWEEN BENDS SHALL BE INDICATED ON THE CONSTRUCTION DRAWINGS TO ENSURE THE PROPER ELEVATIONS NOTED ABOVE.
6. ANCHORS AND BUTTRESSES ARE NOT REQUIRED ON THE VERTICAL BENDS SHOWN UNLESS SPECIFIED IN THE CONSTRUCTION DOCUMENTS.
7. THE TOP OF THE BENCH SHALL BE SLOPED TOWARDS THE CHANNEL. THE DIFFERENCE BETWEEN EDGE OF THE MANHOLE AND EDGE OF THE CHANNEL SHALL BE NO LESS THAN TWO COURSES OF BRICK.
8. THE SECOND FITTING MAY NOT BE NECESSARY IF THE CONSTRUCTION DRAWINGS INDICATE THIS CONDITION. GENERALLY THE FIRST FITTING MAY NOT BE NECESSARY (AS DETERMINED BY THE DIVISION OF WATER AND SEWER) IF THE APPROACHING GRADE OF THE FORCE MAIN DOES NOT REQUIRE THE FITTING.
9. TESTING OF THE FORCE MAIN SHALL BE PERFORMED AFTER THE BRICK CHANNEL AND BENCH HAVE BEEN COMPLETED.



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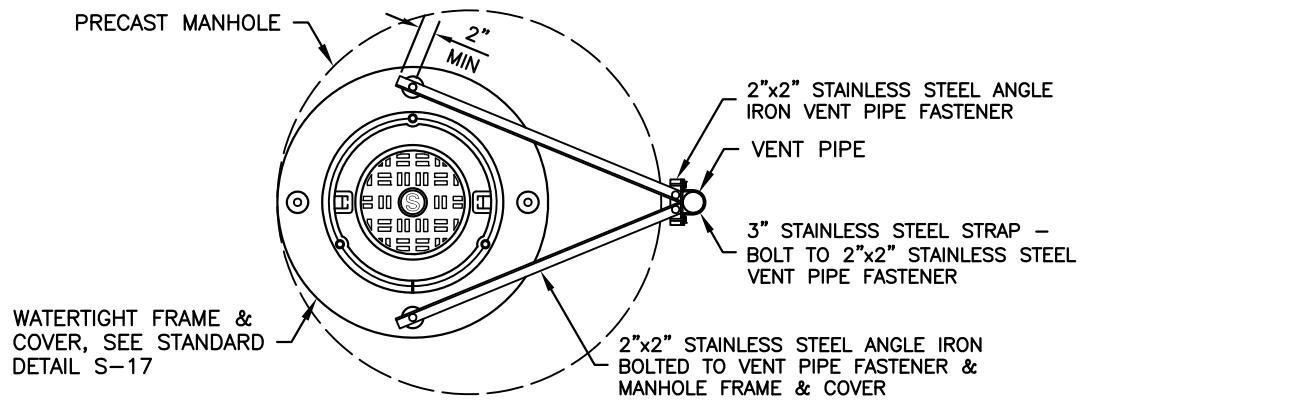
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STANDARD SEWER DETAILS

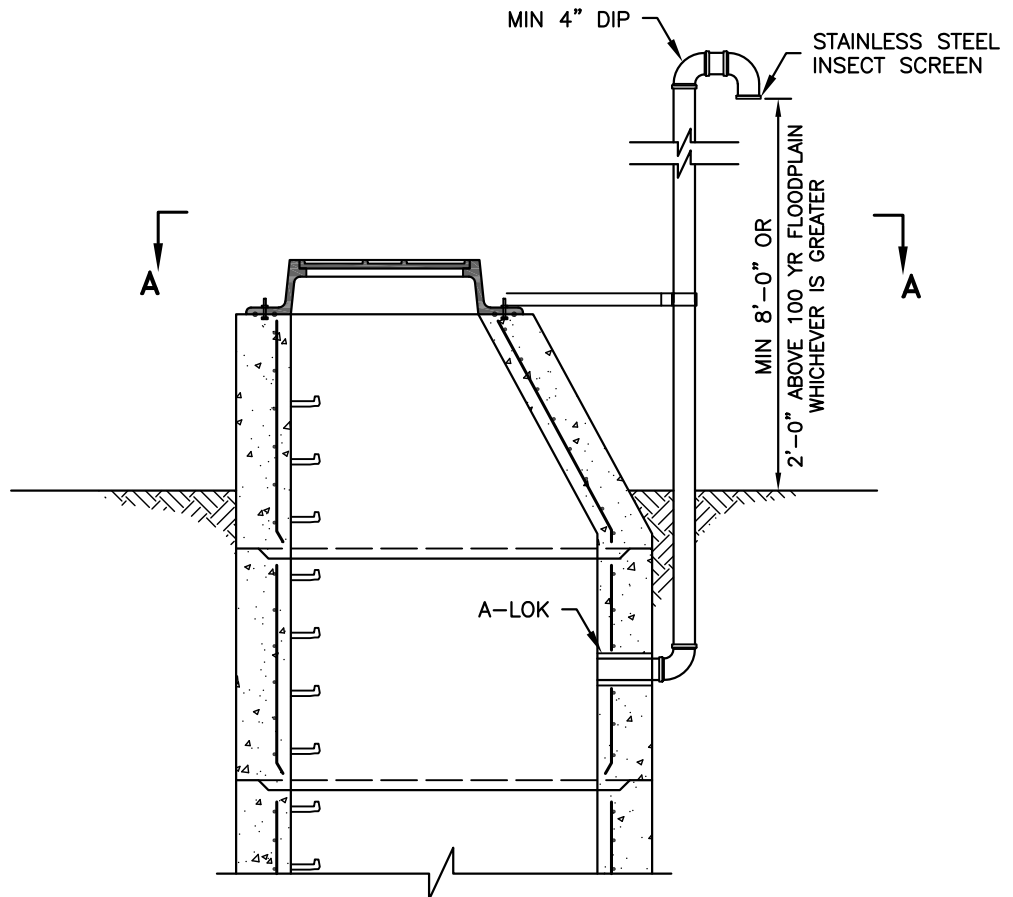
FORCE MAIN DISCHARGE MANHOLE
(FOR 4" DIA PIPE AND GREATER)

ISSUED
01/01/26

PLATE
S-28



SECTION A-A



PROFILE

NOTES:

1. VENT PIPE SHALL BE INSTALLED PLUMB.
2. VENT PIPE SHALL BE INSTALLED ON THOSE MANHOLES SHOWN ON THE CONTRACT DRAWINGS.
3. ALL HARDWARE SHALL BE STAINLESS STEEL.
4. VENT PIPE COATING TO BE THE SAME AS ON MANHOLE FRAME AND COVER.



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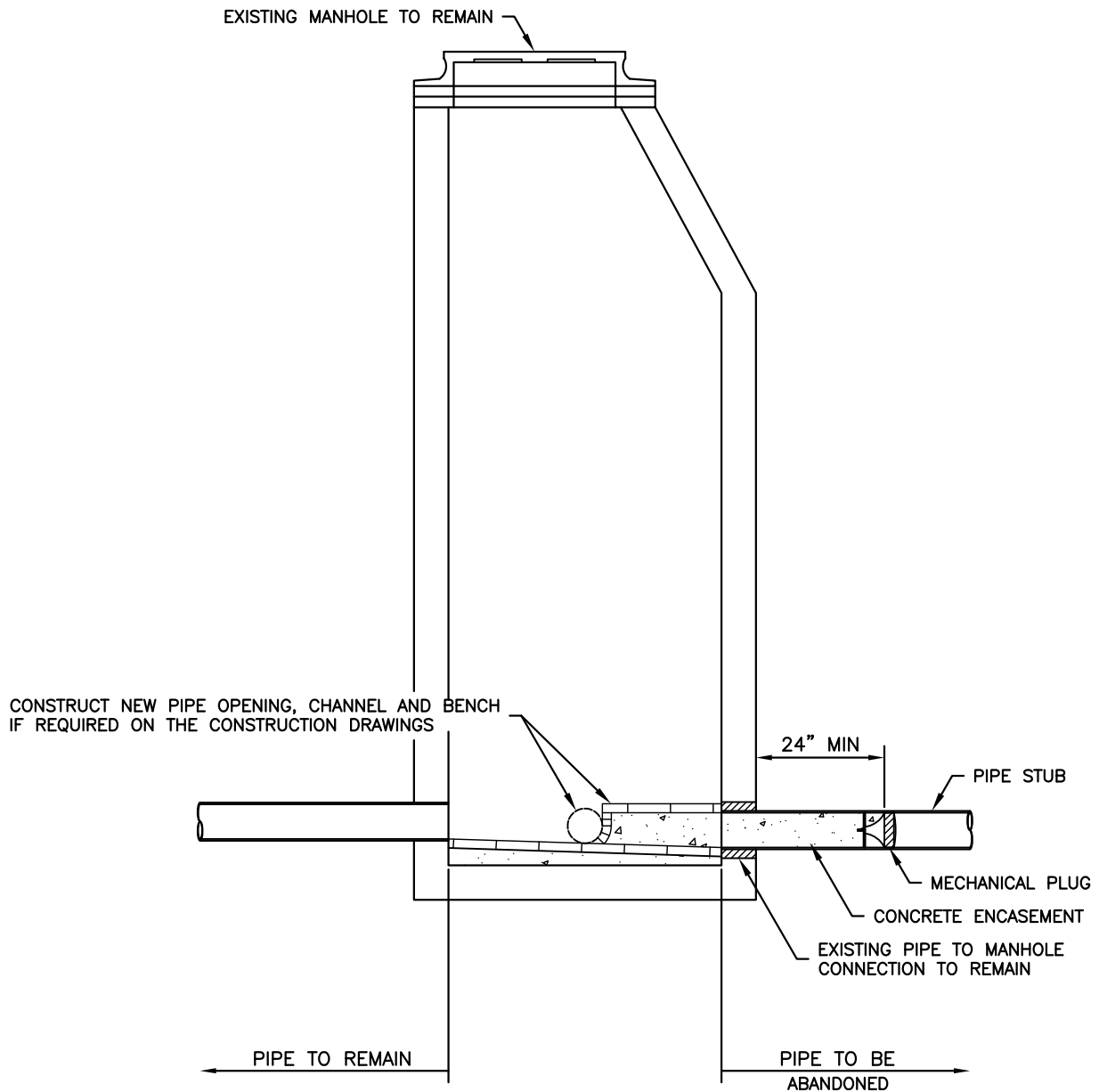
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STANDARD SEWER DETAILS

MANHOLE VENT

ISSUED
01/01/26

PLATE
S-29



NOTES:

1. FOR SEWER DIAMETERS 18" AND SMALLER, DISCONNECT SEWER AS SHOWN. INSERT MECHANICAL PLUGS AND PLACE CONCRETE ENCASEMENT.
2. FOR SEWER DIAMETERS LARGER THAN 18", INSTALL MASONRY BULKHEAD.
3. RESHAPE AND FILL EXISTING CHANNEL AS NECESSARY TO PROVIDE A SMOOTH CONTOUR BETWEEN INCOMING AND OUTGOING PIPES.
4. SEWER PLUGS SHALL BE IN ACCORDANCE WITH SECTION 02050 AND APPROVED MATERIALS LIST.



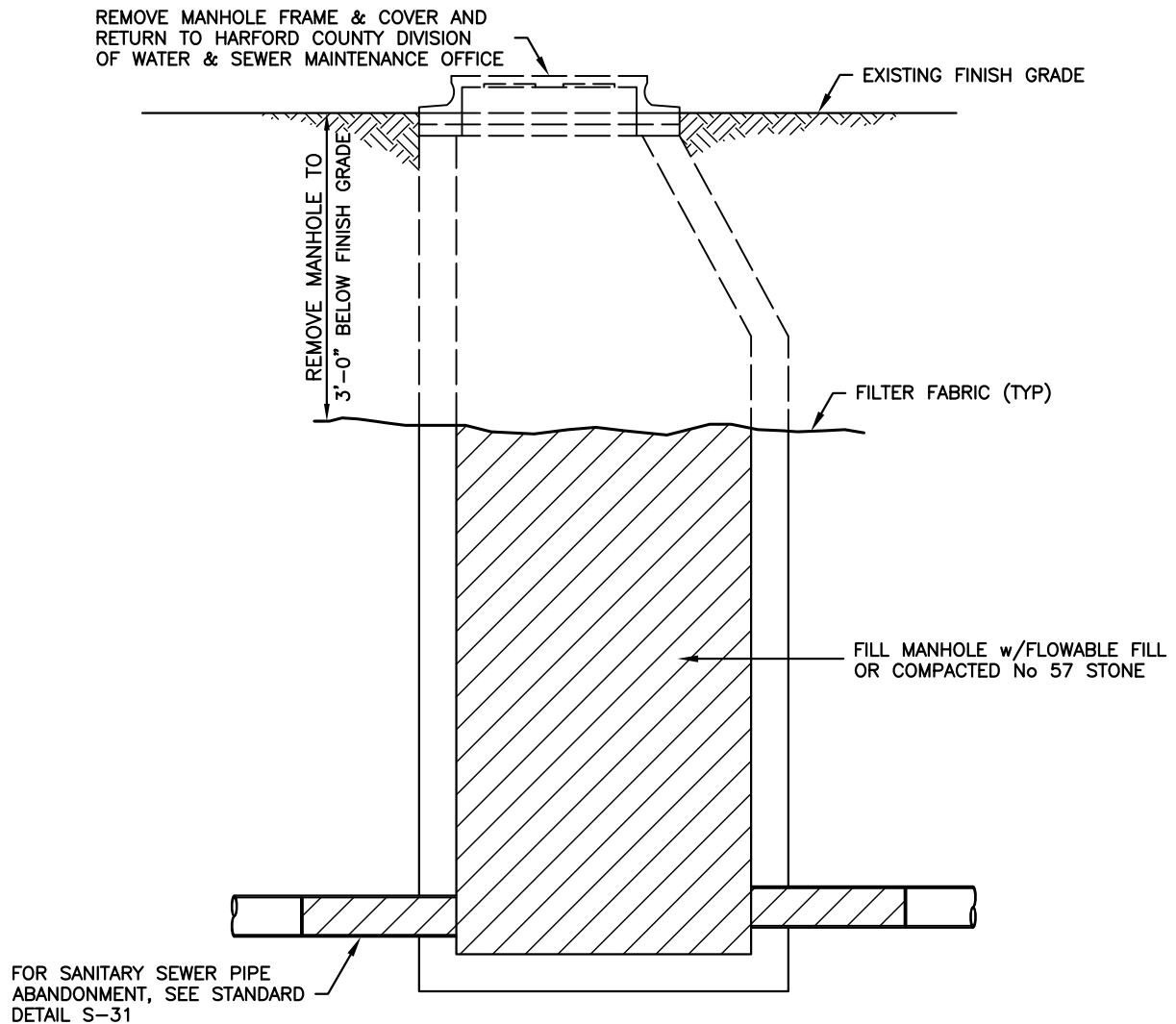
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STANDARD SEWER DETAILS

ABANDONMENT OF PIPE
AT MANHOLE

ISSUED
01/01/26

PLATE
S-30



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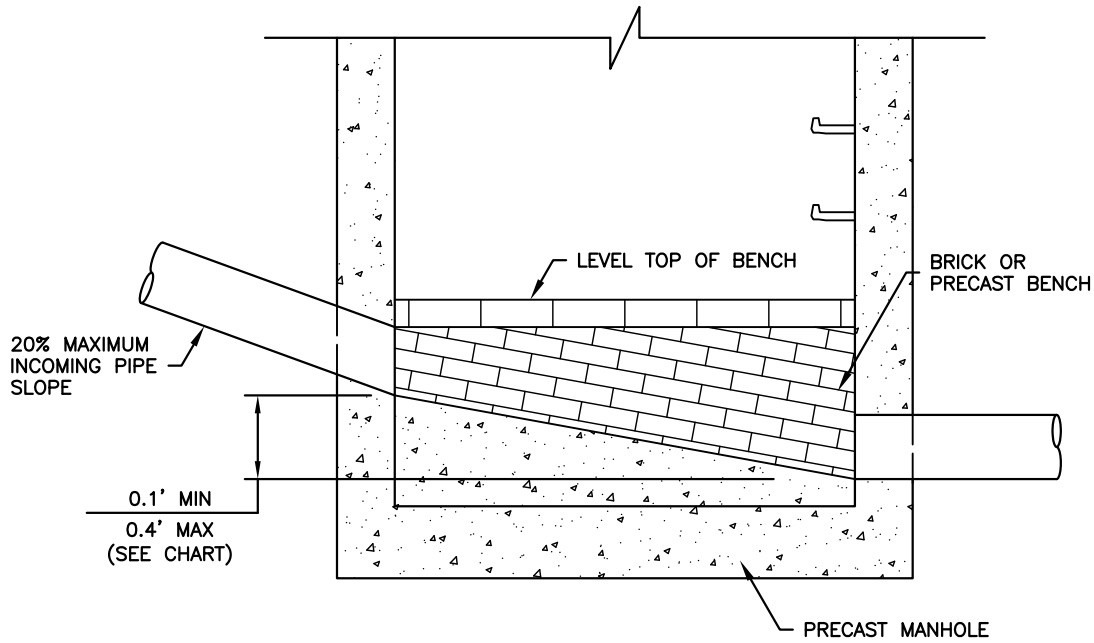
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STANDARD SEWER DETAILS

COMPLETE MANHOLE
ABANDONMENT

ISSUED
01/01/26

PLATE
S-31



INCOMING SLOPE	* DROP
0.4%–7%	0.1'
7%–10%	0.2'
10%–15%	0.3'
15%–20%	0.4'

* DROP IS THE DIFFERENCE BETWEEN THE INVERT IN AND THE INVERT OUT ELEVATIONS.

NOTES:

1. THE CHANGE IN SLOPE BETWEEN THE INCOMING OR OUTGOING PIPE AND THE SLOPE THROUGH THE MANHOLE MAY NOT EXCEED 10% WITHOUT PRIOR APPROVAL FROM THE COUNTY.
2. THE INVERT ELEVATIONS OF INCOMING AND OUTGOING SEWERS SHALL BE BASED ON THE INCOMING SEWER SLOPE ACROSS THE INTERIOR WIDTH OF THE MANHOLE.



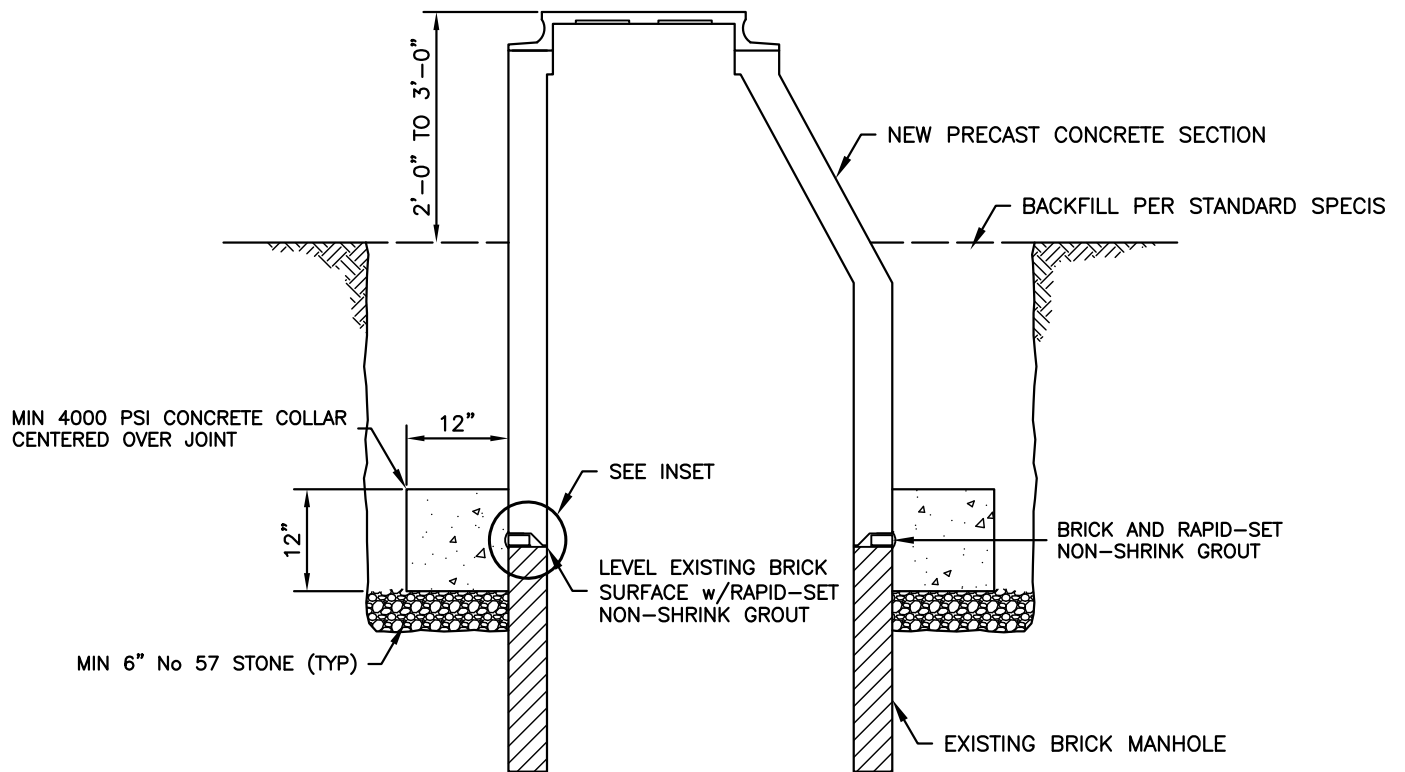
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STANDARD SEWER DETAILS

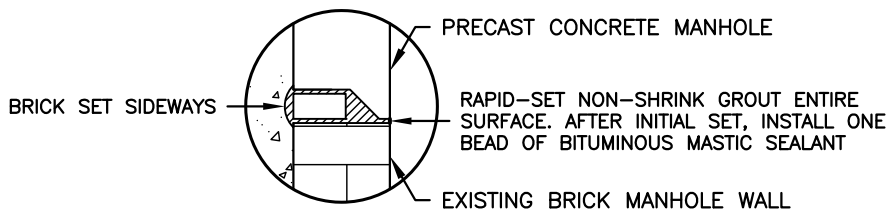
MANHOLE CHANNEL DETAIL

ISSUED
01/01/26

PLATE
S-32



SECTION



INSET

NOTES:

1. PRIOR TO BEGINNING WORK, CONTRACTOR SHALL PLACE PLYWOOD OVER ENTIRE CHANNEL TO PREVENT DEBRIS FROM ENTERING. ALL DEBRIS SHALL BE CLEANED FROM PLYWOOD AND PLYWOOD SHALL BE REMOVED UPON COMPLETION.
2. SUGGESTED METHOD OF CUTTING MANHOLE: AT MORTAR JOINT, USING HAMMER-DRILL, DRILL COMPLETELY THROUGH MANHOLE WALL APPROXIMATELY EVERY TWO FEET. ON EXTERIOR OF MANHOLE USE STRINGLINE FROM DRILLED HOLES TO SAW-CUT BETWEEN EXTERIOR DRILL HOLES. USE SLEDGE HAMMER TO DRIVE SEVERAL SPIKES INTO EXTERIOR SAW-CUT UNTIL BRICKWORK AT CUT "SNAPS" AROUND MANHOLE CIRCUMFERENCE. LIFT APART CONICAL BRICK SECTION.
3. THERE SHALL BE NO VISIBLE LEAKAGE UPON COMPLETION OF MANHOLE CONVERSION.



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STANDARD SEWER DETAILS

BRICK MANHOLE CONVERSION
TO PRECAST CONCRETE

ISSUED
01/01/26

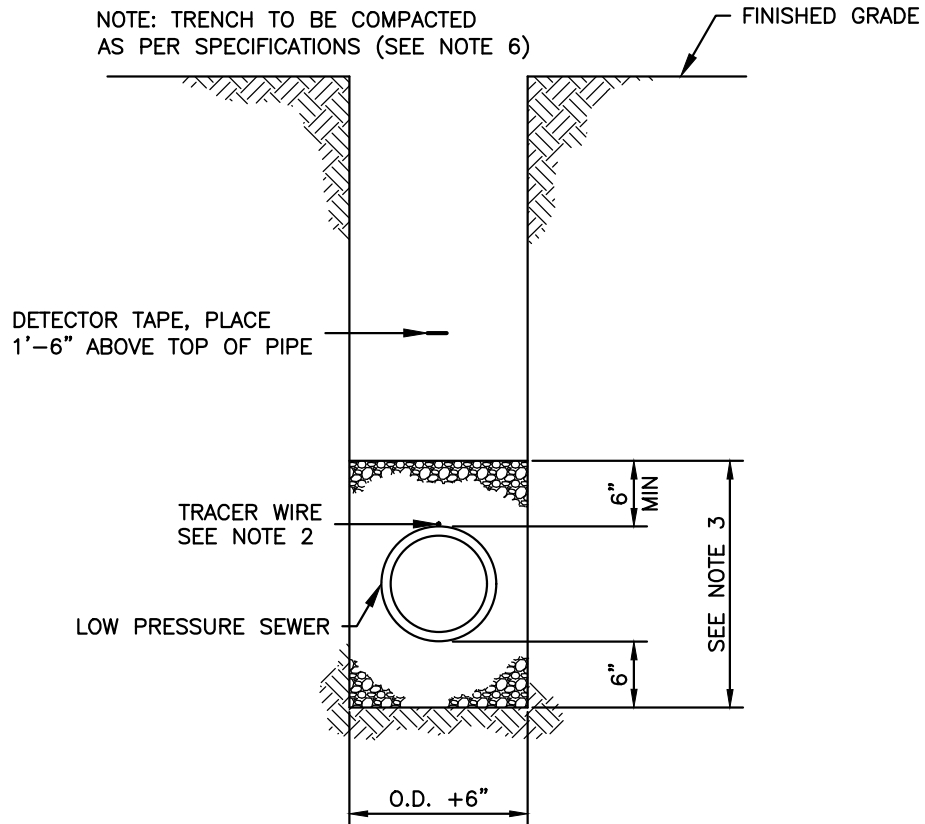
PLATE
S-33

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STANDARD LOW PRESSURE SEWER DETAILS

ISSUED 1/1/2026

LP1	Pipe Bedding
LP2	Isolation Valve Assembly
LP3	Terminal Flushing Connection
LP4	Service Valve Assembly
LP5	Inline Flushing Connection
LP6	Buttresses
LP7	Pipe Anchors
LP8	Cap and Plug Blocking
LP9	Connection at Manhole
LP10	Service Valve Assembly Connection to Pressure Main Connection
LP11	Grinder Pump Location for Simplex Pumps
LP12	Grinder Pump Location for Duplex Pumps
LP13	Anti-Flotation Collar
LP14	Grinder Pump Backfill
LP15	Typical Grinder Pump Electric Service
LP16	New Service Entrance Wiring Diagram
LP17	Control Panel
LP18	Simplex Grinder Pump Section
LP19	Duplex Grinder Pump Section
LP20	Low Pressure Sewer Air Release Valve (for Mainline up to 2-1/2")



NOTES:

1. ALL ROAD REPAIR SHALL BE AS PER HARFORD COUNTY HIGHWAY DETAILS OR MARYLAND STATE PERMIT DETAILS.
2. PROVIDE TRACER WIRE FOR ALL NON-METALLIC MAINS AND SERVICES.
3. PVC AND HDPE PIPE SHALL RECEIVE AASHTO M43, No. 57 AGGREGATE OR COMPACTED SAND THAT MEETS THE MARYLAND SHA REQUIREMENTS FOR FINE AGGREGATE.
4. ALL PIPE SHALL BE INSTALLED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PIPE MANUFACTURER AND COUNTY STANDARDS.
5. PROVIDE CONTINUOUS BEARING FOR FULL LENGTH OF PIPE. MINIMUM BURY DEPTH IS 3'-6".
6. ANY TRENCH LESS THAN 18" IN WIDTH, SHALL BE BACKFILLED WITH AASHTO M43, No 57 AGGREGATE TO 1'-0" BELOW FINISHED GRADE. THE REMAINING SECTION OF TRENCH SHALL BE BACKFILLED AS PER SPECIFICATIONS.



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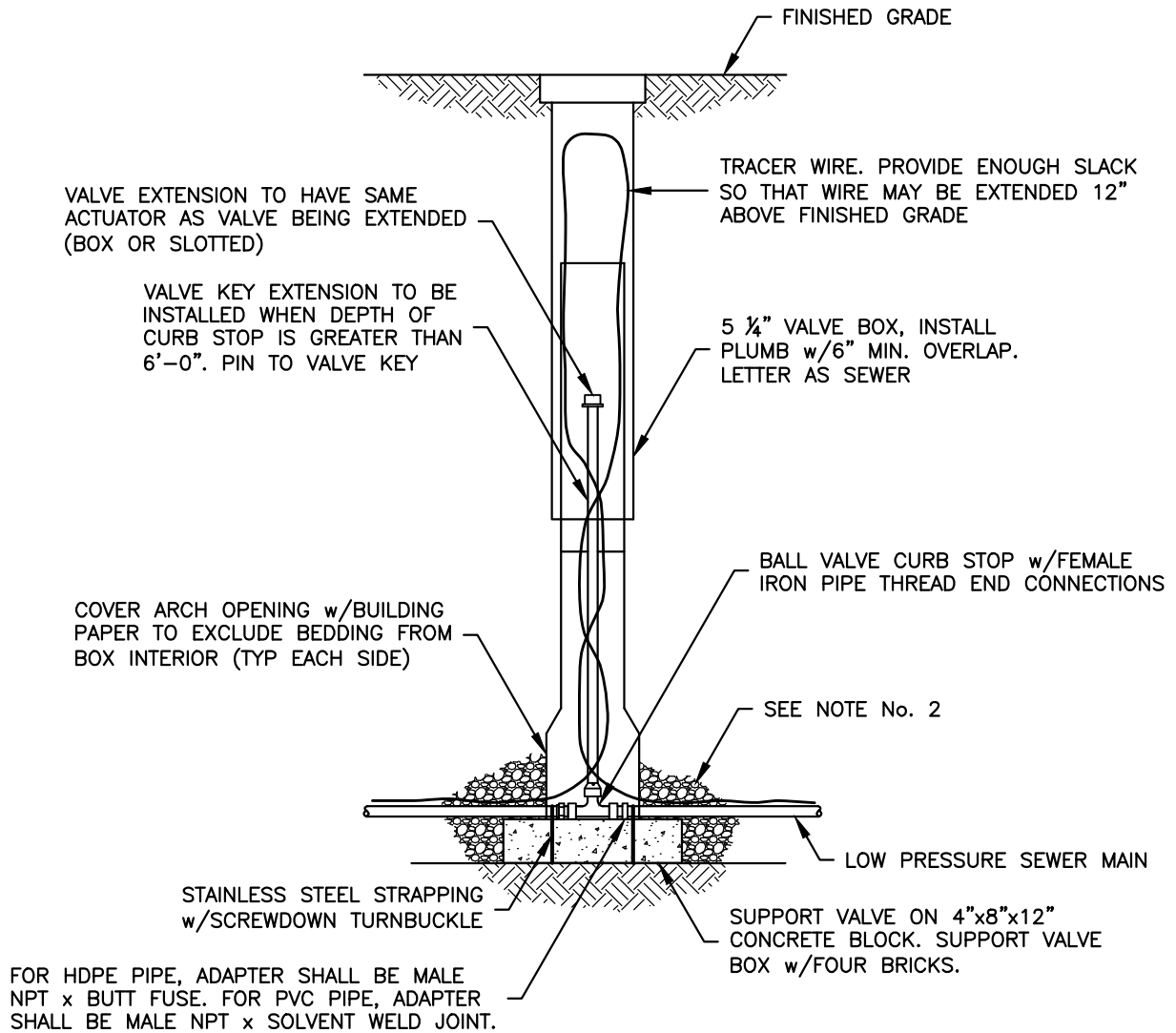
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LOW PRESSURE SEWER

PIPE BEDDING

ISSUED
01/01/26

PLATE
LP-1



NOTES:

1. PROVIDE ADAPTERS FOR ALL CONNECTIONS BETWEEN PIPE AND FITTING.
2. BACKFILL WITH AASHTO M43, No. 57 AGGREGATE OR COMPACTED SAND, EACH SIDE OF BLOCK AND 6" ABOVE PIPE IN OPEN TRENCH AREAS.
3. LOW PRESSURE SEWER MAINS 3 INCHES AND LARGER, SHALL RECEIVE RESILIENT SEATED GATE VALVES IN-LIEU OF BALL VALVE CURB STOPS.



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LOW PRESSURE SEWER

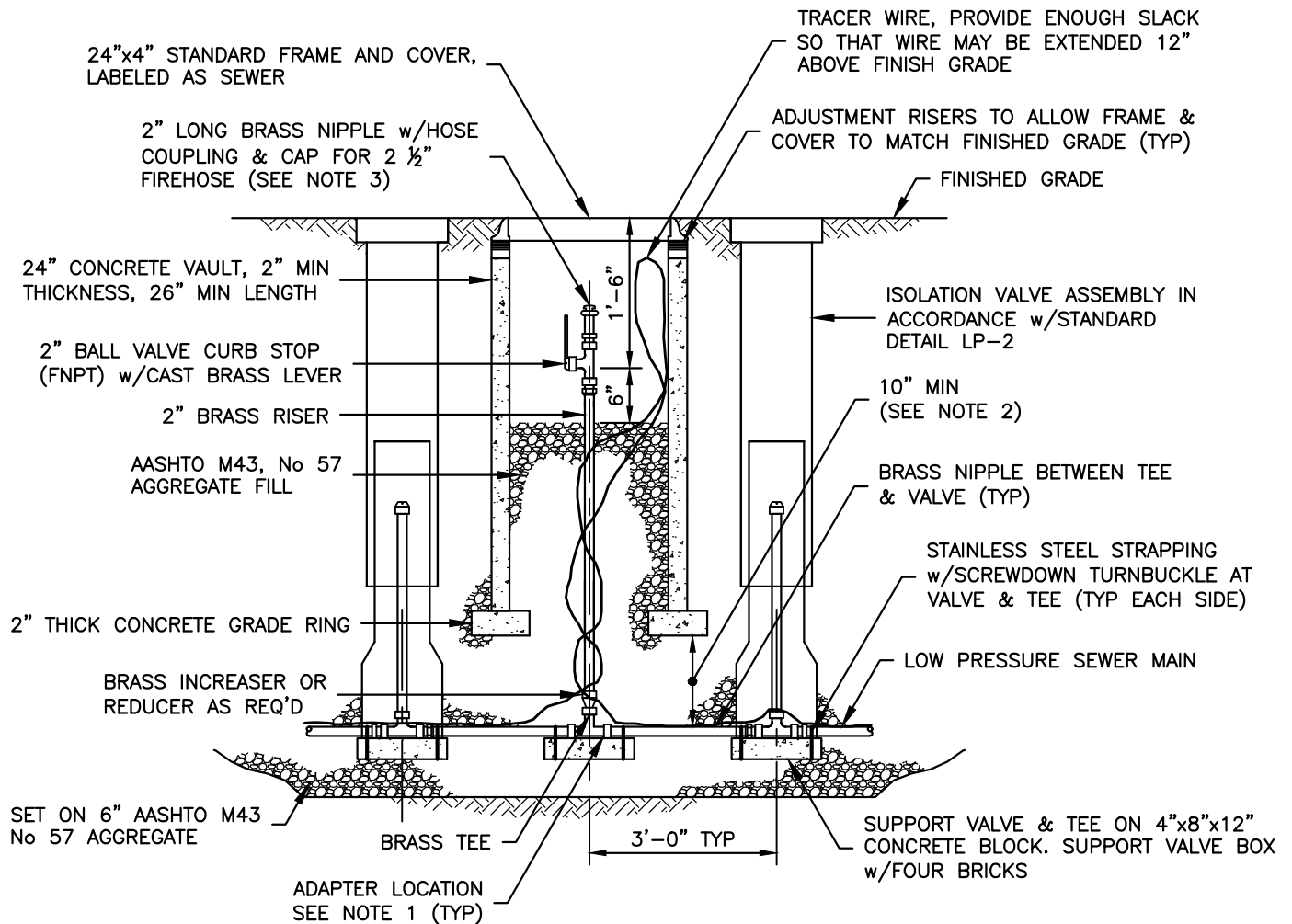
ISOLATION VALVE ASSEMBLY

ISSUED
01/01/26

PLATE
LP-2

PLATE
LP-3

PLATE
LP-4



NOTES:

1. NOT FOR INSTALLATION IN PAVED AREAS.
2. PROVIDE ADAPTERS IN ACCORDANCE WITH STANDARD DETAIL LP-2.
3. BACKFILL WITH AASHTO M43, No. 57 AGGREGATE OR COMPACTED SAND THAT MEETS MARYLAND SHA REQUIREMENTS FOR FINE AGGREGATE.
4. HOSE CONNECTION AND CAP THREADS SHALL CONFORM TO ANSI SPECIFICATION B26 FOR "NATIONAL (AMERICAN) STANDARD FIRE-HOSE COUPLING SCREW THREAD".
5. BRASS TEE SIZE SHALL BE THE SAME AS LINE SIZE.
6. ADJUSTMENT RISER TOTAL DEPTH SHALL BE 3" MIN AND 6" MAX WITH A MINIMUM OF TWO RISERS. MAXIMUM THICKNESS OF EACH RISER SHALL NOT EXCEED 1 1/2".



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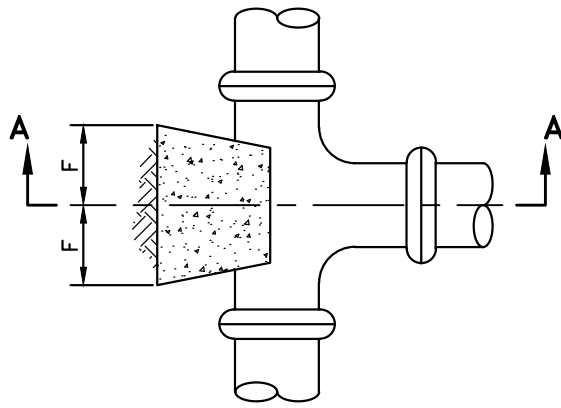
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LOW PRESSURE SEWER

INLINE FLUSHING CONNECTION

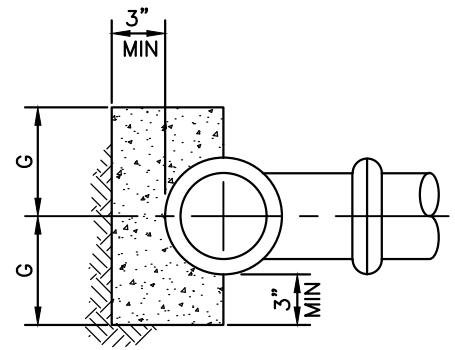
ISSUED
01/01/26

PLATE
LP-5

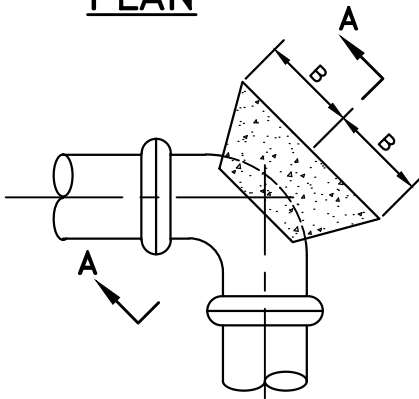


PLAN

TEES/WYES



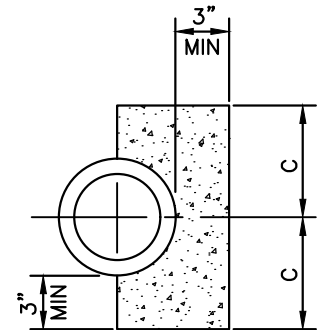
SECTION A-A



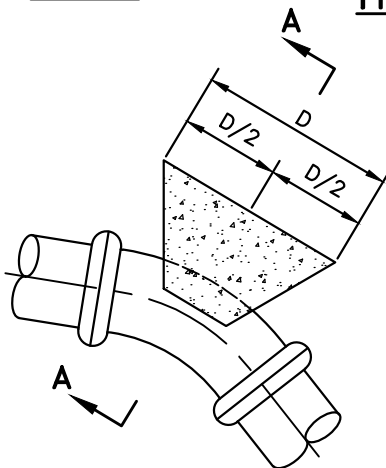
PLAN

90°

HORIZONTAL BENDS



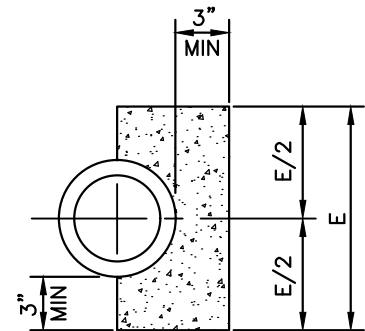
SECTION A-A



PLAN

11 1/4°, 22 1/2°, 45°

HORIZONTAL BENDS



SECTION A-A

NOTES:

1. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH OR SOIL THAT MEETS ALL COMPACTION REQUIREMENTS.
2. ALL CONCRETE TO BE MIX No. 2, 3000 PSI.
3. BUTTRESS SIZED FOR 150 PSI.
4. DO NOT ENCASE JOINTS.

PIPE SIZE	B	C	D	E	F	G
1 1/4" & 1 1/2"	5"	5"	5"	7"	3"	3"
2"	5"	5"	7"	9"	5"	5"
2 1/2"	5"	5"	7"	9"	5"	5"
3'	6"	6"	9"	9"	6"	6"
4"	13"	6"	12"	12"	8"	6"



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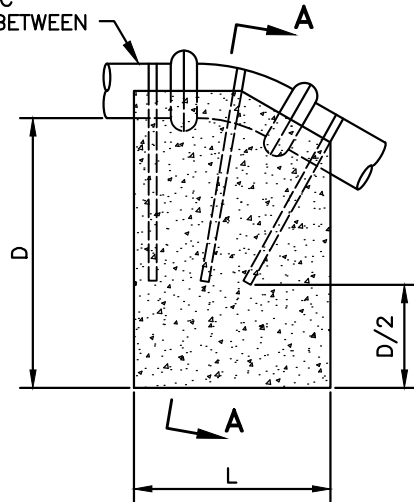
LOW PRESSURE SEWER

BUTTRESSES

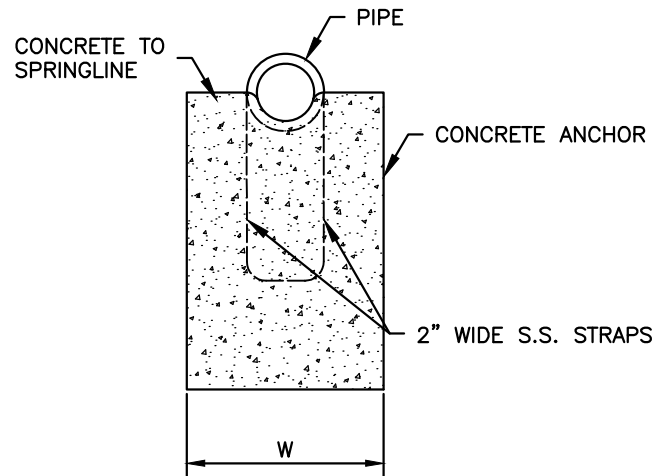
ISSUED
01/01/26

PLATE
LP-6

1/8" THICK SYNTHETIC
GASKET MATERIAL BETWEEN
STRAP & PIPE



PROFILE



SECTION A-A

SIZE BEND		1 1/4", 1 1/2"	2", 2 1/2"	3"	4"
1/32 (11 1/4')	L	12"	15"	18"	18"
	W	10"	12"	15"	18"
	D	10"	15"	15"	18"
1/16 (22 1/2')	L	15"	20"	20"	24"
	W	15"	20"	20"	24"
	D	12"	12"	18"	20"
1/8 (45')	L	20"	24"	24"	30"
	W	20"	20"	24"	30"
	D	12"	20"	24"	26"

NOTES:

1. STAINLESS STEEL STRAPS SHALL BE 20 GAGE AND 2" WIDE.
2. STRAPS SHALL BE EMBEDDED IN CONCRETE A DISTANCE OF D/2.
3. 1/8" THICK SYNTHETIC GASKET MATERIAL SHALL BE PLACED BETWEEN STRAP AND PIPE.
4. USE MIX No. 2 CONCRETE, 3000 PSI.
5. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH OR SOIL THAT MEETS COMPACTION REQUIREMENTS.
6. CONCRETE ANCHORAGE DIMENSIONS ARE BASED ON TOTAL PRESSURE OF 150 PSI.



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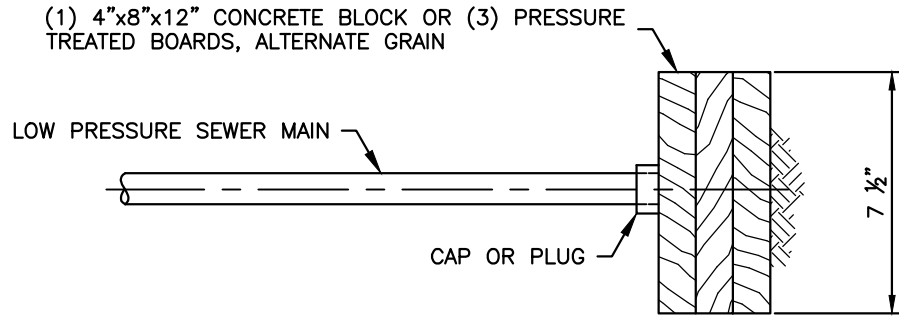
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LOW PRESSURE SEWER

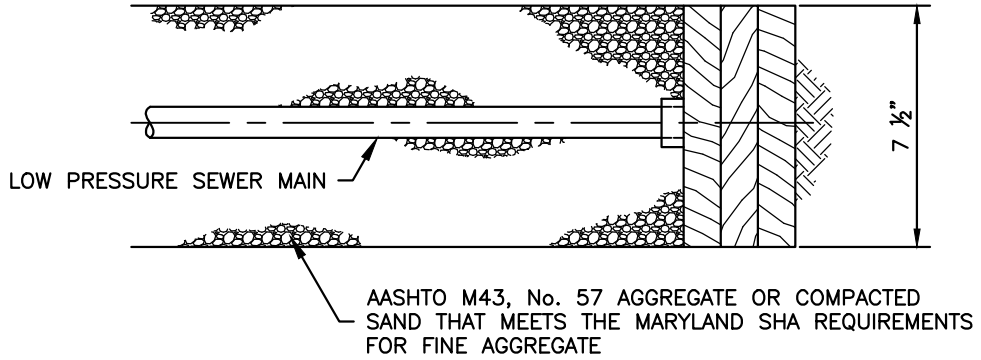
PIPE ANCHORS

ISSUED
01/01/26

PLATE
LP-7



PLAN



ELEVATION

NOTES:

1. CARRY ALL BEARING SURFACES TO UNDISTURBED EARTH OR SOIL THAT MEETS COMPACTION REQUIREMENTS.
2. BUTTRESS SIZED FOR 150 PSI.
3. NOMINAL THICKNESS OF ALL BOARDS IS 2".
4. MINIMUM OF 3 BOARDS TO BE PRESSURE TREATED YELLOW PINE.



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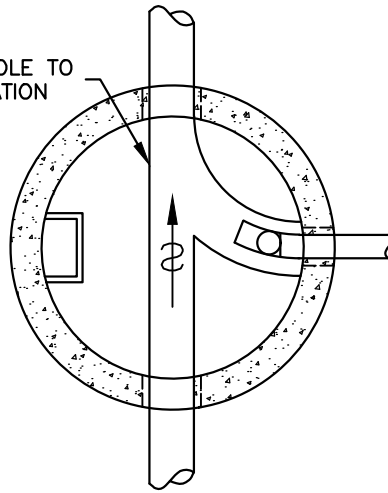
LOW PRESSURE SEWER

CAP AND PLUG BLOCKING

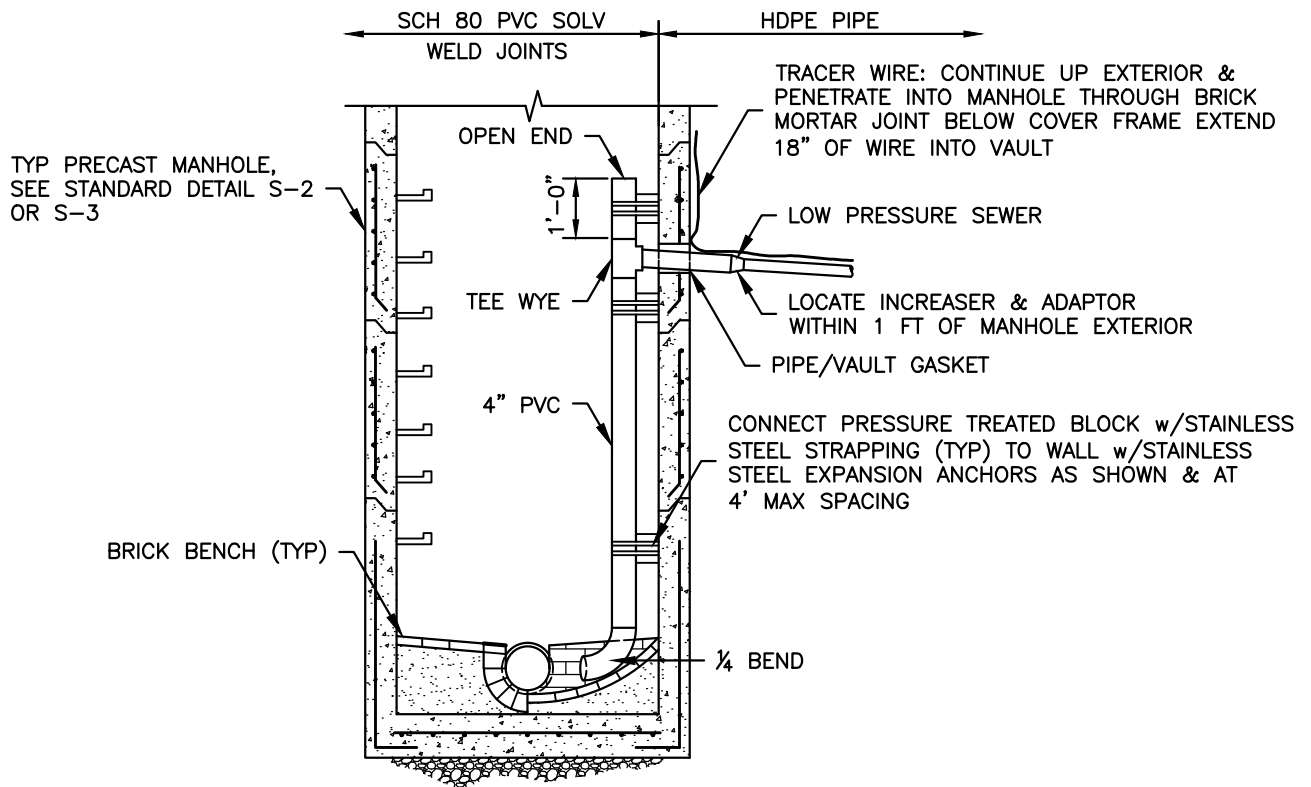
ISSUED
01/01/26

PLATE
LP-8

CHANNEL MANHOLE TO
SUIT CONFIGURATION



PLAN



SECTION

NOTES:

1. IF A NEW MANHOLE IS REQUIRED AT THE LOW PRESSURE SEWER DISCHARGE POINT, THE MANHOLE SHALL HAVE A FACTORY INSTALLED COATING AS INDICATED IN THE APPROVED MATERIALS LIST.
2. ALL INTERIOR CONCRETE SURFACES OF EXISTING MANHOLES SHALL BE COATED AS INDICATED IN THE APPROVED MATERIALS LIST.
3. DELETE 4" PVC PIPE AND INCREASER WHEN INVERT OF LOW PRESSURE SEWER IS LESS THAN 1'-0" FROM TOP OF BENCH.
4. THIS DETAIL DEPICTS CONNECTION TO A NEW MANHOLE. IF CONNECTION IS TO AN EXISTING MANHOLE, THE 4" PVC SHALL TERMINATE ON THE BENCH. THE BRICK SHALL BE BUILT UP ON THE BENCH TO CREATE A CHANNEL. THE BRICKWORK ON THE OPPOSITE BENCH SHALL BE RAISED AND TAPERED TOWARDS THE CHANNEL.



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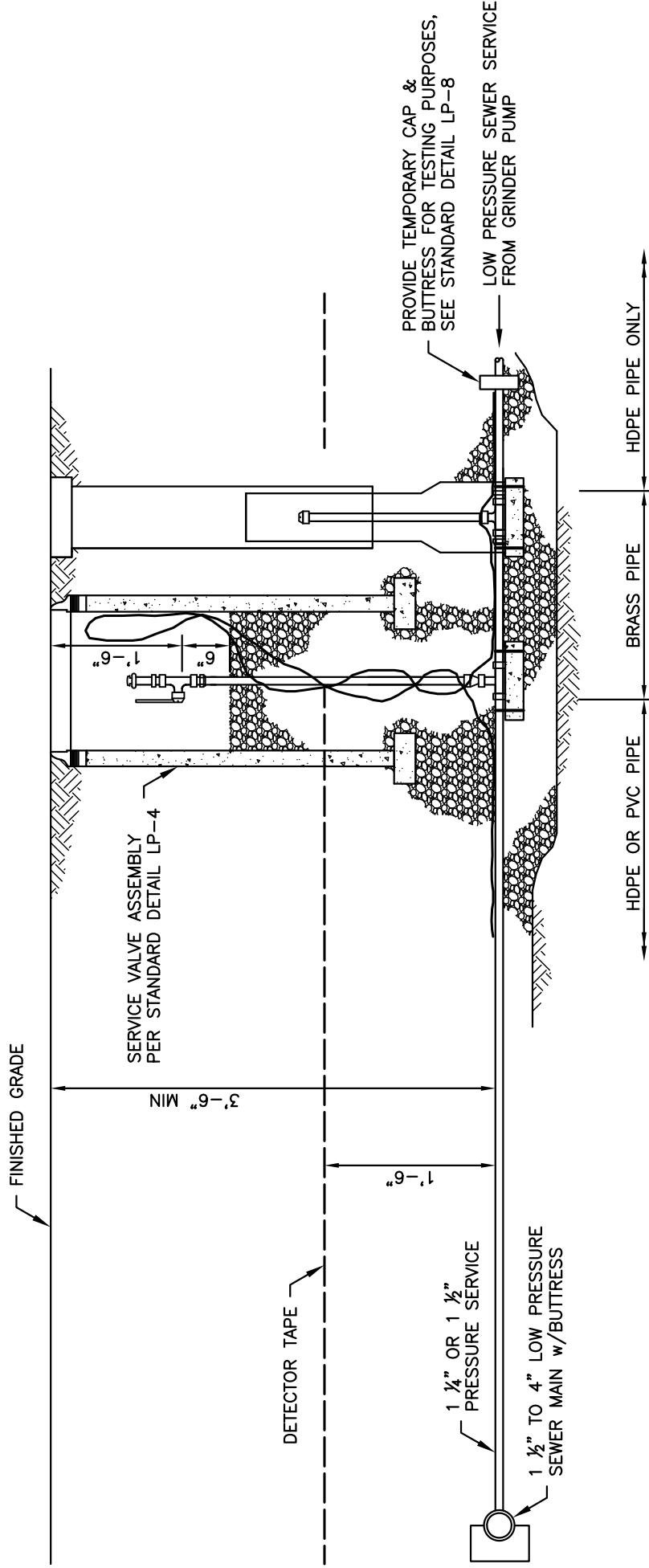
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LOW PRESSURE SEWER

CONNECTION AT MANHOLE

ISSUED
01/01/26

PLATE
LP-9



NOTES:

1. IF TAPPING EXISTING HDPE MAIN, USE HDPE MECHANICAL TAPPING TEE. SEE STANDARD SPECIFICATION SECTION 02731.



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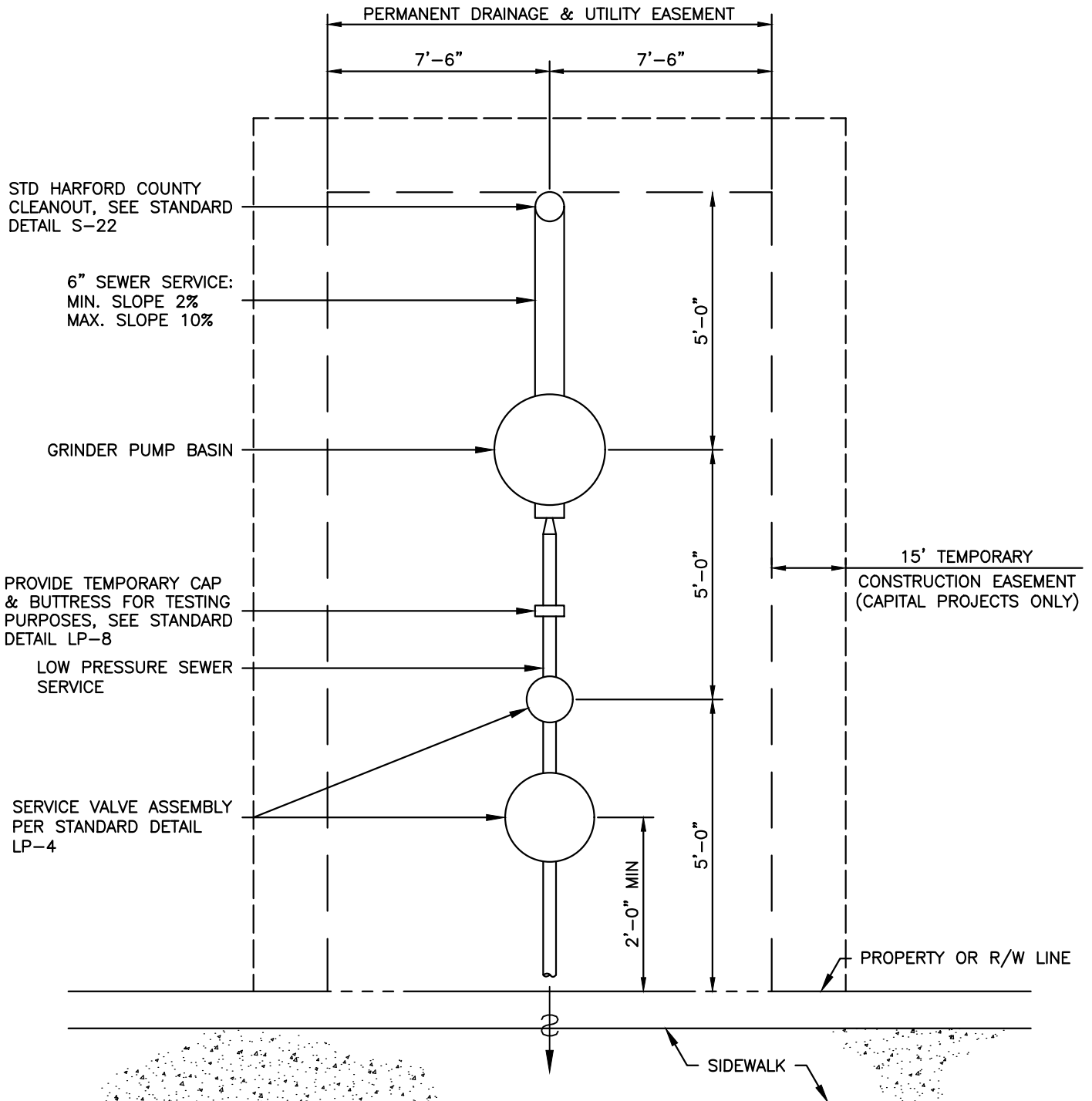
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LOW PRESSURE DETAILS

**SERVICE VALVE ASSEMBLY
CONNECTION TO PRESSURE MAIN**

ISSUED
01/01/26

**PLATE
LP-10**



NOTES:

1. CENTER GRINDER PUMP AND APPURTENANCES IN EASEMENT UNLESS OTHERWISE DIMENSIONED.
2. THERE SHALL BE A PHYSICAL BREAK IN THE LOW PRESSURE SEWER BETWEEN THE SERVICE VALVE ASSEMBLY AND GRINDER PUMP BASIN FOR TESTING PURPOSES. THE PHYSICAL BREAK SHALL REMAIN UNTIL THE LOW PRESSURE SYSTEM HAS BEEN FULLY TESTED AND APPROVED.



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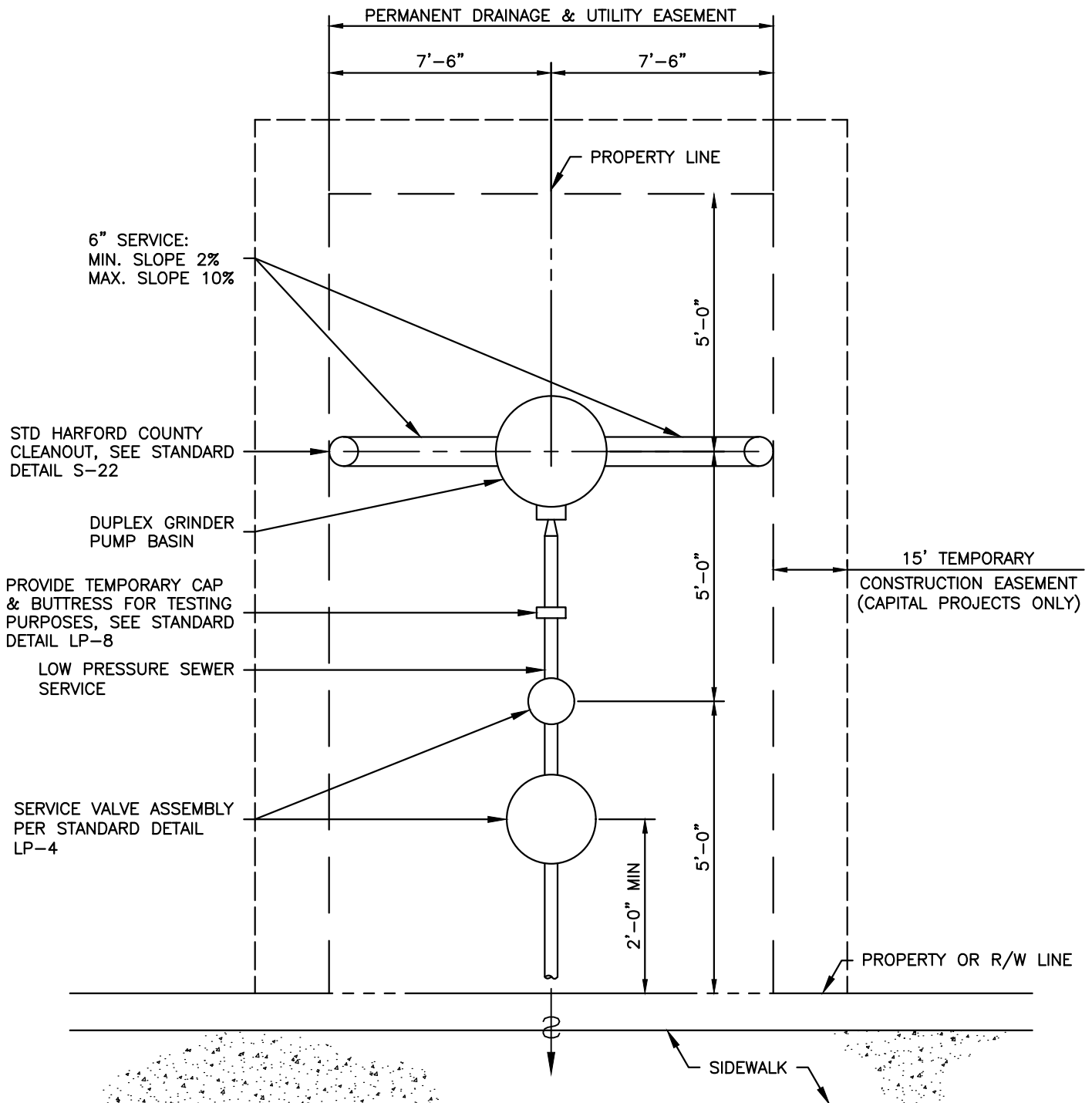
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LOW PRESSURE SEWER

GRINDER PUMP LOCATION
FOR SIMPLEX PUMPS

ISSUED
01/01/26

PLATE
LP-11



NOTES:

1. CENTER GRINDER PUMP AND APPURTENANCES IN EASEMENT UNLESS OTHERWISE DIMENSIONED.
2. THERE SHALL BE A PHYSICAL BREAK IN THE LOW PRESSURE SEWER BETWEEN THE SERVICE VALVE ASSEMBLY AND GRINDER PUMP BASIN FOR TESTING PURPOSES. THE PHYSICAL BREAK SHALL REMAIN UNTIL THE LOW PRESSURE SYSTEM HAS BEEN FULLY TESTED AND APPROVED.



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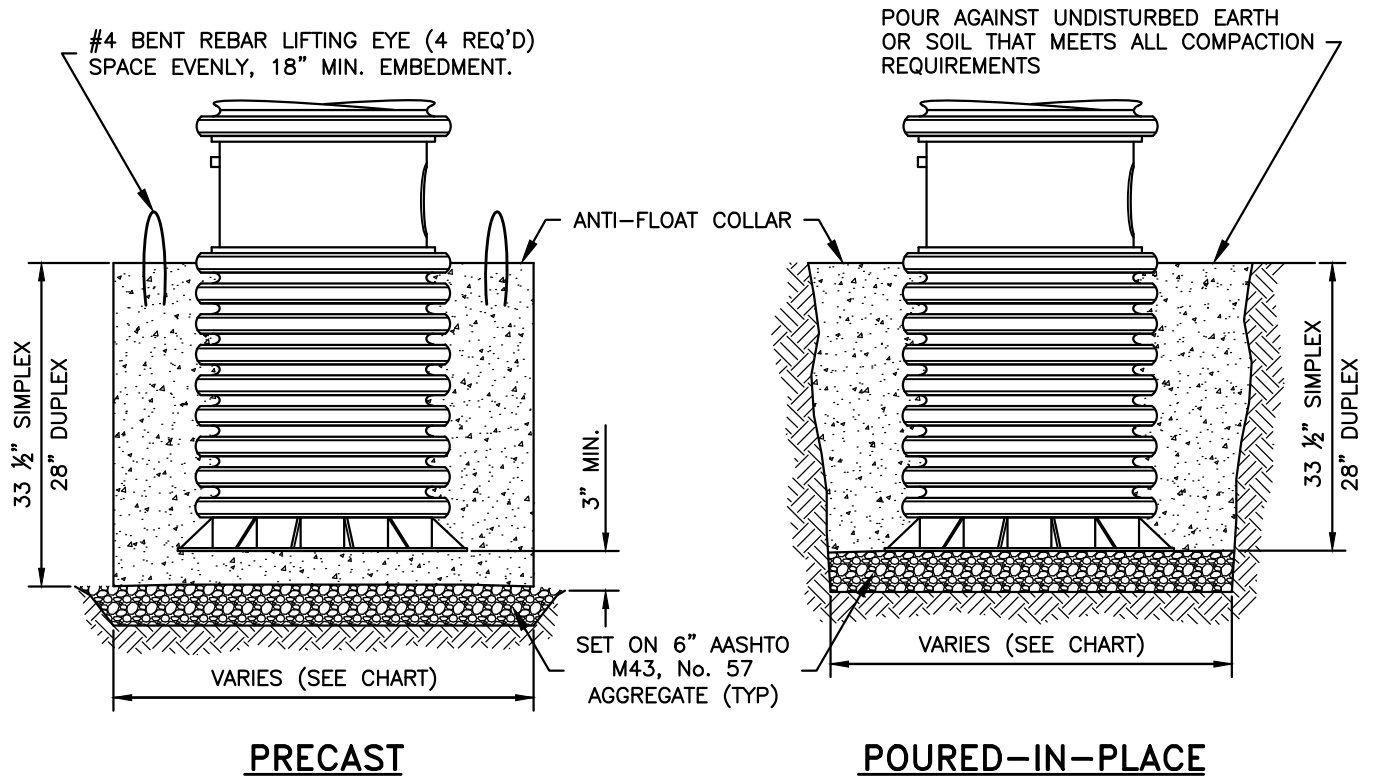
LOW PRESSURE SEWER

GRINDER PUMP LOCATION
FOR DUPLEX PUMPS

ISSUED
01/01/26

PLATE
LP-12

	ENVIRONMENT ONE MODEL	CONCRETE VOLUME	PRE-CAST DIA. AT 33 1/2 IN. H.
SIMPLEX	DH71-61	0.36 YD ³	ø 36 IN.
	DH71-74	0.48 YD ³	ø 39 1/8 IN.
	DH71-93	0.63 YD ³	ø 42 1/2 IN.
	DH71-124	0.90 YD ³	ø 47 1/2 IN.
	DH71-129	0.93 YD ³	ø 48 IN.
	DH71-158	1.17 YD ³	ø 52 1/4 IN.
	DH71-160	1.18 YD ³	ø 52 1/2 IN.
	ENVIRONMENT ONE MODEL	CONCRETE VOLUME	PRE-CAST DIA. AT 28 IN. H.
DUPLEX	DH152-93	1.10 YD ³	ø 58 3/8 IN.
	DH152-129	1.40 YD ³	ø 63 3/8 IN.
	DH152-160	1.60 YD ³	ø 67 1/2 IN.



NOTES:

1. INSTALL PLUMB – PROVIDE TEMPORARY BRACING TO MAINTAIN POSITIONING DURING CONCRETE PLACEMENT.
2. ALL CONCRETE TO BE MIX No 1 AND SHALL CURE 24 HOURS PRIOR TO BACKFILL.
3. SEE STANDARD DETAIL LP-14 FOR COMPACTION.



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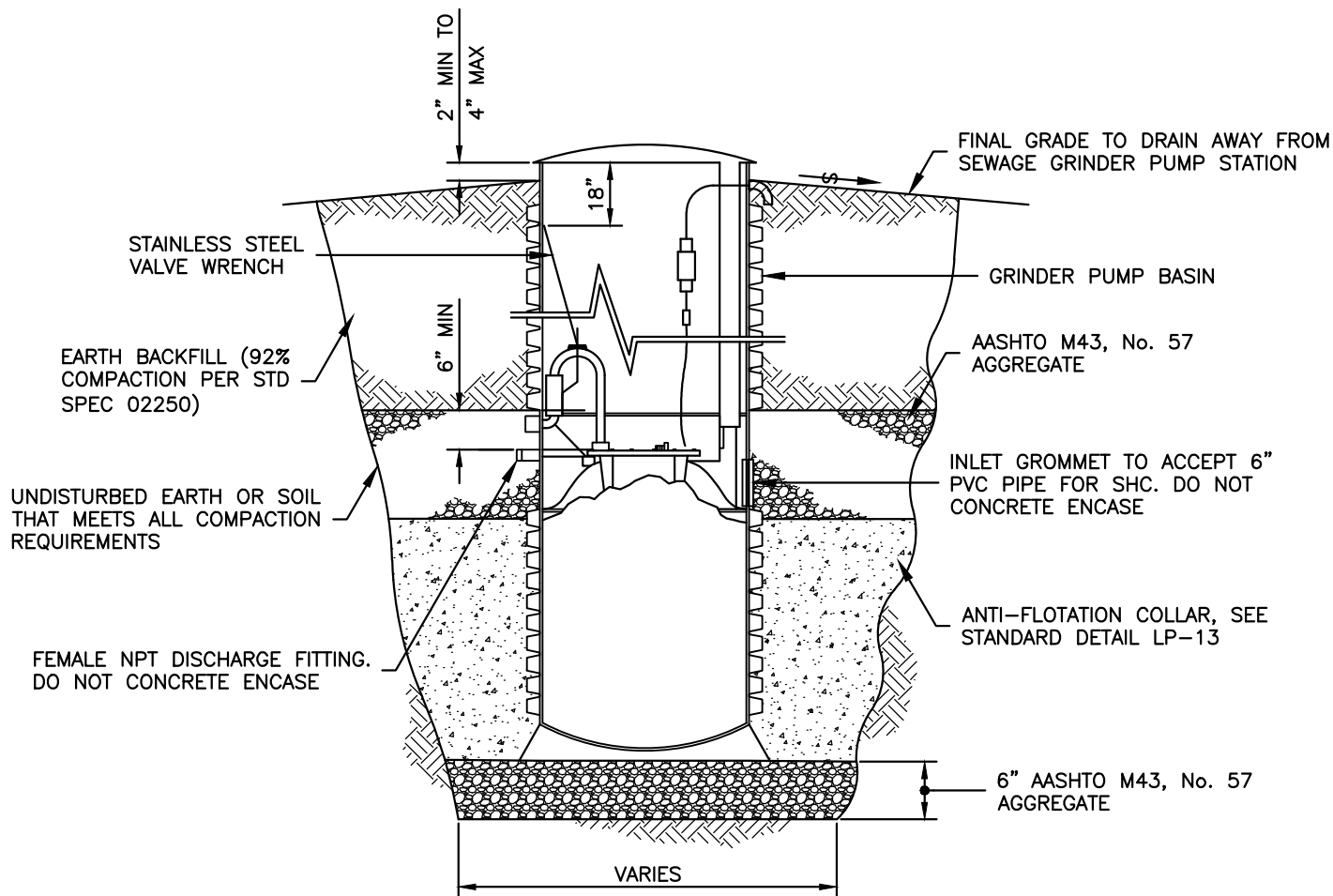
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LOW PRESSURE SEWER

ANTI-FLOATATION COLLAR

ISSUED
01/01/26

PLATE
LP-13



NOTES:

1. SIMPLEX PUMP SHOWN. DUPLEX PUMP BACKFILL IS THE SAME.
2. INSTALL PLUMB. PROVIDE TEMPORARY BRACING TO MAINTAIN POSITIONING DURING BACKFILL.
3. SEE STANDARD DETAIL LP-13 FOR ANTI-FLOATATION COLLAR DETAILS.
4. CONCRETE SHALL CURE A MINIMUM OF 24 HOURS PRIOR TO BACKFILL.



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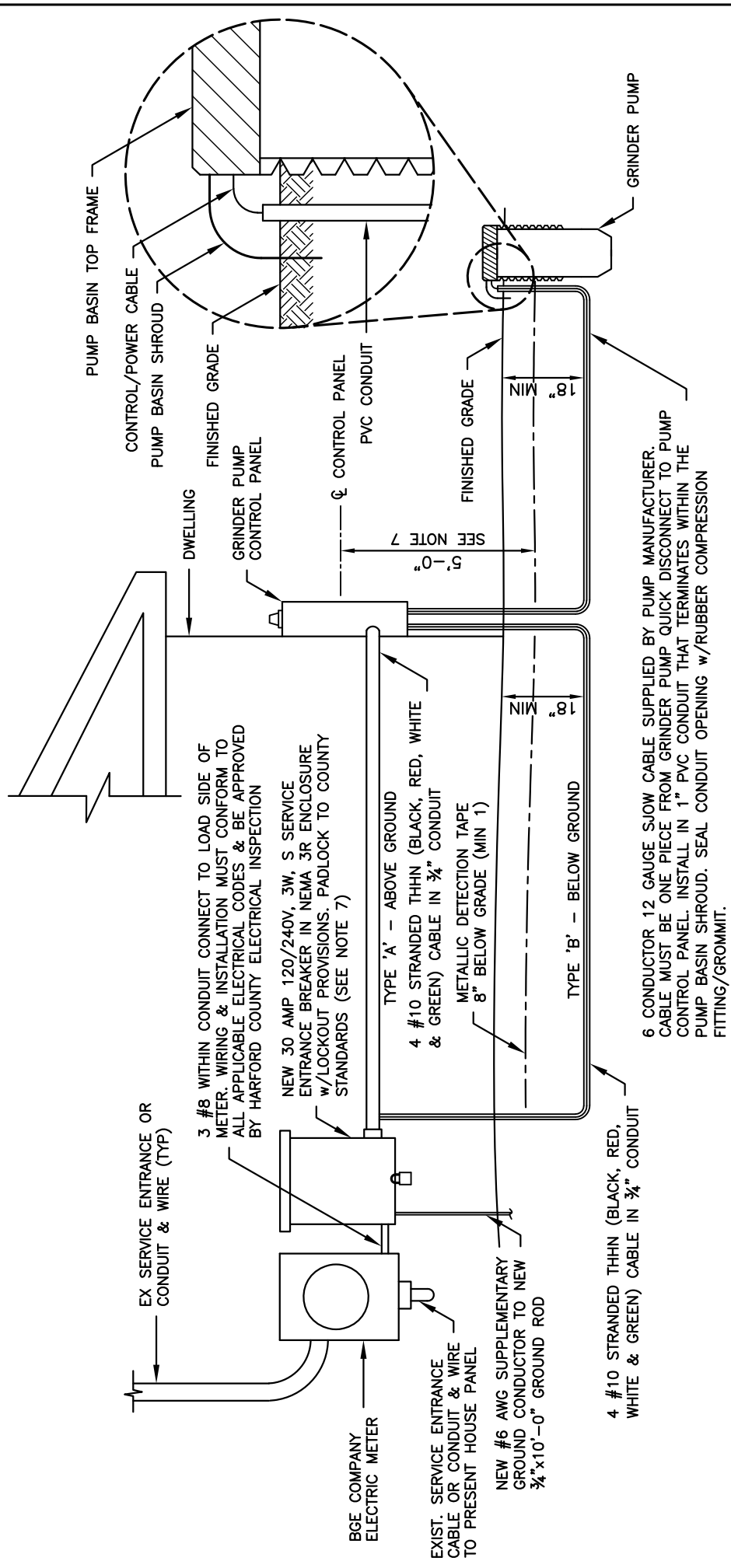
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LOW PRESSURE SEWER

GRINDER PUMP BACKFILL


ISSUED
01/01/26

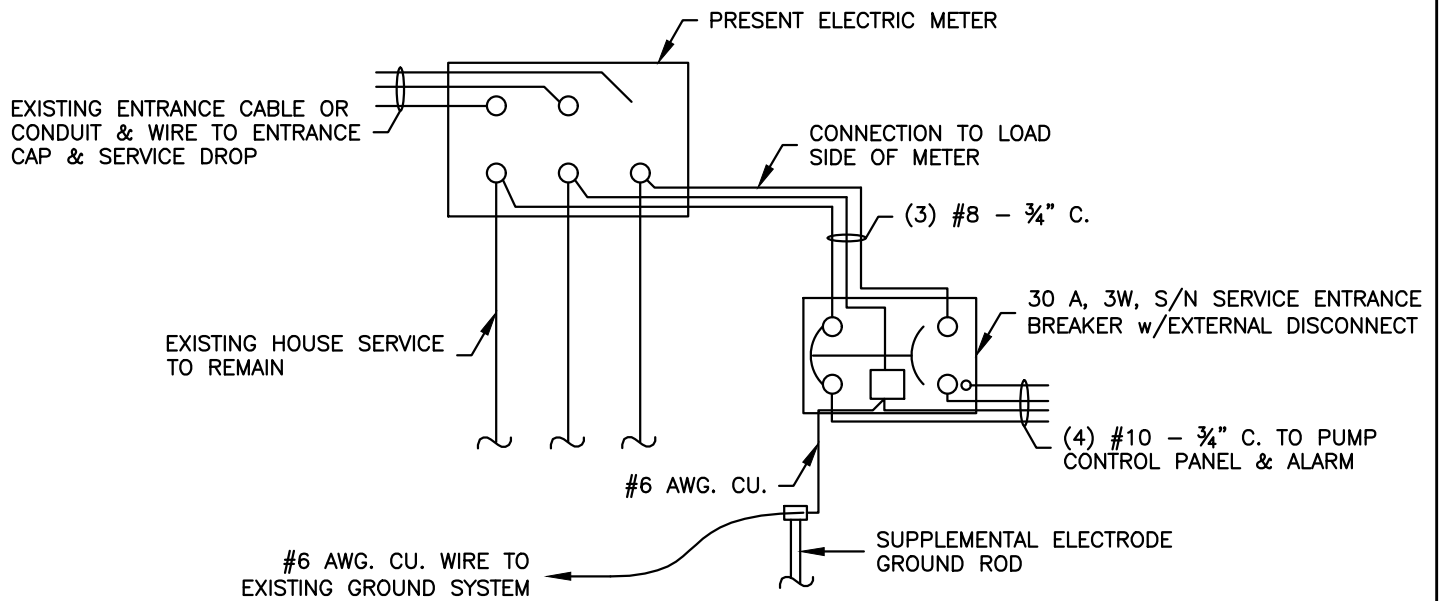
PLATE
LP-14



NOTES:

1. USE TYPE "A" CONFIGURATION WHERE PUMP PANEL IS WITHIN 10 FT OF NEW SERVICE ENTRANCE.
2. USE TYPE "B" CONFIGURATION WHERE PUMP SUB PANEL IS MORE THAN 10 FT AWAY FROM NEW SERVICE ENTRANCE.
3. CONNECTIONS TO ELECTRIC METER SHALL BE COORDINATED WITH POWER COMPANY.
4. SIDEWALKS, DRIVEWAY, AND FENCES THAT ARE DISTURBED SHALL BE REPLACED IN KIND. LANDSCAPING SHALL BE REMOVED, RELOCATED OR REPLACED AS APPROVED BY THE ENGINEER.
5. PUMP CONTROL PANEL MUST BE INSTALLED ON SIDE OF HOUSE AT THE FRONT CORNER WITHIN SIGHT DISTANCE OF THE GRINDER PUMP.
6. NO WIRING WILL BE PERMITTED WITHIN THE DWELLING.
7. IF THE HOME IS WITHIN THE 100-YEAR FLOODPLAIN, THE SERVICE ENTRANCE BREAKER AND CONTROL PANEL SHALL BE MOUNTED A MINIMUM ONE FOOT ABOVE THE 100-YEAR FLOOD PLAIN ELEVATION AND SHALL BE FULLY ACCESSIBLE BY HARFORD COUNTY MAINTENANCE PERSONNEL. THE DISTANCE OF 5'-0" SHALL BE MAINTAINED AND MAY REQUIRE THE CONSTRUCTION OF A PLATFORM AND STAIRS. THE PLATFORM AND STAIRS SHALL HAVE RAILINGS.
8. CONTRACTOR TO PROVIDE MASTER LOCK PADLOCK TO COUNTY STANDARDS FOR ENTRANCE BREAKER, CONTROL PANEL AND GRINDER PUMP BASIN.

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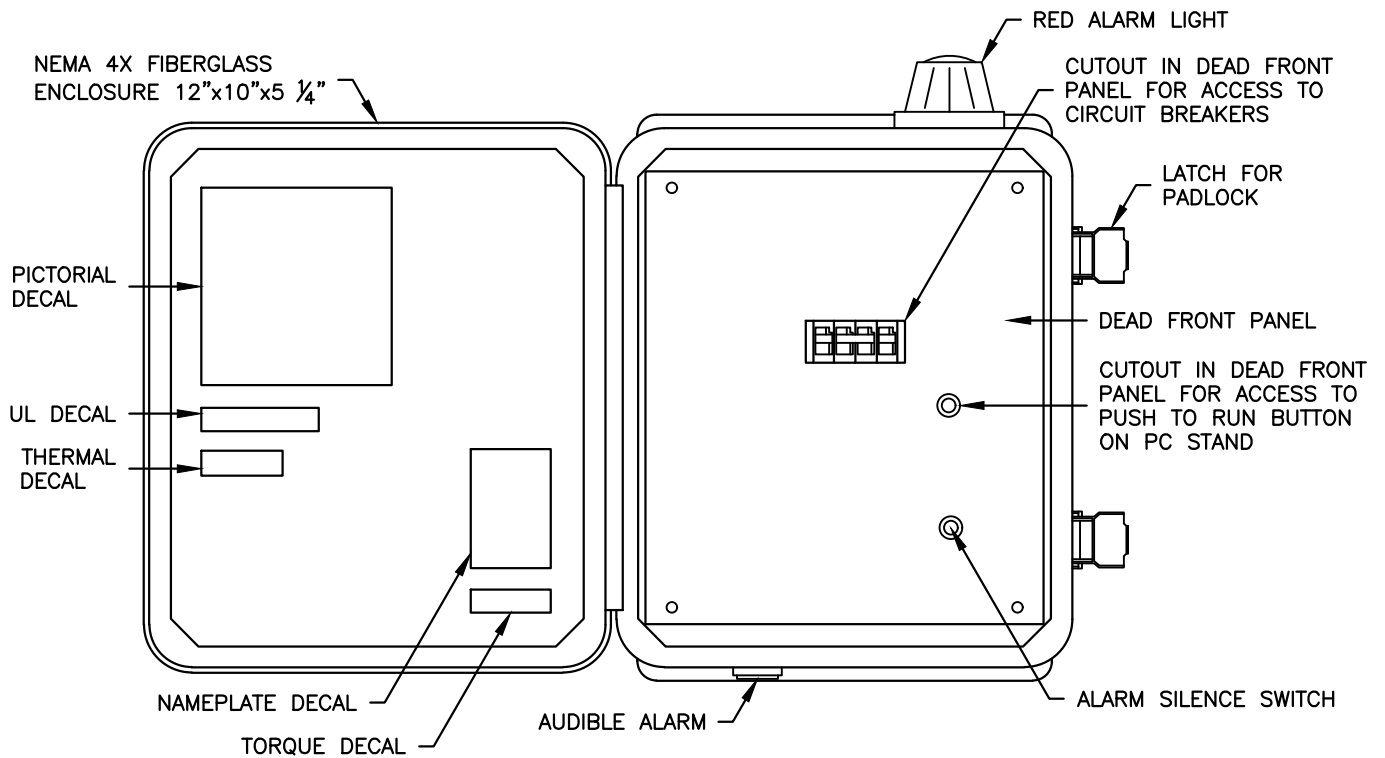
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LOW PRESSURE SEWER

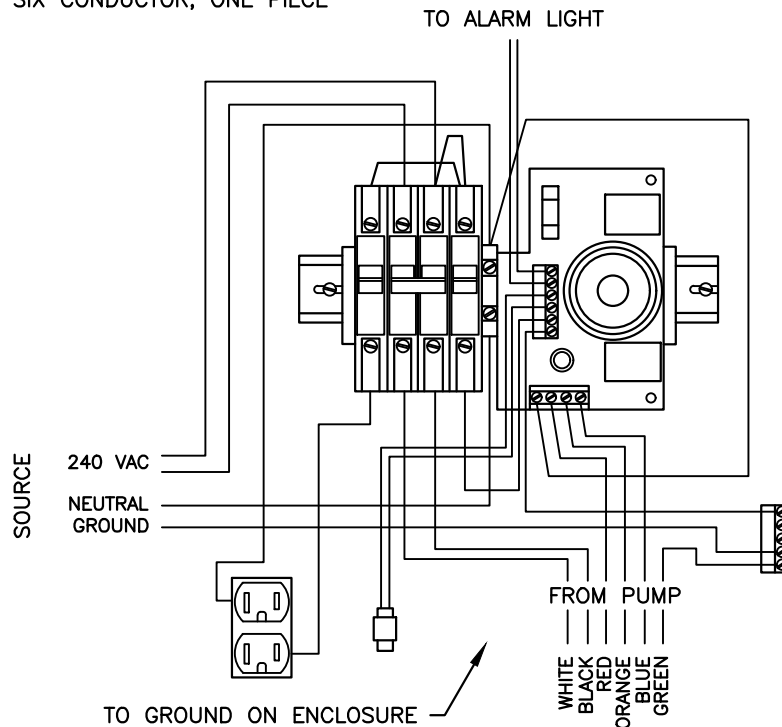
NEW SERVICE ENTRANCE
WIRING DIAGRAM

ISSUED
01/01/26

PLATE
LP-16



CONTROL CABLE:
TYPE TC; DIRECT BURIAL, 12 AWG
SIX CONDUCTOR, ONE PIECE



NOTES:

- CONTROL PANEL SHOULD INCLUDE:
1. REDUNDANT RUN (HIGH LEVEL)
 2. VISUAL & AUDIBLE ALARM
 3. MANUAL SILENCE
 4. MANUAL RUN
 5. 240VAC
 6. NEMA 4X FIBERGLASS ENCLOSURE
 7. MOUNT SECURITY TO HOUSE IN ACCORDANCE w/ALL ELECTRICAL CODES



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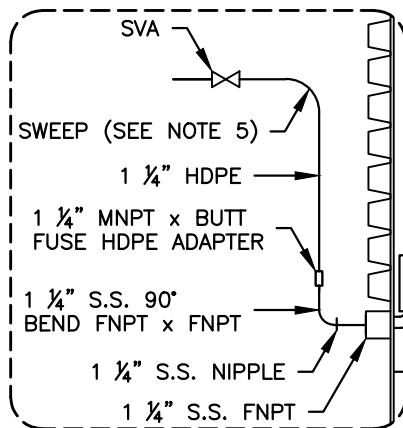
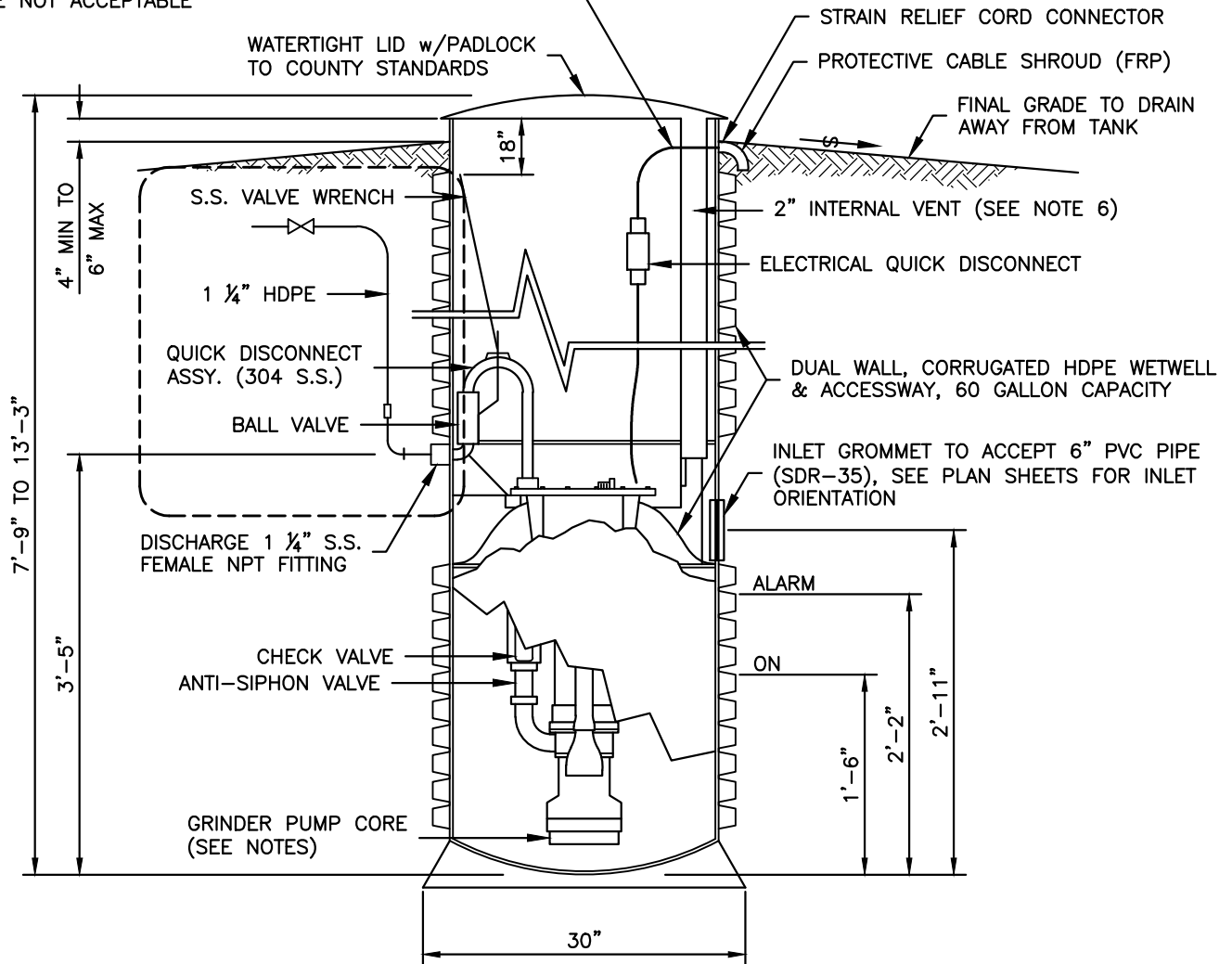
LOW PRESSURE SEWER

CONTROL PANEL

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01/01/26

PLATE
LP-17

POWER/ALARM CABLE 12-6 TYPE SJOW OR EQUAL.
LENGTH TO SUIT ONE CONTINUOUS CABLE TO CONTROL
PANEL. SPlicing OR USE OF BURIED JUNCTION BOXES
ARE NOT ACCEPTABLE



NOTES:

1. NO FIELD JOINTS ARE ALLOWED.
2. SEE STANDARD DETAIL LP-13 FOR ANTI-FLOATATION COLLAR.
3. SEE STANDARD DETAIL LP-14 FOR BACKFILL AND BEDDING REQUIREMENTS.
4. FOR DEVELOPER PROJECTS, PUMP AND CABLE TO BE STORED AT PUMP SUPPLIERS WAREHOUSE.
5. DELETE SWEEP IF DISCHARGE PORT HAS LESS THAN 5 FEET OF COVER.
6. A MANUFACTURER FLOOD VENT SHALL BE INSTALLED ON ALL GRINDER PUMPS WITHIN THE 100-YEAR FLOOD PLAIN.



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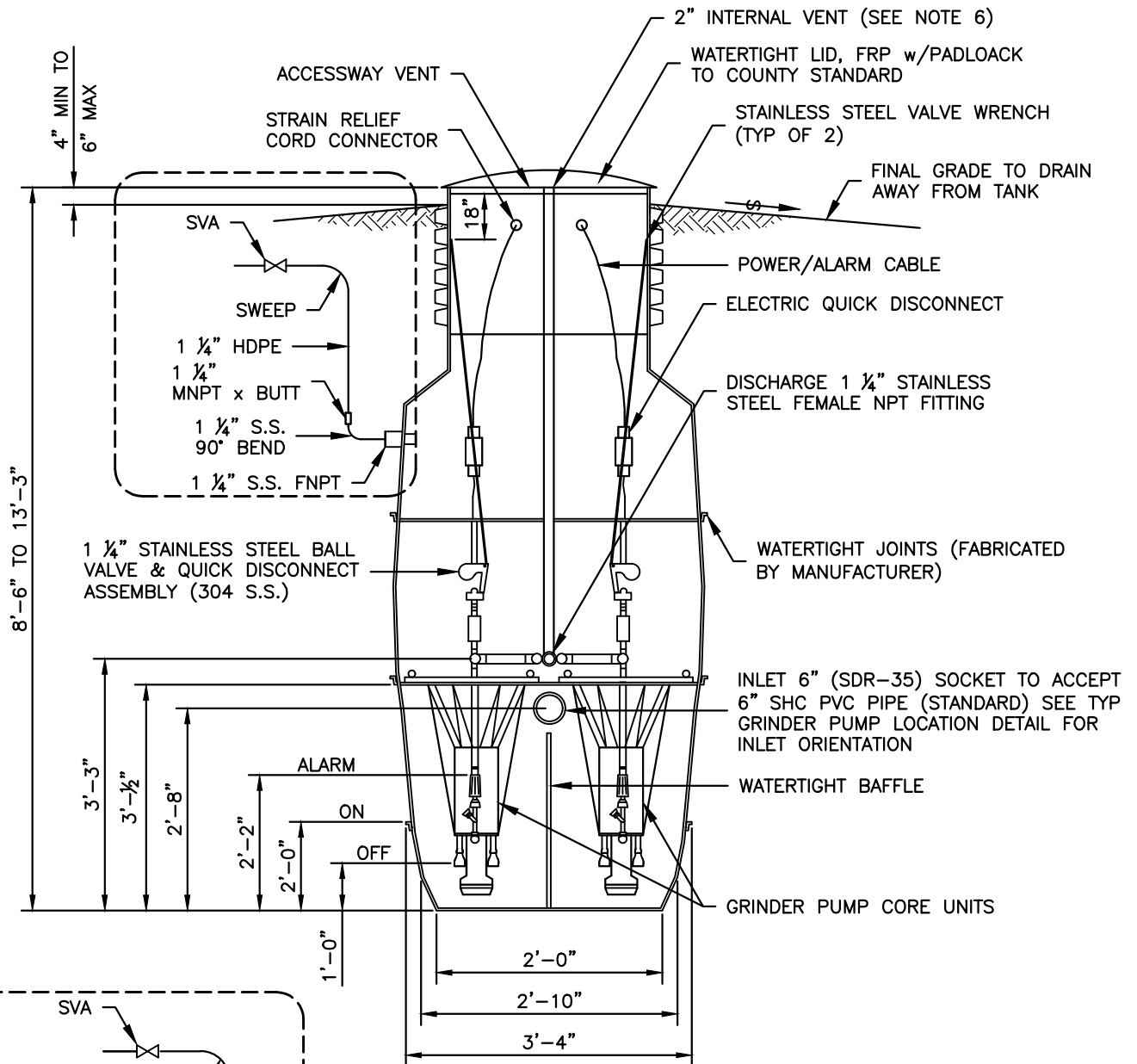
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LOW PRESSURE SEWER

SIMPLEX GRINDER
PUMP SECTION

ISSUED
01/01/26

PLATE
LP-18



NOTES:

1. NO FIELD JOINTS ARE ALLOWED.
2. SEE STANDARD DETAIL LP-13 FOR ANTI-FLOATATION COLLAR.
3. SEE STANDARD DETAIL LP-14 FOR BACKFILL AND BEDDING REQUIREMENTS.
4. DELETE SWEEP IF DISCHARGE PORT HAS LESS THAN 5 FEET OF COVER.
5. A MANUFACTURER FLOOD VENT SHALL BE INSTALLED ON ALL GRINDER PUMPS WITHIN THE 100-YEAR FLOOD PLAIN.



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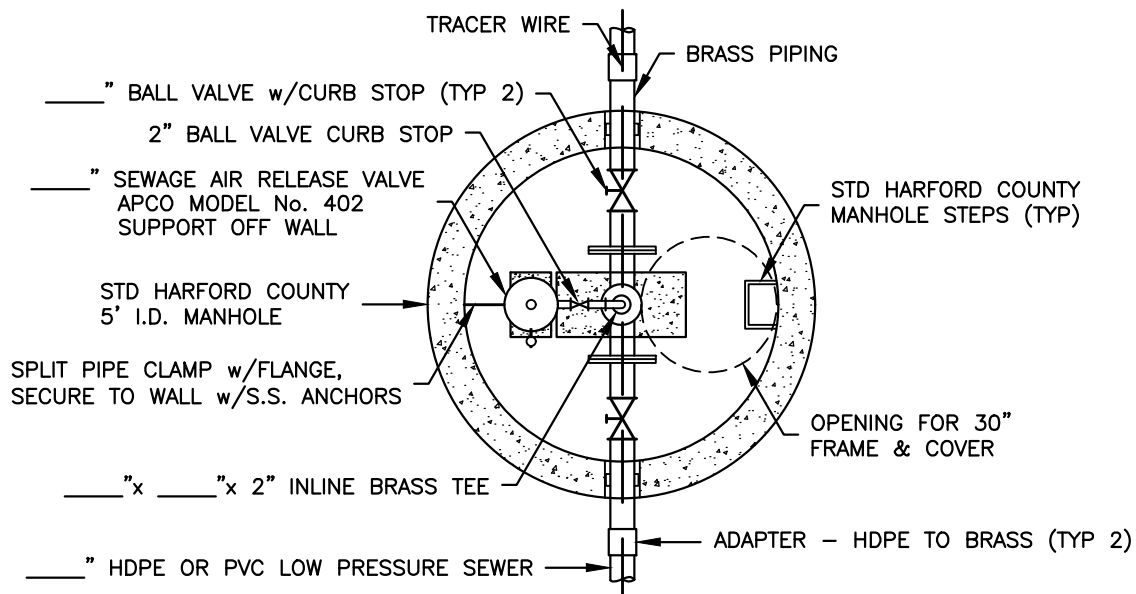
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LOW PRESSURE SEWER

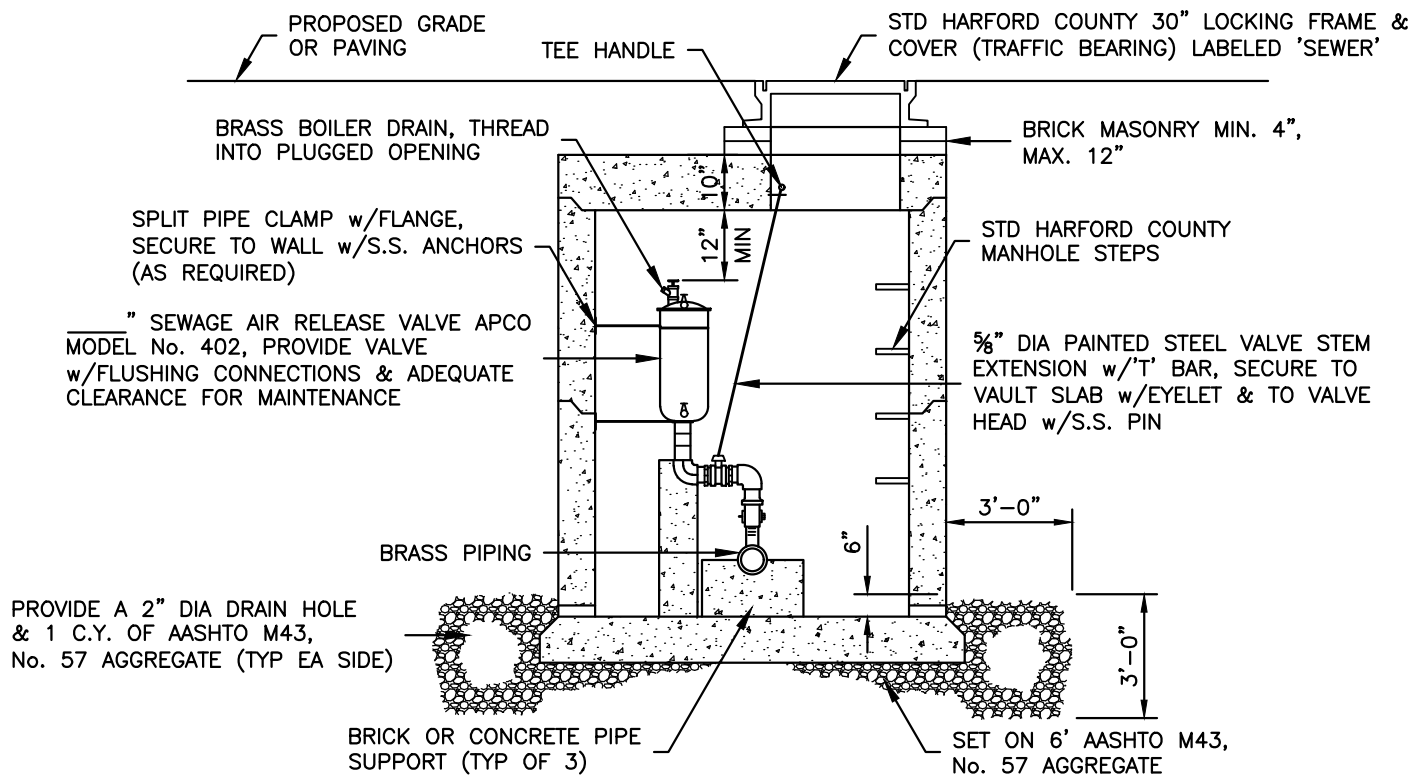
DUPLEX GRINDER
PUMP SECTION

ISSUED
01/01/26

PLATE
LP-19



PLAN



SECTION

NOTES:

1. ALL FITTINGS BELOW AIR VALVE TO BE HEAVY DUTY THREADED, UNPOLISHED BRASS UNLESS NOTED OTHERWISE.
2. ALL PIPE SUPPORTS AND BRACING TO BE SIZED BY ENGINEER.
3. SET MANHOLE ON 6\"/>



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LOW PRESSURE SEWER

**LOW PRESSURE SEWER
AIR RELEASE VALVE
(FOR MAINLINE UP TO 2 1/2")**

ISSUED
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**PLATE
LP-20**

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