

Washington County, Maryland
Division of Environmental Management
Department of Water Quality

STANDARD SPECIFICATION FOR CONSTRUCTION OF SANITARY SEWAGE & WATER FACILITIES



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Memo

To: Consultants and Developers
From: Mark Bradshaw, PE
Date: 6/21/2012
Re: Standard Specification for Construction of Sanitary Sewage & Water Facilities

Washington County Department of Water Quality has updated our Standard Specification for Construction of Sanitary Sewage & Water Facilities. The revised Standard Specification for Construction of Sanitary Sewage & Water Facilities will become effective for all plans submitted after January 1, 2013.

Any plans that currently have an approval can continue under that approval until May 4, 2017, with periodical approval updates. If the approval elapses, the plans will be considered void and must be redesigned under the revised Standard Specification for Construction of Sanitary Sewage & Water Facilities. If the project isn't completed by May 4, 2017 the approval will expire at this time and the Developer will be required to redesign the project under the revised Standard Specification for Construction of Sanitary Sewage & Water Facilities.

In addition to revised Standard Specification for Construction of Sanitary Sewage & Water Facilities, the Department's of Water Quality approval will be valid for a two (2) year instead of the current one (1) year approval period.

Chapter 1, Section 101

Definitions and Abbreviations

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I. Definitions and Abbreviations

A. Definitions

For the purpose of these specifications the following words and terms shall have the meaning hereinafter ascribed to them.

1. "Washington County Department of Water Quality" or "Department" means the governmental entity furnishing public water and sewer at various areas in Washington County.
2. "Division" means Division of Environmental Management.
3. "Owner" means the Washington County Department of Water Quality and/or its duly authorized representative acting in its behalf.
4. "Service Area" is the geographical area wherein the County is providing, or intends to provide, public water or sewer service, the "Service Area" having been created and delineated by the County.
5. "Developer" shall mean the person, firm, corporation or agency entering into a contract with the contractor for the construction of the work.
6. "Contractor" shall mean the corporation, company, partnership, association, or individual, named and designated in the contract agreement as "party of the second part" who has entered into this contract for the performance of the work covered thereby, and its, his, or their duly authorized agents or legal representatives. Sub-contractors as such will not be recognized.
7. "Sub-Contractor" shall mean a person, firm, or corporation supplying labor and materials or only labor for work in conjunction with the project and under separate contract or agreement with the contractor.
8. "Engineer" shall mean the person, firm, or corporation responsible for the design of the work and for the preparation of the contract drawings, and other pertinent contract documents.
9. "Inspector(s)" shall mean the engineering or technical inspector(s) duly authorized by the Department, limited to the particular duties entrusted to him(them).
10. The "work" shall mean the labor, tools, materials, equipment, appurtenances and services to be performed under this contract, unless some other meaning is indicated by the context.

11. Whenever in the contractor documents the words “As Directed”, “As Required”, “As Permitted”, or words or phrases or like import are used, it shall be understood, unless otherwise particularly stipulated, that the directions, requirement, or permission of the owner or engineer is intended only to the extent of judging compliance with the terms of the contract documents. None of these terms shall imply that the developer, the County or engineer is intended only to the extent of judging compliance with the terms of the contract documents. None of these terms shall imply that the developer, the County or Engineer has any authority or responsibility for supervision of the contractor’s forces or operations, such supervision including sole responsibility therefore shall be strictly reserved to the contractor.
12. Whenever in the contract documents the words “Approved”, “Reasonable”, “Suitable” “Acceptable”, “Properly”, “Satisfactory”, or words of like effect and import are used, unless otherwise particularly stipulated, shall mean approved, reasonable, suitable, acceptable, proper or satisfactory in the judgment of the County.
13. Whenever any statement in the contract documents contain the expression “It is understood and agreed”, or an expression of like import, such expression means the mutual understanding and agreement of the parties executing the contract documents.
14. Whenever in the contract documents the words “By Others”, or words or phrases of like import are used, it shall be understood, unless otherwise particularly stipulated, to mean a corporation, company, partnership, association, or individual who has entered into contract with or has been directed by the developer to perform work in the project area.
15. Whenever in the contract documents the phrase “Or Equal”, or words or phrase or like import are used, it shall be understood to mean the reference to manufacturers’ or vendors’ names, trade names, catalogue numbers, etc. is intended merely to establish a standard; and any material, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed is, in the opinion of the County, of equal substance and function. The contractor shall not substitute an alternate manufacturers’ or vendors’ material, article or equipment without prior written approval of the County.
16. “Work Order” shall mean that notification from the County to the Developer specifying any deficiencies or corrective actions that must be made by the Contractor.

17. “Standard Specifications” shall embrace all items and sections included within this volume.
18. “Specifications” shall mean this volume and all items contained herein which are pertinent to the particular project under consideration, together with any other supplemental specification, referred to specifications, and special provisions approved by the County to the extent that affects the sewer or water systems.
19. Whenever in the specifications reference is made to any part or all of the work being subject to acceptance or approval by the County, it shall mean to include acting within the limits of its particular interest or jurisdiction.
20. “May” is permissive, “Shall” is mandatory.
21. “Service Connection” that portion of the sanitary sewer or public water between the sewer main / water main and the property line to which the building is connected.
22. “Sanitary Sewer” – a sewer which carries sewage and to which storm, surface, and ground waters are not intentionally admitted.

B. Standards

The following standards and their designations used herein are:

1. Aluminum Association – AA
2. American Association of State Highway and Transportation Officials – AASHTO
3. American Concrete Institute – ACI
4. American Institute of Steel Construction – AISC
5. American National Standards Institute – ANSI
6. American Society for Testing and Materials – ASTM
7. American Society of Mechanical Engineers – ASME
8. American Water Works Association – AWWA
9. American Welding Society – AWS

10. Code of Maryland Regulations - COMAR
11. Commercial Standards – CS
12. Federal Specifications- Fed. Spec.
13. Maryland State Highway Administration Standard Specifications for Construction and Materials-SHA
14. Maryland Department of the Environment – MDE
15. Maryland Occupational Safety and Health Administration - MOSHA
16. 1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control (or latest adopted version) – SCS
17. National Electric Code – NEC
18. National Electrical Manufacturer’s Association – NEMA
19. National Fire Protection Association - NFPA
20. National Safety Council – NSC
21. National Sanitation Foundation – N.S.F.
22. Occupational Safety and Health Administration, Department of Labor – OSHA
23. Standards of the Hydraulic Institute- SHI
24. Steel Structures Painting Council – SSPC
25. Underwriters Laboratories- UL

C. Abbreviations

For the purpose of these specifications the following abbreviations shall represent the words and phrases hereinafter ascribed to them:

1. United States Geological Survey Elevation Datum – USGS
2. Elevation – Elev. Or El.

3. Feet – 0'
4. Inches – 0''
5. Degrees fahrenheit – F
6. Degrees Centigrade – C
7. Pounds per square inch – PSI
8. Gallons per minute – GPM
9. Revolutions per minute – RPM
10. Percent - %
11. Brinell hardness number (ASTM E 10) BHN
12. Horsepower – HP
13. Angular Degrees – 0
14. Year – yr.
15. Direct Current – DC
16. Alternating Current – AC
17. Kilovolt Ampere – kVA
18. Kilowatt – KW
19. Feet per minute – FPM
20. Pound Feet – LB. Ft. (Torque)
21. Maximum – Max.
22. Minimum – Min.
23. Cubic Feet Per Second – CFS
24. Gallons Per Linear Foot Per Day – Gal/L.F./Day
25. Rockwell Hardness Number (ASTM E 18) – RHN

26. Pounds Per Square Inch – PSI
27. Gage or Gauge – GA.
28. Million Gallons Per Day – MGD
29. Linear Foot – L.F.
30. Cubic Yard – C.Y.
31. Vertical Foot – V.F.
32. Cubic Foot (Feet) – C.F. or CU. FT.
33. Square Foot (Feet) – S.F. or SQ. FT.
34. Thousand Feet Board Measure – MFBM
35. Lump Sum – L.S.
36. Vitrified Clay Pipe, Extra Strength – VCPX
37. Reinforced Concrete Sewer Pipe – RCSP
38. Acrylonitrile Butadiene Styrene- ABS
39. Poly-Vinyl Chloride – PVC
40. Cast-Iron – C.I.
41. Ductile Iron – D.I.

D. Standard Specifications

Reference to Standard Specifications of any technical society, organization, or association, or to codes of local or state authorities, shall mean the latest standard, code, specification, or tentative specification adopted and published at the date of receiving bids, unless specifically stated otherwise herein

Chapter 1, Section 102

**Instruction for the Preparation of Construction Plans and Specifications for Construction of
Public Sanitary Sewer**

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II. Instruction for the Preparation of Construction Plans and Specifications for Construction of Public Sanitary Sewers

A. General

The requirements outlined below are intended to supplement the requirements of the State of Maryland Department of the Environment for submission of plans and specification for the construction of such facilities under the jurisdiction of the Washington County Department of Water Quality and shall be prepared and submitted in accordance with the following requirements.

1. Construction Drawings

Together with applicable supplemental specifications, shall be submitted to the Department of Water Quality for review and approval prior to being submitted to the State. A set will be returned along with indication of approval or disapproval with noted revisions.

2. Revisions

The revision shall be made and drawings shall be resubmitted along with the copy of the original submittal with noted revisions. After approval by the Department of Water Quality and prior to any construction, one (1) complete set of mylars and three (3) paper copies shall be submitted to the Department of Water Quality with all approval blocks being signed.

3. Sheet Size

All drawings shall be 24" X 36".

B. General Map

Construction plans shall include a project number assigned by the Division, a general map showing the extent of the project, an index of sheets, location map and a legend where needed.

Bench marks and the plane datum shall be on the general map or on the individual plan and profile sheets.

An approval block for Washington County Department of Water Quality on every sheet that contains water and sewer drawings information.

A general note shall appear as follows: "All sanitary sewers shall be constructed in strict accordance with the latest edition of the Washington County Department of Water Quality's Standard Specifications for Construction of Sanitary Sewer". The words "water lines" will be substituted for sanitary sewer when water lines are being constructed.

C. Plans

Plans and profile sheets shall be prepared in such a manner that the alignments match vertically. The plan and profile sheets shall also show existing improvements, underground and overhead utilities along, across, or near the proposed construction.

Plans for sewer or water construction in easements across private property shall show survey and alignment data. Width of temporary and permanent easements shall be dimensioned.

Where sewers, manhole, and other appurtenances are referenced to survey baseline, this baseline must be shown and stationed on the plans.

Construction drawings shall include a continuous profile of all sewers and waterlines to be constructed showing existing ground surface, proposed finish grade, pipe invert elevations, manhole rim elevations, and type of frame and cover.

Pipe size, slope, type of pipe, and location of special structures and appurtenances shall be shown on the profile.

Lot numbers shall be shown with proposed or existing basement or first floor elevations on sewer profiles at their proper station position. If no basements exist or if none are proposed, this shall be so indicated.

Stationing of gravity sewer lines shall be shown on the profile and shall proceed upgrade starting with 0+00 at each manhole. Length of manhole run shall be shown from center line to centerline of each successive manhole. Stationing of force mains and low pressure mains shall be shown on the profile and shall proceed upgrade, starting with 0+00 at the lowest point or at intersection point and continuing to limits of work.

Location of tee branches are to be considered approximate unless otherwise noted. Each lateral is to connect with the mainline at a right angle. Where laterals are to connect to manhole, angles shall be shown on contract drawings and shall not be less than 90 degrees to direction of

flow. Each sewer service is to be extended to the easement or property line, and terminate with a cleanout or valve shown at this point.

Location of water service taps and water meters are to be considered approximate unless otherwise noted. Each service connection is to be connected to the water main according to detail W-10.2. Each service connection is to be extended to the easement or property line where the water meter is to be installed.

Each manhole shall be identified by a number assigned by the Department of Water Quality. Manhole numbers shall be shown in both plan and profile.

All sewers shall have a minimum of four feet (4') cover, unless otherwise specified or approved by the Division. Sewers designed with less than four feet (4') of cover shall require concrete encasement, which must be shown in both plan and profile.

The maximum distance allowed between manhole runs (center to center) shall be 400 feet, and minimum slope allowed from face of manhole to face of manhole for each run of sewer line shall be 0.4%.

Horizontal scale shall be 1" = 50' and the vertical scale shall be 1" = 5'.

Each drawing shall include a north arrow, and match lines shall be easily identifiable.

All drops across the manhole shall be 0.10' (foot) minimum.

D. Special Details

Special structures and any other work not covered by standard details or by specifications shall be detailed fully to insure that the finish work is structurally sound and hydraulically correct. Special structures shall be designed for compatibility with existing Department of Water Quality structures.

E. Inspection by Washington County Department of Water Quality

The Washington County Department of Water Quality shall inspect all facilities during construction to insure conformance to design and specifications. All cost incurred by the inspection (labor, overhead, transportation, testing, record drawings, etc.) shall be paid by the developer prior to the start of construction. The Department shall estimate

the inspection costs and invoice the developer for payment. At the completion of the project the actual costs will be determined and the Department will return any unused funds or the developer shall be invoiced for any additional costs above the estimate.

F. Record Drawings

The Department of Water Quality shall record, during the construction period, all data required to complete the record drawings. The Department of Water Quality shall be responsible for revising the mylar reproducible.

G. Approval and Permits – “Water / Sewerage Construction Permit

The developer shall submit to the Department of Water Quality for application of the State of Maryland Department of the Environment. The developer is responsible for paying all fees associated with the construction permit.

Details relative to construction within State and County road right-of-way and within any other governmental or private right-of-way shall be obtained by the developer from agency having jurisdiction. One (1) copy of each shall be filed with the Department of Water Quality by the developer prior to start of construction.

The Developer is responsible for obtaining all permits, necessary for the project, prior to the start of construction. A copy of these permits shall be supplied to the Department of Water Quality prior to start of construction.

H. General Guaranty

Upon acceptance of the system by the Department of Water Quality, the developer shall warranty all work from date of acceptance for a period of one year. The developer shall remedy any defects in the work and pay for any damages to other work resulting there from, which shall appear within the warranty period. The Department of Water Quality will give notice of observed defects with reasonable promptness.

Under certain conditions, the Department of Water Quality may require the developer to provide a longer warranty period other than the one (1) year standard warranty, unless a longer specified warranty period is required elsewhere in these standards.

I. Allocation

The proposed water consumption and sewage usage shall be included on the cover sheet of the construction drawings. Allocation fees will be charged based upon this information. After being in service for a period of one year, the County may adjust the allocation for the project based upon actual rates and shall adjust the allocation accordingly. If additional allocation is required at this time, the owner will be invoiced for the additional allocation. In the event that a developer over estimated water usage and purchased extra allocation, a refund will not be granted for the extra allocation.

Chapter 1, Section 103

Special Conditions

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III. Special Conditions

A. Approval of Materials

Prior to construction on a project, a complete list of materials must be submitted to the Department for approval. Only those approved materials shall be utilized on the project. No substitutions shall be made during construction. See materials, Chapter 2, Section III and Section VIII.

B. Notice To Proceed

In order to properly coordinate the inspection services provided by the Department with the schedule of construction activities, the Department requires notification 72 hours prior to construction.

Should the contractor delay operating for a period of time, the Department shall require notification 72 hours prior to continuing operations.

C. Legal Holidays and The Work Week

Washington County observes the following legal holidays: New Year's Day, Martin Luther King's Birthday, Good Friday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Friday after Thanksgiving, Christmas Eve, Christmas Day and New Year's Eve. The contractor shall be permitted to work on these holidays only in emergency situations. Should inspection by the Department be required on any of these holidays, inspection services shall be invoiced at 2 ½ times the hourly rate.

The 40 hour work week shall be Monday through Friday. The contractor must submit to the Department in writing, and with 48 hours in advance notice, any request for additional work hours above and beyond the normal 40 hour work week. Should inspection by the Department be approved in excess of the normal work hours, inspection services shall be invoiced at 1 ½ times the hourly rate.

D. Project Completion Time

The Department encourages completion and acceptance of the total project in a timely manner, therefore to emphasize this point, it should be noted that no permits for utility use shall be issued until the project is accepted by the Department.

E. Scope of Work

The intent of the drawings and specifications is that the contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the work in accordance with the standard specifications and all

incidental work necessary to complete the project in an acceptable manner, ready for use, occupancy or operation by the Department.

All work that may be called for in the specifications and not shown on the drawings or shown on the drawings and not called for in the specifications shall be executed and furnished by the contractor, as if described in both these ways; and should any work or material be required, which is not defined in the specifications or drawings either directly or indirectly, but which is nevertheless necessary for the proper execution of the intent thereof, the contractor is to understand the things to be implied and required, and shall perform all such work and furnish any such material as fully as if they were particularly delineated or described.

Any discrepancies found between the drawings and the specifications and site conditions or any inconsistencies or ambiguities in the drawings or specifications shall be immediately reported to the Department, in writing. Work performed by the contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be performed at the contractor's risk.

F. Access to Work

The Department, their representatives and the representatives of any governmental body or agency having jurisdiction will at all times have access and observation to the work. Contractor shall provide proper and safe facilities for such access and observation of the work and also for any inspection or testing thereof by others. No work will be performed without the Department having notice thereof and all work shall be subject to inspection by the Department.

The construction drawings are not to be considered as all inclusive. They do not indicate every fitting, elbow, offset, valve, etc., which will be required to complete the job. The Contractor shall prepare shop drawings, as required for the use of his mechanics, to insure proper installation.

G. Uncovering Work

If any work is covered contrary to the written request of Department or without the Department's having timely written notice that such work is being performed, it must, if requested by Department, be uncovered for his observation and replaced at contractor's expense.

If any work, the performance of which the Department has given written notice, has been covered without the Department observing it prior to its being covered, or if Department or owner's or owner's representative considers it necessary or advisable that covered work be inspected or tested by others, contractor, at Department's request, shall uncover, expose or otherwise make available for

observation, inspection or testing as Department may require, that portion of the work in question, furnishing all necessary labor, material and equipment.

H. Department's Status during Construction

1. Clarification and Interpretations

The Engineer will issue, with reasonable promptness, such written clarifications or interpretations of the standard specifications as he may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the project.

2. Rejecting Defective Work

The Department's representative will have authority to disapprove or reject work which is "defective"(which term is hereinafter used to describe work that is unsatisfactory, faulty or defective, or does not conform to the requirements of the standard specifications has been damaged prior to approval of final payment. He will also have authority to require special inspection or testing or the work whether or not the work is fabricated, installed or completed.

3. Limitations of Department's Responsibilities

- a. The Department's authority to act under this article or elsewhere in the contract documents nor any decision made by him in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility to Department or contractor, any subcontractor, any material man, fabricator, supplier or any of their agents or employees or any other person performing any of the work.
- b. Department will not be responsible for contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto; and Department does not guarantee the performance of the work in accordance with the contract documents
- c. Department will not be responsible for the acts or omissions of contractor, or any subcontractors, or any of his or their agents or employees, or any other persons at the site or otherwise performing any of the work.

I. Existing Utilities

All work requiring changes to or affecting existing utilities, or affecting their operation, shall be performed in a manner and time approved by the Division. Requests to do such work shall be submitted to the Division at least three (3) calendar days to the time that such work is to be performed.

J. Location and Protection of Existing Utilities

The contractor will be responsible for locating all existing utilities including, but not limited to, water, steam, oil, gas mains, sanitary and storm sewers, telephone and electric conduits which may be encountered in the performance of the work. He shall also be responsible for locating all underground structures. He shall, at his own expense, arrange with the owners of such utilities for locating them. The contractor shall be responsible for providing adequate protection against damage to utilities encountered during the course of construction.

K. Use and Storage of Explosives

The Contractor shall give notice to the Department and State Fire Marshall prior to using any explosives. Such explosives shall be stored, handled and used as prescribed by the federal, state and/or local authorities having jurisdiction over such storage and use. The contractor shall comply with all special rules and regulations that may be in effect at the time the work is actually done. The contractor shall obtain the permission of the State Fire Marshal before storing and using any explosives.

L. Protection of Material and Work

The Contractor shall at all times take necessary steps to protect and preserve all materials, supplies, equipment and shall work which has been performed. Should work be suspended temporarily because of inclement weather or other causes, the Contractor shall take such steps as are necessary to protect materials, supplies, equipment and work performed, work not properly protected shall be removed and replaced at the expense of the Contractor.

M. Safety and Protection

Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to: all employees on the work and other persons who may be affected thereby; all the work and all materials or equipment to be incorporated therein, whether in storage on or off the site; and other property at

the site or adjacent thereto, including utilities not designated for removal, relocation or replacement in the course of construction.

Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss.

Chapter 1, Section 104

Work Within Public Right-of-Way and Easements

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IV. Work Within Public Right-of-Way and Easements

All work to be performed within Washington County Public Right-of-Way other than State Highway Administration property shall be in strict accordance with the conditions of the special utility installation permit issues by Washington County.

All work to be performed on Maryland State Highway Administration (SHA) property shall be in strict accordance with the conditions of the access and construction permit issued by SHA.

Where right-of-way or easements have been obtained for construction of sewer or water lines on private property, the Contractor shall confine his operations to and conduct all work within the limits of the right-of-way or easements as shown on the drawings or as specified. The contractor shall not enter upon or occupy with men, tools, or materials, any private property outside the limits of the right-of-way or easements obtained, without written consent of the owner of such property.

All work within public right-of-way, easements, and/or private property shall be in accordance with the specification contained herein. Width of easement (temporary and/or permanent) shall be:

- A. Thirty (30) feet for permanent conventional easement for gravity sewers, sewer force mains and water lines
- B. Fifteen (15) feet for permanent grinder pump service connection
- C. Temporary easements will be of determinable width based upon site conditions.

The easement widths listed above are minimum widths and the Department may require the easement to be wider based upon site conditions.

In case of conflict, the agency having jurisdiction and/or issuing the permit for construction shall govern.

Chapter 2, Section 201

Surveys and Construction Stakeout

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I. Surveys and Construction Stakeout

A. General

The Contractor / Developer shall perform and furnish all survey and stakeout required for the work. The Contractor / Developer shall provide competent personnel under the employ of professional surveyor(s) or engineer(s) and shall provide the necessary materials and equipment for setting stakes and making measurements in order to complete the installations in accordance with the plans and specifications. All information obtained by the surveys shall become the property of the Department.

Cut / reference sheet(s) shall be submitted to the Department, in triplicate, at least 72 hours in advance of intended start of construction. No pipeline work shall begin by the Contractor without approved cut / reference sheet(s) in his possession at the work site.

Surveyor shall stakeout all right-of-way, property corners, and easements adjacent to water/sewer utility construction. All proposed work shall be confined to County right-of-way or easements. This paragraph doesn't apply to residential developments.

All sewer laterals shall be located within the County right-of-way or platted easement. No lateral shall be placed within a drainage swale, or other depressions.

B. Gravity Sewer Stakeout

Standard Detail S-12.3, *CUT SHEET*, shall be utilized to show all stakeout information for gravity sewers containing manholes, cleanouts, include service lateral location, benchmarks, or other structures, consisting of horizontal layout and vertical control at each manhole. Only one manhole-to-manhole section shall be described per each cut sheet submittal.

Vertical control shall be achieved by a bench mark set at within 100 feet of each manhole. Datum shall be *U.S.G.S.* looped and tied to a monument, or established County bench mark.

Additional vertical control shall be provided by field run centerline profile ground elevations at 25 feet stations. (Offset hubs and cut-to-invert shall be used at 25 feet stations for batter board construction. At least three (3) consecutive stakes shall be set with the same cut-to-invert.) Where profiles determine that embankments are required for minimum pipe cover, the location must be listed under *REMARKS*. Embankment must be constructed to a minimum of 3 feet above crown of pipe prior to pipe line installation.

Where the laser beam method of construction is utilized, offset stakes will be required at 100' intervals, at all connections, and at each manhole for horizontal and vertical control. Laser beam set-up shall be made utilizing this control. In this case, sewer stakeout grade and cut sheets shall be required as above.

Sewer slope shall be calculated by actual pipe length from outside face of manhole (i.e. two feet from center of 4' manhole) to outside face of manhole. *CUT TO INVERT* shall be computed and listed on Standard Detail S-12.3. Inverts of additional manhole connections (invert) as well as lateral connections to manholes shall be described under *REMARKS*.

Horizontal control shall be referenced by right angle beginning at the downstream structure or manhole. Two offset hubs and tacks shall be set for each manhole center location. Offsets shall be located out of the path of construction traffic. Turned angles shall be shown for additional manhole connections. Sketch shall show street names, etc. for visual reference.

C. PRESSURE PIPE

Pressure pipe shall include water lines, force mains, low-pressure sewers, and service connection. Standard Detail SW-12.4, *REFERENCE SHEET*, shall be utilized to show all stakeout information, consisting of horizontal layout and vertical control.

Vertical control shall be achieved by a bench mark set at three hundred (300') feet intervals maximum. Datum shall be *U.S.G.S.* looped and tied to an existing monument, or County benchmark.

Additional vertical control shall be provided by field run centerline profile ground elevations at 25 feet stations. Where profiles determine that embankments are required for minimum pipe cover, the location must be listed under *REMARKS*. Embankment must be constructed to a minimum of three feet pipe cover prior to pipeline installation.

Horizontal control shall be provided by offset hubs and tacks set at one hundred (100') feet intervals listing station and offset, and at all valves, fittings and appurtenances, listing the same. Offsets shall be located out of the path of construction traffic. Sketch shall show street names, etc. for visual reference.

REMARKS column shall show the beginning and ending stations of stabilized area construction, and the limits of paving restoration, top soil, seeding & mulch, stone drives, parking lots and concrete.

D. SURVEY REPSONSIBILITIES

The method employed by the Contractor for transferring line and grade from the stakeout to the pipe laying shall be subject to the Department's approval. The Contractor shall be responsible for any error in the line or grade of the finished work.

The Contractor shall carefully preserve bench marks, reference points and stakes, and in case of willful or careless destruction, the Contractor shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

Prior to the final acceptance of the work by the County, the Contractor shall re-establish and replace any disturbed property monuments within the project limits of work at no cost to the affected property owner, easement holder, or the Department and shall furnish the property owner with a property survey of the affected portions of the project site certifying by a licensed P.S. or P.L.S. that all disturbed property monuments have been accurately replaced.

Chapter 2, Section 202

Excavation and Backfill

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II. Excavation and Backfilling

A. Scope of Work

The Contractor shall furnish all plant, labor, material and equipment to perform all excavation of every kind required for the work under the Contract. Contractor shall perform all filling and backfilling, shall construct all embankments and fills including furnishing, hauling and placing all material required for constructing embankments and fills. Contractor shall perform all grading, shall remove all water, shall satisfactorily dispose of all unsuitable and excess materials, shall furnish, install and remove all sheeting, bracing and shoring necessary to hold the sides of the excavations and to protect the work and existing structures and utilities. Contractor shall perform all incidental and appurtenant work required to satisfactorily complete the work as shown on the drawings, standard details and as specified, herein, and or as directed.

B. General

All excavation for pipes shall be in open trenches, except where and to such extent as the Department may authorize or direct that the same be constructed by tunneling, jacking or boring, or where such is specified herein or shown on the Contract Drawings. Trenches may be, in general, excavated and backfilled either by machinery, or by hand as the Contractor may elect, provided however, that the Department shall be empowered, wherever such necessity exists, to direct that hand excavation be employed, and provided further, that excavation and backfilling by hand shall be performed to the extent herein specified or directed if so deemed necessary. The Contractor shall have no claim for extra compensation due to the fact that hand, instead of machine, excavation may be made necessary from any cause whatsoever. Excavation shall be considered as the removal of all necessary materials from their present location to their final location, as shown on the plans as described in these Specifications.

C. Clearing and Grubbing

The Contractor shall be responsible to perform all work in accordance with the Maryland Standards and Specifications for Soil Erosion and Sediment Control. The approved Soil Erosion and Sediment Control plan shall be a guide of acceptable practices required for this project. Any additional measures required due to field conditions or the methods of construction utilized shall be provided by the Contractor at no additional cost to the Department.

The work under this item shall include the furnishing of all labor, materials and equipment necessary to clear and remove from the site, or dispose of in an

approved manner, all perishable and objectionable materials, including stumps, roots, and rocks within the line of construction to be accomplished.

As herein used, perishable material shall include boards, fences, trees, brush, vines, shrubs, logs, stumps, roots, weeds, rubbish and other organic matter above the surface of the ground, but not sod or topsoil, although a portion of sod and soil may be removed in connection with other materials.

All stumps and organic material shall be removed from areas to be occupied by structures, or areas that are to be finish-graded. Rock shall be removed to 12" below final grade to allow for a clay cap and topsoil for establishing ground cover as specified.

D. Removal of Pavement and Storage of Trench Materials

The Contractor shall clear and grub the surface and remove all surface materials of whatever nature over the line of the trench; he shall properly separate and classify the materials removed; and he shall store, guard and preserve said materials as may be required for use in backfilling, earth, sand, curbing, gutter and flagstones, and all sectional paving units which may be moved, together with all materials taken from the trenches, shall be removed from the street or roadway area to the approved waste area, or such other suitable place, and in such manner as shall be approved or directed by the Department. The Contractor shall be responsible for any loss of, or any damage to, paving materials through his own or his employees' careless removal or neglectful or wasteful storage, disposal or use of same.

The Contractor shall remove all pavements, road surfaces, curbing, driveways and sidewalks within the lines of excavation. Portland Cement Concrete pavements shall be opened by sawing at close joint and asphalt pavements by cutting two neat straight lines with channeling machine, hand operated pneumatic tools or by such other methods as will furnish a clean cut in the pavement and base without undue shattering. All concrete curbing, driveways or sidewalks within the lines of excavation shall be broken up and removed by the Contractor. All such work as above designated shall be performed at the Contractor's expense and in accordance with the rules and regulations of the municipality in which the work is performed. *The use of "pear" or weight dropped on pavement for breaking will not be allowed except by prior written permission of the Department.*

The Contractor shall remove paving of such width only as is necessary for the excavation of the trench, and in case he removes the paving for a greater width than is deemed necessary or in case he removes or disturbs any paving on account of settlement, slides or cave-ins or in making excavation outside the lines of the work without the written order of the Department, cost of permanently replacing the paving so removed shall be borne entirely by the Contractor. The Contractor

shall replace the pavement at his expense, to the extent (as directed) by the Department.

In case more material is excavated from any trench than can be backfilled over the completed pipe line or can be stored within the limits of the right-of-way, leaving space for drainage as herein provided, the excess material shall be removed to some convenient place, provided by the Contractor. The Contractor shall at his own cost and expense, bring back so much of the material so removed, as may be required to properly backfill the trench, if of the proper kind; or, if so directed by the Department, the Contractor shall, at his own cost and expense, furnish such other suitable material as may be deemed necessary.

When it is necessary to haul soft or wet material over the streets or roads, the Contractor shall provide suitable, tight vehicles, of a pattern approved by the Department for the purpose.

E. Removal of, Stockpiling of, and Replacement of Surface Materials

Sod and/or topsoil shall be removed from all areas where excavations or fills are to be made. Sod, if specified to be replaced, shall be cut in suitable strips and carefully removed and stored for subsequent use. During the period of storage, the sod shall be kept suitably protected and watered.

Where seeding, sodding, or grading of areas is called for on the drawings or by these specifications, or where the topsoil or loam, or overburden is unsuitable for use in embankments, dams, or filled areas, the topsoil shall be removed and stockpiled for future use, or where unsuitable for use, as called for above, shall be discarded to such areas approved by the Department and/or the Washington County Soil Conservation District, where applicable, otherwise it shall become the property of the Contractor and shall be removed from the site.

In placing topsoil for sodding or seeding, all roots, logs, sticks, weeds, and other debris shall be removed. Stones or rocks that can be removed by garden rakes, as normally used, shall also be removed. The topsoil shall be spread to a minimum depth of four inches (4"), and shall be well raked and graded to drain, and depressions shall be filled in to leave the area level or to the lines and grades indicated on the drawings. Final raking shall take place at the time seeding or sodding is to be performed.

All shrubbery and trees located in the Right-of-Way, easements and work area which would interfere with or become damaged by the construction, shall be removed by balling in burlap, stored in a protected area and watered. Upon completion and backfill the shrubs and trees shall be replanted, except over utility lines or within easement area, in which case they shall be relocated as approved by the owner. The Contractor shall replace all shrubs and trees that are destroyed

by his removal or are not thriving at the end of the guarantee period, incidental to all work at no cost to the Department.

F. Excavation Unclassified

All excavation unless otherwise specified shall be unclassified and shall include all material of any kind encountered, whether earth, rock, concrete, old foundations or other obstacles, hard or soft material, wet material, silt, water or other material. Unless and except as shown on the drawings, no subsurface explorations have been made to determine the character of the material at the side of the work.

The County has not investigated subsurface conditions to determine soil types, rock, water table, etc., and shall not be responsible for extra compensation nor delays caused by any encountered conditions.

If during construction a solution cavity is discovered, the Department may elect to have the developer to retain the services of a Geotechnical Engineer or other professional to evaluate and recommend corrective measures when a solution cavity (sinkhole) or a hazardous material is encountered in the excavation or project area. The Geotechnical Engineer shall submit a proposed recommendation to the County for review and approval. The Contractor shall perform the corrective measures as recommended within the report prepared by the Geotechnical Engineer.

G. Trench Excavation General

The Contractor shall excavate, protect and backfill all trenches that may be necessary for completing the work to be performed under the contract. All excavation shall be in open trenches, except where and to such extent as the County may authorize or direct that the same be performed in tunneling, jacking/boring, or where such is specified in the special conditions or Contract plans. The use of excavation machinery shall be permitted. Hand methods of excavation shall be performed in places where operation of machinery will cause damage to trees, buildings, or other existing utilities above or below ground. No tunneling, boring, or forcing shall be allowed without special permission from the Department. The excavated material in non-paved areas must be stored in such a manner as not to encroach on private property, endanger the work, obstruct sidewalks nor interfere with surface drainage. In roadways and paved areas, all excavated material must be immediately removed from the work area to an approved storage site or removed from the project area for disposal by Contractor.

The Contractor may elect, provided, however, that the Department shall be empowered, wherever such necessity exists, to direct that hand excavation shall

be performed to the extent hereinafter specified. The Contractor shall have no claim for extra compensation due to the fact that hand, instead of machine, excavation may be made necessary from any cause whatsoever.

The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depth indicated by the drawings, as specified herein or as directed by the Department. All excavated materials not required for backfill shall be removed and wasted or otherwise disposed in a legal manner by the Contractor.

H. Removal of Water

The Contractor shall, at all times during construction, provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such a manner as shall not interfere with the prosecution of the work or the proper placing of concrete or other work, and in such a manner as will provide against the flotation of any structure, or pipe, without flooding such structure or pipe.

The Contractor shall build all dams and other devices necessary and provide and operate pumps, or well-point systems, of sufficient capacity for continuous dewatering of the excavations. The Contractor shall provide for the disposal of the water removed from excavations, in such manner as shall not cause injury to the public health, to public or private property, to any portion of the work completed or in progress, or produce any impediment to the use of highways, roads, lanes and streets by the public.

All discharge areas of pumping devices shall be in full compliance with the Washington County Soil Conservation District's regulations and specifications.

I. Excavation Below Sub-Grade

When excavation is carried below sub-grade without the direction of the inspector the excavation is to be brought back to sub-grade with materials and in a manner approved by the Department.

If the Contractor excavates to the grade shown on the plans and the inspector finds on inspection of this sub-grade that it will not sustain the loads to which it will be subjected, the inspector may then direct further excavation and backfill with specified materials. The Contractor shall perform the corrective measures as directed by the Department and shall be paid for said work as unclassified excavation.

The term "sub-grade" as used herein shall mean the bottom of the excavated

trench, ready to receive bedding material.

J. Width and Depth of Trenches

Sides of trenches shall be kept as nearly vertical as possible and shall be excavated true to line so that a clear space eight (8") inches in width is provided on each side of the barrel of the pipe to a height not less than the top of the pipe. If sheeting is required at the level of the pipe, the dimensions in the foregoing shall be applicable to the faces of the sheeting.

The depth of the excavation for the pipe or other structure herein specified shall be such that the proper grade as established on the plans is achieved in accordance with the installation detail.

Should the Contractor excavate beyond the limits herein specified, the space so caused alongside or below the sub-grade of the pipe shall be completely filled with materials approved by the Department, at the Contractor's expense.

Wherever necessary to prevent caving, trenches shall be adequately sheeted and braced. Trench sheeting shall remain in place until pipe has been laid and backfill completed to a minimum height of one foot above the crown of the pipe. All sheeting shall be raised and/or removed as backfilling is completed and no sheeting to remain in place without the written permission of the inspector.

Sub-grade of pipe trenches shall be taken to mean a horizontal plane six inches (6") below the underside of the pipe barrel or other structure as shown on the standard detail drawings herein.

K. Length of Open Trench

The Department shall have the right to limit the amount of trench opened in advance of pipe laying and the amount of pipe laid in advance of backfilling, as determined and directed by the inspector. Generally, in undeveloped cross-country work areas, no more than two hundred feet (200') of trench shall be opened at any one place in advance of the completed trench. The amount of pipe laid in advance of backfilling shall not exceed 60 feet. In all roadways and residential areas, no more than fifty feet (50') of trench shall be opened in any one place in advance of the completed trench. In all cases, trench excavation shall be fully completed, except for the shaping of the bottom of the trench, at least twenty-five feet (25') in advance of the pipe placement, and shall be kept free from obstructions, except that at the close of the work at night, or at the discontinuance of work, the pipe laying shall be completed to within ten feet (10') of the end of the open trench. In all roadways and residential areas, all open trenches must be suitably bridged against intruders and traffic loading at the end

of each work day.

The inspector shall be empowered, at any time, to require the refilling of open trenches over completed pipelines, if, in his judgment, such action is necessary, and the Contractor shall thereby have no claim for extra compensation, even though to accomplish said refilling he is compelled temporarily to stop excavation or other work at any place.

If work is stopped on any trench, for any reason except by order of the Department, and the excavation is left open for any unreasonable length of time (in the opinion of the Department) in advance of construction, the Contractor shall, if so directed, refill such trench, at his own cost, and shall not again open said trench until he is ready to complete the structure therein.

L. Protection of Traveling Public

Contractor shall in all cases be held liable for the safety of the general public entering or near the work area as related to his methods of construction, use of equipment, or control of traffic.

Streets, roads and alleys shall not be completely closed during construction unless authorized in writing, by the Washington County Division of Public Works.

The roadway on one side of the line of work shall be kept open at all times, and driveways shall be kept open.

The Contractor shall construct and maintain such adequate and proper bridges over excavation as may be necessary or as directed for safe accommodation of pedestrians or vehicles. The Contractor shall furnish and erect substantial barricades at crossings or trenches, or along the trench, to protect the traveling public.

Roadways, driveway, and sidewalks shall be kept clean, clear and free for the passage of vehicles or pedestrians, unless otherwise authorized in writing by the County. A straight and continuous passageway on sidewalks and over crosswalks, at least three feet (3') in width, shall be preserved free from all obstructions.

Where deemed necessary, such additional passageway as may be directed shall be maintained free of obstructions. Under no circumstances shall the Contractor obstruct fire hydrants or prevent their use at any time.

M. Accommodation of Drainage

Gutters, sewers, drains and ditches shall be kept open at all times for surface drainage. No damming or ponding of water in gutters or other waterways will be permitted, except where stream crossings are necessary and then only to an extent, which the Department shall consider necessary in accordance with applicable permit. The Contractor shall not direct any flow of water across or over pavements except through approved pipes or properly constructed troughs, and he shall when so required, and at his own cost and expense, provide pipes or troughs of such sizes and lengths and as may be required, and place the same as directed. The grading in the vicinity of trenches shall be controlled so that the ground surface is properly pitched to prevent water running into the trenching.

In open water courses, ditches or pipes, encountered during the process of the work, the Contractor shall provide for the protection and securing of a continuous flow in such courses or pipes and shall repair any damage that may be caused by construction.

N. Obstruction Shown on Drawings

Certain information regarding the reputed presence, size, character and location of existing underground structures may be shown on the contract drawings. There is no certainty of the accuracy of this information. The location of underground structures shown may be inaccurate and other obstructions than those shown may be encountered. The Contractor hereby distinctly agrees that the Department is not responsible for the accuracy of the information given; that he shall have no claim for delay, or extra compensation due to inaccuracy, insufficiency or absence of information regarding obstructions either revealed or not revealed by the drawing. 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 pipe or other underground structure is not as indicated on the drawings, or in case any pipe or other underground structure is encountered that is not shown on the drawings.

O. Removal of Obstructions

Should the position of any pipe, conduit, pole or other structures, above or below the ground, require its removal, realignment, or change due to the Contract work; but not be indicated in the Contract documents as part of the work, as determined by the Department; the work shall be performed by the owner of the obstructions, without cost to the Contractor; but the Contractor shall uncover and sustain the structures, at his own expense, before such removal and before and after such realignment or change as constituting part of the contract; and 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.

The Contractor shall, without extra compensation, break through and reconstruct, if necessary, the invert or arch of any sewer, culvert or conduit that may be encountered and damaged, if the said structure is in such a position that, in the judgment of the County, removal, realignment or complete reconstruction is required.

The Contractor shall not interfere with any persons, firms, or corporations, or with the Owner in protecting, removing, changing, or replacing their pipes, conduits, poles, or other structures; but he shall offer said persons, firms, or corporations, or the owner, to take all such measures as they may deem necessary or advisable for the purpose aforesaid, and the Contractor shall thereby be in no way relieved of any of his responsibilities under the contract. At railway or railroad track crossings, any expense to which the owner of the trackage is put, in shoring up tracks, or in maintaining traffic shall be borne by the Contractor, whether same is billed directly to him, or the owner. Should any such bill be unpaid by the Contractor, before final payment under the contract is made, the Owner shall be empowered to pay said bill and retain the amount thereof, from any monies due, or to become due to the Contractor.

Except when trees are in rights-of-way, in immediate proximity to the trench, and are indicated for removal, relocation, or replacement, they shall not be cut down except by authorization of the County or owner of the project, and the Contractor shall have no claim for the extra compensation owing to the fact that he may be required to excavate by hand, or tunnel in the vicinity of trees that may be left standing. Trees located in SHA's Right-of-Ways needing to be removed require the Contractor to first apply and be granted a roadside tree permit from Maryland Department of Natural Resources.

P. Change of Trench Location

Any change in the location of the trench, from that shown on the approved drawings, shall be authorized by the Department. The developer shall prepare revised construction drawings showing the proposed alignment prior to installing any pipe.

Q. Miscellaneous Excavation

The Contractor shall do such miscellaneous excavating work as may be necessary or directed. Such excavation shall be subject to the same conditions and requirements as specified for trench excavation.

Miscellaneous excavation shall include the digging of test pits, or excavation for any special structure, outside the trench, that may not be shown on the drawings or described in the specifications, where such excavation is performed at the direction of the inspector.

Test pits shall be dug by the Contractor in areas of questionable existing utilities locations shown on the drawings, or utilities located by "Miss Utility", to verify size, location, and type prior to performing work in close proximity, at his own expense. All test pitting shall be done in the presents of the County's Inspector. Any utility, so shown or marked, and damaged by the Contract work, shall be repaired immediately, by direction of the respective utility.

R. Embankment

Where embankment is necessary to achieve the subgrade of the pipe or structure, it shall be made to a minimum height of three feet (3') above the crown of the proposed pipe grade, or to the height, width, and slope shown as finished grade on the plans. The embankment shall then be excavated to the proper form and grade of the trench for the pipe installation.

For proposed roadways, the entire embankment or such portion thereof as may be deemed necessary, as directed by the Department, shall be made prior to the construction of the pipe utility, at such time and in such order as the Department may direct; and the embankment and the pipe and its appurtenances which may be laid thereon or therein, shall be maintained by the Contractor, at his own cost and expense, until the completion of the period of twelve (12) months from and after the date of the certificate of completion and acceptance unless otherwise noted for a longer period.

After carefully grubbing and clearing the ground, removing all loose rock and stone, and all muck and improper material, to such a depth as the inspector may determine, the embankment shall be built up of specified or selected approved materials, free from all stones above six inches (6") in diameter.

In case materials, which is unsatisfactory for the foundation of an embankment is encountered, said material shall be removed to such depth, and for such length and width as may be directed by the inspector. Acceptable embankment foundation (subgrade) shall be not less than 92 percent of maximum dry density as specified in AASHTO T-180.

The material for embankment shall be deposited in layers of not more the eight inches (8") in compacted thickness. Each layer shall be separately compacted to ninety five percent (95%) of maximum density at moisture content of within two (2) percentage points of optimum to final subgrade. The whole embankment shall be carried up evenly to the height given by the inspector in such a manner as to

make a compact and solid foundation. All performance/acceptable testing shall be the responsibility of the Contractor at his own expense. Field testing results shall become the property of the Department and provided to the inspector at the end of each day unless otherwise approved by the Department. Reports shall be completed and given to the inspector at the end of the work day or the start of the next work day. Complete test reports shall include the following: Date, weather, site conditions, test locations & results, maximum dry density & optimum moisture of fill material tested.

S. Pipe Trenches in Fill

Where pipes are to be laid in areas of fill, the fill shall be made prior to laying pipe. After the fill is in place, the pipe trench shall be excavated to subgrade or to natural ground if lower than subgrade. Where it is necessary to excavate below subgrade, that portion of the trench above natural ground and below subgrade shall be filled with gravel or crushed stone as specified herein.

T. Rock Excavation

Unless otherwise directed by the Department, rock or boulders shall be fully taken out at least twenty-five feet (25') in advance of pipe laying, and to a point at least six inches (6") below the invert of the pipe, and to a width not to exceed the width of the trench, for the size of pipe to be laid therein. The space below the outer bottom of the pipe shall be filled with specified aggregate bedding, as detailed. If rock below the specified trench subgrade is shattered due to excessive drilling or blasting, and, if in the opinion of the inspector, it is unfit for foundations, such shattered rock shall be removed and the area backfilled to the proper grade with material acceptable to the inspector, at the expense of the Contractor.

Where manholes are excavated in rock, they shall be excavated to a point twelve inches (12") from the outside the exterior lines of the masonry and to a depth of six inches (6") below the outside bottom of the masonry.

Wherever rock is encountered in the excavations for manholes where future connection are shown on the Contract drawings or where manholes would accept future connections as determined by the Department, or where stubs are to be left for future extension, the excavation shall conform to the lines of the prism required by the dimensions of such extension, but not less than five feet (5') from outside the exterior lines of the manhole, structure, or pipe end.

Rock appearing in miscellaneous excavations directed by the Department, shall be removed to lines and grade prescribed by the Department, if directed by the Department.

U. Use of Explosives and Blasting

1. General

The Contractor shall provide all labor, materials, equipment, and services necessary for, and incidental to, the use of explosives and blasting for excavation.

Failure to comply or to complete any work in accordance with any specifications set forth will be sufficient grounds for suspension of privilege to blast. The Contractor shall not be entitled to any claims or any additional compensation, which shall arise from the suspension of the blasting.

Wherever rock is encountered in the excavation, it may be removed by means of explosives, however, the Contractor shall be solely responsible for injury to persons or property that may result from his use of explosives, and the exercise of, or failure to exercise control on the part of the Department shall in no way relieve him of responsibility for injury or damage resulting from their use.

All blasting shall be performed under the supervision of a licensed blasting expert, and subject to NFPA 495, Explosive Material Code, latest edition.

Blasting for excavation shall be permitted only after securing the required license for the use and handling of explosives from the State Fire Marshal. The Contractor shall notify the State Fire Marshall as required for any and all blasting operations. The Contractor's method for procedure relative to blasting shall conform to state laws and local municipal ordinances.

The State Fire Marshall is empowered to enforce regulations concerning the character and strength of explosives used, and the manner of their use and storage. Handling and storage of explosives shall be in accordance with Federal Regulation 18 U.S.C., Chapter 40, Sections 841-848.

Only the amounts of explosives required shall be kept in an approved location and shall be kept under lock, the key to be only in the hands of a licensed blaster.

The Contractor shall use the utmost care in the use of explosives necessary for the prosecution of the work, so as not to endanger life or property.

All explosives shall be transported and stored in a secure manner, and in accordance with local, state and federal laws, all vehicles and such storage

places shall be marked clearly “DANGEROUS – EXPLOSIVES”.

Controlled blasting techniques shall be used. Modify the blasting round as necessary to achieve the best obtainable results and to keep the air blast over pressure, vibrations and noise within the limits of COMAR 12.03.01.09 “Control of Airblast and Ground Vibration for Blasting Operations”. Exercise all possible care in drilling and blasting operation to minimize overbreak and blast damage of adjacent unexcavated ground. It shall be the Contractor’s responsibility to produce a satisfactory excavated surface by determining the proper relationships of the factors of burden, spacing, depth of charge, amount of type of explosive, hole size and delay pattern, and other necessary considerations to achieve the required results.

Blasts shall be made only during daylight hours and all blasts shall be carefully confined and adequately covered, to prevent injury to persons and to protect adjacent structures and pipes against damage. Before detonation of each blast, ample warning shall be given to permit all persons to reach positions of safety. The Contractor shall control fly rock and materials so as to prevent damage to persons or structures. Rubber tire mats shall be used prior to blasting.

Equipment used for drilling of holes shall have a positive means of dust control to the Department’s approval, and maintained in working order.

Whenever any pipe main or conduit is encountered in the trench, the right is reserved to direct that all rock within five feet (5’) of the same is to be removed by some method other than blasting.

Any damage resulting from lack of control during the blasting last operation shall be the responsibility of and repaired at the expense of the Contractor.

2. Blast Report

The Contractor shall complete, maintain and submit permanent blast reports including logs of each blast. Logs shall be available for inspection by the County or authorized personnel at all times and retained for at least three (3) years. Reports may be accrued for one (1) week and must be submitted within five (5) days after the end of each week. Complete reports after each blast shall include the following:

1. Name of company or Contractor.
2. Location, date, and time of blast.
3. Name and signature of blaster in charge.
4. Type of material blasted.

5. Number of holes, burden, and spacing.
6. Diameter and depth of holes.
7. Types of explosives used.
8. Total amount of explosive used.
9. Maximum amount of explosive per delay period of 8 msec or greater.
10. Method of firing and type of circuit.
11. Direction and distance in feet to nearest structure neither owned nor leased by the person conducting the blasting.
12. Weather conditions including such factors as wind direction, etc.
13. Height or length of stemming.
14. If mats or other protection so as to prevent fly rock where used.
15. Type of detonators used and delay period used.
16. Seismograph recording including seismograph reading when required shall contain:
 - a. Name and signature of individual operating the seismograph
 - b. Name of individual analyzing the seismograph recorder
 - c. Seismograph reading
17. The maximum number of holes per delay period of 8 msec. Or greater.
18. The person taking the seismograph reading shall accurately indicate the exact location of the seismograph, if used and shall also show the distance of the seismograph from blast.

3. Blasting Within Existing Development

All blasting will be monitored by the Contractor and at the expense of the Contractor, to control vibrations in the vicinity of roadways, structures and utilities. The Contractor shall provide the Department of Water Quality with 24 hours advance notice prior to any blasting with an existing development.

Peak particle velocity shall not exceed one inch (1") per second in the vicinity of structures and utilities and other objects subject to damage from the blasting operation. Particle velocities in excess of these limits shall be classified as out-of-control blasting and shall not be permitted.

The monitoring device shall be capable of measuring the velocity parallel and transversely to the direction of the blast and vertically. The equipment shall be capable of providing a permanent record of all recordings.

Monitoring instruments shall be placed directly on bedrock at a sufficient number of locations to develop attenuation curve. At least five percent of

the measurements shall be made within ten (10) feet of the blast.

The Contractor shall furnish to the County a certification of calibration for each monitoring instrument used on the project, and a list of qualified personnel certified to operate field equipment.

All data obtained from monitoring equipment shall be interpreted by an independent firm and a report to be forwarded directly to the Department on a timely basis. If the equipment used is capable of analyzing and interpreting data, that equipment must be approved by the Department prior to use.

V. Blasting Within State Highway Right-of-Way

All blasting within the Maryland State Highway Right-Of-Way shall be in strict accordance with the "Standard Blasting Plan Within State Highway Right-Of-Way".

W. Responsibility for Condition of Excavation

The Contractor shall be responsible for the condition of all excavations made by him. All slides and cave-ins shall be removed without extra compensation at whatever time and under whatever circumstances they may occur.

Neither action nor omission by the Department to order the use of bracing, sheeting, or their associated materials and equipment, shall relieve the Contractor of his responsibility concerning the safety of the excavation.

Delays caused by any action or lack of action by the Contractor or the Department, their agents or employees, which result in the excavation being kept open longer than necessary shall not relieve the Contractor from properly and adequately protecting the excavation from caving or slipping.

The Contractor shall maintain at his expense, all refilled excavations in proper condition until the end of the one (1) year period following the date of acceptance of the work by the owner, unless otherwise noted for a longer duration. All depressions appearing in the refill excavations shall be properly refilled and surface restored. If the Contractor shall fail to do so within a reasonable time after the receipt of written notice from the owner, the Department may refill and restore said depression and the expense thereof shall be the responsibility of the Contractor. In case of emergency the owner may refill and restore any dangerous depression without giving notice to the Contractor, and the expense of so doing shall be the responsibility of the Contractor.

The Contractor shall be responsible for any injury or damage that may result from improper maintenance of any excavation, within the one (1) year maintenance period, unless otherwise noted for a longer duration.

X. Sheeting, Bracing and Shoring

The Contractor shall be responsible for properly supporting the sides of all trenches and excavations with sheeting, bracing, shoring, or other supports so as to furnish safe and acceptable working conditions. Bracing shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.

The Contractor shall furnish all labor, materials and equipment and perform all operations required for sheeting, bracing, and shoring of excavations and for constructing foundations. The Contractor is responsible for complying with all OSHA and MOSHA requirements.

Sheeting, sheet piling, bracing and shores shall be withdrawn and removed as the excavations are being backfilled, except where and to such an extent as the Department shall order, in writing, that the same be left in place, or where the County shall permit the Contractor to leave the same in place, at the Contractor's own cost and expense. Any sheeting or sheet piling left in place, whenever and at such point as the County shall order or permit, shall be cut off at least one (1') foot below finished grade, and the Contractor shall remove and dispose of the portion cut off.

In withdrawing sheeting and sheet piling, special care shall be taken to insure that all voids or holes left by the planks as they are withdrawn are filled with satisfactory material and thoroughly rammed with thin rammers provided especially for that purpose.

Y. Protection of Property and Structures

The Contractor shall, at his own expense, sustain in their places, and protect them from direct or indirect injury, all pipes, tracks, walls, buildings and other structures or properties in the vicinity of his work, whether above or below the ground, or that may appear in the trench. He shall at all times have sufficient quantity of timber and planks, chains, ropes, etc., on the site and shall use them as necessary for sheeting the excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened.

The Contractor shall take all risks attending the presence or proximity of pipes, poles, tracks, walls, buildings, and other structures and property, of every kind and description, in or over his trenches, or in the vicinity of his work, whether above or below the surface of the ground; and he shall be responsible for all

damages and assume all expenses for direct or indirect injury, caused by his work, to any of them, or to any person or property by reason of injury to them, whether such structures are or are not shown on the drawings.

Where necessary, in order to keep one side of the street or roadway free from any obstruction or to keep the material piled alongside of the trench from falling on private property outside the right-of-way, a safe and suitable fence shall be placed alongside the work.

In the event of encountering unstable material, subsurface streams or similar dangerous contingencies, or when passing buildings or any structures which by its construction or position might have its foundation undermined or cause unsafe pressure upon the trench; the right is reserved by the Department to direct that such building, or structure, shall be underpinned, or supported and protected; or that special sheeting shall be driven in such a manner and to such a depth, as may be directed; or that only a short length of trench shall be opened at one time; and furthermore, if necessary that the trench shall be securely sheeted and braced on all sides, after the manner of a shaft, and that the permanent work shall be constructed in the same and the shaft backfilled before another opening is made. Any work directed by the Department to be performed by the Contractor, shall be at the cost and expense of the Contractor.

The Department reserves the right under such conditions to stop the excavation or any other part of the work, and to require the Contractor to complete the pipe and the backfilling up to such a point as the Department may direct before proceeding further with the excavations; and the Contractor shall not thereby become entitled to demand or receive any allowance or compensation.

Z. Pipe Bedding and Granular Encasement

Trenches shall be filled for their entire width with compacted granular material, as specified in section "Sanitary Sewer Materials" and "Water Line Material", 6" below invert of the pipe. The bedding material shall be thoroughly compacted by means of mechanical tampers the full width of trench, and screened to a uniform plane on grade having dust out of bell, ready to receive the pipe. After the pipe has been placed to the proper grade and alignment, backfill and lightly tamp both sides, evenly, in 6" loose lifts and to a 12" horizontal plane above the crown of the pipe with the same pipe bedding aggregate material. Areas along side of the installed pipe and to a level plane two (2') feet above the crown of the pipe must be mechanically tamped using a hand tamper and in such a manner as to not damage or disturb the pipe or its alignment. Compaction achieved shall be ninety-two percent (92%) of maximum density per AASHTO T-180 to finish grade. Areas within proposed County right-of-ways shall be compacted in accordance to the Department of Public Work's S-3 Policy.

AA. Backfilling of Trenches (General)

Backfilling of trenches include all backfill material, compaction as specified, re-grading of adjacent disturbed areas, replacing other surface and sub-surface pipes and structures, placing and maintenance of temporary sidewalks and driveways, re-sodding lawns and replacing trees and shrubbery outside of the trench limits damaged by the Contractor and all appurtenant work incidental thereto refilling of excavations.

All lumber, rubbish and debris shall be carefully removed from spaces to be backfilled and kept clean of such during backfilling. All trenches and excavations shall then be backfilled to the subgrade of the respective surface restoration materials or other foundation subgrade.

No backfilling shall be performed prior to the time that joints in pipelines are set, inspected, measured, and approved.

All excavations in stabilized and non-stabilized surface areas must be backfilled or satisfactorily bridged at the end of each day's work. Adequate fencing may be allowed in undeveloped areas by the approval of the Department. Otherwise, partially excavated or open trenches will not be permitted outside the work day.

Puddling and/or jetting of trenches with water will not be permitted. The condition of the trench shall be restored to the full satisfaction of the Department.

Trenches shall be carefully backfilled without causing shock to the pipe and to prevent after-settlement. The backfill shall be of specified materials, selected for the purpose, in section "Sanitary Sewer Materials" and "Water Line Materials".

Every precaution shall be taken in the backfilling of excavations to prevent materials so placed from falling directly upon or against any pipe, conduit or other structures in such a way as to cause the displacement of or damage to said pipe, conduit or structure. The backfilling, filling and embankments shall be brought up evenly and all eccentric loading shall be avoided.

As the trenches are filled in and the work completed, the Contractor shall, at his own cost and expense, remove and dispose of all surplus earth, stone or other materials as specified hereinbefore. The Contractor shall leave all roads, sidewalks and other places free, clear and in good order. In case the Contractor shall fail or neglect to do so, or to make satisfactory progress in doing so, after the receipt of a written notice from the Department, the owner may remove such surplus material and clear the roadways, sidewalks and other places, and the cost of said work shall be charged to the Contractor.

Should there be a deficiency of proper material for refilling; the Contractor shall

furnish the same at his own cost and expense. Material lacking any specified property shall not be used as backfill.

No backfilling shall be made during freezing weather except by permission of the Department. No backfill shall be made when the material already in the trench is frozen, nor shall frozen material be used in backfilling.

Backfill may be deposited using mechanical or power equipment, except that care shall be exercised in placing material directly from a machine bucket, cars or other vehicle, such that the pipe is not damaged or displaced.

Compaction density shall be measured as specified by AASHTO T-180, and shall be as follows:

LOCATION	LOOSE LIFT	MAX DENSITY	OPTIMUM MOSTURE
a. More than 7' off roadway or driveway edge (open area)	8"	90%	+/-2%
b. Within 7' of road or driveway edge to 1' below grade	8"	90%	+/-2%
c. Within 7' of road or driveway edge top one (1) foot	8"	90%	+/-2%

Backfill of trench in State and County Roads, or areas to be accepted or maintained by same, shall be in accordance with the requirements of the State Highway Administration and Washington County Division of Public Works, respectively.

The Contractor shall furnish and install six inch (6") wide non-detectable warning tape two feet (2') centered above and continuous with the pipe, including service connection piping. The tape shall be colored and marked appropriate to the respective utility pipe. The Contractor shall also furnish and install a continuous 12 gauge copper tracer wire, with all pressure PVC piping. The tracer wire is to be laid along side the pressure pipe, with testing boxes installed at maximum spacing of five hundred feet (500').

BB. Backfill of Trenches Within New Developments

1. Stabilized Areas

Stabilized areas are areas within seven (7') feet of a proposed or future roadway, street, or driveway; measured from the edge of shoulder or curb; shall be backfilled from a plane one foot (1') above the crown of pipe using materials as specified by Washington County Division of Public

Works.

2. Non-Stabilized Areas

Non-stabilized areas are areas greater than seven feet (7') outside or off of a proposed or future roadway, street, or driveway; measured from the edge of shoulder or curb; and usually as open, vegetated area; may be backfilled from a plane one foot (1') above the crown of the pipe using clean earth free of rocks over six inches (6") in any dimension.

CC. Backfill of Trenches Within Existing Developments

1. Stabilized Areas

Stabilized areas are areas within seven (7') feet of a proposed or future roadway, street, or driveway; measured from the edge of shoulder or curb; shall be backfilled from a plane one foot (1') above the crown of pipe using materials as specified by Washington County Division of Public Works.

2. Non-Stabilized Areas

Non-stabilized areas are areas greater than seven feet (7') outside or off of a proposed or future roadway, street, or driveway; measured from the edge of shoulder or curb; and usually as open, vegetated area; may be backfilled from a plane one foot (1') above the crown of the pipe using clean earth free of rocks over six inches (6") in any dimension.

DD. Backfilling of Structures

Special care will be required in backfilling around structure walls. Backfill to be placed on both sides of a foundation all, shall be placed in simultaneous lifts on both sides of the wall so that there is no uneven pressure against the wall surface.

Backfill against one (1) exposed surface of a structure wall shall not begin prior to the completion of the floors or other portions of the structure tending to brace the walls in their final position. Vehicle and heavy equipment loads shall not be imposed prior to the time that the materials in the wall construction have reached their design strength.

Backfill material and compaction shall be as specified, detailed, and/or shown on the Contract drawings.

EE. Dust Control Clean-up and Repair

The Contractor shall remove from the site of the work, all materials not to be utilized in the scope of work. All construction materials and equipment during non-working hours must be stored so as not to impede traffic. The streets during working hours shall be kept free from surplus material and in a convenient condition for travel.

The Contractor shall be responsible for maintaining the streets, driveways, parking areas, etc. in clean and dust free condition in so far as the dust and dirt relates to his work. Dust control materials shall be calcium, water or other materials approved by the Department.

Upon direction of the County and the failure of the Contractor to control dirt and dust, the Department shall stop the progress of construction until such time the work is performed as directed. At the end of each day's work, the work area(s) shall be swept (hand or mechanical) until area is clean and free of dirt and debris.

The Contractor may store, during the work day, excavated material from the trench that is suitable backfill material to the extent of the amount required to complete backfilling in the general localized are of the work, as approved by the Department. However, at the completion of backfill or at the end of the day's work, all material must be removed, stored, and/or disposed as specified hereinbefore.

The Contractor shall be responsible for maintaining the streets during the construction period. Temporary asphalt base paving (cold mix) shall be placed, rolled and maintained, to provide a smooth riding surface over trench areas until such time the trench areas in existing paving are permanently restored.

The Contractor shall repair any and all damage he has caused to the streets, sidewalks, shrubbery, lawns, lawns, ornamental works, real property, etc., and shall save free and harmless the principal in this contract from all suits for damages to person or property arising from or caused by this construction.

Before final acceptance of the work the Contractor shall remove all equipment and material from the site; restore and/or repair all property, private or public, to a condition equal to or better than originally found.

FF. Tunneling Jacking and Boring

All methods of tunneling, jacking or boring shall be performed to the requirements and satisfaction of the agency issuing the permit, and/or having jurisdiction over same.

It shall be the Contractor's responsibility and expense to provide any additional insurance coverage which may be required by the agency issuing the permit. The

Contractor shall also be responsible for any cost involved in inspection by the Railroad Company, state highway or agency having jurisdiction over same.

All construction methods and materials proposed for use in tunneling, jacking or boring shall be submitted to and approved by the Department prior to construction. The Contractor shall assume all responsibility for the sufficiency and safety of his method.

The staging excavation shall be kept to a minimum size required to perform the work. During non-working hours, the excavation shall be kept tightly secured (if greater than three feet deep) by solid fencing and safety flagging, or bridging.

All erosion and sediment control, dewatering, restoration and appurtenant work relating to the tunneling/jack and bore operation, shall be incidental to the work.

Steel casing pipe shall meet the following minimum Requirements:

<u>Sewer Diameter</u>	<u>Minimum Casing Inside Diameter</u>	<u>Minimum Casing Thickness</u>
4"	12"	0.251"
6"	18"	0.313"
8"	18"	0.313"
10"	18"	0.313"
12"	24"	0.407"
15"	30"	0.469"
24"	36"	0.532"
27"	42"	0.563"
30"	48"	0.626"
36"	54"	0.688"

The encasement pipe shall be installed with even bearing throughout its entire length, and shall maintain the grade required for the carrier pipe to function as designed. The completed installation shall meet the requirements as shown in the Standard Detail Drawings.

Care should be used in trimming the surfaces of the excavated section. It is extremely important that firm contact exist between the casing pipe and the ground around the entire ring. Any space outside of the casing pipe shall be filled with uniform mixture of grout placed under pressure. Grouting shall start at the lowest middle hole of each grout panel, with grout holes above being open, and proceed upward progressively and simultaneously on both sides of the casing.

The staging excavation shall be entirely backfilled and compacted in accordance with these specifications, while protecting the end of the installed carrier pipe. The completed backfill excavation may then be excavated to the proper form and

grade of the trench for the pipe installation to connect to the carrier pipe at the casing end.

The Contractor shall provide and install sacrificial anodes on all carrier pipes. The anodes shall be sized according to the pipe diameter, thickness, and length of the pipe.

Chapter 2, Section 203

Sanitary Sewer Materials

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III. Sanitary Sewer Materials

A. Scope

This section of these Specifications details the requirements governing the quality of the various materials specified for use in other Sections and on the Construction Drawings and Details.

All pipes, fittings and other related materials used in the construction of sewer lines shall have the approval of and be in compliance with the Specifications and Standards of the Washington County Department of Water Quality, as set forth herein.

B. General

Material of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

Whenever reference is made to the requirements of the American Society for Testing Materials (ASTM), the American Water Works Association (AWWA), the American National Standards Institute (ANSI), or other standard specifications or codes, the latest modifications or revisions of such specifications by ASTM, AWWA, ANSI, or other standards organizations, shall be certified in writing by the manufacturer.

Representative samples of materials, intended for incorporation in the work, shall be submitted, when indicated or directed, for examination and/or test.

The Contractor shall furnish to the Department a minimum of seven (7) copies of Shop Drawings and/or certifications for each type of material used in the work. The Department will retain three (3) copies for our records and will return the remaining four (4) copies to the Contractor. If the Contractor requires more than four (4) copies, the Contractor will have to submit additional copies as part of his submittals. All materials to be used in construction shall have the Department's prior approval before use in the work.

No material shall be used until it has been inspected and approved on the site of the work by the inspector. Such inspection shall not relieve the Contractor of his obligations to complete the work as specified. Any defective material or workmanship which may have been passed by the Department shall be at all times liable to rejection when discovered, until the final completion of the project.

Where a manufacturer's name is used in these Specifications, it is used to designate a standard of quality. The use of said manufacturer's name does not

eliminate other manufacturer's equipment and materials equally as good and efficient and that can perform the same function, as approved by the Department.

C. Sewer Pipe and Fittings

1. General

Poly Vinyl Chloride (PVC) pipe and fittings shall be made from PVC compounds as defined and described in ASTM D-1784, Type I, Grade 1, Cell Classification 12454-B for rapid poly vinyl chloride compounds. Chlorinated poly vinyl chloride compounds (CPVC) shall be Type IV, Grade 1, Cell Classification 23447-B. All pipes shall be NSF Standard 14 certified. All fittings shall be one-piece injection molded.

All PVC pipe and fittings supplied shall have the following markings on each:

1. Manufacturer's name or trademark
2. Nominal Size
3. Material designation
4. Psm (and type for pipe)
5. ASTM designation
6. National Sanitation Foundation (N.S.F.) seal of approval
7. Full insertion mark

PVC pipe and fittings shall be manufactured by North American, J. M. Eagle, Harco, R & G Sloane, Spears, or equal. Installation shall be in accordance with the manufacturer's recommendations and as specified herein, whichever is more stringent.

The Contractor shall furnish to the Department sworn statements from the manufacturer that the inspection and all specified tests of the applicable ASTM Standards for PSM poly vinyl chloride gravity and pressure sewer pipe have been made and the results thereof comply with the requirements of these Specifications.

2. Gravity Sewer Main and Fittings

PVC pipe for gravity sewer shall be SDR-26 Heavy Wall PS 115 and must conform to the requirements of ASTM D-1784, ASTM F-679, and ASTM D-2241. All PVC sewer pipe must utilize the bell and spigot concept with the utilization of a single sealing rubber gasket provided by the manufacture.

SDR-26 PVC heavy wall gasketed sewer fitting 4" through 18" shall be manufactured in accordance with ASTM D 3034 and F 1336. Fitting

gaskets shall comply with ASTM F 477 or ASTM F 913. Fitting gaskets shall be locked firmly in position to prevent displacement. 4" through 8" SDR-26 fittings shall have green color coded gasket retaining rings for easy identification. 4" through 8" fittings shall be injection molded from virgin PVC compound having a minimum cell classification of 12454 or 13343 in accordance with, and certified by the National Sanitation Foundation (NSF), to meet ASTM D 1784. 10" through 15" gasketed SDR-26 sewer fittings may be injection molded or fabricated from pipe meeting the requirements of ASTM D 3034. Gasket joints of all fitting sizes must comply with ASTM D 3212 Internal Pressure Test (exfiltration) and vacuum test (infiltration) at 5 degrees of gasket joint deflection. Gasketed SDR-26 sewer fittings shall be certified by the NFS to meet ASTM D 3034.

Jointing for all PVC gravity sewer pipe and fittings shall be bell and spigot concept (ASTM D-3212) with the utilization of a flexible elastomeric seal (ASTM F-477) provided by the manufacturer. All spigots shall have a full insertion mark and beveled end. Lubricant for the gasket shall be as recommended by the pipe manufacturer.

3. Gasketed Long Radius Tee Wye

SDR 26 Heavy Wall gasketed tee wye shall be manufactured to meet the following requirements:

- a) ASTM D 3034 – Fittings
- b) ASTM D 1784 – Materials
- c) ASTM D 3212 – Joints
- d) ASTM F 477 – Gaskets or F913
- e) Fitting Wall Thickness – Minimum SDR 26

Long sweep tee wyes shall be made from PVC compounds, as defined and described in ASTM D 1784 for rigid PVC compound and shall have the following markings:

- a) Manufacturers Name or Trademark
- b) Nominal Size
- c) Material Designation
- d) ASTM Designation
- e) Color coded green end rings

The dimensions shall be as follows:

- a) Bell Depth 2-1/2" GSK to pipe minimum
- b) Wall SDR 26 H.W. Minimum
- c) Height 14" Minimum
- d) Length 14" Minimum
- e) Gasket Cross Section .21 Square Inches Minimum

Long sweep tee wyes may be factory fabricated until such time as a one piece injected molded fitting is available. At which time the molded fitting shall be required. Each fitting shall have a factory fabricated sticker for inspection purposes.

Fittings shall have the same warranty as the manufacturer applies to their other products.

Certification required.

4. Pressure Sewer and Fittings

Buried PVC pressure pipe 1½" through 4" diameter shall conform to the requirements of ASTM D-2241 (SDR-21) for working pressure of 200 psi.

Buried PVC pressure pipe 6" diameter and larger, shall conform to the requirements of ASTM D-2241 and AWWA C-900 class 150 (DR-18), for 150 psi working pressure unless otherwise specified.

Integral bell and spigot joints shall utilize flexible elastomeric seals and shall meet or exceed the requirements of ASTM D-3139 with rubber gasket meeting the requirements of ASTM F-477. Spigot ends shall have a reference mark around the circumference to denote the depth of seating into the bell or coupling. Lubricant for elastomeric gasket shall be specified by the pipe manufacturer.

5. Ductile Iron Pipe (DIP) and Fittings

Ductile iron pipe shall meet the requirements of AWWA C-150 and C-151, thickness Class 54. All pipe shall be centrifugally cast with double thickness cement-mortar lining and seal coated with asphaltic material inside and outside in accordance with AWWA C-104.

Underground installations shall maintain mechanical joints complying with AWWA C-110 with working pressure rating of 350 psi.

Inside of structure and above ground installations shall be flanged joints complying with ANSI/AWWA C-110/A21.10, with water working pressure rating of 250 psi. Flanges shall be flat faced and bolt arrangement shall be compatible with ANSI B 16.1, Class 125 flanges.

ASTM A307 bolts and ASTM A563 nuts used to connect the flanges in a mechanical joint shall conform to ANSI B18.2.

Bolt length shall be such that after installation, the projection of the thread is 1/8 inch to 3/8 inch. All mechanical joints shall be restrained utilizing Megalug or approved equal joint restraining device.

All pipe fittings shall be cement lined and coated inside and outside with coal tar pitch varnish. The varnish shall be made from coal tar to which sufficient oil has been added to make a smooth coating tough and tenacious when cold and not brittle with any tendency to scale off. The coating and the varnish shall both be heated to a temperature of 300 degrees F prior to dipping of the casting.

Flanged adapter shall be manufactured of ASTM A-126, Class B cast iron with Standard ANSI B16.1 125 pound flange. Mechanical joint shall be Standard ANSI/AWWA C-111/A21.11. Unit shall be rated for 250-psi water working pressure. Adapter shall be factory-coated exterior with corrosion resistant manufacturer coating and interior with coal tar epoxy.

Wall pipe shall meet the requirements of D.I.P. Pipe shall be sized to allow a minimum clearance of six inches (6") from face of flange to face of wall for mechanical joints and three inches (3") for flanged joints.

The Contractor shall submit to the Department, prior to installation of the pipe and fittings, a certificate, certifying that the pipe and/or fittings were manufactured and tested in accordance with AWWA Specifications.

6. Cast Bronze Fittings

Pipe and fittings shall be composition bronze, ASTM B-62, made of 85% copper, and 5% each of tin, lead, and zinc, and shall be threaded NPT, in accordance with ANSI B16.15.

D. Valves

1. General

Valves shall be of the sizes and types shown on the Drawings and shall joint as specified or be compatible with the pipes in which they are installed. All valves of one classification shall be of the same manufacture, and shall open left, counter-clockwise.

All wetted parts of valves shall be of materials or coatings resistant to corrosion caused by sulfides in sewage, and rated for 150-psi water working pressure in either direction.

Buried valves shall have bituminous, epoxy, or other approved coating applied to the exterior of the valve along with the extension stems and valve boxes.

No valves may be placed within the wetwell area.

2. Ball Valves: 1-½" Through 2-½" Pipe Size

Valve body, ball and stem shall be ASTM B-62 (85-5-5-5) bronze with ball specially coated to compliment ease of turning and no leakage against the resilient Buna-N rubber seat. Stem shall be Buna-N rubber o-ring sealed. Open valve shall allow full port flow. Actuator shall be the tee-head style capable of connecting to an extension stem for buried applications. End connections shall be female threaded NPT. Valves shall be as manufactured by Ford Meter Box Co. B-11 Series, A.Y. McDonald Mfg. Co. Pattern 3101, or equal.

3. Plug Valves: 3" and Larger Pipe Size

Plug valves shall be of the non-lubricated, eccentric plug type, as manufactured by Dezurik, or approved equal. Minimum full-open flow area through the cast iron (ASTM A-126, Grade 'B') body shall be 100% of full pipe, and shall not drip when closed. Valve shall have nickel seat, neoprene plug facing, stainless steel bolts, and stainless steel bearings. Packing shall be nitrile butadiene (buna vee).

Actuator type: lever, handwheel, chainwheel, square nut, cylinder, and electric motor.

All valves shall have 2 coats of Tnemec Series 141 Pota-Pox 80 applied to all surfaces by the factory prior to shipping.

4. Check Valves: 1-½" Through 3" Pipe Size

Horizontal swing check valves shall have a removable cap to allow for seat and disc renewal. Valve body, cap and disc material shall be ASTM B-62 (85-5-5-5) bronze. Hinge pin material shall be a 300 series stainless steel. End connections shall be female threaded NPT. Valves shall be as manufactured by Nibco Inc. Figure No. T-413-B, or equal.

5. Check Valve: 4" and Larger Pipe Size

Resilient seated check valves shall be manufactured from ductile iron meeting or exceeding ASTM A536 65-45-12. Valves shall be rated for 250 p.s.i.g. cold water working pressure.

Valves shall have a ductile iron disc fully encapsulated with rubber. Disc travel to closure shall not be more than 35 degrees and shall seal drop tight at pressures above 5 p.s.i.g.

Valves to be coated with fusion-bonded epoxy on all internal and external ferrous surfaces.

Bronze seat rings are not allowed. Disc shall be the only allowable moving part. No O-Rings, pivot pins or other bearings are allowed. Disc must be reversible such that either side will seal equally.

Valves shall be equal to American Flow Control's Series 2100 Ductile Iron Resilient Seated Check Valve.

All resilient seat check valves shall be placed inside a building or within a vault. Resilient seat check valves can not be direct buried.

6. Combination Air & Vacuum Pressure Release Valve

Combination air valves shall be heavy-duty "Universal" style single body units incorporating the functions of an air and vacuum valve with an air release valve in a single housing.

Combination air valves shall release accumulations of air at high points within a pipeline by exhausting large volumes of air as the pipeline is being filled, and then by releasing accumulated pockets of air while the pipeline is in operation and under pressure. Combination air valves shall also be designed to permit large volumes of air to enter the pipe-line during pipeline drainage.

The valve body and cover flange shall be cast or fabricated 316 stainless steel and shall incorporate a "sanitary clamp" to attach the flange to the body at the outlet. Valves that use traditional bolting to attach the cover flange to the body are not acceptable. The flange clamp must be located at the outlet of the body for ease of cleaning and maintenance. Other clamping locations are not acceptable.

All non-sealing internal metal components shall be 316 stainless steel. No plastic, nylon, or fiberglass components will be acceptable.

The valve shall incorporate an Air Release orifice of 3/16" for use at 200 psig. No deviation from this orifice size will be allowed. This orifice will be located in the outlet of the valve and shall be drilled in a 316 stainless steel orifice plate that seals against a Buna-N rubber seat. Valves with seals that flex or "roll" will not be acceptable.

Unit may have a maximum height of 14 inches and a maximum weight of 28 lbs.

The valve shall be Crispin "X" Series, model # UX20 or approved equal.

All combination air valves shall be placed inside a building or within a vault. If the valve is placed within a building, it must be vented to the outside. Air valves can not be direct buried.

7. Sewage Surge Relief Valve

The sewage surge relief valve shall have standard 125 lb flanged elbow type body. The valve shall open immediately upon the inlet pressure exceeding the preset relief setting specified for the project.

The valve shall have a cast iron body and a stainless steel ring to hold the resilient, replaceable seat in position. The valve shall have a normally closed drop tight position. The valve disc movement shall allow for full flow opening when required but the opening stroke shall be limited to that needed to provide surge protection set by the operator. The disc movement shall be guided throughout its stroke length. Valve closure shall be at a slow speed consistent with adjustment of a self-contained oil cushion chamber integral to the valve. The valve closure rate shall be adjustable over a range to prevent hammer.

External springs shall be enclosed in protective casings and in compression. The disc stem bushing shall be bronze capped with a lantern-type gland, which is vented to the atmosphere to reveal seal leakage.

The valve shall be Golden-Anderson Figure 625-D or equal and sized as shown on the drawings.

E. Pipeline Appurtenances

1. Valve Box and Lid

Valve boxes shall be two-piece screw-type adjustable, made of gray cast iron, and shall have a coal tar epoxy coating (or equal) inside and out. Boxes shall be 3 to 4 feet long with one adjustment. Mid box extensions may be required for greater depths. Compatible lid shall be cast iron drop lid type with coal tar epoxy coating and "sewer" identification cast in.

4- $\frac{1}{4}$ " roadway valve box barrel shall have an arched bottom for 1- $\frac{1}{2}$ " through 2- $\frac{1}{2}$ " valves.

5- $\frac{1}{4}$ " valve box barrel shall have a flat round bottom for 3" and larger valves.

2. Valve Extension Stem

All buried valves shall have extension stems that attach to the valve operator and extend inside of the valve box to within approximately one foot (1') of finished grade.

Stem materials shall be coal tar epoxy (bitumastic or equal) coated ASTM A-36 steel and/or ductile iron. Rod shall have a welded end piece to

connect to the valve operator by means of a stainless steel or brass cotter pin or set screw, provided by the stem manufacturer. The top end of the rod shall have a welded tee-head aligned with the valve operator or a two inch (2") square nut, each of which shall indicate open or closed valve position.

A ¼" steel centering ring piece, ¼" in diameter less than the inside diameter of the valve box, shall be welded to the rod within three to six inches of the top, for alignment.

3. Warning and Identification Tape

All piping including service connections shall have a 4-mil polyethylene tape; 6" wide placed centered, continuous, 2 feet above the crown of the sewer.

Color shall be bright green with black printed letters on one side spaced continuously stating:

CAUTION – SEWER LINE BURIED BELOW

Tape shall be Terra Tape Mark Line or Sentry Line as manufactured by Reef Industries, or equal.

4. Flushing Connection Vault

Heavy wall PVC bullet meter vaults shall be manufactured to meet the following requirements:

- a. Manufactured of a one piece molded construction.
- b. Manufactured from a three layered polyethylene.
- c. Dimensionally tapered at its top with an expanded body with the maximum inside dimension starting at approximately 6" down from the top of the box.
- d. The nominal wall thickness shall be not less than 0.550 inches.
- e. Each box shall have molded in the wall an insulation layer having a minimum thermal transfer of 4.0 according to ASTM C171 to resist frost jump.
- f. The vertical free standing load should be minimum of 25,000 lbs.
- g. Each box shall have a top flange for frame & cover seating and bottom flange for anti-settling at its base.

- h. The box shall incorporate a top lip shelf to facilitate the use of an additional insulation disc as need may arise.
- i. The interior shall be bright white in color for light reflection to ease meter reading and provide light for maintenance work.
- j. The exterior shall be black in color to retard UV degradation.
- k. Material shall be modified polyethylene with low temperature brittleness exceeding 76 degrees Fahrenheit.
- l. The manufacture shall be able to provide grade box adjustment in heights of 3” to 12” with tapered risers to accommodate scoping installation.
- m. Meter vaults shall have the following dimensions: 20”(opening)X24”(inside diameter)X30”(depth).
- n. Meter vaults shall be manufactured by Carson Industries L.L.C. or approved equal.

5. Flushing Connection Frame and Cover

Frame and cover shall be cast iron, factory bituminous coated, double lid type, with 11” – 13” diameter recessed cover, and an inner lip on the bearing flange equal in diameter to the vault I.D. An extension ring collar may be utilized to meet the vault I.D. and must have the same inner lip on the bearing flange.

The cover shall have a standard pentagon bolt / ‘lifter worm lock’ locking device, and shall have the word ‘SEWER’ cast in. The plastic inner lid shall provide sufficient dead air space for frost protection.

Frame and cover shall be as manufactured by Ford Meter Box Co., or equal, to the following Ford catalog numbers:

	<u>TRAFFIC AREA</u>	<u>NON-TRAFFIC AREA</u>
Frame Cat. No.	W32H	W32
Cover Cat. No.	WA32LH	WA3L
Inner Lid No.	W3BP	W3BP

6. Cast Iron Clean-Out Adaptor and Brass Plug

The cast iron clean-out adaptor shall have a heavy-duty designation, suitable for use in light traffic areas. All castings shall be tough and of even grain free of gas holes and flaws thoroughly coated at the factory

with one coat of a bitumastic protective coating. The casting shall have a grooved retainer ring for installation of a single piece "O" ring gasket provided by the manufacturer, which joint when properly fitted to the riser pipe shall produce a flexible and water tight connection. The brass plug shall be threaded to fit the cast iron adaptor with a two inch (2") square countersunk head, brass to cast iron threads shall be coated with anti-seize compound. The cast iron adaptor and plug shall be the Panella clean-out Order #PA_SVCSK as manufactured by the Jones Manufacturing Co., Inc., or equal.

7. Tracer Wire and Testing Station

Tracer wire shall be UL Listed, Type THHN, gasoline and oil resistant, and suitable for operations at 600 volts as specified in the National Electric Code. Conductor size shall be a 12 AWG solid copper conductor (or "12 AWG 19-Strand copper conductor"). Conductor shall be annealed copper, insulated with high-heat and moisture resistant PVC, jacketed with abrasion, moisture, gasoline, and oil resistant nylon or listed equivalent. Tracer wire shall be manufactured on 500' non-returnable plastic spools. Splicing of tracer wire shall not be permitted. Tracer wire shall be Pro-Line Safety Products Company or approved equal.

All tracer wires are to be connected to a combination cast iron & ABS tamper proof tracer wire access box. The cover is to be manufactured of cast iron and ABS components produced in the USA. Cast iron collar & cover is to be manufactured in accordance with ASTM A 48 Class 25. The ABS is to be manufactured in accordance with ASTM D 1788. The cover shall be lettered Electric and shall have a standard AWWA size cast-in pentagonal bolt. Testing station shall be manufactured by C.P. Test Services-Valvco, Inc. or approved equal. The maximum spacing for the test stations shall not exceed 500 feet.

F. Manholes

1. Precast Base, Section and Top

All manhole sections shall be constructed of precast reinforced concrete pipe having an inside diameter of 48" unless otherwise shown on Drawings. The pipe shall conform to the requirements of ASTM designation C-478, and to the configuration shown in the Standard Details.

The pipe shall have tongue and groove joints, which utilize an extruded, butyl sealant (AASHTO M-198) in flexible rope form to achieve watertight joints.

The base section shall be cast integral (monolithic) with side wall to 12" minimum height above the pipe crown.

Lifting holes shall be provided with inserts not longer than 4". The bottom riser section shall fit into the concrete base and the top section shall either be an eccentric tapered section, tapering from 48" inside diameter to 30" inside diameter respectively and thickened upper walls at frame and cover, or flat top section as shown on Standard Details.

All top sections shall have embedded inserts positioned 90 degrees apart for anchoring bolts to hold the cast iron frame in place. Bolt inserts shall be designed to withstand a 400-pound pullout force and shall be threaded to receive 5/8 inch galvanized all thread rod. Length of bolt is determined by the height of grade rings to place the frame and cover at the proper finished grade.

The Department reserves the right to require HDPE lined manhole where high concentration of sewer gasses are expected.

2. Steps

Each step shall be manufactured using 0.5 inch (13 mm) diameter deformed reinforcing steel, grade 60 standards, and conforms to ASTM A-615. The steel shall be covered with high impact copolymer polypropylene which has been proven non-corrosive in sewer environments and conforms to an ASTM D-4101 specific number.

The steps shall be contoured to fit the hand for comfort and a sure grip with sturdy tread design with side molded slip-resistant wings. Each step shall be stamped with manufacturing data.

Steps shall be installed by the manhole manufacturer as per the step manufacturer's requirements, to achieve minimum horizontal pullout strength of 400 pounds, and withstand a 70 foot-pound vertical impact at 6 degrees F.

3. Pipe to Manhole Seal

All seals shall be resilient elastomeric material conforming to the physical requirements of ASTM C-923. Manufacturer shall certify that the seal is designed to accommodate the respective pipe outside diameter. Installation configurations shall comply with Standard Detail SW-2.10.

New precast manholes shall have flexible seals, through which the pipes are inserted, simultaneously cast with the manhole into the wall by the precast manufacturer.

Cast-in place seals shall have a water stop feature molded into the embedded surface and a retainer groove molded into the inside surface to hold the elastomeric seal.

Seals for core-drilled connections to existing manholes shall be the expansion ring & rubber boot type, with all stainless steel hardware including “worm screw” tightening mechanism.

Seals shall follow the style of “Hail Mary Rubber Co., Inc., Star Seal”, “Kor-N-Seal Wedge Korband”, or equal.

4. Frame and Cover

Frame and cover manhole castings shall be of ASTM A-48 Class 30B gray iron or ASTM A-536 Grade 60-40-18 Ductile Iron, conforming to the configuration and dimensions shown on the Standard Details. Frame and cover shall be certified to withstand H-20 traffic loading and have a minimum opening of 30”.

For manholes located in non-traffic areas and not within the 100 yr floodplain, the frame and cover shall pivot away from the hole opening, eliminating the need for manually raising or lowering the cover. The cover rotates in either direction on a cast-in stainless steel rod that ensures its remains attached to the frame. No special tools are required to open or close the cover. The frame and cover shall be East Jordon Iron Works, Inc. Revolution Access Assembly of approved equal.

Castings shall be true to pattern in form and thickness, free from cracks, gas holes, flaws and excessive shrinkage, sound, cleaned by means of sand blast and neatly finished. Runners, fins, risers and other cast-on pieces shall be removed. All castings shall be tough and of even grain.

Makings shall be cast-in to the cover as shown on Standard Details SW-2.6, 2.7, and 2.9.

Watertight frame and cover shall meet the above requirements.

5. Grade / Leveling Rings

Grade rings shall be manufactured of the same class of concrete as manhole riser sections. Grade rings shall conform to and be compatible with dimensions shown on Standard Details, and shall be provided with openings to match the inserts installed in the conical or flat top section of manhole. Grade rings shall be set in full bed of mortar and two (2) rings of ½ inch butyl sealant.

High Density Polyethylene (HDPE), ASTM D-1248, grade rings shall be one-piece injection molded, UV resistant, withstand HS-25 loadings

without permanent deformation, and seal watertight utilizing butyl rope sealant. Two inch (2") maximum riser rings shall be capable of adjustment to conform to grade slopes, such as manufactured by Ladtech, Inc. or equal. Prior to installation of grade rings, the Contractor shall demonstrate their ability to install grade rings per manufactures requirements. All grade ring installations shall be inspected by a Department's representative.

6. Access Hatch

Access hatches shall be aluminum checkerplate cast into the precast concrete slab flush, designed for H-20 traffic loading. Access hatches shall be watertight utilizing gaskets with a drip channel to collect water and direct it to a 1" NPT discharge pipe connection. All hardware shall be 300 series stainless steel including hinges, hold-open latch with release handle, spring loaded cylinder lifting assist, latch and latch handle, recessed lifting handles, and recessed hasp. Portions of frame embedded in concrete shall be bituminous coated. Doors shall be Bilco Type 'J', size as indicated on drawings. Provide master padlocks keyed to Department of Water Quality's standard.

G. Concrete

All classes of concrete utilized in the work shall conform to the Maryland State Highway Specifications and ASTM C-150 for Portland Cement, ASTM C-33 for aggregates, and shall be acceptable to the Department.

The Contractor shall submit a certified mix design and test results for each class of concrete to be used in the work. Mix designs shall be proportioned in accordance with Section 4.4 of ACI 318. Design shall achieve the minimum 28-day compressive strength specified in pounds per square inch (psi).

Type I Portland Cement may be used in general concrete construction when the special properties specified for Type II are not required, where detailed, or as directed by the Department. Type II Portland Cement shall be used in general concrete construction exposed to moderate sulfate action or where moderate heat of hydration is required, where detailed, or as directed by the Department.

All concrete shall have a maximum water-cement ratio of 0.45, a minimum cement content of 564 pounds per cubic yard, a maximum slump of three inches (3"), and a total air content of six percent (6%) +/- one percent (+/- 1%).

Fine aggregate shall consist of natural sand, manufactured sand or a combination thereof, with maximum particle size of 3/8 inch. Course aggregate shall consist of graded crushed limestone material of sizes within the range 3/8 inch to 1 inch.

Water used in concrete shall be free from objectionable quantities of impurities, as determined by the inspector.

H. Concrete Bonding Agent

A bonding agent shall be applied to bond new concrete to existing concrete and shall be Weldcrete as manufactured by Larsen Products Company, Perma-Lok as manufactured by Sinclair Paint Company or other approved equal.

Surface preparation, application and curing shall be in strict accordance with the manufacturer's recommendations.

I. Non-Shrink Grout

Non-shrink grout shall be used for patching concrete, sealing joints, or setting anchorages, where specified; shall be non-metallic and meet the requirements of ASTM C-827, no shrinkage or expansion. Minimum 28-day compressive strength shall be 6000 psi (ASTM C-39).

Surface preparation, application and curing shall be in strict accordance with the manufacturer's recommendations, and shall be PenngROUT as manufactured by IPA Systems, Waterplug as manufactured by Thoro System, or equal.

J. Mortar

Mortar shall conform to the requirements of ASTM C-270 proportion specifications and shall be composed of Type II cement (ASTM C-175), or Type II masonry cement (ASTM C-91), if specified, ASTM C-144 fine aggregate, and water. Proportioning shall be one-part cement; two-parts fine aggregate and water, by volume.

Water used in mixing mortar shall be free from objectionable quantities of impurities, as determined by the inspector.

The ingredients must be in proportions that can be controlled and accurately maintained by measurement and not by estimation. All cementitious materials and aggregates shall be mixed for a minimum period of three (3) minutes, with the amount of water required to product the desired workability, in a drum type batch mixer. Hand mixing of mortar will be permitted on small jobs with approval from the inspector. No greater quantity of mortar shall be prepared than is required for immediate use, and any mortar that has begun to set shall not be re-tempered or used in any way. Mortar, which has been mixed more than one (1) hour, shall not be used.

The Department shall approve precautions that shall be taken in the mixing and use of mortar during freezing weather.

K. Pipe Bedding Aggregate

1. Pipes Four Inches (4") Diameter and Larger

Maryland State Highway Administration designation "Crusher Run Aggregate CR-6", meeting the requirements of ASTM D-2940.

2. Pipes One and One Half (1-½") Inches to Three (3") Inches Diameter

Stone aggregate shall have the designation of B-10. B-10 aggregate is rounded stone without sharp edges and having a maximum size of one half inch.

L. Trench Backfill Material

1. Clean Earth

Clean earth shall be those materials complying with ASTM D-2487 Soil Classification Groups GM, GC, SE, SP, SM, SC, CL, and ML, or combinations thereof. The minimum AASHTO T-180 Method C density for clean earth shall be not less than 100 pounds per cubic foot at Optimum Moisture Content. Clean earth shall not contain rocks over six (6") inches in any dimension, nor shall it contain any noticeable amounts of loam, topsoil, or organic matter.

2. Dirty Crusher Run (CR-D)

Granular limestone material with 100 U.S. standard sieve and gradation similar to Maryland State Highway Administration Graded Aggregate for Sub base (GA S/B). The aggregate shall be thoroughly blended with 25 to 40 percent by volume or 19 to 32 percent by weight of clean earth material as defined above, except that all constituents must pass the 1-½ inch sieve.

Submit moisture/density curve and gradation analysis, with percent of organic material found.

M. Stone Aggregate Below Subgrade

The aggregate to be utilized below subgrade is dependent upon the site conditions. The inspector will provide the direction as to which aggregate is to be

utilized below subgrade. The Contractor shall perform the corrective measures as directed by the Department, as a change in the scope of work.

N. Bituminous Concrete (Asphalt Pavement)

All asphalt paving materials and placement shall be in accordance with Sections 504, 505, and 904 and all Sections referenced, of the "*Standard Specifications for Construction and Materials*" Maryland Department of Transportation – State Highway Administration – October 2008 or latest edition.

O. Bituminous Protective Coating

When indicated in the Plans and Specifications or directed by the Department, some materials shall be given a bitumastic protective coating. This coating shall consist of one (1) or more coats of bitumastic Super Service Black, as manufactured by Koppers Company, Inc., or Marine Foundation as manufactured by Carboline Company or equal.

The bitumastic material may be applied by brush or spraying. If sprayed, it must be applied at 70 square feet per gallon per coat. Each coat shall have a dry film thickness of 0.016 inches (16 mils).

P. Material Safety Data Sheets

Material Safety Data Sheets (M.S.D.S.) shall be provided for all applicable materials used in performance of the work by the Contractor or his employees, as part of the Shop Drawing Submittal for the sanitary sewer materials used.

M.S.D.S. shall be properly displayed at the site of the work, accessible and visible to all persons within the area of the work.

The inspector may require the Contractor to stop work without compensation or recourse for delay, if the M.S.D.S. for applicable materials being used, are not available at the site.

Q. Steel Pipe Encasement

Where indicated on the Contract Drawings the sanitary sewer pipe shall be installed as a carrier pipe inside of a steel casing pipe within an open trench or by jacking and boring. The carrier shall be adequately secured in place with casing insulators and the ends of the casing shall be sealed, watertight, as indicated on the Standard Detail. Piping joints within the casing pipe shall be restrained with mechanical restraints.

1. Steel Casing Pipe

Casing pipe shall conform to AWWA C200, A-139 Grade 36 steel minimum. Diameter and wall thickness shall be as shown on the Standard Detail for the respective carrier pipe diameter.

All joints shall be welded the full circumference, watertight. Field welding shall comply with AWWA C206, single-welded butt joints. Joints shall be tested for water tightness by means of a vacuum-type look box (AWWA C200), or equal, prior to jacking or setting into place. Casting shall be coated inside and outside with coal tar epoxy in accordance with AWWA C210, to obtain a minimum dry film thickness of 15 mils (0.015 inch).

The contractor shall install #4 anode bags to each end of the casing pipe.

2. Pipe Insulators

Carrier pipe insulators (casing spacers) shall be manufactured to tightly fit the specific class and outside diameter of the carrier pipe so as not to allow slippage along the carrier. The 12-inch wide two-piece solid sleeve band and runner studs shall be either stainless steel lined with PVC or an insulating coating, or steel with a complete coating of fusion bonded PVC. Connecting hardware shall be stainless steel. The runners shall be glass reinforced plastic, HDPE, or UHMW polymer, 2 inches wide, of adjusted size to provide the designated pipe gradient, or be centered within the casing. The outside diameter of the runners shall be within one half inch of the inside diameter of the casing.

Insulators shall be Model AL2G-2 as manufactured by Pipeline Seal and Insulator, Inc., or Model CCS as manufactured by Cascade Waterworks Mfg. Co., or equal.

3. Casing End Seals

Casing end seals shall conform in design to Pipeline Seal and Insulator, Inc., Model 'S', or equal. All banding and tightening device materials shall be 300 Series stainless steel. Size shall be suitable to make a non-crimped, water tight fit between casing and carrier pipes.

R. Sewer Line Markers

Markers shall be Carsonite Utility Markers, Model No. SNFB-072 with 1854-SL decal marked "Sewer Line". Markers shall be installed as per manufacturer's recommendations adjacent to valve boxes or directly over the pipeline where indicated on the Contract Drawings.

S. Wet Well

The wet well shall be constructed of precast reinforced concrete pipe manufactured with Type II Portland Cement and with strength of 4000 psi per ASTM C-478 and shall be fully lined with H.D.P.E. liner. All dimensions and the configuration shall be as shown on the drawings. The wet well foundation shall be cast-in-place, reinforced concrete.

Materials shall conform to ASTM C-76, except as otherwise specified. Fine aggregate shall be natural sand conforming to the requirements for concrete subject to surface abrasion. Manufacture shall be by the wet cast method. Include steam curing, water curing or combination thereof as included in applicable standard.

Rubber gaskets for joints in circular pipe shall be o-ring type, circular cross section conforming to ASTM C-361.

Basis of acceptance per physical test requirements of applicable manufacturing standard and ASTM C-497, primarily performed by manufacturer's testing lab and quality control personnel. Provide mill tests on steel, cement and gasket materials throughout the manufacturing and delivery period. Perform concrete compression tests on molded cylinders on days of production during which pipe cores not required.

T. Wet Well Coating

1. Interior

Concrete wetwell shall be fully coated on the interior and across the full width of all joints, by the wetwell manufacturer with a High Density Polyethylene (H.D.P.E.) liner, as manufactured by AGRU, GSE Studliner, or an approved equal. The H.D.P.E. liner is not required to be installed on the floor of the wet well.

2. Exterior

The exterior of the wet well shall have a protective coating of bitumastic applied to all exterior surfaces. This coating shall consist of one (1) or more coats of bitumastic super service black, as manufactured by Koppers Company, Inc., or marine foundation as manufactured by Carboline Company or approved equal. The bitumastic material may be applied by brush or sprayed; it must be applied at 70 square feet per gallon per coat. Each coat shall have a dry film thickness of 0.016 inches (16 mils).

Once the bitumastic coating has been applied, a protective board will need to be applied to the exterior surfaces. The protective boarding shall be Warm-N-Dri as manufactured by Owens Corning or approved equal.

Board thickness is determined based upon manufacture's information and depth. Varying board thickness, on the exterior of the wet well, will not be permitted. The thickness recommended protective board shall be utilized on the entire exterior of the wet well.

U. Mechanical Restraints

When piping is required to be restrained against movement, this shall be achieved through the use of mechanical restraints. The use of concrete thrust blocks is prohibited.

All mechanical restraints shall be manufactures by Ford Meter Box Company, Inc and shall be the Uni-Flange series or approved equal. The Contractor shall determine which Uni-Flange series is applicable for the intended use and shall submit appropriate shop drawing to the Department of Water Quality for approval.

Chapter 2, Section 204

Sanitary Sewer Installation

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IV. Sanitary Sewer Installation

A. Scope

The Contractor shall furnish all plant, labor and materials and perform all operations required for the construction of sewers and appurtenances including all pipe, jointing materials and joints, laying pipe, fittings, tracer wire, manholes, concrete, granular bedding, backfill, testing, and all incidental work necessary to complete the work as shown on the drawings and/or as specified.

B. General

Included in this section are specifications for the installation of all sanitary sewers of whatever size, material or type required. Gravity sanitary sewer shall consist of straight sections of poly vinyl chloride pipe connected by precast concrete manholes of the size and with jointing materials, as shown on the drawing or specified in Chapter 2, Section III, "Sanitary Sewer Materials". Other sewers shall be as specified.

C. Laying Pipe and Fittings

1. Gravity Sewers

Following the trench excavation and preparation of the aggregate bedding material, as specified in Section III, "Excavation and Backfill", pipe laying shall proceed upgrade with pipe laid carefully, bells upgrade, spigot ends entered into adjacent bells to the insertion mark, and true to lines and grades shown on the drawings. Each length or section of pipe or fitting shall be carefully inspected before installation and those containing cracks or other defects shall be removed from the site.

Extreme care must be exercised to prevent breakage when pipe is handled especially during cold weather. Bells and spigots shall be carefully cleaned before pipes are lowered into trenches. The pipes shall be lowered so as to avoid unnecessary handling in the trench.

In laying pipe, special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the pipe. Before joints are made, each section of pipe shall rest upon the pipe bed for the full length of its barrel, with recesses prepared where required to accommodate bells and joints. After jointing, the recess shall be fully backfilled to provide

adequate support throughout the entire length. Pipe joints shall be made in strict accordance with the pipe manufacturer's specifications.

No pipe shall be brought into position until the preceding length has been adequately braced and backfilled such that it is secure against movement or misalignment.

Field cutting of pipe shall be kept to the minimum required for fitting placement and manhole connection.

The interior of all pipes shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open ends of all pipe and fittings shall be provided with a stopper carefully fitted so as to prohibit dirt and other substances from entering into the pipe. The stoppers shall be kept in the end of pipe at all times when laying is not in actual progress.

Under no circumstance shall pipe be laid in water or on subgrade into which frost has penetrated, nor at any time when the inspector shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation, unless all required precautions as to minimum length of open trench and promptness of refilling are observed. In all cases water shall be kept out of the trench.

Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two (2) feet over the top of the pipe.

Any pipe that has its grade or joint disturbed after laying shall be taken up and relaid. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe, without expense to the Department.

No pipe shall be laid within ten (10) feet of the machine excavating the trench, including in rock excavation, nor within twenty five (25) feet of any place where blasting is being performed. The mouth and exposed portions of the pipe shall be carefully protected from all blasts.

2. Pressure Sewer

Pressure sewer shall be installed in accordance with and as specified herein before under paragraph "1" "Gravity Sewers". Location and grade or depth shall be as shown on the drawings, holding four (4) feet minimum cover unless otherwise indicated to avoid unnecessary high points (air pocket). *Maximum joint deflection shall be limited to one half (1/2) of the maximum joint deflection specified by the pipe manufacturer.*

Tracer Wire Installation

- a. All buried pressure sewer shall be accompanied by a #12AWG standard copper tracer wire and shall terminate in an approved test station located at valves, flushing connections or Air Release and or as directed by the Engineer.
- b. The tracer wire shall form a mechanically and electrically continuous line throughout the pipeline.
- c. Tracer wire shall be tested for continuity in the presence of the inspector, prior to acceptance of the infrastructure.

D. Joints

Before joints are made, the Contractor shall thoroughly clean and inspect all bell and spigot ends to insure there are no defects.

Factory cut or field cut D.I.P. shall have the edge ground smooth to a minimum level width of 1/8", cleaned of extraneous materials and double coated with coal tar epoxy inside and out within three inches (3") of the cut edge and to a dry film thickness of 6 mils each coating. The coating system shall meet the requirements of AWWA C205 and or C210.

1. Elastomeric Gasket Joints

The gasket shall be removed, if possible, from the retainer, thoroughly cleaned and checked for defects, and then reassembled. Gasket shall be fully seated in retainer and facing in the correct direction. Lubricant shall be used and as specified by the manufacturer.

Field cut pipe shall be beveled to the angle specified by the manufacturer. Prior to insertion, a full insertion mark shall be drawn around the visible top half of the cut end of pipe.

2. Mechanical Joint

The last eight inches (8") outside of the spigot and inside of the bell of mechanical joint pipe shall be thoroughly cleaned of foreign matter. The cast iron gland shall then be slipped on the spigot end of the pipe. The

rubber gasket shall be placed on the spigot end with the thick edge toward the gland. The spigot end is inserted into the bell. The gasket is then slid toward the bell and presses into the v-notch of the bell. The gland is placed against the gasket and all of the bolts shall be inserted in the joint and the nuts screwed up tightly with the fingers. All nuts shall be tightened with an automatic cut off torque wrench. The torque for various sizes of bolts shall be as follows:

Size of Bolt (inches)	Torque Setting (FT-LB)
5/8	50
3/4	75
1	85

Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

3. Flanged Joint

Flanged pipe shall be installed in strict conformance with the ANSI/AWWA C110/A21.10 standards. Flanged fittings must be installed with the centerline of the bolts holes properly oriented to ensure correct alignment of the piping system. The responsibility for proper alignment and tightening of the flanges in the field rest solely with the Contractor.

4. Branches

Branches shall be installed at the locations indicated on the drawings, or as directed by the Department, and shall conform with the materials and arrangement as shown in "Standard Detail Drawing S-3.1". Branches for the various types of sewer lines shall be:

- a. Branches for connecting a gravity lateral to a gravity main, shall consist of a commercially manufactured sanitary tee with a one eighth (1/8) bend.
- b. Branches for connecting a pressure lateral to a gravity main, shall consist of a commercially manufactured sanitary tee with a one eighth (1/8) bend. Reducer bushings shall be utilized as required for small diameter low pressure sewer.
- c. Branches for connecting a pressure lateral to a pressure mains, shall consist of a commercially manufactured standard tee.

E. Concrete Cradles and Encasements

Concrete cradles or encasements may be required, as directed by the Department, due to conditions encountered, if not specified or shown in the Contract Documents.

Concrete shall have a 28 day compressive strength of 2500 P.S.I. "Dry-Mix" concrete shall not be used without prior approval by the Department.

Method of placement shall be so as to prevent water, earth, or foreign materials from becoming mixed with the concrete.

Formed or unformed concrete shall be placed under or around the pipe for cradle or encasement conforming to the dimensions shown on the standard details or as indicated on the drawings. The final limits of the beginning and ending of cradles and encasements shall be as approved by the inspector.

F. Potable Water Clearance

Sanitary sewer crossing any potable water pipe shall be one foot (1') minimum clear below the water pipe, measured from the outside of pipes. Sewer parallel to water shall maintain a horizontal clearance of ten feet (10') minimum and the sewer crown shall be below the invert of the water pipe.

In cases where the above clearance cannot be achieved, as determined by the Department (if not shown or specified), the sewers shall be encased in 2500 P.S.I. concrete to ten feet (10') each side of the water crossing or for the entire length of the parallel encroachment. The final limits shall be as directed by the Department; or the sewer shall be installed inside a casing pipe or if approved by the inspector, shall be laid if applicable so that no joint be within 10' either side of the water crossing.

G. Manhole Construction

1. General

The Contractor shall furnish all material for and labor necessary to construct all manholes and appurtenances, as shown, detailed and specified, at such point on the lines of the sewers as are shown on the drawings or as directed by the Department. *Dry cast manholes, risers or tops are not acceptable.*

Drop manholes will be located on sewers only at such points and with such drops as are shown on the drawings or as directed by the Department.

Manholes shall be built as pipe laying progresses. The Department may stop work entirely on laying pipe, until the manhole just passed has been completed and passed vacuum test.

The masonry shall be carried up to such point above or below the ground surface, as the Department shall in each case require. Flow channels for receiving and passing sewage shall be formed in the bottom of manholes.

Manholes shall be built in accordance with the design shown on drawings and conforming to the requirements of the Standard Details and ASTM C-478.

2. Excavation For Manholes:

Excavate as near a vertical plane one (1) foot outside of the manhole base, with the exception that existing pavement shall be cut to a square shape with dimensions two (2) feet greater than the diameter of the manhole base.

Subgrade shall be not less than eight inches (8") below the downstream invert of the sewer except as otherwise shown on the drawings. When it is necessary to excavate wider or deeper foundations than specified or shown, such foundations shall be built of compacted granular material or 500 P.S.I. type II portland cement concrete as directed by the Department, to the specified lines and grades.

3. Precast Concrete Bases:

Shall conform to applicable sections of ASTM standard specification C 478. The base shall be monolithically cast and shall consist of a manhole bottom and a wall which shall extend a minimum of twelve inches (12") above the top of the highest inflowing sewer. The top of the base shall be formed to receive tongue of barrel section. There shall be a minimum distance of four (4) inches between the invert of the lowest out flowing sewer and floor of the precast base to provide for the construction of a formed flow channel and bench within the manhole. No more than two (2) lift inserts shall be cast in the base. Lift inserts shall not extend into the wall more than four (4) inches.

Precast manhole bases shall be installed on top of a layer of Maryland State Highway Administration G.A.S.B. (CR6) crushed stone coarse aggregate which shall be well compacted, screeded to level and uniform bed, have a minimum depth of six (6) inches and be installed on undisturbed earth approved by the inspector.

The pipe-to-manhole seals shall be a compression type rubber joint cast integrally into the manhole base at the time of casting. The minimum pipe to manhole seal/adaptor shall be 4". It shall form a flexible watertight joint, as manufactured by A-Loc or Star Seal.

4. Precast Concrete Sections:

The base shall be monolithically cast consisting of a bottom and a wall which shall extend a minimum of twelve inches (12") above the top of the highest inflowing sewer crown. No more than two (2) lift inserts shall be cast in the base. Lift inserts shall not extend into the wall more than four inches (4").

Precast manhole bases shall be installed on top of a layer of aggregate bedding material, placed on disturbed earth subgrade approved by the inspector to a minimum compacted depth of six inches (6").

The pipe-to-manhole seals shall be a compression type rubber joint cast integrally into the manhole section(s) at time of casting. The minimum pipe to manhole seal/adaptor shall be four inches (4"). It shall form a flexible watertight joint.

All joints between sections shall be of the tongue and groove configuration utilizing butyl rubber gasket material to provide a watertight seal.

The base, rise (barrel), conical section, and top, shall be the production of one recognized manufacturer of precast manholes manufactured by wet casting.

5. The Top Of All Precast Manholes

Tops of all precast manholes may be brought to proper grade for receiving manhole frames by using not more than twelve (12) inches of concrete grade rings. Masonry construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. All joints shall be full and not more than one-half (1/2) inch in thickness. All steps and miscellaneous items specified elsewhere shall be bonded in the masonry. The masonry walls shall be parged on the outside with a one-half (1/2) inch coat of Portland Cement mortar.

Mortar to be used in laying the concrete grade rings or laying and parging the leveling courses of brick and for setting manhole frames shall be prepared by thoroughly mixing; one (1) volume of Type II Portland Cement with two (2) volumes of sand and sufficient clean water to produce a rich mass of approved consistency. Mixing mortar on the

ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well-graded and shall pass a standard no. 4 sieve.

6. Frame and Cover Installation

Precast concrete grade rings shall be used to bring the top of the frame and cover to final grade. No more than twelve inches (12") of concrete grade rings may be used. Rings shall be set in mortar by experienced and qualified workmen. All steps and miscellaneous items specified elsewhere shall be bonded in as the masonry proceeds.

In non-paved areas, rings shall be laid plumb, straight, level, square and true. All joints shall be full and between three eighths inched (3/8") and one-half inch (1/2") in thickness.

In paved roadways only, to match final road grade or pitch, frame and cover shall have beveled grade rings installed to match the roadway cross slope.

Five-eighths inch (5/8") hot-dipped galvanized or stainless steel all thread rod and nuts & washers shall secure the frame to the top manhole section with holes through the leveling courses.

7. Flow channels

Type II Portland cement concrete with 28-day compression strength of 1500 P.S.I. shall be used. Flow channels shall have a smooth trowel finish free of defects and accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer sections.

Changes in size and grade shall be made gradually and evenly, and have not less than one-tenth foot (0.10') slope from invert in to invert out. Pipes of differing diameter shall have inverts set such that crowns are level (matching crowns). Changes in direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit.

Benches shall be installed having a 1/4 inch per foot slope toward the flow channel and have a brushed concrete finish. *Steep slopes outside the flow channel will not be permitted.*

Flow channels may be cast by the manhole manufacturer upon prior approval by the Department.

Flow channels shall be formed in conjunction with forming and pouring of cast-in-place concrete bases, and shall be the same 3500 P.S.I. type II portland cement concrete as the base.

Prior to placement of concrete in manhole bases to form channels, the Contractor shall completely wrap "Styrofoam rope" around the pipe ends at the inside face of the manhole wall to provide a void between the concrete and pipes to insure a flexible pipe to manhole joint.

8. Bedding and Backfilling

Manholes shall be bedded and backfilled the same as pipe with material suitable to the location (i.e. stabilized or non-stabilized), compacted in layers and to the density specified in Chapter 2, Section III, "Excavation and Backfilling".

9. Internal Drop Connection

All internal drops must be installed in a minimum 60" diameter manhole. The inside drop bowl, stainless pipe brackets, and manhole channel system, shall be the RELINER® Inside Drop System. The RELINER® Inside Drop System shall be installed according to the manufacture's requirements.

If more than two internal drops are proposed for a manhole, the manhole shall have a minimum diameter of 72".

H. Connection to Existing Manhole

The Contractor shall neatly core an opening into the existing manhole by methods approved by the Department, and shall fix into place an approved watertight adapter to accept new sewer pipe. (See Standard Detail SW-2.10) For connections of sewer mains and/or services smaller than 4" in diameter, the minimum allowable pipe to manhole adapter shall remain at 4" and a reducer shall be used to adjust the pipe size accordingly outside of the manhole as approved by the Department.

The existing bench shall be saw cut and removed to receive the new pipe invert. The elevation shall be such that all pipes match crowns unless otherwise specified. A new bench and flow channel shall be shaped of brick or concrete to the top of the new pipe. The manhole shall be repaired and made watertight to the satisfaction of the inspector. Vacuum testing may be required.

I. Future Extension

Where directed by the Department, or when indicated on the drawings, provisions shall be constructed for future extension of sewer, as follows.

The flexible manhole seal shall be cast into the manhole base at the time of manufacture, to receive a stub of capped pipe for future extension.

Manhole sections shall be constructed in their entirety for future extensions when any section of a temporary termination falls in or within 7' of a paved area. The full section of sewer to be a future manhole location in a temporary or permanent non-stabilized area shall be built. All backfill requirements as specified in Chapter 2, Section III, "Excavation and Backfilling" shall pertain.

J. Sewer in Casing Pipe

All sewer shall be fitted with pipe insulators and casing end seals as specified and shown in the Standard Details.

All casing pipe shall be true and straight in alignment and grade with no deviation from that as indicated on the drawings.

The carrier pipe shall be centered within the casing. Pipe insulators shall be sized so the skids are snug against the casing pipe in all directions of the circumference in order to prevent movement or change in the grade or alignment of the carrier pipe.

The sewer pipe installed within the casing pipe shall be mechanically restrained by mechanical restraints. The mechanical restraints shall also be installed a minimum of 20' from each end of the casing.

K. Service Piping and Appurtenances

Service piping shall be installed in accordance with and as specified in paragraph 204 - C, "Laying Pipe and Fittings" and Standard Detail Drawings S-3.1 and S-4.1.

1. Gravity

All piping and fittings shall be gasketed PVC SDR26 Heavy Wall. The contractor shall install a gasketed long sweep TEE WYE for the cleanout connection. The cleanout shall be located on the right-of-way or property line but in no case shall it be installed in a swale or another type

depression. Provide easements if so required due to such drainage conflicts.

2. Low Pressure

All piping and fittings shall be gasketed PVC SDR21. The brass ball valve with cast iron roadway valve box shall be located on the right-of-way or property line with a brass swing check valve 18" behind it with a 5' stub of pipe and cap. But in no case shall it be installed in a swale or any other type depression. Provide Easements if so required due to such drainage conflicts.

L. Abandoning of Existing Sewer

The Contractor shall furnish all materials for and labor necessary for the construction of the re-routed sewer main and appurtenances and the abandonment of the existing sewer, as shown on the contract drawings, as specified herein, or as directed by the Department. All abandoned sewer lines shall be removed in the entirety.

Whenever the construction of a new utility or structure over an existing sewer in-place requires the abandoning of the existing sewer the following procedures shall be adhered to.

1. Abandoning Gravity Sewer Mains

Flow shall be maintained in the existing sewer main(s) and/or manhole(s) until such time as the relocated sewer(s) and manhole(s) are constructed and ready for use; this shall include excavation and backfill, testing, flow channel(s), frame(s) and cover(s), service laterals, if applicable; final inspection and acceptance of the newly constructed sewer and appurtenances. Upon acceptance, the flow channel shall be constructed in the existing manhole(s) in which the relocated sewer main has been installed. The sewage is then routed through the new sewer main(s). The Contractor shall then excavate the abandoned sewer main(s) at the face of the existing manhole(s) and remove all portion of the abandoned line.

2. Abandoning Manholes

When existing manhole(s) are to be abandoned, said manhole(s) shall be removed and disposed of by the Contractor. Excavations made for the removal of existing manholes shall be refilled with suitable material as may be required in a stabilized or non-stabilized area, and shall be well compacted to the satisfaction of the inspector.

3. Abandoning Pressure Mains

Flow shall be maintained in the existing pressure main(s) until such time as the relocated pressure main construction is completed; including bends, fittings, thrust blocking, buttresses, testing, final inspection and acceptance of the newly constructed pressure main. Upon acceptance, connection to the existing pressure main shall be performed at a time as specified and as co-coordinated by the Department by cutting out a section of existing pressure main and by utilizing mechanical joint repair sleeves and nipples, mechanical restraints, etc. Upon placing the new pressure main into service, the Contractor shall excavate, remove, and dispose of the abandoned pressure main.

M. Testing

All installed sewers shall be tested in the presence of the inspector together with a representative of the Contractor in the manner prescribed in the "testing" section of these standard specifications. It is the intent that the described testing procedures are to be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish the testing will be considered as non-completion of construction.

If, at any time before the completion of the contract or warranty period any broken pipes or any defects are found in the sewers or in any of their appurtenances; the Contractor shall cause the same to be removed and replaced by proper material and workmanship, without compensation.

Chapter 2, Section 205

Sanitary Sewer Testing

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
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B.	Field Testing	205-1
C.	Low Pressure Air Test	205-1/205-3
D.	Vacuum Test.....	205-3/205-4
E.	Hydrostatic Leakage Test	205-4/205-5
F.	Testing Equipment	205-5/205-6
G.	Concrete	205-6/205-8

V. Sewer Testing

A. Laboratory Testing

All materials require written certification of compliance from the manufacturer stating that representative samples have undergone laboratory tests by the methods and procedures of the ASTM, ANSI, AWWA, or other standards agency and do comply as specified.

Reports of the results of such tests may be requested to be submitted to the Department as sufficient evidence of the acceptance or rejection of the quality of the materials tested.

Representative samples of materials may be requested to be submitted to the Department, properly packaged and identified indicating manufacturer, material name and specification, and the intended use of the material in the project. The Department will determine, based on the materials submitted, whether additional laboratory testing by an independent laboratory will be required, prior to approval for the use of material in the work.

B. Field Testing

All sewers and appurtenances shall be tested in the field in the presence of a inspector together with a representative of the Contractor in the manner prescribed herein.

It is intended that the herein described testing procedures be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish the testing may be considered as non-completion of construction.

The Contractor shall furnish without charge, all labor and equipment necessary to complete specified testing.

Any section of sewer showing leakage in excess of the amounts specified herein shall be repaired or replaced by the Contractor at no cost to the Department.

C. Low Pressure Air Test

Gravity sewers shall be tested by Low Pressure Air Testing. The test is conducted between two (2) consecutive manholes, as directed by the Department. The length of test section for small diameter gravity sewers shall be as directed by the Department. The test procedure is as follows:

1. The test section of the sewer line is plugged at each end. One of the plugs used must be tapped and equipped for the air inlet connection for filling the line from the air compressor. All service laterals, stubs and fittings into the sewer test section shall be complete and properly capped or plugged, and carefully braced against the internal pressure to prevent air leakage by slippage and blowouts.
2. Connect air hose to tapped plug selected for the air inlet then connect the other end of the air hose to the portable air control equipment which consists of valves and pressure gauge used to control the air entry rate to the sewer test section, and to monitor the air pressure in the pipe line.

More specifically, the air control equipment includes a shut-off valve, pressure regulation valve, pressure reduction valve and a monitoring pressure gauge having a pressure range from 0 to 5 psi. The gauge should have minimum divisions of 0.10 psi and an accuracy of +/-0.04 psi.

3. Supply air to the test section slowly, filling the pipeline until a constant pressure of 4.0 psi is maintained. The air pressure must be regulated to prevent the pressure inside the pipe from exceeding 5.0 psi.

When constant pressure of 4.0 psi is reached, throttle the air supply to maintain the internal pressure above 3.5 psi for at least 5 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections.

If leakage is detected at any cap or plug, release the pressure in the line and tighten all leaky caps and plugs. Then start the test operation again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, the five-minute equalization period must be restarted after the pipe has been refilled.

4. After the stabilization period, adjust the air pressure to 4.0 psi and shut off or disconnect the air supply, observe the gauge until the air pressure reaches 3.5 psi, at 3.5 psig commence timing with a stop watch which is allowed to run until the line pressure drops to 2.5 psi at which time the watch is stopped, for a pressure loss of 1.0 psi is used to compute the air loss.

The section of the pipe undergoing the test shall be considered acceptable if the time for the 1.0 psi drops in air pressure from 3.5 to 2.5 psi is greater than given by:

$$T \text{ (MINUTES)} = \frac{0.0119}{60} \times D^2 \times L, \text{ where:}$$

D = pipe diameter in inches,

L = length of pipe tested in feet

An air pressure correction is required when the prevailing ground water is above the sewer line being tested. Under this condition, the air test pressure must be increased 0.433 psi for each foot the ground water level is above the invert of the pipe.

The air test form, Standard Detail S-12.6, shall be completed for each air test by a inspector.

D. Vacuum Test

1. Manholes

Each manhole shall be tested immediately after installation and prior to backfilling. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn inward. The test head shall be placed at the inside or the top of the cone section, or manhole frame and the seal inflated in accordance with the Manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60", and 90 seconds for 72" diameter manholes.

If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout to manhole exterior, while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

Comparable times for a successful vacuum test for different size manholes are:

DEPTH (ft) <u>(height of manhole)</u>	TEST TIME (sec) for DIAMETER (inches)		
	<u>48"</u>	<u>60"</u>	<u>72"</u>
8	14	18	23
10	17	23	28
12	21	28	34
14	25	32	40
16	28	37	45
18	32	41	51
20	35	46	57
22	39	51	62
24	42	55	68
26	46	60	74
28	49	64	80
30	53	69	85

2. **Septic Tanks**

Each tank shall be tested immediately after installation and prior to backfilling. All openings shall be plugged, taking care to secure plugs from being drawn inward. The test head shall be placed in inlet opening and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 3.5 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 2.5 inches. The tank shall pass if the time is greater than 5 minutes.

If the tank fails the initial test, necessary repairs shall be made in accordance with the manufacturer's recommendations or, if repairs cannot be made the tank shall be replaced. Retesting shall proceed until a satisfactory test is obtained.

E. Hydrostatic Leakage Test

Force mains and pressure sewers shall be tested by hydrostatic testing for leakage. The test section shall not exceed 1,000 feet in length where practical and shall be approved by the inspector. Each section shall receive the following hydrostatic test:

1. The pipe shall be slowly filled with water and tested to a pressure specified by the Department based on the elevation of the lowest point of the line of section under test. Before applying the specified test pressure, all air shall be expelled from the pipe. The pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Department.
2. The Contractor shall furnish the gauge and flow meter for measuring pressure and leakage. Leakage is defined as the quantity of water to be supplied to the pipe, or any section thereof necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled.
3. The duration of the test shall be for a period of not less than four (4) hours.

The Contractor shall furnish the water, pump, pipe, connections, meter and all other necessary apparatus, as shown on Standard Detail SW-12.7, and shall furnish all necessary labor to conduct the tests at no cost to the Department.

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{N \times D \times (P)^{1/2}}{7400}, \quad \text{WHERE:}$$

L = allowable leakage in gallons per hour,
 N = number of field joints in the test section,
 D = nominal diameter of pipe in inches,
 P = average test pressure during the test in pounds per square inch.

The pipe shall be pressure tested at 1.5 times the operating pressure.

Should any test of pipe laid disclose leakage greater than that specified above, the Contractor shall locate and repair the line until the leakage is within the specified allowance.

F. Testing Equipment

1. Air Test

Equipment shall be the Unitest System 200 air test system manufactured by United Survey, Inc., Cherne Air Loc low-pressure air testing system, or equal.

All necessary equipment for conducting air testing shall come complete in a self-contained unit. The unit shall include an air test control panel, air hose, hose reel, regulated air tank, air compressor, sewer plugs, float line kit, air test winch, segmenting test kit for each pipe size and other equipment necessary for conducting the air tests.

All labor and equipment shall be furnished by the Contractor.

2. Hydrostatic Test

A pressure test pump shall be provided. The pump shall be capable of providing a minimum flow of six (6) gpm and pressures of 300 psi or greater. The pump shall be the Hydro-Test II, Model No. 36452 manufactured by Wheeler-Pilot International or equal.

A meter to measure make-up water shall also be installed.

The water, pump, pipe connections, taps into the pipe, all necessary apparatus labor and materials shall be furnished by the Contractor.

All testing equipment must be certified by the manufacturer. Before testing can take place, the testing equipment must be calibrated per manufacturer's specification prior to use.

G. Concrete

1. Laboratory Tests

All concrete to be used in the work shall be laboratory tested, and certified by a Maryland Registered Professional Engineer, and a report submitted to the Department for approval prior to use, as specified in Section, "Materials".

Aggregates shall be tested in accordance with ASTM Specifications: C-29, C-40, C-127, C-128, and C-136.

Methods for compressive strength testing shall conform to ASTM Specifications C-31, C-39, and C-192.

The report shall show in detail at least three (3) different water-cement ratio mix designs for each class of concrete to be used, and 7-day, 14-day and 28-day compressive strengths obtained. The strength determinations shall be based on not less than two (2) concrete test specimens for each age and each water-cement ratio.

The tests shall establish three (3) curves representing the relation between the average strength of the concrete at each age, for each water-cement ratio, for each class of concrete to be used in the work.

The maximum water-cement ratio allowed to be used in the work shall be that corresponding to a point on the curve established by these tests, representing a strength of concrete 15% higher than the minimum compressive strengths called for.

The Department shall have the right to make adjustments in concrete proportions if necessary, to meet the requirements of these specifications.

Test results of concrete made with materials from the same sources and of the same class as called for in the current work, along with a certified report dated not more than one (1) year prior to the Contract date, may be submitted for approval by the Department, subject, however, to any provisions to the contrary as required by building codes or ordinances of the governing or permitting authority.

2. Field Tests

During concrete operations, the Department will arrange to have Slump Tests (ASTM C-143), Air Content Test (ASTM C-173), and Test Cylinders (ASTM C-31) made to determine whether the concrete as being produced complies with the standards of quality specified. Tests shall be in accordance with this section. The Contractor shall provide, at no cost to the Department, the required test cylinders.

Sets of four (4) cylinders will be made for each class of concrete used in any one day's operation, but not less than one (1) set for every fifty (50) cubic yards of concrete poured. Two (2) cylinders will be tested at 7 days and two (2) at 28 days.

Whenever it appears that tests fail to meet the requirements herein and/or of the approved mix, the Department shall have the right, at the Contractor's expense, to:

- a. Order changes to the proportions of the mix to increase the strength.
- b. Require additional tests of specimens cured entirely under field conditions.
- c. Order changes to improve procedures for protecting and curing the concrete.
- d. Require additional tests in accordance with "Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete", ASTM C-42.

If the above tests fail to prove that the questionable concrete is of specified quality, the Contractor shall replace such portions of the concrete work as the Department may direct, all at no cost to the Department.

In the event that concrete is placed during freezing weather or that a freeze is expected during the curing period, an additional cylinder will be made for each set, and it will be cured under the same conditions as that part of the work, which it represents.

The Contractor shall provide and maintain for the sole use of the Department, adequate facilities for safe storage and proper curing of concrete test specimens on the project site for the first 24 hours as required by ASTM C-31.

The Department reserves the right, if they elect, to retain the services of a testing laboratory for inspection at the mixing plant.

The Contractor shall make no change from the approved mix or the source or brand of materials used in the concrete without the prior approval of the Department. The Department reserves the right to have periodic checks made to ensure against such changes.

Chapter 2, Section 206

Standard Repair of Main and Service Laterals

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	Repair of ABS Truss Pipe, Concrete Pipe, or Clay Pipe	206-1
B.	Repair of PVC Pipe	206-1
C.	Repair of Cast Iron or Ductile Iron or PVC Force Main	206-2
D.	Pipe Repair Fittings	206-2

VI. Standard Repair of Mains and Service Laterals

A. Repair of ABS Truss Pipe, Concrete Pipe, or Clay Pipe

Repairs to existing Sanitary Sewer mains and/or service lines, consisting of ABS Truss Pipe, Concrete Pipe or Clay Pipe shall be as directed by the Department. A section of the pipe to be repaired shall be cut out at a point as close as possible to the damaged area. The existing pipe shall be sawcut at a right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. A Fernco coupling or approved equal Elastomeric flexible coupling shall be installed on each end of the existing pipe and made ready for the replacement pipe. The length of PVC pipe of equal strength as approved by district, ends cut at right angles and to a length as long as possible to permit installation, shall be installed. The Fernco couplings shall then be centered up over the cuts and the couplings tightened by use of stainless steel clamps. The area of excavation for the repair shall then be backfilled for the length of the repair and for a minimum height of 12" over the pipe, using aggregate specified in Chapter 2, Section III, Sanitary Sewer Materials.

B. Repair of PVC Pipe

Repairs to existing Sanitary Sewer mains and/or service lines, consisting of PVC pipe shall be as directed by the Department. A section of the pipe to be repaired shall be cut out at a point, as close as possible to the damaged area. The existing pipe shall be sawcut at a right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. A Harco, or approved equal, gasketed repair coupling shall be installed on each end of the existing pipe and made ready for the replacement pipe. A length of PVC pipe equal to that removed, ends cut at right angles and to a length as long as possible to permit its setting, shall be installed. The repair couplings shall then be centered up over the cuts. The area of excavation for the repair shall then be backfilled for the length of the repair and for a minimum height of 12" over the pipe using aggregate specified in Chapter 2, Section III, Sanitary Sewer Materials.

* Concrete encasement of the repair, may be directed by the Department, in certain circumstances.

** Methods employed to make pipe repairs in sections A and B, may be altered to allow for installation of a Sanitary Tee to connect another main or service line. At that time the Tee is installed in the length of "Repair" pipe.

C. Repair of Cast-Iron or Ductile-Iron or PVC Force Main

Repairs to an existing Cast-Iron or Ductile-Iron or PVC force main shall be as directed by the Department. A section of pipe to be repaired shall be cut out at a point as close as possible to the damaged area. The existing pipe shall be sawcut at a right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. A Ductile-Iron mechanical joint repair coupling or a Dresser coupling shall be installed on each end of the existing pipe and made ready for the replacement of pipe. A piece of Ductile-Iron or PVC replacement pipe, the same strength as the pipe repaired, shall then be cut at right angles and a length of it installed. The use of Ductile-Iron "Spacers" may be needed at one or both of the repair couplings, to keep the replacement pipe from shifting out of the repair couplings. The repair couplings shall then be centered up over the cuts and the couplings tightened up. The use of a split sleeve repair coupling may be an option considered by the Department. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe, using aggregate specified in Chapter 2, Section III, Sanitary Sewer Materials.

D. Pipe Repair Fittings

1. Repair Clamp

Clamps for pipe sizes four (4) inches diameter and larger shall be as manufactured by Dresser, Ford, Romac, or equal.

All 300 Series stainless steel repair clamp shall be minimum twelve (12) inches wide, 20 gauge, with a full length circumferential rubber gasket seal, pressure rated greater than or equal to the pipe. A bolt retainer-tightening clamp (minimum 3-bolt) shall be continuous welded to the shell.

When required for a service connection, a fully welded all stainless steel, gasketed, I.P. threaded outlet shall be factory made integral with the clamp.

Chapter 2, Section 207

Sewer Lateral Construction

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VII. Sewer Lateral Construction

A. Construction Methods

SCOPE OF WORK - The Contractor shall furnish all plant, labor and materials and perform all operations required for the construction of Sewer Service Laterals and Appurtenances including all pipe, tanks, pumps, jointing materials, joints and fittings, laying pipe, installing tanks and pumps, electrical service, conduit, controls, concrete and granular bedding backfill, testing and all incidental work required for a complete and functional installation as shown on the drawings and/or as specified herein.

GENERAL – Included in this section are specifications for the installation of all Service Laterals including conventional gravity, low pressure (grinder pumps), small diameter gravity and septic tank effluent pumps (S.T.E.P.)

Sewer Service Laterals shall be installed as shown in the Standard Details and shall be laid in accordance with the Specifications herein for Sanitary Sewer Pipe.

The Department shall furnish and provide complete units, in accordance with the Department's Sewer Service Policy, for Sewer Service Laterals requiring the installation of grinder pumps/basins, septic tanks, effluent pumps/basins. The Department shall be the "Supplier" with no exceptions.

B. Conventional Gravity Service

The Contractor shall construct the Service Lateral from the main to a feasible point on the property line, Right-of-Way, easement line, or as directed by the Department.

Gravity sewer services shall be constructed as shown on the Standard Details S-3.1, S-3.2, and S3.3; and shall be laid in accordance with Specifications for Gravity Sewer Pipe.

Gravity Sewer Laterals shall connect to the main sewer through a sanitary tee branch and a forty-five degree (45°) bend. Laterals connecting to the main sewer through a manhole shall be in accordance with Specifications for Connections to Manholes herein.

Where gravity service connections are specified to be made to an existing sewer at such locations where there are no tee branches provided in the sewer line, connections shall be in accordance with Specifications for Connections to Existing Sewers herein.

Where laterals of different materials the main line are approved, the connection of the lateral to the main shall be made by using an approved adaptor in conjunction with the tee branch and forty-five degree (45°) bend.

From the end of the forty-five degree (45°) bend all Gravity Sewer Laterals shall be SDR-26 Heavy Wall PVC.

Gravity Sewer Laterals shall be installed at a minimum grade of two percent (2%), except as otherwise approved by the Department.

Gravity Sewer Laterals shall be a minimum of six inches (6") in diameter.

Double lateral shall only be permitted for duplexes and townhouse construction.

When a designated depth at the property line has been determined by the owner or Department, a sloped riser may be installed to raise the service lateral to the determined depth. Risers sloped at forty-five degrees (45°) maximum shall be permitted. Risers shall be of the same material as the pipe to which they are being fitted, unless otherwise directed, and shall enter the sewer through a tee branch, in conjunction with the Standard Detail Drawings herein. All fittings used in the installation of the riser shall be installed in such a manner as to complete the lateral from the riser to the property line at a constant two percent (2%) grade.

Excavation for Service Lateral shall be opened for the entire length before any pipe is laid therein. If rock is encountered within ten feet (10') of any building or structure, it must be removed by means other than blasting.

Sewer Service Laterals shall be installed to the property line, Right-of-Way, easement line at such depths and at such locations as the Department may direct. Excavation shall be made five feet (5') beyond this location to remove any rock which would prohibit the property owner's connection or possible damage to the installation service. This area shall then be backfilled with suitable material.

All Sewer Service Laterals shall be closed at the end with an approved watertight plug or cap, and guarded by a minimum three foot (3') stake placed vertically.

Vertical clean-outs on each sewer service shall be installed at the property line and 10 feet beyond the property line as shown in the Standard Details S-3.1, S-3.2, and S-3.3. Materials shall be the same as the sewer service.

The top of the clean-out shall be installed approximately three (3) feet above the proposed finish grade. When the final grading is performed, the plumber shall then cut the clean-off at finish grade.

C. Low Pressure Grinder Pump Service

The Contractor shall construct the service lateral from the main line to the grinder pump assembly and shall install the grinder pump system complete at the location designated and determined by the property owner and approved by the Department.

Low pressure services shall be laid in accordance with and as specified herein under the section entitled "Sanitary Sewer Installation" and constructed as shown in the Standard Details. Pressure services and appurtenances shall be installed to line and grade and at locations as shown on the drawings.

Low pressure services shall connect to main sewers through a tee branch. Service Laterals connecting to the main sewer through a manhole shall be installed in accordance with the Specification for "Connections to Manholes".

A low pressure service connecting to an existing gravity sewer main shall be installed by using a "Cut-In" connection to the main line as directed by the Department. Should the flow, size and type of pipe prohibit this method the connection shall be made by tapping the sewer main as directed by the Department of Water Quality.

Low pressure services connecting to an existing pressure main shall be installed by using a "Cut-In" connection to the main. The Contractor shall contact the Department of Water Quality seventy-two (72) hour in advance of performing the work. The Department of Water quality will perform the actual cut-in and will supply the tee, pipe, valve, and concrete. The Contractor will be responsible for the remainder of the work such as but not all inclusive: excavation, backfill, stone backfill, restoration, traffic control, obtain all permits, having a septic hauler's vacuum tanker truck on site, and disposal of all sewage collected by the tanker.

Low pressure service lines shall be SDR-21 PVC pipe and shall extend from the main sewer to the property line, Right-of-Way or easement line, at which point a ball valve and a swing check valve with valve box shall be installed and from that location to the grinder pump location as determined by the owner and approved by the Department.

The Department shall install grinder pump units at the location agreed upon by the Department and the Contractor. Grinder pump units shall be furnished by the Department and shall include grinder pump(s) and motor, fiberglass reinforced basin with cover, guide rail assembly, internal check valve, anti-siphon valve, junction box, level controls, internal wiring to the junction box, shut-off valve, external alarm and control panel. The Department will furnish a unit complete and functional for installation.

Prior to installation, the site for the grinder pump basin shall be excavated to neat lines 12" below the bottom of and the outside dimensions of the basin. A bedding of 4" of Maryland S.H.A. B-10 stone shall be installed and consolidated. Contractor shall furnish and install a concrete anti-flotation collar upon the compacted bedding material. The basin shall be set on top of the concrete and fasten as shown in the Standard Details S-5.1 and S-5.2. Pump and basin shall be installed according to the Manufacturer's instructions. Prior to installation each basin shall be inspected and tested for water tightness. Any tank failing that test shall be rejected. After installation, the area around the outside of the pump shall be backfilled with B-10 stone and to the requirements set forth in Specification Section "Sanitary Sewer Materials".

The Contractor shall furnish and install electrical power for the pump as specified by the pump supplier and shall be installed from the property owner's electric power panel board to the pump.

D. Small Diameter Gravity Service

The Contractor shall construct the service lateral from the main to the septic tank assembly complete at the location designated and determined by the property owner and approved by the Department.

Small diameter services shall be laid in accordance with and as specified herein under the section entitled "Laying Pipe and Fittings" and be constructed as shown in the Standard Details. Small diameter gravity services and appurtenances shall be installed to the line and grade and at locations as shown on the drawings.

Small diameter sewer laterals shall connect to the main sewer through a wye or sanitary tee branch and a forty-five degree (45°) bend. Laterals connecting to the main sewer through a manhole shall be in accordance with specifications for connecting to manholes herein.

Where small diameter gravity service connections are specified to be made to an existing sewer at such locations where there are no wye/tee branches provided in the sewer line, connecting shall be in accordance with specifications for connecting to existing sewers herein.

Where laterals of different material than the main line are approved, the connection of the lateral to the main shall be made by using an approved adaptor in connection with the wye/tee branch and forty-five degree (45°) bend.

Small diameter gravity laterals shall be installed at a minimum grade of two percent (2%), except as otherwise approved by the Department.

Small diameter gravity sewer laterals shall be the same size as the small diameter gravity line they are connecting to.

The section under paragraph B "Conventional Gravity Service" shall apply pertaining to the installation of "Risers".

Excavation for small diameter gravity service laterals shall be opened for the entire length before the pipe is laid therein. If rock is encountered within ten feet (10') of any building or structure, it must be removed by means other than blasting.

A vertical clean-out on each service lateral shall be installed at the property line as shown in the Standard Details. Materials shall be the same as the sewer service.

The top of the clean-out shall be installed to meet final finish grade.

The Contractor shall install the septic tank at the location designated and determined by the property owner and approved by the Department. The septic tank unit shall be furnished by the Department and shall include the tank and all internal and external piping. The Department shall furnish the unit complete and functional for installation.

Prior to installation, the site for the septic tank shall be excavated to a depth of twelve inches (12") below the bottom of and the outside dimensions of the tank. A bedding of twelve inch (12") CR-6 stone shall be compacted prior to setting the tank. The tank shall be installed according to the manufacturer's instructions. After setting the tank, the Contractor shall fill the tank with potable water, at his expense, to an elevation of the inlet/outlet holes in the tank. Prior to installation each basin shall be inspected and tested for water tightness. Any tank failing that test shall be rejected. After installation, the area around the outside of the tank shall be backfilled with B-10 stone and to the requirements set forth in specification section "Excavation and Backfill".

E. Materials

1. Gravity service connections shall consist of sections of SDR 26 HW PVC, or in special cases, other materials of the diameters and with jointing materials, shown on the Drawings or specified under the section entitled "Sanitary Sewer Materials".
2. Low pressure service connections shall consist of sections of SDR 21 PVC, or in special cases, other materials of the diameters and with jointing materials, shown on the Drawings or specified under the section entitled "Sanitary Sewer Materials".

Generally, where main line and service lines are constructed under the same contract, they shall be of the same material and by the same manufacturer. Exceptions to this shall be as approved by the Department.

F. Laying Pipe and Fittings

Service Connections

Following the trench excavation and preparation of the crushed stone bedding by the Contractor, as specified, in the section entitled "Excavation and Backfill", pipe laying shall proceed upgrade with pipe laid carefully, bells upgrade, spigot ends fully entered into adjacent bells, and true to lines and grades shown on the Drawings. Each length or section of pipe shall be carefully inspected before installation and those containing cracks or other defects shall be removed from the site or destroyed. Extreme care must be exercised to prevent breakage when pipe is handled, bells and spigots shall be carefully cleaned before pipes are lowered into trenches. The pipes shall be lowered so as to avoid unnecessary handling in the trench. In laying pipe, special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder or unevenness of any kind along the inside of the pipe. Before joints are made, each section of pipe shall rest upon the pipe bedding for the full length of its barrel, with recesses prepared where required to accommodate bells and joints. No pipe shall be brought into position until the proceeding length has been thoroughly backfilled and secured in place. Pipe joints shall be made in strict accordance with the pipe manufacturer's specifications. The interior of all pipes shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open ends of all pipe and fittings shall be provided with a stopper carefully fitted so as to keep dirt and other substances from entering. The stoppers shall be kept in the end of pipe at all times when laying is not in actual process.

Under no conditions shall pipe be laid in water or on subgrade into which frost has penetrated, nor at any time when the Department representative shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation, unless all required precautions as to minimum length of open trench and promptness of refilling are observed. In all cases water shall be kept out of the trench until concrete cradles or support, where used, and materials in the joints have hardened.

Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two feet (2') over the top of the pipes.

Any pipe that has its grade or joint disturbed after laying shall be taken up and re-laid. Any section of pipe already laid and found to be defective shall be taken up and replaced with new pipe, without expense to the Department.

No pipe shall be laid within ten feet (10') of the machine excavating the trench nor within twenty-five feet (25') of any place where blasting is being performed. In all cases the mouth of the pipe shall be provided with a stopper, carefully fitted to the pipe to prevent any substance from entering. In rock excavation, the mouth of the pipe shall be carefully protected from all blasts, and the excavation shall be fully completed at least ten feet (10') in advance of the laying of the pipe.

If, at any time before the completion of the contract or warranty period any broken pipes or any defects are found in the sewers or any of their appurtenances, the Contractor shall cause the same to be removed and replaced by proper material and workmanship, without compensation.

Joints

Before joints are made, the pipe layer shall thoroughly clean and inspect all bell and spigot ends for defects.

Gasket Joints

Where gasket joints are used, the gasket shall be removed, if possible, from the retainer, thoroughly cleaned and checked for defects, and then reassembled. The gasket shall be fully seated in retainer and facing in the correct direction. The type of lubricant shall be used as specified by the manufacturer.

G. Concrete

Concrete Foundation

Where required by the Department, pipes shall be placed on a formed concrete cradle, or unformed concrete shall be placed around pipes for bedding and encasement. Concrete cradles shall consist of a concrete mix classified as 2500 PSI concrete.

Concrete, built in trenches requiring forms to support pipes, shall conform dimensions shown on the Standard Details SW-1.1 and SW-1.2 or the Drawings or furnished by the Department. Concrete bedding and encasement shall be classified as 2500 PSI concrete.

Concrete, built in trenches without forms as pipe bedding, or encased around pipes shall conform to the dimensions as shown on the Standard Details SW-1.1

and SW-1.2, or as indicated on the Drawings and in the locations as directed by the Department.

In placing concrete cradles and encasements the methods used shall be as such as to prevent mud, earth, clay or other foreign materials from becoming mixed with the concrete.

In no case shall "Dry-Mix" concrete be placed in the trench without permission of the Department.

In cases where the 12 inch (12") clearance cannot be obtained between sewer and water lines, the sewer shall be encased in 2500 PSI concrete 10-feet (10') each side of water main.

Cradles and Encasements

Where required by the inspector, pipes shall be placed on a formed concrete cradle, or unformed concrete shall be placed around pipes for bedding and encasement. Concrete for cradles shall have a minimum strength of 2500 PSI at 28 days (Class B)

Concrete shall be built in trenches to support pipes and to the dimensions shown on the Standard Details SW-1.1 and SW-1.2 or the Drawings. Concrete for bedding and encasement shall have a minimum strength of 2500 PSI at 28 days (Class B)

In placing concrete cradles and encasements, the methods used shall be such as to prevent mud, earth, clay or other foreign materials from becoming mixed with the concrete.

H. Testing

All installed sewers shall be tested in the presence of the inspector together with a representative of the Contractor in the manner prescribed in the "testing" section of these standard specifications. It is the intent that the described testing procedures are to be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish the testing will be considered as non-completion of construction.

If, at any time before the completion of the contract or warranty period any broken pipes or any defects are found in the sewers or in any of their appurtenances; the Contractor shall cause the same to be removed and replaced by proper material and workmanship, without compensation.

Chapter 2, Section 208

Water Line Materials

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VIII. Water Line Material

A. General

This section of specifications sets up the requirements governing the quality of the various materials specified for use in the construction details.

All pipe, fittings and other related materials used in construction of water systems, shall have the approval of and be in compliance with the specifications and standards of the Department, as set forth herein.

Each year the Department shall establish a list of approved materials and products for use in construction projects for the upcoming year. The approved list of materials will be made available July 1st of each year. It shall be the responsibility of the supplier and /or manufacturer to provide the necessary information etc., of the products or materials for acceptance and use.

The format for the procedure shall be as follows: four (4) sets of manufacturer's certification along with shop drawings and/or samples of materials shall be transmitted to the Department for study and approval. If the products are found acceptable for use in projects, the Department will create a list containing the products trade name and its use. A copy of that list shall be made available by the Department upon request to all prospective contractors and suppliers and shall be used as "the list of materials approved by the Department"

Prior to construction of a water line project, the contractor shall submit to the Department the materials or products from "the Department's approved materials list" for use on the project. This submittal shall certify that only these materials will be used for the referenced project. Should the contractor request to use an alternate product not previously approved by the Department, the contractor must submit for approval as described herein. The mixing of materials of different types shall not be permitted. Should the contractor request use of a material not previously approved for a given project for any reason whatsoever, the contractor must prove compatibility with other approved materials and comply with whatever tests, certification etc., required by the Department . All testing of materials shall take place under the direction of the Department, at a testing laboratory, or such other place as may be designated by the Department. Tests will be made in accordance with the latest specification for testing of the A.S.T.M., A.W.W.A. or other standard specification.

If during the year (July 1st through June 30th) certain materials on the "list of materials" are not found satisfactory to the Department, Contractors holding copies of the approved "list of materials" shall be notified of the removal of that material so that they might find an alternate to it for work performed during the remainder of the year.

Materials of construction, particularly those upon which the strength and durability of the structure may depend, shall be subject to inspection and testing to establish conformance with specifications and suitability for uses intended.

Representative samples of materials, intended for incorporation in the work, shall be submitted, when indicated or directed, for examination and/or test. Quantities of such samples shall be as herein indicated.

Whenever reference is made to the requirements of the A.S.T.M. (American Society for Testing Material), A.W.W.A. (American Water Works Association), A.S.A. (American Standards Association) or other standard specifications or codes, the latest modifications or revisions of such specifications shall be applicable for use.

Where a manufacturer's name is used in the specifications, it is used to designate a standard of quality. The use of said manufacturer's name does not eliminate other manufacturer's equipment and materials equally as good and efficient and that can perform the same function listing of materials herein is not to be construed as approved for use. The Department shall alone make the decision of acceptability.

B. Water Line Pipe and Fittings

Water mains shall be ductile iron pipe (DIP) or Poly Vinyl Chloride pipe (PVC). Water service piping shall be polyethylene (p.e. copper tubing size) pipe.

Ductile Iron Pipe (DIP) - 4" and larger
Polyvinyl Chloride (P.V.C.) - 4" and larger
Polyethylene (C.T.S.) - ¾" through 2"

The contractor shall furnish the Department sworn statements that the inspections and all specified tests have been made and the results thereof comply with the requirements of these specifications

The contractor shall furnish without charge, necessary labor and equipment to assist in performing an inspection of pipe and fittings after delivery to job site. All pipe and fittings shall be subject to reasonable tests as to strength and other characteristics and the contractor shall furnish without charge, specimens for test as specified in the section entitled "tests".

1. Ductile Iron Pipe (DIP) and Fittings

All pipe and other related materials used in construction of water lines, shall have the approval of and be in compliance with the specifications and standards of the Department as set forth herein.

DIP pipe stipulated herein shall have an ANSI A-21 class rating for thickness (type 2 based upon 60-42-10 grade ductile iron).

All DIP shall be centrifugally cast in 18 or 20 foot lengths, conforming to ANSI A-21.51 (for AWWA C151-65) for working pressure of 350 p.s.i. with push-on type joint.

Connections for DIP shall be flanged (inside structures) and mechanical joint (outside structures) except as otherwise noted. Mechanical joint connections shall conform to ANSI A-21.11 specifications for rubber gasket joints.

Flanged joints shall conform to ANSI B-16.1 class 125 and have 1/8 inch rubber ring gaskets. Bolts and nuts used to connect the flanged joints shall conform to ASTM A-307 and be grade B, bolt length shall be such that after installation, the projection of the thread is between 1/8 and 3/8 inch.

Push-on joints shall conform to ASA A-21.11-1964 (AWWA C-111-64).

Pipe shall be in accordance with ANSI a-21.10 and shall have joints conforming to ANSI A-21.11 and B-16.1, class 125.

DIP shall have double thick cement mortar lining conforming to ANSI A-21.4 – 1964. Pipe and fittings for direct burial shall have manufacturer's standard outside finish. All machined base plates and flanges shall have one coat of a rust preventative compound.

All ductile iron pipes shall be class 54.

Wall sleeves for DIP shall be mechanical joint, as manufactured by Ford Meter Box Company.

2. DIP Fittings

All fittings shall be standardized mechanical joint pipe fittings conforming with AWWA C110 "American Standard for Cast Iron Pipe Fittings, 2-inch through 48-inch for water and other liquids, with mechanical standard for rubber gasket joints for cast iron pressure pipe and fittings". Bolts and nuts used to connect the flanges in a mechanical joint shall conform to ASTM A 307. Bolt length shall be such that after installation, the projection of thread is 1/8 inch to 3/8 inch.

All pipe fittings shall be double cement-mortar lined, as per ASA A21.4 – 1964 (AWWA C109-64) and outside with coal tar pitch varnish unless otherwise specified. The varnish shall be made from coal tar to which sufficient oil has been added to make a smooth coating tough and tenacious when cold and not brittle with any tendency to scale off. The coating and the varnish shall both be heated to a temperature of 300 degrees Fahrenheit prior to dipping of the casting.

The use of ductile iron fittings meeting the requirements as set forth herein shall be permitted if requested, in writing, and shall require the approval of the Department. .

The Contractor shall submit to the Department, prior to installation of the pipe and fittings, a certificate, certifying that the pipe and/or fittings were manufactured and

tested in accordance with AWWA specifications.

3. Poly Vinyl Chloride (PVC)

All pipe shall be made from PVC compounds as defined and described in ASTM designation D-1784 for rigid poly (vinyl chloride), compounds and chlorinated poly (vinyl chloride) compounds and all PVC pipe and fittings supplied shall have the following markings on each:

- a. Manufacturer's Name and Trademark
- b. Nominal size
- c. Material designation
- d. psm (and type for pipe)
- e. ASTM designation
- f. National Sanitation Foundation (N.S.F.) seal of approval

PVC pipe and fittings shall be manufactured by Certianteed, Johns Manville, National Pipe Company, PW Eagle, or other approved equal. Installation shall be in accordance with the manufacturer's recommendations and as specified herein, whichever is more stringent.

PVC pipe for all water lines shall conform to the requirements of ASTM D-D1784 and AWWA standard C-909 (Ultra-Blue), class 150 pipe utilizing the bell and spigot concept with a single sealing synthetic rubber gasket conforming to ASTM D-1869. For systems that have an operating pressure in excess of 150 psi, C-909, class 200 pipe shall be utilized. Pipe and gasket joints shall have a reference mark around the circumference of the spigot designating the depth of seat into the bell or coupling. Couplings for spigot-end pipe shall be from the same manufacturer. Lubricant for the gasket shall be for potable water systems and shall be supplied by the pipe manufacturer.

No more than ten percent (10%) of the pipe laid shall be less than then (10') laying lengths.

4. PVC Pressure Fittings

Fittings for PVC pipe shall conform to specifications para. B, DIP. fittings, Chapter 2, Section VIII.

C. Gate Valves

Valves 4"-12" shall be resilient wedge type rated for 250 p.s.i.g. cold water working pressure. All ferrous components shall be ductile iron, ASTM A536. Valves 4"-12" shall be

in full compliance with AWWA C515. The words "D.I." or "Ductile Iron" shall be cast on the valve. The wedge shall be ductile iron or bronze encapsulated with EPDM rubber.

The wedge shall be symmetrical and seal equally well with flow in either direction.

The gate valve stem and wedge nut shall be copper alloy in accordance with Section 4.4.5.1 of the AWWA C515 Standard. Stainless Steel stems are not acceptable. The NRS stem must have an integral thrust collar in accordance with Section 4.4.5.3 of AWWA C515 Standard. Two-piece stem collars are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.

Valves shall be certified by NSF to Standard 61.

Bolting materials shall develop the physical strength requirements of ASTM A307 and may have either regular square or hexagonal heads with dimensions conforming to ANSI B18.2.1. Metric size socket head cap screws, therefore, are not allowed.

The operating nut shall be constructed of ductile iron and shall have four flats at stem connection to ensure even input torque to the stem.

All gaskets shall be pressure-energized O-Rings.

Stem shall be sealed by three O-Rings. The top two O-Rings shall be replaceable with valve fully open and while subject to full rated working pressure. O-Rings set in a cartridge shall not be allowed.

Valve shall have thrust washers located with (1) above and (1) below the thrust collar to ensure trouble-free operation of the valve.

All internal and external surfaces of the valve body and bonnet shall have a fusion-bonded-epoxy coating, complying with ANSI/AWWA C550, applied electrostatically prior to assembly.

Valves shall open left, counter-clockwise.

Valves shall be American Flow Control's Series 2500 Ductile Iron Resilient Wedge Gate Valve or approved equal.

D. Roadway Valve Boxes

1. ¾" Through 3" Valve Boxes

¾" through 3" valve boxes shall be cast iron roadway valve boxes. The boxes shall be a two piece screw-type adjustable. The bottoms shall be arched, made of gray cast

iron, and shall have a coal tar epoxy coating. The boxes shall be 34" to 48" long with 4-1/4" shaft, with one adjustment. Mid box extensions may be required for greater depths.

Valve Boxes shall be manufactured by Bingham & Taylor size number 143-R or approved equal.

2. 4" and Larger Valve Boxes

4" and larger valve boxes shall be cast iron roadway valve boxes. The boxes shall be a two piece screw-type adjustable. The bottoms shall be arched, made of gray cast iron, and shall have a coal tar epoxy coating. The boxes shall be 3 to 4 foot long with 5-1/4" shaft, with one adjustment. Mid box extensions may be required for greater depths.

Valve Boxes shall be manufactured by Tyler Union 6850 series, box number 562-S or approved equal.

3. Valve Box Lids

Valve box lids shall fit the appropriate valve boxes. They shall be cast iron and shall have a coal tar epoxy coating. They shall be droplid, which is compatible with the tops of the various valve boxes and shall be marked "water". All valve boxes lids shall be Mueller Company No. H-10360 or approved equal.

E. Air Release Valve

The automatic valve float, coated with soft rubber, ensures sealing at low pressures.

The automatic valve plastic screen basket prevents contact between the float and the casting, enabling smoother operation.

Standard cast iron body - baked polyester coating.

Working pressure range: 0.2-16 bar. (3-250 psi).

Valve shall be an A.R.I. Model S-010 Automatic Air Release Valve or approved equal.

F. Tapping Sleeves and Tapping Valve

Tapping Sleeves

Tapping sleeves shall be ductile iron construction meeting ASTM A536 Grade 65-45-12. Side flange seals shall be of the O-Ring type of either round, oval, or rectangular cross-sectional shape.

Sizes 12" and smaller must be capable of working on Class ABCD pipe.

Sizes 14" and larger must be specified to which class is needed.

All sleeves are to include the end joint accessories and split glands necessary to assemble sleeve to pipe. No special tools are required other than a standard socket wrench.

Sleeve shall be coated with asphaltic varnish in compliance with NSF-61.

Tapping sleeves shall be series 2800 as manufactured by American Flow Control or approved equal.

Resilient Seated Tapping Valves

Tapping valves shall be resilient seat type with bodies and bonnets made of ductile iron for 250 p.s.i.g. working pressure.

The alignment ring dimensions of tapping valve flange conforms to M SS SP 60 to help ensure true alignment of valve with the tapping sleeve. The outlet end of the valve shall have the desired joint connection for the intended pipe.

All tapping valves shall include a minimum 3/8" N PT pipe plug on the bonnet of the valve body to aid in the field testing of the valve.

All wedges shall be fully encapsulated with EPDM rubber.

All wedges shall be provided with guide covers.

All interior and exterior ferrous surfaces shall be protected against corrosion by fusion-bonded epoxy coating. Coating shall be applied prior to assembly to assure coverage of all exposed areas, including bolt holes.

Tapping valve shall be American 4"-48" Series 2500 Ductile Iron 250 p.s.i.g. rating (accepts full-size shell cutter).

Cut-In Sleeves

Cut-in sleeves shall be Mueller type H-840 or equal. Cut-in valves shall meet the requirements specified herein for gate valves and shall be Mueller type 862 or equal. Gaskets shall be as recommended by the manufacturer.

G. Fire Hydrants

Fire hydrants shall meet or exceed AWWA C502, latest revision. Rated working pressure shall be 250 p.s.i.g., test pressure shall be 500 p.s.i.g., and hydrants shall include the following specific design criteria:

The main valve closure shall be of the compression type. Traffic feature to be designed for easy 360° rotation of nozzle section during field installation.

The main valve opening shall not be less than 5-1/4" and be designed so that removal of all working parts can be accomplished without excavating. The bronze seat shall be threaded into mating threads of bronze. The draining system of the hydrant shall be bronze and positively activated by the main operating rod. Hydrant drains shall close completely after no more than three turns of the operating nut. There shall be a minimum of two internal ports and four drain port outlets to the exterior of the hydrant. Drain shutoff to be by direct compression closure.

Nozzle threads shall comply with national standard dimensions.

Hydrants shall open left.

Nozzle height above the ground shall be 18 inches (minimum). The hydrants shall be equipped with a mechanical joint shoe outlet and automatic drain valves. Nozzle caps with attachment chains shall be attached. It shall be a "break away" type hydrant equipped with "quick-fix" bolts. The main hydrant valve, controlling flow into the barrel, shall remain closed if the hydrant bonnet is broken off.

The hydrant shall connect to the main line by a main line tee, (hydrant) valve, 6" DIP, and restrained utilizing mechanical restraints.

The hydrant shall be painted red and paint shall be maintained during the guaranty period.

Hydrant barrels shall be made of centrifugally cast ductile iron. Friction loss not to exceed 3.0 p.s.i.g. at 1000 gpm through 4-1/2" pumper nozzle. Hydrants shall be equal to American Flow Control's American- Darling 5-1/4" B-84-B-5.

H. Service Saddles

Service saddles shall be a single unit. The upper and lower castings are permanently hinged together with a stainless steel pin and a stainless steel bolt. Bolt and nuts shall be 18-8 type 304 stainless steel. Gasket shall be buna-n rubber "0" ring gasket. Service saddles shall be Ford Model FS303 or approved equal.

I. Corporation Stops

Corporation stops of various sizes shall be of the 'square design' conventional plug-type designed and manufactured to meet AWWA standard C800-84.

When used with PVC distribution system piping, corporation stop inlet thread shall be the same as the service saddle thread. Corporation stop outlet shall be pack joint compression type connection for the service piping. Corporation stops for direct tapping of water mains shall be Ford type FB1000 series or approved equal. Corporation stops to be used with service saddles shall be Ford type FB1100 series or approved equal.

J. Service Connection Piping

1. PE C.T.S.

Polyethylene tubing shall have the tolerances and dimensions conforming with copper tube size (C.T.S.) SDR-9, ASTI D-2737 and manufactured from material meeting ASTI D-1248 for PE-3406. The material shall be homogeneous with no cracks, holes, foreign inclusions or defects and uniform in color, opacity, density and other physical properties. Contractors must submit a manufacture's certification of competence and capability to extrude PE tubing complying with all specified characteristics. Backfill material shall be limestone dust. Trace wire shall be looped on all service connection and shall terminate inside the meter vault.

2. Service Fittings

Service fittings shall utilize Ford's Grip Joint Couplings for all C.T.S. PE Tubing connections.

K. PVC Casing Pipe

All service piping crossing under paved surfaces shall be installed in schedule 40 PVC casing pipe with approved end seals as specified herein.

Solvent cement joint pressure pipe shall comply with ASTM D-2241 specifications. Bell-end pipe shall meet the requirements of ASTM D-2672. Solvent cement shall be from the same supplier as the pipe, and shall meet the requirements of ASTM D-2564. PVC couplings for jointing spigot end pipe shall be extruded type having a beveled entrance.

An approved PVC cement shall be used where piping is to be joined. PVC cement shall be manufactured in accordance with the standards of ASTM D-2564 and have a NSF rating.

Solvent cleaner shall be used in conjunction with PVC cement and shall be by same manufacturer as approved PVC cement. PVC solvent shall be rectorseal bill solvent primer and PVC cement shall be rectorseal hurricane homer solvent primer and PVC cement shall be rectorseal Hurricane Homer solvent cement, or compatible approved equals.

For all service connection up to 1" in diameter, the Contractor shall use 4" schedule 40 PVC for casing pipe. For service connection greater than 1", the Department will determine what size schedule 40 casing pipe shall be utilized.

L. Meter Settings

1. Yoked Meter Settings

All meter settings for meters less than 1-1/2" in size shall be made with a pronged meter yoke. The meter setting shall include the following:

- a. Cast iron yoke bracing bar with inlet and outlet pieces and an expansion wheel to hold and lock the meter in place.
- b. Angle key valve on yoke inlet; padlock wings on the valve.
- c. Dual check valve (backflow prevention device) on yoke outlet; side drain on valve.

The yoke assembly shall be as manufactured by Ford Meter Box Company, model numbers as follows, or other equals;

Meter Size	Ford Model Number
5/8"x 3/4"	Y502P
3/4"	Y503P
1	Y504P

Where pressure reducing valves (PRV) are required with the meter a tandem yoke arrangement shall be used in which the PRV is installed in parallel with the meter per requirements of the drawings. The assembly shall consist of additional equipment as might be necessary for a complete installation in the following manner:

- a. Parallel installation of the PRV and meter with PRV preceding the meter i.e. water from the distribution system piping flows first through the PRV.
- b. Yoke bars with expansion wheels for both the meter and the PRV.
- c. Angle key valve on yoke inlet to PRV; padlock wings on the valve.

- d. Dual check valve (backflow prevention device) on the yoke outlet of the meter; side drain on the valve. There shall be no intermediate valving between the PRV and meter. The tandem meter – PRV assembly shall be made with Ford meter box company equipment; model series Y500, or equal. For both the single meter setting and tandem meter – PRV setting, assembly inlet and outlet connections to copper service piping shall be made with appropriate compression fittings.

2. Flanged Meter Settings

The flanged meter shall be used with 1-1/2” meter only. The assembly for setting the meter only shall consist of the following:

- a. Flanged ball valve with padlock wings. Valve on meter inlet.
- b. Dual check valve (backflow prevention device) located on meter outlet.
- c. High bypass pipe incorporating ball valve with padlock wings.
- d. Two (2) pipe bracing eyelets with one (1) cross brace pipe per eyelet spanning the interior diameter of the meter vault.
- e. 21” riser pipes from the service inlet and outlet to the meter vault.
- f. Traverse bracing pipe connecting the meter inlet and outlet riser pipes at the service piping level.

The assembly used for this application shall be the Ford Meter Box Company customsetter, model VBH66-27B, or equal.

Where pressure reducing valves (PRV) are required with the 1-1/2” meter a tandem yoke arrangement shall be used in which the PRV is installed in parallel with the 1-1/2” meter per requirements of the drawings. The assembly shall consist of additional equipment that might be necessary for a complete installation in the following manner:

- a. PRV installed in parallel with the meter; water from the distribution system flowing first through the PRV.
- b. Flanged ball valve on the assembly and meter outlet.
- c. Dual check valve (backflow prevention device) on the assembly and meter outlet.

- d. High meter bypass pipe and ball valve. Ball valve shall have padlock wings. The bypass shall be for the meter only. Under no circumstances shall a bypass of the PRV be installed.
- e. Two pipe bracing eyelets on each of the meter and PRV support bracket assemblies. (4 eyelets total) two eyelet brace pipes shall be provided. Each pipe shall span the interior diameter of the vault and be run through one eyelet of the meter support assembly.
- f. 21" riser pipes from the inlet and outlet service piping to the PRV and meter centerline.
- g. Traverse bracing pipe connection the assembly inlet and outlet riser piping at the service piping level.
- h. The flanged tandem meter-PRV assembly shall be made using Ford Meter Box Company customsetter equipment, or approved equal. No intermediate valving shall be installed between the meter and the PRV. All meter setting equipment shall be by the same manufacturer.

M. Ball Valves

¾" through 2" size may be used in meter settings. The ball shall be fluoro-carbon brass. Directional valves shall not be permitted. The valves shall be by Ford Meter Box Company, B-11 series ball curb valve, or approved equal.

N. Angle Valve / Dual Check Valves

Dual check valves shall be used in conjunction with meter settings and shall have a side drain valve. Angle valves shall be compatible with meter yokes and shall be dual check valve type and will also serve as backflow prevention device. Check valve shall be Ford Meter Box Company model HHCA94-323-DD, ASSE standard number 1024, or approved equal. Angle valve shall be Ford Meter Box Company model BA-94-232W or approved equal.

O. Expansion Connections

Every Ford Yoke setting requires an Expansion Connection. Screwed onto one end of meter, it expands by turning the handwheel to make Compression joints dependably and permanently water tight against the fixed rubber gaskets in Yoke ends. When the connection is retracted, the meter is released and can be removed. Alignment and spacing of service lines is rigidly maintained by the cast iron yoke piece. The Expansion Connections shall be Ford Meter Box Company model EC-23 or approved equal.

P. Pressure Reducing Valves

Use with customer service connections: PRV's when used in a tandem arrangement with a water meter for customer service connections, shall be as described herein.

- a. Bronze body with strainer cup.
- b. Bonnet of fiberglass reinforced engineered plastic.
- c. Single balanced seat for constant outlet pressure.
- d. Cartridge inserts of stainless steel and engineered thermoplastics housing all working parts for quick servicing.
- e. Valve bottom of reinforced engineered plastic designed to rupture if freezing should take place.
- f. Inlet pressure range of 35 to 300 psig.
- g. Outlet pressure range of 21 to 85 psig.
- h. Tapped test hole which will accommodate a pressure gauge to measure PRV outlet pressure. The hole shall be normally sealed with a bronze screw which tightens easily against lead-antimony seat to form a water-tight seal.
- i. Flow capacities per the following table:

PRV Size	MAX FLOW (GPM)
3/4"	25
1"	40
1-1/4"	70
1-1/2"	95
- j. Female inlet and outlet threads.

The pressure reducing valves shall be Honeywell Braukman, model DO6T, or equal.

Q. Water Meters

1. Water Meter Disc

Meters up to and including 2" size shall be the disc type constructed in accordance with AWWA C-700 latest revision "standard for cold water meters-displacement type". Meters shall be of frost-proof construction; be magnetically driven and have hermetically sealed straight, reading registers with visible and accessible calibration gears; be capable of registration adjustment and resetting to zero locally; and be

capable of having general maintenance performed locally. Meters shall be the product of a recognized U.S. manufacturer and shall be Neptune Technology Group's T-10 meter equipped with an "E-CODER)R900i" along with an external antenna, or approved equal. Meters shall be equipped with freeze plates.

All meters shall be constructed in accordance with AWWA C-700 latest revision "standard for cold water meters – displacement type." Specific construction details listed herein refer to section numbers of the standard C-700. Where these details are in conflict then this specification shall prevail. Test specifications refer to AWWA C-705 latest revision.

2. Minimum Performance Level

The meters must be guaranteed to perform to AWWA new meter accuracy standards for a period of one (1) year after date of shipment.

The manufacturer will unconditionally guarantee in writing the meter performance for fifteen (15) years or 1,500,000 gallons in the case of the 5/8" meter; 2,250,000 gallons in the case of the ¾" meter and 3,000,000 gallons in the case of the 1" and 1-1/2" meter.

3. Bottom Cap

Meter shall be equipped with protective coated cast iron bottom caps with plastic liners, or approved plastic bottom caps. All meters shall have frost proof bottoms.

4. Registers

The register shall be a R900i or approved equal.

Neptune Technology Group Inc. warrants that the a fully integrated self-contained solid state absolute encoder register and a radio frequency meter interface unit shall be free from defects in manufacture and design for a period of twenty (20) years for the electronics from the "date of shipment" (such period being the "Warranty Period"). Neptune shall not be responsible for any defects in the E-Coder)R900i (whether due to design, materials, manufacture, or otherwise) which manifest themselves after the expiration of the Warranty Period. Neptune will repair or replace a nonperforming E-Coder)R900i free of charge for the first ten (10) years and at a prorated replacement cost of the current list price during the remaining ten (10) years per the table.

Neptune warrants that any Neptune-supplied batteries installed in the fully integrated self-contained solid state absolute encoder register and a radio frequency meter interface unit (the "Batteries") shall be free from defects in manufacture and design for a period of twenty (20) years from the "date of shipment" (such period being the

“Battery Warranty Period”). Neptune shall not be responsible for any defects in, or failure of, batteries (whether due to design, materials, manufacture, or otherwise) which occur after the expiration of the Battery Warranty Period. Neptune will repair or replace a non-performing E-Coder)R900i Battery free of charge for the first ten (10) years and at a prorated replacement cost of the current list price during the remaining ten (10) years per the table below.

Year of Failure	Battery Replacement Cost*
1 - 10	Full Replacement
11	30%
12	35%
13	40%
14	45%
15	50%
16	55%
17	60%
18	65%
19	70%
20	75%

*Replacement cost percentage will be applied towards published list prices in effect for the year product is accepted by Neptune under warranty conditions. Replacement batteries are warranted for one (1) year after date of shipment or balance of original battery warranty, whichever is greater.

5. Marking

Coincidental serial numbers shall be stamped on both the register box lids and the cases of all meters.

6. Magnetic Drive

The intermediate gear train shall be built into the register. This section of the meter shall be tightly sealed from atmospheric contamination. The actuating power may be transmitted from the lower bronze case by a 2 pied permanent magnet coupling or direct magnetic drive.

7. Measuring Chambers

Meters shall be of the Nutating disc type and the measuring chambers will be furnished on a synthetic polymeric material. The measuring chamber shall not be cast as part of the main case.

The disc and ball shall be molded or machined to precise tolerances and fitted

accurately in chamber so as to operate freely smoothly when exchanged with another unit.

8. Strainers

All meters shall be provided with internal strainers.

R. Heavy Wall PVC Bullet Meter Vaults

Heavy wall PVC bullet meter vaults shall be manufactured to meet the following requirements:

- a. Manufactured of a one piece molded construction.
- b. Manufactured from a three layered polyethylene.
- c. Dimensionally tapered at its top with an expanded body with the maximum inside dimension starting at approximately 6" down from the top of the box.
- d. The nominal wall thickness shall be not less than 0.550 inches.
- e. Each box shall have molded in the wall an insulation layer having a minimum thermal transfer of 4.0 according to ASTM C171 to resist frost jump.
- f. The vertical free standing load should be minimum of 25,000 lbs.
- g. Each box shall have a top flange for frame & cover seating and bottom flange for anti-settling at its base.
- h. The box shall incorporate a top lip shelf to facilitate the use of an additional insulation disc as need may arise.
- i. The interior shall be bright white in color for light reflection to ease meter reading and provide light for maintenance work.
- j. The exterior shall be black in color to retard UV degradation.
- k. Material shall be modified polyethylene with low temperature brittleness exceeding 76 degrees Fahrenheit.
- l. The manufacture shall be able to provide grade box adjustment in heights of 3" to 12" with tapered risers to accommodate scoping installation.
- m. Meter vaults shall have the following dimensions: 20"(opening)X24"(inside diameter)X30"(depth).

n. Meter vaults shall be manufactured by Carson Industries L.L.C. or approved equal.

S. Meter Vault Frames and Covers

1. Frames and Covers for Traffic Area (T.A.) Meter Vaults

All water vaults frames and covers shall not be installed vehicle traffic areas.

Meter vault frames and covers shall be of double lid construction with the recessed top lid being of heavy duty construction. The double lid frame shall have an inner lid providing sufficient dead air space to provide frost protection for the meter setting. The frame shall include a bottom lip just inside the meter box I.D. The purpose of the lip shall minimize the movement in the frame on the meter box.

Meter vault frames and covers shall be a 74H3WRG as manufactured A. Y. McDonald Manufacturing Company or an approved equal.

T. Compound Meters

The compound meter shall be comprised of two basic assemblies, the main case assembly and the measuring chamber assembly. Ends shall be flanged and conform to ANSI 125 pound class. The assembly shall include the flow straightening vane assembly to direct the flow evenly to the rotor, and the measuring chamber shall include the rotor, adjusting valve for calibration, and hermetically sealed direct reading register. The register shall read in gallons. Its capacity shall be 100,000,000 gallons. The meter assembly shall include a removable strainer.

The compound meter shall have an operating pressure of 150 psi, and an accuracy of 100, plus or minus, 1.5% or actual thruput.

The contractor shall submit shop drawings for the compound meter in accordance with the contract drawings.

The Neptune Trident Tru/Flo Compound meter or an approved equal shall be used.

U. Concrete

All classed of concrete shall conform to the Maryland State Highway specifications and the ASTM specifications for portland cement, ASTM V-150, and aggregates, ASTM C-33, and shall be acceptable to the Department

1. Cement

Type II portland cement shall be used in general concrete construction exposed to moderate heat of hydration is required and/or as shown on the standard detail drawings herein or as directed by the Department.

2. Aggregates

Fine aggregate shall consist of natural sand, manufactured sand or a combination thereof.

All other aggregate shall consist of graded crushed limestone material.

3. Concrete Bonding Agent

Where directed by the Department a bonding agent shall be applied to bond new concrete to existing concrete and shall be Weldcrete as manufactured by Larsen Products Company, Perma-Lok as manufactured by Sinclair Paint Company or other approved equal. Surface preparation, application and curing shall be in strict accordance with the manufacturer's recommendations.

V. Mortar

Mortar for laying masonry shall conform to the requirements of ASTM designation C-270 specifications and shall be composed of the following: cement –ASTM C-175, type II, masonry cement (if specified – C-91, type II, aggregates – C-144 and water).

Mortar conforming to the proportioned specifications shall be proportioned by volume and shall be one part cement, two parts fine aggregate and water.

The ingredients must be in proportions that can be controlled and accurately maintained by measurement and not by estimation. All cementitious materials and aggregates shall be mixed for a minimum period of three (3) minutes, with the amount of water required to produce the desired workability, in a drum type batch mixer. Hand mixing of mortar will be permitted on small jobs with approval from the inspector. No greater quantity of mortar shall be prepared than is required for immediate use, and any mortar that has set shall not be retempered or used in anyway, mortar which as been mixed more than (1) hour shall not be used.

Special and approved precautions shall be taken in the moving and use of mortar during freezing weather.

W. Non-Shrink Grout

Grout for anchoring or patching shall consist of a quality controlled hydraulic cement which,

when mixed with specific amounts of water will provide a homogeneous mixture to provide a quick setting, non-shrinking, non-metallic, controlled expansion cement. Non-shrink grout shall be Preco, Thorgrip or Watergrip or Waterplug as manufactured by Thor Systems Products, Blend-Crete as manufactured by Chesco Creative Products, or other approved equal. Installation shall be in strict accordance with the manufacturer's recommendations.

X. Brick

Brick intended for use in structures associated with water line construction shall conform to the requirements of ASTM designation C-32 grade ma and must be preapproved by the Department of Water Quality prior to use.

Brick shall conform to one set of the following dimensions based on their availability in the area of the project in the size specified.

4" X 8-1/2" X 2-1/2" (3" OR 3-1/2")
3-3/4" X 8 X 2-1/2"

Lugged paving brick, cored brick, or brick having recesses or openings extending through the body of the brick shall not be used.

Brick shall be culled after delivery and no culls shall be used except as may be allowed by the Department of Water Quality.

Y. Concrete Grade Rings

Grade rings shall be manufactured of the same class of concrete as manhole riser sections. Grade rings shall conform to and be compatible with dimensions shown on Standard Details, and shall be provided with openings to match the inserts installed in the conical or flat top section of manhole. Grade rings shall be set in full bed of mortar and two (2) rings of 1/2 inch butyl sealant.

High Density Polyethylene (HDPE), ASTM D-1248, grade rings shall be one-piece injection molded, UV resistant, withstand HS-25 loadings without permanent deformation, and seal watertight utilizing butyl rope sealant. Two inch (2") maximum riser rings shall be capable of adjustment to conform to grade slopes, such as manufactured by Ladtech, Inc. or equal. Prior to installation of grade rings, the Contractor shall demonstrate their ability to install grade rings per manufactures requirements. All grade ring installations shall be inspected by a Department representative.

Z. Manhole Section - Precast

All manhole sections shall be constructed of precast reinforced concrete pipe having an inside diameter of 48" unless otherwise shown on the drawings. The pipes shall conform to

the requirements of ASTM designation C-478-61T. The pipe shall have tongue and groove joints which utilize rubber ring, butyl rubber or other approved gaskets as to produce watertight joints. Lifting holes shall be provided with inserts not longer than 4". The bottom rise section shall fit into the concrete base and the top sections shall be an eccentric tapered section, tapering from 48" inside diameter to 24" inside diameter and thickened upper walls at frame and cover or flat top sections as shown on standard details. All top sections shall have either embedded inserts or slots for grouting in anchor bolts to hold the cast iron frame in place. The anchor bolt slots or metal inserts shall be positioned 90 degrees apart. Metal bolt inserts shall be standard, 20-gauge material, anchored at least 3 inches and designed to accommodate the head of a 5/8" inch bolt. If slots are used, they shall be at least 4 inches deep and designed to allow grouting in the anchor hook.

AA. Manhole Bases – Precast

Manhole bases shall be precast reinforced concrete in accordance with standard details and specifications. The dimensions must meet the minimum dimensional requirements shown on the standard detailed drawings for manholes. Deviations from the standard details must have the approval of the Department of Water Quality. **No** deviation will be permitted from the requirement that bases have a flexible water tight seal at the point of pipe entry. Cast in place bases are not permitted.

BB. Manhole Steps

Manhole steps shall conform in design to the requirements of AIA14d and as shown on the standard details. The steps are to be extruded aluminum or ½ inch steel rod encased in corrosion resistant rubber or polypropylene plastic, and shall include a foot slippage feature in the design. Steps shall be true to pattern with surface free from cracks, flows and defects.

CC. Pipe to Manhole Seals

Flexible seals through which pipes are inserted into the wall of a precast base and riser section, shall be elastomeric material conforming to the physical requirements for natural rubber, synthetic rubber, or a blend of both, as specified in ASTM C-361 specifications for reinforced concrete low head pressure pipe. Alternatively, the flexible seals may be manufactured from poly vinyl chloride material or neoprene material conforming to the physical material, Maryland Specifications for Materials, Highways, Bridges, and incidental structures. The contractor shall submit shop drawings of the flexible seals proposed for used to the engineer for approval. The shop drawings shall name the material from which the flexible seal is manufactured, shall indicate the depth of embedment of the flexible seal, and shall give the size of the annular space between the wall of the precast base and the wall of the pipe. The drawings shall show these dimensions for accommodating pipe of various materials.

Flexible seals or water stop seals shall be installed where pipes are inserted into the walls of cast-in-place manhole bases, and the specifications shall depend upon the type pipe material being installed, and shall conform to the details as shown on standards for manhole pipe connections. Deviations from the standard details must have the approval of the Department.

DD. Frames and Covers

Where located in streets or subject to traffic loads, castings shall be capable of safely supporting an "H-S" loading with due allowance for impact included in the design. The American Association of State Highway officials (AASHTO) specification designates "H-S" loadings as designed for a tractor truck and trailer for loaded lengths up to 40 feet or more (H-25).

Castings shall be true to pattern in form and thickness free from cracks, gas holes, flaws and excessive shrinkage, sound, cleaned by means of sand blast and neatly finished. Runners, fins, risers and other cast-in pieces shall be removed. All castings shall be thoroughly coated at the factory with one coat of black asphaltum paint or other impervious preparation approved by the district.

All manhole covers shall have the words "WCDWQ Water" cast in raised letters. Letters shall have a height and width of not less than two and one-half inches (2-1/2" as shown on standard details).

Special water tight manhole frame and covers shall be installed where shown on drawings or directed by the Department. Water tight frame and covers shall conform to the herein before specifications and in accordance with the Department's standard details.

EE. Anchor Bolts for Manhole Frames & Covers

Anchor bolts shall be 5/8 inch diameter with either head or anchor hook 1 inch long, complete with washer and nut. All material to be galvanized. Length of bolt to be determined by number of brick leveling courses or concrete grade rings required to place the cast iron frame at the proper grade.

FF. Bitumastic Protective Coating

When indicated on the plans and specifications or directed by the Department, some materials shall be given a bitumastic protective coating. This coating shall consist of one (1) or more coats of bitumastic Super service Black, as manufactured by Koppers Company, Inc., or Marine Foundation as manufactured by Carboline Company or approved equal. The bitumastic material may be applied by brush or spraying. If sprayed, it must be applied at 70 square feet per gallon per coat. Each coat shall have a dry film thickness of 0.016 inches (16 mil).

GG. Stone Aggregates

All stone aggregate used in water line construction under these specifications shall be a quality limestone material graded to the size designations and other specifications of the Maryland State Highway Administration.

1. Below sub-Grade Aggregate

Below sub-grade aggregate shall be Maryland State Highway CR-6 stone or as directed by the Department.

2. Sub-Grade/Pipe Encasement Aggregate

Sub-grade aggregate and pipe encasement aggregate to one foot above the pipe for water mains shall be CR-6 crusher run. Service piping shall be encased in limestone dust.

3. Select Backfill Aggregate

Select backfill material shall be DCR (dirty crusher run) stone. DCR is defined as granular material having from sixty (60) to seventy-five (75) percent limestone aggregate graded 1.5 inches (minus) with the remainder being soils. It shall have an optimum moisture content. No topsoil or organic material will be permitted; all material shall pass through a 1.5 inch screen.

HH. Marking Tape

Composition of detectable tape shall consist of .50 mil thick, solid core, encased in a reinforced protective plastic jacket that is resistant to alkalis, acids and other destructive elements commonly found in soil. Over all thickness shall be 4.5 mil nominal and a width of 4 inches. Color shall be bright blue with printed black letters on one side stating:

**CAUTION CAUTION
WATER LINE BUIED BELOW**

Tape shall be Allen detectable as manufactured by Allen System. Tape shall be installed in conjunction with all water line mains, including service connections.

II. Trace Wire and Testing Stations

Tracer wire shall be UL Listed, Type THHN, gasoline and oil resistant, and suitable for operations at 600 volts as specified in the National Electric Code. Conductor size shall be a 12 AWG solid copper conductor (or "12 AWG 19-Strand copper conductor"). Conductor

shall be annealed copper, insulated with high-heat and moisture resistant PVC, jacketed with abrasion, moisture, gasoline, and oil resistant nylon or listed equivalent. Tracer wire shall be manufactured on 500' non-returnable plastic spools. Tracer wire shall be Pro-Line Safety Products Company or approved equal.

All tracer wires are to be connected to a combination cast iron & ABS tamper proof tracer wire access box. The cover is to be manufactured of cast iron and ABS components produced in the USA. Cast iron collar & cover is to be manufactured in accordance with ASTM A 48 Class 25. The ABS is to be manufactured in accordance with ASTM D 1788. The cover shall be lettered Electric and shall have a standard AWWA size cast-in pentagonal bolt. Testing station shall be manufactured by C.P. Test Services-Valvco, Inc. or approved equal

JJ. Pipeline Insulators and Casing Seals

Where permits from the Maryland State Highway Administration or Washington County Division of Public Works allow for open cutting the pipeline trench (within a paved right of way) the contractor shall install a steel casing pipe to serve as a conduit for the water carrier pipe. Insulators shall be installed on the carrier pipe and end seals on the casing pipe.

Standard detail drawing SW-9.1, details the use of end seals on the casing, spacing of the insulators and cavity seal (between the inside diameter of the casing and the outside diameter of the water line).

Casing insulators and end seals shall conform in design to model 60 insulators and Multiflex molded end seals as manufactured by Maloney Pipeline Products Company, T.D. Williamson, Inc. or an approved equal.

KK. Mechanical Restraints

When piping is required to be restrained against movement, this shall be achieved through the use of mechanical restraints. The use of concrete thrust blocks is prohibited.

All mechanical restraints shall be manufactures by Ford Meter Box Company, Inc and shall be the Uni-Flange series or approved equal. The Contractor shall determine which Uni-Flange series is applicable for the intended use and shall submit appropriate shop drawing to the Department for approval.

Chapter 2, Section 209

Water Line Construction

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
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B.	General	209-1
C.	Laying Pipe – Bell & Spigot	209-1/209-3
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E.	Joints	209-3
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G.	Air Release Valve, Gate Valve, Valve Box, & 2” Blow-Off Assembly	209-4
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IX. Water Line Construction

A. Scope of Work

The contractor shall furnish and install all plants, labor and materials required for the construction of water lines and appurtenances including jointing materials and joints, laying pipe, fittings, detection tape, concrete encasements, granular foundation, testing and incidental work necessary to complete the work as required.

Piping systems, valves and other appurtenances shall be installed where shown or required and in accordance with manufacturer's recommendations, adequately supported and anchored, free from undue stress and leakage as required.

B. General

The contractor shall furnish and install all piping and fittings. Piping and fittings for water mains shall all either be PVC or ductile iron pipe. Related work in other sections include valves and testing.

Pipe shall comply with applicable ANSI, AWWA, or ASTM Standard Specified hereinafter and all other requirements of the specifications.

The contractor shall furnish the Department with two (2) copies of sworn statements that the inspections and all applicable tests required in the ANSI, AWWA and ASTM Standards have been made and the results thereof comply with the requirements set forth herein.

C. Laying Pipe – Bell & Spigot

Following the trench excavation and preparation of crushed stone bedding, as specified herein under the section entitled "Excavation and Backfill", pipe laying shall proceed.

All pipe and appurtenances shall be carefully lowered into the trench piece by piece by means of a derrick ropes or other suitable tools or equipment, in such a manner as to prevent damage to materials and protective coatings and linings. Under no circumstances shall material be dropped or dumped into the trench.

Pipe shall be laid with ends abutting and true to line and grade and shall be carefully centered, so that when completed the pipe will form a conduit with uniform flow characteristics. Wood blocking of pipe shall not be allowed.

Each length or section of pipe shall be carefully inspected before installation and

those containing cracks or other defects shall be removed from the site or destroyed. Extreme care must be exercised to prevent breakage when pipe is handled, bells and spigots shall be carefully cleaned before pipes are lowered into trenches. The pipes shall be lowered so as to avoid unnecessary handling in the trench. In laying pipe, special care shall be taken to insure that each length shall abut against the next in such a manner that there shall be no shoulder unevenness of any kind along the inside of the pipe. Before joints are made, each section pipe shall rest upon the pipe bed for the full length of its barrel, with recesses prepared where required to accommodate bells and joints. No pipe shall be brought into position until the preceding length has been thoroughly backfilled and secured in place. The interior of all pipes shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. The open ends of all pipe and fittings shall be provided with a stopper carefully fitted so as to prohibit dirt and other substances from entering the end of pipe at all times when laying is not in actual progress.

Under no conditions shall pipe be laid in water or on subgrade into which frost has penetrated, nor at any time when the inspector shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation, unless all required precautions as to minimum length of open trench and promptness of refilling are observed. In all cases water shall be kept out of the trench until concrete cradles or support, where used, and materials in the joints have hardened.

Whenever a pipe requires cutting, the cutting shall be performed in a neat and work man like manner without damage to the pipe or lining and so as to leave a smooth end at right angles to the axis of the pipe. Flame cutting of pipe by means of an oxyacetylene torch shall not be allowed.

Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, the amount of deflection allowed shall not exceed that required for the satisfactory assembly of the joint. Any such necessary deflection shall be made only in accordance with the approval of the Department, and shall not exceed $\frac{1}{2}$ of the manufactures maximum published allowable deflection.

Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two feet (2') over the top of the pipe.

No pipe shall be laid within ten feet (10') of the machine excavating the trench nor within twenty five feet (25') of any place where blasting is being performed. In all cases the mouth of the pipe shall be provided with a stopper, carefully fitted to the pipe to prevent any substance from entering. In rock excavation, the mouth of the pipe shall be carefully protected from all blasts, and the excavation shall, be fully completed at least ten feet (10') in advance of the laying of the pipe.

If, at any time before the completion of the contract or warranty period, any broken pipes or any defects are found in the water lines or in any of their appurtenances; the

contractor shall cause the same to be removed and replaced by proper material and workmanship, without compensation.

Where pipe passes through a structures such as vaults, etc., the piping shall be ductile iron. There shall not be any pipe joint or coupling within a minimum of three feet (3') of the limit of the structure.

All concrete encasements and cradles shall be placed to within one foot (1') of a pipe joint at both ends. The contractor may be required to furnish and install encasements or cradles to greater limits than shown on the contract documents to meet the above which shall be at the contractor's expense.

D. Laying Pipe – Mechanical Joint

The last eight inches (8") outside of the spigot and inside of the bell of a mechanical joint pipe, shall be thoroughly cleaned of foreign matter. The cast iron gland shall then be slipped on the spigot end of the pipe. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland. All of the bolts shall be inserted in the joint and the nuts screwed up tightly with the fingers. All nuts shall be tightened with an automatic cut off torque wrench. The torque for various sizes of bolts shall be as follows:

Size of Bolt (Inches)	Torque Setting (FT./LB.)
5/8	50
3/4	75
1	85

Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of the gland.

E. Joints

Before joints are made, the contractor shall thoroughly clean and inspect all bell and spigot ends for defects.

Where gasket joints are used, the gasket shall be removed, if possible, from the retainer, thoroughly cleaned and checked for defects, and then reassembled. Gasket shall be fully seated the in retainer and facing in the correct direction. Lubricant shall be used and as specified by the manufacturer, for potable water systems.

All joints shall be water tight and any leaks or defects discovered shall be immediately repaired.

F. Fittings

All tees, crosses, bends, etc. shall be mechanical joint ductile iron fittings and shall be installed at the locations indicated on the drawings, or as directed by the Department of Water Quality.

All tees, crosses, and bends shall require mechanical restraints to be installed according to the manufacture's requirement.

G. Air Release Valves, Gate Valves, Valve Boxes, and 2" Blow-Off Assemblies

Gate valves and valve boxes shall be placed along the water mains where shown on the drawings or where designated by the Department of Water Quality and shall require mechanical restraints to be installed according to the manufacture's requirements.

Where valves are placed on the end of a pipe line, a 2-foot minimum length of pipe shall be placed on the back side of the valve.

A valve box and cover shall be placed over all valves shown on the drawings for direct burial. The valve box shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished grade or pavement. Valves shall have a minimum spacing of four (4) feet between centerline of fittings. The box shall not rest directly on the valve, but rather be adequately supported by compacted granular material as shown on std. detail SW-7.1.

H. Fire Hydrant Installation

Fire hydrants shall be installed at locations shown on the drawings or as directed by the Department.

The pipe connecting the hydrant to the distribution system shall be 6" diameter ductile iron. The trench and bedding shall be equal in all respects to 6 inch water distribution piping. Four feet minimum cover shall be provided.

The gate valve shall be located on the 6 inch line connecting the hydrant to the water main as shown on the standard detail drawing and placed within three feet (3') of the hydrant. Where the 6 inch pipe is connected to the water main by a tapping sleeve and valve, the tapping sleeve and valve shall serve as the required gate valve on the 6 inch line connecting the hydrant to the water main. An additional intermediate gate valve shall not be required.

Movement of pipe, gate valve and hydrant shall be restrained by mechanical restraints

installed according to manufacture's requirements and as shown on standard detail W-10.6.

One third cubic yard of SHA #57 gravel shall be placed under and around the hydrant base. This gravel shall provide drainage for hydrant.

I. Pressure Reducing Valve and Vault (Mainline)

When pipes of different pressures are interconnected, a pressure reducing valve and vault shall be installed as per standard details, W-10.11, W-10.12 and W-10.13.

J. Mechanical Restraints

Mechanical restraints shall be provided wherever pipe lines change direction at angles of 11-1/4 degrees or greater, or tees, or plugged ends.

Mechanical restraints shall be installed per the manufacture's requirements.

Where required by field conditions, vertical upward restraint shall be installed as directed by the Department of Water Quality.

K. Cradles and Encasements

Where required by the project representative, pipes shall be placed on a formed concrete cradle, or unformed concrete shall be placed around pipes for bedding and encasement. Concrete for cradles shall have a minimum strength of 2500 P.S.I. at 28 days (Class B).

Concrete shall be built in trenches to support pipes and to the dimensions shown on the standard details or the drawings. Concrete for bedding and encasement shall have a minimum strength of 2500 P.S.I. at 28 days (Class B).

In placing concrete cradles and encasements, the methods used shall be such as to prevent mud, earth, clay or other foreign materials from becoming mixed with the concrete.

In no case shall "dry-mix" concrete be placed in the trench.

L. Connection to Existing Water Main

Connection to an existing main shall be performed in strict accordance with the Counties requirements and under the direction of Department of Water Quality's personnel. The contractor shall furnish all fittings, material, labor, etc. to make connection to the satisfaction of the Department of Water Quality regardless of whether such fittings and materials are shown on the plans. The contractor shall consult the Department of Water Quality's office in this regard prior to start of any work under the contract.

The Contractor and/or his sub-contractor shall be held liable for any damage to existing water lines where such damage is due to negligence and will be required to make the necessary repairs as well as to pay for any damages caused by the lines being out of service.

Connection to an existing line, or main, shall be coordinated with the Department of Water Quality. Where temporary shutting off a section of existing line is required, arrangements must be made with Department of Water Quality at least 72 hours in advance of the desired connection date. The Contractor is prohibited from operating valves on water systems in service without authorization from the governing agency.

M. Testing

All installed water lines shall be tested in the presence of the inspector, together with a representative of the Contractor in the manner prescribed in the "Testing" section of these standard specifications. It is the intent that the described testing procedures are to be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish the testing will be considered as non-completion of construction.

Chapter 2, Section 210

Water Service Connections

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
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B.	General	210-1
C.	Submittals	210-1
D.	Service Saddle	210-1
E.	Tapping Sleeves	210-1/210-2
F.	Materials	210-2
G.	Installing Pipe and Appurtenances	210-2/210-3
H.	Testing	210-3

X. Water Service Connections

A. Scope of Work

The contractor shall furnish all plant, labor and materials and perform all operations required for the construction of water service connection and appurtenances including all pipe casing, service saddles, corporation stops, meters, meter vaults, pressure reducing valves, concrete, granular backfill, testing and incidental work required for a complete and functional installation as shown on the drawings and/or as specified.

B. General

Included in this section are specifications which shall apply to service connections that are installed to both an existing water main as well as a new water main.

In both cases, the water main shall be uncovered and cleaned, a service saddle shall be installed, the main tapped, the service connection installed to the property line in either an open cut trench or by boring/jacking and the use of casing piping. Service connections constructed under paved surface, irregardless of construction method, shall be installed within a casing pipe from edge of paving to edge of paving or as stipulated by the governing agency. Casing for service piping 2" and smaller shall be Sch. 40 PVC as specified in Chapter 2, Section VIII, "Water Line Materials". The casing pipe shall be sealed at each end with approved end seals. A water meter vault meter, yoke, shut off valve, and angle dual check valve shall be installed at the property/easement line. A capped stub of service connection piping shall be installed to extend 2' beyond the meter vault to facilitate the property owner(s) connection.

Water service connections shall be installed as shown in the standard specifications details and shall be laid in accordance with the specifications herein for water line pipe.

C. Submittals

The contractor shall submit when applicable, detailed shop drawings of the connections, piping, meter, box, valves and appurtenances necessary for a complete installation and in accordance with the specifications herein.

D. Service Saddles

Service saddles shall be used with PVC pipe, 4" and larger. The service saddle shall be manufactured with an approved tapped and threaded opening, capable of accepting a corporation stop and service lateral of the size and type designated to be served.

E. Tapping Sleeves

Tapping sleeves shall be used with ductile iron pipe, measuring in size from 4" and

larger and of the class as specified herein. The tapping sleeve shall be manufactured so as to be capable of with standing a working pressure of 200 P.S.I. It shall possess a recessed outlet flange capable of with standing a working pressure of 125 P.S.I. See Chapter 2, Section VIII, Water Line Material, for additional information regarding tapping sleeves.

F. Materials

Service connections shall consist of various types and kinds of materials, as shown on the contract drawings or specified under the section entitled "Water Line Materials". It shall be the Contractor's responsibility to prove material compatibility so as to provide the Department of Water Quality with an integrally sound and operational facility.

Generally, where the main line and service lines are constructed under the same contract, they shall be of materials proven to be compatible and accepted by the Department of Water Quality. Exceptions to this shall be as approved by the Department of Water Quality.

G. Installing Pipe and Appurtenances

Following the trench excavation and preparation of the granular bedding material by the contractor, as specified in the section entitled "Excavation and Backfill" pipe laying shall proceed toward the property or easement line. Each section of pipe shall be carefully inspected before installation and those containing defects or damage shall be removed from the site or destroyed. Care must be exercised to prevent damage to the pipe when it is handled. Any pipe joints that must be made, will be performed in strict accordance with the pipe manufacturer's specifications. The interior or the service pipe shall be kept clean and free of any foreign matter from the time it is received on the job site until it is put into service. The open ends of all pipe and appurtenances shall be provided with a plug or stopper so as to keep dirt and other substances from entering

Under no conditions shall service pipe be laid in mud or water or on subgrade into which frost has penetrated, nor at any time when the inspector shall deem that there is the formation of ice or the penetration of frost at the bottom of the excavation, unless all precautions as to minimum length of open trench and promptness of refilling are observed.

Walking or working on the completed pipeline except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a height of at least two feet (2') over the top of the pipe.

If, any time before the completion of the work or warranty period any broken pipes, or any defects are found in the water lines or any of their appurtenances, the contractor shall cause the same to be removed and replaced by proper material and

workmanship, without compensation.

All joints shall be watertight and any leaks or defects discovered shall immediately be repaired.

H. Testing

All corporation stops shall be installed prior to testing of the water line. All installed water services shall be tested in the presence of the inspector in a manner acceptable to the Department. It is the intent that the testing procedure is to be carried out as an integral part of the pipe-laying procedure. Failure to accomplish the testing will be considered as non-completion of construction.

Chapter 2, Section 211

Water Main Testing

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	Laboratory Tests	211-1
B.	Shop Tests	211-1
C.	Field Tests	211-1/211-2
D.	Hydrostatic and Leakage Test	211-2/211-3
E.	Testing Equipment	211-3
F.	Chlorination Tests	211-3/211-4
G.	Bacteriological Test	211-4

XI. Water Main Testing

A. Laboratory Tests

The Department reserves the right to require the Contractor to perform laboratory testing of materials to be utilized on the project. All testing shall be done in strict compliance with ASTM standards. The testing laboratory shall furnish both the Department and the Contractor with two (2) copies of the report showing the results of such tests and the report shall be considered as sufficient evidence of the acceptance or rejection of quality of the material tested. All expenses associated with the testing are the Contractor's responsibility.

B. Shop Tests

All materials shall be tested at the shop or plant of, and by the producer. Each manufacturer of such materials shall be fully equipped to carry out the tests required. Upon demand of the Department the manufacturer shall perform such additional number of tests as the Department may deem necessary to establish the quality of the material offered for use. The Department shall be furnished with certified records or reports of the results of all tests that have been made as specified. The Department may require additional tests by an independent testing laboratory.

Meters must be tested for accuracy of registrations in accordance with AWWA C-705 recommended procedure for testing cold water meters.

Certification of tests in accordance with AWWA C-705 and the 300 P.S.I.G. static pressure test in accordance with A.3.2 appendix to C700 must be furnished upon shipment of meters.

C. Field Test

All water lines and appurtenances shall be tested in the field in the presence of the inspector, together with a representative of the contractor, in the manner prescribed herein.

It is intended that the herein described testing procedures are to be systematically carried out as an integral part of the pipe-laying procedures. Failure to accomplish the testing may be considered as non-completion of construction.

The contractor shall furnish without charge, all labor and equipment necessary to complete specified testing.

Any section of water line showing leakage in excess of the amounts specified herein shall be repaired or replaced by the contractor at no cost to the Department.

Sufficient backfill shall be placed prior to filling with water and field testing to prevent lifting of the pipe. When local conditions require that the trenches be backfilled immediately after the pipe has been laid, the testing may be carried out after backfilling has been completed, but before placement of permanent surface. Should the contractor elect to backfill the entire trench, or any portion thereof, prior to testing, it shall be his responsibility to locate and repair any leaks which occur during this test.

All testing shall be done after all corporation stops have been installed on the distribution main to be tested. That section of each service connection from the distribution main corporations stop to the curb stop cut off at the customer meter shall be included in the testing program. The curb stop at the meter shall be in the closed position during testing. That section of each service line from and including the meter to and including the customer service line shall not be included in the testing program.

D. Hydrostatic and Leakage Test – Procedure for Testing Water Mains

The test section shall practicable determined by the Department based on field conditions. Each section shall receive the following hydrostatic test: the pipe shall be slowly filled with water and tested to a PSI specified by the Department based on the elevation of the lowest point of the line or section under test. Before applying the specified test pressure, all air shall be expelled from the pipe. The pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Department. The testing pressure shall be 1.5 times the pipe's rated operating pressure.

A leakage test shall be conducted in conjunction with the hydrostatic test. The contractor will furnish the gauge and measuring device for the leakage test. Leakage is defined as the quantity of water to be supplied to the pipe, or any section thereof necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. The duration of the combined tests shall be maintained for a period of not less than four (4) hours. The contractor will furnish and pump, pipe, connections, meter and all other necessary apparatus, as shown on Standard Detail SW-12.8 and shall furnish all necessary labor to conduct the tests at no cost to the Department.

No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{ND P}{7400}$$

In which L equals the allowable leakage, in gallons per hour, N is the number of field joints in the length of the pipe line tested, D is the normal diameter of the pipe in inches, and P is the average test pressure during the leakage test, in pounds per square inch gauge.

**ALLOWABLE LEAKAGE FOR PRESSURE PIPE SYSTEMS
IN U.S. GALLONS PER HOUR**

<u>Nominal Pipe Size, Inches</u>	<u>50</u>	<u>100</u>	<u>150</u>	<u>200</u>	<u>250</u>
	<u>ALLOWABLE LEAKAGE PER 100 FT OR 50 JOINTS</u>				
4"	.19	.27	.33	.38	.43
6"	.29	.41	.50	.57	.64
8"	.38	.54	.66	.76	.85
10"	.48	.68	.83	.96	1.07
12"	.57	.81	.99	1.15	1.28

E. Testing Equipment

A pressure test pump shall be provided. The pump shall be capable of providing a minimum flow of six (6) GPM and pressure of 300 PSI or greater. The pump shall be as the Hydro-Test II, or as Model No. 36452 manufactured by Wheeler-Pilor International of equal. A meter to measure make-up water shall also be installed. The pump, pipe connections, taps into the pipe, all necessary apparatus labor and water, shall be furnished by the contractor.

F. Chlorination Tests

When the mains are completed, each section of main shall be chlorinated and tested.

All labor, tools, materials, and equipment necessary for making these tests and chlorinating these mains shall be furnished by the contractor. The Department's personnel shall perform all chlorination tests. The water required for testing and chlorinating the water lines will be supplied by the owner. The contractor shall notify the Department, in writing, at least three (3) days in advance of the dates and times they plan to test and chlorinate the water line sections.

Disinfection of water mains shall be performed by the contractor, as specified and directed, and shall conform to AWWA C-601. The contractor shall provide all labor, materials, and equipment for and shall perform the sterilizing operations complete under the direction of district personnel.

Procedure: The following methods may be used to apply the chlorine subject to the approval of the engineer: liquid chlorine gas – chlorine mixture/water. A chlorine mixture shall be applied by means of a chlorinating feed device, or, if approved by the County, chlorine gas may be fed directly from a cylinder through proper regulating devices. Any such arrangements must be provided with means for preventing the backflow of water into the chlorine feed system.

The following chlorine compounds may be used: calcium hypochlorite (HTH, perchloron, pittchlor, hoodchlor, which contain approximately 70 percent available chlorine).

During the 24 hour test all valves and hydrants in the section being tested shall be operated in order to disinfect all working parts of the system.

After the chlorine has been in contact with piping and work for 24 hours or longer, samples collected should indicate a residual chlorine contact of 10 ppm or more.

After chlorination, all treated water shall be flushed from the new pipeline until the residual chlorine matches that in the existing water line. The Contractor shall be responsible for proper disposal of all water used in the disinfection process, including that flushed from the pipe. The method disposal shall be approved by the Department. The Contractor shall be responsible for neutralization of chlorinated water to a residual chlorine concentration of no greater than 2.0 mg/l or system residual chlorine level. Such neutralization shall be performed at no additional cost to the Department.

G. Bacteriological Test

The Department shall conduct bacteriological testing of water lines which must meet the Department of the Environment standards for coli forms. The contractor shall be responsible for providing a completed piping system which meets all testing requirements. The Department shall perform the bacteriological testing.

Chapter 2, Section 212

Standard Repair Procedure for Water Mains and Service Lines

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	Repairs of Mains	212-1
B.	Repairs to Service Connection.....	212-1/212-2

XII. Standard Repair Procedure for Water Mains and Service Lines

A. Repairs of Mains

Repairs to existing cast-iron or ductile iron pipe main shall be as shown on standard detail sheet W-10.15. The section of pipe to be repaired shall be cut out at a point as close as possible to the damaged area. The existing pipe ends shall be sawcut at a right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. A ductile iron mechanical joint repair coupling or dresser coupling shall be installed on each end of the existing pipe and made ready for the replacement of pipe. A piece of ductile iron shall then be cut at right angles and a length of it installed. The repair couplings shall then be centered up over the cuts and the couplings tightened up. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe, using granular material.

Repairs to an existing PVC pipe shall be as shown on standard detail sheet W-10.15. A section of the pipe to be repaired shall be cut out at a point, as close as possible to the damaged area. The existing pipe shall be sawcut at right angle to the pipe and shall not have any shoulder or unevenness. The existing pipe shall be sawcut at right angles to the pipe and shall not have any shoulder or unevenness. The existing pipe ends shall be cleaned and squared up. Ductile iron mechanical joint repair coupling or a dresser coupling shall be installed on each end of the existing pipe and made ready for the replacement of pipe. The broken pipe, shall then be cut at right angles and a length of it installed as long as possible to permit installation. The repair couplings shall then be centered up over the cuts and the couplings tightened up. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe, using granular material.

B. Repairs to Service Connections

Repairs to PE C.T.S. service piping shall be by cutting out the damaged section of piping. The ends of the pipe shall be thoroughly cleaned and burrs removed. A quality stainless steel insert stiffener shall be inserted into the pipe ends. Pipe ends shall then be jointed by a pack joint compression type coupling. The compression nut shall be sealed by a beveled buna n gasket locked in place by a stainless steel set screw. The compression nut shall have machined grooves in a split clamping device for gripping tubing and a tap for the set screw. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe with limestone dust.

Repairs to type "K" copper service connections shall be by cutting out the damaged piece of copper piping using a copper pipe cutting tool. Sawing of copper pipe is prohibited. The ends of the pipe shall then be flared with a flaring tool. Pipe ends shall then be joined by a flared copper to copper coupling. Where connecting copper

tubing to a dissimilar metal, the methods and materials of the connection shall be such as to prevent galvanic corrosion. The excavation for the repair shall then be backfilled for the length of the repair and for a height of 12" over the pipe with limestone dust.

Chapter 2, Section 213

Restoration

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
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XIII. Restoration

A. Scope

The Contractor shall furnish all plant, labor, materials and equipment to perform all operations required for removal of temporary surfaces, replacement of permanent surfaces and disposal of any excess or unsuitable material.

B. Bituminous Asphalt Pavements

All asphalt paving placement shall be in accordance with Sections 504 and 505 and all referenced sections of the "*Standard Specifications for Construction and Materials*", Maryland Department of Transportation – State Highway Administration, latest edition.

The materials and configuration of placement shall comply with the Standard Details pertaining to the application, i.e., State Highway, County Road, driveway, parking area, etc.

Cutting of existing pavements shall be by sawing in straight lines parallel with or transverse to the roadway edge. The limit of cuts shall extend to the most distant point of pavement damaged by the work, when beyond the required limits, at no additional cost to the Department.

When the distance from the repair cut is equal to or less than two (2) feet from the edge of the existing pavement, that swath of the existing pavement shall be removed to the full width and depth required, and included in the repair at the expense of the Contractor.

After the removal and disposal of existing pavement materials, the subgrade shall be prepared by repairing cracks and potholes, grading to a uniform plane and compacting to the density as specified in Chapter 2, Section II, "Excavation and Backfill."

Graded Aggregate for Sub-Base shall be placed, rolled, and screeded, subgrade and all cut edges of pavement cleaned, and tack coat applied.

Hot mixed asphalt shall be placed by paving machine upon approval of the subgrade by the County Representative. All paving restoration has to comply with the County's Division of Public Works or SHA, which ever has jurisdiction for the area being restored.

Finish by rolling to an in place density of 92 to 97 percent of Maximum Density prior to cooling to below 185 degrees F.

C. Gravel and Granular Surfaces

After the removal and disposal of existing materials to the limits as detailed, the subgrade shall be prepared by repairing potholes, grading to a uniform plane and compacting to the density as specified in Chapter 2, Section II, "Excavation and Backfill".

Gravel, aggregate, or granular material shall match the material type, gradation, and texture of the existing materials, using commonly available materials, and shall be approved by the Department prior to placement.

Depth shall match existing with a minimum depth of two (2) inches in all areas and no less than eight (8) inches in the trench area.

Final grade shall be uniform and compacted by rolling or tamping with machinery that will produce a minimum of 5000 pounds per square inch bearing capacity.

D. Concrete

Reinforced and non-reinforced concrete pavement materials and placement shall comply with Sections 520, 522, 523, and 902, and all referenced sections of the "*Standard Specifications for Construction and Materials*", Maryland Department of Transportation – State Highway Administration, latest edition.

Concrete sidewalks and curbs shall be formed to be configured as per the Governing Authority's standard details and requirements, to match existing lines and grades. All curb and sidewalk replacement shall be extended to the nearest joint beyond the limits of the repair width.

E. Lawn and Grassy Areas

Whenever the surface of the ground has been disturbed in the course of operation under the Contract, the final graded surface shall be stabilized with temporary and/or permanent topsoil, fertilizer, seeding and mulching as detailed and specified in the approved Erosion and Sediment Control Plan. All materials and practices shall also comply with the "*1994 Maryland Standards and Specifications for Soil Erosion and Sediment Control*", Section G – Vegetative Practices, Article 20.0 and 21.0.

Seeding shall not be performed in cultivated field areas. Rather, restoration of cultivated areas shall take the form of seed crop equal to that planted or to be planted in the next season at the property owner's directions. Topsoil shall be replaced to match the pre-construction depth. In any case, restoration shall be as approved or directed by the Department.

Furnish and spread a minimum of four inches (4") of topsoil over areas to be seeded. Topsoil shall be spread only when prepared to follow up with fertilizing and seeding. Fine grade to finished lines, grades and contours, fertilize, seed, and mulch, all at such times as will meet with the approval of the Department. If adequate topsoil isn't available onsite, the Contractor may add amenities to the soil based upon recommendation from a soils lab.

Delay seeding until after a heavy rain or watering and not sooner than a week after applying fertilizer.

All seed must meet the requirements of the Maryland State Seed Law, and tagged. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable. Seed shall have been tested within the six months immediately preceding the date of sowing.

F. Stabilization of Delayed Seeding Areas

All areas shall be stabilized per Soil Conservation Requirements.

G. Plant Materials

Provide sizes of plants as shown or scheduled, conforming to ANSI Z60.1 "*American Standard for Nursery Stock*" for shape and quality.

Furnish balled and burlapped (B&B) trees or shrubs, except container-grown plants may be furnished if indicated size is below limit established in ANSI Z60.1.

Deciduous shrubs may be furnished in bare root condition if adequately maintained and protected from drying through transplanting period.

Furnish ground cover plants in removable containers or integral peat pots.

Provide topsoil, as defined above in "Lawn and Grassy Areas", to supplement what is available for reuse at the site.

Provide fertilizer, humus and other soil amendments of a type, which are known to improve pH condition of the soil for particular plant material to be planted. Mix peat humus (FS Q-P-166) with topsoil in the ratio of 1:3 for use in planting. For basis of quantity, assume topsoil, which has not been stripped, is 4" in depth.

Fertilize topsoil for planting trees, shrubs and ground cover with 5-10-5 (5% Nitrogen, 10% phosphorus and 5% potash) commercial fertilizer, applied and mixed at a rate of not less than 0.25 lbs. Per cu. Ft. of soil and humus.

H. Planting Trees

Excavate pit to 1-½ times diameter of tree ball and not less than 6" deeper. Compact layer of topsoil in pit to locate collar of plant properly in a slightly dished finish grade. Backfill around ball with topsoil, compacted to eliminate voids and air pockets, watering thoroughly as layers are placed. Build 3" high berm of topsoil beyond edge of excavation. Apply 3" mulch of shredded hardwood, bark chips, peat, or other recognized organic planting mulch.

Prune tree to remove damaged branches, improve natural shape, thin out structure and remove not more than 15% of branches. Do not prune back terminal leader.

Wrap trunk from ground to first branch with tree wrapping tape.

Guy and stake tree three directions with galvanized wire, through flexible hose chafing guards, with wooden stake anchors.

I. Planting Shrubs

Excavate pits or trench to 1-½ times diameter of balls or containers, or 1'-0" wider than spread of roots, and 3" deeper than required for positioning at proper height. Lightly compact a layer of topsoil in the bottom before placing plants. Backfill around plants with topsoil compacted to eliminate voids and air pockets. Water thoroughly as layers are placed. Form grade slightly dished, and bermed at edges of excavation. Apply 2" mulch of peat, straw or other recognized organic planting mulch.

Prune shrubs to remove damaged branches, improve natural shape, thin out structure and remove not more than 15% of branches.

J. Planting Ground Cover

Till soil to a depth of 8" in areas where topsoil has not been stripped.

Loosen subgrade to a depth of 4" in areas where topsoil has been stripped, and spread topsoil to a depth of 4", except as otherwise indicated.

Space plants 2'-0" apart both ways, except as otherwise indicated. Dig holes large enough to allow for spreading of roots. Compact backfill to eliminate voids, and leave grade slightly dished at each plant. Water thoroughly. Apply 2" mulch of shredded hardwood, bark chips, peat, straw or other recognized organic planting mulch over entire planting bed, lifting plant foliage above mulch.

During periods of hot sun and wind at time of planting, provide protective cover for several days.

K. Maintenance of Planted Areas

Maintenance of planted areas shall include irrigation to establish growth in abnormally dry or hot seasons, or on adverse sites; and repairs, replacements, and replanting within a proper season.

All new fill areas with slopes steeper than four to one (4:1) shall be protected from livestock until the permanent seeding stand has become established.

The Contractor shall maintain the planted area until acceptance of the work. Prior to acceptance, of the work, the Department shall inspect all planted areas for failures, and direct the Contractor to make all necessary repairs, replacements, and replanting within the proper season, if possible.

If the seed stand is over 50% damaged, re-establish entire area, following the original fertilizer, seeding, and mulching procedure.

L. Storm Water Drainage

The Contractor shall not change or alter the storm water drainage ways. The Contractor shall restore all surfaces disturbed during construction to the same contour as before construction

M. Special Surfaces and Miscellaneous Items

Vegetable or flower gardens damaged during construction shall be brought to grade with topsoil. All weeds and debris shall be removed, transplanted or damaged plants replaced and the entire area restored as required to remove traces of damage.

Mailboxes, street lighting poles and fixtures, ornamental works, fencing, culverts, drains (both natural and man-made), catch basins, manholes, walks, driveways, walls, etc. shall be restored to the condition equal to, or better than existed prior to the start of the work.

Chapter 3, Section 301

Architectural Building

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I. Architectural Building

A. Scope of Work

The work to be performed under this section shall include all architectural work required in connection with the construction of pump control building as shown on the construction drawings. The work shall be performed in accordance with these standard drawings and as herein specified, and shall include, but not necessarily be limited to, the following:

1. Masonry
2. Steel Decking
3. Roofing and Sheet Metal
4. Structural Steel and Miscellaneous Metal
5. Louvers / Exhaust Fan
6. Stainless Steel Doors and Frames
7. Hardware
8. Carpentry
9. Caulking
10. Painting
11. By-Pass Pumping Connection

The building shall be configured in such a manner that there is three (3) foot clear zone around all pumps and associated piping. In addition to the clear zone around the pumps, there shall be a minimum five (5) foot clear zone in front of the main electrical panels. The pumps clear zone may infringe upon the electrical panels clear zone.

The use of brand-names in this section is intended as a standard for quality of materials and is in no way exclusionary. Equal alternative products may be submitted and the Department shall make the decision of acceptability.

B. Masonry

Scope

The Contractor shall furnish all materials, labor, scaffolding, equipment, and tools necessary to fully complete all masonry work as shown on the drawings and as specified herein. The work shall include, but not necessarily be limited to, the following:

1. Brick
2. Concrete Block
3. Split Face CMU
4. Mortar
5. Pour Type Insulation
6. Bed Reinforcing
7. Precast Concrete Lintels
8. Splash Blocks
9. Perimeter Insulation

Materials

1. Brick:
 - a. Brick shall be of a color selected by the Department, standard 2-1/4" x 3-5/8", and manufactured by the Victor Cushwa and Sons or Glen-Gery Shale Brick Corporation or approved equal.
2. Concrete Block:
 - a. Hollow load-bearing units shall conform to ASTM C 90-70, Grade A.
 - b. Solid concrete block units shall conform to ASTM C 145-71, Grade A.

- c. All block shall come from the same plant, shall be at least 28 days old and at the time of setting shall not exceed 40% moisture content.

3. Split Face CMU

- a. All Split Face Concrete Masonry Units shall conform to ASTM C90-99a.
- b. All aggregates used shall conform to ASTM C33-99a.
- c. All sampling and testing done in accordance with ASTM C140-99b.
- d. All block shall come from the same plant, shall be at least 28 days old and at the time of setting shall not exceed 40% moisture content

4. Mortar:

Mortar for masonry units shall conform to ASTM C 270-68, Type N. The following standards shall be noted:

Portland Cement – ASTM C 150-71, Type I or II.

Masonry Cement – ASTM C 91-71, Type II.

Sand – Clean and conforming to ASTM C 144-70.

Proportion – 1:1:6.

5. Pour Type Insulation:

All concrete block cavities shall be filled with “Zonolite” as manufactured by W. R. Grace or Perlite by Perlite Institute Inc. or equal.

6. Bed Reinforcing:

- a. Joint reinforcement for single wythe wall shall be #120 Lox Truss-Mesh and joint reinforcement for composite walls

shall be #130 Lox Truss-Mess, as manufactured by Hohmann & Barnard, Inc., or approved equal.

- b. Reinforcement shall be fabricated from cold-drawn steel wire conforming to ASTM A82, with smooth cross rods butt welded not more than 16 inches O.C.
- c. Joint reinforcement shall be installed in every other vertical joint.

7. Precast Concrete Lintels:

- a. Unless noted, all openings shall be fitted with precast concrete lintels. Faces which are exposed to view shall be closely matched to the surrounding block in texture and aggregate.
- b. Concrete mix shall be as to achieve 3,000 PSI strength. Steel bars shall be 20,000 PSI deformed billet steel conforming to ASTM A 615-70. Lintel bearing shall be minimum 6 inches.

8. Perimeter Insulation:

Around the foundation wall 1" "Styrofoam" insulation shall be adhered to the concrete block or poured concrete, as manufactured by the Dow Chemical Company or 1" Zonolite Polystyrene foam by W. R. Grace Co. or equal.

Laying Brick

- 1. Brick shall be laid in full beds, with solid vertical joints, 3/8" wide. Three brick courses shall equal one block course. Coursing shall be laid out to meet openings and provide uniform joints.
- 2. All joints shall be tooled slightly concave, using a tool 1/8" wider than the joints.
- 3. In order to improve the bond between mortar and brick, tooling shall not be performed until the mortar is "thumb print hard."
- 4. Brick shall be laid in running bond, that is, there shall be only stretchers.

5. Brick shall be thoroughly drenched, allowed to drain, and shall be damp when laid.
6. All loose lintels and thruwalls flashing shall be installed under this section.

Laying Block

1. Joints:

Horizontal and vertical joints shall be 3/8 in. Joints in exposed walls, either painted or unpainted, shall be tooled slightly concave.

2. Insulation shall be poured into the cell as work progresses.

Storage

Units shall be stacked on platforms well above ground water and kept covered with waterproof sheeting.

Protection

The top of unfinished wall exposed to the weather shall be kept covered with waterproofing sheeting whenever work is not in progress.

Cold Weather Work

No masonry shall be laid when the temperature of the outside air is below 40 degrees F, unless suitable means are provided to heat the masonry materials and protect the work from freezing. Protection shall consist of heating the masonry materials to at least 40 degrees F, and maintaining an air temperature above 40 degrees F on both sides of the masonry, for a period of at least 48 hours.

Cleaning of Masonry

Mortar droppings shall be removed as the work proceeds. Upon completion the masonry shall be washed down with soap and water. If acid is needed, no more than one part hydrochloric to nine parts water shall be used. Before an acid solution is used, the surface shall be soaked thoroughly with water followed immediately with a thorough rinsing of clear water after the solution has been used.

C. Roof Trusses

Scope

The Contractor shall furnish all labor, materials, and equipment necessary to install roof trusses as shown and specified herein. Roof trusses shall be designed by a Maryland registered professional engineer in accordance to all local building codes. The trusses shall be designed to have a 3:1 or 4:1 slope.

Materials

1. Trusses shall be manufactured utilizing kiln dried 2”X4” or 2”X6” lumber.
2. Connector plates shall be made of 20/18/16 gauge ASTM A653 grade 40/60 galvanized steel. Apply plates to each face of truss.
3. Trusses shall be secured to sill plate utilizing one Simpson H3 hurricane anchor to each side of each truss. One shall be installed on the inside of wall plate and one on outside of wall plate, so nails do not interfere.
4. Truss shall extend 1 foot beyond load bearing walls.

Erection

1. Trusses shall be installed according to manufacture’s requirements and local building code requirements.
2. Trusses require extreme care in fabrication, handling, shipping, installation, and bracing. Refer to Building Component Safety Information, published by Truss Plate Institution, and Wood Truss Counsel of America for safety practice prior to performing these functions.

D. Panel Metal Roof

Scope

The Contractor shall furnish all labor, materials, and equipment necessary to install all roofing, roof insulation, surfacing, flashings, gutters, and downspouts as shown on the drawings and as specified herein.

Materials

1. Contractor shall install purlins as specified by on the approved construction drawings. Purlins must be fastened to the roof trusses with a minimum #6 screws at 12" on-center, or two minimum 8d common or pneumatic nails. Purlins must be installed to support the entire width and length of ridge, eave, hip, valley, and gable-end trim.
2. If care is taken, metal roofing application can be aided by pre-drilling panels, allowing screws to go quickly and accurately into desired spacing. Pre-drilling will work provided that pilot holes are placed accurately in proper locations on panels.
3. Panel installation should begin at the gable end of roof opposite the prevailing rain-bearing wind (this will provide added assurance against wind-driven rain being forced under the laps).
4. An overhang of 2 to 3 inches is required to provide a drip edge, while only 1 inch overhang is necessary where gutters are used.
5. Panel roofing shall be 26 gauge steel with baked-on finish over Galvalume ASTM A792, & AZ50.
6. Install panel roofing per manufactures requirements.
7. Panel roofing shall be stored in a well ventilated, dry place where no moisture can contact them. Moisture (from rain, snow, condensation, etc) trapped between layer of material may cause water stains or white rust, which can affect the service life of the material and will detract from its appearance. If outdoor storage cannot be avoided, protect the panels with ventilated canvas or waterproof paper cover. Do not use plastic, which can cause condensation. Keep the material off the ground in an inclined position with an insulator such as wood. Protective film may degrade or become brittle with long term exposure to direct sunlight.
8. Roofing system shall have a 20 year warranty against leak or defects.
9. Flashing and ridge cap shall be manufacture by the same manufacture of the roofing panels. Flashing and ridge cap shall be installed per the manufactures requirements.
10. Flashing and ridge cap shall be considered to be part of the roofing system and shall have a 20 year warranty against leaks or defect.

11. Soffit shall be 12" Traplock 0.019 gauge aluminum soffit as manufactured by Berger or approved equal
12. Gutter and Downspouts – The hanging gutters shall be 5" Ogee Type, .032" thick. The downspouts shall be corrugated rectangular, .024" thick. Gutters and downspout shall be aluminum with a baked enamel finish in a color selected by the Owner. Finish all required hangers, end caps and fasteners.

Installation

1. Owing Corning R30 insulation shall be placed between the trusses.
2. After the insulation has been installed, 5/8 drywall shall be placed on the underside of the trusses. The drywall shall be fasten to the trusses utilizing 1-1/2" drywall screws. All joints shall have drywall tape and compound applied in such a manner to create a smooth surface.

E. Pre Fabricated Buildings

1. Meets IBC 2003 requirements or currently adopted version.
2. Shall be constructed using 5,000 psi steel-reinforced concrete.
3. The building shall be equipped with standard double doors, 6' X 6'-8"; insulated; tamper-proof hinges; deadbolt lock; adjustable mechanical door hold-open arm; door stop and holder; rain guard.
4. Extruded aluminum threshold with integral neoprene seal.
5. Intake and exhaust louvers.
6. Post tension roof and floor, each by a single continuous tendon, creating radial compression in the roof and floor. If floor slab is poured on-site, the slab isn't required to be post tension.
7. Sloped roof panel with prefabricated, architectural ribbed edge.
8. Exclusive turn-down roof with built-in drip edge.
9. Building's exterior shall be approved by the Department of Water Quality.
10. Wiring shall be done on-site.

11. Bullet tested to UL 752, Level 4 (30 caliber rifle fired at 15 feet).
12. Floor load: 250 psf standard.
13. Building shall be manufactured by EASI-SET or approved equal.

F. Miscellaneous Metal

Scope

The Contractor shall furnish all labor, materials and equipment necessary to install all miscellaneous metals as shown on the drawings and as specified herein. The work to be performed shall include, but not necessarily be limited to, the following:

1. Bearing plates, bolts, anchors, loose lintels, checkered plates and connections.

Materials

1. All steel shall conform to the "Specification For Structural Steel," ASTM A 36-70A.
2. All steel shall be free of rust and scale and shall have one shop coat of rust inhibitive primer.

G. Louvers

Scope

The Contractor shall furnish all labor, materials and equipment necessary to install all aluminum louvers as shown on the drawing and as specified herein.

Materials

The Contractor/Developer shall install 2 speed exhaust ventilators and dampers. On high speed, the exhaust fan and damper must provide a minimum of 30 ACH (air exchanges per hour). While operating on low speed, the exhaust fan and damper must provided a minimum of 6 ACH.

The exhaust fan shall have an all aluminum housing, backward inclined all aluminum wheel-mounting flange with keyslots and template, two piece top cap with stainless steel quick release latches, birdscreen, lifting lugs,

permanently lubricated ball bearings motors, static resistant belts, adjustable pitch drives thought 2 hp motor, corrosion resistant fasteners, regreasable bearings in a cast iron pillow block housing rated at 200,000 hours average life, all fans factory adjusted to specified fan RPM, transit tested packaging, and standard motors shipped factory installed.

The gravity backdraft dampers shall be constructed with .02 aluminum blades, .06 aluminum frame, aluminum hinge pins, and nylon bushings.

Square intake grille shall be all steel construction, face bars permanently fixed into heavy steel frame at a 40 degree angle, and shall have a white enamel finish.

Intake grille shall be sized to accommodate the minimum air exchange rate as specified in section 304.

Guarantee

All material furnished and installed shall be unconditionally guaranteed for one full year after installation has been accepted.

H. Stainless Steel Doors and Frames

Scope

The Contractor shall furnish all materials, labor and equipment necessary to install all hollow metal doors and frames as shown on the drawing and specified herein.

Frames

1. Frames shall be 16 gauge type 316 stainless steel .
2. Finish shall be #4 satin.
3. Strike reinforcement tabs shall be 12 gauge.
4. Frame shall have a minimum opening width of 6'-4".
5. Frames shall be manufactured by Stainless Doors, Inc. or approved equal.

Doors

1. Doors shall be 16 gauge type 316 stainless steel, as manufactured by Stainless Doors, Inc. or approved equals.
2. All doors shall be reinforced for hardware.
3. Doors shall have no windows.
4. Finish shall be #4 satin.
5. Vertical hat stiffeners shall be installed 6" on center.
6. Polyurethane insulation shall be installed between the stiffeners.
7. Doors shall have no edge seams.
8. Lock reinforcement box shall be 14 gauge with tabs.
9. Door shall have an inverted 18 gauge top and bottom channel.
10. Door shall have no visible weld marks on doors face skins.
11. Doors shall have a minimum height of 6'-8".

I. Hardware

Scope

The Contractor shall furnish all labor, materials, and equipment necessary to install all hardware as shown, scheduled and specified herein.

Materials

The following hardware shall be furnished and installed:

1. Hinges – Shall be five knuckles constructed from brass with non-rising stainless steel pin (ANSI A5112), 2 ball bearing.
2. Closer – Federal Spec. No. FFH-121C, gov't. series type no. 3009 with parallel arm and hold open. En finish, size IV.
3. Panic Device – Federal Spec. No. FFH-106A, dull chrome no. US 26 D finish, gov't. type no. 820 K.
4. Threshold – Abrasive aluminum, gov't. type 833.

5. Door handle shall be lever type and shall comply with all ADA requirements.

Keying

The lock shall be master keyed to the Department's system.

J. Carpentry

Scope

The Contractor shall furnish all labor, material and equipment necessary to install all carpentry, lumber as shown and specified herein.

Materials

1. Pressure treated lumber shall be used for all required framing, blocking, and nailers.
2. All lumber shall be adequately nailed, anchored or bolted to adjacent surfaces for sufficient strength of the application.
3. Aluminum fascia shall be in a color as selected by the Department.
4. Transite sheet 3'-6" x 8'-8" x 3/8" shall be furnished and adequately fastened to the underside of the deck, above the generator muffler.

K. Caulking

Caulking

The Contractor shall furnish all labor, materials and equipment necessary to complete all interior and exterior caulking required at the door frame, sills, threshold, louvers and other miscellaneous openings.

Materials

All caulking shall be Mono-Lasto-Meric as manufactured by Tremco Manufacturing Company, or by Pecora or approved equal.

Application

1. Joints and spaces to be caulked shall be free from dust, dirt and dampness.

2. Caulking compound shall be applied over 40 degrees F exterior temperature with a pressure gun having nozzles to fit into the joint. Joints shall be filled solidly and smoothly within thin edges, excess compound shall be removed, and adjoining surfaces shall be left clean. Caulking work shall be neat and straight.

L. Painting

Scope

The Contractor shall provide labor, materials, scaffolds, tools, and equipment necessary to perform all painting work required as scheduled, noted and specified herein. The work shall include, but not necessarily be limited to, the following:

1. Interior concrete block walls or concrete poured wall
2. Drywall
3. Piping

Storage of Materials

Paint materials shall be stored in a separate structure furnished by the Contractor. In cold weather, the storage area shall be heated to maintain paint temperature of approximately 70 degrees F. Sufficient portable fire extinguishers shall be furnished and maintained in the storage structure. Paint rags and similar flammable items shall be kept in a closed container when not being used and shall be destroyed when of no further use.

Paint Materials

1. Glidden Protective Coating Systems are specified herein to established type and quality. Equal systems can be by Sherwin Williams or Pittsburgh Paints of approved equal.
2. Materials shall be furnished in unbroken containers, clearly labeled, and shall be used in strict accordance with the manufacturer's recommendations.
3. Colors generally will be stock colors, but certain items may require mixing to match continuous work.

Workmanship

Paint shall be brushed or rolled on in a workmanlike manner by skilled tradesman. Paint may be sprayed only upon specific approval of the inspector. Paint shall not be applied to wet, damp, or other unsuitable surfaces. Painting shall not be performed in cold weather unless the temperature is at least 40 degrees F, and rising. All work shall be to the entire satisfaction and approval of the inspector.

Protection

The Contractor shall protect all work, personnel, and equipment from paint drippings and spray clouds, by use of tarpaulins, drop cloths, masking, or other protective covering. All tarpauline and drop clothes shall be flameproofed by chemical treatment. During the course of work, all paint droppings and overflows shall be cleaned off as they occur.

Preparation of Surfaces to be Painted

1. Cleaning:

All surfaces shall be thoroughly cleaned of all dust, dirt, mill scale, rust, oil, grease, weldburn, and other foreign matter which would affect the quality of the work, along with any loose or baggy paint that may be attached thereto.

2. Touch-Up:

Wherever previously primed or painted surfaces have been destroyed, or defaced, they shall be restored with materials of like kind.

3. Incidental imperfections such as nail holes, gouges, scratches, etc., shall be spackled, sanded, and puttied after the first coat and reprimed as necessary.

4. Interior concrete block walls shall be primed with Ultra Hide PVA Masonry Block Filler #5317 or equal.

5. Aluminum and stainless steel items shall not be painted.

Paint Schedule

	<u>Item</u>	<u>Finish Coat (2) Color</u>	<u>Dry Millage</u>
1.	Concrete Block/ Concrete poured walls	To Be Selected By Department	2.0

2.	Drywall	To Be Selected By Department	2.0
3.	Piping	To Be Selected By Department	2.0

M. By-Pass Pumping Connection

Each pump station shall be equipped with a 6 inch by-pass pumping connection. The by-pass pumping connection shall be installed in the force main after the pumps and prior to exiting the building underground.

The by-pass connection shall consist of install a 6 inch tee in the force main. Connected to the tee will be a 6 inch Dezurik plug valve. The piping will extend through the wall of the building terminating with a 6 inch quick cam lock connector and cap. The cap shall be secured to the wall of the building utilizing a chain.

N. Miscellaneous Items

1. The Contractor shall furnish and install, in each building, one (1) industrial sink and hose bib as shown on the drawings.
2. The Contractor shall furnish and install one (1) electric hoist in each building. The minimum lifting capacity for the hoist shall be one (1) ton. The hoist shall be a trolley hoist. The hoist shall be furnished with a minimum of thirty (30) feet of lifting chain and installed on a monorail. The monorail shall be installed along the centerline of the pumps to just inside the door.
3. Each building shall have 10 pound type ABC dry chemical fire extinguisher installed on the wall next to the entrance door.
4. Each facility shall be equipped with a right-to-know station. The right-to-know station shall consist of 14"Wx20"Hx5"D steel rack that is PVC coated for corrosion resistance and one three-ring MSDS binder 3" diameter with security chain. The rack is wall-mountable and has a 14"Wx20"H screen-printed, polypropylene sign for easy identification of reference material.
5. Each building shall be equipped with a 25 person first aid kit. The first aid kits can be purchased from Hantover, item # 260001 or approved equal.
6. If public water is available to the site, the Developer will be responsible for connecting the pump station to said public water

system. This includes paying water tap fee, installation of water meter, and installation of service line. If the pump station has public water, the station shall include a restroom and slop sink.

7. Each pump station shall be equipped with an emergency eye wash station. If public water is available, then the eye wash station shall be a combo emergency eye wash / shower.

Chapter 3, Section 302

Base mounted Pumping System

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II. Base Mounted Pumping System

A. General

The contractor shall furnish and install one (1) factory built base mounted pumping system. The principal items of equipment shall include two self-priming, horizontal, centrifugal, v-belt motor driven sewage pumps, valves, piping, control panel, liquid level control system, and internal wiring.

Electrical power to be furnished to the site will be 3 phase, 60 hertz, 480 volts, maintained within plus or minus 10 percent. Phase to phase unbalance shall not exceed 1% average voltage as set forth in NEMA Standard MG-1. Control voltage shall not exceed 132 volts.

The pumping equipment shall be manufactured by The Gorman-Rupp Company, Mansfield, OH, or approved equal.

These specifications and accompanying drawings specify and show equipment and materials manufactured by The Gorman-Rupp Company, deemed most suitable for the service anticipated. This is not done, however, to eliminate other products equally as good and efficient. The contractor shall prepare his bid on the basis of the particular equipment and materials specified for the purpose of determining the low bid. The awarding of the contract shall constitute a contractual obligation to furnish the specified equipment and materials.

After execution of the contract, should the contractor desire to substitute equipment other than that specified in the contract, such substitution will be considered for one reason only: the equipment proposed for substitution is superior in construction and efficiency to that specified in the contract, and higher quality has been demonstrated by service in a similar installation.

In the event the contractor obtains Department's approval of equipment other than that for which the system was originally laid out, the contractor shall, at his own expense, make any changes in the structures, buildings or piping necessary to accommodate the equipment. The Contractor shall prepare and submit revised construction plans, to the Department for review and approval, showing the proposed modifications.

B. Submittals

Product Data: Prior to fabrication, submit the following to the Department for approval:

1. Shop drawings providing layout of mechanical equipment and anchor bolt locations.
2. Electrical ladder logic drawings illustrating motor branch and liquid level control circuits to extent necessary to validate function and integration of circuits to form a complete working system.
3. Catalog cut sheets for major items of equipment, materials of construction, major dimensions, motor and v-belt drive data, pump characteristics curves showing design duty point capacity (GPM), head (FT), net positive suction head (NPSHR), and hydraulic brake horsepower.
4. Pump Manufacturer's v-belt drive selection calculation summary sheet showing corrected H.P. Per Belt, total H.P. developed, pitch diameter of sheaves, center distance between driver and driven shafts and combined arc-length correction factor applied to theoretical horsepower transmission per v-belt, and all calculations to demonstrate a minimum Safety Factor of 1.5.
5. Certified dimensional drawings indicating size, location and the spherical solids passing capability of the primary recirculation port.
6. Sample of service agreement and service agreement checklist for the specified equipment.
7. Interconnection wiring diagram showing the field wiring between the Bihlertech Controller and pump manufacturer's control cabinet.
8. Copy of certificate with course I.D. number for pump manufacturer's Maryland approved Startup/Training course that counts toward Maryland continuing education unit requirements.
9. Foundry certificates and results of Brinell hardness testing on similar components for hardened alloy steel and ADI (austempered ductile iron) pump components.

Certified Tests: Prior to shipment of the equipment from the manufacturer's facility, submit the following certified tests to the Department for approval.

1. Certified copies of factory run pump performance tests. Characteristics of pumps may have a tolerance of plus 10% of rated capacity at rated head or plus 8% at rated head capacity. No minus tolerance will be acceptable. The performance tests will substantiate the correct performance of the equipment at the design head, capacity, suction lift, speed and horsepower as herein specified.
2. Certified reprime performance test data in accordance with procedures herein specified.
3. Certified copies of air release valve closure performance test.
4. Tests shall be certified by a registered professional engineer.

Operation and Maintenance Manuals:

1. Operation shall be in accordance with written instructions provided by the pump system manufacturer. Comprehensive instructions supplied at the

- time of shipment shall enable personnel to properly operate and maintain all equipment supplied. Content and instructions shall assume operating personnel are familiar with pumps, motors, piping and valves, but lack experience on exact equipment supplied.
2. Documentation shall be specific to the pumping equipment supplied and collated in functional sections. Each section shall combine to form a complete system manual covering all aspects of equipment supplied by the manufacturer. Support data for any equipment supplied by others, even if mounted or included in overall system design, shall be provided by those supplying the equipment. Instructions shall include the following as a minimum:
 - a. Functional description of each major component, complete with operating instructions.
 - b. Instructions for operating pumps and pump controls in all modes of operation.
 - c. Calibration and adjustment of equipment for initial start-up, replacement of level control components, or as required for routine maintenance.
 - d. Support data for commercially available components not produced by the system manufacturer, but supplied in accordance with the specifications, shall be supported by literature from the prime manufacturer and incorporated as appendices.
 - e. Electrical schematic diagram of the pump control circuits shall be in accordance with NFPA 70. Schematics shall illustrate, to the extent of authorized repair, pump motor branch, control and alarm system circuits including interconnections. Wire numbers and legend symbols shall be shown. Schematic diagrams for individual components, not normally repairable by the system operator, need not be included. Details for such parts shall not be substituted for an overall system schematic. Partial schematics, block diagrams, and simplified schematics shall not be provided in lieu of an overall system diagram.
 - f. Mechanical layout drawing of the pumping equipment and components, prepared in accordance with good commercial practice, shall provide installation dimensions and location of all pumps, motors, valves and piping.
 3. Operation and maintenance instructions, which rely on vendor cut-sheets and literature, which include general configurations, or require operating personnel to selectively read portions of the manual shall not be acceptable. Operation and maintenance instructions must be specific to equipment supplied in accordance with these specifications.
 4. Gorman Rupp is to supply the Bihlertech Controller representative with a wiring schematic of the Gorman Rupp control panel. The Bihlertech representative will be responsible for preparing and submitting interconnection wiring diagram to the Department and Gorman Rupp for approval.

Manufacturer's Field Performance Test Report: The manufacturer's technical representative shall inspect the completed installation, correct or supervise the correction of any defect or malfunction, instruct operating personnel in the proper operation and maintenance of the equipment. A written report covering the equipment startup shall be mailed from the Manufacturer's startup technician directly to the Department. At a minimum, the report shall include:

1. Nameplate information.
2. Recordings of gauge readings, total dynamic head and operating speed for each pump.
3. Recordings of level control settings.
4. Certification that equipment has been properly installed and lubricated and is in accurate alignment.
5. Certification that the v-belt drive system has been properly aligned using a laser alignment instrument and v-belts tensioned using a belt-tensioning instrument.
6. Results of electrical tests including voltage readings and amperage readings of all motors.
7. Certification that the equipment has been operated fully loaded and that it operated satisfactorily.
8. Outline in detail any deficiencies noted, and proposed remedial corrections.
9. Fully test all of the alarms related to the Gorman Rupp control panel and verify the alarms are transmitted to the Bihlertech controller.

C. Quality Assurance

Manufacturer's Qualifications: Upon request from the Department, the pumping equipment manufacturer shall demonstrate the following:

1. Proof of financial stability and ability to produce the pumping equipment within the specified delivery schedules.
2. Evidence of the facilities, equipment, and expertise to demonstrate the manufacturer's commitment to long-term customer service and project support.
3. Evidence of adequate local and factory spare parts inventory to provide timely delivery of spare parts.
4. Evidence that the pump manufacturer is an Underwriters Laboratories (UL) panel builder.
5. Evidence that the pumps and pumping equipment are constructed, assembled and tested in the United States. All pump parts including the casing shall be machined at a common facility located within the United States with demonstrated ability to fit Gorman-Rupp pump casings manufactured for the past 30 years.

6. Evidence that the pump manufacturer can provide operator training that counts toward Maryland experience and continuing education requirements.
7. Consideration will be given only to pump manufacturers meeting the following qualifications:
 - a. Twenty-five years minimum experience successfully producing pumping equipment of the type specified herein.
 - b. A minimum of twenty-five installations of pumping equipment of the type specified herein in successful operation for a minimum of ten years.
8. Pump manufacturer must be ISO 9001:2000 certified, with scope of registration including design control and after sales activities.

Manufacturer's Representative Qualifications: Upon request from the Department, the equipment manufacturer's local representative shall demonstrate the following:

1. Evidence of adequate local spare parts inventory to provide timely delivery of spare parts.
2. Evidence of established locally based factory-trained service personnel.
3. Evidence that representative offers comprehensive equipment service agreements for the equipment specified.
4. List of at least ten local municipalities with installations similar to the specified equipment.
5. Evidence that the representative offers full-day operator training seminars on Centrifugal Pump Maintenance and Troubleshooting.
6. Evidence that the representative offers technical design assistance and hydraulic recommendations for pump station design.
7. Certification from manufacturer that the service technician has been factory-trained and is authorized for such duties by the manufacturer.

Pump Performance:

Design and construct the pumps in accordance with standards of the Hydraulic Institute. The efficiency of the pumps, when operating under conditions of the specified capacities and heads shall be as near peak efficiency as practicable.

Design the pumps designated as self-priming centrifugal to pump raw sewage containing solids up to ten percent and stringy materials with a minimum of clogging. Pumps may be protected by screening equipment, but materials passing through may combine by a felting or balling process.

Source Quality Control:

Obtain pumping equipment, motors, motor starters, pump controls and appurtenances from the pump manufacturer whose responsibility it is to insure that the pumping equipment is properly furnished, coordinated, and tested in accordance with these specifications.

The pump control panel including the level controls shall be constructed at the pump manufacturer's facilities. The pump manufacturer shall be an Underwriters Laboratories (UL) panel builder. The control panel shall meet all UL and Joint Industrial Council (JIC) standards.

Factory System Test:

All components including the pumps, motors, valves, piping and controls will be tested as a complete working system at the pump manufacturer's facility. Tests shall be conducted in accordance with Hydraulic Institute Standards at the specified head, capacity, rated speed and horsepower. Factory operational tests shall simulate actual performance anticipated.

Upon request from the Department, the operational test may be witnessed by the Department and/or representatives of his choice at the manufacturer's facility.

D. Manufacturer's Warranty

All components of the pumping equipment shall be manufactured, assembled and tested as a unit by the pump manufacturer. The pumping equipment must be a standard catalog item with the manufacturer. The pump manufacturer must assume system responsibility, i.e. the pumping equipment must be warranted by the manufacturer as described herein. Individual component warranties are desirable. However, individual warranties honored solely by the manufacturers of each component will not be acceptable.

The pump manufacturer shall warrant all equipment to be of quality construction, free of defects in material and workmanship. A written warranty shall include specific details described below.

1. All equipment, apparatus, and parts furnished shall be warranted for one (1) year, excepting only those items that are normally consumed in service, such as light bulbs, oils, grease, packing, gaskets, O-rings, etc. The pump manufacturer shall be solely responsible for warranty of the pumping equipment components when installation is made and use and maintenance is performed in accordance with the manufacturer's recommendations.
2. The pump shall be warranted for five (5) years.
3. Components failing to perform as specified by the engineer, or as represented by the manufacturer, or as proven defective in service during

the warranty period, shall be replaced, repaired, or satisfactorily modified by the manufacturer without cost of parts labor to the Department.

It is not intended that the pump manufacturer assume liability for consequential damages or contingent liabilities arising from failure of any vendor supplied product or part which fails to properly operate, however caused. Consequential damages resulting from defects in design, or delays in delivery are also beyond the manufacturer's scope of liability.

The warranty shall become effective upon the acceptance by the purchaser or the purchaser's authorized agent, or sixty (60) days after installation, or ninety (90) days after shipment, whichever occurs first.

E. Pumps

Pump Description:

Pumps shall be Gorman-Rupp Model Super T-Series, V-Series or VS-Series (Whichever is deemed more suitable for the application) horizontal, self-priming, centrifugal pumps, specifically designed for pumping raw, unscreened, domestic sanitary sewage.

All openings, internal passages, and internal recirculation ports shall be large enough to permit the passage of the specified spherical solids passing capacity, and any trash or stringy material which may pass through the average house collection system. Screens or any internal devices that create a maintenance nuisance or interfere with priming and performance of the pump shall not be permitted.

The pumps shall have the following characteristics:

- | | | |
|-----|--|-----|
| 1. | Suction connection, flanged, in. | TBD |
| 2. | Discharge connection, flanged, in. | TBD |
| 3. | Minimum shutoff head, each pump, ft. | TBD |
| 4. | Pump speed, rpm | TBD |
| 5. | Maximum NPSH required at design point, ft. | TBD |
| 6. | Minimum reprime lift capacity, ft. | TBD |
| 7. | Spherical solids passing capability, in.
3" | TBD |
| 8. | Motor horsepower | TBD |
| 9. | Motor speed, rpm | TBD |
| 10. | Impeller diameter, in. | TBD |

Pump Performance:

Each pump must have the necessary characteristics and be properly selected to perform under these operating conditions:

		Initial	Future
a.	Capacity, gpm	TBD	TBD
b.	Total dynamic head, ft.	TBD	TBD
c.	Total dynamic suction lift, ft.	TBD	TBD
d.	Maximum static suction lift, ft.	TBD	TBD
e.	Static discharge head, ft.	TBD	TBD

Consideration shall be given to the sanitary sewage service anticipated, in which occasionally debris will lodge between the pump suction check valve and seat, resulting not only in loss of the suction leg, but also in the siphoning of liquid from the pump casing to the approximate center line of the impeller. Such occurrence shall be considered normal with proper installation of air release line to atmosphere.

In consideration of such occurrence and of the unattended operation anticipated, each pump shall be so designed as to retain adequate liquid in the pump casing to insure unattended automatic repriming while operating at its rated speed in a completely open system without suction check valves and with a dry suction leg.

Reprime Performance:

Each pump must be capable of the specified reprime lift while operating at the selected speed and impeller diameter. Reprime lift is defined as the static height of pump suction centerline above liquid that the pump will prime; and delivery within five minutes on liquid remaining in the pump casing after a delivering pump is shut down with the suction check valve removed. Systems requiring ancillary vacuum generating devices shall not be acceptable. Additional standards under which reprime tests shall be run are:

1. Piping shall incorporate a discharge check valve down stream from the pump. Check valve size shall be equal (or greater than) the pump discharge diameter.

2. A ten-foot length of one-inch pipe shall be installed between pump and discharge check valve. This line shall be open to atmosphere at all times to duplicate the air displacement rate of a typical pump system fitted with an air release valve.
3. No restrictions shall be present in pump or suction piping that could serve to restrict the rate of siphon drop of the suction leg. Suction pipe configuration for reprime test shall incorporate a minimum horizontal run of 2 feet and one 90-degree elbow.
4. The pipe size used for the reprime performance test shall be the same size as the pump suction diameter.
5. Impeller shall be set at the clearances recommended by the manufacturer in the pump service manual.
6. Reprime lift repeatability shall be demonstrated by five sequential reprime cycles.
7. Liquid to be used for reprime test shall be water.

Serviceability:

The pump manufacturer shall demonstrate to the Department's satisfaction that due consideration has been given to reducing maintenance costs by incorporating the following features:

1. No special tools shall be required for replacement of any components within the pump.
2. The mechanical seal shall be a one-piece cartridge type to allow for easy replacement. Mechanical seals requiring assembly of individual components shall not be acceptable.
3. The pump must be equipped with a removable cover plate, allowing access for service and repair without removing suction or discharge piping.
4. The pump shall be fitted with a replaceable wear plate. Replacement of the wear plate, impeller, seal, and suction check valve shall be accomplished through the removable cover plate without removing suction or discharge piping.
5. The entire rotating assembly, which includes bearings, shaft, seal, and impeller, shall be removable as a unit without removing the pump volute or piping.
6. Each pump shall incorporate a suction flap valve that can be removed or installed through the removable cover plate opening, without disturbing the suction piping. Sole function of the suction flap valve shall be to eliminate re-priming with each cycle. Pumps requiring suction flap valves to prime or reprime will not be acceptable.
7. Atmospheric isolation: The shaft bearings shall be isolated from the seal cavity with an air gap to provide positive protection of the

- bearings in the event of a seal leak and to provide for external monitoring of the seal integrity.
8. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.
 9. Clearances shall be maintained by a 4 point external shimless coverplate adjustment system with four collar and adjusting screws. Provide 4-point incremental clearance adjustment. Each of the 4 points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration. The 4 point system shall provide equal clearance gaps at all points between the impeller and wear plate. Systems that require realignment of belts, couplings, sheaves, etc., each time a clearance adjustment is performed shall not be acceptable. Coverplate shall be capable of being removed and reinstalled without disturbing the clearance settings. Clearance adjustment systems that utilize less than 4 point system will not be considered.
 10. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above
 11. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

Construction:

1. Pump design: Pumps shall be the original design of the pump manufacturer. Products violating intellectual property regulations shall not be allowed, as they may violate domestic or international law and expose the user or engineer to unintended liabilities. Reverse-engineered products fabricated to imitate the design of original products shall not be allowed as they may contain substantial differences in tolerances and material applications that may contribute to product failure.
2. Pump casing: Made of gray iron no. 30, shall be foot supported, and shall have a horizontal centerline suction and vertical discharge.
 - a. The casing shall have a top mounted 3-1/2 inch priming fill port with a safety lock bar cover. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detent lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
 - b. Casing shall have no openings of smaller diameter than the specified sphere size.

- c. Casing shall be designed to retain sufficient liquid to ensure automatic repriming and unattended operation.
 - d. A minimum 1-1/4 inch diameter drain hole shall be provided for attachment of the pump drain kit and to ensure complete and rapid draining.
 - e. Suction flap valve: Molded neoprene with integral steel and nylon reinforcement. A blow-out center shall protect the pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the cover plate opening without disturbing the suction piping. Sole function of the suction flap valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.
 - f. Pump shall be provided with a separate capped threaded port for use of an optional casing heater.
3. Cover plate: Cover plate shall be cast iron Class 30.
- a. Retained by four (4) hand nuts for complete access to pump interior. Cover plate removal must provide ample clearance for removal of stoppages, and the allow removal or service to the impeller, seal, wear plate or suction flap valve.
 - b. Replaceable wear plate: Secured to the cover plate by four (4) welded studs and nuts. The wear plate shall be hardened steel with a minimum Brinell Hardness of 400. The wear plate shall be of sufficient width to maintain the manufacturer's recommended clearance between the entire edge of each impeller vane and the wear plate. Wear plate attachment hardware shall be located out of the direct flow path of the liquid into the impeller. Two (2) Buna-N o-rings shall seal cover plate to the pump casing.
 - c. O-ring Seals: Two (2) Buna-N o-rings shall seal cover plate to the pump casing. The inner cover plate o-rings shall provide a seal between the suction chamber and the discharge chamber of the pump casing to eliminate the possibility of recirculation at the wear plate.
 - d. In consideration for safety, a pressure relief valve shall be supplied in the cover plate. Relief valve shall open at 75 PSI.
 - e. Pusher bolt capability to assist in removal of coverplate. Threaded pusher boltholes shall be sized to accept same retaining capscrews as used in rotating assembly.
 - f. Easy-grip handle shall be mounted to face of coverplate.
4. Rotating assembly:
- a. Impeller (ADI): Two-vaned, semi-open, non-clog, cast in Austempered Ductile Iron with a minimum Brinell Hardness of 400 with integral pump out vanes on the back shroud.

- Impeller shall thread onto the pump shaft and be secured with a lockscrew.
- b. Shaft: Shaft shall be constructed of Alloy Steel No. 4140 and shall employ an Alloy Steel No. 4130 shaft sleeve.
 - c. Mechanical seal: A mechanical cartridge seal shall seal the pump shaft against leakage. The stationary sealing member and the mated rotating face shall be tungsten titanium carbide. Each of the mated surfaces shall be lapped to a flatness of three light bands (35 millionths of an inch), as measured by an optical flat under monochromatic light. The stationary seal seat shall be double floating so that faces will not lose alignment during periods of shock loads that will cause deflection, vibration, and axial movement of the pump shaft. The seal shall be warranted for five (5) years from date of shipment.
 - d. Lubrication: Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Oil cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.
 - 1) The bearing cavity shall have an oil level sight gauge and fill plug with check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.
 - 2) The seal cavity shall have an oil level sight gauge and fill plug with vent. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the vented fill plug.
 - 3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.
 - e. Atmospheric isolation: The shaft bearings shall be isolated from the seal cavity with an air gap to provide positive protection of the bearings in the event of a seal leak and to provide for external monitoring of the seal integrity.
 - f. Seal plate (ADI): Replaceable seal plate shall be constructed of Austempered Ductile Iron with a minimum Brinell Hardness of 400, and shall be bolted to the bearing housing.
 - g. Shaft bearings: Shall be anti-friction ball or tapered roller bearings, of ample size and proper design to withstand all radial and thrust loads which can reasonably be expected during normal operation. Pump designs in which the same oil lubricates both the shaft bearings and the shaft seal shall not be acceptable.

- h. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.
5. Suction and discharge spools: Each pump shall be equipped with one-piece, cast iron spools, flanged on each end. Each spool shall have one 1 1/4-inch NPT and one 1/4-inch NPT tapped hole with pipe plugs for mounting of gauges or other instrumentation.

F. Pump Accessories

Spare Parts:

There shall be furnished with the following minimum spare parts:

1. Two (2) Spare Parts Kit(s) each including one (1) mechanical cartridge seal, one (1) set of rotating assembly adjustment shims, one (1) cover plate “o”-ring, one (1) rotating assembly “o”-ring
2. One (1) complete rotating assembly (with austempered ductile iron impeller, and seal plate)
3. Four (4) suction flap valve assembly(s)
4. One (1) belt tensioning gauge(s) – spring loaded
5. Two (2) quart(s) of seal lubricant
6. Two (2) air pump repair kits for bubbler level control system
7. Two (2) discharge check valve springs

Gauge Kit With Vibration Isolation Frame:

1. Each pump shall be equipped with a glycerin-filled compound gauge to monitor suction pressures, and a glycerin-filled pressure gauge to monitor discharge pressures. Gauges shall be a minimum of 4-inches in diameter, and shall be graduated in feet water column. Rated accuracy shall be 1 percent of full-scale reading. Compound gauges shall be graduated -34 feet to +34 feet water column minimum. Pressure gauges shall be graduated 0 to 140 feet water column minimum.
2. Gauges shall be mounted on a vibration isolation frame assembly with resilient panel, frame, and adjustable brackets which shall be firmly secured to pumps or piping. Gauge installations shall be complete with all hoses and fittings, and shall include a shutoff valve installed in each

gauge inlet at the point of connection to suction and discharge pipes.

3. Gauge kit shall be supplied with stainless steel fittings.

Pump Drain Kit:

1. Each pump shall be equipped with a pump drain kit shall consist of a 10' length of plastic hose with a quick connect female Kamlock fitting on one end of hose and two sets of fittings for pump drains. Each set of fittings for pump drain includes a pipe nipple, bushing, bronze ball valve and quick connect male Kamlock fitting.
2. Pump drain kit shall be supplied with stainless steel fittings.

Self Cleaning Wear Plate:

The wear plate shall be constructed with a minimum of six (6) semi-circular machined channels and a tapered face designed to provide self-cleaning action and ensure that debris is cleared away from and does not collect between the impeller and the wear plate.

G. Valves and Piping

Check Valves:

4-inch and 6-inch check valves

Each pump shall be equipped with a full flow type check valve, each capable of passing a 3" spherical solid, with flanged ends and be fitted with an external lever and spring. The valve seat shall be constructed of stainless steel and shall be replaceable. The valve body shall be cast iron. The valve shall be equipped with a removable cover plate to permit entry for complete removal and replacement of internal components without removing the valve from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings, sealing bushing shall have double o-rings. O-rings shall be easily replaceable without requiring access to interior of valve body. Valve shall be rated at 175-PSI water working pressure, 350-PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

OR

8-inch or larger check valves

Each pump shall be equipped with a full flow type check valve, capable of passing a 3” spherical solid, with flanged ends and be fitted with an external lever and spring. 316 stainless steel body ring shall be threaded into the valve port. Valve clapper shall be cast iron, rubber face, and shall swing completely clear of waterway when valve is full open. Hinge pin shall be of 18-8 stainless steel construction and shall be utilized with bronze bushings and packing type seal. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve shall be rated at 175-PSI water working pressure, 350-PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3” spherical solid shall not be acceptable.

Plug Valve:

Each pump shall be equipped with a 2-way plug valve to allow for isolation of the pump from the force main.

Plug valves shall be of the non-lubricated, eccentric plug type, as manufactured by Dezurik, or approved equal. Minimum full-open flow area through the cast iron (ASTM A-126, Grade ‘B’) body shall be 100% of full pipe, and shall not drip when closed. Valve shall have nickel seat, neoprene plug facing, stainless steel bolts, and stainless steel bearings. Packing shall be nitrile butadiene (buna vee).

Valve shall be operated with a single lever actuator providing lift, turn, and reseal action. The lever shall have a locking device to hold the plug in the desired position.

All valves shall have 2 coats of Tnemec Series 141 Pota-Pox 80 applied to all surfaces by the factory prior to shipping.

Air Release Valves (High-Impact Composite Polyester):

1. Each pump shall be equipped with an automatic air release valve to vent air to atmosphere during initial priming or unattended repriming cycles. The valve shall automatically close operating solely on discharge pressure to prevent recirculation. A visible indication of valve closure shall be evident.
2. Air release valve piping must discharge directly into wet well. ARV piping shall not discharge to a sump.
3. The air release valve shall be constructed of high-impact composite polyester containing not less than 30% glass-filler. The valve body shall incorporate an internal passageway that allows all debris to pass through the valve chamber between operational cycles. The

- diaphragms shall be Buna-N, Fluorocarbon or EPDM, with a polyester mesh rated for 250 PSI of pressure.
4. The vertical plunger shall be constructed of Acetal and PTFE fluorocarbon filler. The independent, dual diaphragms and single, vertical valve plunger shall incorporate a media fluid that passes through an orifice and separates the actions of each.
 5. The valve shall employ an externally-adjustable restrictor for applications below four feet of static discharge head.
 6. The valve body shall incorporate passageways having minimal constrictions and no directional course changes integral to the body of the valve. The inlet shall be 1 inch NPT female and the discharge outlet shall be 1-1/4 inch NPT female. The valve shall be mounted horizontally, at 90 degrees to the vertical plunger.
 7. The valve shall be capable of operation on applications ranging from four to 400 feet of water column without the need for adjustment or change of springs or other parts.
 8. Air release valves shall be connected to pump station piping using stainless steel pipe fittings.
 9. Each air release valve shall be provided with an isolation ball valve.

Piping:

1. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and Class 53 thickness. Flanges shall be cast iron Class 125 and comply with ANSI B16.1. All piping pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.
2. Boltholes shall be in angular alignment within ½-degree between flanges. Flanges shall be faced and a gasket finish applied that shall have concentric grooves a minimum of 0.01 inch deep by approximately 0.03 inch wide, with a minimum of three grooves on any given surface spaced a maximum of ¼ inch apart.

Supports and thrust blocks:

1. Contractor must insure all pipes connected to the pumping system are supported to prevent piping loads from being transmitted to pumps or system piping.
2. Pump station discharge force main piping shall be anchored with thrust blocks by the contractor where shown on the contract drawings.

Gauge Connection Assembly:

1. The header piping shall be equipped with a gauge connection assembly located between the discharge check valve and force main isolation plug valve allowing the operator to easily attach a discharge gauge on any pump for troubleshooting.

2. The gauge assembly shall consist of a 1/4" stainless steel pipe nipple, 1/4" brass full port ball valve and a quick connect fitting.
3. The gauge connection assembly shall be installed in the discharge header piping such that the static and dynamic pressure in the force main can be read at all times unless the force main isolation plug valve is closed for that particular pump.

H. Fabricated Steel Base

One fabricated steel base shall be provided for the duplex pump and motor assembly. The base shall comprise a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel not less than 1/4" thick, and shall incorporate openings for access to all internal cavities to permit complete grouting of unit base after installation. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

Contractor shall provide and install high-grade commercial neoprene material under the fabricated steel pump bases to isolate the skid assembly from the concrete floor. Neoprene material shall be 1/2-inch thick with the following properties: Tensile Strength: 800 psi, Ultimate Elongation: 350%, and a durometer hardness of 50 (+/-5).

I. Drive Unit

Motors:

1. The pump motors shall be horizontal, totally enclosed fan cooled for motors 10 HP and less and open drip-proof for motors 15HP and higher, induction type, with normal starting torque and low starting current characteristics. The motors shall not be overloaded at the design condition or at any head in the operating range as specified.
2. Motors shall be tested in accordance with provisions of ANSI/IEEE Std. 112.
3. Each motor shall be in current NEMA design B cast iron frame with copper windings.

Drive Transmission:

1. Power shall be transmitted from motors to pumps by means of v-belt drive assemblies. The drive assemblies must be selected to establish proper pump speed to meet the specified operating conditions.

2. Each drive assembly shall have a minimum of two v-belts. In no case will a single belt drive be acceptable. Each v-belt drive assembly shall be selected on the basis that adequate power will be transmitted from driver to pump. Drive systems with a safety factor of less than 1.5 shall not be considered sufficient for the service intended. Computation of safety factors shall be based on performance data published by the drive manufacturer.
3. Kevlar V-belts shall be the corded type.

Belt Guards:

1. Pump drive transmissions shall be enclosed on all sides in a guard constructed of any one or combination of materials consisting of expanded, perforated, or solid sheet metal, except that maximum perforated or expanded openings shall not exceed ½ inch.
2. Guards shall be manufactured to permit complete removal from the pump unit without interference with any unit component, and shall be securely fastened to the unit base.
3. All metal shall be free of burrs and sharp edges. Structural joints shall be continuously welded. Panels may be riveted to frames with not more than five-inch spacing. Tack welds shall not exceed four-inch spacing.
4. The guard shall be finished with one coat of gray W.R. non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

J. Finish

Surface Preparation:

1. Pumps, piping and exposed steel framework shall be prepared utilizing a six-stage surface preparation system including the application of iron phosphate and sealer/rust inhibitor.
2. The method shall provide excellent removal of substrate contaminants and very effectively etch pores in the metal resulting in a superior adhesion of primer and paint.
3. Surface preparation shall be in accordance with United States Government mil spec # MIL-T-704J. Sandblasting shall not be acceptable.

Paint:

1. Pumps, piping and exposed steel framework shall be coated with one coat gray W.R. non-lift primer and one coat white acrylic alkyd W.R. enamel. Paint shall be low VOC, alkyd based, high solids, semi-gloss white enamel for optimum illumination enhancement and incorporate rust inhibitive additives.

2. The finish coat shall be 1.0 to 1.5 MIL dry film thickness (minimum), resistant to oil mist exposure, solvent contact and salt spray.
3. The factory finish shall allow for over-coating and touch up after final installation.
4. All flanged connections including pumps, valves, piping and fittings shall be painted prior to assembly.

K. Pump Control System

General:

1. This specification covers a pump control system for the duplex pumping system including motor circuit breakers, starters, thermal overload relays, door mounted operator controls, and liquid level controls.
2. The liquid level control will include an air bubbler level control, electronic pressure switch, pump sequence control, alarms and pump safety shutdowns.

UL Listing:

1. The pump controls shall be manufactured by the pump manufacturer who shall be a UL panel builder and each assembly shall bear a serialized UL label listed for "Enclosed Industrial Control Panels."
2. The enclosure and all components mounted on the sub-panel or control cover shall conform to UL descriptions and procedures. Listing for open style industrial control panels or an assembly of listed or recognized components shall not be acceptable.

Panel Enclosure:

1. Enclosure shall be constructed in conformance with applicable section of national electrical manufacturers' association (NEMA) standards for Type 1 electrical enclosures. Enclosure shall be fabricated of stainless steel having a minimum thickness of not less than 0.075 inch (14 gauge).
2. Door shall be hinged and sealed with a neoprene gasket and shall be held closed with clamps that are quick and easy to operate. The door shall accommodate the mounting of switches and indicators.
3. Enclosure shall be furnished with a removable back panel, fabricated of steel having a thickness of not less than 0.106 inch (12 gauge), which shall be secured to the enclosure with collar studs. Such panel shall be of adequate size to accommodate all basic components.
4. All control components shall be securely fastened to a removable back panel with screws and lock washers. Switches, indicators and

- instruments shall be mounted through the control panel door. Self-tapping screws shall not be used to mount any components.
5. Each control assembly shall be furnished with main terminals and ground lug for field connection of the electrical supply. The connections shall be designed to accept copper conductors of sufficient size to serve the loads. The main terminals shall be mounted to allow incoming wire bending space in accordance with article 373 of the National Electric Code (NEC). A separate terminal strip shall be provided for 115 volt, single-phase control power and shall be segregated from the main terminals. Ten percent of the control terminals shall be furnished as spares.

Motor Branch Components:

1. All motor branch components shall be of the highest industrial quality. Operating coils of all AC control devices shall be rated for 120 volts, and shall be suitable for use in a voltage range of 108 to 132 volts, 60 hertz.
2. **Circuit Breakers and Operating Mechanisms:**
 - a. A properly sized heavy duty air circuit breaker shall be furnished for each pump motor, and shall have a symmetrical RMS interrupting rating of _____ amperes at ____ volts (to be determined by the power company and/or electrical engineer). All circuit breakers shall be sealed by the manufacturer after calibration to prevent tampering.
 - b. A padlocking operating mechanism shall be installed on each motor circuit breaker. Operator handles for the mechanisms shall be located on the exterior of the control compartment door, with interlocks which permit the door to be opened only when circuit breakers are in the "off" position.
3. **Motor Starters (for Motors 15 HP and less):**
 - a. An open frame, across-the-line, NEMA rated magnetic motor starter shall be furnished for each pump motor. Starters of NEMA size 1 and above shall be designed for addition of at least two auxiliary contacts. Starters rated "0", "00", or fractional sizes shall not be acceptable. Power contacts shall be double-break and made of cadmium oxide silver. All motor starters shall be equipped to provide undervoltage release and overload protection on all three phases.
 - b. Motor starter contacts shall be easily replaceable without removing the motor starter from its mounted position.
4. **Overload Relays:**
 - a. Overload relays shall be of the thermal block-type and shall have visual trip indication with trip-free operation.

Pressing of the overload reset lever shall not actuate the control contact until such time as the overload thermal element is reset. Resetting of the overload reset lever will cause a snap-action control contact to reset, thus re-establishing a control circuit.

- b. Overload reset pushbuttons shall be mounted through the door of the control panel in such a manner as to permit resetting the overload relays without opening the control panel door.

For Motors 20 HP and greater, delete above paragraphs "Motor Starters" and "Overload Relays" and add the following:

- 1. Reduced Voltage Starters:
 - a. A reduced voltage, solid state motor starter shall be furnished for each pump motor. The power section shall consist of six back-to-back SCRs rated 208 to 480 volts, 50/60 hertz. The power section shall be capable of 300% rated current for 30 seconds. The SCRs shall have a minimum repetitive peak inverse voltage rating of 1400 volts at 480 volts. Operating temperature range shall be 0 to 50 degrees C at altitudes up to 2000 meters without derating.
 - b. The starter shall be capable of soft starting the pump and be adjustable from 2 to 30 seconds. Ramp time is load dependent. Fault diagnostics shall be displayed on the starter and shall include stalled motor, start fault, temperature fault and line fault.
 - c. Pump Control option: The starter shall provide smooth acceleration and deceleration using an algorithm, which approximates the torque requirements of a centrifugal pump. The starter's microcomputer shall analyze motor variables and generate control commands, which will minimize surges in the system. Pump stop time shall be adjustable from 0 to 120 seconds.
 - d. Protective features
 - 1) The starter shall be equipped with the following protective features:
 - a) Built in Overload relay, Class 10, 15, 20 or 30 trip, Ambient insensitive, Thermal
 - Memory
 - b) Stall protection-0-10s after start ramp
 - c) Jam protection-0-10s after up-to-speed
 - d) Phase rebalance
 - e) Underload-0-99%, 0-99s
 - f) Undervoltage-0-99%, 0-99s
 - g) Overvoltage-0-99%, 0-99s

- h) Voltage Unbalance-0-25%
- i) Excessive starts per hour
- e. Operator Interface

The starter shall be equipped with a digital display and data entry terminal mounted on the exterior of the starter enclosure door. The operator interface shall be an English language display and include the following data:

 - a) Volts Phase to Phase
 - b) Current each Phase
 - c) Watts
 - d) KWh
 - e) Elapsed Time
 - f) Motor Thermal Usage
 - g) Power Factor
 - h) Fault Display
 - i) Fault Buffer (last five faults in code)
 - j) Set-up Parameters
- 2. Bypass contactors
 - a. Each solid-state reduced voltage motor starter shall be provided with a bypass contactor.
 - b. When the pump motor is up to speed, the bypass contactor shall be "pulled in" for "run" in order to reduce the amount of heat produced by the reduced voltage starter.
 - c. When the pump motor is called to "Stop", the bypass contactor shall "drop out" and allow for the reduced voltage starter to take over in order to provide for smooth deceleration of the pump motor.
- 3. Converter modules
 - a. Each motor branch circuit shall include a control module.
 - b. Control module shall provide three-phase current feedback to the solid-state reduced voltage starter for metering and overload protection during phase rebalance and bypass operation.

Indicators:

- 1. Indicating lights shall be oil tight type and equipped with integral step-down transformers for long lamp life. Lamps shall be incandescent type rated 14 volts or less with a minimum life of 15,000 hours. Lamps shall be replaceable from the front without opening the control panel door and without the use of tools.
- 2. Indicating lights will be furnished for the following functions:
 - a. Pump No. 1 run
 - b. Pump No. 2 run

Switch Controls:

1. A normal duty thermal-magnetic circuit breaker shall protect all control circuits by interrupting control power.
2. Pump mode selector switches shall be connected to permit manual start and manual stop of each pump individually or permit automatic operation under control of the liquid level control system. Manual operation shall override shutdown systems except motor overload and phase failure relays. Selector switches shall be oil-tight design with contacts rated NEMA A-300.
3. Pump sequence selector switch shall permit selection of automatic pump alternation, or selection of either pump to run as lead pump for each cycle. Pump alternator relay shall be electro-mechanical industrial design. Relay contacts shall be rated 10 amperes minimum at 120 volts non-inductive.
4. Override switches shall be connected to bypass the level control system and all shutdown systems supplied with it, to provide manual start and manual stop of each pump individually in the event of level control system malfunction.
5. A selector switch shall provide manual alternation of the air pumps in the bubbler system. The switch shall be connected in such a manner that either pump may be selected to operate continuously.
6. A pushbutton switch shall be provided to silence the 115-volt AC alarm circuits while corrective actions are underway. Depressing the alarm silence pushbutton shall also cause the high water alarm circuit to reset when the liquid level has been lowered.

High Pump Temperature Shutdown:

1. The control panel shall be equipped with circuitry to override the level control system and shut down the pump motor(s) when required to protect the pump from damage caused by excessive temperature.
2. A thermostat shall be mounted on each pump to detect its temperature. If the pump temperature should rise to a level that could cause pump damage, the thermostat shall cause the pump motor to shut down. A visual mechanical indicator shall indicate that the pump motor has been stopped because of a high temperature condition.
3. The pump shall remain locked out until the pump has cooled and the circuit has been manually reset. Automatic reset of such a circuit shall not be acceptable.

Elapsed Time Meters:

Six-digit elapsed time meters (non-reset type) shall be connected to each motor starter to indicate the total running time of each pump in "hours" and "tenths of hours".

Pump Start Delay:

The lag pump will be equipped with a time delay to prevent simultaneous motor starts.

Alarm Contacts:

1. Provide separate alarm contacts for the following alarm conditions:
 - a. High water – normally open
 - b. Phase failure – normally open
 - c. High pump temperature, #1 – normally open
 - d. High pump temperature, #2 – normally open
 - e. Station low temperature – normally closed
 - f. Pump run, #1 – normally open
 - g. Pump run, #2 – normally open
 - h. Dry well flood – normally open
 - i. Pump run, #1 – normally closed
 - j. Pump run, #2 – normally closed

Three Phase Voltage Monitor:

The control panel shall be equipped to monitor the incoming power and shut down the pump when required to protect the motor(s) from damage caused by phase-reversal, phase loss and voltage. The motor(s) shall automatically restart when power conditions return to normal.

Secondary Surge Arrestor:

The control panel shall be equipped with a surge arrestor to minimize damage to the pump motors and control from transient voltage surges. The arrestor shall utilize metal-oxide varistors encapsulated in a non-conductive housing. The arrestor shall have a current rating of 60,000 Amps and a Joule rating of 1,500.

Receptacle:

A duplex ground fault interrupter utility receptacle providing 115 VAC, 60 hertz, single-phase current shall be provided. Receptacle circuit shall be protected by a 15-ampere thermal-magnetic circuit breaker.

Auxiliary Power Transformer:

The control panel shall be equipped with a 3 KVA step-down transformer to supply 115 volt, AC, single phase for the control and auxiliary circuits. The primary side of the transformer shall be protected by a thermal-magnetic air circuit breaker, specifically sized to meet the power requirements of the transformer. A mechanical operating mechanism shall

be installed on the circuit breaker to provide a means of disconnecting power to the transformer.

The padlockable operator handle for the operating mechanism shall be located on the exterior of the control panel with interlocks which prevent opening the door until primary circuit breaker is in the "OFF" position.

L. Wiring

General:

1. The pump control as furnished by the manufacturer shall be completely wired except for the power feeder lines to the branch circuit breakers and final connections to remote alarm devices and between control assemblies.
2. All wiring, workmanship, and schematic wiring diagrams shall be in compliance with applicable standards and specifications set forth by the National Electric Code (NEC).
3. All user serviceable wiring shall be type MTW or THW, 600 volts, and shall be color-coded as follows:

a.	Line and load circuits, AC or DC power	Black
b.	AC control circuit less than line voltage	Red
c.	DC control circuit	Blue
d.	Interlock control circuit, from external source	Yellow
e.	Equipment grounding conductor	Green
f.	Current carrying ground	White
g.	Hot with circuit breaker open	Orange

Wire Identification and Sizing:

1. Control circuit wiring inside the panel, with the exception of internal wiring of individual components, shall be 16-gauge minimum, type MTW or THW, 600 volts. Motor branch wiring shall be 10-gauge minimum.
2. Motor branch conductors and other power conductors shall not be loaded above 60-degree C temperature rating, on circuits of 100 amperes or less, nor above 75-degree C on circuits over 100 amperes. Wires shall be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be of the ring tongue type with nylon insulated shanks. All wires on the subplate shall be bundled and tied or installed in duct. All wires extending from components mounted on door shall be terminated on a terminal block mounted on the back panel. All wiring outside the panel shall be installed in conduit.

Wire Bundles:

Control conductors connecting components mounted on the enclosure door shall be bundled and tied in accordance with good commercial

practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall be allowed so that the door can swing to its full open position without undue mechanical stress or abrasion on the conductors or insulation. Bundles shall be clamped and held in place with mechanical fastening devices on each side of the hinge.

Conduit:

1. All conduit and fittings shall be UL listed.
2. Liquid tight flexible metal conduit shall be constructed of a smooth, flexible, galvanized steel core with a smooth abrasion resistant, liquid tight, polyvinyl chloride cover.
3. Conduit shall be supported in accordance with Articles 346, 347, and 350 of the National Electric Code.
4. Conduit shall be sized according to the National Electric Code.

Grounding:

The pump control manufacturer shall ground all electrical equipment to the enclosure back panel. The mounting surface of all ground connections shall have any paint removed before making final connections.

The contractor shall provide an earth driven ground connection to the control panel at the main ground lug in accordance with the National Electric Code (NEC).

M. Level Control System

Liquid Level Control:

1. The manufacturer of the liquid level control system must be ISO 9001:2000 revision certified, with scope of registration including design control and service after sales activities.
2. The level control system shall start and stop the pump motors in response to changes in wet well level, as set forth herein.
3. The level control system shall be furnished as an air bubbler type level control system; however, it must be capable of being operated as a submersible transducer type system or ultrasonic transmitter type system.
4. The level control system shall incorporate automatic alternation to select first one pump, then the second pump, to run as lead pump for a pumping cycle. Alternation shall occur at the end of a pumping cycle.
5. The level control system shall utilize an electronic pressure switch, which shall continuously monitor the wet well level, permitting the operator to read wet well level at any time. Upon operator selection of automatic operation, the electronic pressure switch shall start the motor for one pump

when the liquid level in the wet well rises to the "lead pump start level". When the liquid is lowered to the "lead pump stop level", the electronic pressure switch shall stop this pump. These actions shall constitute one pumping cycle. Should the wet well level continue to rise, the electronic pressure switch shall start the second pump when the liquid reaches the "lag pump start level" so that both pumps are operating. These levels shall be adjustable as described below.

- a. The electronic pressure switch shall include integral components to perform all pressure sensing, signal conditioning, EMI and RFI suppression, DC power supply and 120 volt outputs. Comparators shall be solid state, and shall be integrated with other components to perform as described below.
- b. The electronic pressure switch shall be capable of operating on a supply voltage of 12VDC in an ambient temperature range of -10 degrees C (14 degrees F) through 55 degrees C (131 degrees F). Control range shall be 0 to 12.0 feet of water with an overall repeat accuracy of (plus/minus) 0.1 feet of water. Memory shall be retained using a non-volatile lithium battery back-up.
- c. The electronic pressure switch shall consist of the following integral components: pressure sensor, display, electronic comparators and output relays.
 - 1) The internal pressure sensor shall be a strain gauge transducer and shall receive an input pressure from the air bubbler system. The transducer shall convert the input to a proportional electrical signal for distribution to the display and electronic comparators. The transducer output shall be filtered to prevent control response to level pulsations or surges. The transducer range shall be 0-15 PSI, temperature compensated from -40 degrees C (-40 degrees F) through 85 degrees C (185 degrees F), with a repeat accuracy of (plus/minus) 0.25% full scale about a fixed temperature. Transducer overpressure rating shall be 3 times full scale.
 - 2) The electronic pressure switch shall incorporate a digital back lighted LCD panel display which, upon operator selection, shall indicate liquid level in the wet well, and the preset start and stop level for both lead and lag pump. The display shall include twenty (20), 0.19" high alpha-numeric characters calibrated to read out directly in feet of water, accurate to within one-tenth foot (0.1 foot), with a full-scale indication of not less than 12 feet. The display shall be easily convertible to indicate English or metric units.
 - 3) Level adjustments shall be electronic comparator set points to control the levels at which the lead and lag pumps start and stop. Each of the level settings shall be easily adjustable with the use of membrane type switches, and

accessible to the operator without opening any cover panel on the electronic pressure switch. Controls shall be provided to permit the operator to read the selected levels on the display. Such adjustments shall not require hard wiring, the use of electronic test equipment, artificial level simulation or introduction of pressure to the electronic pressure switch.

- 4) Each output relay in the electronic pressure switch shall be solid state. Each relay input shall be optically isolated from its output and shall incorporate zero crossover switching to provide high immunity to electrical noise. The "ON" state of each relay shall be indicated by illumination of a light emitting diode. The output of each relay shall be individually fused providing overload and short circuit protection. Each output relay shall have an inductive load rating equivalent to one NEMA size 4 contactor. A pilot relay shall be incorporated for loads greater than a size 4 contactor.
- d. The electronic pressure switch shall be equipped with an output board, which shall include LED status indicators and a connector with cable for connection to the main unit.
- e. Circuit design in which application of power to the lag pump motor starter is contingent upon completion of the lead pump circuit shall not be acceptable.
- f. The electronic pressure switch shall be equipped with a simulator system capable of performing system cycle testing functions.
- g. The electronic pressure switch shall be capable of controlling liquid levels in either a pump up or pump down application.
- h. The electronic pressure switch shall be equipped with one (1) 0-33 ft. W.C. input, one (1) scalable analog input of either 0-5VDC, 0-10VDC, or 4-20mA, and one (1) 4-20mA scalable output. Output is powered by 10VDC supply. Load resistance for 4-20mA output shall be 100-400 ohms.
- i. The electronic pressure switch shall include a DC power supply to convert 120 VAC control power to 12VDC EPS power. The power supply shall be 500-mA (6W) minimum and be UL listed Class II power limited power supply.
- j. The electronic pressure switch shall be contained within a NEMA 4X enclosure including a polycarbonate face and stainless steel case.
- k. The electronic pressure switch shall be equipped with an electronic comparator and solid state output relay to alert maintenance personnel to a high liquid level in the wet well. An indicator, visible on the front of the control panel, shall indicate that a high wet well level exists. The alarm signal shall be maintained until the wet well level has been lowered and the circuit has been

manually reset. High water alarm shall be furnished with a dry contact wired to terminal blocks.

6. An alarm silence pushbutton and relay shall be provided to permit maintenance personnel to de-energize the audible alarm device while corrective actions are under way. After silencing the alarm device, manual reset of the alarm condition shall clear the alarm silence relay automatically. The pushbutton shall be oil tight design with contacts rated NEMA A300 minimum.

Air Bubbler System:

The level control system shall be the air bubbler type, containing air bubbler piping, which extends into the wet well. A pressure sensor contained within the electronic pressure switch shall sense the air pressure in this piping to provide wet well level signals for the remainder of the level control system.

Two vibrating reeds, industrial rated, air pumps shall be furnished to deliver free air at a rate of approximately 5 cubic feet per hour and a pressure not to exceed 7 psi. Liquid level control systems utilizing air compressors delivering greater quantities of air at higher pressures, requiring pressure-reducing valves, air storage reservoirs, and other maintenance nuisance items will not be acceptable. A selector switch shall be furnished to provide manual alternation of the air pumps. The switch shall be connected in such a manner that either pump may be selected to operate continuously. The selector switch shall be oil-tight design with contacts rated NEMA A300 minimum.

An air bell constructed of PVC 3 inches in diameter shall be provided for installation at the outlet of the air bubbler line in the wet well. The air bell shall have a 3/8" NPT tapped fitting for connection to the bubbler line.

An air flow indicator gauge shall be provided and connected to the air bubbler piping to provide a visual indication of rate of flow in standard cubic feet per hour.

N. Independent High Water and All Stop Alarm Float

Float switches shall be mounted in the wet well and wired to the Gorman-Rupp and Bihlertech Controllers to serve as an independent high water alarm (all pumps on) and an all stop alarm (all pump off). Float switches shall be non-intrinsically safe.

O. Examination

Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Pumping equipment manufacturer shall provide written instructions for proper handling. Immediately after off-loading, contractor shall inspect pumping equipment and appurtenances for shipping damage or missing parts.

Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all serial numbers and parts lists with shipping documentation. Notify manufacturers representative of any unacceptable conditions noted with shipper.

P. Installation

Install, level, and align pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

Suction pipe connections must be vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump system piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

Check motor and control data plates for compatibility to site voltage. Install and test the electrical ground prior to connecting line voltage to pump control panel.

Prior to applying electrical power to motors or control equipment, check all wiring for tight connection. Verify that fuses and circuit breakers conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

After all anchor bolts, piping connections are installed, seal all openings between wet well and pump enclosure.

Q. Protection

The pumping equipment should be placed into service soon after delivery of the equipment. If installation is delayed, the pumping equipment and motor control center shall be stored indoors, free of excessive dust, in a low humidity, heated environment.

During installation and after the pumping equipment is placed into operation the motor control center shall operate in an environment free of excessive dust, in a low humidity, heated environment.

R. Field Quality Control

Prior to acceptance by the owner, an operational test of all pumps drives, and control systems shall be conducted to determine if the installed equipment meets the purpose and intent of the specifications. Tests shall demonstrate that all equipment is electrically, mechanically, structurally, and otherwise acceptable; it is safe and in optimum working condition; and conforms to the specified operating characteristics.

Prior to start-up, clean wet well by removing construction debris and foreign material.

S. Manufacturer's Pre-startup Inspection

Coordinate system pre-startup with manufacturers factory-trained service technician. The factory-trained service technician will inspect the installation and answer any installation questions by the Contractor, Engineer, or Department.

Verify that operations and maintenance manual is on site and installation instructions contained in the manual have been followed.

Verify that all pumping equipment, piping, level control system, alarms and ancillary equipment has been properly installed and all wiring is complete.

Verify that all spare parts for the pumping equipment are on site.

Pre-startup inspection shall be a separate trip and shall not be less than two weeks prior to the startup of the equipment.

T. Manufacture's Field Performance Testing

Coordinate system start-up with manufacturers factory-trained service technician. The factory-trained service technician will inspect the completed installation, calibrate and adjust instrumentation, and correct or supervise correction of defects or malfunctions. Startup shall be performed in the presence of the Engineer and Department.

Equipment startup shall be tested under both utility power and emergency power.

Contractor shall supply clear water of adequate volume to operate the system including the force main through several pumping cycles.

Observe and record operation of pumps, suction and discharge gage readings, voltage readings, ampere draw, pump controls, and liquid level controls. Check calibration of all instrumentation equipment. Test manual and automatic control systems. Test all alarms. Report any undue noise, vibration or other operational problems.

Startup shall be a separate trip.

U. Manufacturer's Operation and Maintenance Training

The manufacturer shall furnish the services of a qualified, factory-trained operations and maintenance serviceman to instruct and train Department's personnel in the proper care, operation and maintenance of the equipment. The training shall include, but not be limited to, the following:

1. Theory of operation
2. Actual operation
3. Mechanical maintenance
4. Hydraulic troubleshooting
5. Electrical maintenance
6. Instrumentation and level controls
7. Optimization of the system
8. Alarm circuits
9. Safe operating and working practices and operation of safety devices

One (1) training session is required. Training shall be completed after startup services have been performed. Training shall be a separate trip and shall not be less than two weeks after the startup of the equipment. Time, location, and duration of all training sessions shall be coordinated with Department's personnel.

Hands-on training and demonstrations shall use the installed equipment.

Supplier shall provide all materials for training and shall provide training manuals to all personnel being trained.

V. Manufacturer's Equipment Re-Certification

The Contractor shall require, and cover the cost in his bid, for the manufacturer's factory-trained service technician to return to the site six (6) month's after initial startup of the equipment to perform a final re-certification of the equipment.

The re-certification shall consist of demonstrating and certifying that the equipment is meeting the performance requirements of the specifications. Equipment service technician shall perform field-testing of the equipment in the presence of the Department. Results of all field-testing shall be submitted to the Engineer and the Department.

W. Cleaning and Housekeeping

Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap and debris.

Chapter 3, Section 303

Electrical

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III. Electrical

A. General

The work covered by this portion of the specification shall include furnishing all labor, materials, tools, equipment and services to construct and install complete electrical systems as shown on the plans and specified herein for the sewage pumping station and the associated controls and instrumentation.

Reference shall be made to all sections of the specifications for items and materials for all trades required for a complete and functional electrical installation. The Contractor shall be responsible for coordination of all electrical equipment furnished or installed under this portion of the specification.

All electrical materials and equipment shall be furnished under this section of the specification except as specified in other sections of the specification. Certain equipment will be furnished under other sections of these specifications, but installed and wired under this section of the specifications.

B. Electrical Scope

The Contractor shall furnish all labor, materials, electrical equipment and services to construct and install complete electrical systems as shown on the drawings and specified herein. This work shall include, but not be limited to, the following:

1. Utility Company Electrical Services
2. Standby Facilities
3. All wire and wiring materials
4. Instrumentation, alarm and controls
5. Grounding
6. Lighting and power systems including all electrical apparatus and equipment
7. Certain electrical equipment and devices furnished under other portions of the specifications
8. Receiving, handling, storing, setting and connecting all electrical equipment, machinery, devices and controls unless specifically noted otherwise.
9. All excavation, backfill, forming and concrete involved with embedded conduit

10. All anchors, inserts supports, sleeves, fasteners, conduit and equipment racks, equipment and floor steel, etc... necessary for a complete electrical Installation
11. Opening and closing all necessary floor, wall and ceiling penetrations
12. Temporary lighting and power services necessary for construction

C. Regulations

1. Other Specifications

Any reference to other specifications shall always imply the latest edition of the specifications, at time of bidding, unless otherwise stated.

Abbreviations for various organizations issuing standards used in these specifications are as follows:

<u>ABBREVIATION</u>	<u>ORGANIZATION</u>
IEEE	Institute of Electrical and Electronic Engineers
ANSI	American National Standards Institute
IPCEA	Insulated Power Cable Engineers Association
NEC	National Electric Code
NEMA	National Electric Manufacturers Association
UL	Underwriters Laboratories
CBM	Certified Ballast Manufacturers
ASME	American Society of Mechanical Engineers
NFPA	National Fire Protection Association
RLM	Reflector Lighting Manufacturers
IES	Illuminating Engineering Society

2. Site Visitation

The Contractor shall visit the site of the work in order to satisfy himself as to its condition and the progress to be anticipated.

The Construction Drawings show the existing conditions and it shall be the responsibility of the Contractors to verify all conditions, distances and locations in the field. The construction schedule shall be in accordance with the schedule outlined in a previous section.

3. Permits

The Contractor shall give all necessary notices, obtain all permits and pay all costs in connection with his work, file all necessary plans and obtain all necessary approvals with the departments having jurisdiction, obtain all required certificates of inspection for his work and deliver same to the Department.

4. Materials

All materials furnished and all work installed shall comply with the applicable requirements of NEC, NEMA, IEEE, UL, and ANSI standards. All requirements of utility companies, local, state, and federal governmental departments having jurisdiction shall be supported and secured in place. All work shall be installed in first class neat workmanlike manner. All materials shall be new and protected from the elements prior to installation. The Department reserves the right to approve all electrical work, equipment, and materials.

5. Elevations

All elevations indicated on the drawings or specified refer to mean sea level, as established by the U.S. Coast and Geodetic Survey NAVD 88 survey.

6. Protection

The Contractor shall protect, at his own expense, all of his work, materials and equipment that may be liable to injury during the construction period.

Any materials, controls and devices obviously a part of the electrical systems and necessary for a complete installation and its satisfactory operation although not specifically called for in the specifications nor shown on the drawings, shall be furnished and installed by the Contractor.

All equipment shall be completely tested at the factory and meet the applicable standards of NEMA, IEEE, and ANSI requirements.

7. Service

The manufacturer of all electrical equipment, including the emergency generator, shall provide the services of a competent service engineer to provide assistance during the installation and testing and shall instruct the owner's operation and maintenance personnel in the operation and maintenance of the equipment and generator unit. Service time shall be as required for proper start-up.

It will be the responsibility of the Contractor to contact the manufacturer's representative and/or the supplying contractor, as to the alignment, direction

of rotation and condition of the machine or piece of equipment after all wiring to the unit is complete.

No unit shall be rotated, even for test, without written consent from the manufacturer's representative and/or the supplying contractor. The written consent must be given to the Contractor prior to energizing the equipment. This is to prevent injury to personnel as well as damage to the machine or unit.

D. Conduit System

1. General

The Contractor shall furnish all labor, material and equipment necessary to install a complete coordinated raceway system as described on the drawings, including all necessary hangers, brackets and supports. Spare conduits, cleaned and plugged or capped, are required as shown on the drawings.

2. Material

All conduit and fittings shall be new, rigid, or intermediate metallic conduit. All conduits shall be hot dipped galvanized steel with a smooth protective internal coating.

3. Sizes

Conduit sizes shown on the drawings are based upon the use of the specified conductors. If there are any substitutions it shall be the contractor's responsibility to resize the associated conduit. Minimum size conduit for this project shall be ¾" except for conduit embedded in concrete or earth for which the minimum size conduit shall be one (1") inch. Where specifically noted on drawings, such as fixture pendants or mountings, ½" conduit may be used.

4. Fittings - Exposed

Conduit fittings on exposed systems shall be the cast metal, threaded hub type suitable for the wiring device to be installed. All pull boxes, junction boxes and device enclosures shall have screw covers and gaskets. Sheet metal enclosures shall be of code gage steel without knockouts and have all seams welded closed. Conduit entrance to these boxes shall be by means of threaded and gasketed hubs with insulated throat. Rigid conduit shall be connected with galvanized conduit couplings or threaded galvanized electrical conduit unions only.

5. Boxes

Where junction or pull boxes of unusual proportion or size are noted on the drawings, they shall be fabricated according to the latest edition of the NEC, be of code gauge steel, have all seams tight and shall be screw covered and gasketed. All pull or junction box covers shall be permanently fastened to the box by means of a chain welded to both the box and the cover. Chain shall be of sufficient strength to adequately support the cover.

6. Installation

The conduit shall be installed in accordance with the manufacturer's instructions and the applicable provisions of the NEC by qualified and experienced personnel to assure a safe, neat and functional system.

Conduit shall be supported by approved hangers, brackets or other devices specifically designed and constructed for this purpose. Spacing between conduit supports shall be no more than eight (8') feet and all conduits shall be supported within three (3') feet of every box, cabinet, fixture or other terminating enclosure.

Hangers shall be fabricated of durable material suitable for the application involved. The use of perforated strap for conduit support will not be permitted. Support brackets and hangers shall be of sufficient strength and size to adequately support the conduit load including cables. Vertical conduits shall be fastened to supports by means of U bolts.

Field bends shall be made only with approved hickey or hydraulic bending machine and shall be of sufficient radius that conduit will not be flattened, distorted or have the interior or exterior coatings damaged. The use of heat to facilitate bending will not be permitted.

Exposed conduit shall be installed with a minimum number of joints and shall be run parallel or perpendicular to building column lines. Multiple conduit runs shall be straight and parallel; offsets shall be uniform and symmetrical. Insofar as practical, conduit runs shall be as shown on the drawings. Minor deviations may be made to avoid interference with other trades or with openings or passageways as directed by the engineer.

All threaded conduits must be wrench tight and correctly aligned to provide a sound electrically continuous conduit system.

Embedded conduit shall be encased in concrete envelopes which shall have three (3") inch minimum dimensions between conduit and earth. Where embedded conduit passes under roadways the concrete envelope shall be reinforced per typical detail on drawings.

All embedded conduit shall be plugged or capped before pouring concrete envelopes and backfilling. These plugs or caps shall remain in place until

conduit is ready for cleaning prior to cable installation. All excavation, concrete, and backfill for concrete envelopes shall be the responsibility of the contractor.

All conduits shall be free of foreign materials, thoroughly swabbed and lubricated before installation of wire or cable. All conduit shall be identified with non-ferrous metallic tags on which the conduit number, as obtained from the conduit schedule, has been permanently embossed.

Where conduits terminate in sheet metal, NEMA 1 enclosures, double locknuts, and insulated bushings shall be used.

All conduit connections to motors or equipment having an appreciable amount of vibration shall be made with liquid tight, flexible steel conduit. Flexible liquid tight conduit shall be used only with approved connectors and flexible connections shall not exceed twenty-four (24") inches in length.

The conduit shall be furnished in standard ten (10') foot lengths complete with thread protectors. Condulets shall be furnished with stainless steel fasteners or screws to provide for accessibility.

All conduit installed in the wet wells shall be installed according to requirements of the NEC for Class 1, and Division 1, Group D Hazardous Installation. All fixtures and devices installed in this area shall be approved by the Underwriters' Laboratories for Class 1, Division 1, Group D installation.

E. Conductors

1. General

The Contractor shall furnish all labor, material, and equipment necessary to install all conductors as shown on the drawings, or called for in this specification. The sizes of individual conductors shall be indicated on the drawings.

2. Material

All wire and cable shall be new, standard, and conform to the applicable requirements of NEC, IPCEA, the Utility Company, and the Local, State, and Federal Departments having jurisdiction. Conductor insulation shall be type THW, rated for 600 volts and 75 degrees C or equal.

Conductors, when used for control, instrumentation, lighting and receptacles shall be stranded copper and conform to, or exceed requirements or ICPEA, NEMA, and NEC. Grounding conductors, when laid in earth or run bare within two (2") inches of masonry type construction, shall be copper.

3. Size

Wire sizes shall be shown on the drawings. All wire will be tagged or marked with the appropriate wire and circuit numbers as determined from the diagrams. Minimum wire size shall be #12 AWG.

4. Installation

Conductors shall be installed in a manner which will not injure their insulation or covering. Raceways shall be complete before any wire is installed. Only pulling lubricants approved for this purpose shall be used.

All connections shall be made with either bolted pressure type or high compression crimp-on type terminations. Solder connections will not be permitted.

All conductors shall be continuous from origin to panel or equipment termination with no splices in intermediate pull or junction boxes unless specifically shown on the drawings.

Running splices in conduit or tray are not acceptable. Each wire shall be permanently marked with the appropriate wire number. Each conductor group shall be identified with a fibrous tag embossed with the appropriate circuit number.

F. Lighting System

1. General

The Contractor shall furnish and install a complete lighting system as shown on the drawings and as described herein.

2. Lighting Fixtures

All lighting fixtures shall be as outlined in the fixture schedule shown on the drawings. The fixtures and lamps shall be installed as shown on the drawings, in place, wired, connected, tested, and left in satisfactory operating conditions. Fluorescent lighting fixtures shall utilize either T8 or T5 bulbs.

3. Outlet, switch, and junction box

Outlet, switch and junction boxes shall be of the type and size as required at locations shown on the drawing. The boxes shall be secured firmly in place and set true and square with the finished surface.

Where required, boxes for light outlets shall be provided with fixture studs of a size suitable for the weight of this fixture to be supported. Studs shall be an integral part of the box.

Outlet boxes for exterior lights subject to the weather shall be cast aluminum with gasketed covers.

Type FS cast boxes shall be used for all surface mounted switches and convenience outlets.

Junction and splice boxes shall be made of code gauge galvanized steel without knockouts and sized in accordance with standards set forth in the National Electric Code. Covers shall be of the screw-on and gasketed type.

4. Switches and convenience outlets

All switches and for-control of branch circuit lighting shall be heavy duty, toggle type, rated at 20 amperes, 120 volt AC unless otherwise specifically noted herein.

Switches shall be single pole, three-way, or four-way as shown on the drawings.

Receptacles shall be duplex, 3-wire, grounding type, rated at 20 amperes, 120 volt AC unless noted otherwise.

All receptacles and switch cover plates shall be metal with a clear, anodized aluminum finish except where a weatherproof device is indicated. Weatherproof cover plates for receptacles shall be equipped with hinged gasketed lids.

Special receptacles for use in hazardous areas such as wet well area shall be explosion proof type for Class I, group D locations.

5. Standard Occupancy & Vacancy Light Switch Controls

- a. Occupancy sensors provide up to 150 degree field of view and 900 sq. ft. of major motion coverage.
- b. Vacancy sensors provide up to 180 degree field of view and 450 sq. ft. of major motion coverage.
- c. Selectable time delay of 5 seconds to 20 minutes for lights to remain on after room is vacated.
- d. Occupancy sensor provides a selectable ambient light override preventing lights from switching ON when there is acceptable natural light.
- e. Occupancy sensor version allows to toggle between Auto-On/Auto-OFF or manual ON/Auto-OFF mode.

- f. Occupancy sensor provides for a bypass feature to allow the sensor to perform as a traditional switch (Manual ON/Manual OFF).
- g. Walk-in-delay feature allows sensor to turn lights off without time delay when motion detected briefly in room.
- h. Electrostatic discharge protection.
- i. No leakage to load in off mode.
- j. Switch shall be a Cooper Wiring VSIRO4W or approved equal.

G. Panel Boards

1. General

Furnish and install, where shown on the drawings, panel boards for control of light and power circuits. Panels shall be dead front with protective devices of the number, rating, and type shown on the drawings. Panels shall be NEMA 1 general purpose enclosures and shall be surface mounted. Panels shall be rated 120-240 volts, 1 phase, 60 hertz or 120Y-208 volts, 3 phase, 4 wire as shown on the drawings.

All panels shall be rated in accordance with the Underwriters' Laboratories, Inc., standards for cabinets and boxes and shall be so labeled. Panels shall also comply with NEMA standards and the national Electric Code.

All panel interiors shall be completely factory assembled with the specified protective devices, wire connectors, and terminals for copper or aluminum conductors of the sizes indicated.

Panel interiors shall be designed so that protective devices can be replaced without disturbing adjacent units and without removing the main bus connections.

Branch circuits shall be arranged using double row construction as shown on the drawings. Each panel shall have a name plate, which shall include panel type, number, and size of protective devices.

Bus bars shall be plated aluminum sized in accordance with Underwriters' Laboratories standards. Neutral shall be full-size, and have a suitable lug for each outgoing feeder requiring a neutral connection. The ground bus shall NOT be connected to the insulated neutral bus.

Boxes shall be made of unpainted galvanized code gauge steel having multiple knockouts except where noted. The boxes shall have a minimum gutter space of four 4" inches on all sides where main feeder cables supplying a panel are carried through the box, to supply other panels, the box shall be so sized as to include this wiring space, which shall be in addition to the minimum gutter space required by code.

The box shall be provided with at least four (4) interior mounting studs. The box identification number shall be on the box.

2. Box Trim

On all lighting panels the front shall include door and have flush, brushed stainless steel, cylinder tumbler type locks with catches and spring loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panel locks shall be keyed alike, two (2) for each panel shall be furnished. A typed circuit directory frame and card shall be provided on the inside of the door. All panels shall be similar in appearance. All trims shall be painted to match the surrounding décor.

All panels for lighting or power shall be the circuit breaker type and rate 100% for continuous duty.

3. Panels – Surface type

Lighting and/or receptacles, all must be 100% rated, factory assembled with fastrim fronts and minimum size cabinet gutters. Boxes to be code gauge galvanized steel with knockouts. All with main circuit breakers and bus sized as shown on drawings. Main breaker to be at top of panel. The panels shall be:

- A. 120/240 Volt AC 10,000 A.I.C.
Single Phase, 3 Wire, 60 Hertz
Branch Breakers – 1 Pole or 2 Pole – Rating
And number of Breakers as shown on the drawings
- B. 120/208 Volts AC 10,000 A.I.C.
Three Phase, 4 Wire, 60 Hertz
Branch Breakers – 1 Pole, 2 Pole, or 3 Pole - Rating
And number of Breakers as shown on the drawings

Panels shall be, Square D or approved equal.

H. Vendor's Drawings

1. Installation

Manufacturer's (Vendor's) drawings shall be submitted for approval. Vendor's drawings or Catalog Data Sheets shall be submitted for the following equipment by this Contractor:

- a. Emergency Generators
- a. Lighting Fixtures

- b. Panel Boards
- c. Automatic Transfer Switches
- d. Conduit and Wire
- e. Ground Rods
- f. Service Circuit Breakers

2. Wiring

The Contractor shall also be responsible for furnishing wiring diagrams for all equipment whether supplied by him or by other contractors. These wiring diagrams shall be furnished for the following categories:

- a. Elementary or schematic wiring diagrams which show the complete scheme or logic for all equipment other than covered on the schematic wiring provided by the engineer.
- b. Connection wiring diagrams which show all wiring between terminals and devices located within the equipment.
- c. Interconnection wiring diagrams which show the wiring between terminal boards, connection points, studs, etc...and all remote devices. These drawings shall indicate the cable numbers as shown on the cable schedules, issued as part of this specification.

3. Type of Drawings Acceptable

- a. Reproducible drawings of elementary and connection wiring diagrams of the type normally furnished by the equipment suppliers shall be considered acceptable. Prints of these drawings shall be submitted to the Department for approval, and it shall be the responsibility of the contractor to make or have made all additions or corrections. Any necessary revision to these drawings as a result of field changes shall be given to the Department at the time of plant acceptance by the owner.
- b. Interconnection diagrams shall be furnished by the Contractor on suitable, or Mylar. The size of the drawings shall be 24" X 36" and shall contain all information as previously specified. Prints of the drawings shall be submitted to the Department for approval and they shall be maintained in "As Built" condition at all times. The original reproducible will be given to the Department at the time of plant acceptance by the Department.

The above drawing requirements apply, but are not necessarily limited to the following equipment in the plant:

1. Standby Facilities
2. Automatic Transfer Switches

I. Tests

The Contractor shall notify the Department, in writing, when the electrical installation is complete and ready for acceptance and test. These tests shall be made by the Contractor in the presence of the engineer to determine whether the installation complies with the specification and drawings.

To prevent injury to personnel and damage to equipment, no equipment should be tested until it is approved by the Contractor.

The Contractor shall furnish all lubricating oils, greases, etc...for the rotating equipment and machinery installed by any contractor.

The Contractor shall furnish all labor and supervision, necessary to properly lubricate all machinery, equipment, and rotating units installed by him.

It shall be the duty of the Contractor to obtain proper written certification from the general contractor that all driven equipment (coupled to motors) and not a part of the Contractor's work, shall have been lubricated and in running condition before tests are made.

All equipment, motors, control centers, and wiring must be tested for proper phasing, motor, and equipment rotation. Power continuity of circuitry grounding, lighting, and switching shall also be tested.

The Contractor shall at once remedy any and all noted defects. After defects are corrected, the Contractor shall make any additional tests that may be required. Testing shall be furnished by the Contractor. The entire installation shall have an insulation resistance in accordance with the requirements and recommendations of the national electric code.

J. Guarantee

All electrical equipment, wiring, fixtures, and control must be guaranteed, new and of the latest design. All wiring, materials, and workmanship shall be guaranteed for a period of one year after acceptance as detailed in the general and special conditions unless noted otherwise in these specifications.

K. Louvers

Electrically closed, spring opened louvers shall be furnished and installed under other sections of these specifications. The Contractor shall under this section of the specifications furnish, install and connect the required conduit and cable to connect the louvers where and as shown on the drawings.

L. Standby Facilities

1. Scope

The Contractor shall furnish, install and connect, where shown on the drawings, complete diesel engine driven generator set. Each engine generator set shall consist of but not be limited to the following:

1 - Engine

1 - Generator

1 - Automatic start and transfer panel complete with battery and battery charger

The entire assembly of engine, generator and transfer switch shall be the products of a single supplier.

Each engine generator set shall be sized as shown on the drawings or as specified and rated at 80% power factor. Each set shall be capable of supplying the rated load with no more than 50 degrees centigrade rise above 40 degrees centigrade ambient.

Each engine generator set shall be mounted on a welded steel base which shall be mounted on vibration isolators. Steel base design shall permit installation of the unit on any level surface. Vibration isolators shall be sized and furnished by generator set manufacturer for installation by the Contractor.

The equipment will automatically start the set upon power failure and then transfer the load to the generator. After return of power the equipment will automatically transfer the load back to the normal power source. However, in the event power outage is less than 30 minutes, time delay shall be provided to allow load to remain on generator set for 30 minutes before transferring back to normal power. An emergency stop switch must also be provided for mounting at generator control panel. Each engine generator set must be capable of assuming the required load in the following sequence:

- a. Control Power, Lighting, heating, ventilation, and building power
- b. All Raw Sewage Pumps. Sized as follows:

As per Contract Design

RVNR starting is accomplished by means of auto transformer type starters connected on the 65% Tap.

2. Engine Construction

Each unit shall be constructed, arranged, and guarded to minimize the danger of accidents to operating or maintenance personnel. Contact with hot components or rotating parts shall be prevented.

Lubrication shall be by means of gear type oil pumps providing full positive oil pressure lubrication to bearings. Engines shall be furnished with oil pressure gauge, oil filter, oil cooler, high water temperature cut-off, high oil temperature cut-off, block heater and all other equipment necessary for satisfactory operation. All gauges and indicators shall be located on front of unit mounted control panel.

3. Each engine shall be provided with a hydraulic or electric governor capable of maintaining generator output frequency between 58 and 62 Hertz from no load to 110% load. A trickle charger shall be provided for each battery.

4. Engine Cooling

Engine shall be supplied with a unit mounted, radiator type, cooling system where required or specified. Each cooling system shall include a radiator cooling fan, suitable circulating water pump, water temperature thermostat control and high water temperature cut-off.

Cooling system shall be capable of maintaining proper engine temperature under rated load at 80% power failure and 40 degrees centigrade ambient temperature.

Each radiator and engine cooling system shall be filled with a solution of 50% Ethylene Glycol.

All radiators shall be equipped with a one (1") inch wide duct adapter flange and fire resistant, flexible neoprene collar suitable for connection to exhaust air duct which will not restrict the flow of air through the radiator core.

Where required or specified, engine generator set shall be supplied and arranged with the proper fans and shrouds for direct air cooling, as contract design.

5. Fuel System

Engine shall be diesel fueled, spark ignition, with appropriate number of single action cylinders. Each engine shall be equipped with reliable lube oil

cooler, fuel regulator, and any attachment required for continued, dependable operation. Flexible fuel connections shall be provided with each engine.

Diesel fueled generator set shall be installed at pump station site.

6. Weather Housing

Each stationary generator set shall be protected from rain, snow, and sleet.

- a. Rust-inhibiting primer protects the inside and outside surfaces of these rugged 14 to 18 gauge steel construction weather housings. The weather housing outside surface has a top coat of Kohler cream beige and black enamel. Field-installed kits shipped with electro-coat gray primer.
- b. Easy-to-remove side panels allow convenient access for generator set service. Lockable latch panels prevent tampering. The skid end cap kit protects the generator set from weather and deters entry by animals.
- c. Louvers at the generator and radiator ends supply ample cooling air flow, eliminating the need to remove the side panels for additional air circulation.
- d. Weather housing shall include a silencer mounting kit for mounting the silencer on top of the weather housing.

7. Generators

Each generator shall be rated as shown on the drawings at 80% power factor, with Class F insulation but sized for 80 degree Centigrade temperature rise above 40 degree Centigrade Ambient on continuous duty. Each generator shall be close coupled to a diesel engine and housed in drip proof enclosure. Each generator shall be equipped with a brushless type exciter and solid state voltage regulator capable of plus or minus one (1%) percent regulation and commercial grade radio frequency suppression. Generators shall be capable of supplying the loads specified previously with no more than twenty (20%) percent voltage drop anywhere on the loading curve. The loads shall be applied to the generator in sequence as specified.

8. Generator Auxiliaries

Each generator voltage regulator and voltage adjusting Rheostat shall be housed in the unit mounted control panel. Each Rheostat shall be capable of adjusting voltage plus or minus five (5%) percent of rated voltage.

Each generator shall be equipped with a factory installed engine block heater.

Each generator shall be equipped with a sub-base fuel tank. The fuel tank shall have a UL 142 listed double-wall construction equipped with fuel level gauge, low level alarm, and fuel-in-rupture-basin-alarm. Each fuel tank shall have a minimum capacity equal to that required to operate the generator for 24 hours under maximum loading.

9. Control and Starting Panel

The Contractor shall furnish, install and connect one (1) unit mounted control and starting panel complete, for the generator set. Each panel shall house all instruments or meters called for in the specifications, shown on the drawings or necessary for the proper, and satisfactory automatic operation of the standby generator unit as specified unless noted otherwise.

Each control and starting panel shall be unit mounted and shall contain the following instruments, controls or devices:

- a. Oil Pressure Gauge
- b. Water Temperature Gauge, where applicable
- c. Low Oil Pressure Shut-Down and Indicating Light
- d. High Water Temperature Shut-Down and Indicating Light, where applicable
- e. Over-speed Shut-Down and Indicating Light
- f. Manual Start and Stop Switches
- g. Automatic Battery Charging Control and Charging Current Amppmeter
- h. All Devices and Timers necessary for automatic starting of engine upon loss of normal power.
- i. Automatic Shut-Down Timer to shut down engine if engine does not start after three twenty (20) second cranking cycles and Indicating Light
- j. Device to provide positive protection against engaging starting motor while engine is turning
- k. A 6-Digit Elapsed Time Meter graduated in Hours and Tenths of Hours
- l. Two (2) Isolated Contacts shall be provided for Remote Alarm if generator should shut down for any reason when called on to operate

10. Exhaust System

- a. Critical grade silencer will be mounted on the roof of the outdoor enclosure.

- b. All exhaust connections will be completed prior to shipment to the job site, unless shipping height prohibits it.
- c. Exhaust outlets shall be equipped with tail pipe and rain cap.

11. Tests & Warranty

All equipment furnished under this section shall be guaranteed against defective parts and workmanship for a period of eighteen (18) months from date of shipment or one (1) year from date of field testing and acceptance by the owner, whichever comes last.

Each electric generator set shall receive the manufacturer's standard testing. Prior to acceptance of installation, the complete unit shall be subjected to full load test for two (2) hours. The Contractor shall be responsible for furnishing all necessary equipment to load test the generators including load banks, temporary cables and other required equipment. Any defects which become evident during test shall be corrected at no expense to owner.

On completion of the factor authorized installation, each initial startup shall be performed by a factory trained representative of the generator set manufacturer. At the time of startup, operating instructions and maintenance procedures shall be thoroughly explained to owner's operating personnel. Six (6) copies of operating and maintenance instructions shall be supplied for each generator set and its auxiliary equipment.

The generator set shall be as manufactured by Kohler, or approved equal, sized and located according to the following:

<u>LOCATION</u>	<u>MODEL #</u>
AS PER CONTRACT DESIGN	

The Contractor shall furnish a listing showing manufacturer's Model Number, overall dimensions and weight for each electric set and auxiliary equipment.

M. Automatic Transfer Switch

1. Scope

The Contractor shall provide and install, where shown on the drawings, six 3-Phase and one single-phase fully rated automatic transfer switches capable of protecting both inductive and resistive loads from loss of continuity of power. Each switch shall be sized as shown on the drawings. Each switch shall provide complete protection (loss of any one phase shall initiate transfer from normal to emergency power) and be rated as shown on the drawings, on

normal power. Each switch shall be enclosed and rated for all classes of loads without de-rating.

Each switch shall automatically transfer the load circuit to an emergency power supply upon failure of its normal supply. Upon restoration of the normal supply, each switch shall automatically re-transfer its load circuit to the normal supply and then initiate shut down of the emergency generator set.

2. Mechanism

Each common transfer mechanism shall be electrically operated by a single BI-Directional motor, with all parts in positive contact at all times. It shall be capable of being operated manually. Each transfer switch shall be mechanically and electrically interlocked so that it shall not be possible for load circuits to be connected to normal and emergency sources simultaneously, regardless of whether switch is electrically or manually operated, or if any part should malfunction.

3. Protection

Close differential voltage sensing relays shall be provided to monitor each phase of the normal supply. A drop in voltage in any phase below 70% shall initiate transfer of load. The relays shall initiate retransfer of load to the normal supply as soon as the voltage is restored in all phases, to 90% of rated voltage.

The voltage sensing relays shall be of the completely solid state type and have temper proof field adjustable pick-up and drop out valves.

Each transfer switch shall obtain its operating current from the source to which the load is being transferred.

4. Accessories

All accessories and equipment shall be front mounted. All pilot devices or relays shall be industrial type, rated for 10 amperes, with self-cleaning contacts. Components of operating mechanism shall be electrically installed during transfer.

The following accessories in addition to standard equipment shall be supplied as part of each automatic transfer switch:

- a. Time Delay normal to emergency adjustable 0.2 seconds to 60 seconds.
- b. Time Delay emergency to normal adjustable motor driven 0-30 minutes.
- c. Time Delay engine cool-off adjustable motor driven 0-30 minutes.

- d. Frequency Relay-Prevent transfer until generator has reached operating speed.
- e. Four (4) position Selector switch – “Off”, “Test”, “Auto”, and “Engine Start”.
- f. Provision for Remote Pilot Lights – Green (normal), Red (emergency).
- g. Contractors shall be “Below On” type.
- h. Overlapped, switched neutral.
- i. Plant Exerciser to run engine once a week, under load, without interrupting utility company service.
- j. Programmed transition On Transfer and Retransfer to provide variable Time Delay with load connected to neither source.
- k. Two-position Selector Switch with “Hand-Auto” nameplate for control of Generator Inlet Louver. In hand position louver will open. In “Auto” position louver will be closed unless generator is running.
- l. Two (2) isolated contacts which will close on generator set failure for use on Alarm System.
- m. Time Delay Engine start adjustable 0.2 second to 60 seconds.
- n. Two (2) isolated normally open contacts for remote indication of power failure.
- o. Front panel mount Red and Green pilot Lights.

5. Arrangement

Each transfer switch shall be housed in a NEMA 1 enclosure arranged for wall mounting and shall contain all accessories and devices listed above. Each transfer switch shall be series OT as manufactured by Onan Company or Russelectric Inc. or approved equal.

N. Heating

The Contractor shall furnish and install complete one 5 kw electric suspension heater.

Each heater shall be a complete self contained unit complete with integral thermostat, fan, motor assembly and contactor for heating element. Control voltage for all heaters shall be 120 volts, single phase. An optical "Fan Only" switch shall be built into the electric suspension heater.

Each heater shall include a cast aluminum heating grid and shall be manufactured by Qmark.

The electrical work required for the electric heaters shall be covered under this section of these specifications.

O. Service Entrance

The electrical supply voltage for each pump station shall be 3-phase, 4-wire, 277Y/480 Volts, or 120/240 Volts single-phase 60 cycles, or as shown on the drawings. The service entrance for the diesel generator stations, as well as the main feed to each respective pump station, shall be as shown on the drawings.

In addition to the phase conductors, the service entrance shall include a grounded conductor connected to the utility company service at the pole and the ground bar in the main service entrance switch in the diesel station building.

The installation shall meet NEC and Potomac Edison Power Company requirements. It shall be the responsibility of the Contractor to coordinate the service entrance installation with the utility company. For information contact Potomac Edison Power Company, Hagerstown, Maryland.

There shall be furnished, installed, and connected on the line side of each service entrance disconnect, one (1) each, low voltage lightning arrester at the Pumping Stations. Where required the 3-phase, 4-wire, or single-phase, 4-wire lightning arrestors, shall be Westinghouse type MV Catalog # 632A392A01, or equal.

The Contractor shall include in his bid all fees, aid to construction and other charges levied by Potomac Edison Company for providing electric service.

P. Grounding

A complete grounding system shall be installed in accordance with these specifications, the applicable drawings, and in accordance with provisions of the National Electric Code.

1. Equipment Grounds

Conductor enclosures, structures, motors, equipment, generators, transformers, switch gear, panels, motor control centers, and portable equipment shall be adequately grounded for both normal and fault current.

Equipment ground conductor shall be connected by bolting to the motor terminal box and the other end shall connect to the ground bus in the motor control center.

Although neutral conductors are grounded at the source they shall not be used for equipment grounding.

Equipment grounding conductors, if insulated, shall be identified with green color code as specified by the National Electric Code. Care must be taken that only the green conductor is connected to the parts to be grounded.

All branch circuits for receptacles shall include a grounding conductor to provide effective grounding for the receptacle and cord connectors.

Where ground cables are run underground, they shall be laid with a reasonable amount of slack to reduce the possibility of breakage.

All ground conductors shall be made of copper.

Q. Temporary Electrical Power

During the entire construction period, from date of ground breaking until accepted by the Department, the Contractor shall under this portion of the specifications, provide any and all temporary construction and/or maintenance electrical power required by the project to maintain all equipment properly until accepted by the Department.

Any damage to Pump Station equipment because sump pumps or dehumidifiers or other devices are not connected to electrical power because permanent electric is not on the site will be repaired or replaced, by the Contractor, at no cost to the Department.

R. Service Entrance Breakers

Furnish, install, and connect 600 Volt 3-pole thermal magnetic, molded case circuit breaker, where and as shown on the drawings or as required. Circuit breaker shall be sized as shown on the drawing and rated 30,000 RMS amperes interrupting capacity. The breaker shall be U.L. listed for service entrance equipment, meet NEC and NEMS standards, and shall meet Federal Specification W-C-375A.

The Contractor shall furnish, install and connect 3-pole service entrance circuit breakers and pole service entrance circuit breaker as shown on the drawings or as required. The circuit breakers shall be rated for 10,000 symmetrical A.T.C. at 240 volts. The circuit breakers shall be rated as shown on the drawings.

Circuit breaker enclosures shall be NEMA 1A, for surface mounting and shall be furnished with provisions for surface mounting and shall be furnished with provisions for three (3) padlocks in the off position. Circuit breakers shall have dual interlocks to prevent unauthorized opening of the breaker door in the "ON" position or closing the breaker with the door open. Defector mechanism shall be provided to allow intentional opening of doors with breakers closed or intentionally closing breakers with doors open.

In addition, each service entrance breaker shall be supplied with a U.L. approved lightning arrestor rated at 480 volts or 240 volts as required and suitable for use on services as rated on the drawings, Westinghouse Type MV, or General Electric, or approved equal. Lightning arrestor shall be installed on line side of service entrance breaker.

U.L. listed line and load terminals shall be provided on the circuit breaker for cables as shown on drawings. Service entrance breaker shall be provided with insulated groundable neutral bar.

A 4" X 3" nameplate with 3/4" letters shall be mounted on enclosure door reading:

SERVICE ENTRANCE BREAKER

S. Emergency Generator Breakers

Furnish, install, and connect complete 3-480 Volt, 3-pole, 1-240 Volt, 2-pole and 3-600 Volt, 3-pole thermal magnetic molded case circuit breakers in NEMA 1 enclosures for surface mounting where and as shown on the drawings. The circuit breakers shall meet Federal Specifications W-C-375A.

Emergency generator breakers shall be provided with insulated solid neutral bar. Line and load lugs shall be suitable for use with copper cables as shown on drawings. Neutral bars shall have lugs suitable for conductors as shown on the drawings. Circuit breakers interrupting capacity shall be sized to handle the maximum short circuit available from the generators plus the full load current of raw sewage pump motors. Circuit breakers shall have their continuous rating as shown or as recommended by the generator set manufacturer.

T. Comminutor

Comminutors shall be supplied and installed where and as shown on the drawings, as specified in another section of these specifications. Combination magnetic starters shall be supplied, installed and connected where and as shown on the drawings, under this section. Each combination starter shall be NEMS size one with motor circuit protector (MCP) type molded case circuit breakers in NEMA 1 enclosure. Overload heaters, one (1) for each power conductor, shall be sized from motor nameplate full load amps. Starters will be for use on 277V/480. Control voltage shall be 120 Volts. Momentary contact Stop-Start push buttons, hand-off-auto selector switch and Red and Green indicating lights shall be supplied in cover of each starter. Stop-Start push buttons shall be connected in "hand" side of selector switch. Overload reset push button shall extend through cover. Defeatable interlocks to prevent opening or closing door with circuit breaker closed or closing breaker with door open shall be provided. Circuit breaker shall be capable of being pad locked in Open or Closed

position. Comminutor and associated devices shall be connected as shown on the drawings.

U. Alarm status System

Under this portion of these specifications the Contractor shall furnish, install and connect the pump station into an alarm status reporting system, as specified by the Department.

The following alarm functions shall be monitored:

1. Pump Failure
2. Seal Water Failure
3. Station Flooding
4. Comminutor Failure
5. Normal Power Fail
6. Stand By Power Fail
7. Check Valve Failure
8. High Wet Well Level
9. Low Wet Well Level

In the pump station building the Contractor shall furnish and install a station flooding sensor. The station flooding sensor shall consist of a sonic type level switch which shall output a high frequency sonic signal from its probe mounted 1" above the pump station floor. A ½" depth of water buildup on the pump station floor will cause an interruption of the sonic signal which will in turn open a contact contained within the sensor. The sensor contact will be inter-wired with the RTU. Opening of the contact will trigger a station flooding alarm.

V. Pump Station Control Panels

Pump station control panel for pump station shall be furnished under other sections of the specifications. The Contractor shall, under this section of the specifications, install and connect the control panel where and as shown on the drawings.

W. Electrical Outlets

One double electrical outlet shall be installed on the interior of every wall within the pump station building. In addition to the internal electrical outlets, an outlet shall be placed on the exterior of the building adjacent to the entrance door.

Chapter 3, Section 304

Gas Monitoring Equipment

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	General	304-1
B.	Scope	304-1
C.	Equipment	304-1
D.	Wiring Configuration	304-1/304-2

IV. Gas Monitoring Equipment

A. General

Each pump station building shall have continuous gas monitoring equipment installed inside the building. The gas monitoring equipment shall be connected to the pump station's alarm monitoring system.

B. Scope

The Contractor shall furnish all labor, materials, equipment, and service to construct and install complete gas monitoring system as shown on the plans and specified herein.

C. Equipment

The gas monitoring equipment shall consist of a Seirra Sentry Controller (4 channel), Seirra gas sensor modules (combustible gas, oxygen, carbon monoxide, and hydrogen sulfide) or approved equal.

The Contractor shall furnish and install two (2) alarm panels: one (1) located at the entrance to the pump station building and one (1) located within the building, to meet the alarm requirements of NFPA-820. The alarm panels shall be NEMA 4X boxes mounted above grade in a visible location at the entrance to the building and within the building.

The control boxes shall be connected to the gas detector and the exhaust fan circuit. Each control box shall have a green light to indicate that the fan circuit is operational or that the fan is running and shall be labeled "Safe to Enter". Each control box shall also have two (2) red flashing lights. One (1) warning light shall be labeled "Unsafe to Enter" and shall be connected to the gas detector. The second warning light shall be labeled "Unsafe to Enter, Exhaust Fan Failure" and shall be connected to the exhaust fan. In addition to the indicator lights, each control box shall be equipped with a manual "Reset" push-button, that enable the latched relays to reset.

D. Wiring Configuration

Upon receipt of high/low gas level signal from the gas detection system, the exhaust fan shall energize and shall operate in the high speed purge mode, 30 ACH (air changes per hour) for ten (10) minutes and then shall

automatically reduce speed to 5 ACH, as required to purge the space. The exhaust fan shall continue to operate at low speed (5 ACH) mode until manually reset.

The gas monitoring controller shall be connected to the alarm monitoring system. Upon a receipt of a gas alarm, gas detector failure alarm, or exhaust fan failure the alarm monitoring system shall notify proper personnel.

Chapter 3, Section 305

Bihlertech Controller

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	General	305-1/305-2
B.	System Operation	305-2/305-5
C.	Pump Control Panel	305-5/305-8
D.	Adjustable Torque Drives and Panels	305-9/305-14
E.	Recommended Sources for Pump Control System Components	305-15
F.	Installation	305-15

V. Bihlertech Controller

A. General

1. Scope of Work

This document provides specifications for a preconfigured fully integrated digital pump control system for controlling up to three (3) TVDs (Torque Vector Drives).

The pump control panel and drive panels shall be setup, adjusted, and tested by the manufacturer or authorized manufacturer's representative.

All the panels and the HMI (human machine interface) shall communicate digitally via a RS232 serial link.

Any exceptions/deviations to this specification shall be indicated in writing and submitted for the Department's approval.

2. Submittals

Submittal packages including drawings shall be furnished for Engineer's approval. These packages shall consist of elementary power and control wiring diagrams and include outline drawings as well as complete BOM (Bill of Materials). The enclosure drawings shall include front and side views of the enclosures with overall dimensions, and general component arrangement of the subplate. Standard catalog specification sheets showing voltage, horsepower and maximum current ratings shall be furnished as part of the submittal package.

Submittal package shall also include interconnection wiring diagram showing the field wiring between the Bihlertech Controller and the Gorman Rupp control cabinet. The wiring diagram can not include any modification, of any circuit, within the Gorman Rupp control panel without first obtaining Gorman Rupp's approval.

The vendor shall complete electrical drawings and shall submit them to the Department and pump manufacturer for approval.

3. Warranty

An 18-month parts warranty shall be provided on materials and workmanship from the date of purchase, or 12 months from the date of startup, whichever occurs first.

Warranty work will only be performed by the manufacturer or the manufacturer's authorized service representative.

4. Quality Assurance

The manufacturer of the panels shall be a UL508 (or equivalent) certified facility.

All panels shall be designed, constructed and tested in accordance with NEMA, IEC and UL508A standards.

Prior to shipment or at start-up, the pump control system shall be functionally tested as a complete system with motors connected to ensure proper sequencing and operation. All display screens and controls shall be tested to insure proper operation. Documentation of test results shall be furnished at the Engineers' request.

B. System Operation

1. General

Operation of the pumps shall be controlled by the direct manipulation of motor torque. Speed control shall not be an acceptable alternative.

All control of the lift station operations shall be completely integrated through a central processing LLU (Local Logic Unit) as described below, including the following:

- Level Measurement
- TVD(s)/ Pump Control
- Alarms and Error Codes
- Corrective functions
- Pages via Internet

The control system shall be able to determine whether a pump failure is due to loss of power at the TVD or due to TVD fault/ trip and it shall cause an error code to be displayed. In the case of TVD fault/ trip, the pump shall remain off until serviced. In the event of loss of

power or communication error to the TVD, the controller shall attempt to re-start the TVD every time in its sequence.

2. Level Setting

The pump operation levels shall be settable through the HMI. The pump operation levels shall be Low Level Off, Normal Pump Start, Second Pump Start, Third Pump Start and High Level Alarm. Once the parameters have been selected the LLU shall use these settings to operate the pump(s).

The control system shall have a settable P.I.D. hold point. The P.I.D. hold point shall adjust the torque input to the TVD's thereby maintaining a constant wet well level while simultaneously trimming the torque setting to find the BEP for the required flow rate.

3. Normal: Station Operation and Alternation

Upon power up, the LLU shall load the initial saved values and the program from EEPROM. The LLU shall check the calibration signal from the digital ultra sonic transducer to make sure it is within operational parameters. If the ultra sonic transducer is not functioning properly the system shall automatically change to Gorman-Rupp control panel while sending an error code.

The LLU shall have an internal seven- (7) day memory storage capacitor. This shall insure that no information shall ever be lost in the event of a momentary power failure. The LLU shall have no user serviceable parts, and shall have no battery backup that may require future service. The ultra sonic transducer shall send a digital signal to the LLU in 10ths of an inch every scan. The ultra sonic transducer range shall be 0 to 100 inches of water.

The TVDs shall operate in a continuously alternating sequence and shall recognize if it has 1, 2 or 3 pumps on line.

In PID the first time the level reaches the first pump start, pump 1 shall operate and the logic control shall automatically alter the pump torque thereby allowing the pump to operate at the most efficient point of the curve. If the level continues to rise after TVD #1 is at its maximum torque setting pump 2 shall come on line. If the level continues to rise with 2 pumps running at their maximum torque setting, the LLU shall bring pump 3 on line and monitor all three pumps.

If the level continues to rise with all three (3) pumps running and it reaches the high level alarm set point, the high water alarm shall be activated and an error code shall be displayed.

All pump(s) shall operate until the level has been decreased to the Low Level Off set point programmed, at which time all pumps shall drop out, and normal pump rotation shall resume.

The next time that the level reaches the level for first pump start pump 2 shall operate, and follow the same sequence as described above. The third time that the level reaches pump start; pump 3 shall operate as described above.

In the event of an TVD(s) tripping from motor internal thermal overload, the pump shall be temporarily removed from active service and the lift station shall operate in Duplex or Simplex mode and display an error code corresponding to this condition. Once the pump has been manually reset it shall be returned to service. Returning the pump to service shall re-initiate triplex operation automatically.

In the event that a seal failure is detected from a pump(s), a “Non-Fatal” error code shall be displayed and the pump will remain in service.

The operator shall have the option of taking one (1) pump off line and operating the system as a duplex lift station without any changes in hardware or software.

4. Operation Modes

P.I.D. Operation: The lift station shall be capable of wet-well learning without software changes. The wet-well learning mode shall be capable of activation with a switch change by the operator. In this mode, the wet well shall be held at the P.I.D. Hold Point specified by the operator and shall be capable of change through the HMI. The controller shall not just follow influent flow. The internal algorithm shall predict and move the torque setting in front of flow so as to not have the TVD “Hunt”.

Emergency Mode: If the LLU does not get a proper signal from the ultra sonic transducer, the system shall automatically switch to the emergency mode, Gorman-Rupp control panel operation, and shall set an error code on the display.

When the PLC receives a proper signal from the ultra sonic transducer, the system shall automatically switch back to normal mode.

5. Alarms and Error Codes

All alarms and error codes shall be displayed through the HMI and shall be controlled through the LLU.

The HMI will show the current error and three previous errors for ease of error interpretation and troubleshooting.

Listed below are the minimum alarms and error codes

- Digital Ultra Sonic Transducer Primary Failure
- 4-20Ma Analog Signal Primary Failure
- 0-10Vdc Analog Signal Primary Failure
- High Water
- TVD 1 Trip
- TVD 2 Trip
- TVD 3 Trip
- TVD 1 Not Responding
- TVD 2 Not Responding
- TVD 3 Not Responding
- Pump 1 Seal Fail
- Pump 2 Seal Fail
- Pump 3 Seal Fail
- Pump 1 Internal Thermal Overload
- Pump 2 Internal Thermal Overload
- Pump 3 Internal Thermal Overload
- Pump 1 Running Dry
- Pump 2 Running Dry
- Pump 3 Running Dry
- Send Buffer Error
- Receive Buffer Error
- LLU RAM Error

The high water alarm shall reset itself if the condition is corrected.

All error codes whether in controller or TVD shall be given a three digit code upon display. When this code is entered into PLC it will, in English, describe the error and advice corrective action.

6. TVD Communications

All communications between the pump control panel and the TVDs will be digital via a 4 wire/2 wire RS485 link.

C. Pump Control Panel

1. General

The components of the pump control panel shall be designed to be modular, easily replaceable, and provide the maximum reliability possible. The components of the pump control panel shall provide a standardized control system for pump stations utilizing TVDs.

The control system shall communicate with the TVDs via RS-485 bus, or approved equal. The controls shall be a completely integrated solid state pump station management control system specifically designed for the municipal and industrial markets. The complete control package shall be a standard product of a single manufacturer. The management system shall continually monitor the flow of up to three (3) pumps and alter the pump(s) curve for either set point on/off or to maintain a constant level in the wet well under varying flow conditions. The pump station control panel must use less than 0.5 amps including linear compressors. It shall eliminate motor inrush at startup, allow the number of pump starts per hour to be limit-less and allow the wet well size to be reduced to the physical dimensions of the pumping equipment itself. After completion of set up, change of power supply phase shall not change pump rotation.

2. Control Panel Construction

A. Enclosure

The control equipment shall be completely housed in one (1) NEMA 4x enclosure. The enclosure shall be rated for indoor and outdoor applications. The molded fiberglass polyester must have outstanding chemical and temperature resistance and must exhibit weatherability and physical properties. The enclosure shall have a foam-in-place gasket, which shall assure a watertight and dust-tight seal. All major components shall be identified and labeled. All connection terminals shall be labeled.

B. Selector Switches

The control panel shall have no physical selector switches.

All controls (switches, settings, alarms, error codes, pilot lights, pump controls, level measurement, etc.) shall be accessed through the human machine interface.

3. Level Control

Level measurement shall be performed by an intrinsically safe pneumatically calibrated direct digital or optional analog ultra sonic transducer system. Digital ultra sonic transducer shall not be affected by electrical noise and shall not require shielded wiring. As an option, analog ultra sonic transducers that use a voltage or current signal can also be used. The digital ultra sonic transducer shall utilize two (2) linear motor compressors with a rated constant running life of a minimum of 40,000 hours each. The ultra sonic transducer shall transmit a minimum digital signal at all times to allow for the LLU to monitor proper operation thereof.

The level measurement system shall be direct inputs to the local logic unit, and shall have a routine to monitor the ultra sonic transducer and, in the event of a failure, be capable of switching to the Gorman-Rupp controller.

4. Logic Control

Local Logic Unit: The LLU (local logic unit shall) be capable of continuously monitoring up to two (2) high-speed digital pulse inputs. The logic program will be stored in non-volatile EEPROM. The LLU shall be upgradable and with the upgrade, may be expandable, via Bus communication, to 72 I/O. It shall be capable of operation in an ambient temperature range of -0 to 55 degrees C and 20 to 95% non-condensing humidity. The LLU must have surge resistance of 5kV (1.2 * 50) micro seconds, and be self-cooling.

Program Storage Module: The Panel shall include a self-contained Program Storage Module (EEPROM module). This module shall contain a copy of the program and shall give the operator the option of being able to purchase and replace the LLU from any supplier and reload the logic program for the panel. Also, this module shall allow for quick and easy upgrades, if necessary, to the logic control program.

Human Machine Interface: The HMI (human machine interface) shall allow setting and display of all system operation parameters. It shall operate at 24 Vdc.

The HMI shall allow setting of the following:

Low Level Pump Off
Normal Level Set Point

Second Pump Set Point
Third Pump Set Pump
High Level Alarm Set Point
P.I.D. Hold Point
Pump Seal Fail Logic, N/O or N/C
Pump Internal Thermal Logic, N/O or N/C
Minimum Run Torque Percentage - 1 Pump Running
Minimum Run Torque Percentage - 2 Pumps Running
Minimum Run Torque Percentage - 3 Pumps Running
Maximum Torque Below _ Hertz
Minimum Torque Percentage - All drives
Maximum Hertz- All pumps Reverse pumps on start - on/off
5 Minute off for pumps in hand position - on/off
Auto Trim or P.I.D mode
All P.I.D parameters

The HMI shall be able to display the follow:

Pump 1; Online/ Offline, On/ Off, Trip, AMPS, RPM,
Torque
Pump 2; Online/ Offline, On/ Off, Trip, AMPS, RPM,
Torque
Pump 3; Online/ Offline, On/ Off, Trip, AMPS, RPM,
Torque
Run Hours each pump
Run Hours two pumps operating
Run Hours three pumps operating
Cumulative Run Time all pumps
Bar graph station well level
Error codes & descriptions as defined in the TVD manual

Allocation for Pager System: The LLU shall have the capability to provide the following to an optional pager system. The pager system shall utilize the County's Broadband Wireless Network.

Eight (8) dry contacts (NO/NC) integrated into the management system allocated for operating an Auto-Dialer system. Integrated into the controls there shall be a two- (2) minute time delay between an alarm condition and the starting of the dialer. Delay shall be changeable via software alteration if required by the Engineer or the Owner.

The eight (8) dry contacts shall be for Non-Fatal Fault, Pump 1 Run, Pump 2 Run, Pump 3 Run, High Water Alarm, Pump 1 Failure, Pump 2 Failure and Pump 3 Failure.

D. Adjustable Torque Drives and Panels

1. Description

This specification covers AC Voltage Source PWM Type Variable Torque Inverter Drives in the power range from 56KVA to 400KVA. All drives shall be furnished by the same manufacturer.

The TVD will be powered from the pump's required voltage, three-phase, 60 HZ bus, with maximum voltage variation of $\pm 10\%$ and maximum frequency fluctuation of $\pm 2\text{HZ}$. (380V-415V/50Hz also available) The TVD shall be capable of operation on a system with 5% Total Harmonic Distortion (THD) present. The TVD output voltage will be varied proportionally to the output frequency to maintain a constant V/Hz up to the nominal 60 hertz. Above 60 hertz, the output voltage shall be constant.

The TVD shall be suitable for operating standard NEMA Design B motors. The drive shall be a minimum 6 pulse design. The design will incorporate three distinct diode bridges configured in a series connection. The series connection will provide continued balance of the bridges to insure the harmonic litigation remains consistent throughout the life of the drive. The input to the diode bridges will be a full phase shifting isolation transformer with multiple secondaries. Designs that provide parallel connected diode bridges or designs incorporating an autotransformer will not be acceptable. The variable frequency drive system shall also include a filter network and a transistorized inverter section. The TVD manufacturer will also manufacture the Transistors used in the inverter section of the drive. The output will be a sinusoidal wave, pulse width modulated (PWM) voltage wave form for reduced harmonic heating in the motor.

2. TVD Quality Assurance

The manufacturer of the TVD shall have had at least 5 years experience in furnishing similar size and type TVD systems. Upon request provide a list of installations of such systems giving size, type and date of installation. The manufacturer shall meet the quality and program requirements of ISO 9001.

The complete variable torque drive assembly shall be listed and labeled for the purpose for which it is used by Underwriters Laboratories Inc.

3. Ratings

Service Conditions

Input Power: 400-460VAC, plus 10 percent, minus 10 percent, 3 phase, 60 Hz, plus 2, minus 2 Hz.

Ambient Temperature: -10 to 40°C (14 to 104°F)

Storage Temperature: -20 to 60°C (4 to 140°F)

Relative Humidity: 0 to 95% Non-Condensing

Vibration: Acceleration at 0.6 G maximum (10-55 Hz).
Amplitude at 0.1mm maximum (50-100 Hz).

Altitude: 0 to 3300 Ft (0 to 1000 M)

The TVD power rating will be ___ KVA minimum for operation of a HP motor driving a centrifugal load with a torque versus speed characteristic proportional to the square of the speed ratio of operating speed over motor full load speed. The motor will have poles operating at approximately ___ RPM at 60 HZ and full rated load. The TVD shall be capable of operating with an output frequency speed range of 10 to 60 HZ. The operating speed range for this application will be ___ RPM to ___ RPM based on the load performance and system requirements. The drive shall be capable of 100% full load continuous output with 120% overload rating for sixty (60) seconds.

In the event of a sustained power loss, the control shall shut down safely without component failure. Upon return of utility power, the system shall be capable of automatically returning to normal operation. In the event of a momentary power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation. The drive shall be capable of starting into a rotating motor in either direction without damage to connected equipment.

Minimum drive efficiency for NEMA 1 assemblies: 95.0 percent or better at motor base speed and rated torque. Losses shall include all control power and cooling system losses associated with the drive as well as the input phase shifting transformer.

Displacement power factor: 95 percent or higher throughout the entire operating speed range, measured at drive input terminals.

Output frequency drift: No more than plus or minus 0.5 percent of maximum frequency.

Power transistors to be Insulated Gate Bipolar Transistors (IGBT's) with a PIV rating of 1200 volts minimum.

4. TVD Construction

Each drive shall be designed for stand alone operation. Multiple drive units shall not utilize shared components. The drive shall be housed in a free standing, front accessible, general purpose indoor enclosure rated NEMA 1. Cabinets shall be single or multi-bay, sheet steel with hinged doors. Doors will have concealed hinges with lockable through-the-door handle operator mechanism. Optional enclosure styles for drives rates 60HP through 400HP shall be available for NEMA TYPE 12.

Provisions shall be made for top or bottom entry/exit of incoming line power cables, outgoing load cables and control wiring.

Addition of a Bypass circuit will increase the width of the drive package.

Each TVD shall have a molded case, circuit breaker type main power disconnect switch, with an external operating handle. The circuit breaker shall have a minimum short circuit rating of 25,000 amperes RMS symmetrical interrupting capacity and shall be labeled in accordance with UL Standard 489.

5. Control Wiring

Wiring: 600 volt, stranded copper. 90 degrees C color coded insulation, minimum size No. 16 AWG (120VAC control power only).

Identification and termination: Crimp type wire lugs with sleeve type markers at each termination point. Provide numbered terminal blocks for external connections.

Control power: Provide a 120VAC, fused, control power transformer for cooling fans and external control circuits when required. All control circuits shall be isolated from power circuits.

6. Local OIS

Provide a door-mounted digital keypad/display, capable of controlling the drive and setting the drive parameters. The digital

keypad will be a 2 line backlit LCD display with 20 characters per which will normally display:

Frequency in Hertz

Control mode - manual or automatic

Real time and date.

KW

The digital keypad shall allow operators to enter exact numerical settings in English engineering units. A user menu shall be provided as a guide to parameter settings. These parameters shall be adjustable for specific project application requirements on site. All setup operations and adjustments will be digital, stored in non-volatile (EEPROM) memory. No analog or potentiometer adjustments will be allowed. The variables stored in EEPROM shall be transferable to new and spare boards. As a standard feature, these variables shall be protected from unauthorized tampering, revision, or adjustment by a personal lockout code.

The digital keypad shall have 20 keys to provide easy programming of the drive. These keys shall include:

Up and Down arrow keys to increase or decrease output frequency or data values.

Monitor key for selection of control mode.

Run and Stop keys for starting and stopping in the manual mode.

Fault clear/enter keys for quick reset of fault conditions and entry of changes.

Program key to enter the program mode and adjust parameters.

Remote/Local keys for speed control in the monitor mode.

Auto/Manual keys for run mode control in the program mode.

0 through 9 number keys to access specific parameters. These keys eliminate scrolling through many program features to find a specific value.

All keypad digital illustrations shall be in English. The display shall be capable of illustrating 50 past faults.

7. Features

An RS485 communication interface shall be installed on each TVD.

Provide the following short circuit and input protection:

High speed current limiting fuses rated 200,000 AIC, specifically designed for solid state applications.

Solid state instantaneous overcurrent trip set at 180%.

Undervoltage protection with automatic restart.

Provide the following internal protective features:

Transient surge protection using metal oxide varistors (MOV's).

Transistor overtemperature and overcurrent protection.

Current limit comparator circuit to automatically phase back the output current and frequency to prevent excessive currents from damaging motor insulation.

DC bus fuse protection.

DC bus overvoltage trip.

Provide the following output protective features.

Inverse time motor overload protection. Adjustable from 10% to 100%.

Static overspeed protection.

Stall protection on overload with inverse time overcurrent trip. Current limit shall be adjustable from 10% to 215%.

Protection against opening or shorting of motor leads.

Critical frequency avoidance circuit. Three set points selectable from 0 to maximum frequency. Band width of set points to be adjustable from 0-30HZ.

For test purposes, it shall be possible to run the drive with no load (the motor is disconnected from the drive output).

Fault protection: The following conditions shall cause an orderly TVD shutdown and lockout:

Overcurrent at startup.

Instantaneous overcurrent.

Over temperature of TVD or external fault.

Ground fault.

Blown input fuse.

Control power supply failure.

8. Factory Tests

Upon completion of manufacture and assembly, the drives shall be subjected to a complete factory test to demonstrate compliance with specified features and characteristics. The purchaser at his option shall be able to witness factory testing of his unit, with factory coordination.

The testing procedure shall be the manufacturer's standard procedure to assure maintenance free service. The buyer shall be given a 5 day notice prior to the start of factory testing for the buyer's representative to witness the testing.

All equipment, devices, instrumentation, and personnel required to perform the factory tests shall be supplied by the manufacturer. Upon satisfactory completion of the test, the seller shall upon request submit two (2) certified copies of the test report to the buyer. Component failure during testing will require repeating any test associated with the failure or modified components to demonstrate proper operation.

E. Recommended Sources for Pump Control System Components

Terminal Strips: Weidmuller Z Series.

Human Machine Interface: Monotouch HMI.

Local Logic Unit:

AT2K: Toshiba T1 (TDR116S6S) micro PLC.

Digital Ultra sonic ultra sonic transducers: BihlerTech, Inc. P40P Series.

Adjustable Speed Drives: Toshiba S11, G9, H9, or AS1 Series

F. Installations

As evidence of competence the contractor shall submit at least five (5) Maryland installations from the supplier with his bid. This list shall include names and phone numbers. If these installations cannot be verified the contractor shall be deemed as nonresponsive.

Chapter 3, Section 306

Comminutor

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	General	306-1
B.	Grinder(s)	306-1/306-4
C.	Motor Control	306-4/306-6
D.	Installation	306-6/306-7
E.	Spare Parts	307-7

VI. Comminutor

A. General

This section of the specification describes the sewage grinder(s) and motor controller(s). The equipment will be furnished and installed as shown on the plans, as recommended by the supplier, and in compliance with all OSHA, local, State, and federal codes and regulations.

Each grinder will be capable of processing pump station's design flow with a maximum headloss of 45" of water column on clean wastewater.

The in-line comminutor shall be manufactured by JWC Environmental or approved equal.

B. Grinder(s)

General

Each grinder will include cutters, spacers, shafts, bearings and seals, in-line housing with pipe flanges, inspection ports, cutter stack, and motor.

The cutter cartridge and drive assembly will be removable from the main housing as a complete assembly without further disassembly. The components of that assembly include cutters, spacers, shafts, reducer, motor, bearings, and seals.

The grinder will be two (2)-shaft design and be capable of continuous operation, processing wet or dry.

The two (2) shaft design will consist of two (2) parallel shafts alternately stacked with individual intermeshing spacers positioned on the shaft to form a helical pattern. The two (2) shaft will counter-rotate with the driven shaft operating at approximately two-thirds (2/3) the speed of the drive shaft.

Individual Cutters and Spacers

The cutting chamber will be a nominal height of 24" inches.

Individual Cutter and Spacers

Individual cutters and spacers will be 4130 heat treated surface ground for uniformity and through-hardened to a minimum 45-50 Rockwell C.

The inside configuration of both the individual cutters and the individual spacers will be hexagonal so as to fit the shaft with a total clearance not to exceed 0.018 inches across the flats to assure positive drive, minimum wear on the cutters, and increase the compressive strength of the spacers.

Cutter configuration will consist of 11T CAM 4130 STL. To maintain particle size, the height of the tooth will not exceed ½ inch above the root diameter. Cutter to root diameter will not be less than 1/16 inch or greater than ¼ inch to maintain the best possible cutting efficiency while incurring the least amount of frictional losses. Clearance between overlapping cutters of opposing shafts will be no greater than 0.011 inches.

The cutters will exert a minimum force at the tooth tip of 2,051 lbs/hp during momentary load peaks.

Shafts

Grinder drive and driven shafts will be made of 4140 heat treated hexagon steel with a tensile strength of not less than 149,000 psi.

Each hexagonal shaft will measure a nominal two (2) inches across parallel surfaces.

Intermediate Shaft Support

An intermediate shaft support will be provided in the center of the cutter stack for all grinders with 24 inch cutter stack.

The intermediate shaft support will provide additional support for heavier than normal influent demand loads and protection for the seal assemblies.

The intermediate shaft support will be made of cast 303 stainless steel collar and two (2) bushings. The bushings will act as bearing to allow the free rotation of the shafts.

Main Housing and Cover

The main housing will be a solid cast structure made of A536-84 ductile iron. The one (1)-piece flanges body will be capable of remaining in-line if removal of cutter cartridge and drive assembly is required for service.

The inside profile of the main will be concave to follow the radial arc of the cutters. To direct larger particles toward the cutters and assure fineness of grind, the main housing will maintain a clearance not to exceed 5/16 inch between the major diameter of the cutter and the concave area of the housing.

The main housing will be provided with a cover access port for equipment inspection. Inspection port covers will be A536-84 ductile iron.

Shaft Bearings and Seals

The radial and axial loads of the cutter shaft will be borne by seals, oversized, deep-groove ball bearings at each end.

The bearings will be protected by a combination of a replaceable and independent tortuous path device and mechanical seals.

Face material will be tungsten carbide to tungsten carbide.

O-rings will be made of BUNA-N elastomers.

The mechanical seal will be rated at 90 psi continuous duty by the seal supplier.

The bearing will be housed in a replaceable cartridge that supports and aligns the bearings and seals, as well as protects the shaft and end housing. The seal elements will be independent of the stack height, therefore cutter stack tightness will not affect seal performance. The seal elements will maintain their factory set preload independent of the cutter stack tightness.

Seals will meet required pressure rating regardless of cutter stack fit. The seal cartridge will provide seal protection against axial loading on shafts and bearings during shaft deflection.

Each seal element will be positively locked to its corresponding rotating or static cartridge element. This positive lock on the seal elements is critical to long seal life in applications where grit or other abrasive materials are present.

Gear Housing and Cover

The gear housing will be provided with a covered access port for cutter stack tightening.

The gear housing will be A536-84 ductile iron.

The cutter stack tightening cover will be A36 Carbon steel.

Reducer

The speed reducer will be grease-filled planetary-type of reducer with 50% shock load capacity. The reduction ratio will be 29:1.

The input shaft of the reducer will be directly coupled to the motor using three (3)- piece coupling, and the output shaft of the reducer will be directly coupled with the grinder using a two (2)-piece coupling.

Motor

The motor will be a 5HP, TEFC, 1725 rpm, 480V, 3PH, 60HZ.

Required Running Torque per Horsepower (kW):

At Momentary Load Peaks: 4,756 in-lbs/hp.

C. Motor Control

General

The controller will provide independent control of the grinder.

Controller will be the supplier's standard UL/cUL listed Model.

The Controller will be rated for 5HP, 480V, 3PH, 60HZ.

Operations

The controller will be equipped with an ON-OFF/RESET-REMOTE three (3) position selector switch.

In the ON position the grinder will run.

In the OFF/RESET position the grinder will not run.

In the REMOTE position the grinder will start and stop as controlled by a remotely-located dry contact.

The grinder will only be reset by switching the ON-OFF/RESET-REMOTE selector switch to the OFF/RESET position.

Enclosure

Enclosure will be NEMA 4X, fabricated of fiberglass-reinforced polyester resins, and will be suitable for wall mounting. Door will have hinges and corrosion-resistant latches.

Enclosure will house the control device, terminal blocks and reversing motor starter.

Control Devices

Pilot devices will be mounted on the enclosure front panel door.

The controller will have indicator lights for POWER ON, RUN, and FAIL SEE O&M MANUAL.

Indicator lights will be LED type pilot lights. Lights and the selector switch will be heavy duty NEMA 4X type.

Control transformer will be protected by two (2) primary fuses and one (1) secondary fuse. The 120 volt secondary will have one (1) leg ground.

Contacts will be included for grinder RUN and FAIL signal output. The contacts will be rated for two (2) amperes.

Motor Starter

Starter will be full-voltage reversing type with 120 volt operating coils.

Forward and reverse contactors on the starters will have both mechanical and electrical interlocks.

Overload relays (OL) will be adjusted so that the range selected includes the FLA (full load amperes) rating and service factor.

Safety Features

When the grinder jam condition occurs in the grinder ON or REMOTE mode, the controller will stop the grinder and then reverse the grinder rotation to clear the obstruction. If the jam is cleared, the controller will return the grinder to normal operations. Up to two (2) additional reverse cycles (3 times total) may occur within 30 seconds before the controller de-energizes the grinder motor and activates the grinder fail indicator and fail contact.

If a power failure occurs while the grinder is running, operation will resume when power is restored.

If a power failure occurs while the grinder is in fail condition the fail indicator will reactivate when power is restored.

The controller will provide overload protection for the motor through an overload relay mounted directly on the grinder starter.

Short-circuit protection requires that a properly-sized circuit breaker be installed by others.

Controller reset will be from the local controls only.

D. Installation

The comminutor shall be installed in accordance to the manufactures requirements and per Department's standard detail.

The comminutor shall be an in-line model and shall installed within a 60" diameter manhole. The manhole shall have a sloping floor that direct water to a 4" deep sump pit. A sump pump shall also be located within the manhole and shall discharge directly into the wetwell under the top slab. The sump pump discharge line shall have a check valve and a quick disconnect installed on the line.

A sensor shall also be installed in the manhole that is connected to the alarm system. In the event that water trip the sensor, an alarm will be sent out by the Bihlertech controller.

A by-pass will need to be installed around the comminutor so that the comminutor can be removed from service without requiring by-pass pumping.

E. Spare Parts

The Comminutor shall be furnished with the following minimum spare parts:

1. One complete set of cutting teeth
2. One comb
3. One tooth puller
4. One dowel bar extractor
5. One complete set of cap screws, nuts, and dowels
6. Two copies of installation instruction
7. Two copies of operation manuals

Chapter 3, Section 307

Wastewater Pumping Station Design

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE/PAGES</u>
A.	Hydraulic Computations	307-1/307-3
B.	Site Design	307-3/307-7
C.	Wet Well Design	307-7/307-8
D.	Wet Well Aeration System	307-9/307-10

VII. Wastewater Pumping Station Design

A. Hydraulic Computations

1. Design Flow Rate:

Wastewater pumping stations must satisfy the design flow rate. The design flow rate is the peak flow rate for the service area plus the I/I allowance. The design of wastewater pumping stations shall consider existing and projected peak flow rates and wastewater composition. Wastewater pumping stations shall be designed to pump the peak flow for existing and future users plus the I/I allowance. In developed areas, population shall be determined by house count and non-domestic user inventory with allowances made for remaining undeveloped tributary areas. Population densities and per capita flows shall be as established by Facility Plans or in their absence, in agreement with the Master Plan or as instructed by the Department. Institutional, commercial and industrial flows shall be determined by a study of the establishment. The Department shall be consulted for future domestic and non-domestic land use and population densities. Flow rate computations shall follow guidance from MDE's Design Guidelines for Sewage Facilities. A drainage area map and tabulation of the design flow shall appear on the plans. The map and tabulations shall show initial and ultimate drainage areas and wastewater flows.

2. Planning Period:

Wastewater pumping station design flow rates shall, at minimum, accommodate a 20-year planning horizon. For all pumping stations, consideration shall be given to future upgrading flexibility necessary to accommodate flows beyond the normal planning horizon. This is especially important for larger stations.

3. Wastewater Composition:

Wastewater composition can vary widely depending upon the proportion of design flow generated by non-domestic users. Non-domestic user wastewater composition shall be investigated. Adequate consideration and all necessary provisions shall be taken to ensure that wastewater pumping station equipment and materials are suitable for the anticipated composition of the wastewater. Consultation with the Department is required in the event that the wastewater composition affects standard material and equipment requirements.

4. Number of Pumps:

Wastewater pumping stations shall be capable of pumping the design flow rate with the largest single pump out of service.

5. Hydraulic Analysis:

Wastewater pumping stations must satisfy the hydraulic conditions of the system. The Designer shall perform a complete hydraulic analysis of each wastewater pumping station. The hydraulic analysis shall consider potential impacts on existing force mains, gravity sewers and pumping stations when the new pumping station is added to the system. Department will determine the design requirements and analyses that must be performed in conjunction with the pumping station design. A hydraulic model will be required if the proposed pump station and force main connect to an existing force main. The modeling software shall be Bentley's SewerCad and the model shall be provided to the Department on CD and shall become the property of the Department. Wastewater pumping stations shall be designed to operate at the appropriate discharge head and flow rate.

6. Pump and System Curves:

System curve (Head vs. Flow) characteristics shall be determined by the Hazen-Williams formula for piping head loss. The pump/system curve shall be shown on the plans to scale. The pump/system curve shall show the following information at a minimum:

Static Head

Pipe Friction Losses

Pump Curve

Pump Horsepower, Efficiency and RPM

Pump / system curves shall be shown for single pump operation, as well as for multiple pump operation in stations having two or more pumps.

7. Water Hammer:

The potential impact of water hammer shall be evaluated. If the combined effects of static head and water hammer do not exceed the weakest piping system component working pressure by a safety factor of 1.1, no special provisions need to be included to control water hammer. Where the maximum water hammer pressure exceeds the weakest piping system component working pressure

by a safety factor of 1.1, strengthen those elements affected, reevaluate pipe size and velocities or select an appropriate device to control water hammer. Hydraulically operated, time adjustable, pump check service valves and spring type, oil-cushioned elbow hydraulic surge relief valves at a minimum are the preferred choices of the Department. No pressure vessel/surge tank type devices will be acceptable. The decision to strengthen piping system components instead of utilizing a water hammer control device or different pipe size shall be based upon a life cycle cost economic comparison and shall be approved by the Department.

8. Pump Selection Criteria:

Provide proper wet well design and suction line design per Hydraulic Institute Standards to avoid cavitation. The Designer shall perform a net positive suction head available (NPSHA) analysis and include this information in the pump specification.

The NPSHA shall be calculated for the expected design flows and shall exceed the pump manufacturer's requirements by an added margin of safety of not less than five (5) feet. Pumps shall be selected to have their maximum efficiency at the operating point. Under no circumstances shall a pump be specified to operate outside of its published recommended range. Examples would be pumps operating at very low flows and high heads, near shutoff heads, or "runout" conditions (maximum possible flow rate of the pump). These conditions can result in excessive hydraulic loading or cavitation damage to impellers, casings and shafts, rapid bearing and mechanical seal wear, and high vibration. The Designer shall avoid the selection of pumps whose curves are flat (i.e. small changes in head resulting in large changes in flow rate).

B. Site Design

1. Location:

Wastewater pumping stations shall be located as far as possible from populated areas. Natural screening and remoteness of the site shall be primary elements of site selection wherever possible. Where pump stations are sited in proximity to developed areas, the architecture of the station shall be compatible with the surrounding area. Predominant wind direction for potential odor dispersion and building aspects such as generator exhaust and ventilation fan noises shall be considered. Similarly, building setbacks shall be considered to provide minimal impact to neighboring properties.

2. Land Acquisition:

Land required for pumping stations, including necessary vehicular access routes to an existing or proposed public roadway shall be owned in fee simple by Washington County. As part of this process, a boundary survey of the property is required together with a record plat and a metes and bounds description of the parcel. In determining the space requirements for the facility, particular attention shall be given to the width provided for the access road to ensure adequate space for grading and drainage within the access road right-of-way.

3. Site Plan:

The site design and location must conform to applicable portions of the Division of Permitting and Plan Review requirements for site development plans. Wherever possible, land acquisition shall provide generous space around the building to permit landscaping to minimize the impact of the station on the neighborhood. All plans applicable to the site (site and grading, landscaping, sediment control, etc.) shall be prepared on a scale of 1"=20' and shall meet all requirements of the Division of Permitting and Plan Review. The location of all proposed facilities required for the pumping station site shall be clear and concise to permit complete field stakeout from plan information. A stake out table listing all components of the proposed facility along with their corresponding survey coordinate locations shall be provided on the plans. As an alternative to using coordinates to stake out the pumping station, the location of proposed facilities may be projected from a base line established from the traverse shown on the plan. The base line shall be located so that it will not be interrupted by the proposed construction. The location of proposed facilities shall not be referenced from other proposed facilities for stakeout purposes.

4. Topography:

Sewers tributary to wastewater pumping stations commonly dominate site selection. Adjacent drainage areas potentially served by the wastewater pumping station must also be considered. Wastewater pumping station site selection shall also be compatible with suitable site access, and soil capability with respect to land grading in conjunction with site development. Existing contours and other topography shall be shown for the entire site including a 100-foot minimum width outside of the proposed property boundary. Contour interval shall be one-foot, unless otherwise approved by the Department.

5. Floodplain:

Wastewater pumping stations shall be sited to remain operational and permit access during a 100-year return frequency flood. The pumping station top slab elevation shall be set a minimum of two-feet above the 100-year floodplain elevation. The access road shall be above the 10-year return flood level elevation with a maximum inundation of 6" during the 100-year storm.

6. Wetlands:

Avoid direct impacts wherever possible and minimize impacts to wetland buffer areas. Buffer areas include the first 25 feet beyond non-tidal wetlands.

7. Grading:

Wastewater pumping station grades for paved areas shall prevent local ponding, provide positive drainage away from structures and generally be limited to no greater than 4 percent slopes. Stone surfaces around paved areas shall provide proper site drainage at slopes 10 percent or less. Land grading outside of the wastewater pump station perimeter fence shall not exceed 3 to 1 slopes; 4 to 1 slope maximums are desirable. Lesser slopes wherever possible are preferred. Site grading design shall be compatible with slope stability for the soils encountered. Slope stabilization shall be appropriate for the degree of slope and soil conditions. The use of retaining walls on or adjacent to the wastewater pumping station site is not permitted.

8. Sediment Control:

A sediment control plan shall be provided in accordance with the Subdivision Regulations. Design requirements for sediment control devices shall be as described in MDE's 1994 Maryland Standards and Specification for Soil Erosion and Sediment Control manual or latest addition.

9. Soil Boring:

At least two test borings shall be taken at the building location to determine soil types, rock, water table elevations, soil bearing values, etc. When in soil, standard penetration tests shall be taken at intervals not to exceed five (5) feet. When in rock, the rock shall be cored with a double tubed core barrel sized NWX and length of

the core shall be taken to a depth of not less than fifteen (15) feet below the bottom of the proposed structure. Borings shall be taken deeper as necessary, depending on soil conditions.

10. Landscaping:

Landscaping must meet all Departments of Planning requirements. All wastewater pumping station sites shall be screened as appropriate from surrounding development. A 4-foot wide planting bed shall be placed outside of the fence line, for planting shrubs to screen the site. Shrubs shall consist of various types and shall be selected based on maximum height, foliage thickness, compatibility with existing surrounding foliage and required maintenance. Where extensive clearing is involved during construction, or where otherwise applicable for aesthetic purposes, new trees shall be planted. A landscaping plan shall be prepared showing planting arrangement of shrubs and trees, identifying each by both genetic names as well as common names, and specifying size and planting information. Landscaping materials should be aesthetically pleasing and require minimal maintenance (watering, fertilizing, trimming, etc.). The entire area to be landscaped shall have the topsoil removed, weed guard placed over the entire area, and 4" of mulch placed on top the weed guard.

11. Site Security:

Pumping station sites shall be fenced with galvanized chainlink fencing, black vinyl coated post and black hardware, and a 12-foot wide double leaf locking gate for vehicle access. Where the entrance gate is more than 100 feet from the public roadway, a second gate shall be provided at the driveway entrance to the station access road. Additional property line fencing may be required as determined by the Department. The pumping station building shall have exterior lighting controlled by motion detectors. Pumping station doors shall be bulletproof steel with locks keyed as specified by the Department. The entire area located within the security fence shall be paved per Standard Detail SW-8.1.

12. Paving:

Pumping station sites shall have a paved access road and a minimum of two parking spaces along with the entire area within the security fence. The access road shall have sufficient room and turn-around area so as to allow access to the wet well by maintenance and vacuum trucks. The turning area in a pumping

station site shall have a minimum turning radius of 48 feet. Paving shall conform to Standard Details SW-8.1. Pumping station access roads shall be used exclusively for pumping station maintenance and access.

13. Exterior Lighting:

The need for and quantity of exterior lighting shall be determined on a case-by-case basis. Once the need is determined, the exterior lighting and layout shall be designed by an Electrical Engineer.

14. Station Sign:

A permanent sign shall be provided at each pumping station stating the station name, street address and emergency telephone number.

15. Stormwater Structures:

Pumping stations shall not be located downstream of any stormwater management facility.

C. Wet Well Design:

Wet wells shall be considered a hazardous environment, classified as NEC Class I, Division I for explosive gases. Wet wells shall be designed and constructed to be as hazard free as possible, and corrosion-resistant materials shall be used throughout. All materials and equipment used in wet wells shall meet NEC Class I, Division I standards, with the exception of control floats. Conduits between the junction box and control building shall be sealed at the junction box with explosion-proof seals. Conduits carrying float cables between the junction box and the wet well shall be sealed with explosion-proof seals.

1. Structure:

Wastewater pumping station wet wells shall be constructed of reinforced concrete. Wastewater pumping station wet wells shall have poured-in-place or cast-in-place, reinforced concrete base slabs, riser sections/walls and top slabs. Wet wells shall have an Agru Sure Grip system applied to the interior (except wetwell floor slab) and elastomeric membrane waterproofing applied to the exterior along with protective boarding. The bottom of the wet well shall be grouted to a minimum slope of 45 degrees toward the pump suction inlet. Wet wells shall be adequately designed to

prevent flotation. The wet well size and depth shall be as required to accommodate the influent sewer, as well as pump suction submergence as recommended by Hydraulic Institute Standards. The required working volume and preferred intervals between influent sewer and control elevations shall be determined as follows:

Wet wells shall be designed for a minimum pump cycle time of 10 minutes as defined by the following formula:

$$T = 4V/Q$$

where:

T = Pump Cycle Time (time between pump starts) in minutes

V = Volume of wet well between the lead pump start and pump stop elevations, in gallons

Q = Pump rate of the lead pump, in gallons per minute

The detention period for wastewater in the wet well shall not exceed 30 minutes at the average flow rate for the initial, intermediate and ultimate design years. When initial average flows are insufficient to actuate the pumps within a 30-minute period, temporary removable appurtenances shall be placed in the wet well or the liquid level control points for pump start shall be lowered.

2. Access:

Wet well access shall be through a top slab opening with aluminum hatch cover and frame. The top slab access hatch shall be 36-inch by 36-inch minimum size and as large as necessary to allow removal of equipment from the wet well.

3. Ventilation:

Wet wells shall be provided with a separate ventilation system and shall be sized to provide a minimum of 30 complete air changes per hour. In addition to manual control, time clock operation of fans shall be provided to allow a minimum of two (2) complete air changes per hour.

Ventilation shall be accomplished by the introduction of fresh air into the wet well under positive pressure. The fan shall be installed outdoors. The fan assembly and housing shall be corrosion-resistant and weatherproofed. The entrance hatch to the wet well shall be provided with a limit switch to energize the fan whenever the hatch is open. The fan shall be direct drive.

D. Wet Well Aeration System:

1. General:

A wet well aeration system including control panel shall be installed at the pump station, and with air discharge piping in the wet well as shown on the standard details. Aeration system shall be an Envirep Model 110S1C or approved equal.

The specification listed below are for a wet well that measure between six (6) and 10 (ten) feet in diameter. If a larger wet well is required, the engineer will have to determine if a larger wet well aeration system is required.

2. Aeration Blower Assembly:

a. The aerator shall be capable of producing sustained aeration and sufficient agitation to mitigate formation of grease build-up. The aerator shall be suitable to operate with discharge piping submerged at a depth of at least four feet. The aerator shall produce continuous, non-pulsating, oil-free air. Inlet and outlet ports shall be a minimum of 1-1/2 inch FNPT.

b. The aeration blower shall be rated for continuous duty at a maximum speed of 3,450 rpm and operate at a maximum ambient temperature of 104 degrees f. The motor shall be 1.0 hp, 3 phase, 480 volt, 60 Hz with TEFC enclosure and Class B insulation.

c. The following accessories shall be installed with the wet well aeration system:

1. (1) Gauge kit – including independent, full-range indication of aeration blower inlet and outlet conditions. Total pressure across the aeration blower shall be the difference of the gauge indications.
2. (1) Filter kit with replaceable filter element and shall be designed to protect the aerator from pre-mature wear.
3. (1) Spare filter
4. (1) Check valve
5. (1) Discharge ball valve
6. (1) Relief valve of adequate capacity to provide system protection
7. (1) Flexible mounting system
8. (1) Inlet muffler/silencer

- d. A set of dry contacts shall be provided in the pump control panel to interface with the aeration system to insure coordination between systems.
 - e. The discharge piping for the aeration blower shall be installed as shown on the plan sheets. Discharge piping to the wet well shall be minimum 2-inch diameter.
 - f. Aeration blower, inlet filter, relief valve, gauges, muffler, ball valve and check valve shall be mounted on an aluminum base using no less than seven flexible vibration isolation mounts. All piping shall be schedule 40 galvanized pipe and shall be pre-assembled on an aluminum base.
 - g. The aeration blower assembly shall be installed inside the pump building. The air intake line shall be vented to the outside of the building and the intake shall be installed at height above the snow line.
3. Wet Well Aeration System Control Panel:
- a. NEMA 4X wall mounted panel. Dimensions: 16" wide x 24" tall x 8" deep.
 - b. Main connections to accept 3/60/230/460
 - c. Motor starter, FVNR (across the line), NEMA rated.
 - d. Provide timer and repetitive cycle interval circuit, operator-selectable timing, operational mode selection device, and pump control panel interface. In the "Automatic" mode, the aerator shall operate in a coordinated manner with the sewage pumping system.
 - e. HOA switch
 - f. Control interface for use with pump control panel.
 - g. Control transformer, 120 volt secondary for control circuit.

Standard Detail Drawings & Forms

For Construction of Water and Wastewater Facilities

Drawing
Number

Title

Trenching

SW-1.1 Standard Trench Width & Stone Bedding
SW-1.2 Concrete Cradle and Encasement
SW-1.3 Trench Details – Parallel Lines

Manholes

S-2.1 Standard Through Manhole Precast Base
SW-2.2 Flat Top Manhole Section Precast Manhole
S-2.3 Standard Precast Flat Top Monitoring Manhole
S-2.4 Typical Bench & Flow Channel Section Precast Base
S-2.5 Plans of Flow Channels (Typical)
SW-2.6 Standard Manhole Frame & Cover
SW-2.7 Standard Water Tight Manhole Frame & Cover
SW-2.8 Non-Traffic Bearing Manhole Frame & Cover
SW-2.9 Standard Manhole Steps
SW-2.10 Manhole Pipe Connections
SW-2.11 60" Dia. Precast Concrete Manhole
S-2.12 Reliner Inside Drop Installation with Manhole Details
SW-2.13 HDPE Adjustable grade Ring

Gravity Service Connection

S-3.1 Conventional Gravity Sewer Lateral
S-3.2 Alternative Gravity Sewer Lateral

Low Pressure Service Connection

S-4.1 Typical Grinder Pump Arrangement

Grinder Pump Detail

S-5.1 Grinder Pump Basin Installation
S-5.2 Grinder Pump Anti-Floatation Concrete Base
S-5.3 Traffic Bearing Access Structure

Comminutor Details

S-6.1 Comminutor Profile View
S-6.2 Comminutor Plan View

Valves

SW-7.1	Valve & Box Installation
S-7.2A	Sewage Air Release Manhole Working Pressure Less Than or Equal to 100 PSI
S-7.2B	Sewage Air Release & Flushing Connection Manhole Working Pressure Less Than 100 or Equal to 100 PSI
S-7.3	Low Pressure Sewer Flushing Connection
S-7.4	Force Main Flushing Connection

Section 8 Future Detail

Casing

SW-9.1	Steel Pipe Encasement for Water & Sewer
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Water Details

W-10.1	Service Connection Typical Trench Detail
W-10.2	Water Meter Location
W-10.3	Metered Domestic Service Installation
W-10.4	Metered Domestic Service Twin Setting
W-10.5	Metered Domestic Service with PRV
W-10.6	Typical Hydrant Setting
W-10.7	2" Blow Off Assembly
W-10.8	Air Release and Vacuum Valve Pit Plan
W-10.9	Air Release and Vacuum Valve Pit Section 1-1
W-10.10	PRV Assembly Vault Plan View
W-10.11	PRV Assembly and Vault Section A-A
W-10.12	PRV Assembly and Vault Section B-B
W-10.13	Tapping Sleeve and Valve
W-10.14	Repair of Existing Water Mains
W-10.15	Typical Meter Vault (2" Meters & Larger)
W-10.16	Reference Sheet for Pressure Pipe
W-10.17	Service Connection Construction Report

Section 11 Future Details

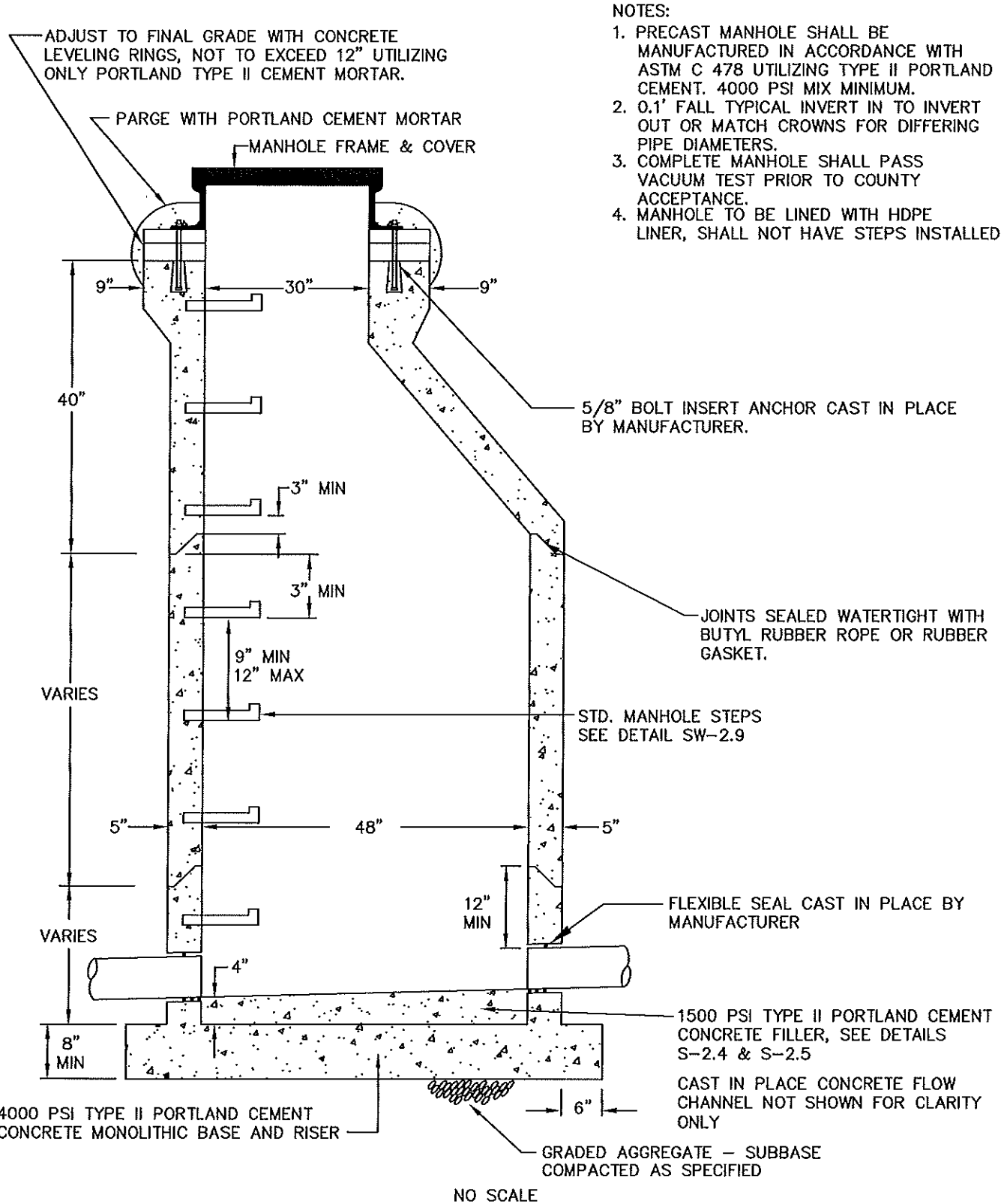
Field Data Forms

SW-12.1	Shop Drawing Cover Sheet
SW-12.2	Pre-Approved Products/Materials
S-12.3	Cut Sheet for Gravity Sewer
S-12.4	Reference Sheet for Pressure Pipe
SW-12.5	Vacuum Test Report for Manhole and Septic Tanks
S-12.6	Low Pressure Air test of Sanitary Sewer
S-12.7	Hydrostatic & Leakage Test
S-12.8	Pressure Test System

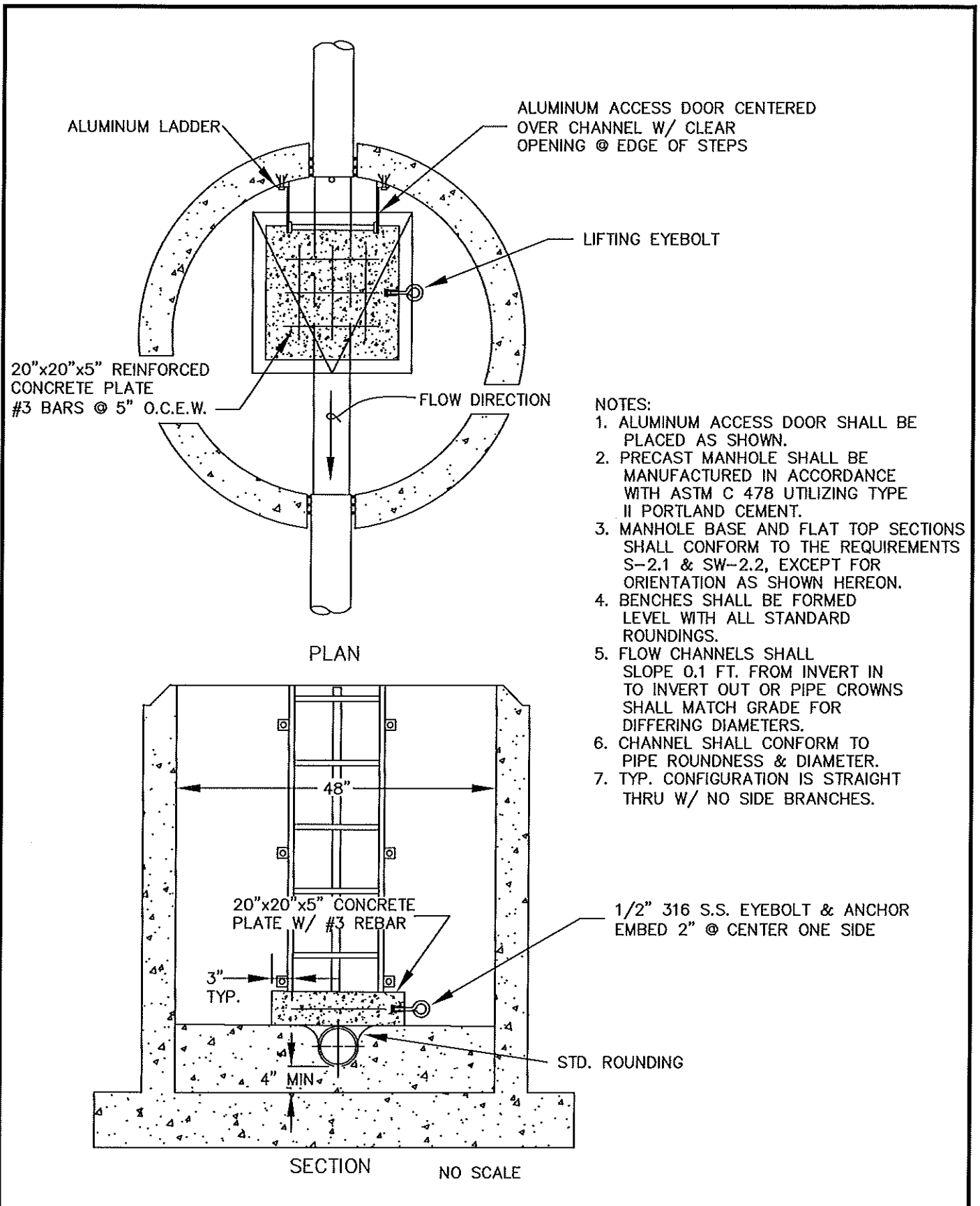
S-12.9 Concrete Test Data
S-12.10 Construction Inspection Report
S-12.11 Collections Division Draw Down Test

Service Connection Forms

S-13.1 Gravity Sewer Service Location Sheet
S-13.2 Gravity Sewer Service Connection Sheet
S-13.3 Modified Service Lateral Gravity Sewer
S-13.4 Low Pressure Sewer Service Location Worksheet
S-13.5 Low Pressure Sewer Service Connection Sheet
S-13.6 Sewer Service Electrical Connection Sheet
S-13.7 On-Site Sewage Disposal Sketch Plan

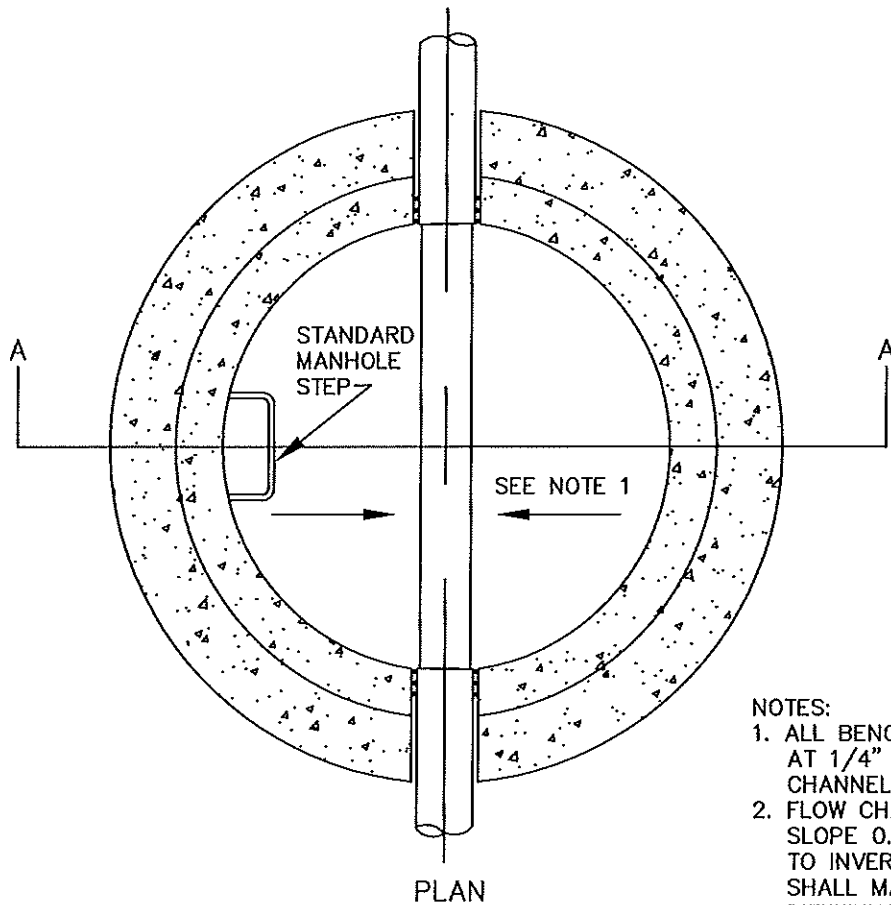


<p>REVISÉ</p> <p>REVISÉ</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie A. Pepper</i></p> <p>Director of Environmental Management</p>	<p>Standard Through Manhole Precast Base</p>	<p>Detail</p> <p>S-2.1</p>
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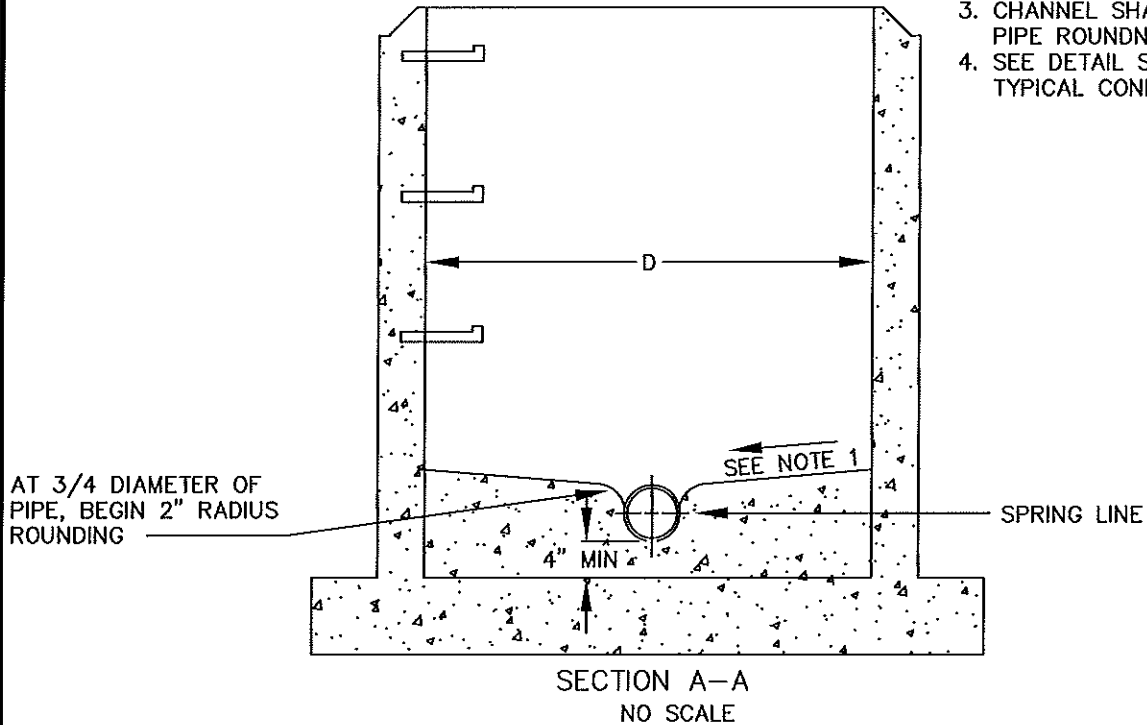
- NOTES:
1. ALUMINUM ACCESS DOOR SHALL BE PLACED AS SHOWN.
 2. PRECAST MANHOLE SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 UTILIZING TYPE II PORTLAND CEMENT.
 3. MANHOLE BASE AND FLAT TOP SECTIONS SHALL CONFORM TO THE REQUIREMENTS S-2.1 & SW-2.2, EXCEPT FOR ORIENTATION AS SHOWN HEREON.
 4. BENCHES SHALL BE FORMED LEVEL WITH ALL STANDARD ROUNDINGS.
 5. FLOW CHANNELS SHALL SLOPE 0.1 FT. FROM INVERT IN TO INVERT OUT OR PIPE CROWNS SHALL MATCH GRADE FOR DIFFERING DIAMETERS.
 6. CHANNEL SHALL CONFORM TO PIPE ROUNDNESS & DIAMETER.
 7. TYP. CONFIGURATION IS STRAIGHT THRU W/ NO SIDE BRANCHES.

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Pippa</i> Director of Environmental Management	Standard Precast Flat Top Monitoring Manhole	Detail S-2.3
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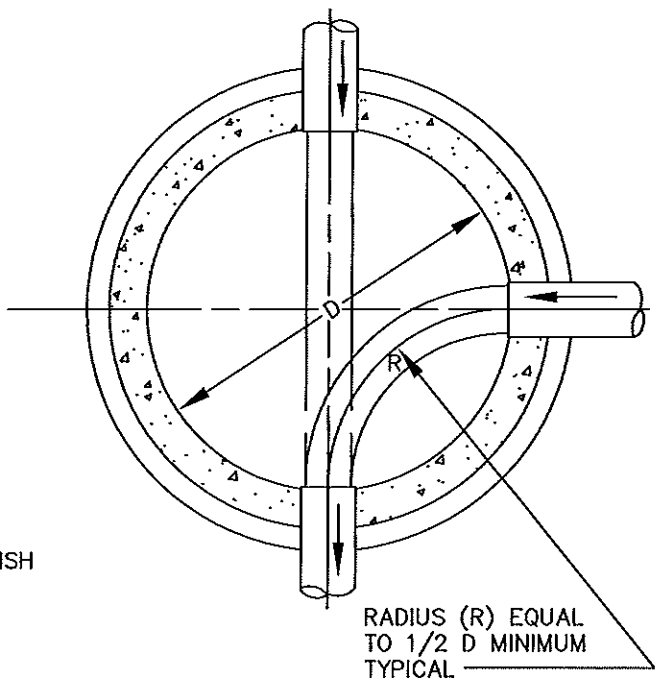
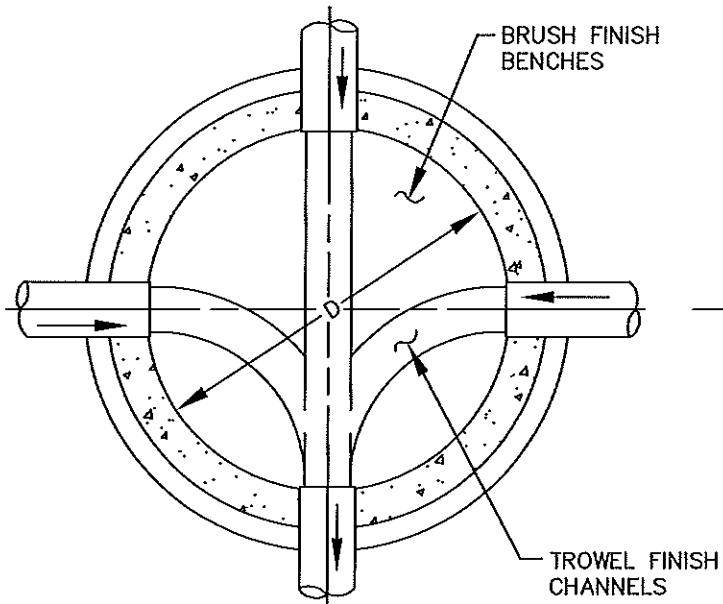
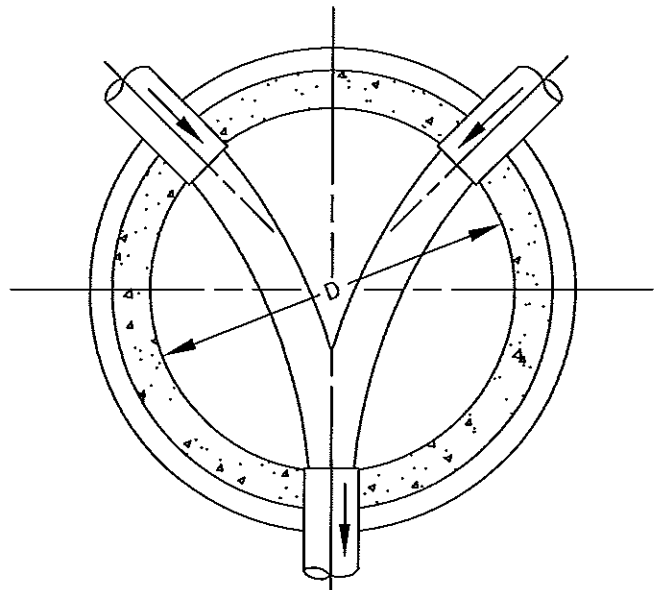
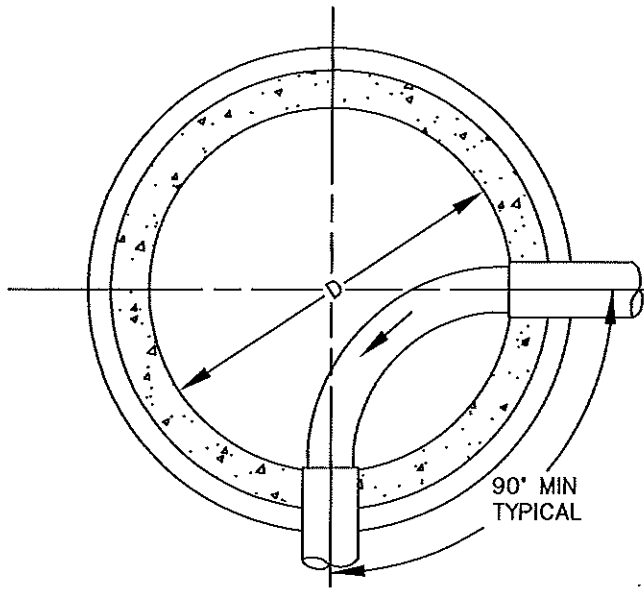


NOTES:

1. ALL BENCHES SHALL SLOPE AT 1/4" /FT. TOWARD FLOW CHANNEL.
2. FLOW CHANNELS SHALL SLOPE 0.1 FT. FROM INVERT IN TO INVERT OUT OR PIPE CROWNS SHALL MATCH GRADE FOR DIFFERING DIAMETERS.
3. CHANNEL SHALL CONFORM TO PIPE ROUNDNESS & DIAMETER.
4. SEE DETAIL S-2.5 FOR TYPICAL CONFIGURATIONS.



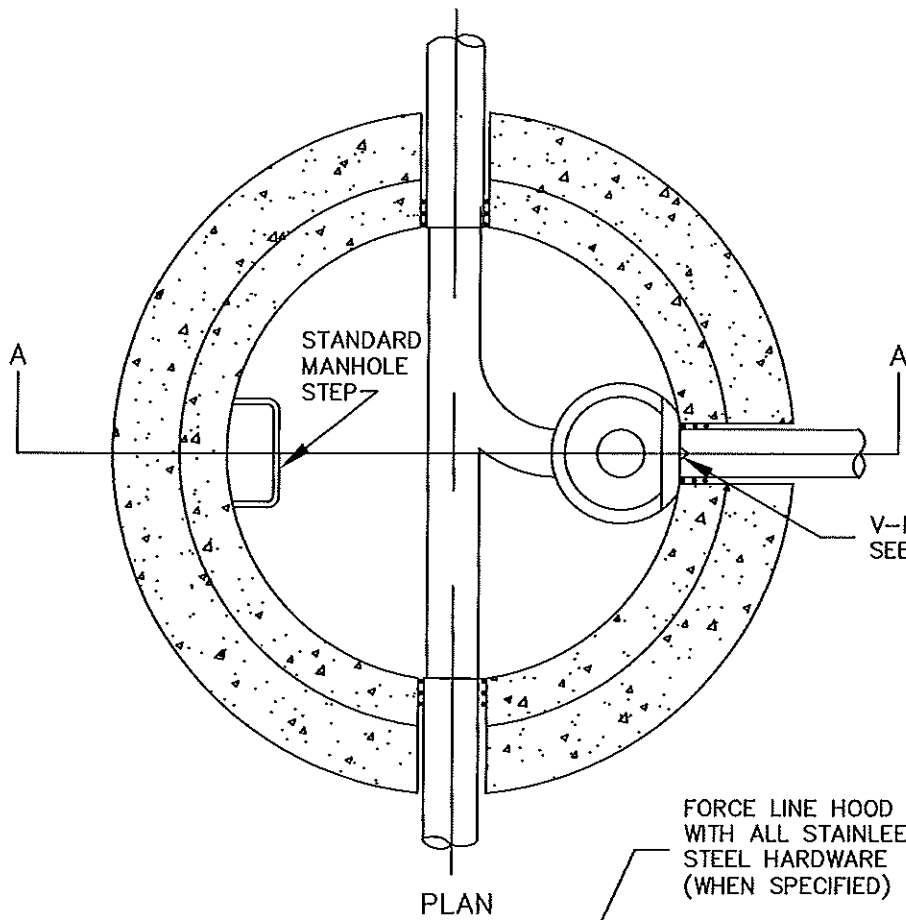
REVISED <hr/> REVISED <hr/> APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julie A. Poppel</i> Director of Environmental Management	Typical Bench and Flow Channel Section Precast Base	Detail S-2.4
--	---	--	----------------------------



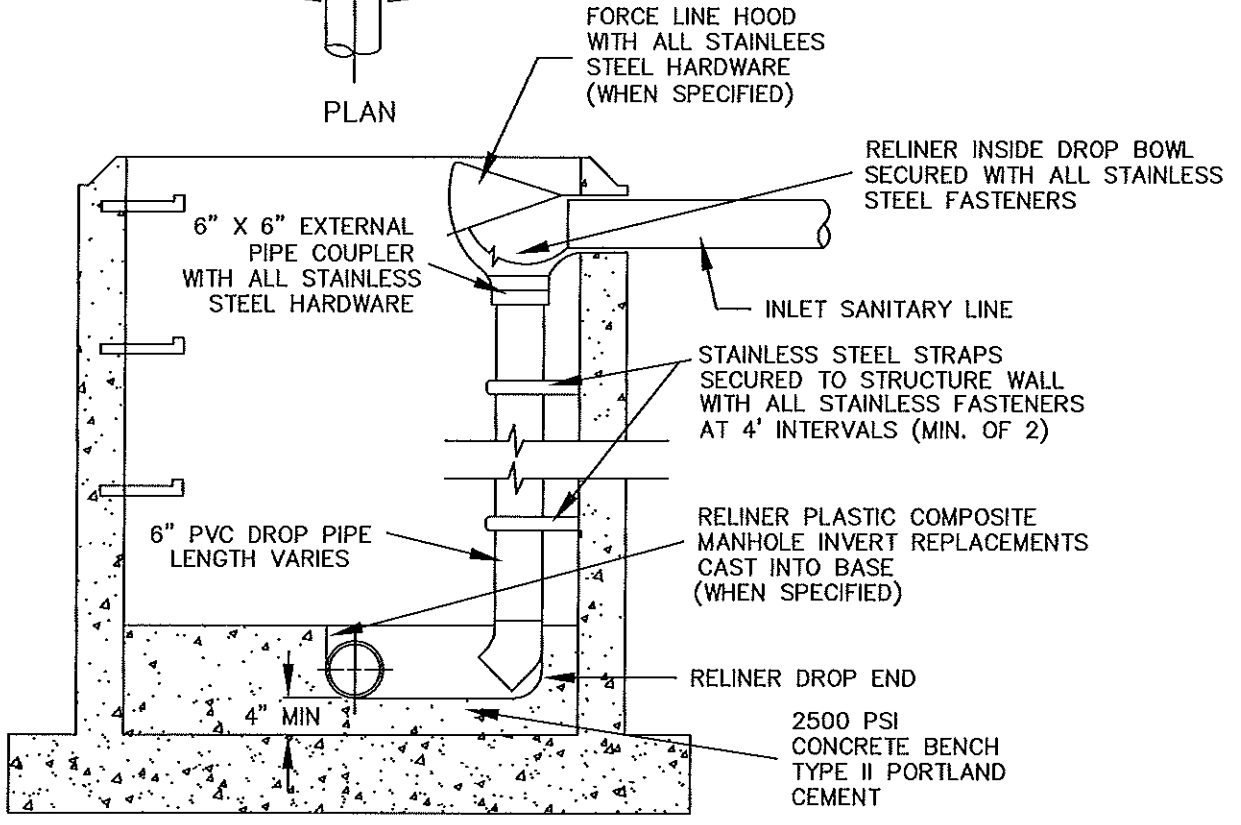
EVENLY TAPER CHANNEL WIDTHS FROM INVERT IN TO INVERT OUT FOR DIFFERING PIPE DIAMETERS.

NO SCALE

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie A. Poppel</i></p> <p>Director of Environmental Management</p>	<p>Plans of Flow Channels (Typical)</p>	<p>Detail</p> <p>S-2.5</p>
---	---	---	----------------------------



- NOTES:
1. CORED IN PLACE DROP CONNECTION SHALL UTILIZE KOR-N-SEAL I-WEDGE S-106 SERIES KORBAND FLEXIBLE PIPE TO MANHOLE CONNECTOR OR APPROVED EQUAL, WITH ALL S.S. HARDWARE.
 2. INFLUENT LINE SHALL BE "V" CUT @ FLOW LINE & SMOOTH EDGED TO CONCENTRATE FLOW TO DROP BOWL/ DROP PIPE.



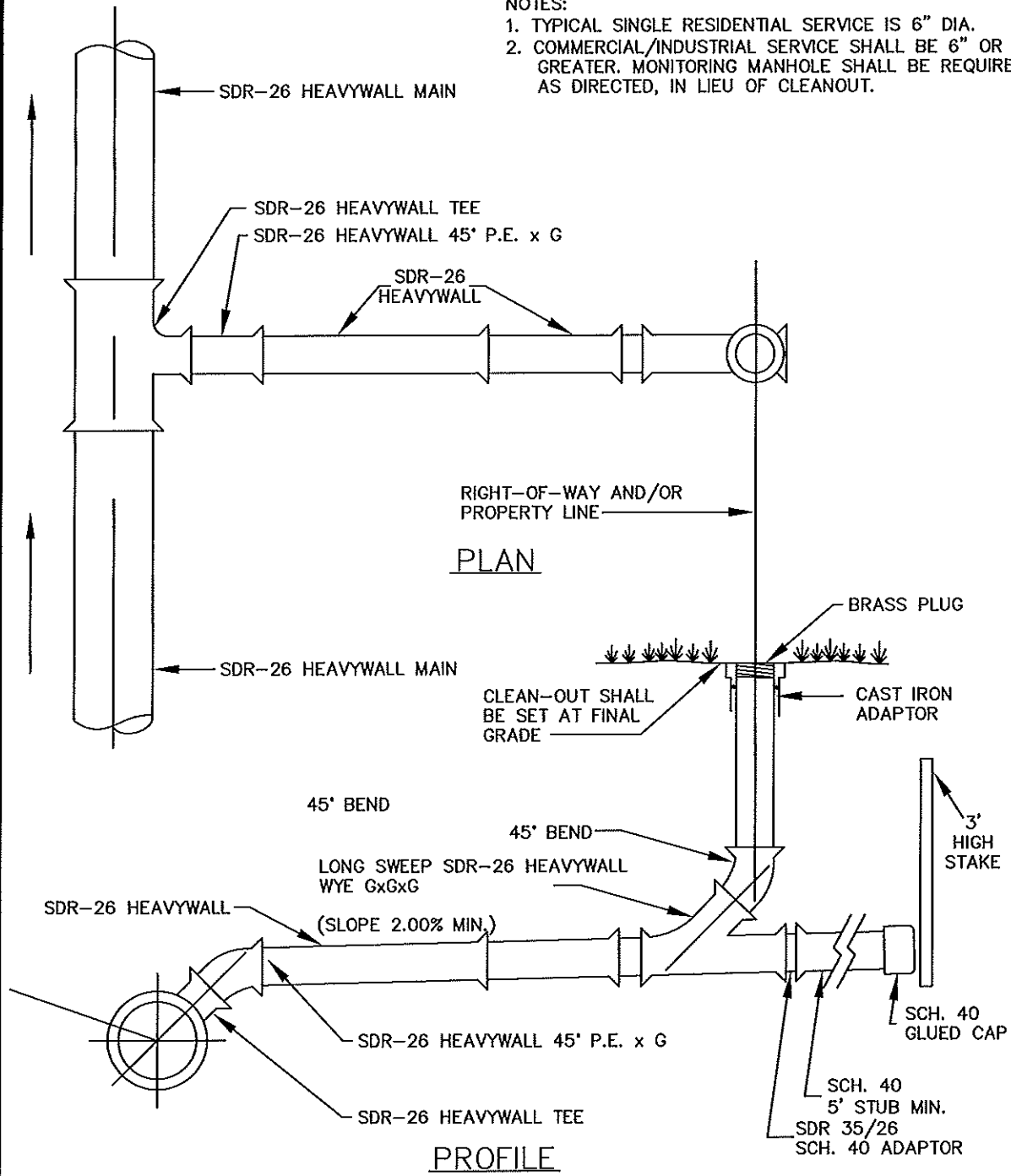
SECTION A-A

NO SCALE

<p>REVISID</p> <p>REVISID</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Pappas</i> Director of Environmental Management</p>	<p>Reliner Inside Drop Installation With Manhole Details</p>	<p>Detail</p> <p>S-2.12</p>
---	--	--	-----------------------------

NOTES:

1. TYPICAL SINGLE RESIDENTIAL SERVICE IS 6" DIA.
2. COMMERCIAL/INDUSTRIAL SERVICE SHALL BE 6" OR GREATER. MONITORING MANHOLE SHALL BE REQUIRED AS DIRECTED, IN LIEU OF CLEANOUT.



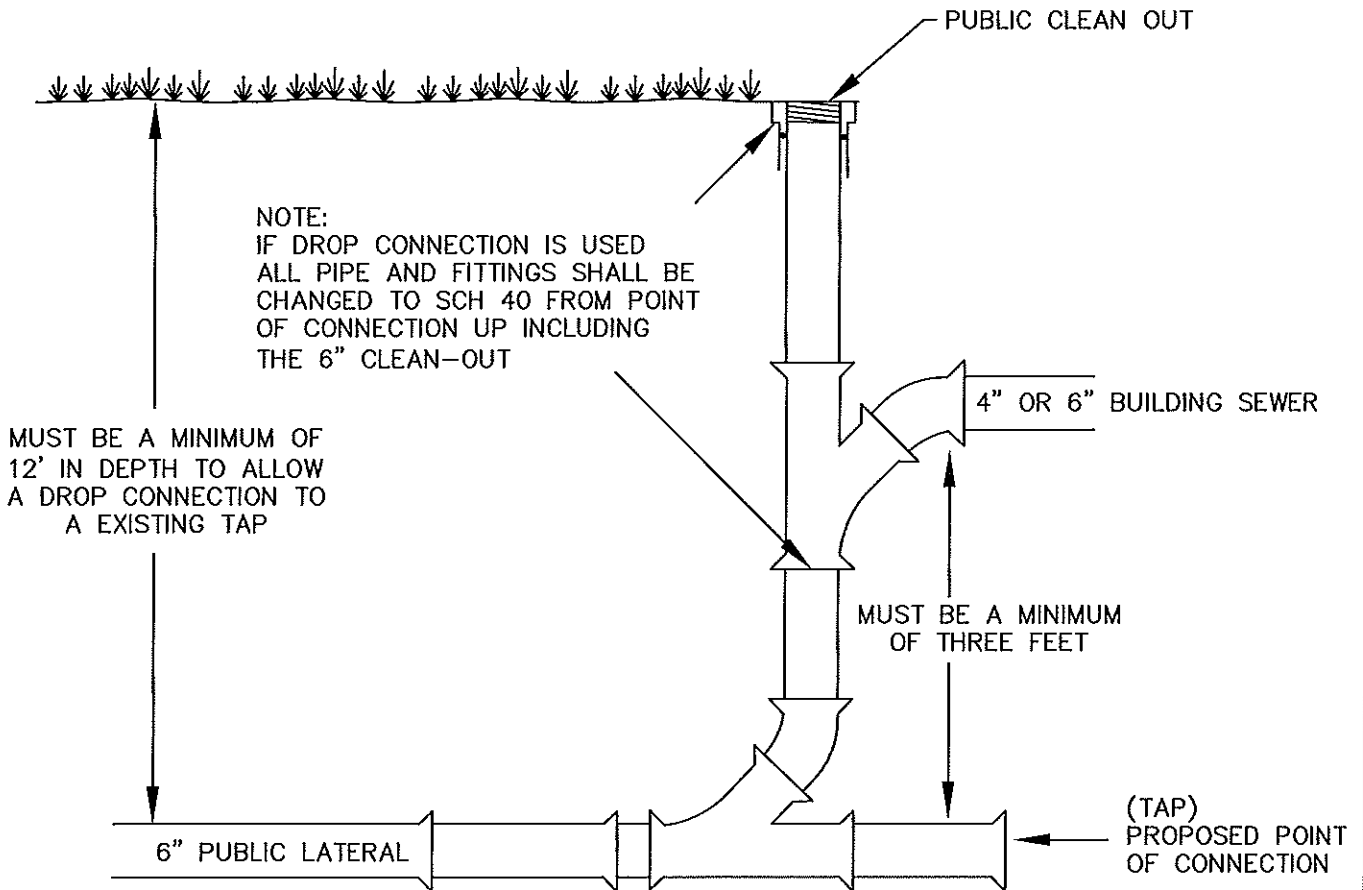
<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie A. Pappas</i></p> <p>Director of Environmental Management</p>	<p>Conventional Gravity Sewer Service Lateral SDR-26 Heavywall Sewer Main</p>	<p>Detail</p> <p>S-3.1</p>
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CONNECTION TO EXISTING PUBLIC SEWER :

1. IN THE EVENT THAT THE BUILDING SEWER LINE IS A MINIMUM OF THREE VERTICAL FEET ABOVE THE TAP AND THE PUBLIC CONNECTION IS A MINIMUM OF TWELVE FEET DEEP AT THE TAP IT SHALL BE ACCEPTABLE TO COMPLETE CONNECTION BY TYING INTO THE PUBLIC SIX INCH CLEAN OUT AS SHOWN BELOW.

2. IF THIS STYLE CONNECTION IS USED ALL OVER DIG AROUND THE PUBLIC CLEAN OUT AND UNDER THE BUILDING SEWER MUST BE BACK FILLED WITH MD #57 CLEAN GRAVLE 30" ABOVE THE BUILDING SEWER CONNECTION.

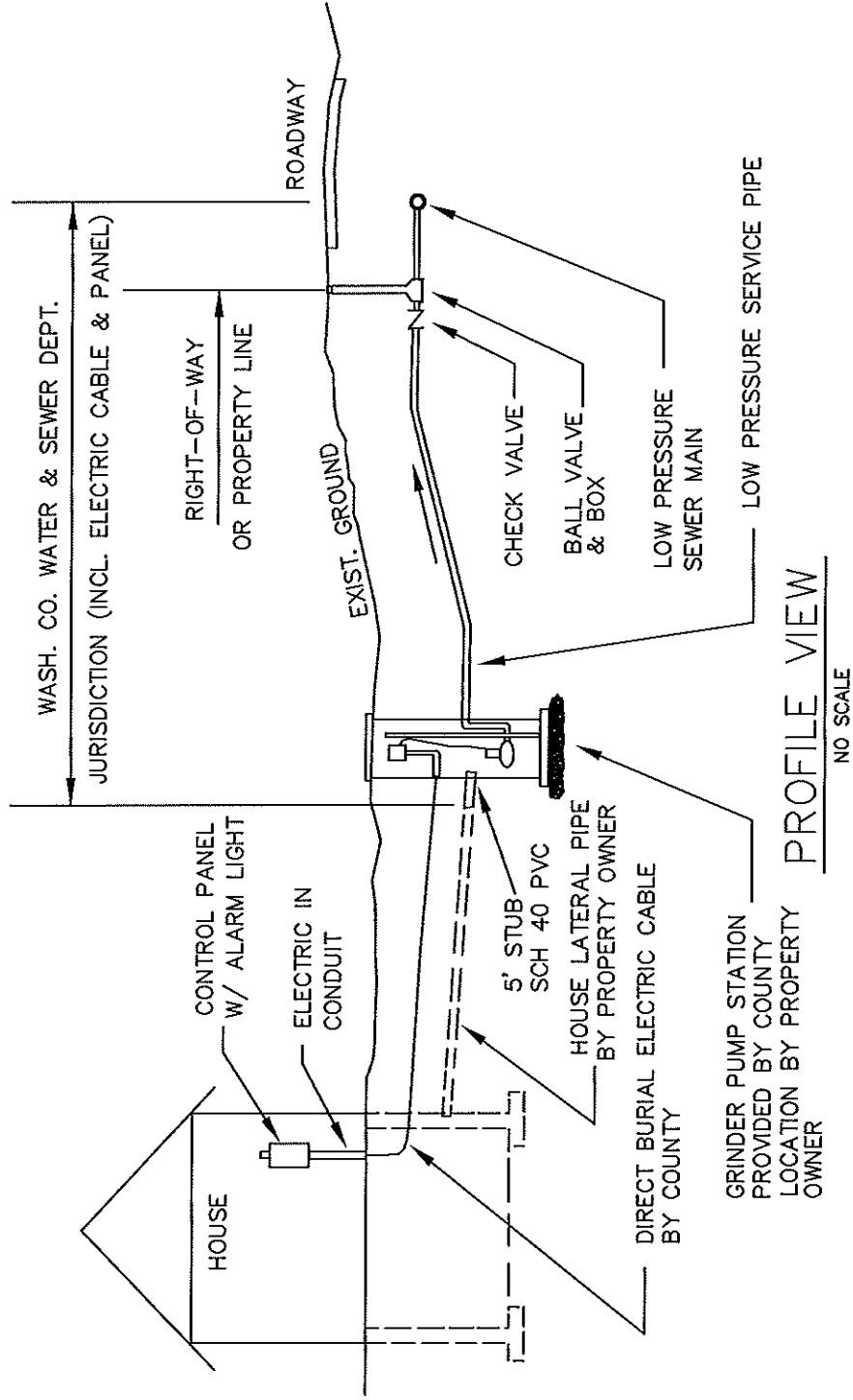
3. IF THE CLEAN-OUT LOCATION FALLS IN THE SIDEWALK OR DRIVEWAY AREA A LAMP POST FRAME AND COVER MUST BE INSTALLED OVER THE 6" SCH. 40 CLEAN-OUT



<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Pappas</i> Director of Environmental Management</p>	<p>ALTERNATIVE GRAVITY SEWER DEEP SERVICE LATERAL</p>	<p>Detail</p> <p>S-3.2</p>
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NOTES

1. LOW PRESSURE SERVICE PIPE TO BE PVC SDR-21, GASKET JOINT.
2. CONNECT BALL & CHECK VALVE USING GASKET X MALE THREAD ADAPTORS.
3. DEVELOPER IS TO PERFORM ALL EXCAVATION FOR THE COUNTY



Washington County, MD Div. of
Environmental Management

Approved: *Julie A. Pappas*
Director of Environmental Management

REVISED

REVISED

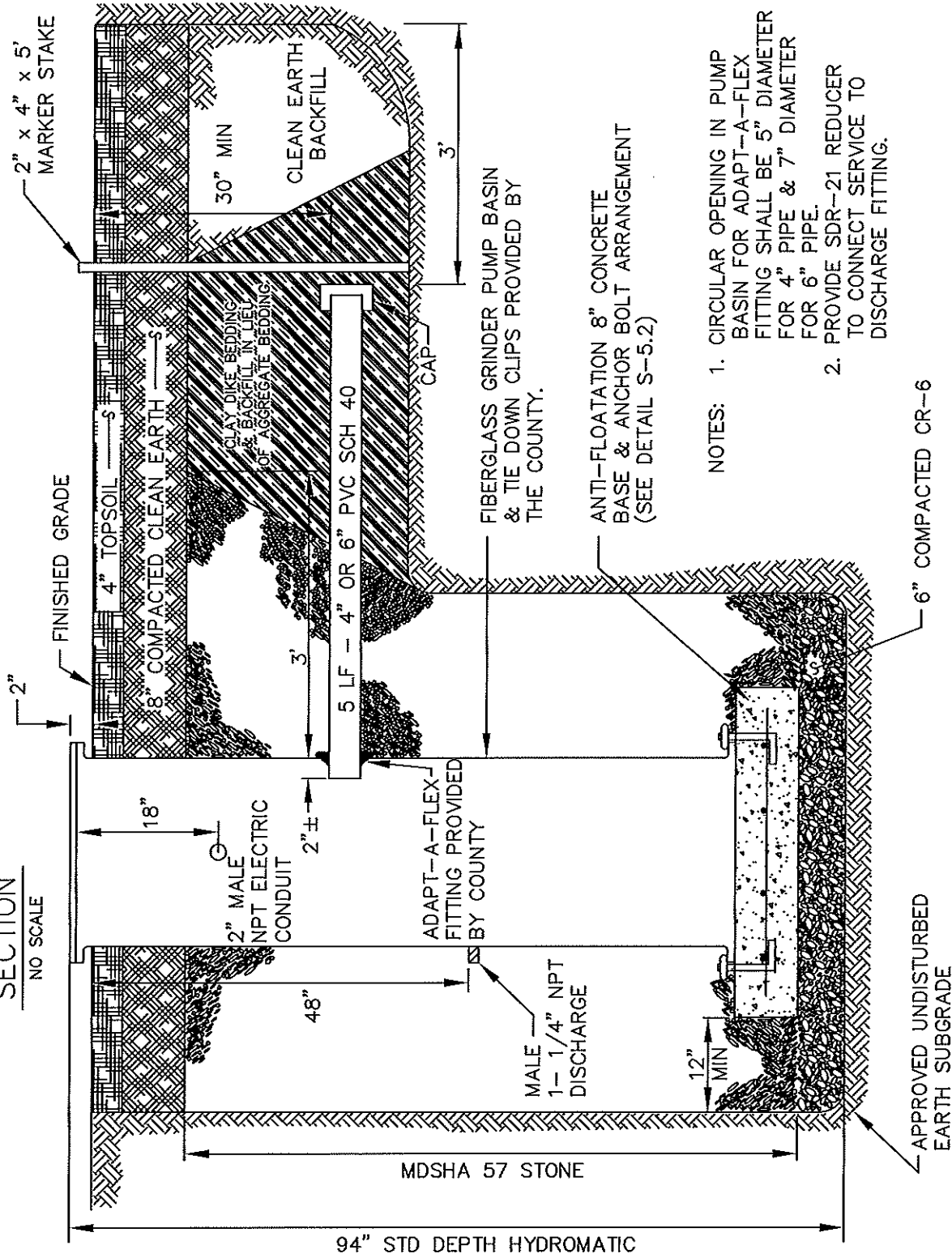
APPROVED

Typical Grinder Pump Arrangement

Detail

S-4.1

SECTION
NO SCALE



- NOTES:
1. CIRCULAR OPENING IN PUMP BASIN FOR ADAPT-A-FLEX FITTING SHALL BE 5" DIAMETER FOR 4" PIPE & 7" DIAMETER FOR 6" PIPE.
 2. PROVIDE SDR-21 REDUCER TO CONNECT SERVICE TO DISCHARGE FITTING.

Grinder Pump Basin Installation

Detail

S-5.1

Washington County, MD Div. of
Environmental Management

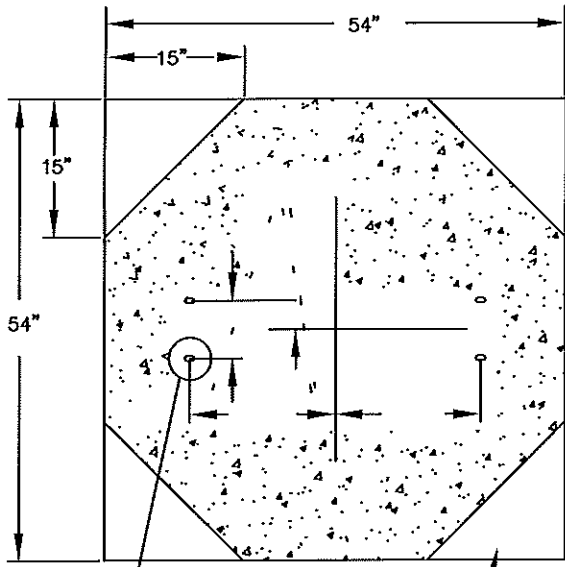
Approved: *Julie L. Lopez*
Director of Environmental Management

REVISED

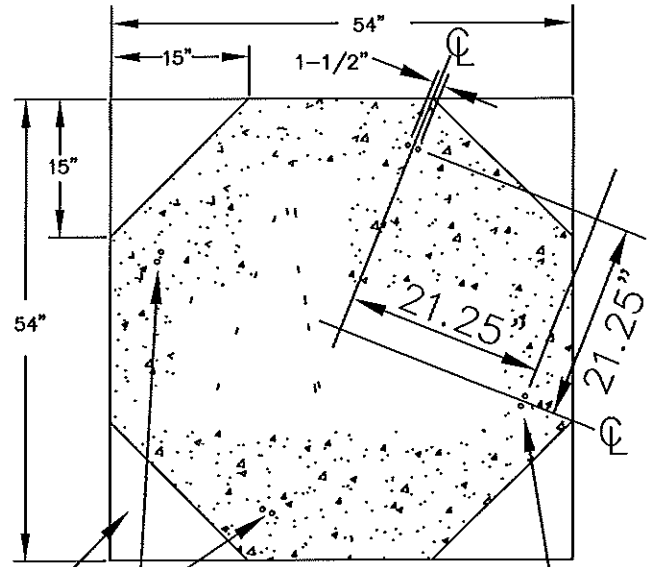
REVISED

APPROVED

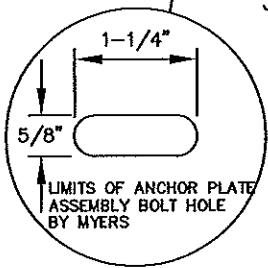
ULTIMATE CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 2500 PSI. BASE SLABS SHALL BE 8" THICK WITH #4 BARS AT 12" O.C. EACH WAY.



36" DUPLEX



36" DUPLEX



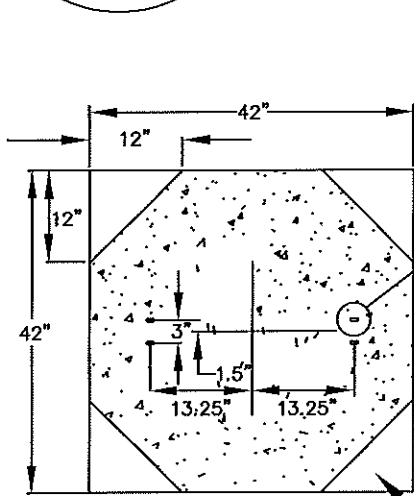
CAST-IN-PLACE 4 - 1/2"x8" SS HOOKED ANCHOR BOLTS EMBEDDED 5" (MYERS)

BLOCK OUT CORNERS OF FRAME TYPICAL (NOT REQUIRED)

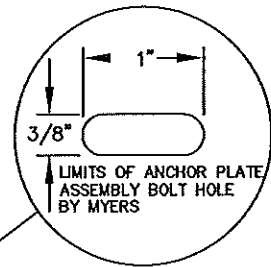
4 OF 8 (TYP) HYDROMATIC

2 OF 8 CAST-IN-PLACE 5/8"x 8" SS HOOKED ANCHOR BOLTS EMBEDDED 5" (HYDROMATIC)

PROVIDE S.S. WASHERS AND NUTS FOR ASSEMBLY. EXPOSED PART OF BOLTS THREADED.



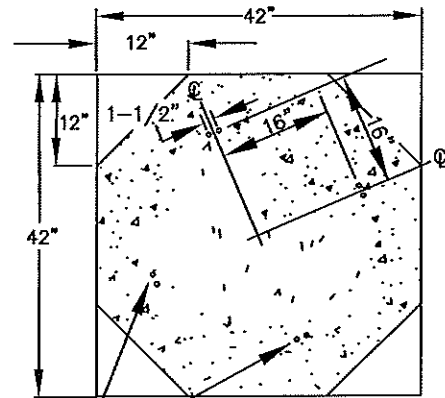
SIMPLEX



CAST-IN-PLACE 4 - 1/4"x8" SS HOOKED ANCHOR BOLTS EMBEDDED 5" (MYERS)

BLOCK OUT CORNERS OF FRAME TYPICAL (NOT REQUIRED)

4 OF 8 (TYP) HYDROMATIC



SIMPLEX

8 CAST-IN-PLACE 5/8"x 8" SS HOOKED ANCHOR BOLTS EMBED 5" (HYDROMATIC)

PLAN

NO SCALE

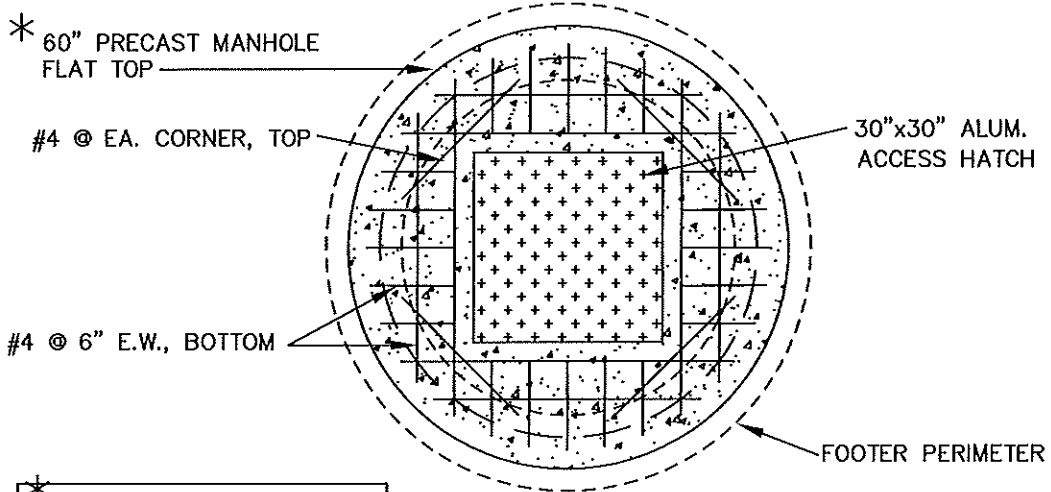
REVIS	Washington County, MD Div. of Environmental Management
REVIS	<i>Julie Lippert</i>
APPROV	Approved: <i>Julie Lippert</i> Director of Environmental Management

Grinder Pump Anti-Floatation Concrete Base

Detail S-5.2

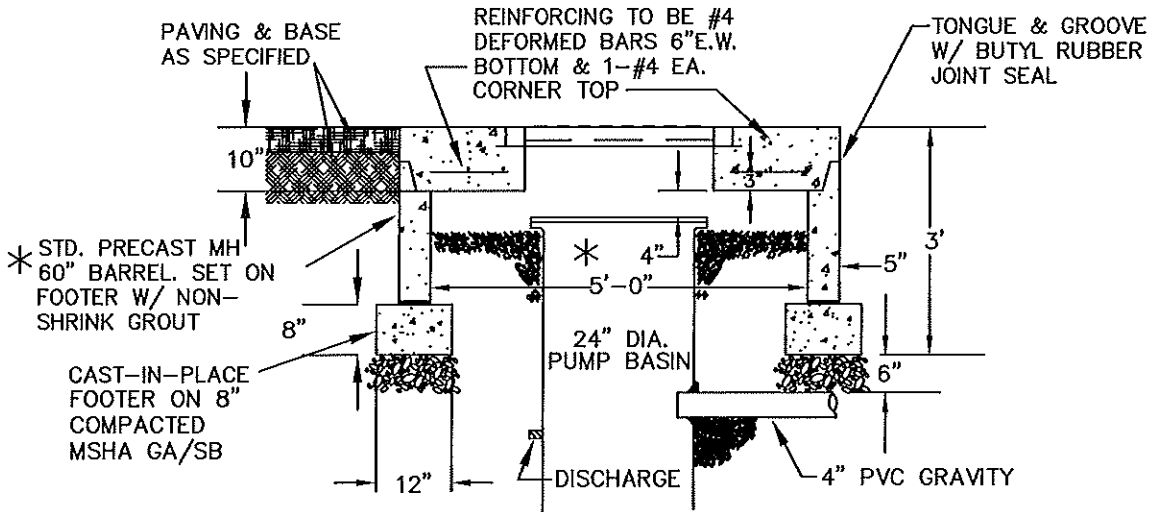
NOTES:

1. HATCH: BILCO TYPE 'JAL' 30"x30"
W/ S.S. HRDWR., H-20 TRAFFIC
BEARING. BIT. COAT EXT. FRAME.
CAST-IN BY MANHOLE MANUF.
2. SEE STD. S-5.1 FOR FRP GRINDER
PUMP BASIN DETAILS.
3. PRECAST MH SHALL COMPLY
W/ ASTM C 478.
4. ORIENTATION OF HATCH
HINGE TO PUMP BASIN
SHALL BE DIRECTED BY
THE COUNTY.
5. RESTORATION FOR THIS
INSTALLATION SHALL BE
AT THE DEVELOPERS EXPENSE



* 72" PRECAST UNITS REQ'D.
FOR 36" DIA. PUMP BASIN

PLAN



SECTION

NO SCALE

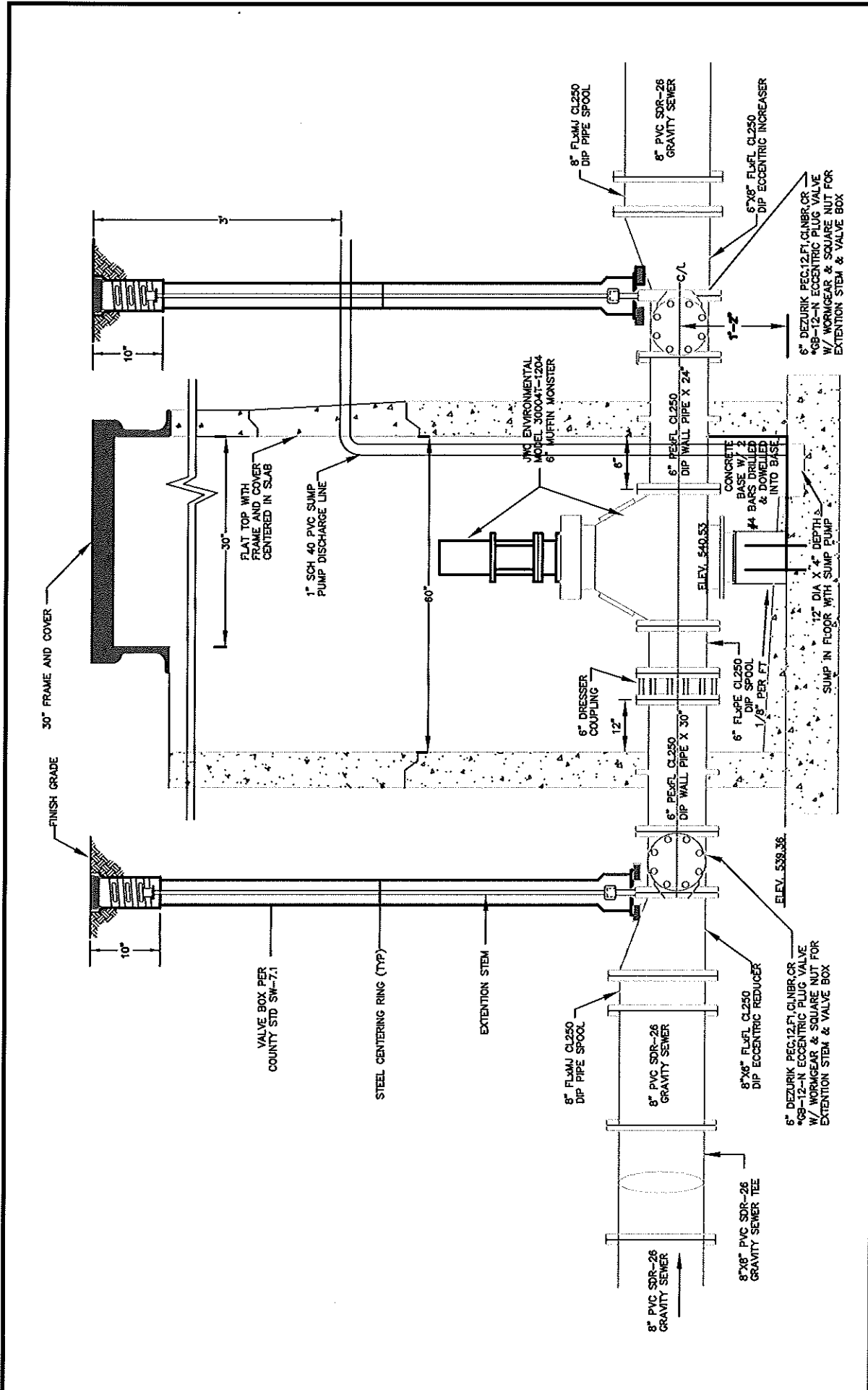
REVIS
REVIS
APPROVED

Washington County, MD Div. of
Environmental Management

Approved: *Julia A. Pappas*
Director of Environmental Management

Traffic Bearing Access Structure

Detail
S-5.3



Detail

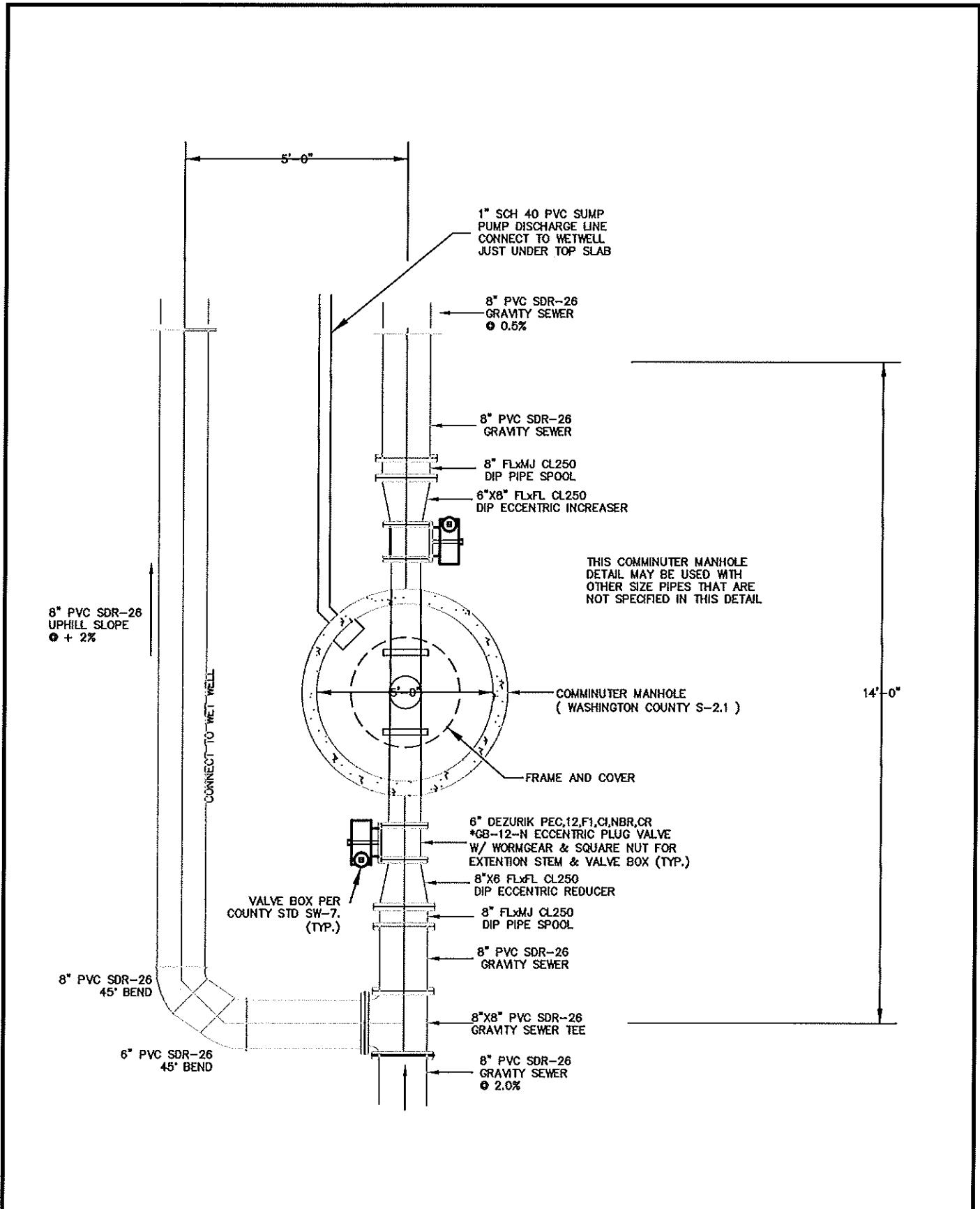
S-6.1

Comminutor Profile View

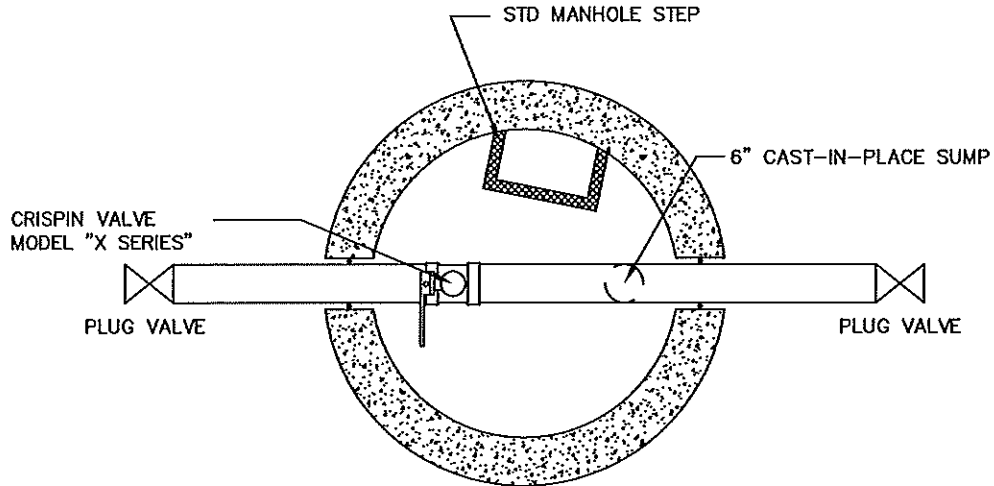
Washington County, MD Div. of
Environmental Management

Approved: *A. Lipp*
Director of Environmental Management

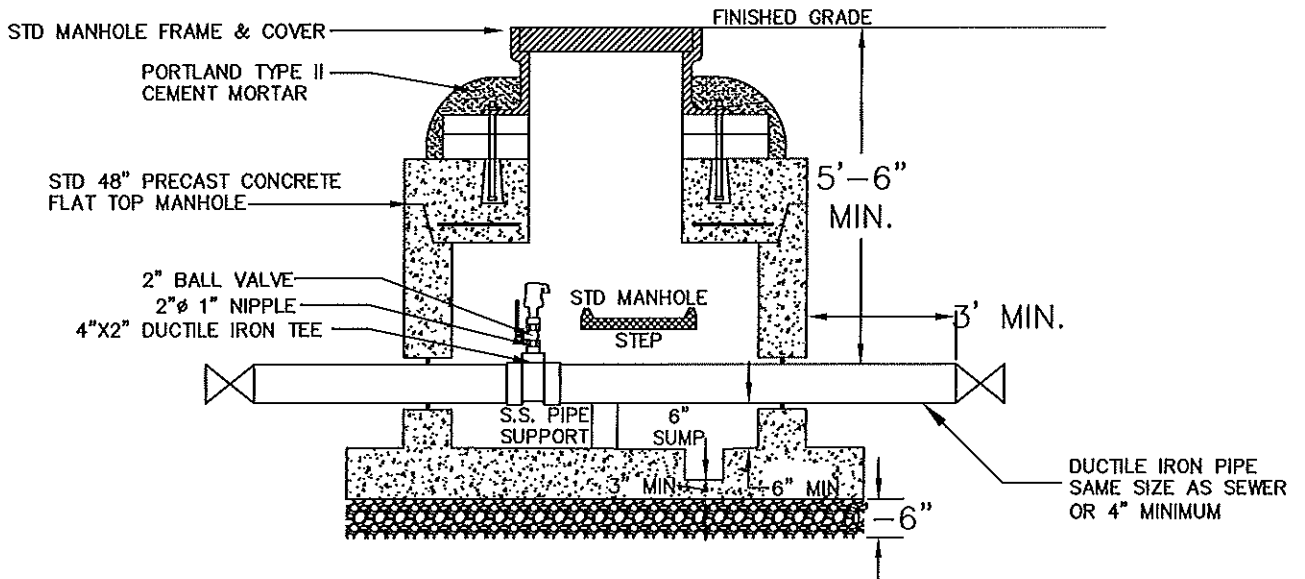
REVISION
REVISION
APPROVED



<p>REVISD</p> <p>REVISD</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Pippin</i></p> <p>Director of Environmental Management</p>	<p>Comminutor Plan View</p>	<p>Detail S-6.2</p>
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PLAN
NO SCALE

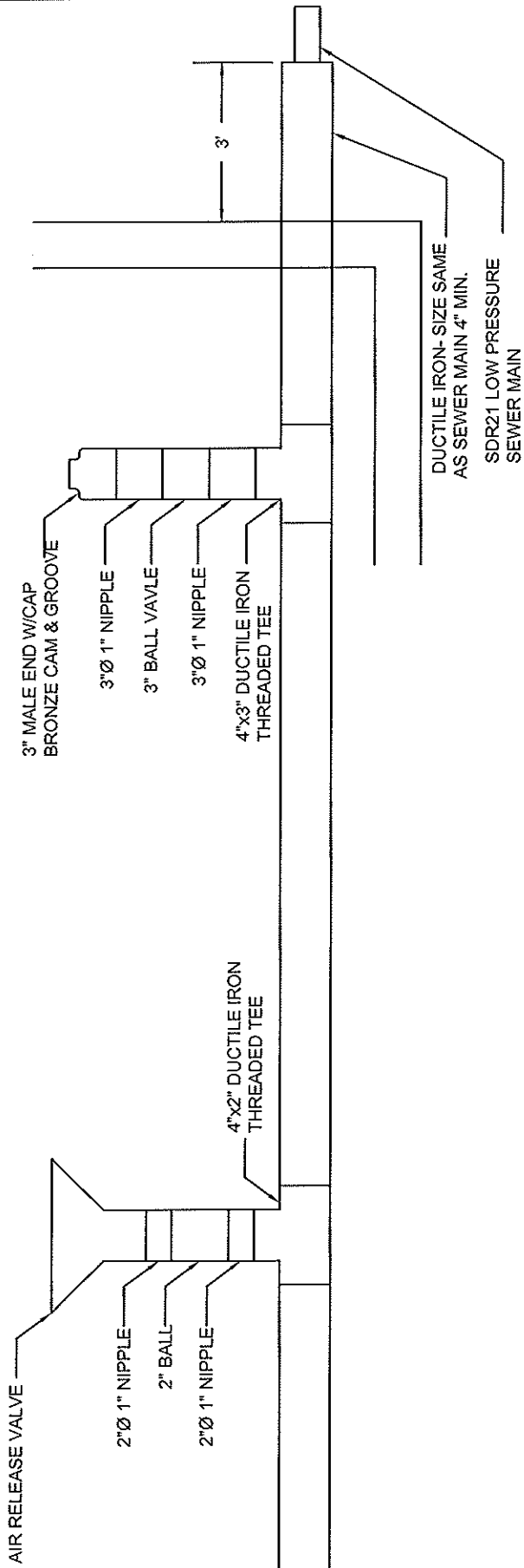


SECTION
NO SCALE

NOTES:

1. PRECAST MANHOLE SHALL COMPLY WITH STANDARD DETAILS S-2.1-S-2.4, S-2.11-S-2.13
2. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
3. VALVES SHALL BE ORIENTED AS SHOWN IN PLAN VIEW. AIR RELEASE VALVE IS NORMALLY OPEN.
4. ALL VAULT PIPING SHALL BE DUCTILE IRON UNLESS OTHERWISE NOTED.
5. THE A.R.V. SHALL BE TAPPED INTO THE CROWN OF PIPE.

<p>REVIS</p> <hr/> <p>REVIS</p> <hr/> <p>APPROV</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Pappas</i> Director of Environmental Management</p>	<p>Sewage Air Release Manhole Working Pressure Less Than or Equal To 100 PSI</p>	<p>Detail S-7.2A</p>
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Detail

S-7.2B

Sewage Air Release and Flushing Connection Manhole
Working Pressure Less Than or Equal To 100 PSI

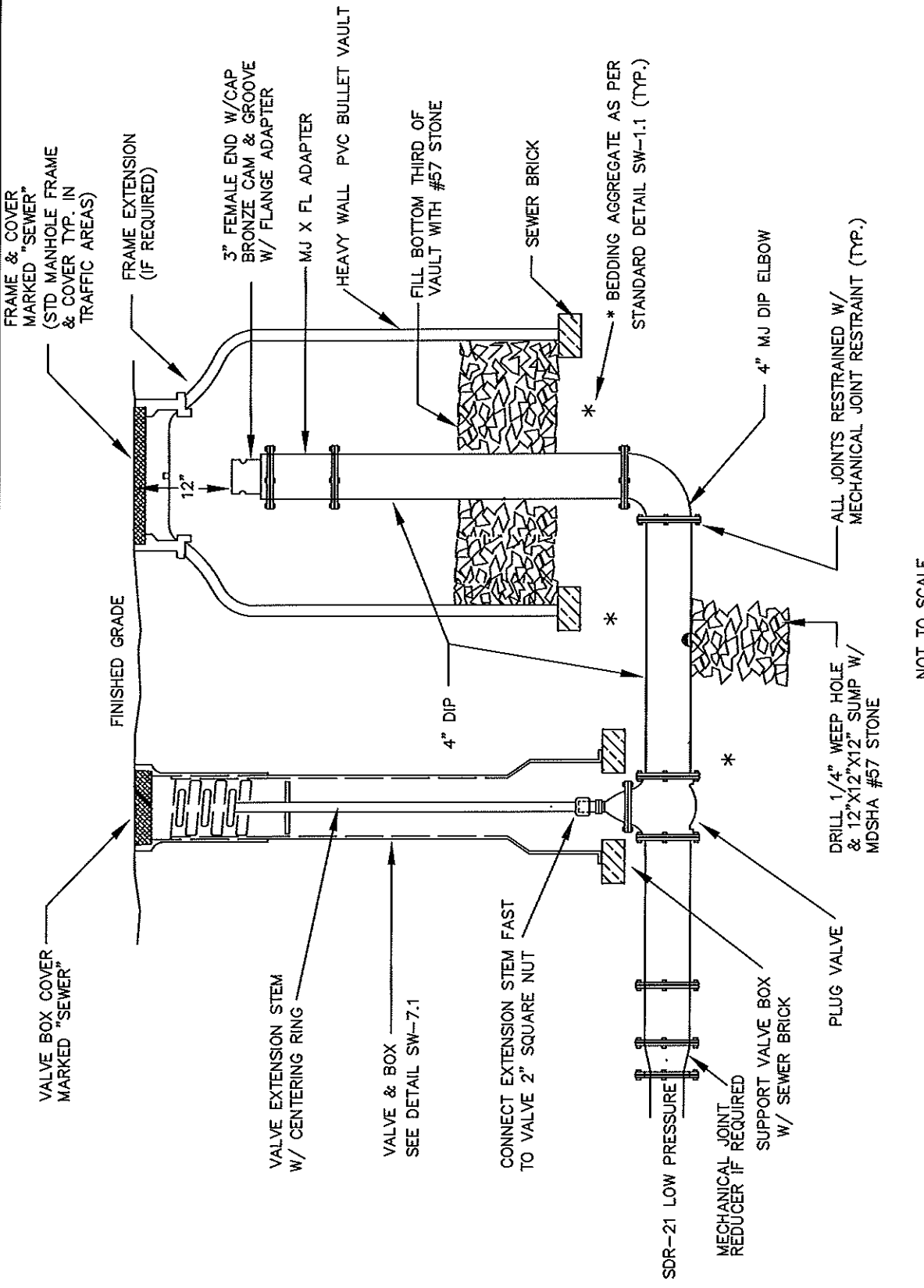
Washington County, MD Div. of
Environmental Management

Approved: *Julie A. Piper*
Director of Environmental Management

REVISED

REVISED

APPROVED



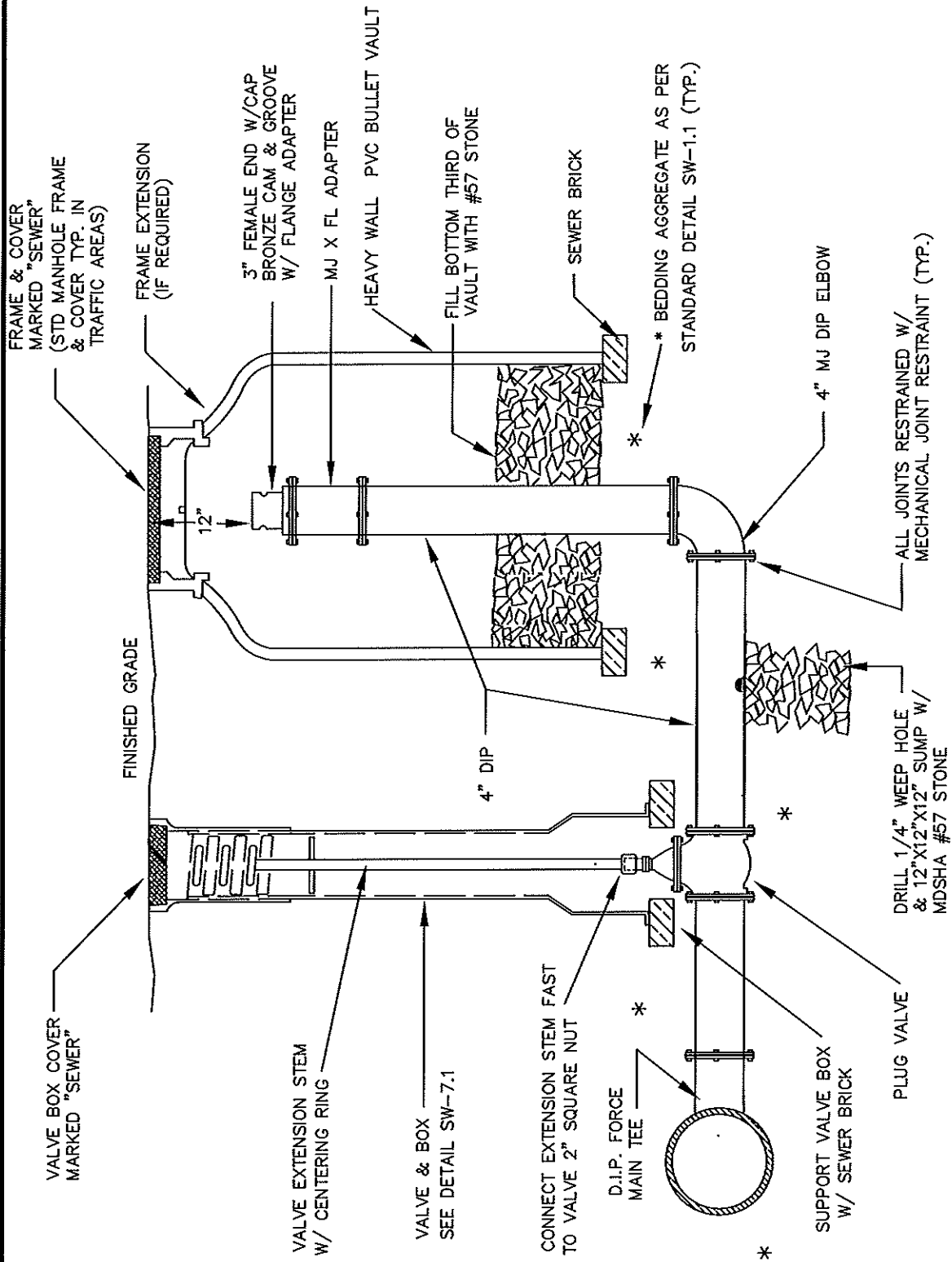
NOT TO SCALE

Washington County, MD Div. of
Environmental Management
Approved: *Julia K. Ruppel*
Director of Environmental Management

Low Pressure Sewer Flushing Connection

Detail
S-7.3

REVISIONS
REVISIONS
APPROVED



NOT TO SCALE *ALL JOINTS SHALL BE MECHANICAL RESTRAINED

Washington County, MD Div. of
 Environmental Management
 Approved: *Julia A. Ruppel*
 Director of Environmental Management

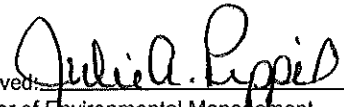
Detail
 S-7.4

Force Main Flushing Connection

REVISED
 REVISED
 APPROVED

PROJECT: _____ PROJECT NO.: _____
 CONTRACTOR: _____ SHEET NO.: _____
 PREPARED BY: _____ PHONE NO.: _____ DATE: _____
 DRAWING REFERENCE: _____ REVISION DATE: _____
 LOCATION: _____ PIPE SIZE: _____
 _____ TYPE/CLASS: _____
 BENCH MARK: _____ FILE NAME: _____

STATION	INVERT ELEVATION	P R O F I L E		TYPE OF RESTORATION SHOW STA. @ CHG. OF TYPE	REMARKS
		GROUND ELEVATION	CUT TO INVERT		

_____ REVISSED _____ REVISSED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Reference Sheet for Pressure Pipe	Detail S-12.4
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PROJECT: _____ PROJECT NO.: _____

CONTRACTOR: _____

DRAWING REFERENCE: _____

FROM MANHOLE/STATION: _____ TO MANHOLE/STATION: _____

NUMBER OF PREVIOUS TESTS THIS SECTION: _____ (ATTACH COPIES)

DATE OF TEST: _____ AIR TEMPERATURE AT TIME OF TEST: _____ °F

WEATHER CONDITIONS: _____

PIPE DIAMETER (D)
(INCHES)

PIPE LENGTH (L)
(FEET)

ACCEPTABLE TIME (T)
(MINUTES)

$$\left[= \frac{0.0119}{60} \times D^2 \times L \right]$$

TOTAL ACCEPTABLE TEST TIME:
_____ MINUTES

TEST STABILIZATION PRESSURE TO BE USED = 4.0 P.S.I.G. + 0.433 X H = _____ P.S.I.G.
(‘H’ = HEIGHT OF WATER ABOVE PIPE INVERT IN ‘FEET’)
* (REDUCE BY 0.5 P.S.I.G. FOR TEST PRESSURE.)

GAUGE PRESSURE DURING 5 MINUTE STABILIZATION PERIOD: _____ P.S.I.G.

TIME OF DAY AT START OF PRESSURE TEST: _____ A.M. P.M.

GAUGE PRESSURE AT START OF PRESSURE TEST: _____ P.S.I.G.

GAUGE PRESSURE AT END OF PRESSURE TEST: _____ P.S.I.G. TEST TIME FOR PRESSURE DROP:

DROP IN PRESSURE (MAX. 1.0 P.S.I.G.) _____ P.S.I.G. _____ MINUTES

TEST CONDUCTED BY:

COUNTY REPRESENTATIVE: _____

CONTRACTOR’S REPRESENTATIVE: _____

ACCEPTANCE OF TEST IS A PREREQUISITE OF PROJECT ACCEPTANCE.
UNACCEPTABLE SEWERS REQUIRE CORRECTION AND RE-TESTING.

BY: _____
WASHINGTON COUNTY WATER QUALITY DEPARTMENT

ACCEPTABLE
 NOT ACCEPTABLE

REVISED

REVISED

APPROVED

Washington County, MD Div. of
Environmental Management
Julie A. Pepper
Approved: _____
Director of Environmental Management

Low Pressure Air Testing of
Sanitary Sewers

Detail
S-12.6

PROJECT: _____ PROJECT NO.: _____

DRAWING REFERENCE: _____ DATE: _____

CONTRACTOR: _____

FROM STATION: _____ TO STATION: _____

NUMBER OF PREVIOUS TESTS THIS SECTION: _____ (ATTACH COPIES)

MAINTAIN THE TESTING PRESSURE FOR A FOUR (4) HOUR PERIOD AFTER EXPULSION OF ALL AIR.
TEST PRESSURE TO BE USED SHALL BE 1.5 TIMES PIPES OPERATING PRESSURE AT THE LOWEST POINT IN
THE TEST SECTION PLUS 50 P.S.I.G., NOT TO EXCEED 150 P.S.I.G. UNLESS OTHERWISE SPECIFIED OR DIRECTED.

TEST PRESSURE (P)(PSIG) = 1.5 TIMES PIPES OPERATING PRESSURE = _____ P.S.I.G.

PRESSURE (P)	100	150	200
DIAMETER (D) INCHES	ALLOWABLE LEAKAGE PER 1000 FEET OR 50 JOINTS (L) U.S. GALLONS PER HOUR		
4"	0.27	0.33	0.38
6"	0.41	0.50	0.57
8"	0.54	0.66	0.76
10"	0.68	0.83	0.96
12"	0.81	0.99	1.15
16"	1.08	1.32	1.53
20"	1.35	1.66	1.91

(TEST DURATION = 4 HOURS)

BEGIN: _____ A.M. P.M.

END: _____ A.M. P.M.

TEST TIME: _____ HOURS

BEGIN PRESSURE: _____ P.S.I.G.

END PRESSURE: _____ P.S.I.G.

WATER USED: _____ GALLONS

TEST SECTION ALLOWABLE LEAKAGE (GAL) = $\sum \frac{N * D * \sqrt{P}}{7400}$ X TEST TIME (HOURS)

DIAMETER (D) INCHES	TYPE OF PIPE	LENGTH (FEET)	NO. OF JOINTS (N)	ALLOWABLE LEAKAGE (L)

ALLOWABLE LEAKAGE : ADD SUM OF (L) ABOVE & MULTIPLY BY TEST TIME = _____ GALLONS

NUMBER OF HYDRANTS IN TEST SECTION: _____

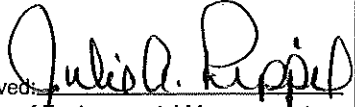
CONTRACTOR'S REPRESENTATIVE: _____

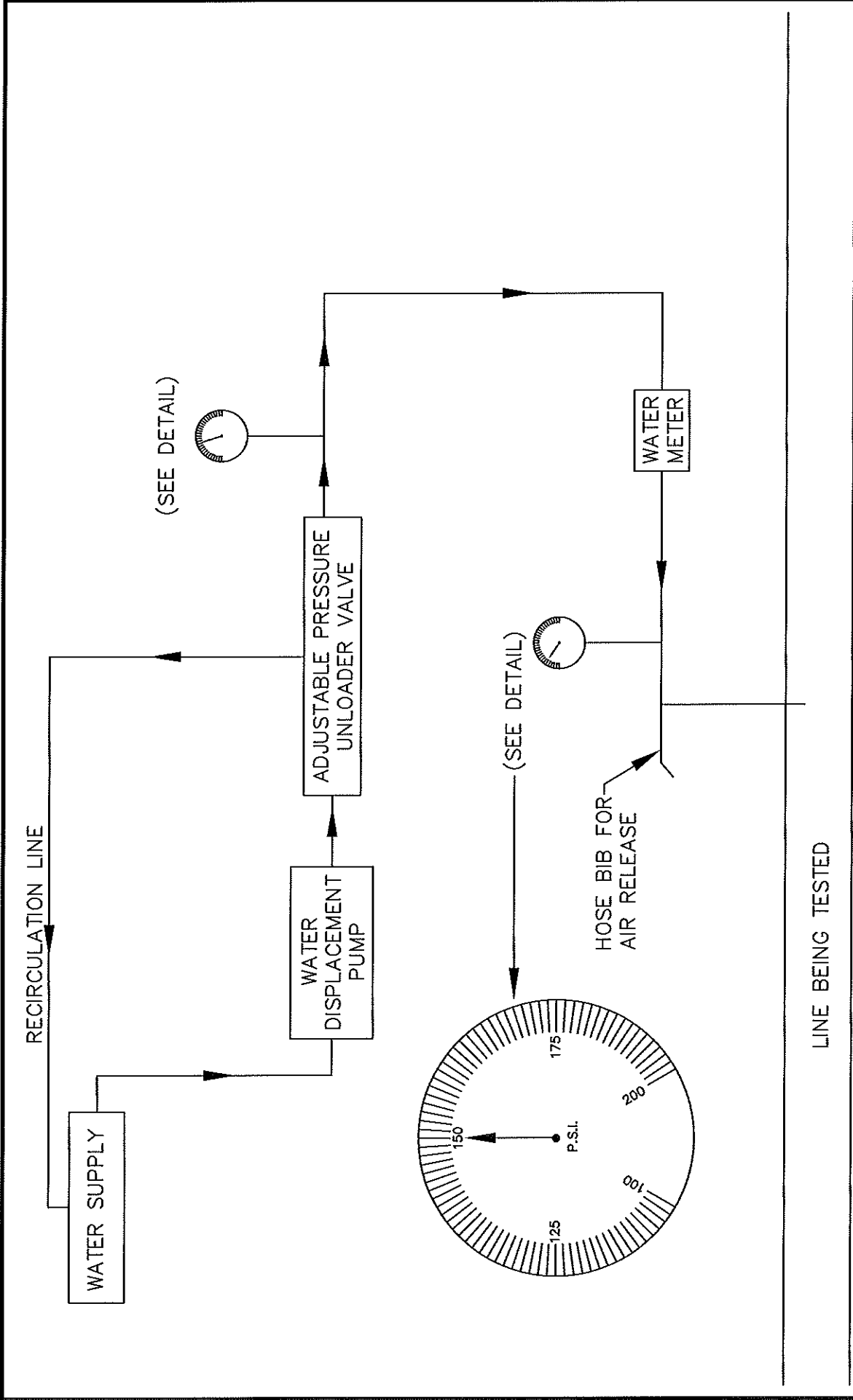
ACCEPTANCE OF TEST IS A PREREQUISITE OF PROJECT ACCEPTANCE.
UNACCEPTABLE SECTIONS REQUIRE CORRECTION AND RE-TESTING.

BY: _____
WASHINGTON COUNTY WATER QUALITY DEPARTMENT

ACCEPTABLE:

NOT ACCEPTABLE:

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	<h2 style="margin: 0;">Hydrostatic & Leakage Test</h2>	Detail <h1 style="margin: 0;">S-12.7</h1>
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Washington County, MD Div. of
 Environmental Management
 Approved: *Julius R. Papp*
 Director of Environmental Management

Pressure Test System

Detail
 S-12.8

- REVISION
- REVISION
- APPROVED

SITE: _____ PROJECT NO.: _____

CONTRACTOR: _____ DATE: _____

OPERATORS: _____

PRESSURES STATIC: #1 PUMP: #2 PUMP: BOTH:

AMPERAGE: #1 L 1/2/3 #2 L 1/2/3
 OPERATIONAL: OPERATIONAL:
 DEADHEAD: DEADHEAD:

LEVEL TESTING: FORMULA: $3.14 \times R \times R \times H = \text{CUBIC FEET} \times 7.48 = (\text{GALLONS})$
KEY: CIRCULAR WET WELL:
 3.14 = PIE
 R = RADIUS - WHICH IS HALF THE DIAMETER OF WET WELL EXPRESSED AS FEET
 H = HEIGHT OF DRAW DOWN EXPRESSED AS FEET, 1 INCH = 0.083 FT. (EX. 4" = 0.332 FT.)
 7.48 = GALLONS OF WATER IN A CUBIC FT.
 GALLONS = THE TOTAL AMOUNT OF GALLONS PUMPED, REMEMBER IF YOU DO A TWO MINUTE
 TEST DIVIDE THIS NUMBER BY TWO.

SQUARE / RECTANGULAR WET WELL:
LENGTH x WIDTH x HEIGHT = CUBIC FEET x 7.48 = (GALLONS)

DO: TAKE EXACT ACCURATE MEASUREMENTS EVEN A 1/4" CAN MAKE A HUGE DIFFERENCE.
 PLUG ALL INFLUENT LINES TO THE WET WELL, TO INSURE ACCURATE NUMBERS.
 KEEP A COPY OF THIS SHEET AT THE SITE, AND FORWARD A COPY TO SUPERVISOR.
 SHOW FORMULA IN THE SPACE PROVIDED BELOW.

DO NOT: ALLOW THE LEVEL TO REACH THE FLOOR GRATING OR INFLUENT LINES
 BACKFLUSH CHECK VALVES OR MAIN PRIOR TO TESTING, THAT WILL EMPTY THE MAIN, AND
 GIVE FALSE GPM RATING.

PUMP #1 START:
 STOP:
 TOTAL DRAW DOWN:

PUMP #2 START:
 STOP:
 TOTAL DRAW DOWN:

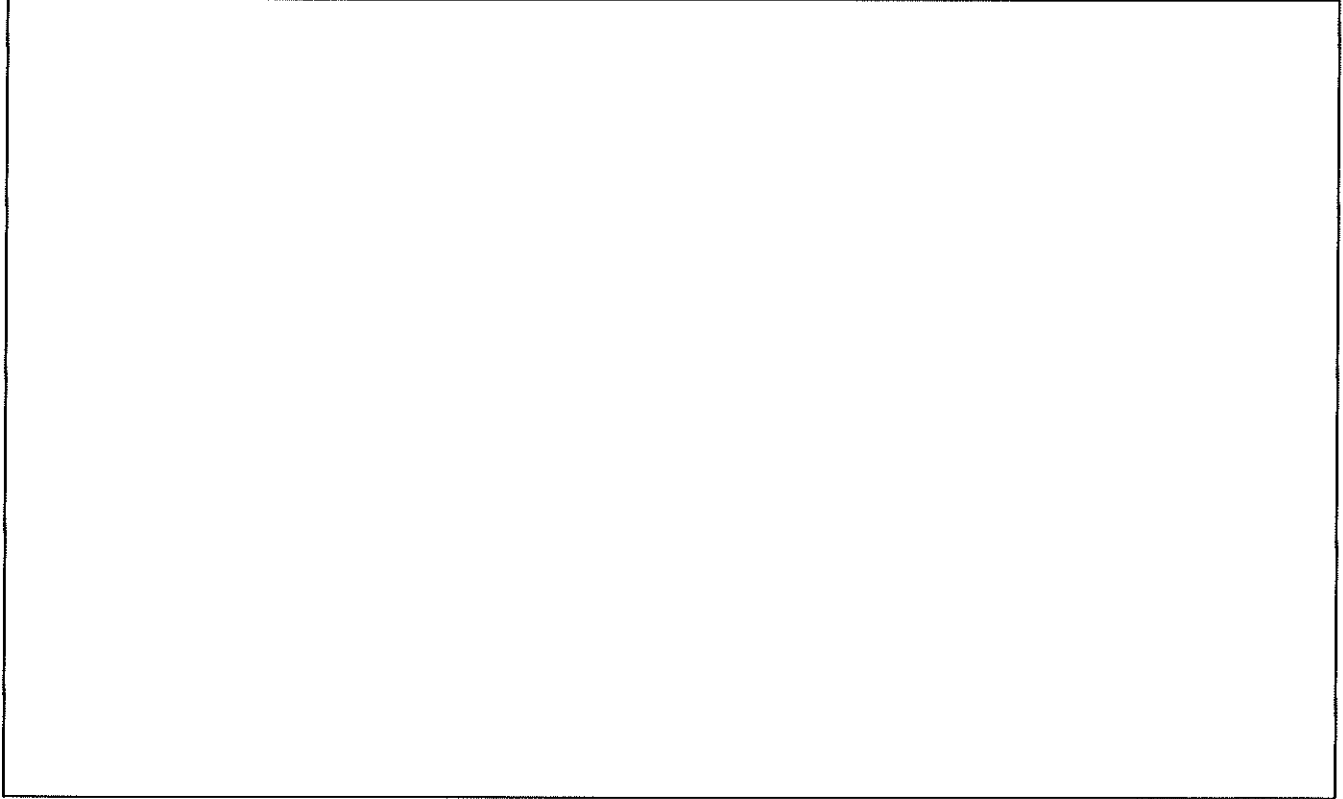
COMMENTS:

REVISÉ	Washington County, MD Div. of Environmental Management	Collections Division Draw Down Test	Detail
REVISÉ	Approved: <i>Julio A. Pappalardo</i>		
APPROVED	Director of Environmental Management		

S-12.11

PROJECT NAME: _____ PROJECT NO.: _____
 PROPERTY ADDRESS: _____ DRAWING NO.: _____ OF _____
 MAIN LOCATION: STREET/EASEMENT _____ MAIN STATION: _____
 PROPERTY OWNER NAME: _____ MAIN INVERT: _____
 PROPERTY OWNER ADDRESS: _____ LATERAL SIZE: _____
 _____ SINGLE: _____ DOUBLE _____

Place an "X" on the sketch below to indicate where the property owner wants the service connection (lateral) to enter the property. A County representative will place a wooden stake in the ground at that location.



(NOT TO SCALE)

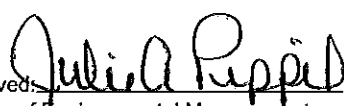
The undersigned agrees that the Water and Sewer Department may excavate an additional five (5) feet inside the property line so as to facilitate and make less expensive, the owner's connection to the lateral and to prevent damage to the clean out which will be installed by the County at or near the property line.

Date: _____

 Property Owner Name

 Property Owner Signature

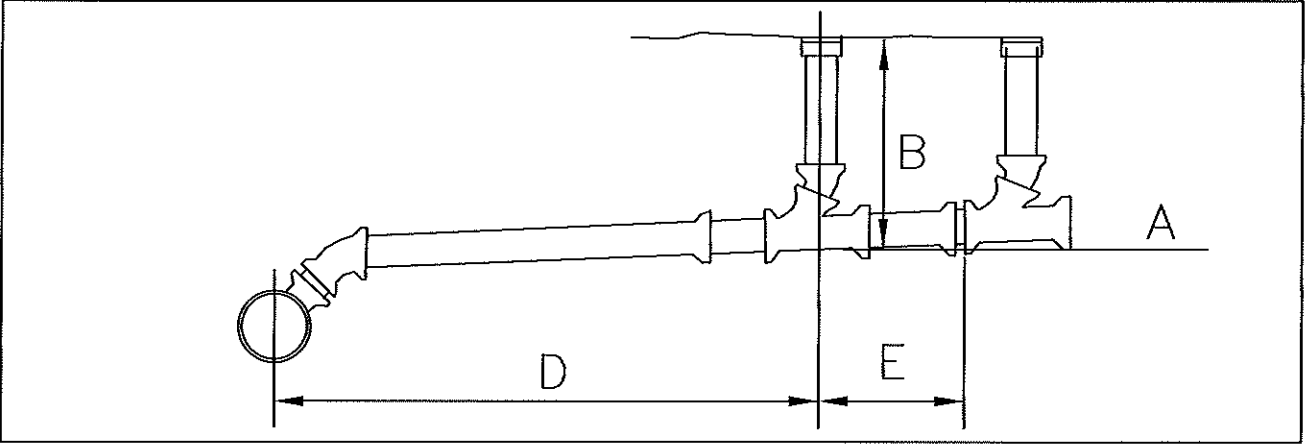
Attest: _____
 Washington County Water Quality Department

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Gravity Sewer Service Location Sheet	Detail S-13.1
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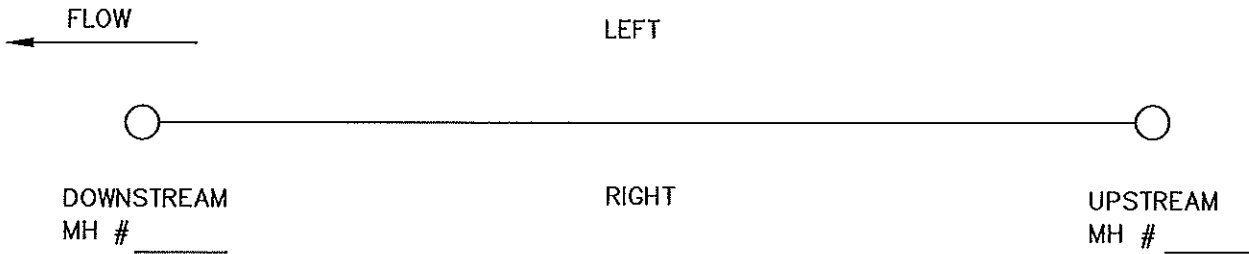
PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO: _____
 MAIN LOCATION: STREET/EASEMENT _____ DATE INSTALLED: _____
 PROPERTY OWNER NAME: _____ MH _____ TO MH _____
 PROPERTY OWNER ADDRESS: _____ MAIN STATION: _____
 _____ SINGLE: _____ DOUBLE: _____
 CONTRACTOR: _____ CONNECTION @ MH: _____

SIZE & TYPE TEE/WYE	SIZE & TYPE SERVICE PIPE	INVERT @ C.O. WYE (A)	DEPTH C/O (B)	DROP DEPTH (C)	D	E	F

INDICATE TYPE OF LATERAL BY CROSSING OUT OTHERS. FOR CONNECTION TO MANHOLE, CHECK ABOVE, AND LIST INVERT DIMENSION 'B' AND DROP DIMENSION 'C' (IF APPLICABLE).



SHOW LATERAL LOCATION, STATION, UTILITY CROSSINGS AND DIMENSION ALL PERTINENT ITEMS



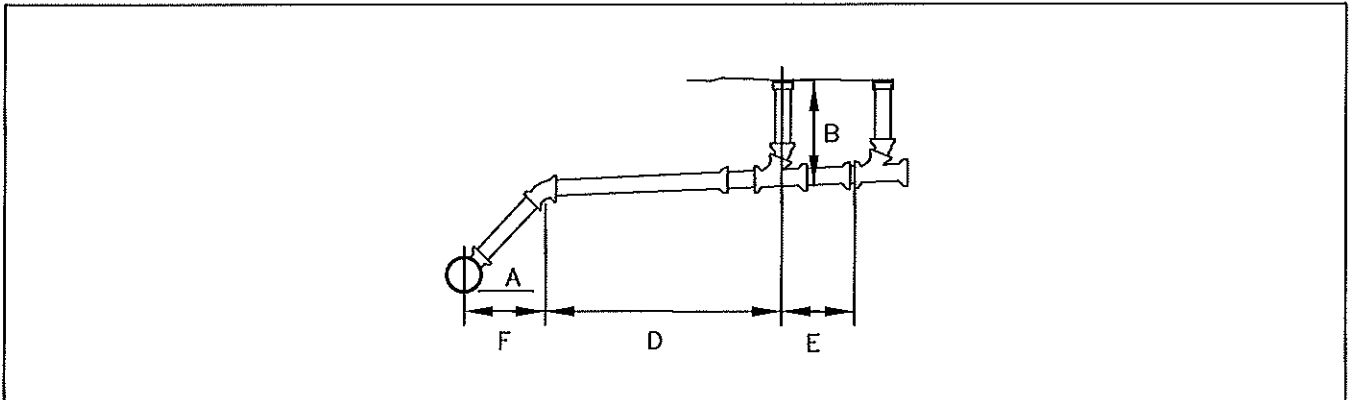
BY: _____ WASHINGTON COUNTY INSPECTOR
 _____ CONTRACTOR'S REPRESENTATIVE
 CO. NAME: _____

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Reppel</i> Director of Environmental Management	<h2>Gravity Sewer Service Connection Sheet</h2>	Detail <h1>S-13.2</h1>
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PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO: _____
 MAIN LOCATION: STREET/EASEMENT _____ DATE INSTALLED: _____
 PROPERTY OWNER NAME: _____ MH _____ TO MH _____
 PROPERTY OWNER ADDRESS: _____ MAIN STATION: _____
 _____ SINGLE: _____ DOUBLE: _____
 CONTRACTOR: _____ CONNECTION @ MH: _____

SIZE & TYPE TEE/WYE	SIZE & TYPE SERVICE PIPE	INVERT @ MAIN (A)	DEPTH C/O (B)	DROP DEPTH (C)	D	E	F

INDICATE TYPE OF LATERAL BY CROSSING OUT OTHERS. FOR CONNECTION TO MANHOLE, CHECK ABOVE, AND LIST INVERT DIMENSION 'B' AND DROP DIMENSION 'C' (IF APPLICABLE).



NO SCALE

WE, THE UNDERSIGNED, BEING SAID OWNERS OF THIS PROPERTY, REQUEST PERMISSION TO INSTALL THE
 _____ HOUSE LATERAL AT THE MODIFIED HEIGHT DESCRIBED ABOVE.
 (PROPERTY ADDRESS)

DATE: _____

 PRINTED NAME

ATTEST: _____

WASHINGTON COUNTY WATER QUALITY DEPT.

 SIGNATURE

THIS FORM SHALL BE USED IN CONJUNCTION WITH THE GRAVITY SEWER SERVICE CONNECTION SHEET, STANDARD DETAIL S-3.1.

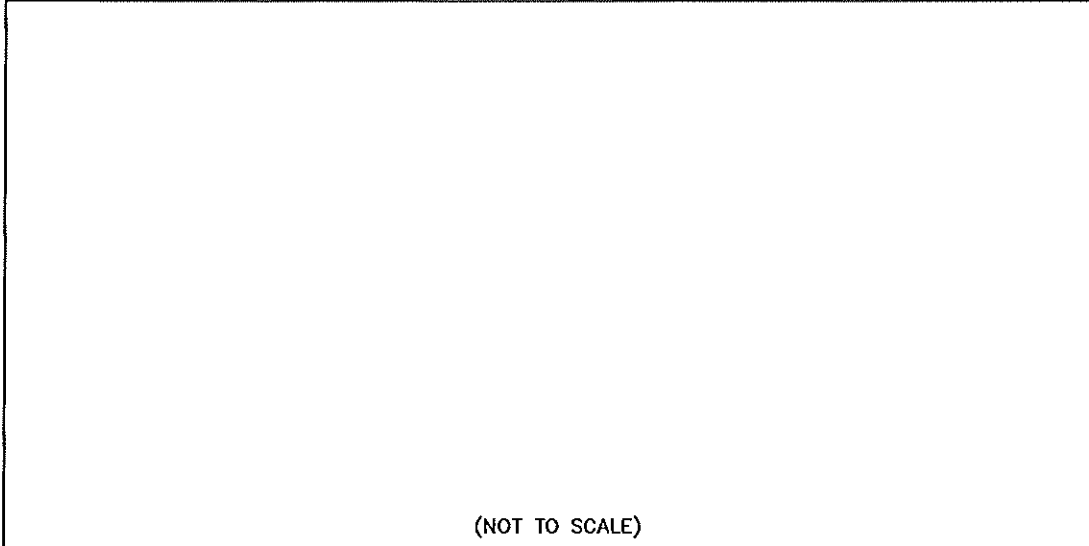
_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julio P. Pappalardo</i> Director of Environmental Management	Modified Service Lateral Gravity Sewer	Detail S-13.3
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PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO. _____ OF _____
 MAIN LOCATION: STREET/EASEMENT _____ MAIN STATION: _____
 PROPERTY OWNER NAME: _____ UNIT NO: _____
 PROPERTY OWNER PHONE NO. _____ UNIT TYPE: _____
 PROPERTY OWNER ADDRESS: _____ ELECTRIC UPGRADE : _____
 _____ SINGLE _____ DOUBLE _____

Place an "O" on the sketch below to indicate where the existing sewer system is located.
 (Septic Tank/Drain Field etc)

Place an "E" on the sketch below to indicate where the house electric panel is located.

Place an "X" on the sketch below to indicate the desired location of the grinder pump/septic tank
 If the location is FEASIBLE to construct, a County representative will place a wooden stake in the
 ground as indicated in sketch.



The undersigned hereby agrees to and authorizes the Washington County Water and Sewer Department and or it's agent(s) to enter upon the above described property shown in the sketch, to excavate, install and backfill a sewer service lateral, and a grinder pump/septic tank station at a feasible location, install underground electrical service from the station to an electrical control panel on the dwelling, and wire the panel to the existing house power supply, and restore the area at no cost to the property owner.

The undersigned also agrees that the Washington County Water and Sewer Department and or it's agent(s) shall have the right to operate and maintain the completed sewer service, station and control panel, upon the completion of the construction at no cost to the property owner, and that no fee shall be paid by the County to the property owner, for use of the property being occupied by the completed sewer service.

 Property Owner Name (Print)

 Property Owner Name (Print)

 Property Owner Signature

 Property Owner Signature

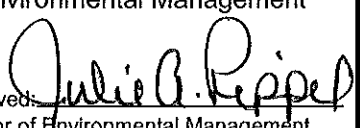
STATE OF MARYLAND, COUNTY OF WASHINGTON, to-wit:

I HEREBY CERTIFY, that on this ____ day of _____ 19 _____, before me, a Notary Public in and for State and County aforesaid, personally appeared _____
 _____ known to me to be the person(s) whose name(s) is (are) signed
 to the foregoing Agreement, and this date acknowledge that said person(s) executed the same as their
 voluntary act; and did further affirm that the consideration stated is correct.

WITNESS my hand and Official Notarial Seal.

 Washington County Water and Sewer Department

Commission Expires:

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	<h2 style="margin: 0;">Low Pressure Sewer Service Location Worksheet</h2>	Detail <h1 style="margin: 0;">S-13.4</h1>
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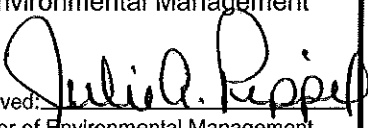
PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO. _____ OF _____
 MAIN LOCATION: STREET/EASEMENT _____ MAIN STATION: _____
 PROPERTY OWNER NAME: _____ UNIT TYPE: _____
 PROPERTY OWNER ADDRESS: _____ MANUFACTURER: _____
 _____ DATE INSTALLED: _____
 CONTRACTOR: _____ SINGLE _____ DOUBLE _____

SIZE & TYPE TEE	SIZE & TYPE SERVICE PIPE	SIZE & TYPE TANK	TOP ELEV & DEPTH	SIZE & TYPE PUMP(S)	IMPELLER SIZE	SERIAL NO.

SKETCH PROFILE AND PLAN VIEWS SHOWING MAIN, SERVICE,
 VALVES, TANK, CONTROL PANEL, UNDERGROUND UTILITIES,
 STRUCTURES, STREETS, ETC. SHOW LOCATION TIES, ANGLES, DISTANCES TO ALL PERTINENT ITEMS.

(NO SCALE)

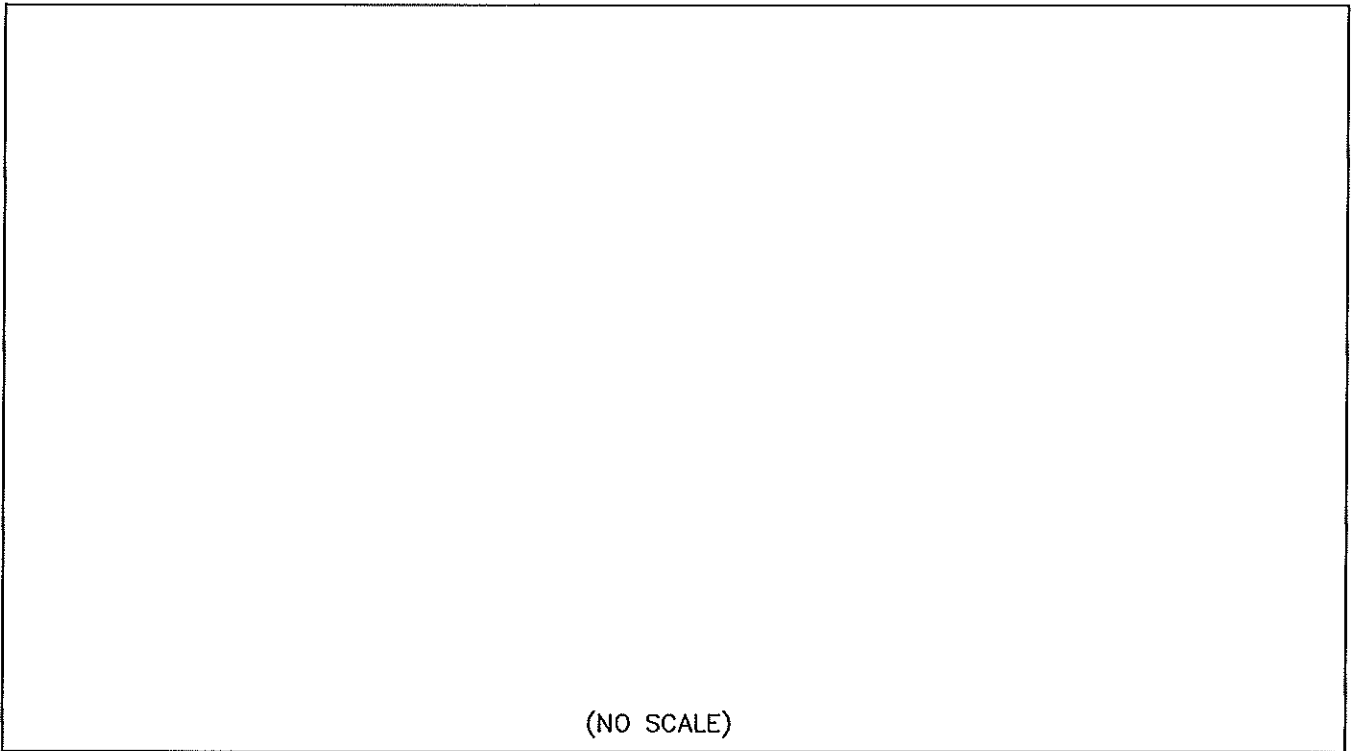
BY: _____ WASHINGTON COUNTY WATER QUALITY _____ CONTRACTOR'S REPRESENTATIVE

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	<h2 style="margin: 0;">Low Pressure Sewer Service Connection Sheet</h2>	Detail <h1 style="margin: 0;">S-13.5</h1>
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PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO. _____ OF _____
 PROPERTY OWNER NAME: _____ UNIT TYPE: _____
 PROPERTY OWNER ADDRESS: _____ MANUFACTURER: _____
 _____ DATE INSTALLED: _____
 CONTRACTOR: _____ SINGLE _____ DOUBLE _____


SIZE & TYPE CONDUIT	WIRE SIZE	SIZE & TYPE DIRECT BURIAL	AVERAGE DEPTH	LENGTH PANEL TO TANK	MANUFACTURE & TYPE BRANCH CIRCUIT

SKETCH PLAN VIEW SHOWING TANK, ELECTRIC SERVICE,
 CONTROL PANEL, UNDERGROUND UTILITIES, STRUCTURES,
 STREETS, ETC. SHOW LOCATION TIES, ANGLES, DISTANCES TO ALL PERTINENT ITEMS.



AMOUNTS PERTAINING TO WORK COMPLETED THIS PERIOD, REVIEWED AND APPROVED.

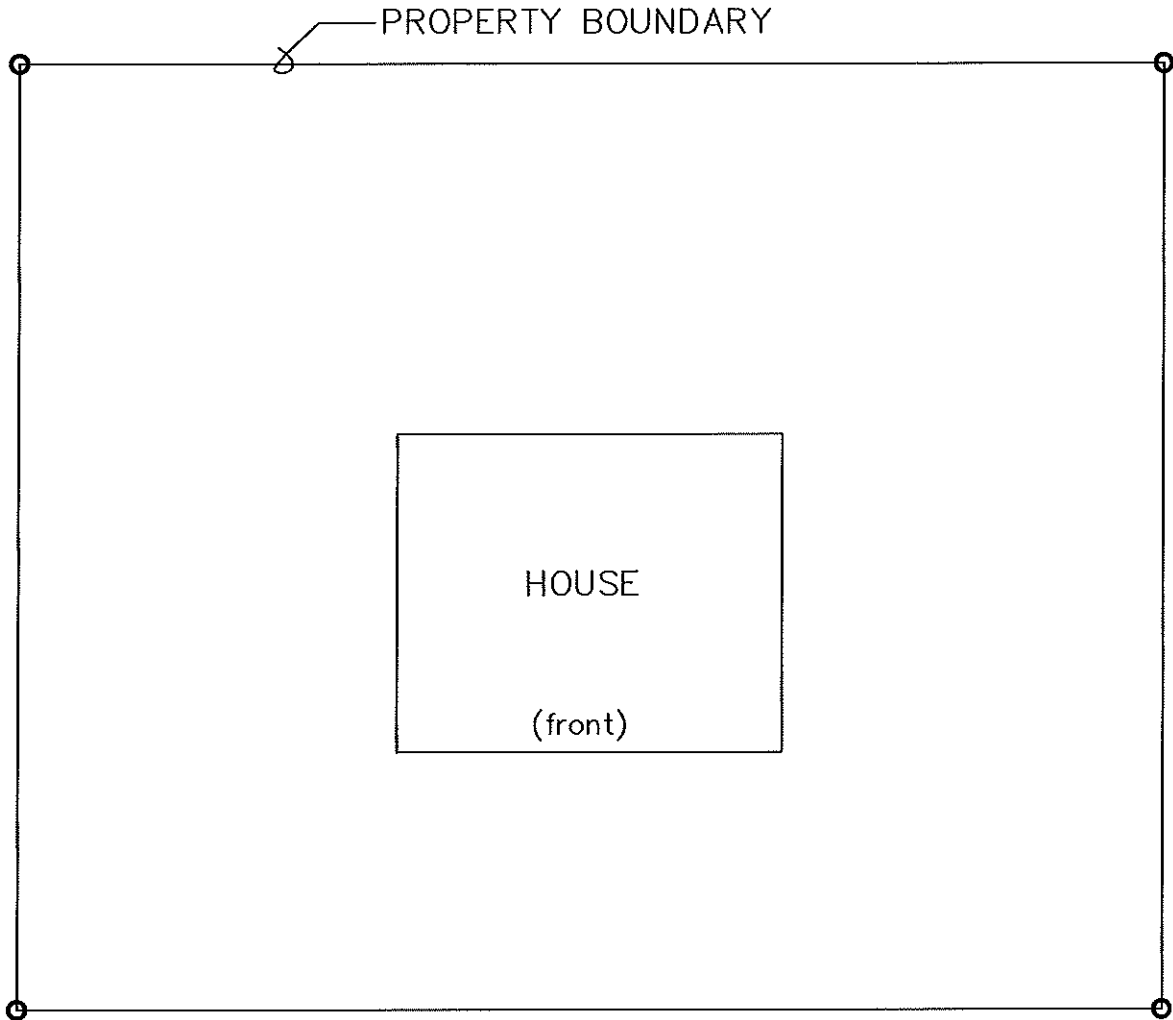
BY: _____ WASHINGTON COUNTY WATER QUALITY _____ CONTRACTOR'S REPRESENTATIVE

REVISIONS <hr/> REVISIONS <hr/> APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Sewer Service Electrical Connection Sheet	Detail S-13.6
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NAME: _____

ADDRESS: _____

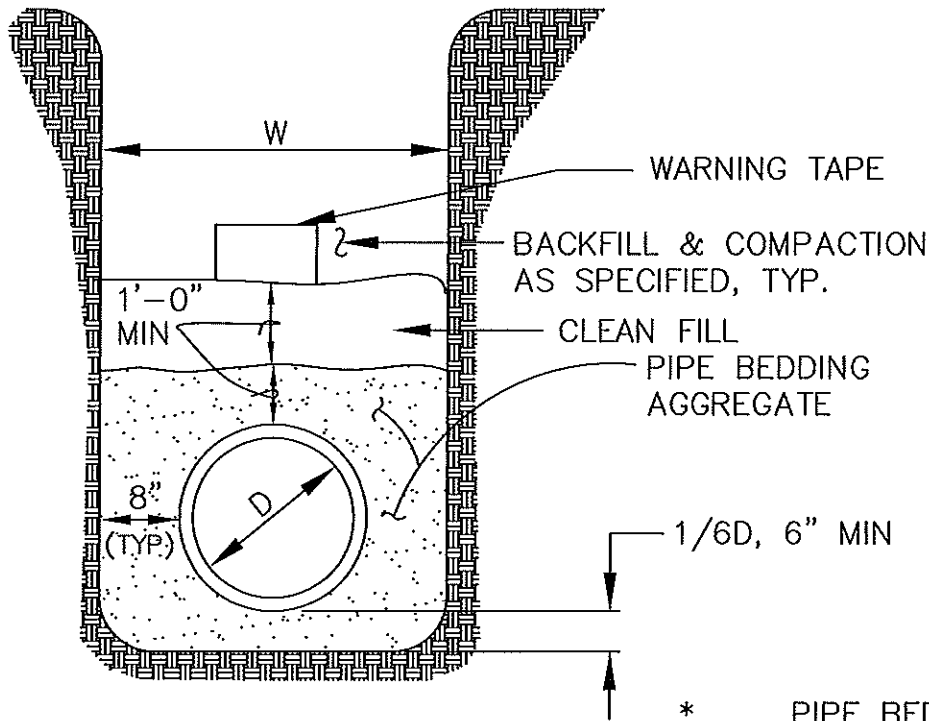
PLEASE SKETCH & LABEL: Pertinent information to show the general arrangement of your house with the street, and the location of the sewer pipe exiting the house. For example, label the "front", show a 2nd street if a corner lot, show driveway, shed, fence, trees, etc. Also show your septic tank & tile field, if known. Show dimensions to building corners, trees, fences, etc., measured approximately to the nearest foot.



STREET: _____

NO SCALE

<p>_____ REVISED</p> <p>_____ REVISED</p> <p>_____ APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio P. Pappas</i> Director of Environmental Management</p>	<p>On-Site Sewage Disposal Sketch Plan</p>	<p>Detail</p> <p>S-13.7</p>
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GRANULAR BEDDING & BACKFILL

* PIPE BEDDING AGGREGATE

D = 4" AND LARGER - SHA GRADED CRUSHER RUN CR-6

D = 1-1/2" THROUGH <4" - SHA GRADED B-10

D = LESS THAN 1-1/2" - STONE DUST

* = NOMINAL PIPE DIAMETER (INCHES)

REVISIONS

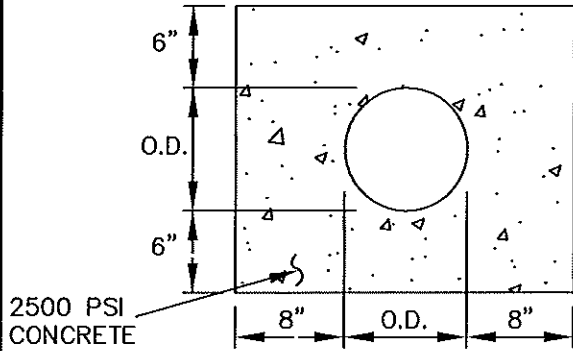
 REVISION

 APPROVED

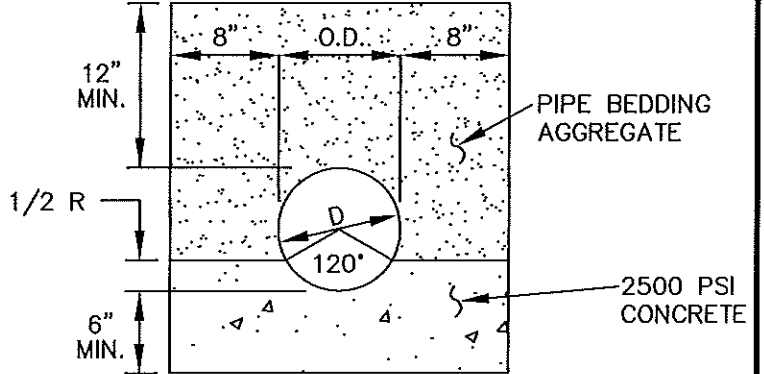
Washington County, MD Div. of
 Environmental Management
 Approved: *Julia A. Poppe*
 Director of Environmental Management

STANDARD
 TRENCH WIDTH &
 STONE BEDDING

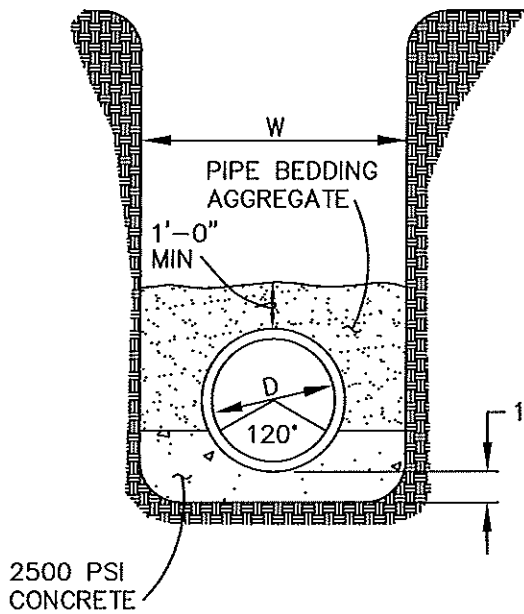
Detail
 SW-1.1



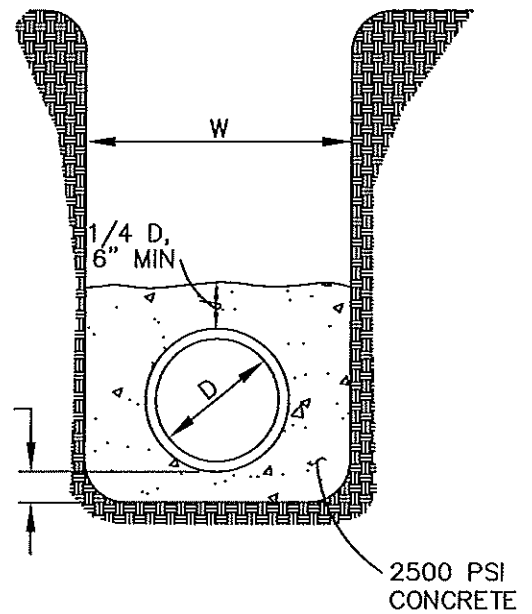
CONCRETE ENCASEMENT



LOW CRADLE



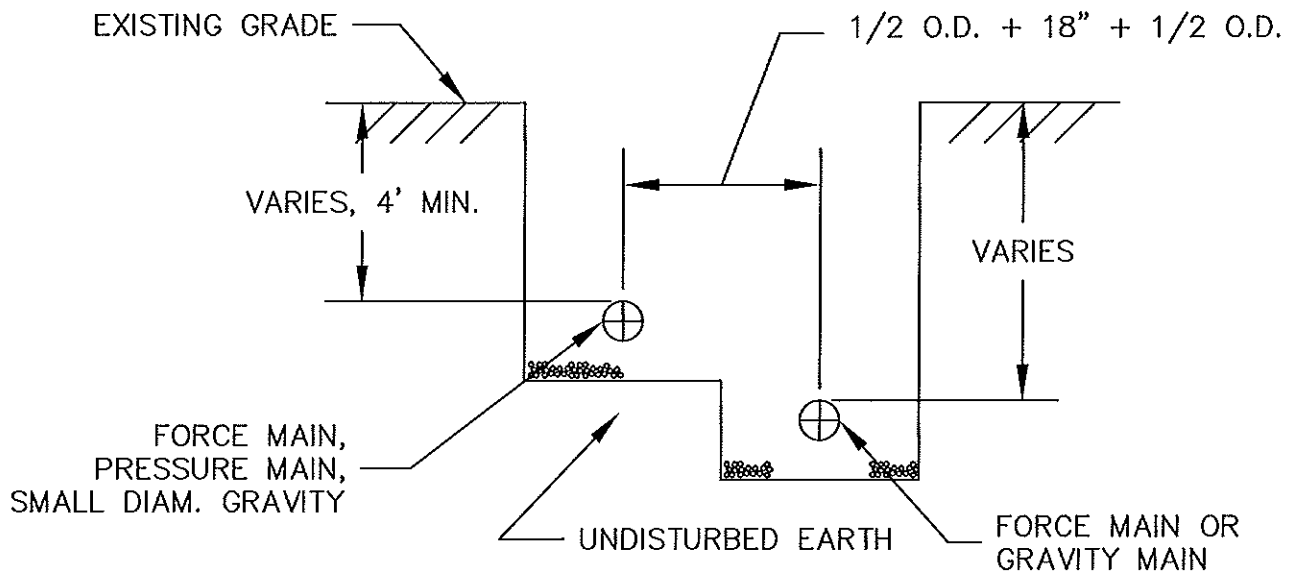
LOW CRADLE



CONCRETE ENCASEMENT

NO SCALE

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Audrey A. Pappalardo</i></p> <p>Director of Environmental Management</p>	<p>Concrete Cradles and Encasement</p>	<p>Detail</p> <p>SW-1.2</p>
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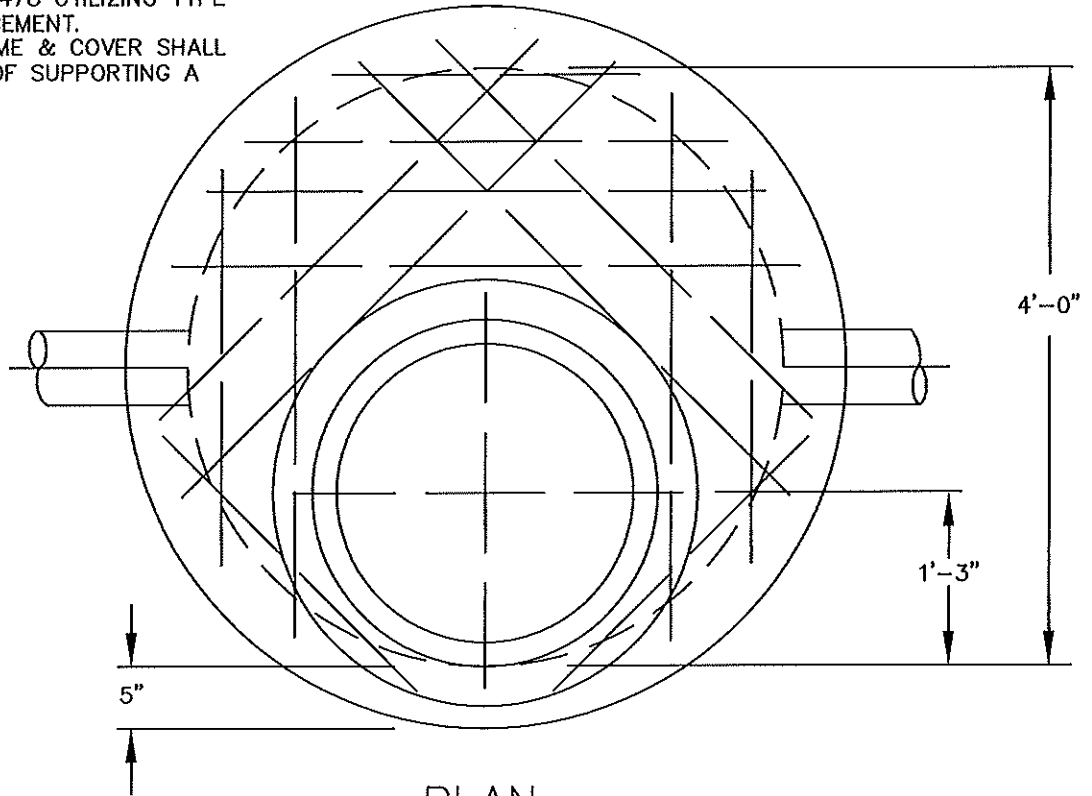


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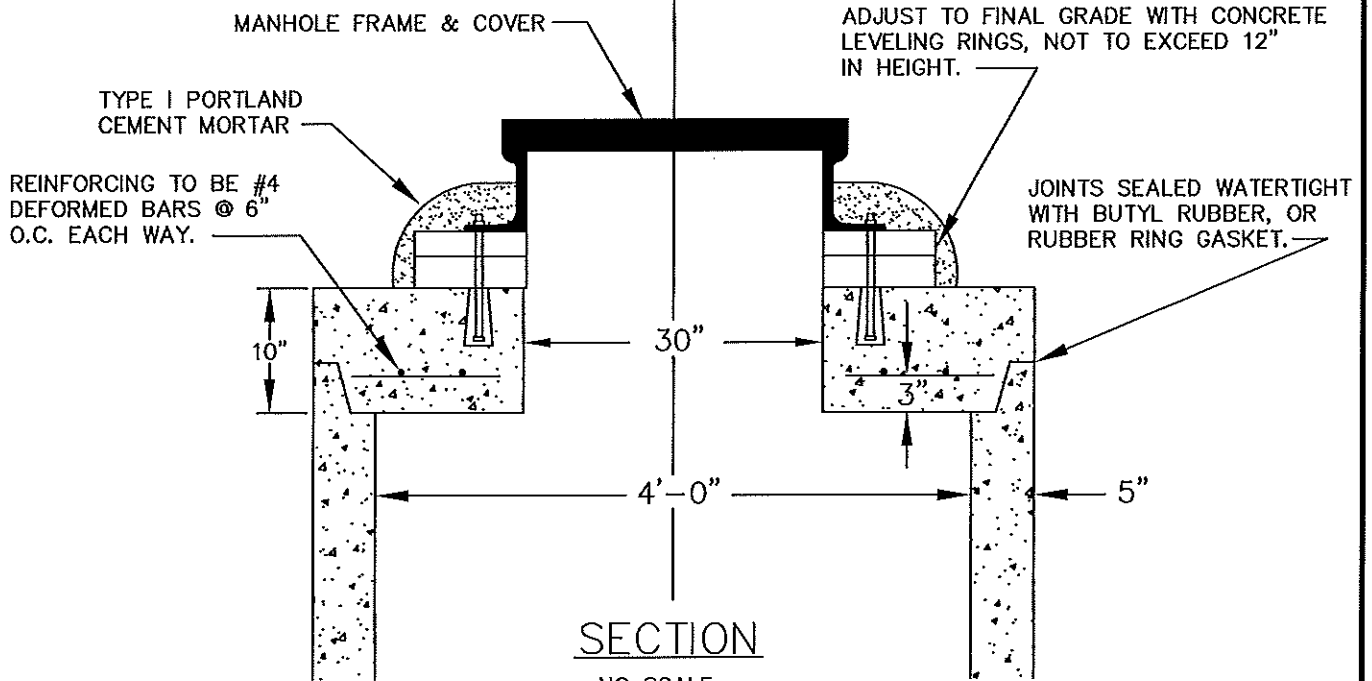
<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie Peppel</i></p> <p>Director of Environmental Management</p>	<p>TRENCH DETAILS</p> <p>PARALLEL LINES</p>	<p>Detail</p> <p>SW.1-3</p>
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NOTES:

1. MANHOLE FRAME & COVER SHALL BE PLACED AS SHOWN.
2. PRECAST MANHOLE SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 UTILIZING TYPE II PORTLAND CEMENT.
3. MANHOLE FRAME & COVER SHALL BE CAPABLE OF SUPPORTING A H₂O LOADING.



PLAN

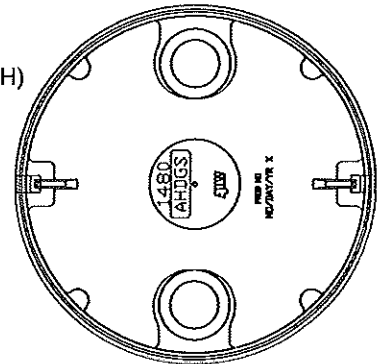
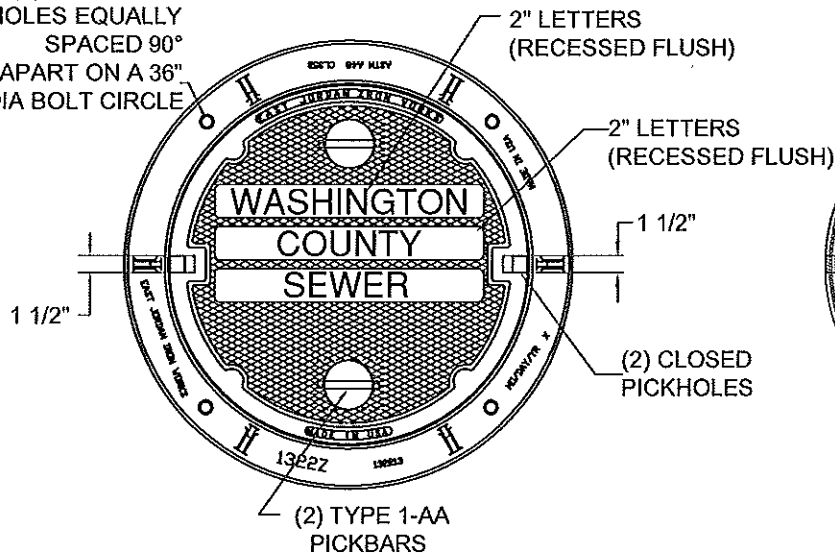


SECTION

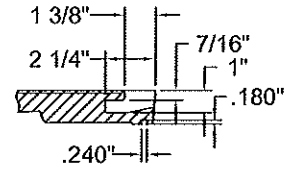
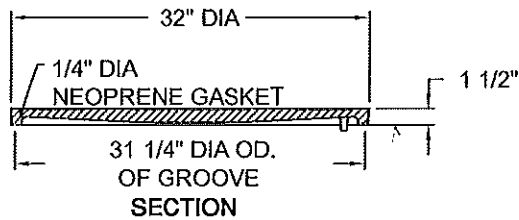
NO SCALE

<p>REVIS</p> <hr/> <p>REVIS</p> <hr/> <p>APPROV</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Pappas</i> Director of Environmental Management</p>	<p>Flat Top Manhole Section Precast Manhole</p>	<p>Detail</p> <p>SW-2.2</p>
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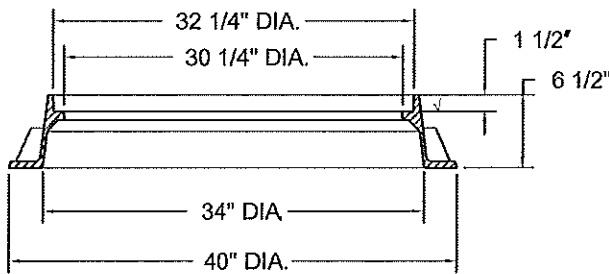
(4) 1" DIA BOLT HOLES EQUALLY SPACED 90° APART ON A 36" DIA BOLT CIRCLE



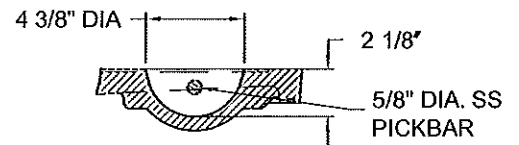
BOTTOM VIEW OF COVER



PICKHOLE & GASKET DETAIL



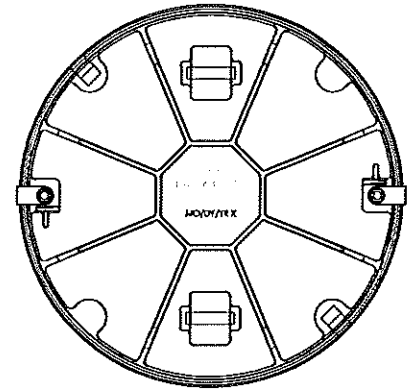
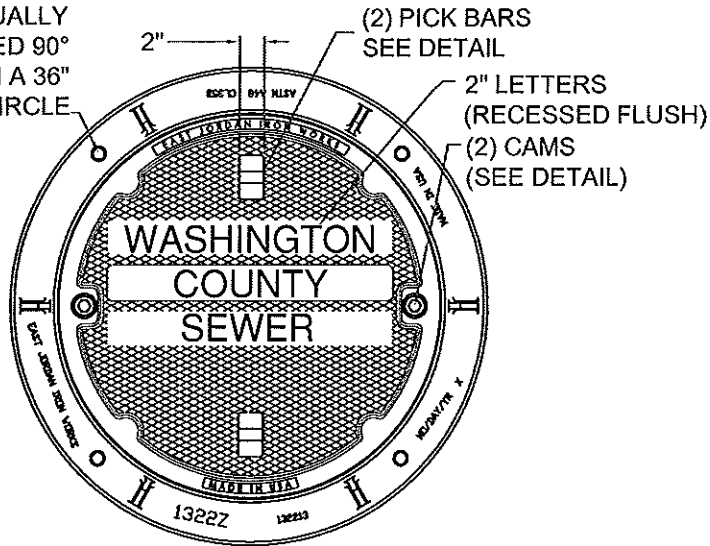
SECTION



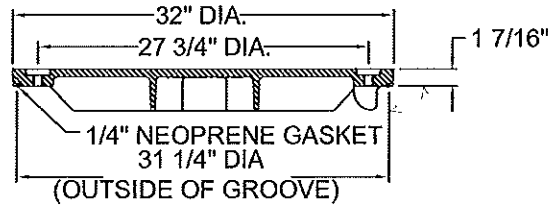
PICKBAR DETAIL

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>REVISOR</p> <p>DATE</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Pippes</i></p> <p>Director of Environmental Management</p>	<p>Standard Manhole Frame & Cover</p>	<p>Detail</p> <p>SW-2.6</p>
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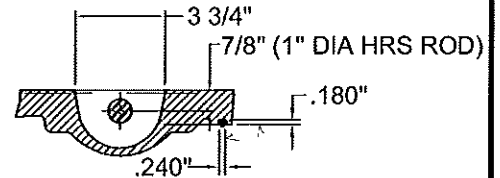
(4) 1" DIA BOLT HOLES EQUALLY SPACED 90° APART ON A 36" DIA BOLT CIRCLE



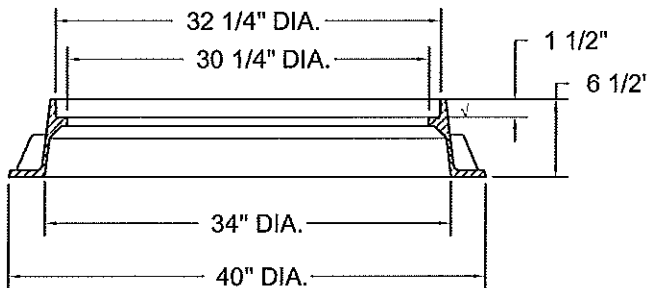
BOTTOM VIEW OF COVER



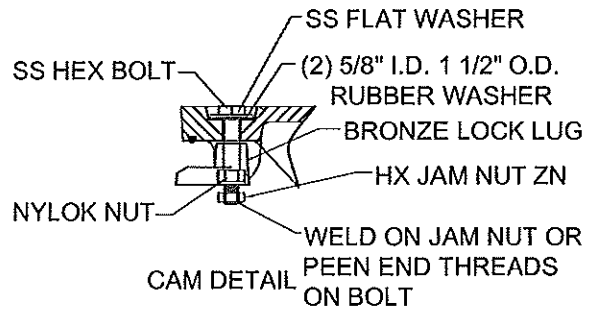
SECTION VIEW



PICKBAR & GASKET GROOVE DETAIL

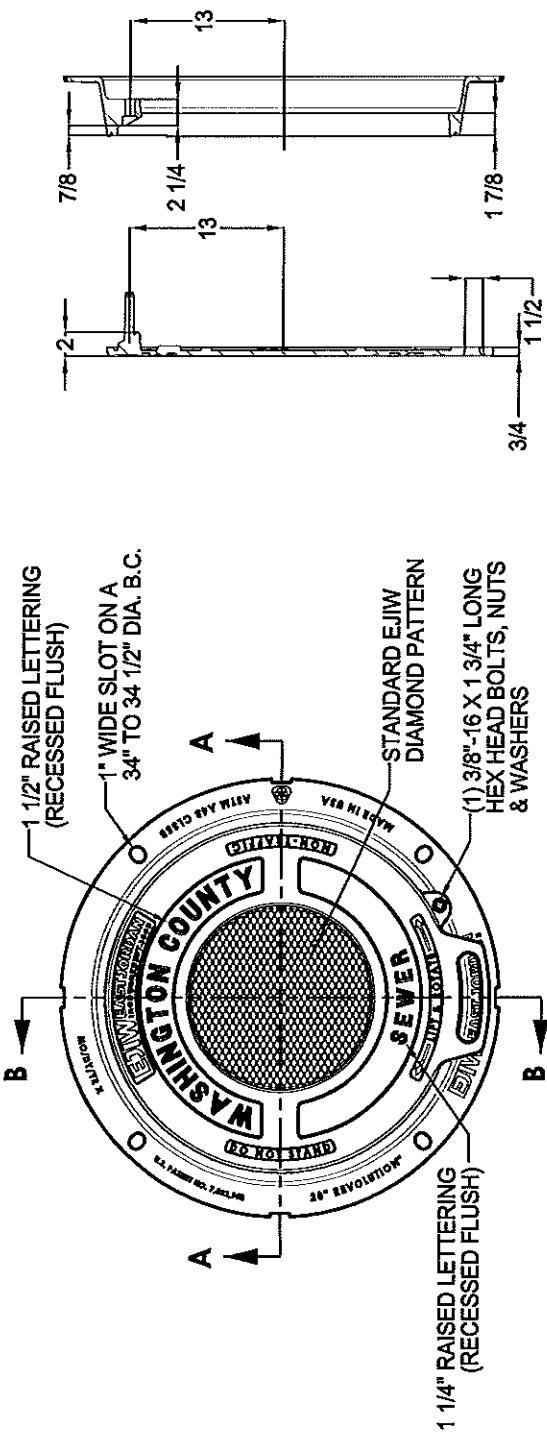


SECTION

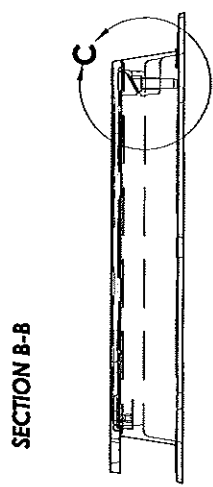


CAM DETAIL

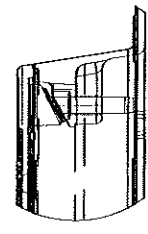
<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Lopez</i></p> <p>Director of Environmental Management</p>	<p>Standard Water Tight Manhole Frame & Cover</p>	<p>Detail</p> <p>SW-2.7</p>
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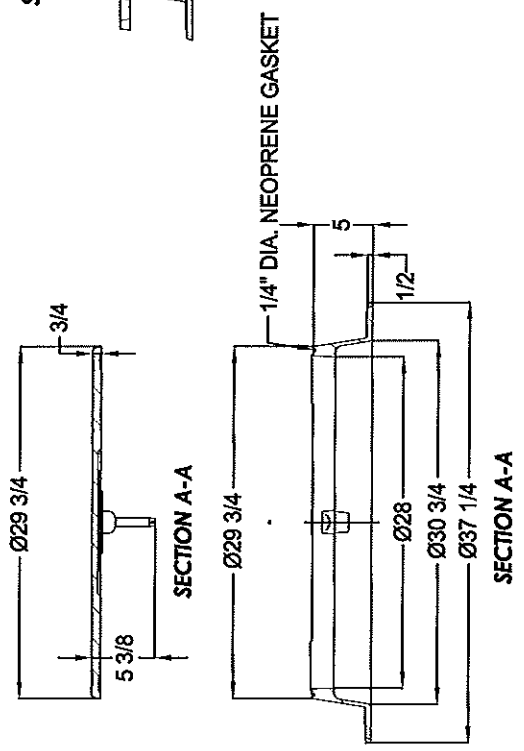
SECTION B-B
SCALE 1 : 15



SECTION B-B



VIEW C



SECTION A-A

SECTION A-A

Washington County, MD Div. of
Environmental Management

Approved: *Judith A. Pipes*
Director of Environmental Management

REVISED
REVISED
APPROVED

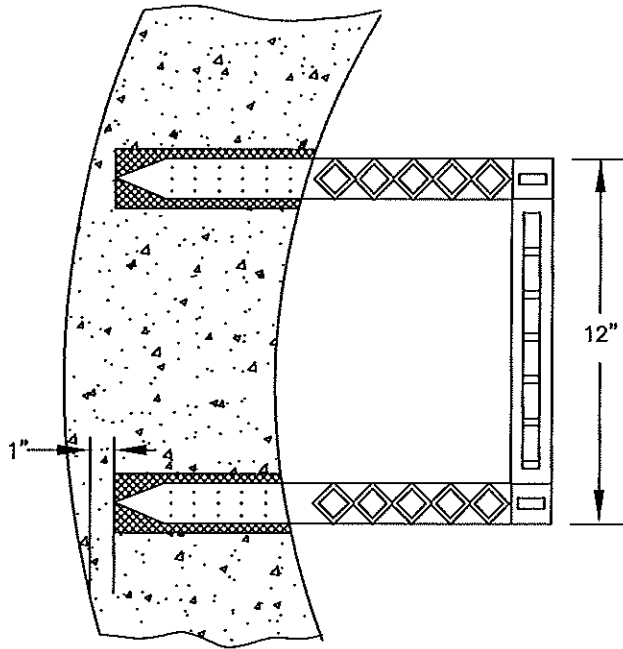
Non-Traffic Bearing Manhole Frame & Cover

Detail

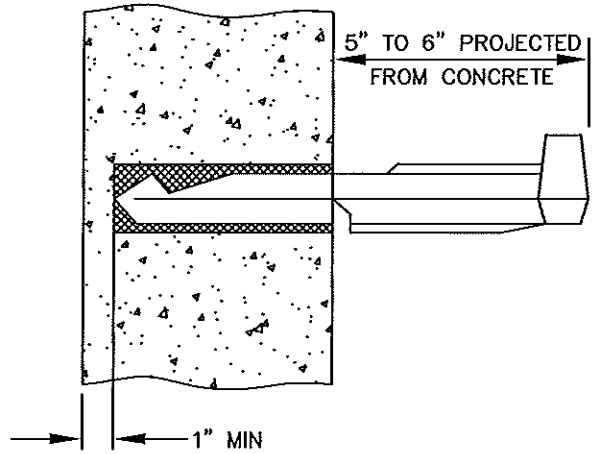
SW-2.8

NOTES:

1. STEPS SHALL BE INSTALLED AS PER MANUFACTURER'S REQUIREMENTS BY MANHOLE MANUFACTURER.
2. WHEN STEPS ARE TO BE INSTALLED ON SITE, MANHOLE SECTIONS SHALL HAVE APPROVED INSERTS PROVIDED AND INSTALLED AS PER INSERT MANUFACTURER'S SPECIFICATIONS.
3. MANHOLES TO BE LINED WITH HDPE LINER, SHALL NOT HAVE STEPS INSTALLED.

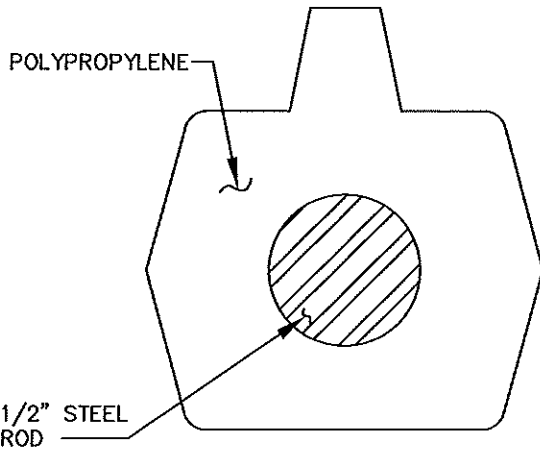


PLAN

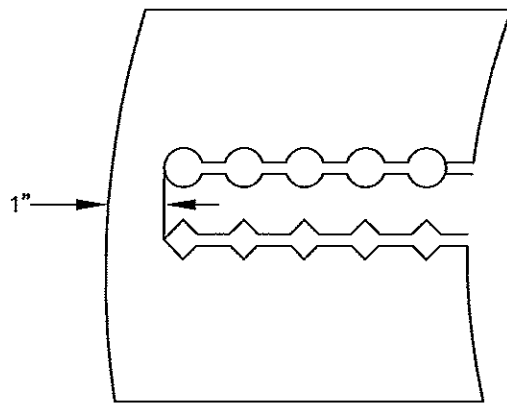


PROFILE

COATED STEP



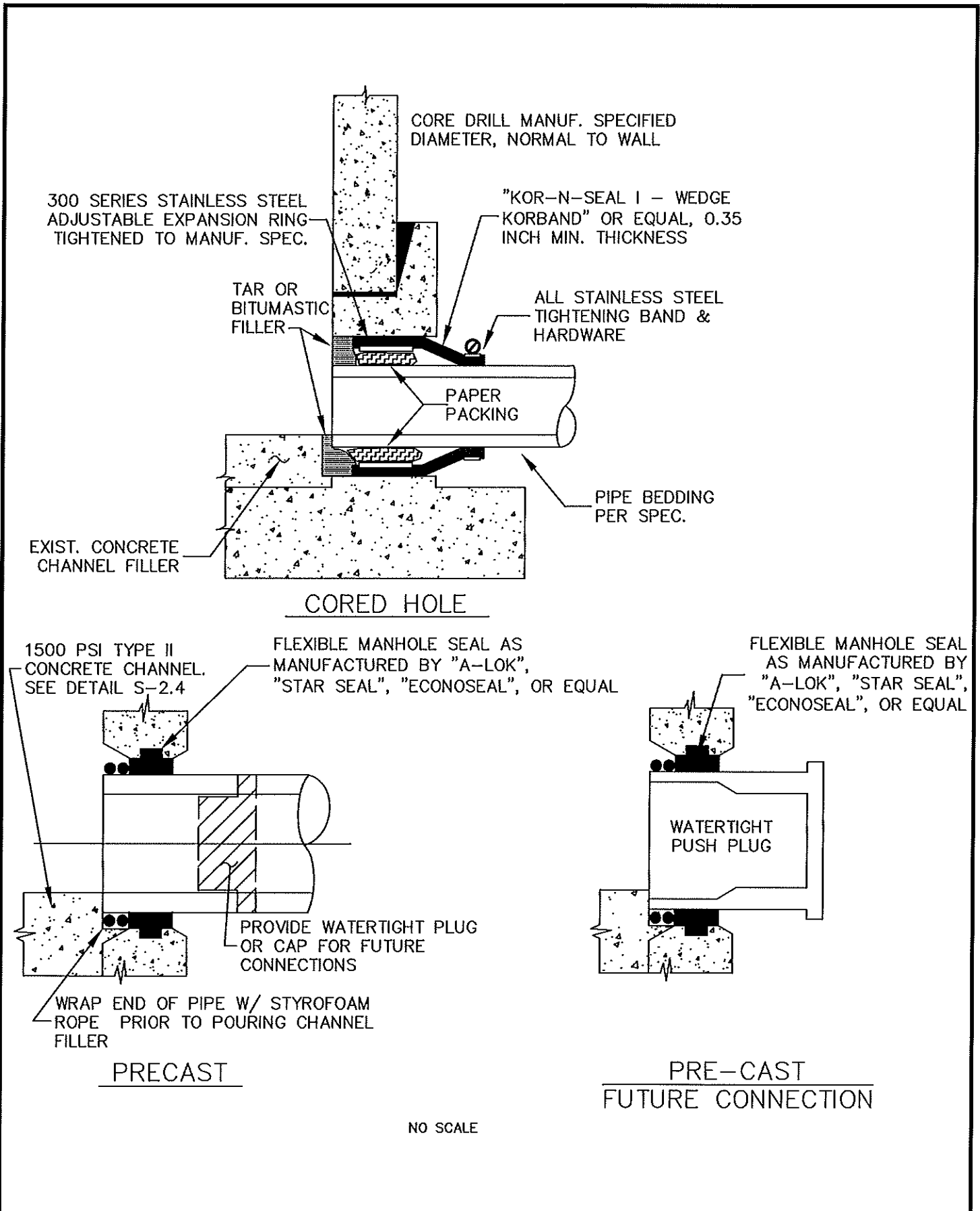
SECTION



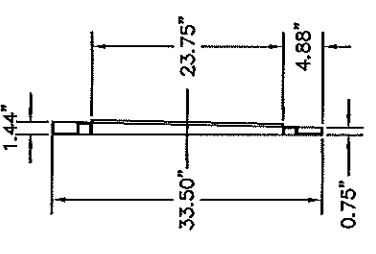
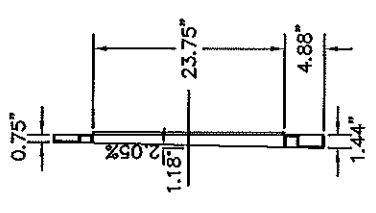
INSERT

NO SCALE

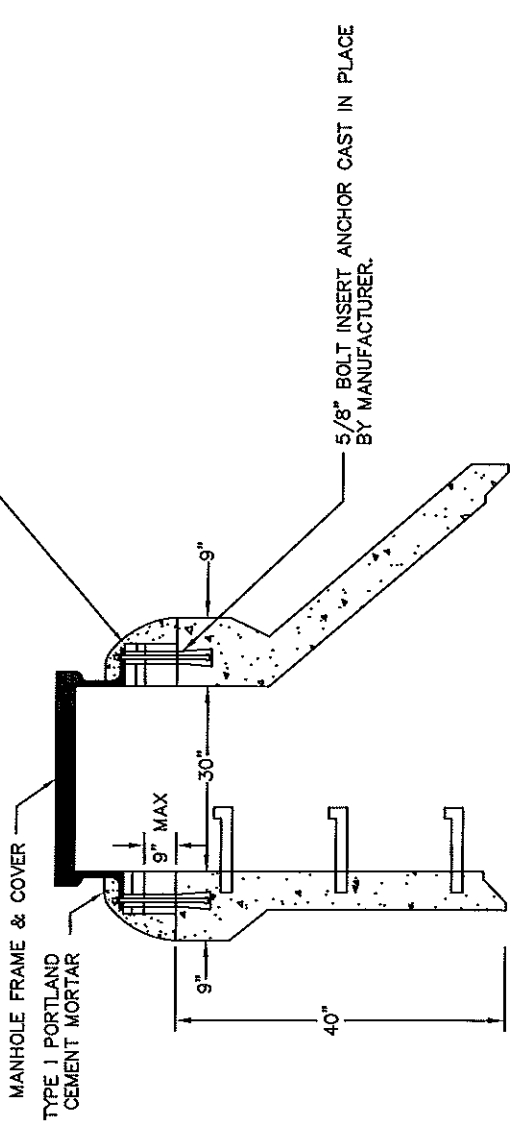
REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Poppel</i> Director of Environmental Management	Standard Manhole Steps	Detail SW-2.9
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REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Lopez</i> Director of Environmental Management	Manhole Pipe Connections	Detail SW-2.10
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ADJUST TO FINAL GRADE WITH CONCRETE LEVELING RINGS OR HDPE ADJUSTABLE GRADE RINGS, NOT TO EXCEED 12" IN HEIGHT.



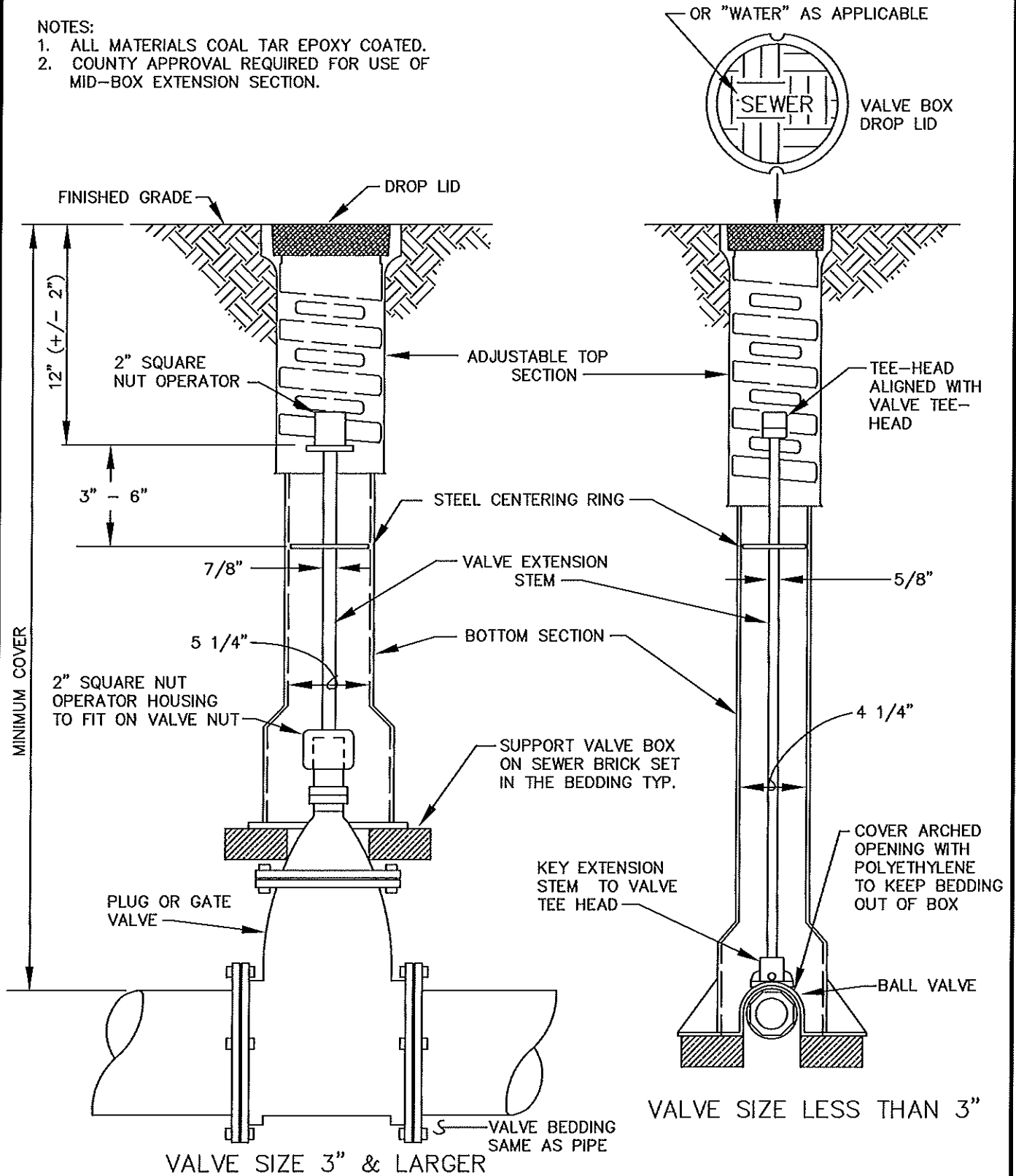
DESCRIPTION
 PLASTIC INJECTION MOLDED ADJUSTMENT RING
 MOLDED FROM HIGH DENSITY POLYETHYLENE AS DEFINED IN ASTM SPECIFICATION D1248
 ACTUAL RESIN PROPERTIES WILL VARY ALLOWING FOR THE UTILIZATION OF A MAXIMUM PERCENT OF RECYCLED MATERIAL
 THE PERCENT OF POST CONSUMER WASTE TO INDUSTRIAL WASTE WILL VARY WITH AVAILABILITY AND PROPERTY RETENTION NEEDS
 COLOR, SHAPE, AND UNIFORMITY WILL VARY WITH THE MIX OF THE POST CONSUMER AND INDUSTRIAL WASTE MATERIALS
 DIMENSIONS SHOWN ARE NOMINAL - ACTUAL SIZE WILL VARY WITHIN ALLOWABLE TOLERANCE AND REQUIRED FIT

NO SCALE

REVISIONS _____ REVISIONS _____ APPROVED _____	Washington County, MD Div. of Environmental Management Approved: <i>David L. Lippel</i> Director of Environmental Management	Detail HDPE Adjustable Grade Ring SW-2.13
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NOTES:

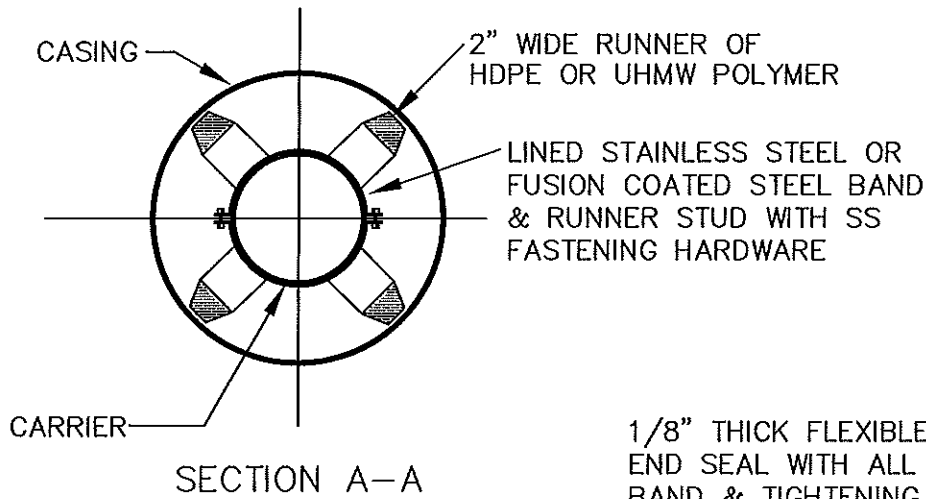
1. ALL MATERIALS COAL TAR EPOXY COATED.
2. COUNTY APPROVAL REQUIRED FOR USE OF MID-BOX EXTENSION SECTION.



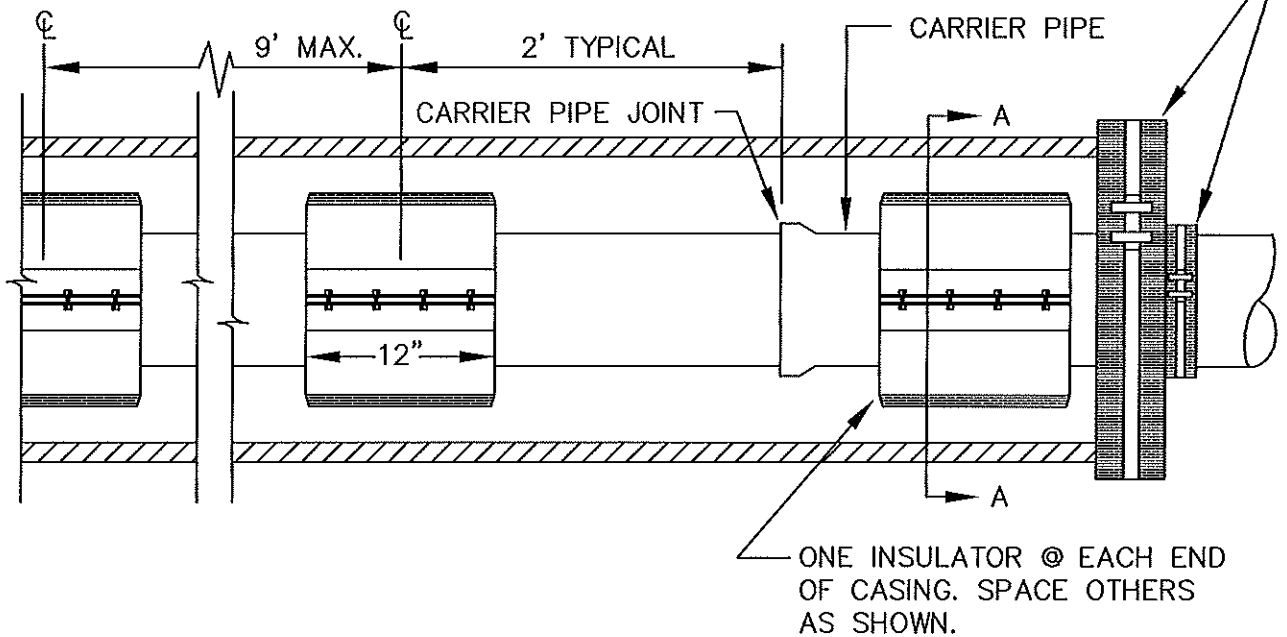
<p>REVISD</p> <p>REVISD</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Pappas</i></p> <p>Director of Environmental Management</p>	<p>Valve & Box Installation</p>	<p>Detail</p> <p>SW-7.1</p>
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PIPE INSULATOR SHALL CENTER THE CARRIER PIPE & FIT TO RESTRAIN AGAINST MOVEMENT

NOMINAL DIAMETER	
MAIN	CASING
4"	10"
6"	14"
8"	16"
10"	18"
12"	20"
15"/16"	24"
18"	26"



1/8" THICK FLEXIBLE RUBBER CASING END SEAL WITH ALL STAINLESS STEEL BAND & TIGHTENING DEVICE HARDWARE



NOTES:

1. WELD JOINTS SHALL BE CONTINUOUS & WATERTIGHT. PIPE SHALL BE A139 GRADE 36.
2. WALL THICKNESS FOR ALL CASING SIZES SHALL BE STANDARD 0.375 INCH MIN
3. ALL PIPES JOINTS INSIDE CASING PIPE SHALL BE RESTRAINED WITH MECHANICAL RESTRAINTS

NO SCALE

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie R. Pappas</i></p> <p>Director of Environmental Management</p>	<p>Steel Pipe Encasement For Water & Sewer Mains</p>	<p>Detail</p> <p>SW-9.1</p>
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SECTION I: TO BE COMPLETED BY CONTRACTOR (ATTACH TO EACH COPY OF SUBMITTAL)

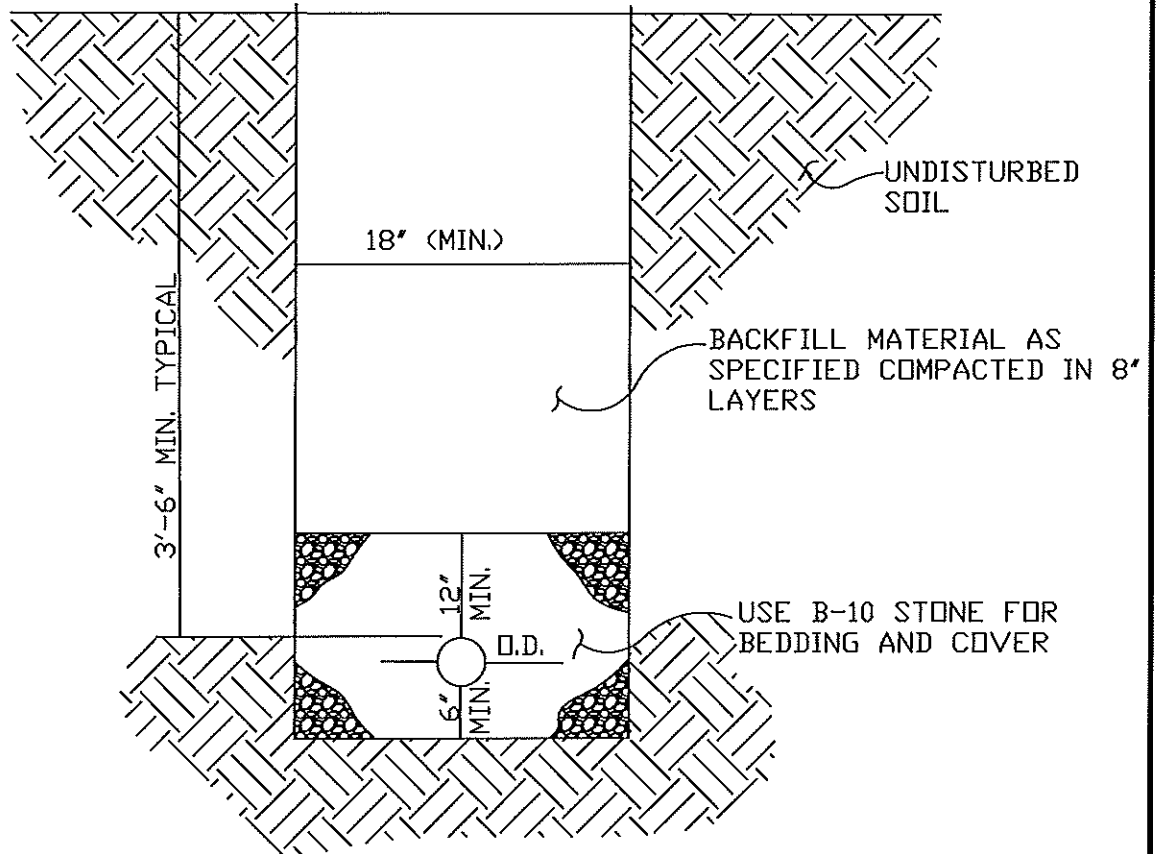
PROJECT: _____ PROJECT NO.: _____
_____ SUBMITTAL NO.: _____
CONTRACTOR: _____ DATE: _____
ADDRESS: _____ SHEET 1 OF _____
_____ CONTACT PERSON: _____ PHONE: () _____
SPECIFICATION REFERENCE: _____
DRAWING(S) REFERENCE: _____
SPECIFIC APPLICATION/USE: _____
_____ PRODUCT NAME: _____
MODEL/TYPE/SERIES: _____ FOR SIZE(S): _____
MODEL/TYPE/SERIES: _____ FOR SIZE(S): _____
MANUF.: _____ SUPPLIER: _____
PHONE: () _____ PHONE: () _____

SECTION II: TO BE COMPLETED BY WASHINGTON COUNTY WATER QUALITY DEPARTMENT

COMMENTS: _____

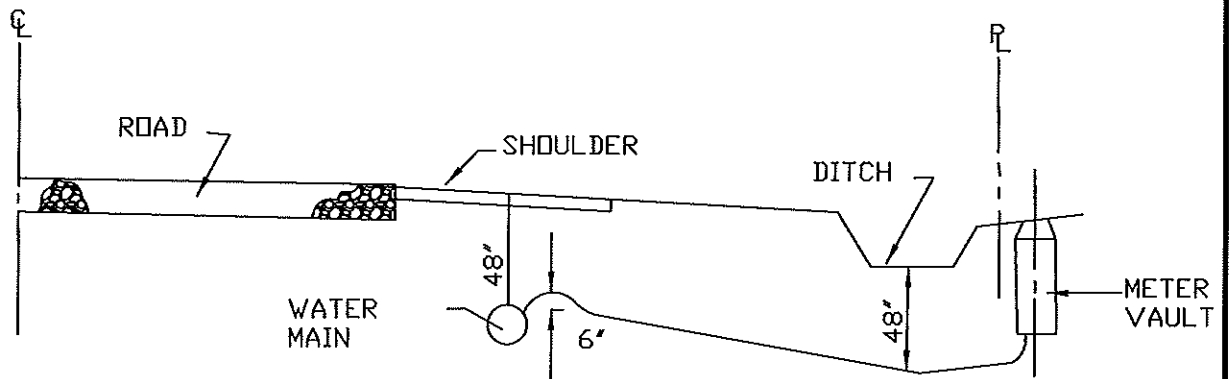
_____	APPROVED
_____	APPROVED AS NOTED
_____	REVISE & RESUBMIT
_____	NOT AS SPECIFIED
BY: _____	DATE: _____

REVISID REVISID APPROVED	Washington County, MD Div. of Environmental Management <i>Julia A. Pappas</i> Approved: _____ Director of Environmental Management	Shop Drawing Cover Sheet	Detail SW-12.1
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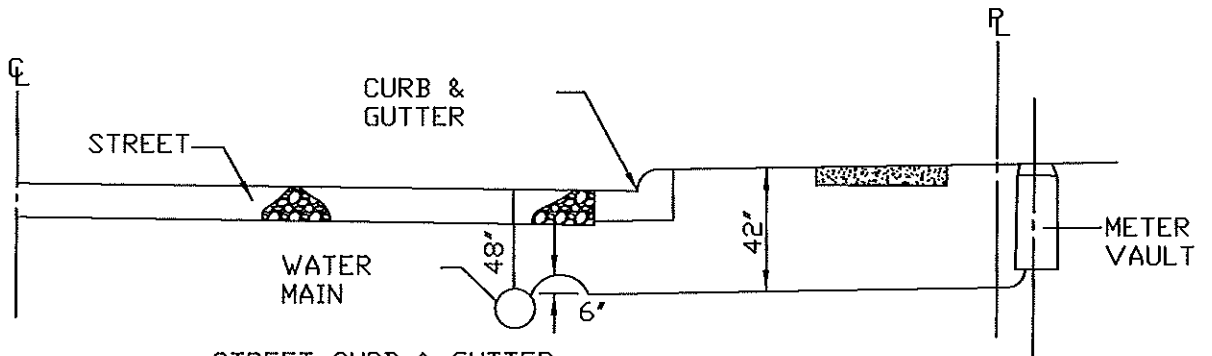


1. TRENCH WALLS SHALL BE VERTICAL 18" ABOVE TOP OF PIPE.
2. ALL BACKFILL IN STABILIZED AREAS COMPACTED TO 95% MAX. DENSITY PER A4SHTD T-180 METHOD D.

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia Lippio</i> Director of Environmental Management	SERVICE CONNECTION TYPICAL TRENCH DETAIL	Detail W-10.1
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ROAD-DRAINAGE DITCH



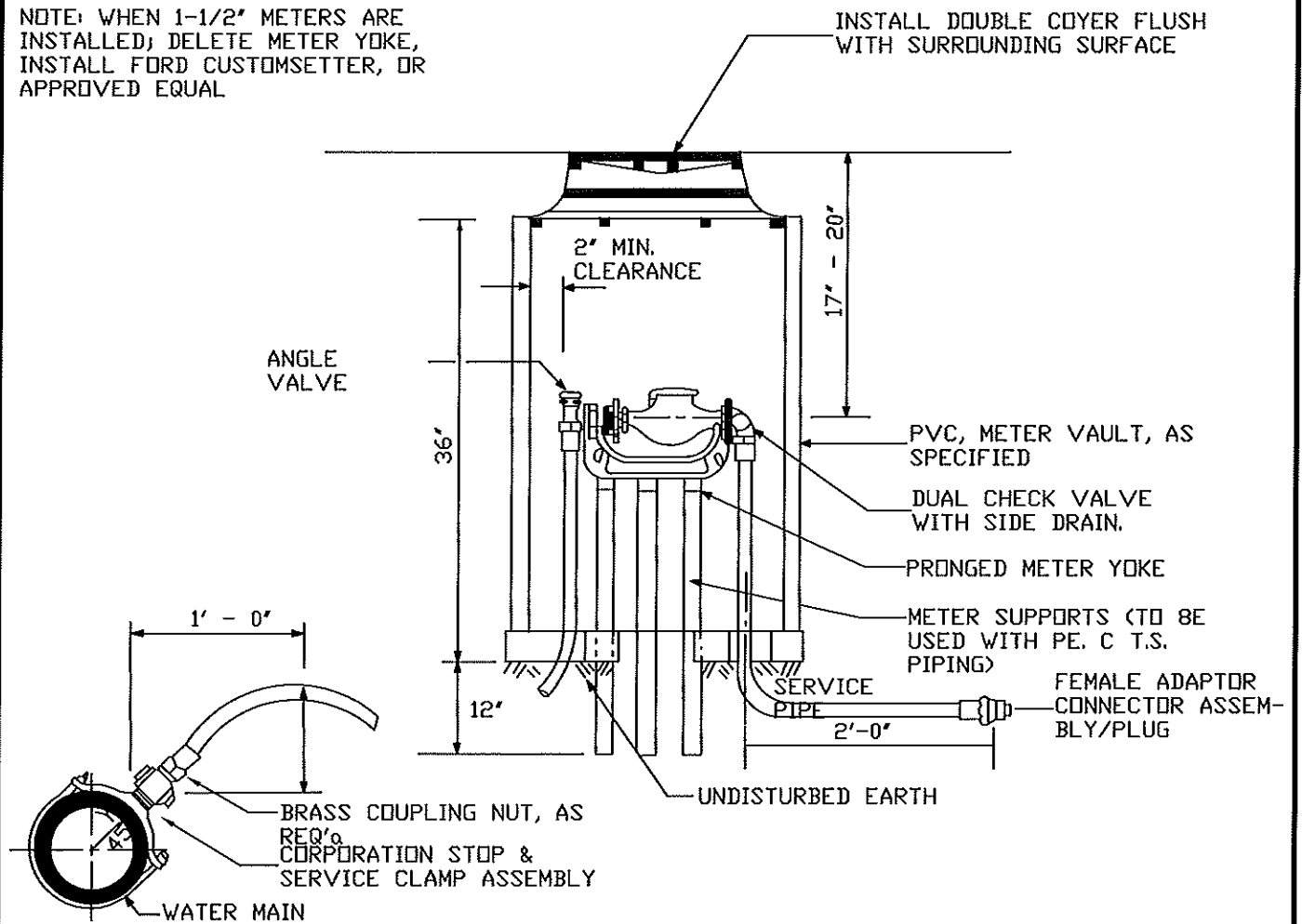
STREET-CURB & GUTTER

NOTES:

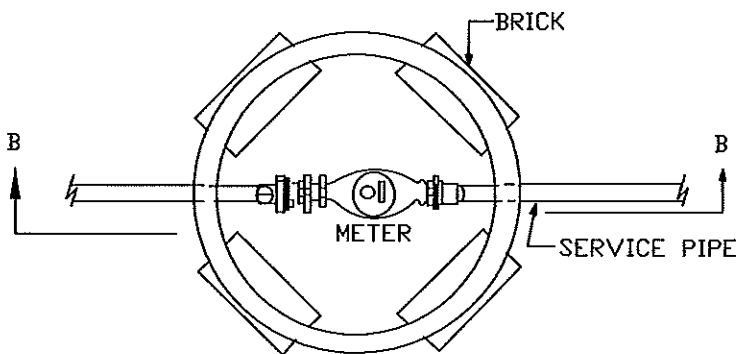
1. METER VAULTS SHALL BE PLACED AT OR NEAR THE PROPERTY LINE
2. METER VAULTS SHALL IN NO CASE BE PLACED IN A STEEP SLOPE, EXPOSING THE FRONT OF THE METER VAULT, NOR SHALL THEY BE INSTALLED IN STEEP SLOPES AT A SHARP ANGLE.
3. CORPORATION STOP TO BE LEFT ON, ANGLE VALVE OFF.

REVISOR	Washington County, MD Div. of Environmental Management	WATER METER LOCATION	Detail
REVISOR	Approved: <i>Julia A. Pappas</i>		W-10.2
APPROVED	Director of Environmental Management		

NOTE: WHEN 1-1/2" METERS ARE INSTALLED; DELETE METER YOKE, INSTALL FORD CUSTOMSETTER, OR APPROVED EQUAL



SECTION B - B

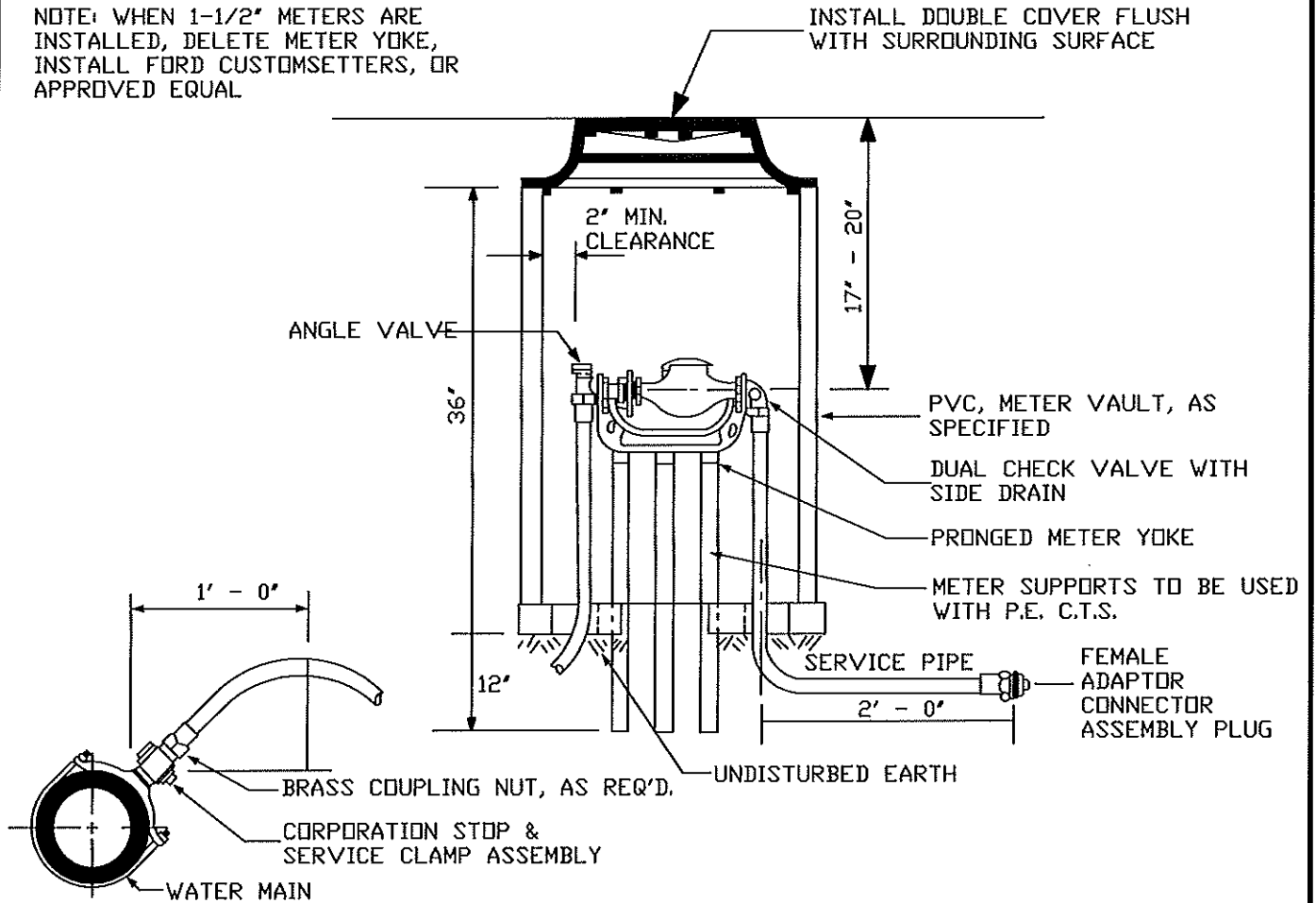


PLAN

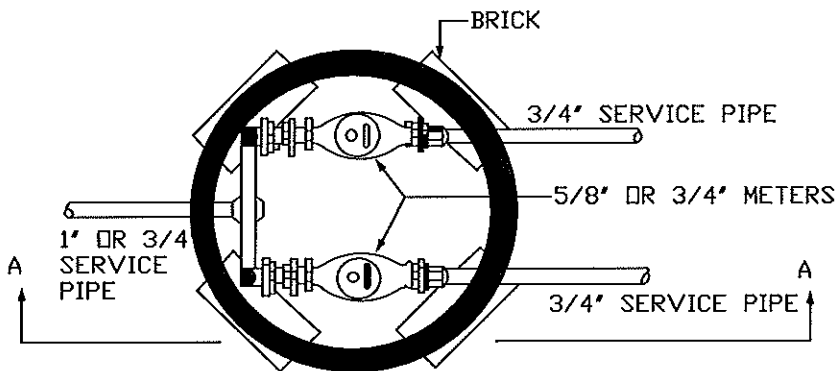
SERVICE PIPE DIAMETER	METER SIZE	VAULT SIZE
3/4"	5/8"	24"
1"	3/4"	24"
1 1/4"	1"	36"
2"	1 1/2"	36"

REVISIONS _____ REVISD _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Peppie</i> Director of Environmental Management	METERED DOMESTIC SERVICE INSTALLATION	Detail W-10.3
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NOTE: WHEN 1-1/2" METERS ARE INSTALLED, DELETE METER YOKE, INSTALL FORD CUSTOMSETTERS, OR APPROVED EQUAL



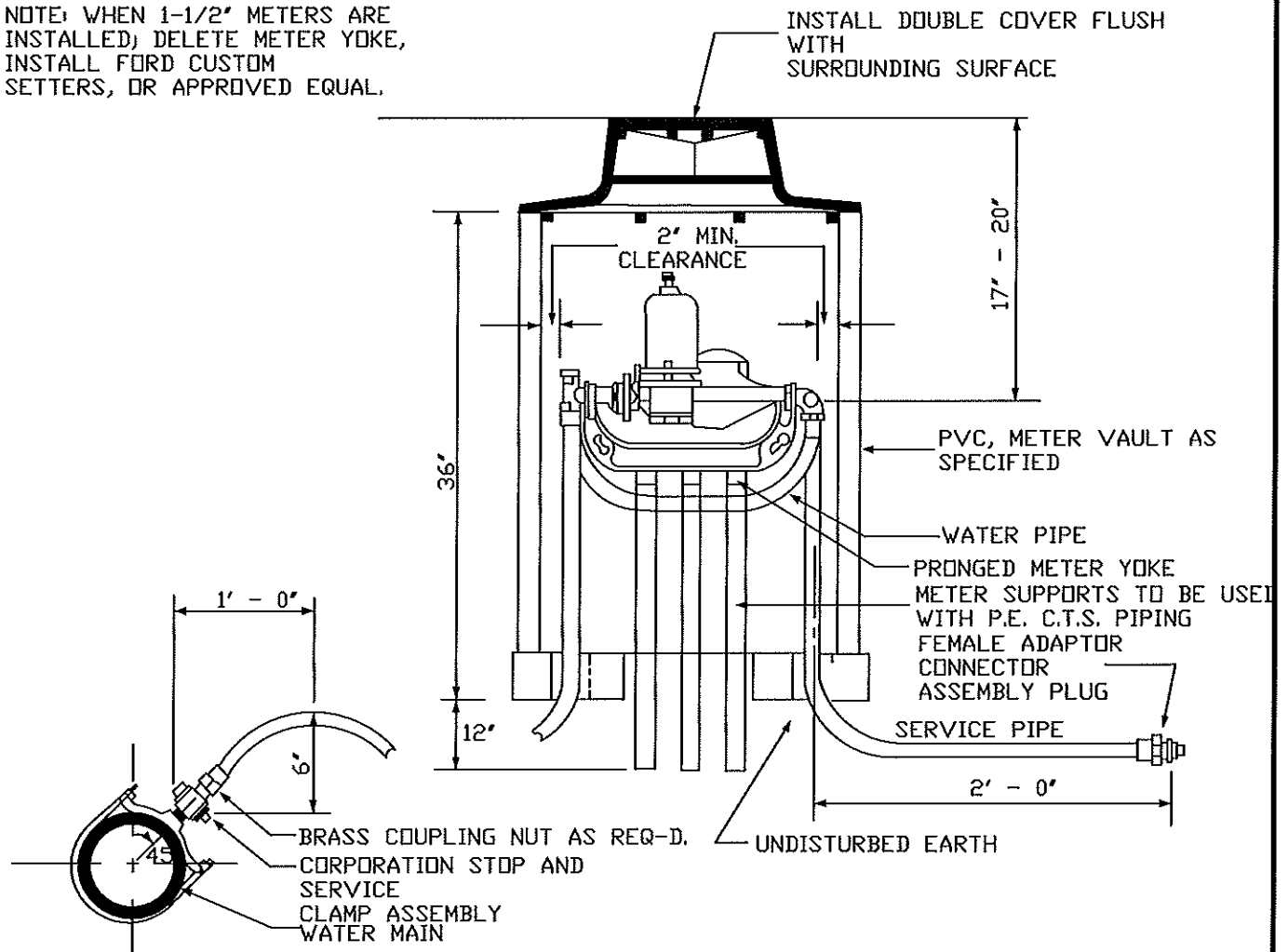
SECTION A-A



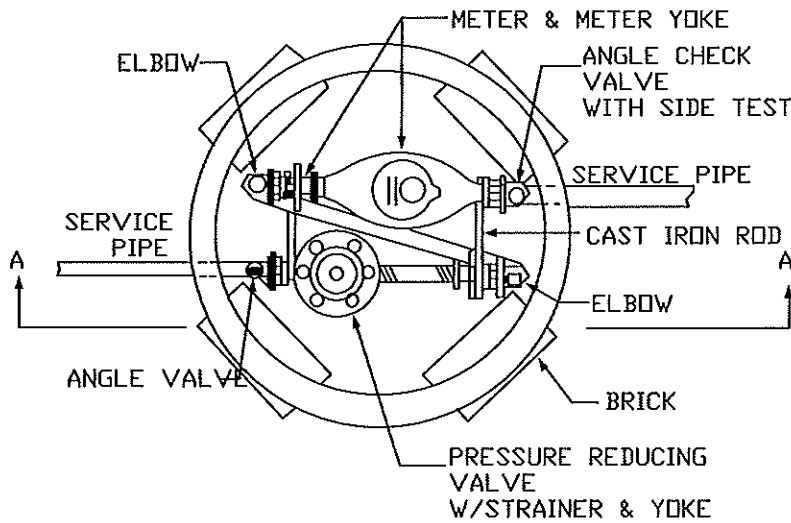
NOTE: MINIMUM VAULT SIZE SHALL BE 36"

<p>REVISD</p> <p>REVISD</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julius A. Pippel</i> Director of Environmental Management</p>	<p>METERED DOMESTIC SERVICE TWIN SETTING</p>	<p>Detail</p> <p>W-10.4</p>
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NOTE: WHEN 1-1/2" METERS ARE INSTALLED; DELETE METER YOKE, INSTALL FORD CUSTOM SETTERS, OR APPROVED EQUAL.



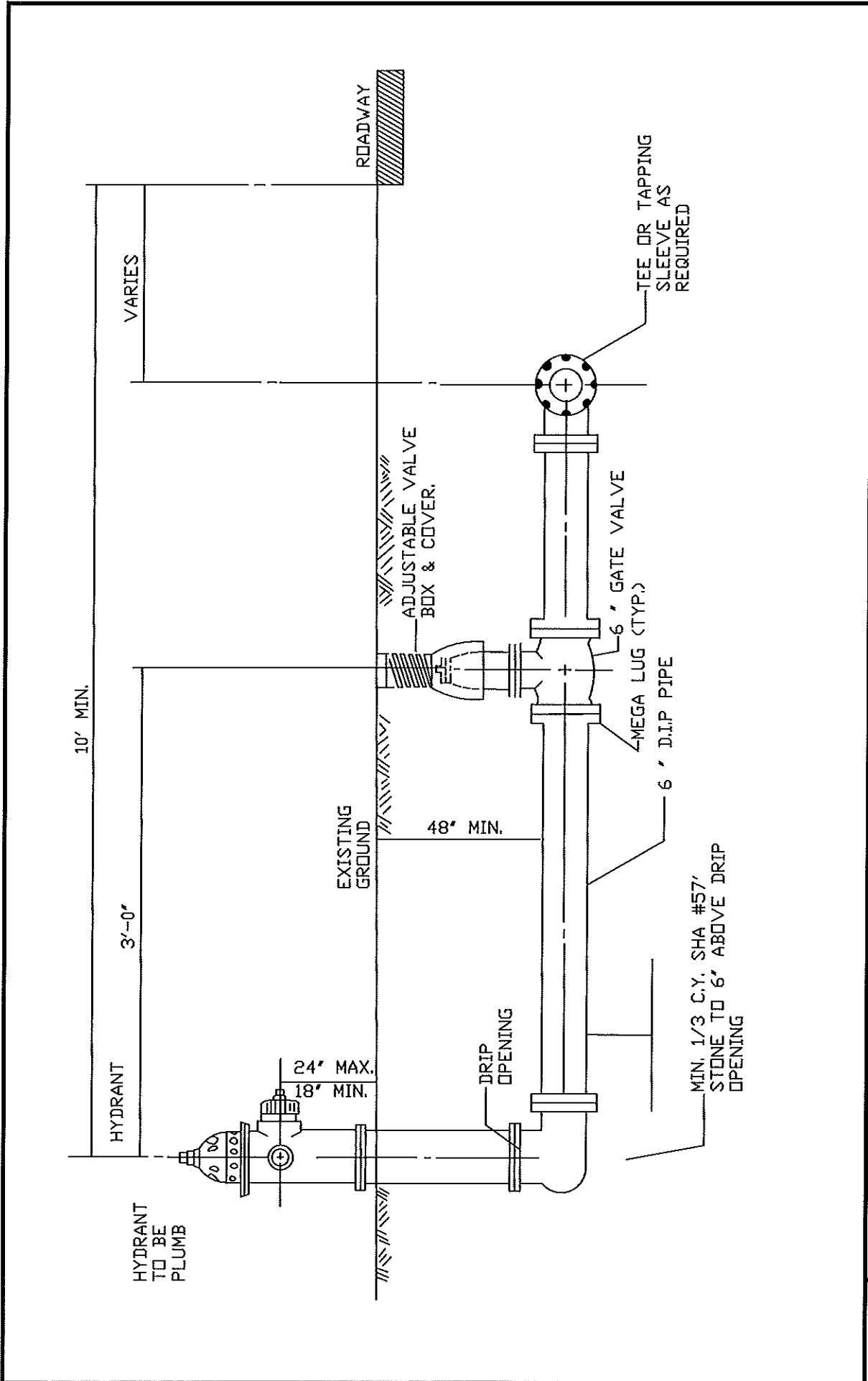
SECTION A-A



PLAN

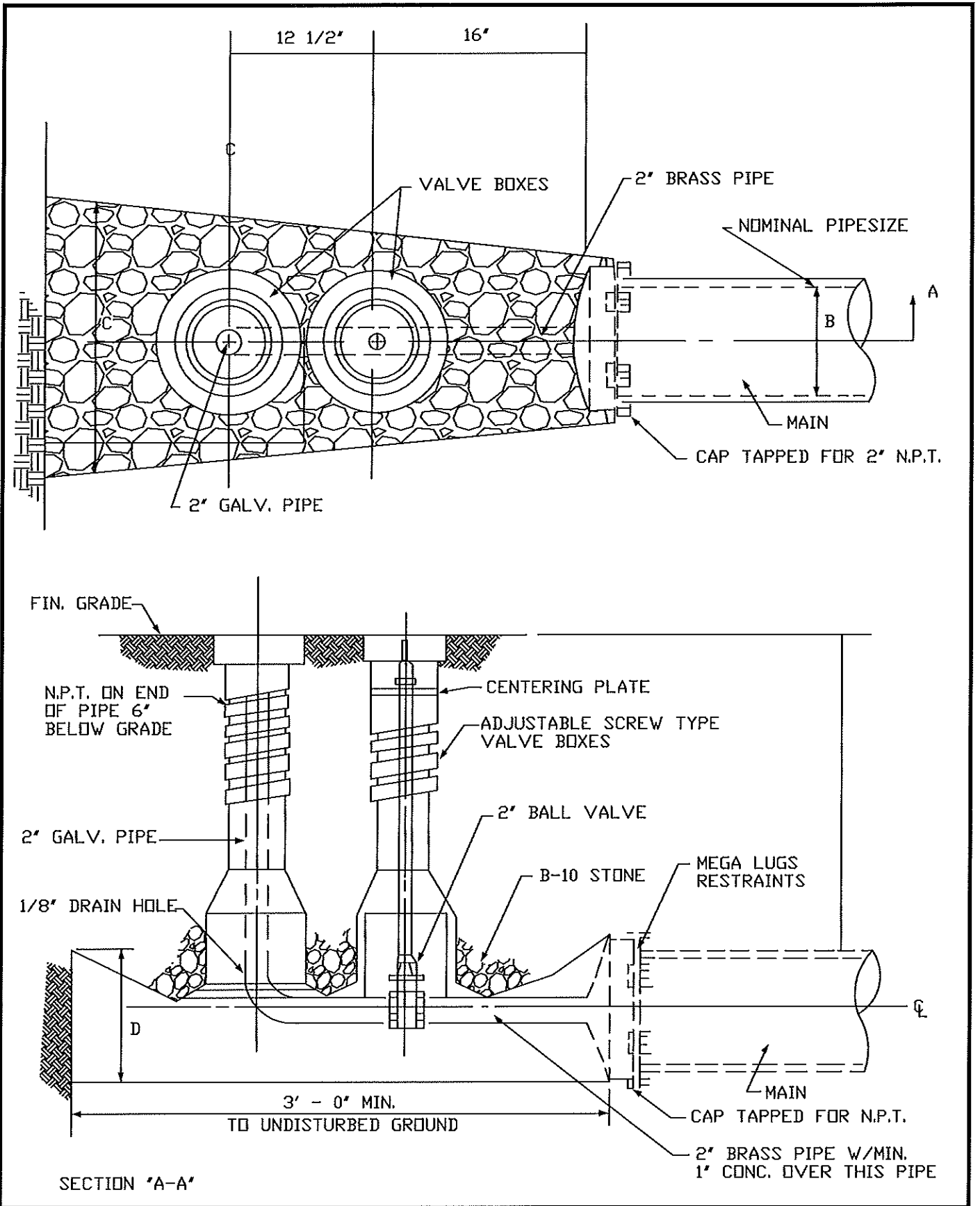
SERVICE PIPE DIAMETER	METER SIZE	PRV SIZE	VAULT SIZE
3/4"	5/8"	3/4"	24"
1"	3/4"	1"	24"
1 1/4"	1"	1 1/4"	36"
2"	1 1/2"	1 1/2"	36"

REVISIONS _____ REVISOR _____ APPROVED _____	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Ruppel</i> Director of Environmental Management	METERED DOMESTIC SERVICE WITH PRESSURE REDUCING VALVE	Detail W-10.5
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Detail W-10.6	TYPICAL HYDRANT SETTING	Washington County, MD Div. of Environmental Management Approved: <i>Julio Pappalardo</i> Director of Environmental Management
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_____ REVISED
 _____ REVISED
 _____ APPROVED

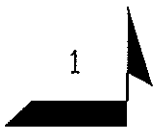
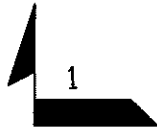


REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Peppie</i> Director of Environmental Management	2" BLOW OFF ASSEMBLY	Detail W-10.7
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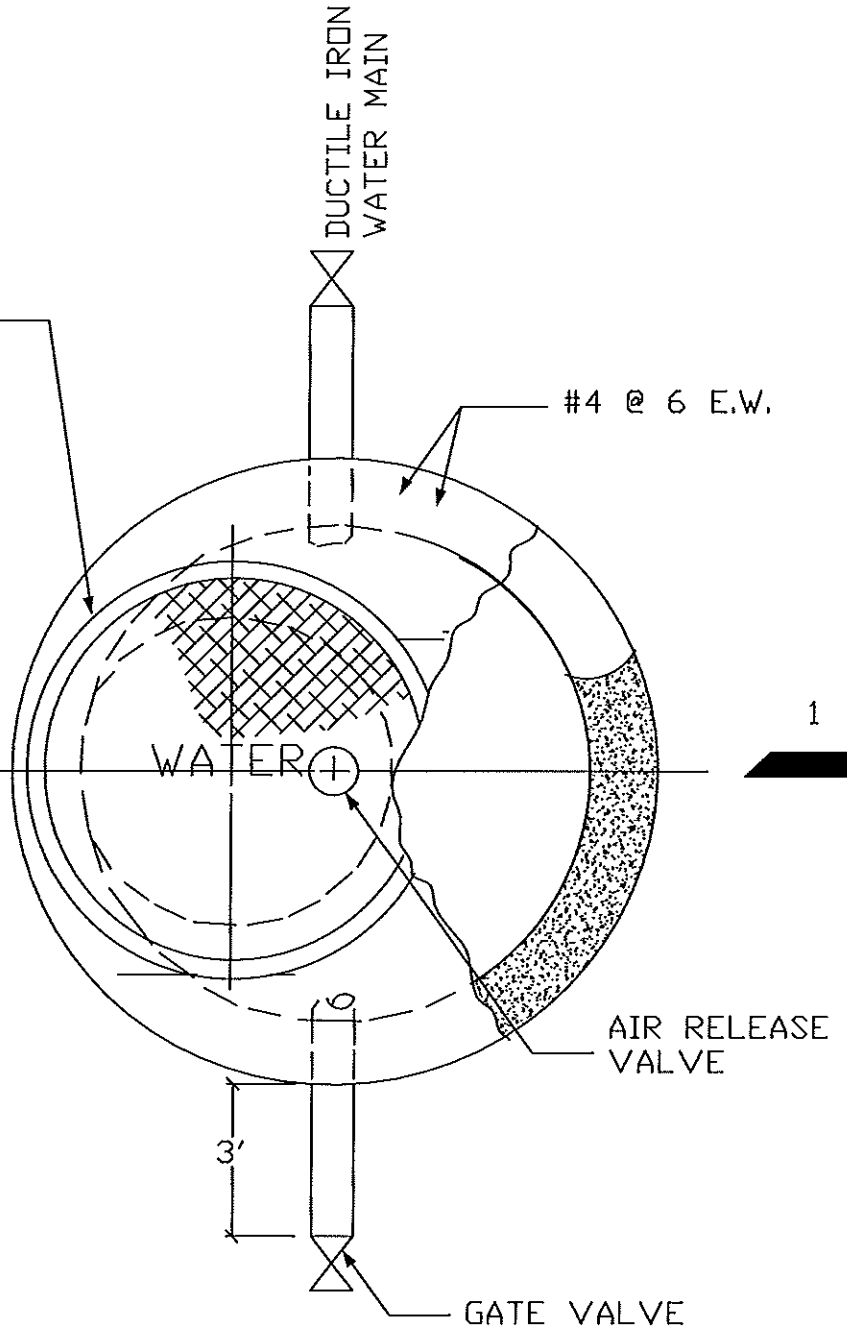
30" STD. MANHOLE FRAME
& COVER - SEE DETAILS
S-2.6

DUCTILE IRON
WATER MAIN

#4 @ 6 E.W.

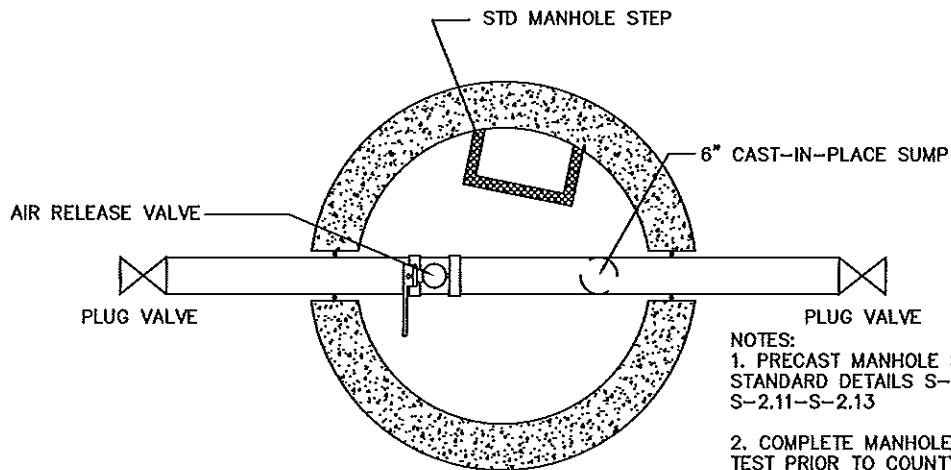


SEE SHEET W-10.9 FOR
SECTION 1-1



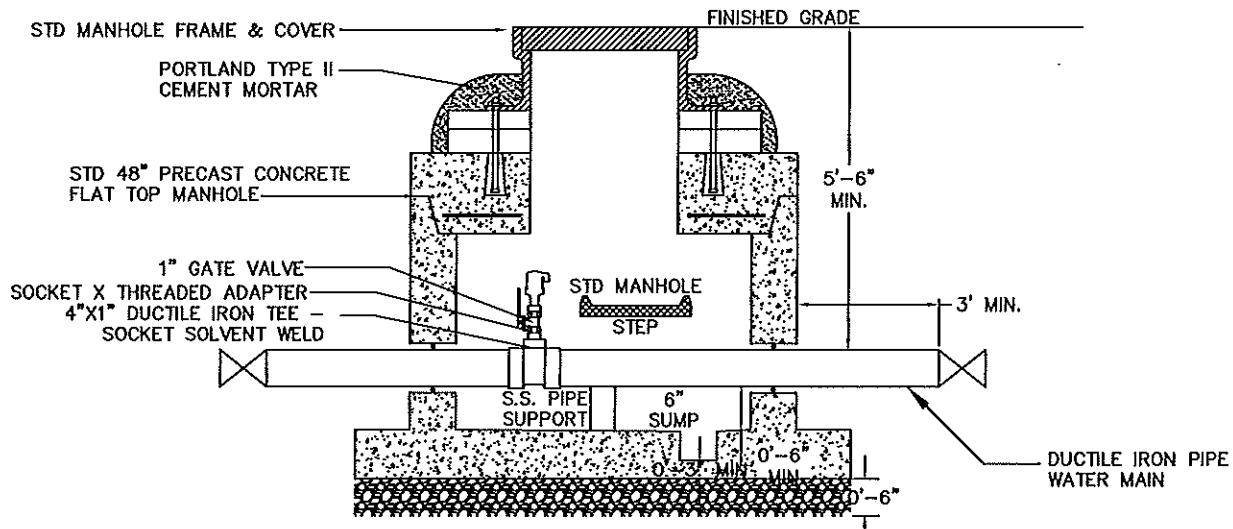
PLAN

REVISOR	Washington County, MD Div. of Environmental Management	AIR RELEASE AND VACUUM VALVE PIT PLAN	Detail W-10.8
REVISOR	<i>Julia R. Kippel</i>		
APPROVED	Approved: <i>Julia R. Kippel</i> Director of Environmental Management		



PLAN
NO SCALE

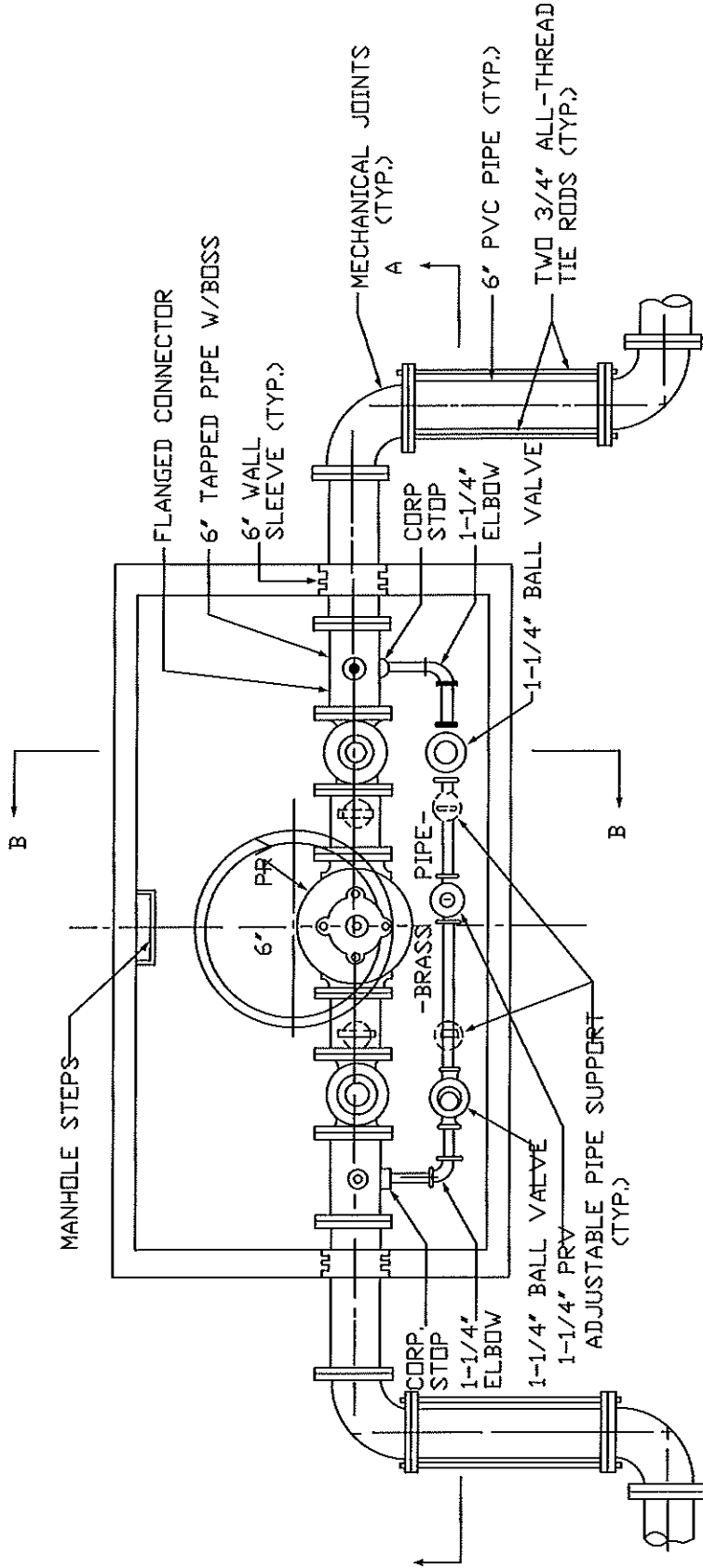
- NOTES:
1. PRECAST MANHOLE SHALL COMPLY WITH STANDARD DETAILS S-2.1-S-2.4, S-2.11-S-2.13
 2. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
 3. VALVES SHALL BE ORIENTED AS SHOWN IN PLAN VIEW. AIR RELEASE VALVE IS NORMALLY OPEN.
 4. AIR VALVE SHALL BE EITHER AN AIR RELEASE, OR AN AIR & VACUUM VALVE, AS SPECIFIED ON THE DRAWINGS,
 5. ALL VAULT PIPING SHALL BE BRONZE UNLESS OTHERWISE NOTED.



SECTION
NO SCALE

- NOTES:
1. PRECAST MANHOLE SHALL COMPLY WITH STANDARD DETAILS S-2.1-S-2.4, S-2.11-S-2.13.
 2. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
 3. VALVES SHALL BE ORIENTED AS SHOWN IN PLAN VIEW. AIR RELEASE VALVE IS NORMALLY OPEN.
 4. ALL VAULT PIPING SHALL BE DUCTILE IRON SOCKET SOLVENT WELD UNLESS OTHERWISE NOTED.
 5. THE A.R.V. SHALL BE TAPPED INTO THE CROWN OF PIPE.

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia Lopez</i></p> <p>Director of Environmental Management</p>	<p>AIR RELEASE & VACUUM VALVE PIT SECTION 1-1</p>	<p>Detail</p> <p>W-10.9</p>
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PLAN

NOTES:

1. ENTIRE 1-1/4" BYPASS LINE SHALL HAVE THREADED BRASS PIPES AND FITTINGS. ALL OTHER INTERIOR PIPE AND FITTINGS SHALL BE D.I. OR C.I. FLANGED.
2. 1-1/4" BRASS PIPE SHALL BE SEAMLESS RED BRASS PIPE, EXTRA STRONG, CONFORMING TO ASTM B-43.
3. 1-1/4" BALL VALVES SHALL BE FORD METER BOX COMPANY B11-555 WITH HB-67 MANHOLE OR EQUAL
4. FITTINGS SHALL BE ANSI B16-15 CAST BRONZ, THREADED, 125 LBS.

Washington County, MD Div. of
Environmental Management

Approved: *David L. Roper*
Director of Environmental Management

PRESSURE REDUCING VALVE ASSEMBLY AND VAULT
PLAN VIEW

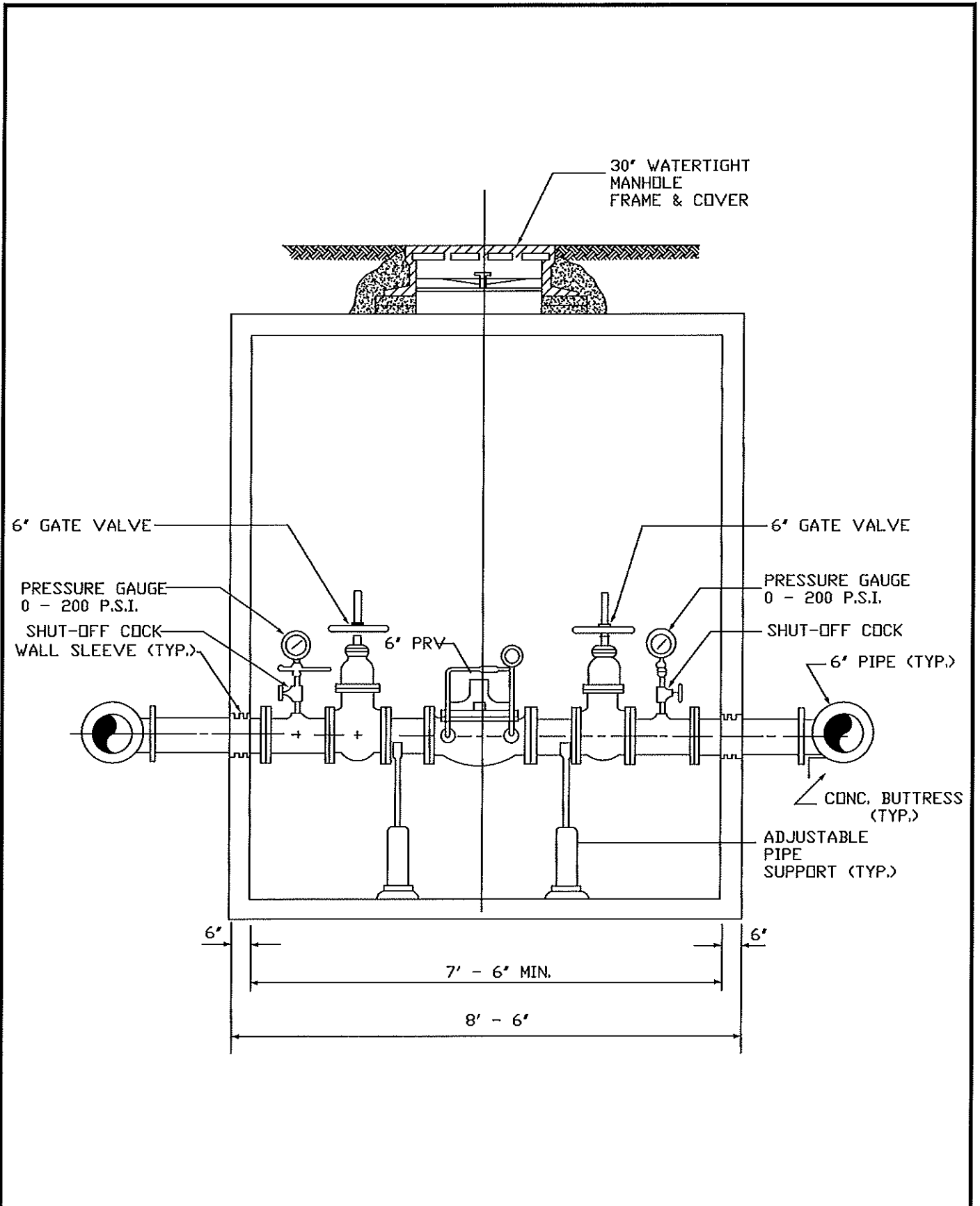
Detail

W-10.10

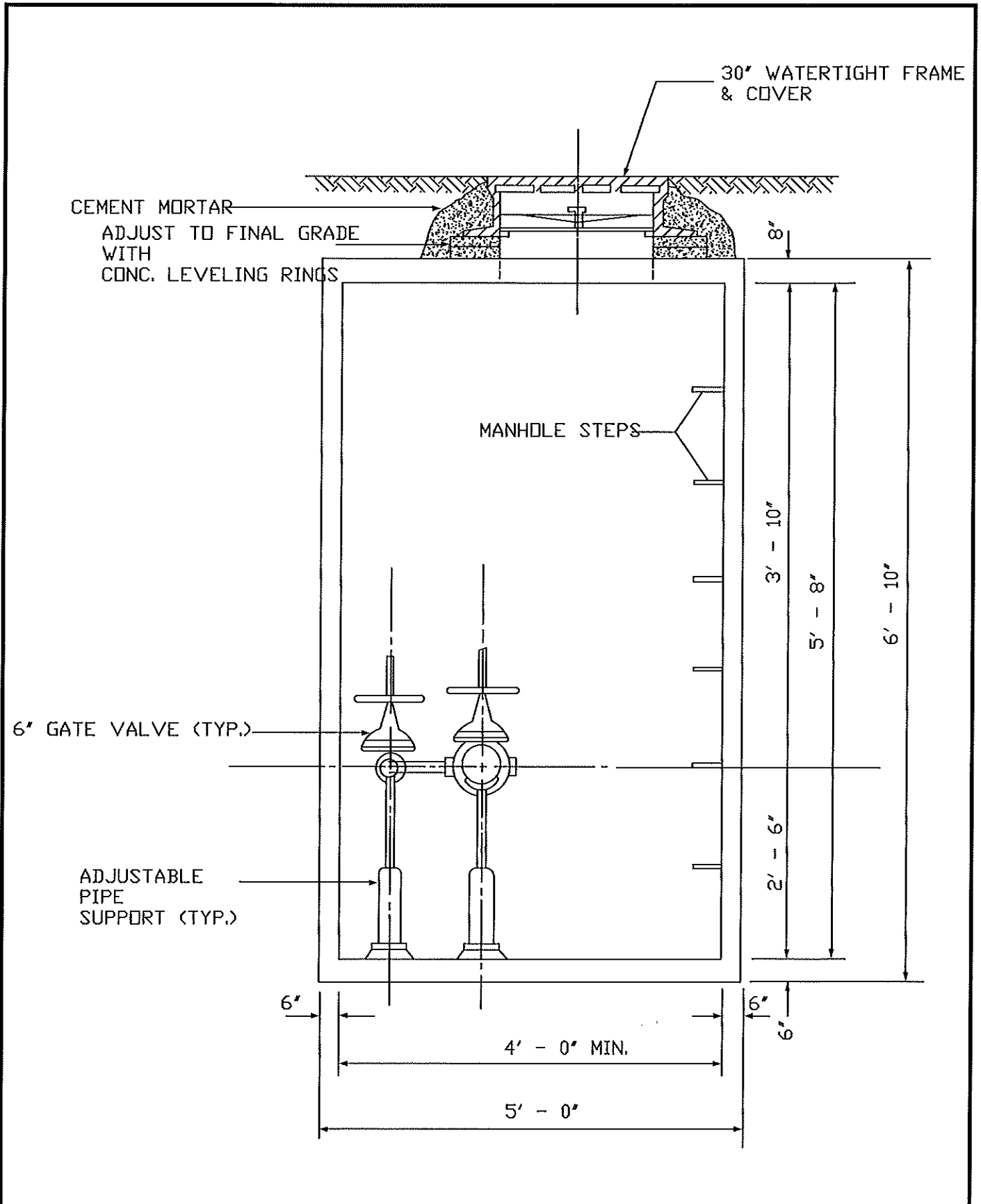
REVISED

REVISED

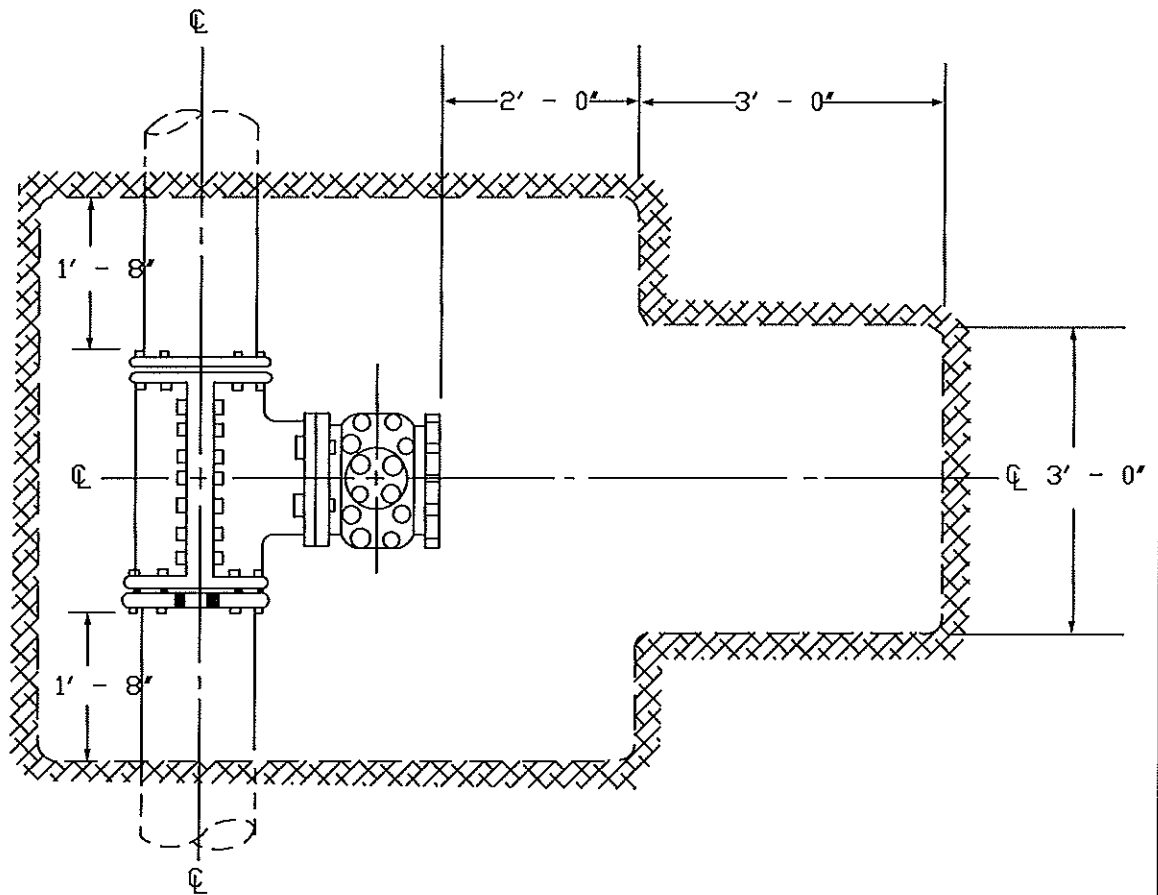
APPROVED



<p>REVISÉ</p> <hr/> <p>REVISÉ</p> <hr/> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Ruppel</i> Director of Environmental Management</p>	<p>PRESSURE REDUCING VALVE ASSEMBLY AND VAULT SECTION A - A</p>	<p>Detail</p> <p>W-10.11</p>
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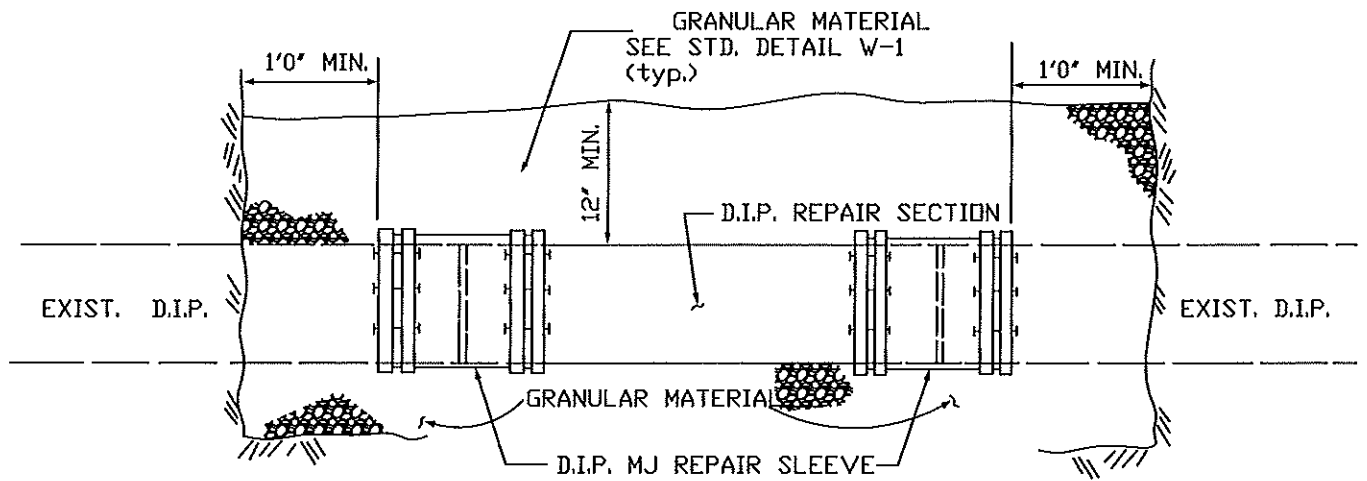


<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>REVISOR</p> <p>DATE</p> <p>REVISION</p> <p>REVISOR</p> <p>DATE</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julius B. Pepper</i> Director of Environmental Management</p>	<p>PRESSURE REDUCING VALVE ASSEMBLY AND VAULT SECTION B - B</p>	<p>Detail</p> <p>W-10.12</p>
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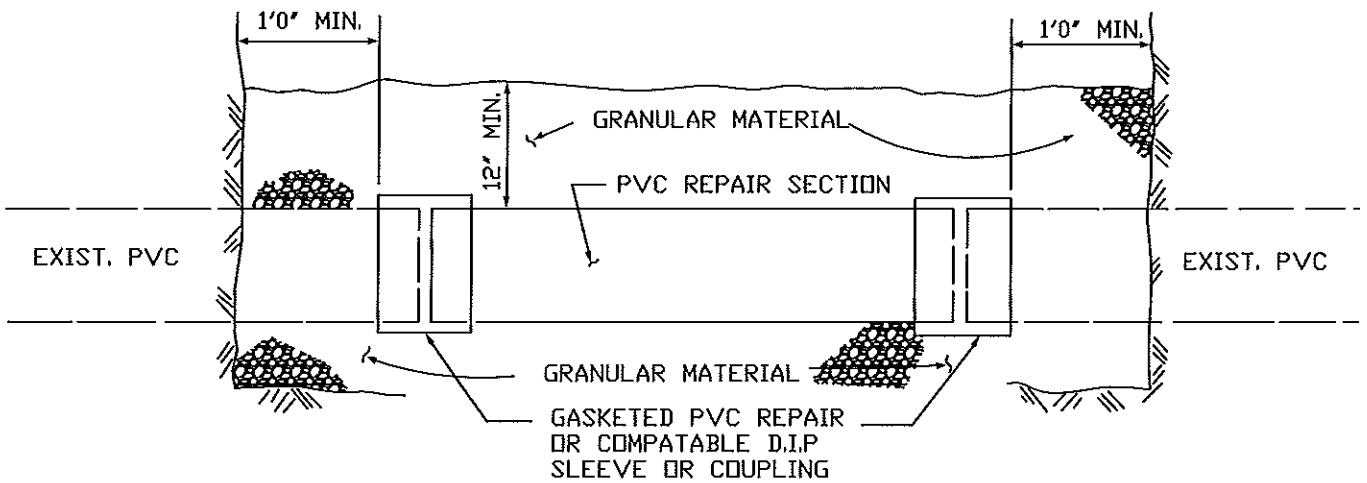


NOTE: ALL DIMENSIONS ARE MINIMUM REQUIRED.

REVISED <hr/>	Washington County, MD Div. of Environmental Management	TAPPING SLEEVE AND VALVE	Detail
REVISED <hr/>	 Approved:		W-10.13
APPROVED <hr/>	Director of Environmental Management		



EXISTING DUCTILE IRON PIPE REPAIR



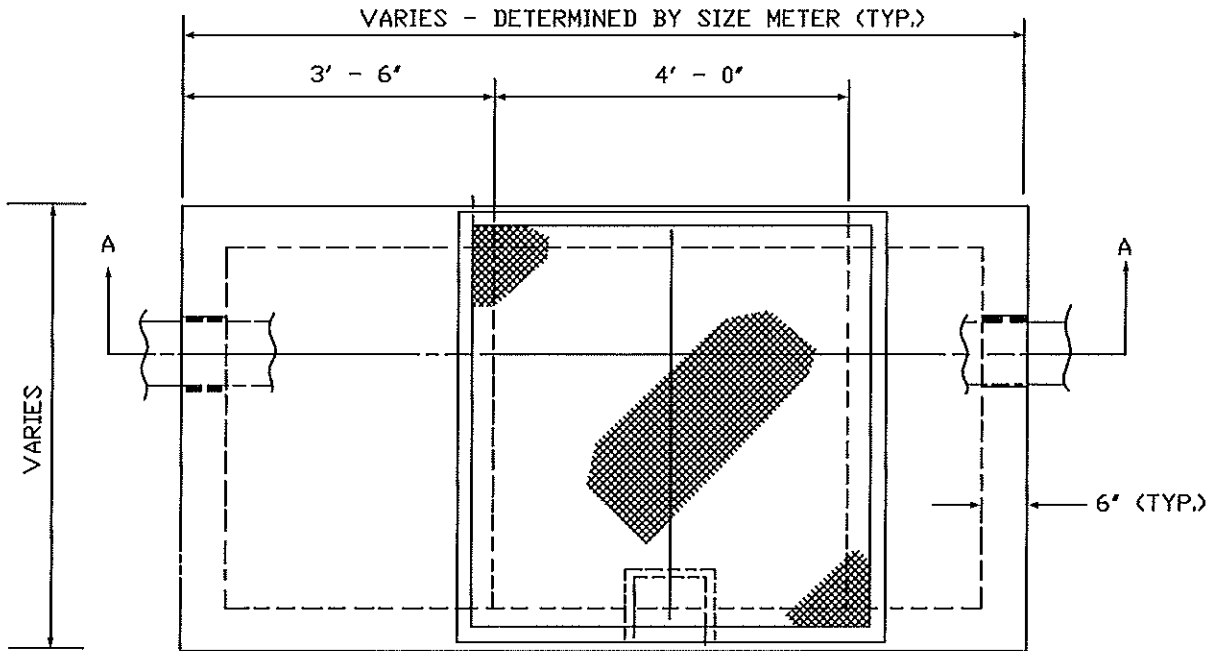
EXISTING PVC PIPE REPAIR

NOTES:

FIELD CUTTING OF PIPE SHALL BE DONE IN A SATISFACTORY MANNER WHICH WILL LEAVE A SMOOTH END AT RIGHT ANGLES TO THE AXIS OF THE PIPE.

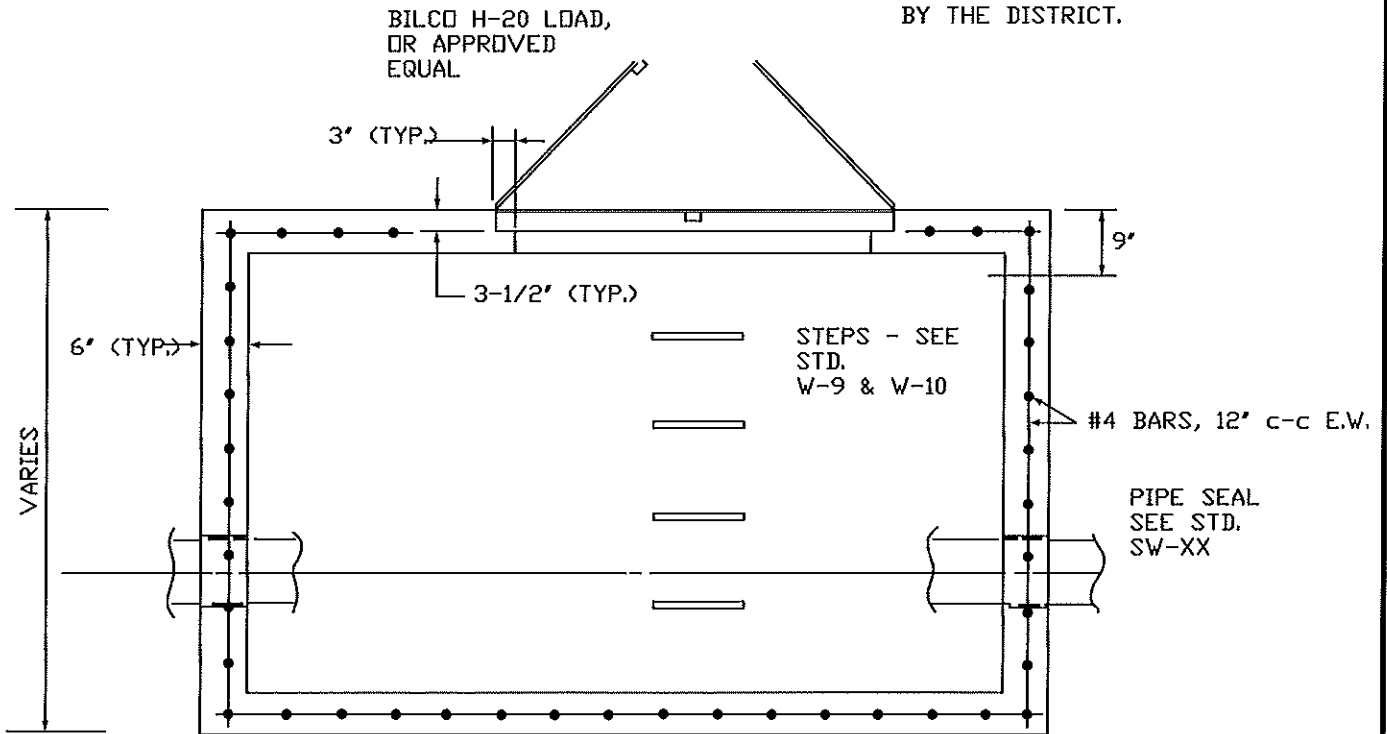
PIPE LENGTH BEING INSTALLED SHALL ABUT AGAINST THE NEXT IN SUCH A MANNER THAT THERE SHALL BE NO SHOULDER OR UNEVENNESS OF ANY KIND ALONG THE INSIDE OF THE PIPE.

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia R. Pappas</i> Director of Environmental Management	REPAIR OF EXISTING WATER MAINS	Detail W-10.14
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PLAN VIEW

NOTE: INDIVIDUAL DESIGN TO BE SUBJECT TO THE APPROVAL BY THE DISTRICT.



PROFILE

<p>REVISÉD</p> <hr/> <p>REVISÉD</p> <hr/> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Pappalardo</i> Director of Environmental Management</p>	<p>TYPICAL METER VAULT (2" METERS AND LARGER)</p>	<p>Detail W-10.15</p>
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WASHINGTON COUNTY DEPARTMENT OF WATER QUALITY
WASHINGTON COUNTY, MARYLAND

SERVICE CONNECTION
CONSTRUCTION REPORT

PROJECT: _____

SUBDISTRICT _____

STREET OR LOCATION _____

CONTRACTOR _____

DATE INSTALLED _____

CONTRACT DWG. NO. _____

OWNERS' NAME _____

IDENTIFICATION NO. _____

TAPPED STA. on MAIN _____

MAILING ADDRESS _____

SIZE & TYPE MAIN	SIZE & TYPE SERVICE PIPE	SIZE & TYPE METER	SIZE & TYPE METER VAULT	TYPE METER LID	EXCAVATION LENGTH	LAYING LENGTH

METER NO. _____

METER READING _____

SKETCH PROFILE VIEW OF MAINLINE, CONNECTION, ANGLES, DISTANCES, OTHER
UNDERGROUND
UTILITIES, STRUCTURES, ETC.

SKETCH PLAN VIEW OF CONNECTION TO METER SHOWING ANGLES, STATIONING, DISTANCES,
LOCATION OF OTHER UTILITIES OR STRUCTURES WITH TIES, ETC.

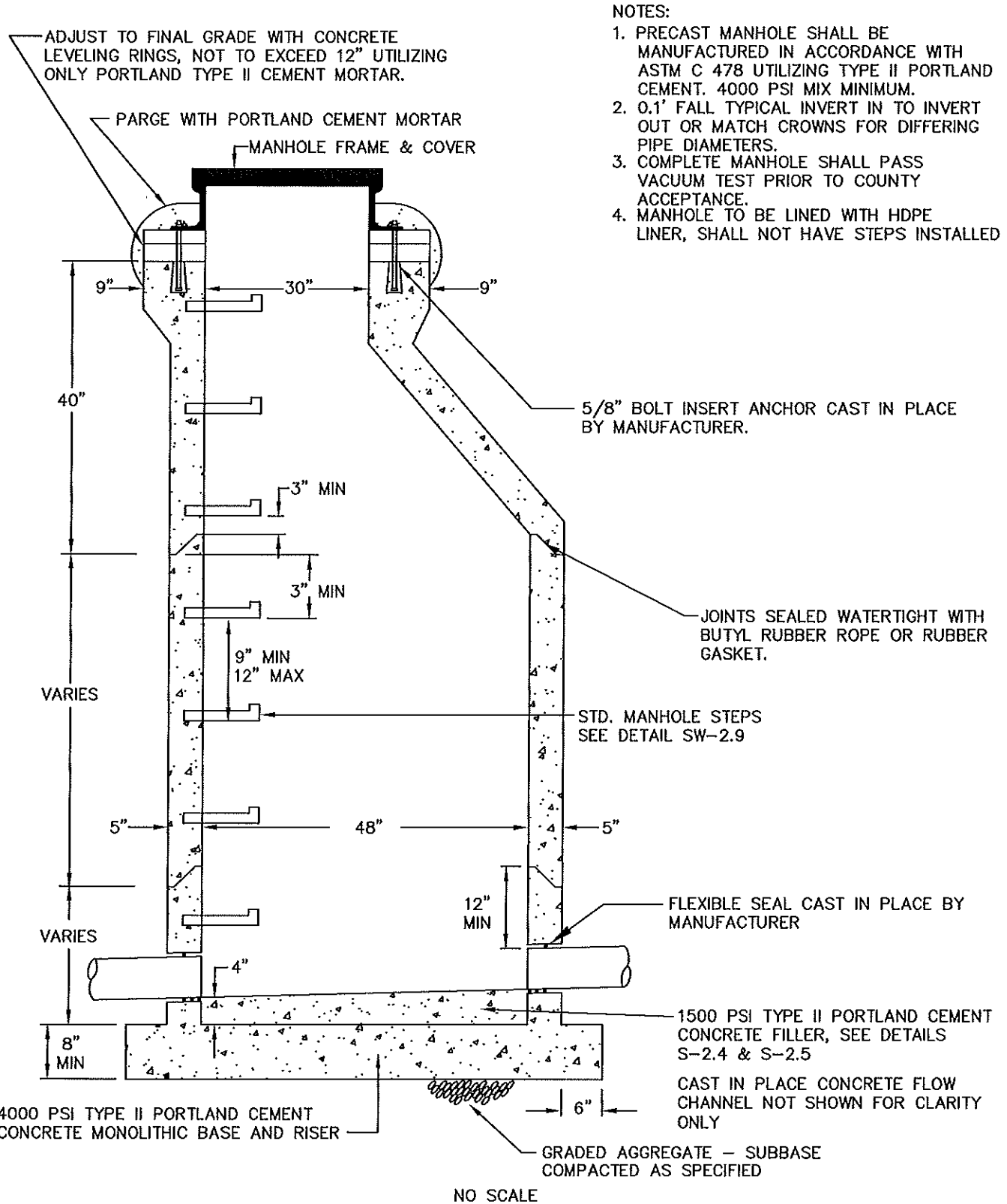
AMOUNTS PERTAINING TO WORK COMPLETED THIS PERIOD, REVIEWED & APPROVED.

BY _____

INSPECTOR

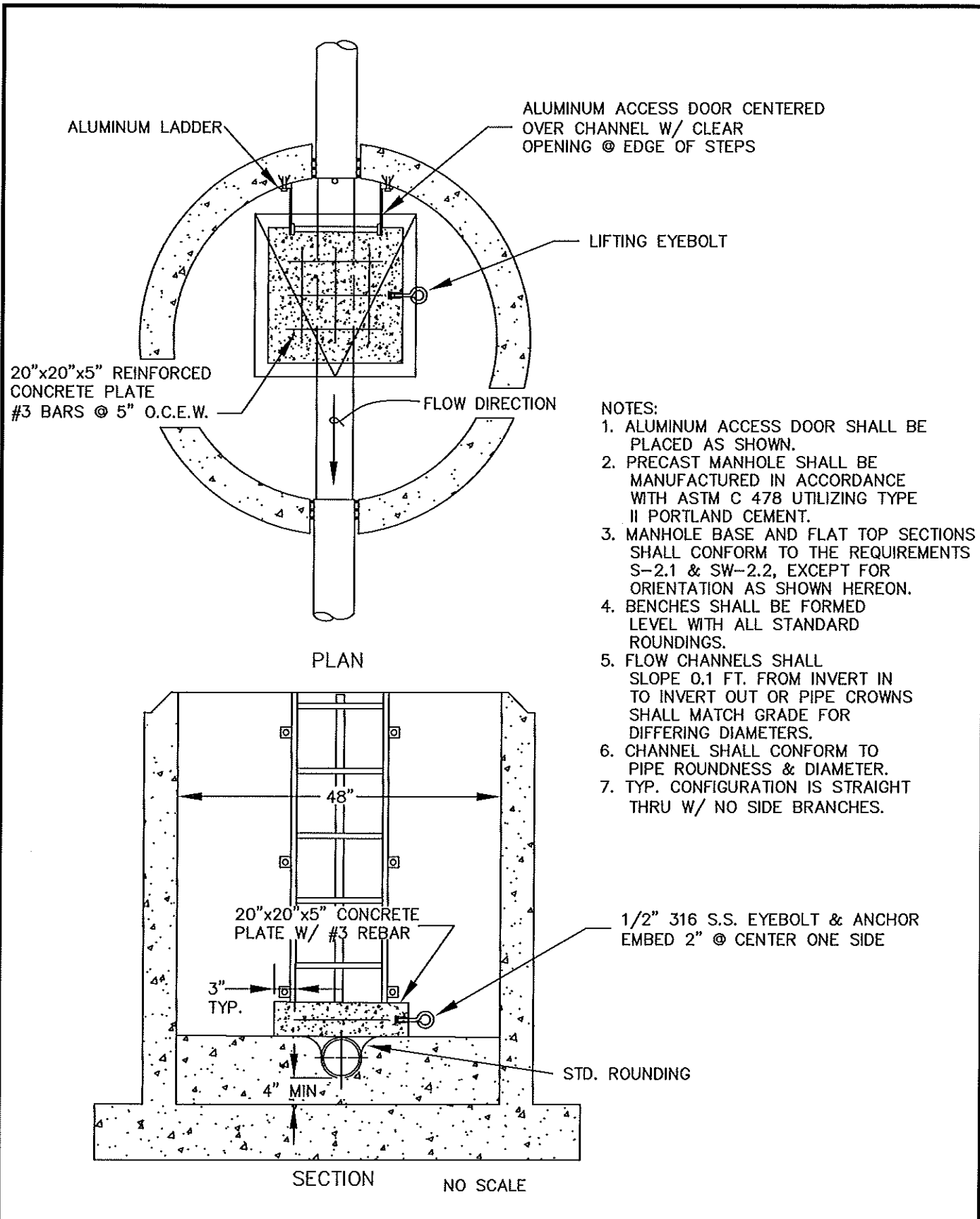
CONTRACTOR'S REPRESENTATIVE

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia L. Pappas</i> Director of Environmental Management	SERVICE CONNECTION CONSTRUCTION REPORT	Detail W-10.17
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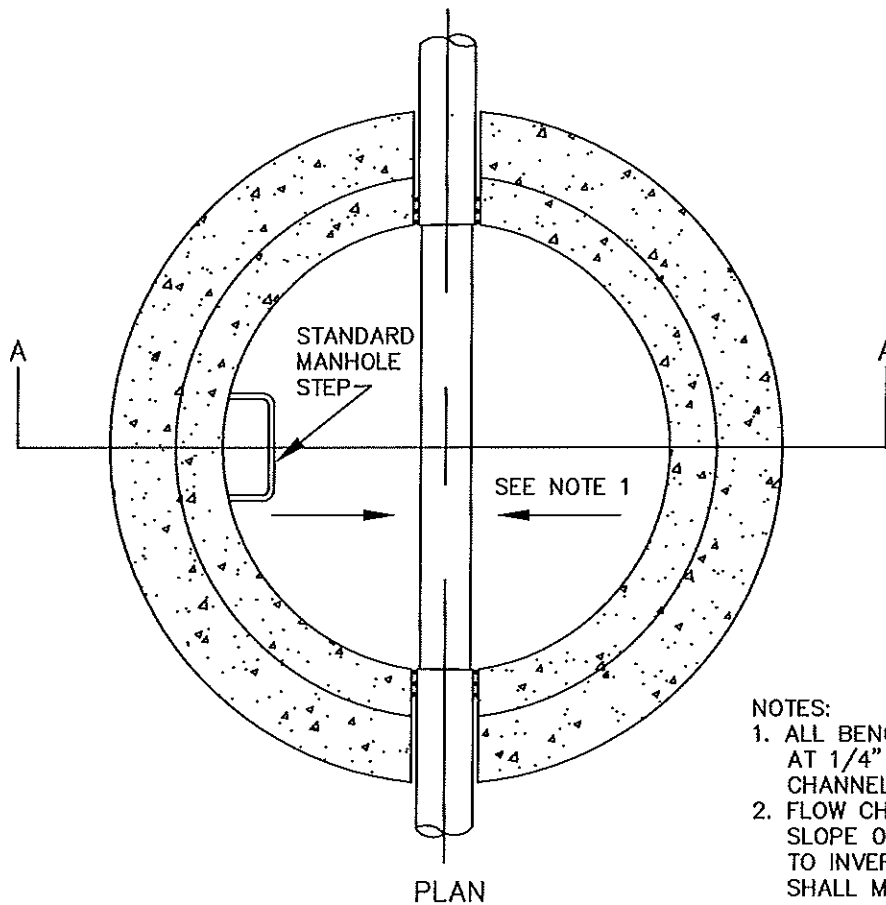
- NOTES:
1. PRECAST MANHOLE SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 UTILIZING TYPE II PORTLAND CEMENT. 4000 PSI MIX MINIMUM.
 2. 0.1' FALL TYPICAL INVERT IN TO INVERT OUT OR MATCH CROWNS FOR DIFFERING PIPE DIAMETERS.
 3. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
 4. MANHOLE TO BE LINED WITH HDPE LINER, SHALL NOT HAVE STEPS INSTALLED

<p>REVISÉ</p> <p>REVISÉ</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie A. Peppers</i></p> <p>Director of Environmental Management</p>	<p>Standard Through Manhole Precast Base</p>	<p>Detail</p> <p>S-2.1</p>
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- NOTES:
1. ALUMINUM ACCESS DOOR SHALL BE PLACED AS SHOWN.
 2. PRECAST MANHOLE SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 UTILIZING TYPE II PORTLAND CEMENT.
 3. MANHOLE BASE AND FLAT TOP SECTIONS SHALL CONFORM TO THE REQUIREMENTS S-2.1 & SW-2.2, EXCEPT FOR ORIENTATION AS SHOWN HEREON.
 4. BENCHES SHALL BE FORMED LEVEL WITH ALL STANDARD ROUNDINGS.
 5. FLOW CHANNELS SHALL SLOPE 0.1 FT. FROM INVERT IN TO INVERT OUT OR PIPE CROWNS SHALL MATCH GRADE FOR DIFFERING DIAMETERS.
 6. CHANNEL SHALL CONFORM TO PIPE ROUNDNESS & DIAMETER.
 7. TYP. CONFIGURATION IS STRAIGHT THRU W/ NO SIDE BRANCHES.

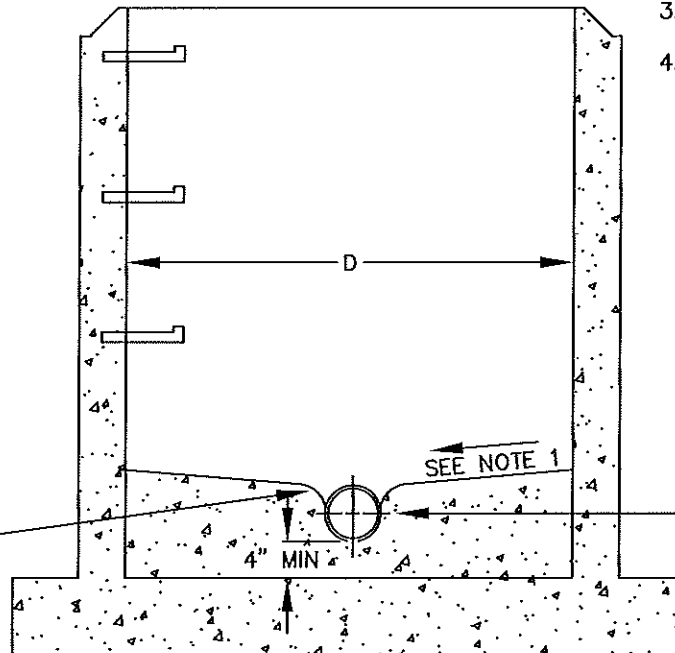
REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia P. Pipp</i> Director of Environmental Management	Standard Precast Flat Top Monitoring Manhole	Detail S-2.3
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PLAN

NOTES:

1. ALL BENCHES SHALL SLOPE AT 1/4" /FT. TOWARD FLOW CHANNEL.
2. FLOW CHANNELS SHALL SLOPE 0.1 FT. FROM INVERT IN TO INVERT OUT OR PIPE CROWNS SHALL MATCH GRADE FOR DIFFERING DIAMETERS.
3. CHANNEL SHALL CONFORM TO PIPE ROUNDNESS & DIAMETER.
4. SEE DETAIL S-2.5 FOR TYPICAL CONFIGURATIONS.



AT 3/4 DIAMETER OF PIPE, BEGIN 2" RADIUS ROUNDING

SPRING LINE

SECTION A-A
NO SCALE

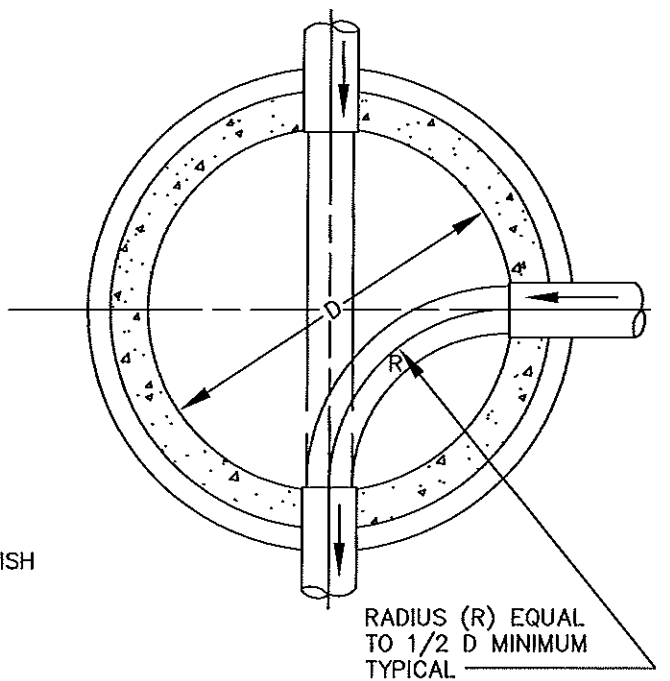
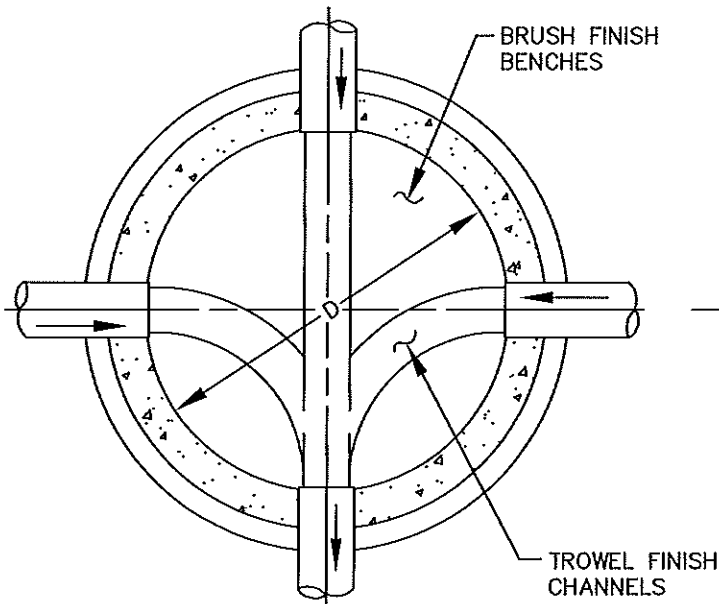
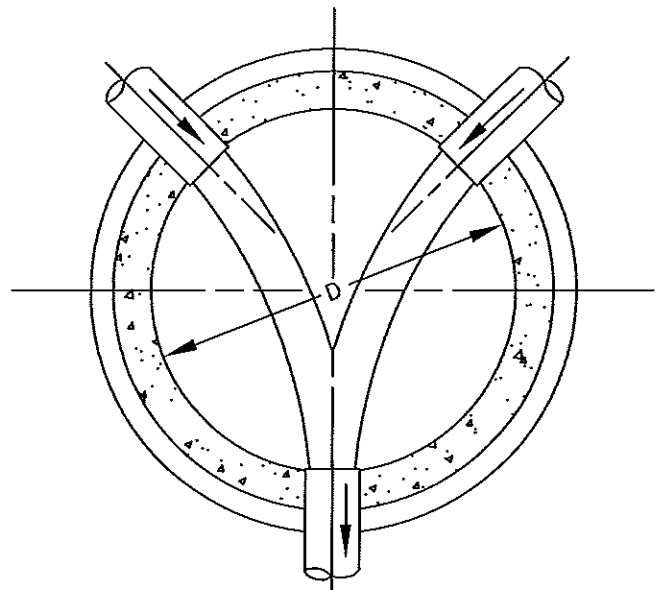
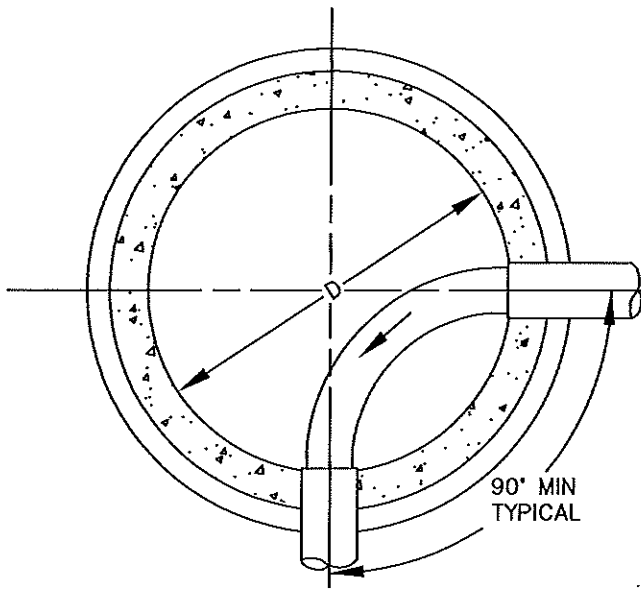
REVISION	
REVISION	
APPROVED	

Washington County, MD Div. of Environmental Management

Approved: *Julie A. Pippel*
Director of Environmental Management

Typical Bench and Flow Channel Section Precast Base

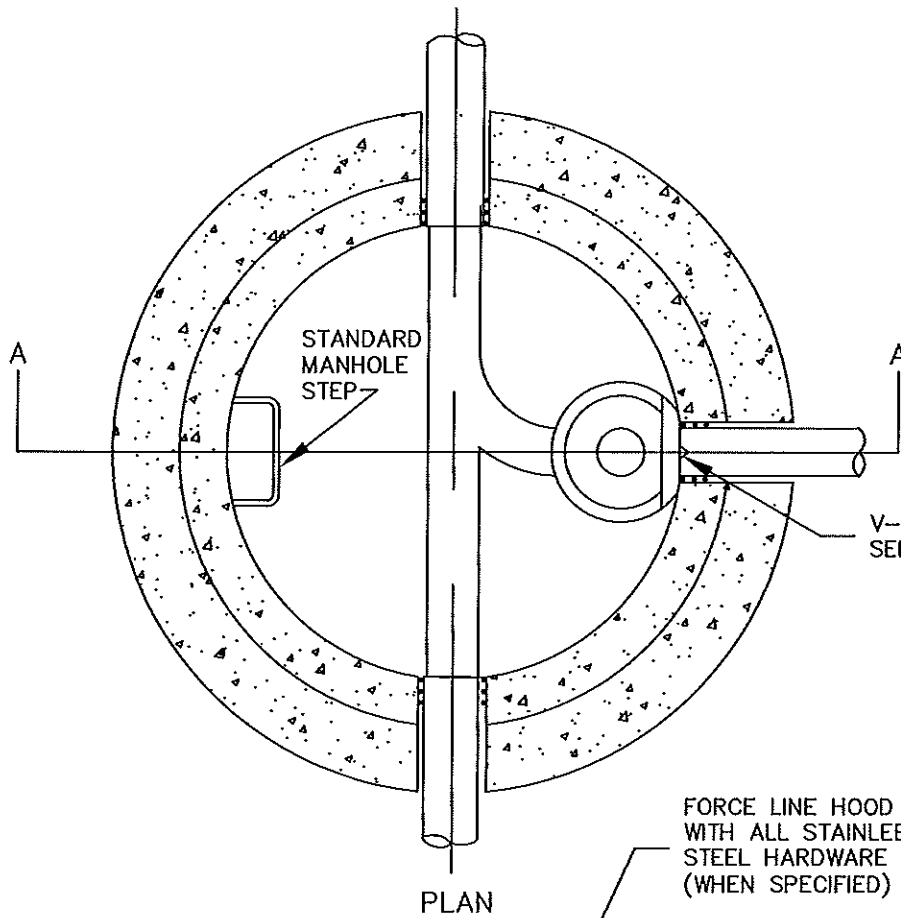
Detail
S-2.4



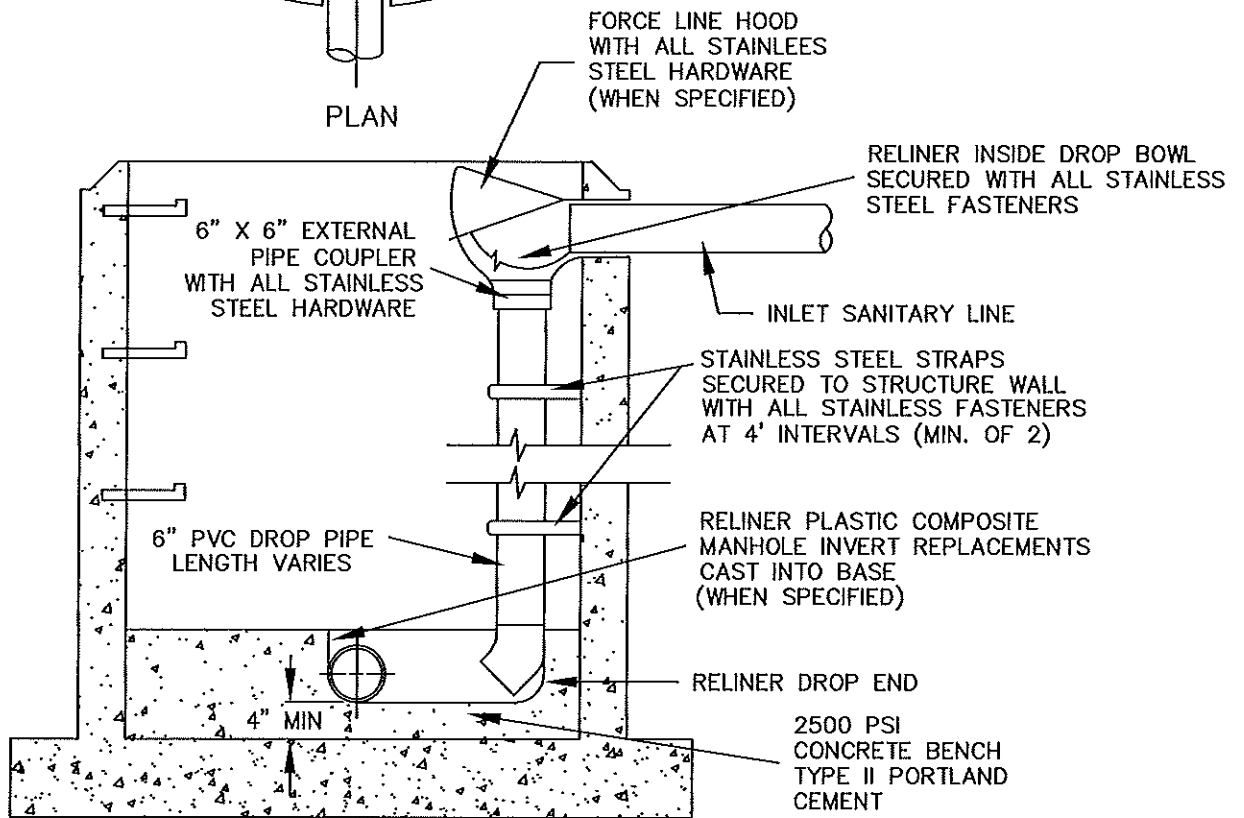
EVENLY TAPER CHANNEL WIDTHS FROM INVERT IN TO INVERT OUT FOR DIFFERING PIPE DIAMETERS.

NO SCALE

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie A. Poppel</i></p> <p>Director of Environmental Management</p>	<p>Plans of Flow Channels (Typical)</p>	<p>Detail</p> <p>S-2.5</p>
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- NOTES:
1. CORED IN PLACE DROP CONNECTION SHALL UTILIZE KOR-N-SEAL I-WEDGE S-106 SERIES KORBAND FLEXIBLE PIPE TO MANHOLE CONNECTOR OR APPROVED EQUAL, WITH ALL S.S. HARDWARE.
 2. INFLUENT LINE SHALL BE "V" CUT @ FLOW LINE & SMOOTH EDGED TO CONCENTRATE FLOW TO DROP BOWL/ DROP PIPE.



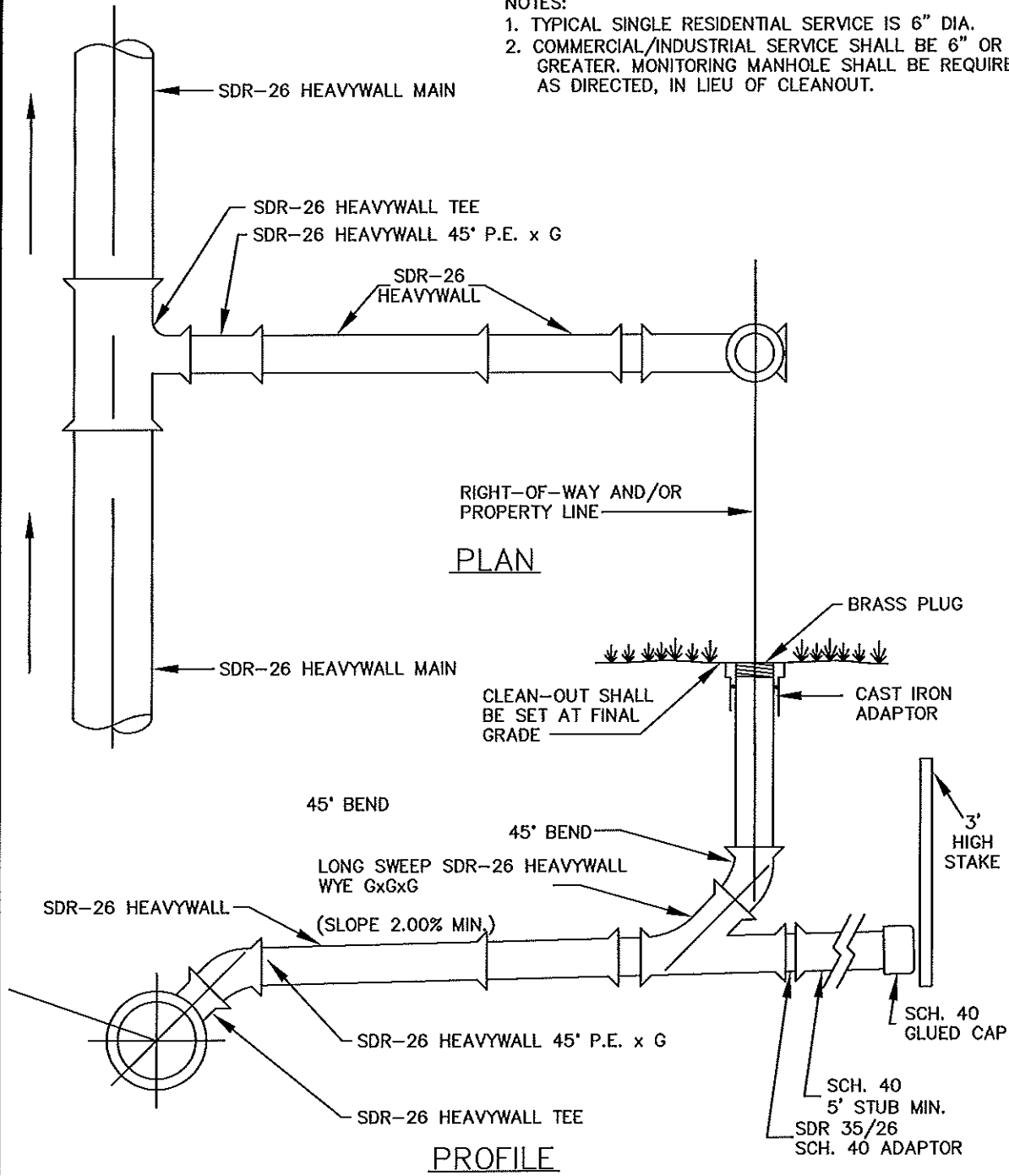
SECTION A-A

NO SCALE

<p>REVISID</p> <p>REVISID</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Pappas</i> Director of Environmental Management</p>	<p>Reliner Inside Drop Installation With Manhole Details</p>	<p>Detail</p> <p>S-2.12</p>
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NOTES:

1. TYPICAL SINGLE RESIDENTIAL SERVICE IS 6" DIA.
2. COMMERCIAL/INDUSTRIAL SERVICE SHALL BE 6" OR GREATER. MONITORING MANHOLE SHALL BE REQUIRED AS DIRECTED, IN LIEU OF CLEANOUT.



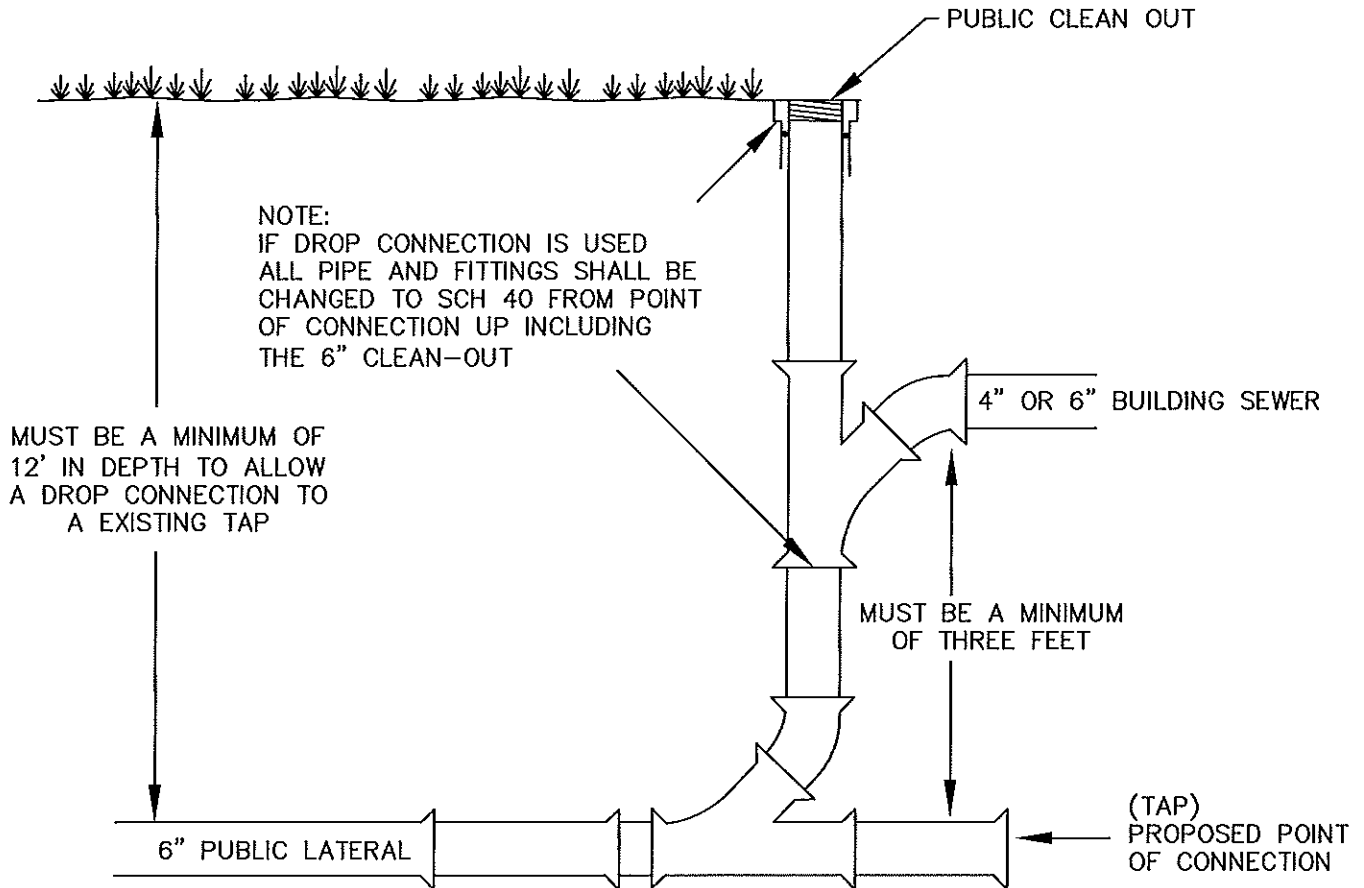
<p>REVISÉ</p> <p>REVISÉ</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie A. Popper</i></p> <p>Director of Environmental Management</p>	<p>Conventional Gravity Sewer Service Lateral SDR-26 Heavywall Sewer Main</p>	<p>Detail</p> <p>S-3.1</p>
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CONNECTION TO EXISTING PUBLIC SEWER :

1. IN THE EVENT THAT THE BUILDING SEWER LINE IS A MINIMUM OF THREE VERTICAL FEET ABOVE THE TAP AND THE PUBLIC CONNECTION IS A MINIMUM OF TWELVE FEET DEEP AT THE TAP IT SHALL BE ACCEPTABLE TO COMPLETE CONNECTION BY TYING INTO THE PUBLIC SIX INCH CLEAN OUT AS SHOWN BELOW.

2. IF THIS STYLE CONNECTION IS USED ALL OVER DIG AROUND THE PUBLIC CLEAN OUT AND UNDER THE BUILDING SEWER MUST BE BACK FILLED WITH MD #57 CLEAN GRAVLE 30" ABOVE THE BUILDING SEWER CONNECTION.

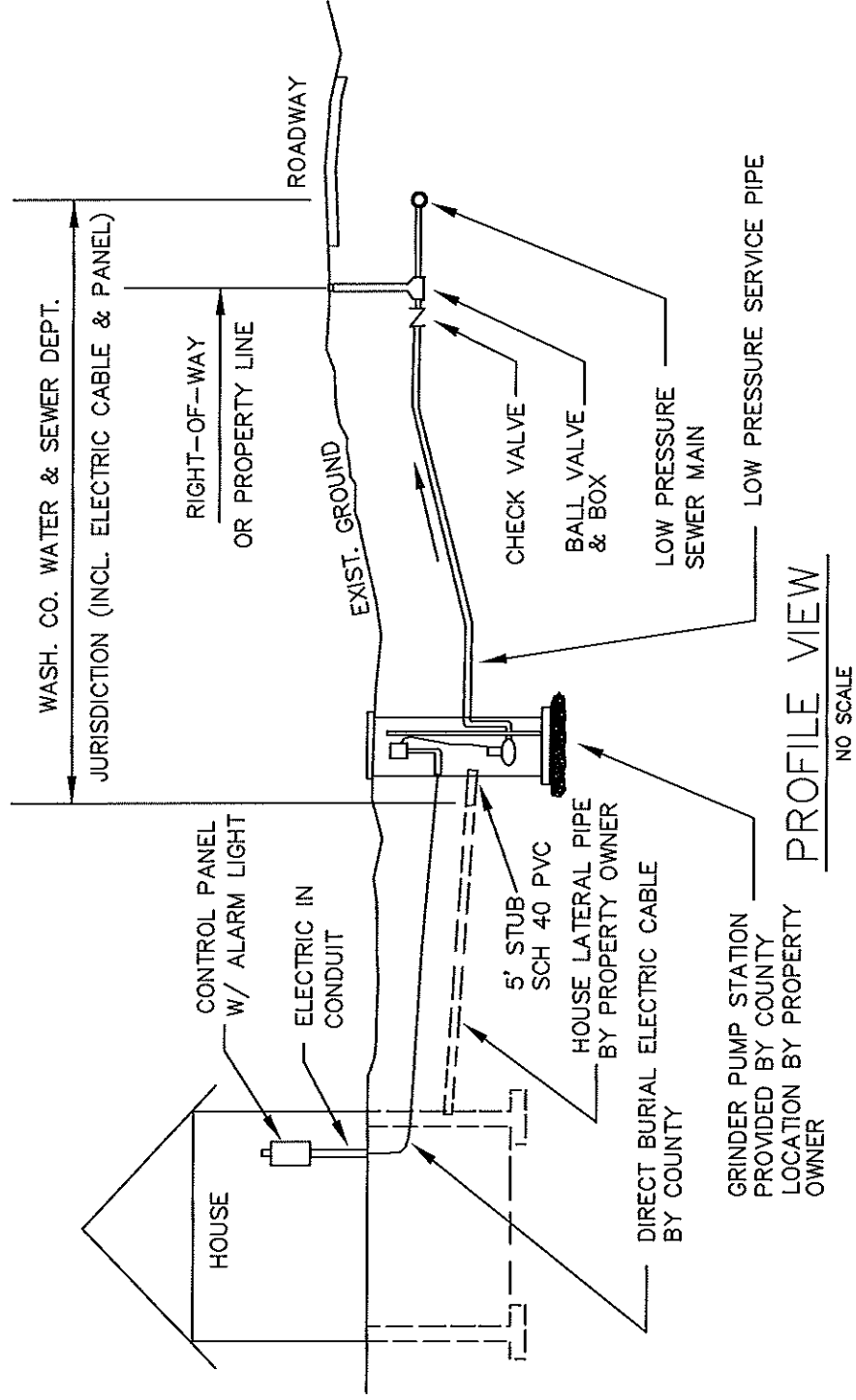
3. IF THE CLEAN-OUT LOCATION FALLS IN THE SIDEWALK OR DRIVEWAY AREA A LAMP POST FRAME AND COVER MUST BE INSTALLED OVER THE 6" SCH. 40 CLEAN-OUT



<p>REVISIONS:</p> <p>REVISOR: _____</p> <p>DATE: _____</p> <p>APPROVED: _____</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Lopez</i> Director of Environmental Management</p>	<p>ALTERNATIVE GRAVITY SEWER DEEP SERVICE LATERAL</p>	<p>Detail S-3.2</p>
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NOTES

1. LOW PRESSURE SERVICE PIPE TO BE PVC SDR-21, GASKET JOINT.
2. CONNECT BALL & CHECK VALVE USING GASKET X MALE THREAD ADAPTORS.
3. DEVELOPER IS TO PERFORM ALL EXCAVATION FOR THE COUNTY



Washington County, MD Div. of
Environmental Management

Approved: *Julie C. Ruppel*
Director of Environmental Management

REVISED

REVISED

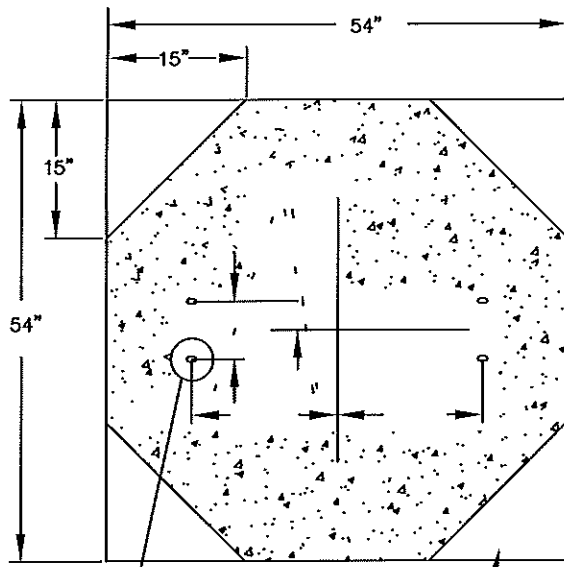
APPROVED

Detail

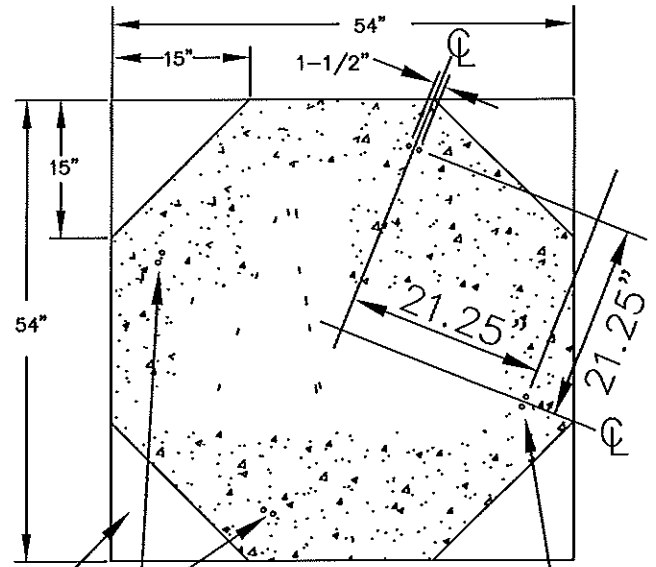
S-4.1

Typical Grinder Pump Arrangement

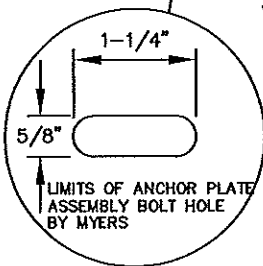
ULTIMATE CONCRETE COMPRESSIVE STRENGTH AT 28 DAYS SHALL BE 2500 PSI. BASE SLABS SHALL BE 8" THICK WITH #4 BARS AT 12" O.C. EACH WAY.



36" DUPLEX



36" DUPLEX



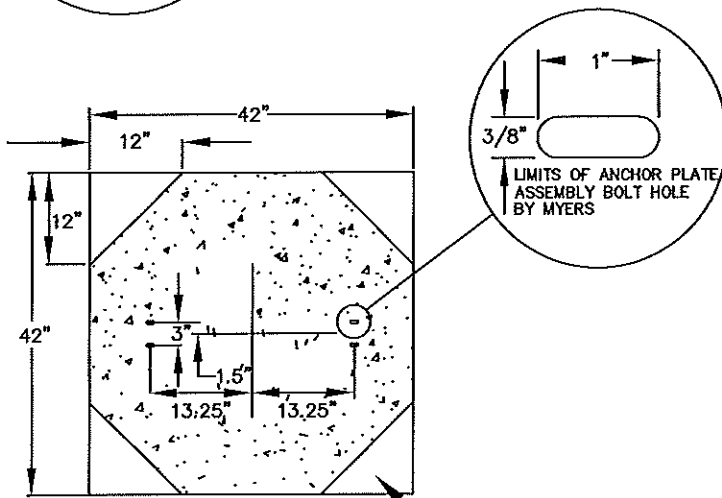
CAST-IN-PLACE 4 - 1/2"x8" SS HOOKED ANCHOR BOLTS EMBEDDED 5" (MYERS)

BLOCK OUT CORNERS OF FRAME TYPICAL (NOT REQUIRED)

4 OF 8 (TYP) HYDROMATIC

2 OF 8 CAST-IN-PLACE 5/8"x 8" SS HOOKED ANCHOR BOLTS EMBEDDED 5" (HYDROMATIC)

PROVIDE S.S. WASHERS AND NUTS FOR ASSEMBLY. EXPOSED PART OF BOLTS THREADED.

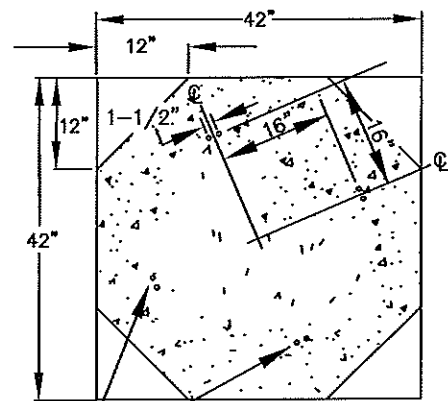


SIMPLEX

BLOCK OUT CORNERS OF FRAME TYPICAL (NOT REQUIRED)

4 OF 8 (TYP) HYDROMATIC

CAST-IN-PLACE 4 - 1/4"x8" SS HOOKED ANCHOR BOLTS EMBEDDED 5" (MYERS)



SIMPLEX

8 CAST-IN-PLACE 5/8"x 8" SS HOOKED ANCHOR BOLTS EMBED 5" (HYDROMATIC)

PLAN

NO SCALE

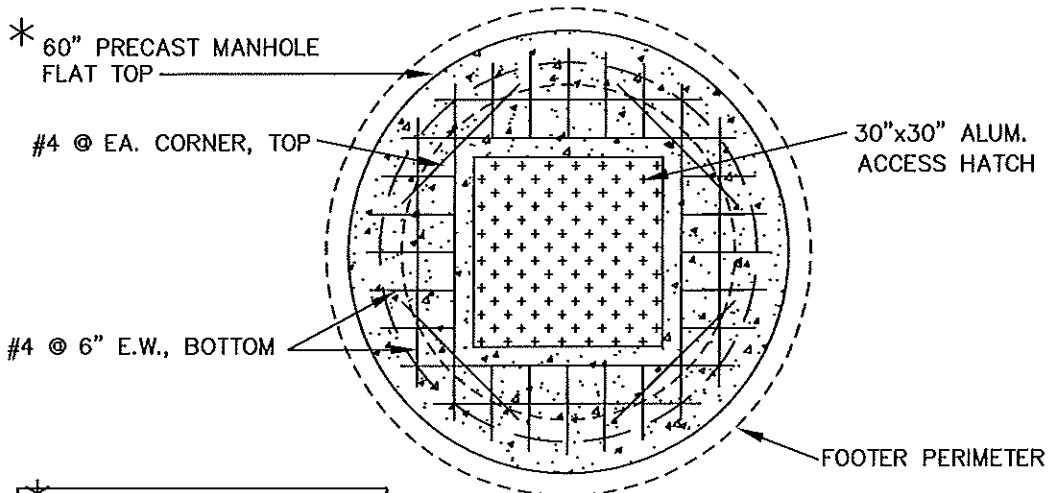
REVIS	Washington County, MD Div. of Environmental Management
REVIS	<i>Julia Lippert</i>
APPROV	Approved: <i>Julia Lippert</i> Director of Environmental Management

Grinder Pump Anti-Floatation Concrete Base

Detail
S-5.2

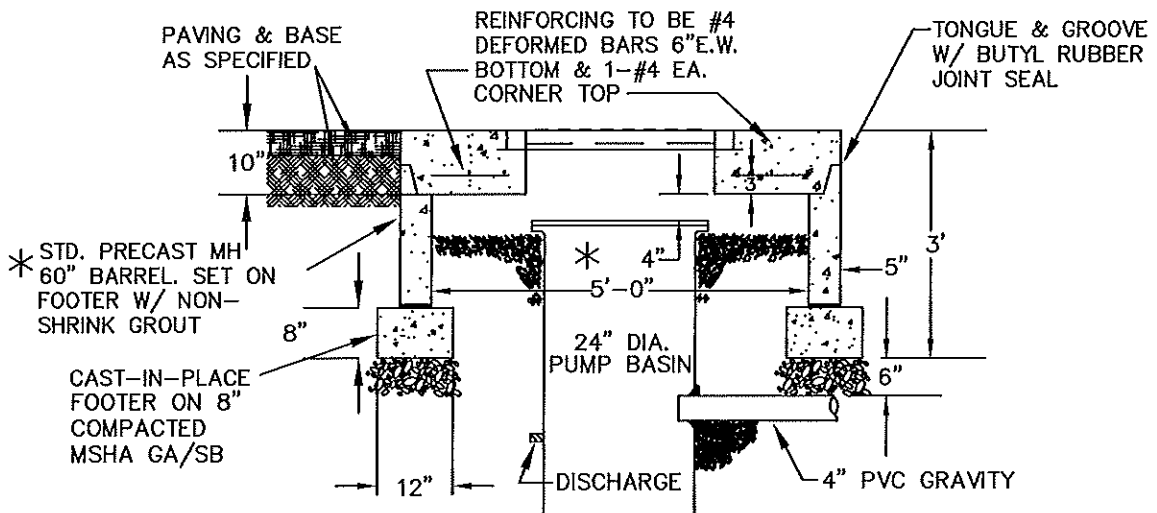
NOTES:

1. HATCH: BILCO TYPE 'JAL' 30"x30"
W/ S.S. HRDWR., H-20 TRAFFIC
BEARING. BIT. COAT EXT. FRAME.
CAST-IN BY MANHOLE MANUF.
2. SEE STD. S-5.1 FOR FRP GRINDER
PUMP BASIN DETAILS.
3. PRECAST MH SHALL COMPLY
W/ ASTM C 478.
4. ORIENTATION OF HATCH
HINGE TO PUMP BASIN
SHALL BE DIRECTED BY
THE COUNTY.
5. RESTORATION FOR THIS
INSTALLATION SHALL BE
AT THE DEVELOPERS EXPENSE



* 72" PRECAST UNITS REQ'D.
FOR 36" DIA. PUMP BASIN

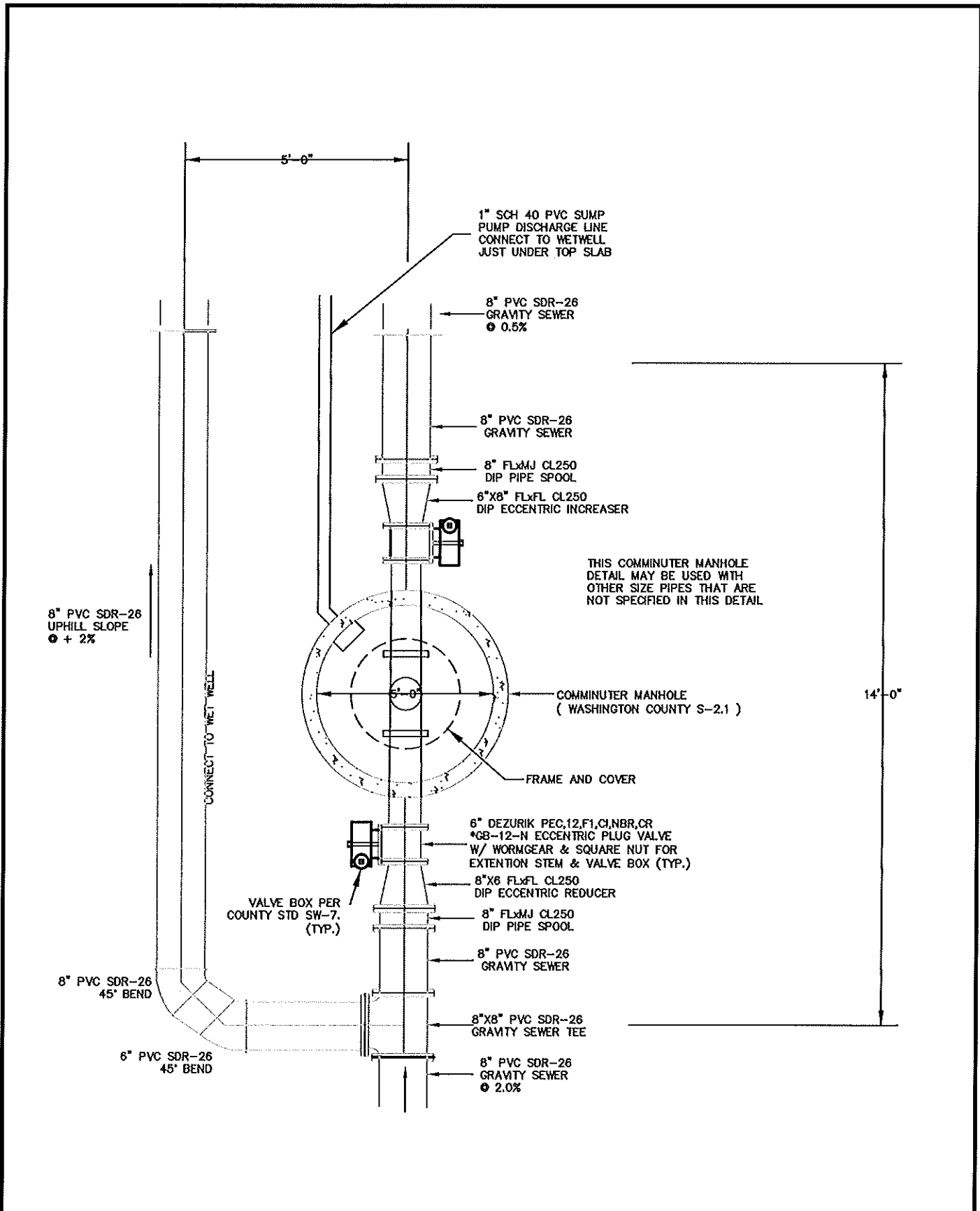
PLAN



SECTION

NO SCALE

<p>REVIS</p> <hr/> <p>REVIS</p> <hr/> <p>APPROV</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia Pippel</i> Director of Environmental Management</p>	<p>Traffic Bearing Access Structure</p>	<p>Detail S-5.3</p>
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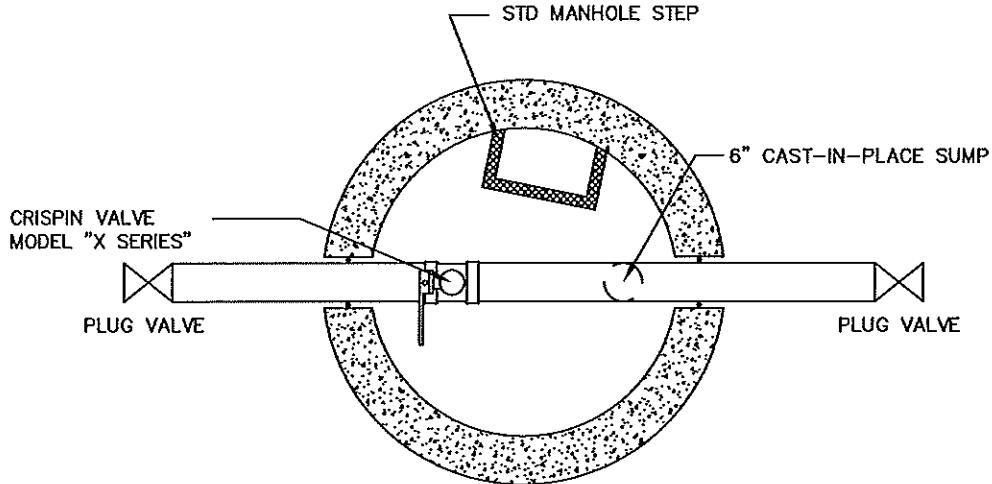
REVISION	REVISOR	DATE
REVISION	REVISOR	DATE
APPROVED		

Washington County, MD Div. of
Environmental Management

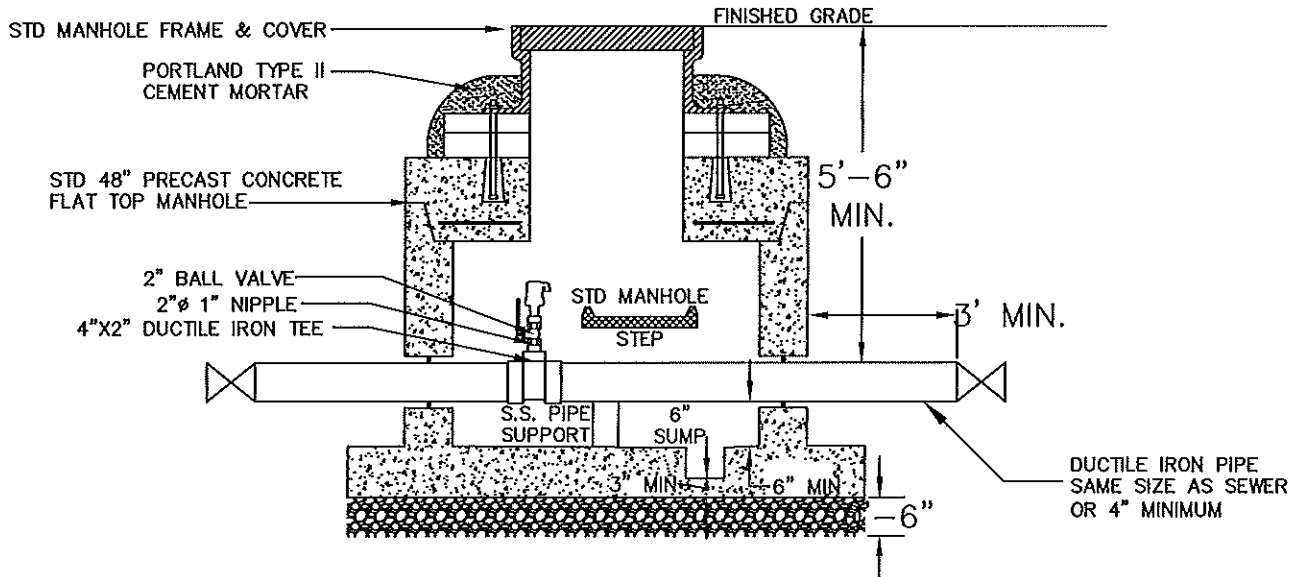
Approved: *Julia A. Pippin*
Director of Environmental Management

Comminutor
Plan View

Detail
S-6.2



PLAN
NO SCALE

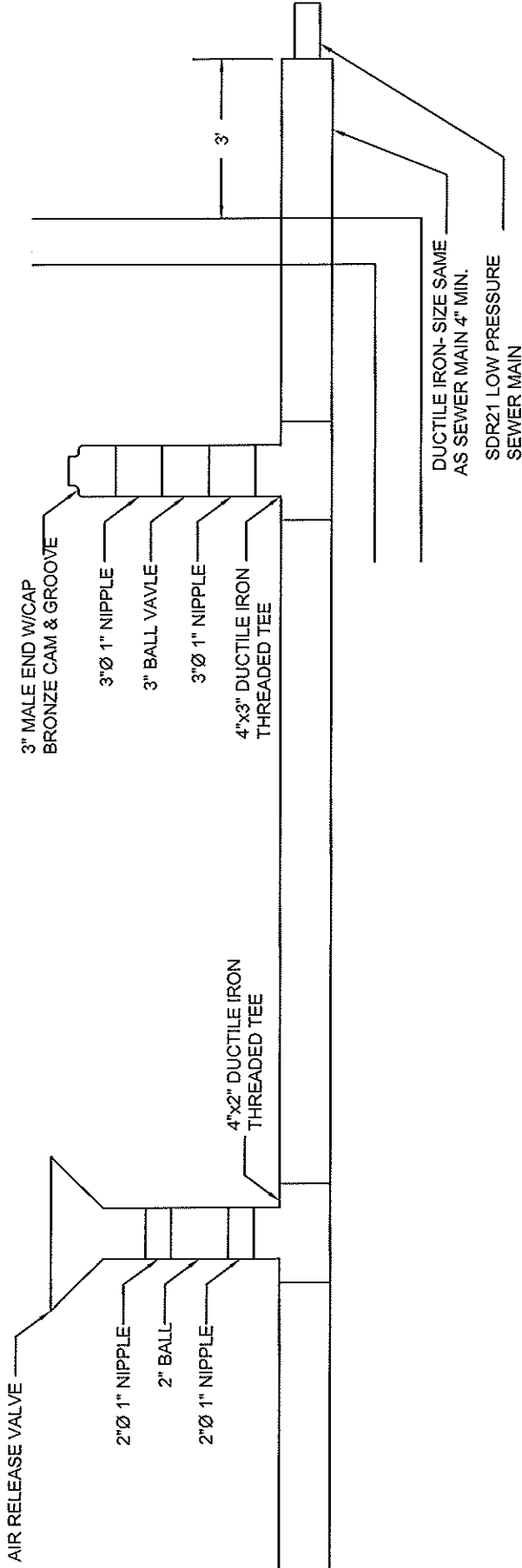


SECTION
NO SCALE

NOTES:

1. PRECAST MANHOLE SHALL COMPLY WITH STANDARD DETAILS S-2.1-S-2.4, S-2.11-S-2.13
2. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
3. VALVES SHALL BE ORIENTED AS SHOWN IN PLAN VIEW. AIR RELEASE VALVE IS NORMALLY OPEN.
4. ALL VAULT PIPING SHALL BE DUCTILE IRON UNLESS OTHERWISE NOTED.
5. THE A.R.V. SHALL BE TAPPED INTO THE CROWN OF PIPE.

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia Pappas</i> Director of Environmental Management	Sewage Air Release Manhole Working Pressure Less Than or Equal To 100 PSI	Detail S-7.2A
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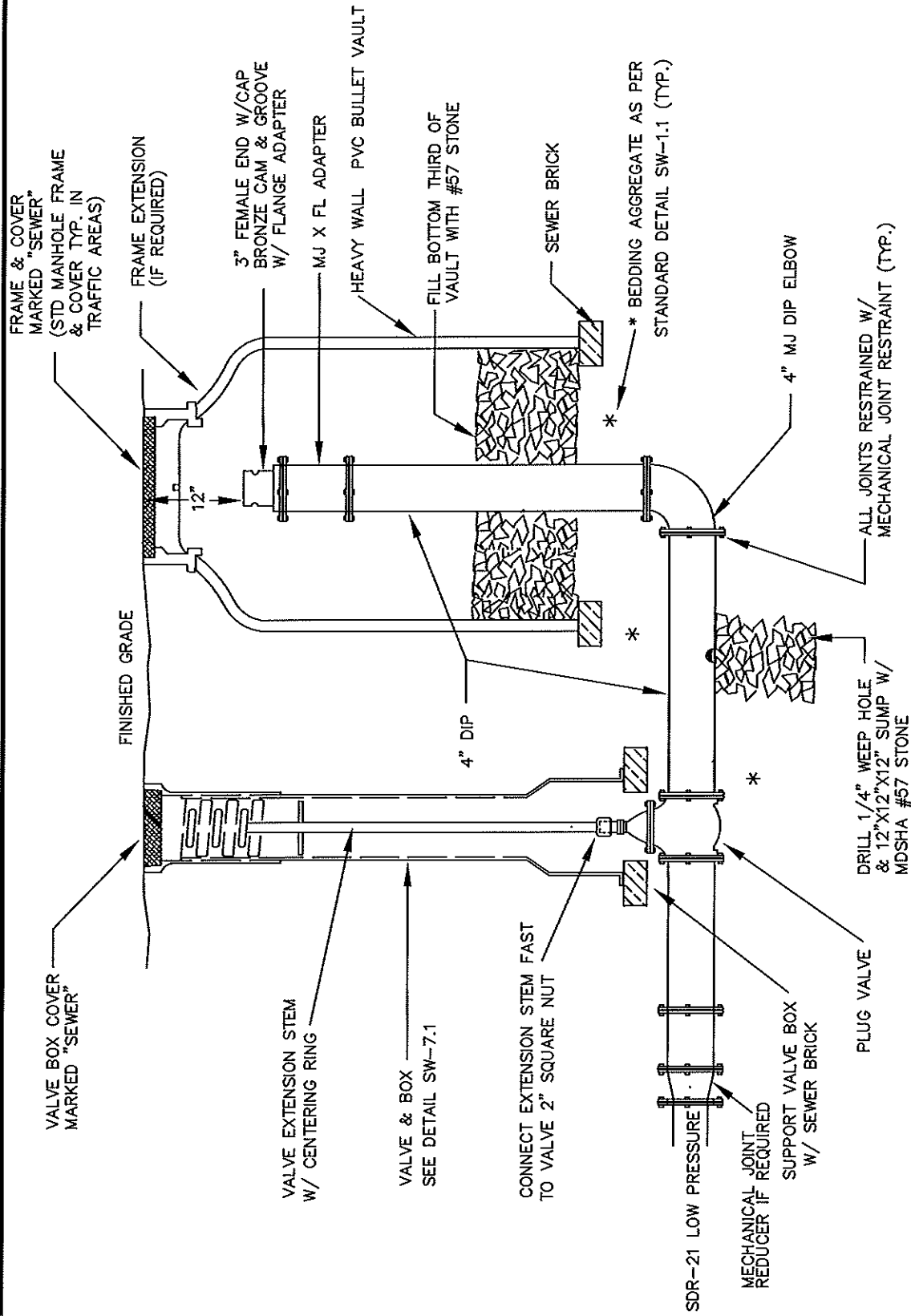
Washington County, MD Div. of
Environmental Management

Approved: *Julie A. Pippel*
Director of Environmental Management

Sewage Air Release and Flushing Connection Manhole
Working Pressure Less Than or Equal To 100 PSI

Detail
S-7.2B

REVISED
REVISED
APPROVED



NOT TO SCALE

Washington County, MD Div. of Environmental Management

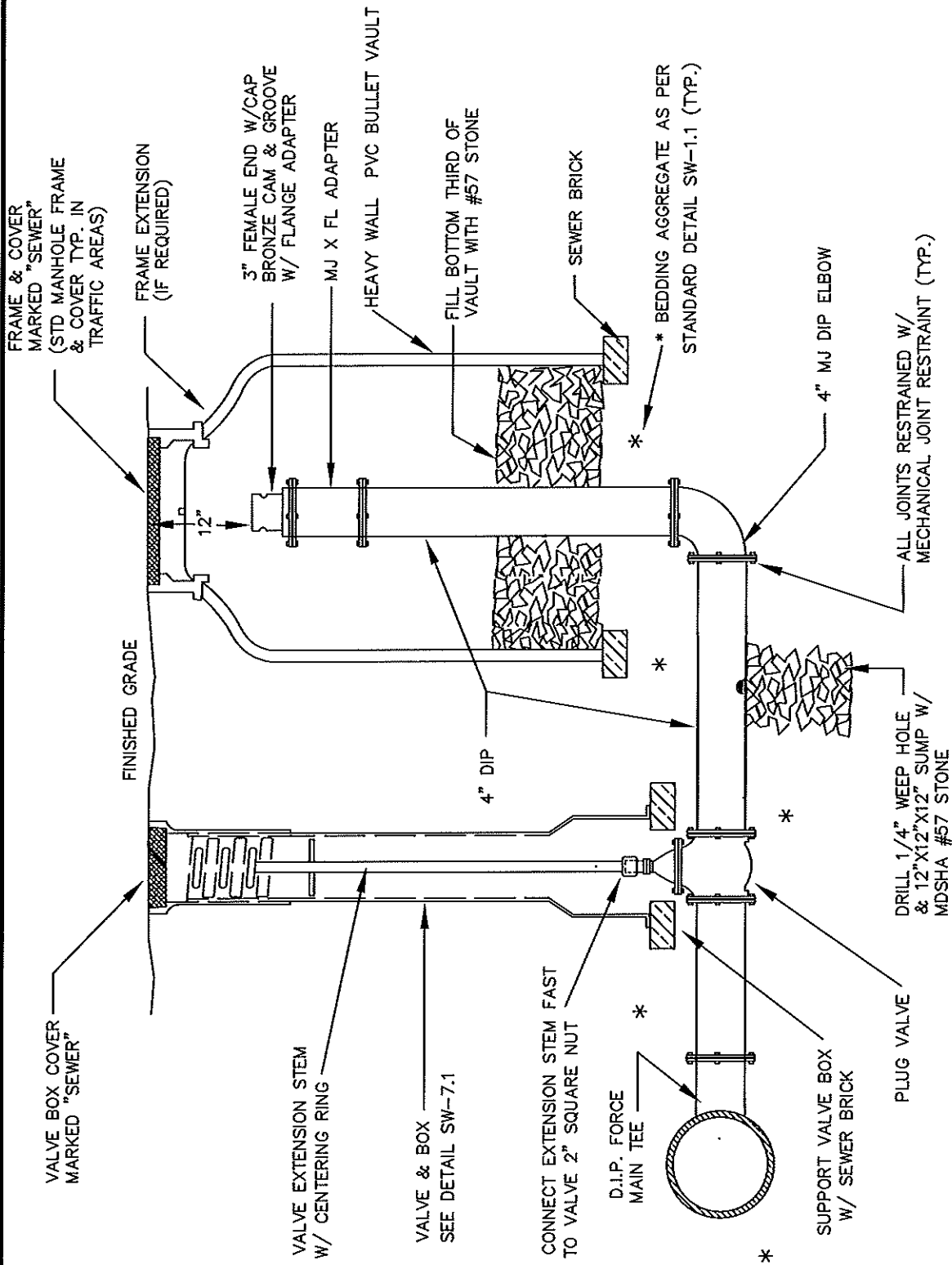
Approved: *Julia L. Ruppel*
 Director of Environmental Management

Detail

S-7.3

Low Pressure Sewer Flushing Connection

REVIS
 REVIS
 APPROV



NOT TO SCALE *ALL JOINTS SHALL BE MECHANICAL RESTRAINED

Detail
S-7.4

Force Main Flushing Connection

Washington County, MD Div. of
Environmental Management
Approved: *Julia A. Ruppel*
Director of Environmental Management

REVISED
REVISED
APPROVED

PROJECT: _____ PROJECT NO.: _____

CONTRACTOR: _____

DRAWING REFERENCE: _____

FROM MANHOLE/STATION: _____ TO MANHOLE/STATION: _____

NUMBER OF PREVIOUS TESTS THIS SECTION: _____ (ATTACH COPIES)

DATE OF TEST: _____ AIR TEMPERATURE AT TIME OF TEST: _____ °F

WEATHER CONDITIONS: _____

PIPE DIAMETER (D) (INCHES)	PIPE LENGTH (L) (FEET)	ACCEPTABLE TIME (T) (MINUTES)	$\left[= \frac{0.0119}{60} \times D^2 \times L \right]$
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
_____	_____	_____	
			TOTAL ACCEPTABLE TEST TIME: _____ MINUTES

TEST STABILIZATION PRESSURE TO BE USED = 4.0 P.S.I.G. + 0.433 X H = _____ P.S.I.G.
 ('H' = HEIGHT OF WATER ABOVE PIPE INVERT IN 'FEET')
 * (REDUCE BY 0.5 P.S.I.G. FOR TEST PRESSURE.)

GAUGE PRESSURE DURING 5 MINUTE STABILIZATION PERIOD: _____ P.S.I.G.
 TIME OF DAY AT START OF PRESSURE TEST: _____ A.M. P.M.
 GAUGE PRESSURE AT START OF PRESSURE TEST: _____ P.S.I.G.
 GAUGE PRESSURE AT END OF PRESSURE TEST: _____ P.S.I.G. TEST TIME FOR PRESSURE DROP:
 DROP IN PRESSURE (MAX. 1.0 P.S.I.G.) _____ P.S.I.G. _____ MINUTES

TEST CONDUCTED BY:
 COUNTY REPRESENTATIVE: _____
 CONTRACTOR'S REPRESENTATIVE: _____

ACCEPTANCE OF TEST IS A PREREQUISITE OF PROJECT ACCEPTANCE.
 UNACCEPTABLE SEWERS REQUIRE CORRECTION AND RE-TESTING.

BY: _____ ACCEPTABLE
 WASHINGTON COUNTY WATER QUALITY DEPARTMENT NOT ACCEPTABLE

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Low Pressure Air Testing of Sanitary Sewers Detail S-12.6
---	---	---

PROJECT: _____ PROJECT NO.: _____
 DRAWING REFERENCE: _____ DATE: _____

CONTRACTOR: _____

FROM STATION: _____ TO STATION: _____

NUMBER OF PREVIOUS TESTS THIS SECTION: _____ (ATTACH COPIES)

MAINTAIN THE TESTING PRESSURE FOR A FOUR (4) HOUR PERIOD AFTER EXPULSION OF ALL AIR.
 TEST PRESSURE TO BE USED SHALL BE 1.5 TIMES PIPES OPERATING PRESSURE AT THE LOWEST POINT IN
 THE TEST SECTION PLUS 50 P.S.I.G., NOT TO EXCEED 150 P.S.I.G. UNLESS OTHERWISE SPECIFIED OR DIRECTED.

TEST PRESSURE (P)(PSIG) = 1.5 TIMES PIPES OPERATING PRESSURE = _____ P.S.I.G.

PRESSURE (P)	100	150	200
DIAMETER (D) INCHES	ALLOWABLE LEAKAGE PER 1000 FEET OR 50 JOINTS (L) U.S. GALLONS PER HOUR		
4"	0.27	0.33	0.38
6"	0.41	0.50	0.57
8"	0.54	0.66	0.76
10"	0.68	0.83	0.96
12"	0.81	0.99	1.15
16"	1.08	1.32	1.53
20"	1.35	1.66	1.91

(TEST DURATION = 4 HOURS)

BEGIN: _____ A.M. P.M.

END: _____ A.M. P.M.

TEST TIME: _____ HOURS

BEGIN PRESSURE: _____ P.S.I.G.

END PRESSURE: _____ P.S.I.G.

WATER USED: _____ GALLONS

TEST SECTION ALLOWABLE LEAKAGE (GAL) = $\sum \frac{N * D * \sqrt{P}}{7400}$ X TEST TIME (HOURS)

DIAMETER (D) INCHES	TYPE OF PIPE	LENGTH (FEET)	NO. OF JOINTS (N)	ALLOWABLE LEAKAGE (L)

ALLOWABLE LEAKAGE : ADD SUM OF (L) ABOVE & MULTIPLY BY TEST TIME = _____ GALLONS

NUMBER OF HYDRANTS IN TEST SECTION: _____

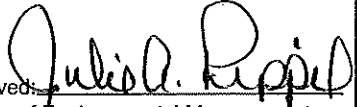
CONTRACTOR'S REPRESENTATIVE: _____

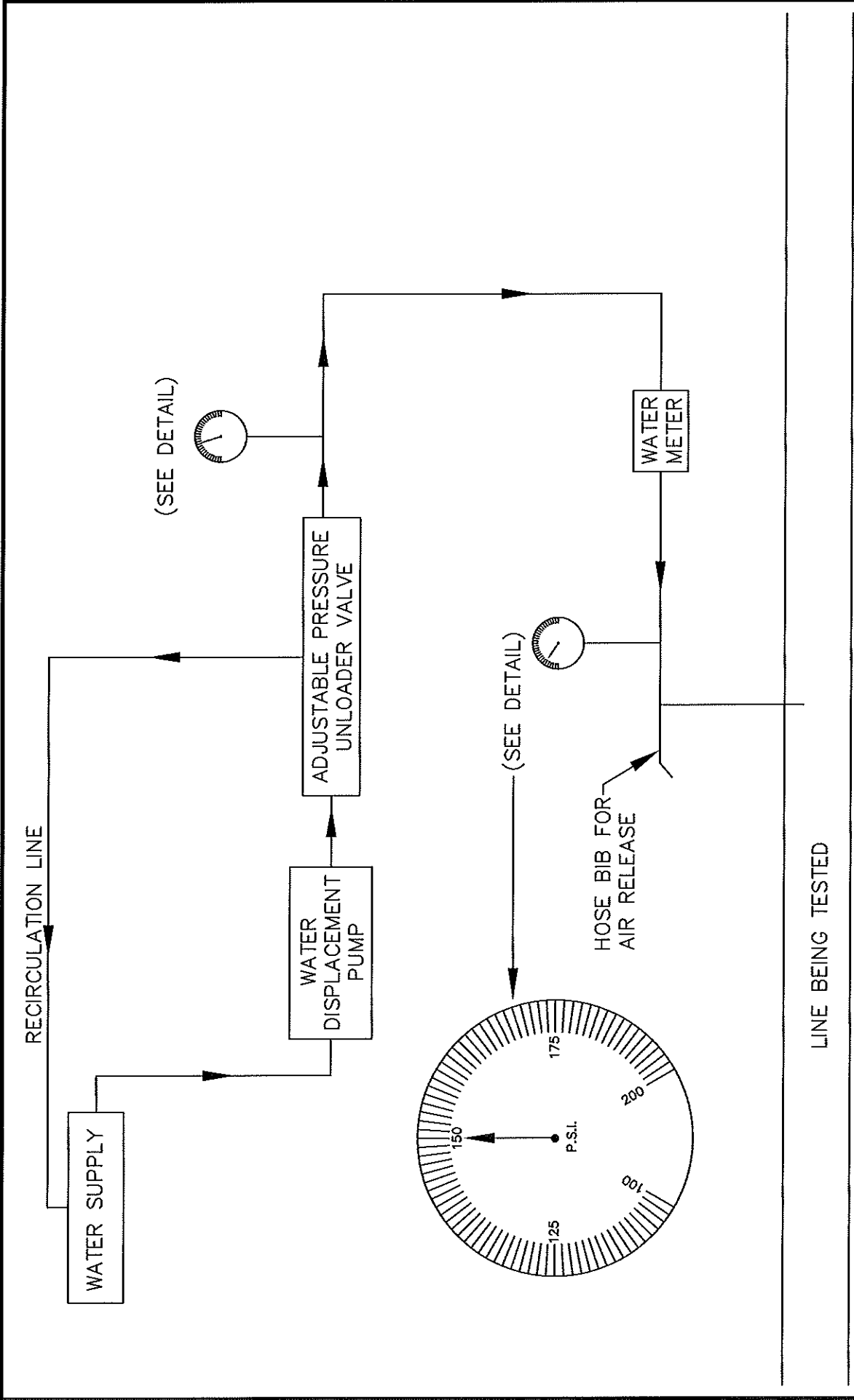
ACCEPTANCE OF TEST IS A PREREQUISITE OF PROJECT ACCEPTANCE.
 UNACCEPTABLE SECTIONS REQUIRE CORRECTION AND RE-TESTING.

BY: _____
 WASHINGTON COUNTY WATER QUALITY DEPARTMENT

ACCEPTABLE:

NOT ACCEPTABLE:

_____ REVISION _____ REVISION _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	<h2>Hydrostatic & Leakage Test</h2>	Detail <h1>S-12.7</h1>
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REVISER

REVISER

APPROVED

Washington County, MD Div. of Environmental Management

Approved: *Julius P. Ruppel*
 Director of Environmental Management

Pressure Test System

Detail

S-12.8

SITE: _____ PROJECT NO.: _____

CONTRACTOR: _____ DATE: _____

OPERATORS: _____

PRESSURES STATIC: #1 PUMP: #2 PUMP: BOTH:

AMPERAGE: #1 L 1/2/3 #2 L 1/2/3
 OPERATIONAL: OPERATIONAL:
 DEADHEAD: DEADHEAD:

LEVEL TESTING: FORMULA: $3.14 \times R \times R \times H = \text{CUBIC FEET} \times 7.48 = (\text{GALLONS})$
KEY: CIRCULAR WET WELL:
 3.14 = PIE
 R = RADIUS - WHICH IS HALF THE DIAMETER OF WET WELL EXPRESSED AS FEET
 H = HEIGHT OF DRAW DOWN EXPRESSED AS FEET, 1 INCH = 0.083 FT. (EX. 4" = 0.332 FT.)
 7.48 = GALLONS OF WATER IN A CUBIC FT.
 GALLONS = THE TOTAL AMOUNT OF GALLONS PUMPED, REMEMBER IF YOU DO A TWO MINUTE
 TEST DIVIDE THIS NUMBER BY TWO.

SQUARE / RECTANGULAR WET WELL:
LENGTH x WIDTH x HEIGHT = CUBIC FEET x 7.48 = (GALLONS)

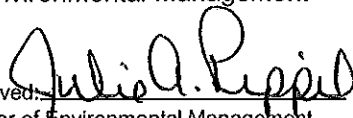
DO: TAKE EXACT ACCURATE MEASUREMENTS EVEN A 1/4" CAN MAKE A HUGE DIFFERENCE.
 PLUG ALL INFLUENT LINES TO THE WET WELL, TO INSURE ACCURATE NUMBERS.
 KEEP A COPY OF THIS SHEET AT THE SITE, AND FORWARD A COPY TO SUPERVISOR.
 SHOW FORMULA IN THE SPACE PROVIDED BELOW.

DO NOT: ALLOW THE LEVEL TO REACH THE FLOOR GRATING OR INFLUENT LINES
 BACKFLUSH CHECK VALVES OR MAIN PRIOR TO TESTING, THAT WILL EMPTY THE MAIN, AND
 GIVE FALSE GPM RATING.

PUMP #1 START:
 STOP:
 TOTAL DRAW DOWN:

PUMP #2 START:
 STOP:
 TOTAL DRAW DOWN:

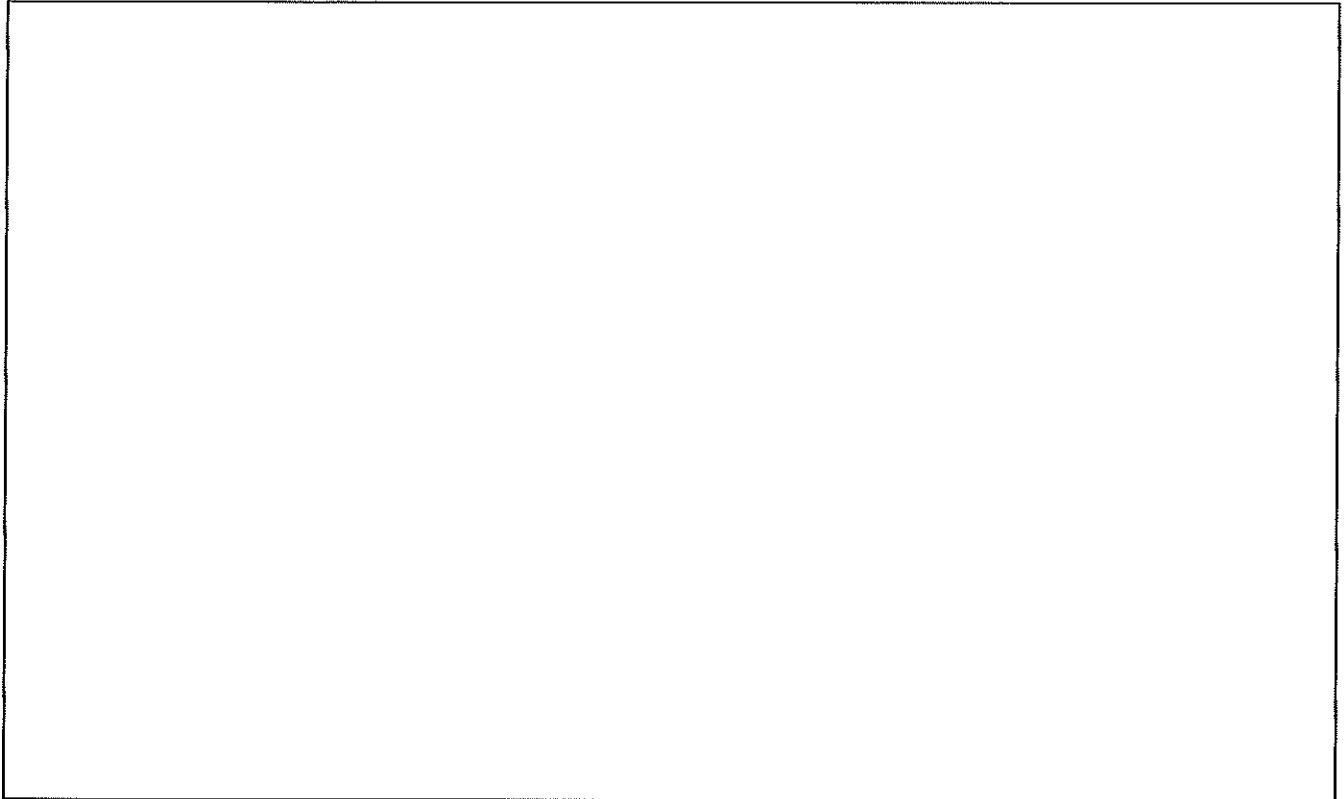
COMMENTS:

REVISOR	Washington County, MD Div. of Environmental Management	Collections Division Draw Down Test	Detail
REVISOR			
APPROVED	Approved: _____ Director of Environmental Management		

S-12.11

PROJECT NAME: _____ PROJECT NO.: _____
 PROPERTY ADDRESS: _____ DRAWING NO.: _____ OF _____
 MAIN LOCATION: STREET/EASEMENT _____ MAIN STATION: _____
 PROPERTY OWNER NAME: _____ MAIN INVERT: _____
 PROPERTY OWNER ADDRESS: _____ LATERAL SIZE: _____
 _____ SINGLE: _____ DOUBLE _____

Place an "X" on the sketch below to indicate where the property owner wants the service connection (lateral) to enter the property. A County representative will place a wooden stake in the ground at that location.



(NOT TO SCALE)

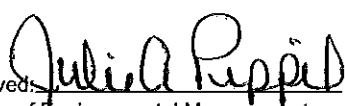
The undersigned agrees that the Water and Sewer Department may excavate an additional five (5) feet inside the property line so as to facilitate and make less expensive, the owner's connection to the lateral and to prevent damage to the clean out which will be installed by the County at or near the property line.

Date: _____

 Property Owner Name

 Property Owner Signature

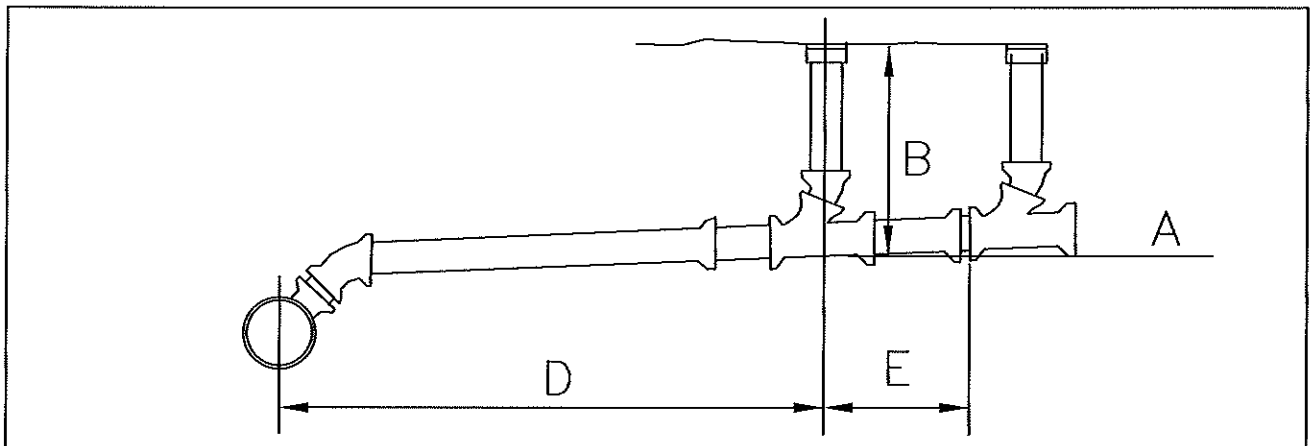
Attest: _____
 Washington County Water Quality Department

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Gravity Sewer Service Location Sheet	Detail S-13.1
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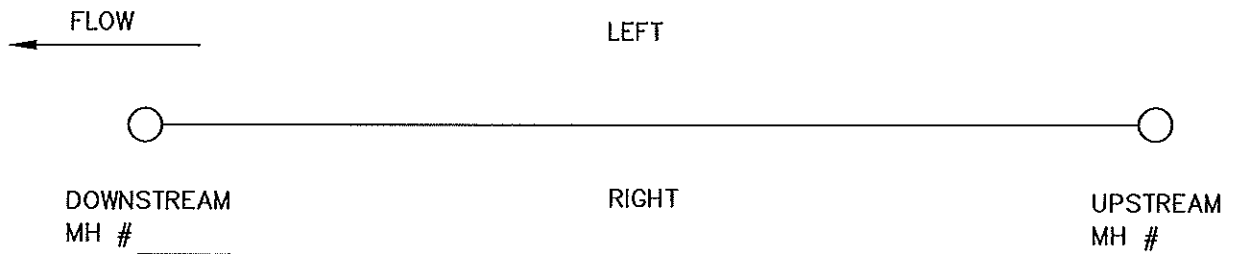
PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO: _____
 MAIN LOCATION: STREET/EASEMENT _____ DATE INSTALLED: _____
 PROPERTY OWNER NAME: _____ MH _____ TO MH _____
 PROPERTY OWNER ADDRESS: _____ MAIN STATION: _____
 _____ SINGLE: _____ DOUBLE: _____
 CONTRACTOR: _____ CONNECTION @ MH: _____

SIZE & TYPE TEE/WYE	SIZE & TYPE SERVICE PIPE	INVERT @ C.O. WYE (A)	DEPTH C/O (B)	DROP DEPTH (C)	D	E	F

INDICATE TYPE OF LATERAL BY CROSSING OUT OTHERS. FOR CONNECTION TO MANHOLE, CHECK ABOVE, AND LIST INVERT DIMENSION 'B' AND DROP DIMENSION 'C' (IF APPLICABLE).



SHOW LATERAL LOCATION, STATION, UTILITY CROSSINGS AND DIMENSION ALL PERTINENT ITEMS



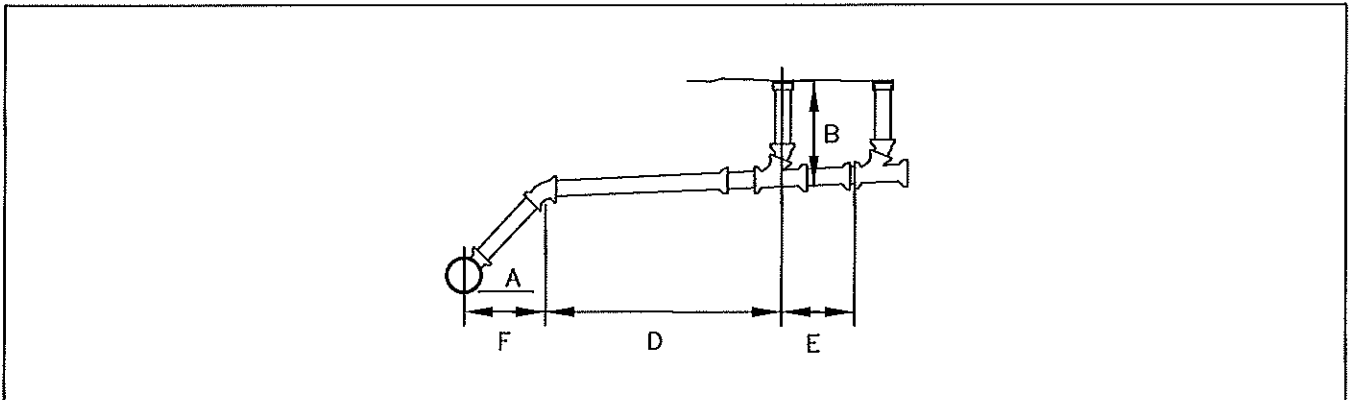
BY: _____ WASHINGTON COUNTY INSPECTOR
 _____ CONTRACTOR'S REPRESENTATIVE
 CO. NAME: _____

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management <i>Julia A. Reppel</i> Approved: _____ Director of Environmental Management	<h2 style="margin: 0;">Gravity Sewer Service Connection Sheet</h2>	Detail <h1 style="margin: 0;">S-13.2</h1>
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PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO: _____
 MAIN LOCATION: STREET/EASEMENT _____ DATE INSTALLED: _____
 PROPERTY OWNER NAME: _____ MH _____ TO MH _____
 PROPERTY OWNER ADDRESS: _____ MAIN STATION: _____
 _____ SINGLE: _____ DOUBLE: _____
 CONTRACTOR: _____ CONNECTION @ MH: _____

SIZE & TYPE TEE/WYE	SIZE & TYPE SERVICE PIPE	INVERT @ MAIN (A)	DEPTH C/O (B)	DROP DEPTH (C)	D	E	F

INDICATE TYPE OF LATERAL BY CROSSING OUT OTHERS. FOR CONNECTION TO MANHOLE, CHECK ABOVE, AND LIST INVERT DIMENSION 'B' AND DROP DIMENSION 'C' (IF APPLICABLE).



NO SCALE

WE, THE UNDERSIGNED, BEING SAID OWNERS OF THIS PROPERTY, REQUEST PERMISSION TO INSTALL THE
 _____ HOUSE LATERAL AT THE MODIFIED HEIGHT DESCRIBED ABOVE.
 (PROPERTY ADDRESS)

DATE: _____

 PRINTED NAME

ATTEST: _____

WASHINGTON COUNTY WATER QUALITY DEPT.

 SIGNATURE

THIS FORM SHALL BE USED IN CONJUNCTION WITH THE GRAVITY SEWER SERVICE CONNECTION SHEET, STANDARD DETAIL S-3.1.

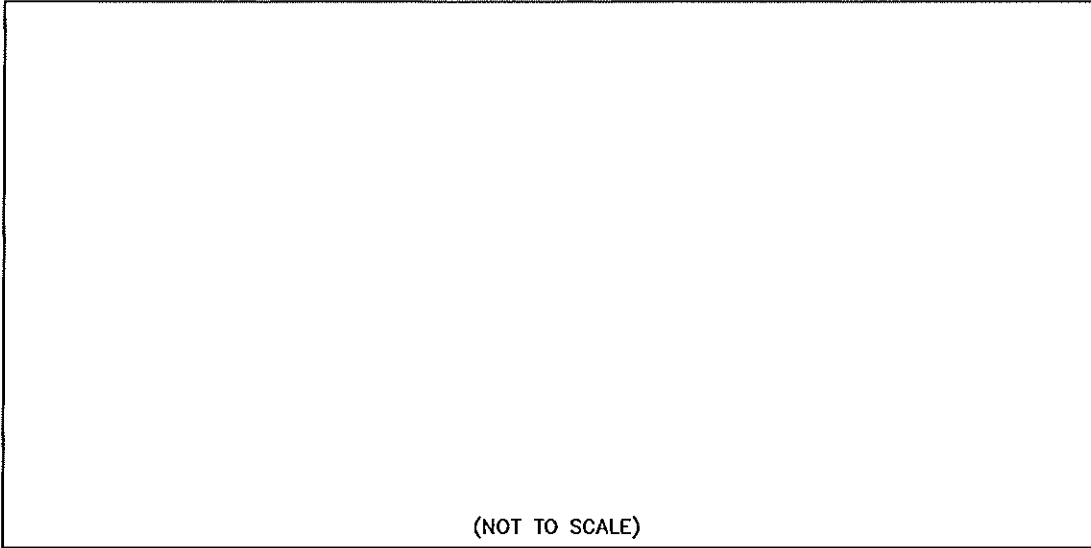
_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julio P. Pappalardo</i> Director of Environmental Management	Modified Service Lateral Gravity Sewer	Detail S-13.3
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PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO. _____ OF _____
 MAIN LOCATION: STREET/EASEMENT _____ MAIN STATION: _____
 PROPERTY OWNER NAME: _____ UNIT NO: _____
 PROPERTY OWNER PHONE NO. _____ UNIT TYPE: _____
 PROPERTY OWNER ADDRESS: _____ ELECTRIC UPGRADE : _____
 _____ SINGLE _____ DOUBLE _____

Place an "O" on the sketch below to indicate where the existing sewer system is located.
 (Septic Tank/Drain Field etc)

Place an "E" on the sketch below to indicate where the house electric panel is located.

Place an "X" on the sketch below to indicate the desired location of the grinder pump/septic tank
 If the location is FEASIBLE to construct, a County representative will place a wooden stake in the
 ground as indicated in sketch.



The undersigned hereby agrees to and authorizes the Washington County Water and Sewer Department and or it's agent(s) to enter upon the above described property shown in the sketch, to excavate, install and backfill a sewer service lateral, and a grinder pump/septic tank station at a feasible location, install underground electrical service from the station to an electrical control panel on the dwelling, and wire the panel to the existing house power supply, and restore the area at no cost to the property owner.

The undersigned also agrees that the Washington County Water and Sewer Department and or it's agent(s) shall have the right to operate and maintain the completed sewer service, station and control panel, upon the completion of the construction at no cost to the property owner, and that no fee shall be paid by the County to the property owner, for use of the property being occupied by the completed sewer service.

 Property Owner Name (Print)

 Property Owner Name (Print)

 Property Owner Signature

 Property Owner Signature

STATE OF MARYLAND, COUNTY OF WASHINGTON, to-wit:

I HEREBY CERTIFY, that on this ____ day of _____ 19 _____, before me, a Notary Public in and for State and County aforesaid, personally appeared _____
 _____ known to me to be the person(s) whose name(s) is (are) signed
 to the foregoing Agreement, and this date acknowledge that said person(s) executed the same as their
 voluntary act; and did further affirm that the consideration stated is correct.

WITNESS my hand and Official Notarial Seal.

 Washington County Water and Sewer Department

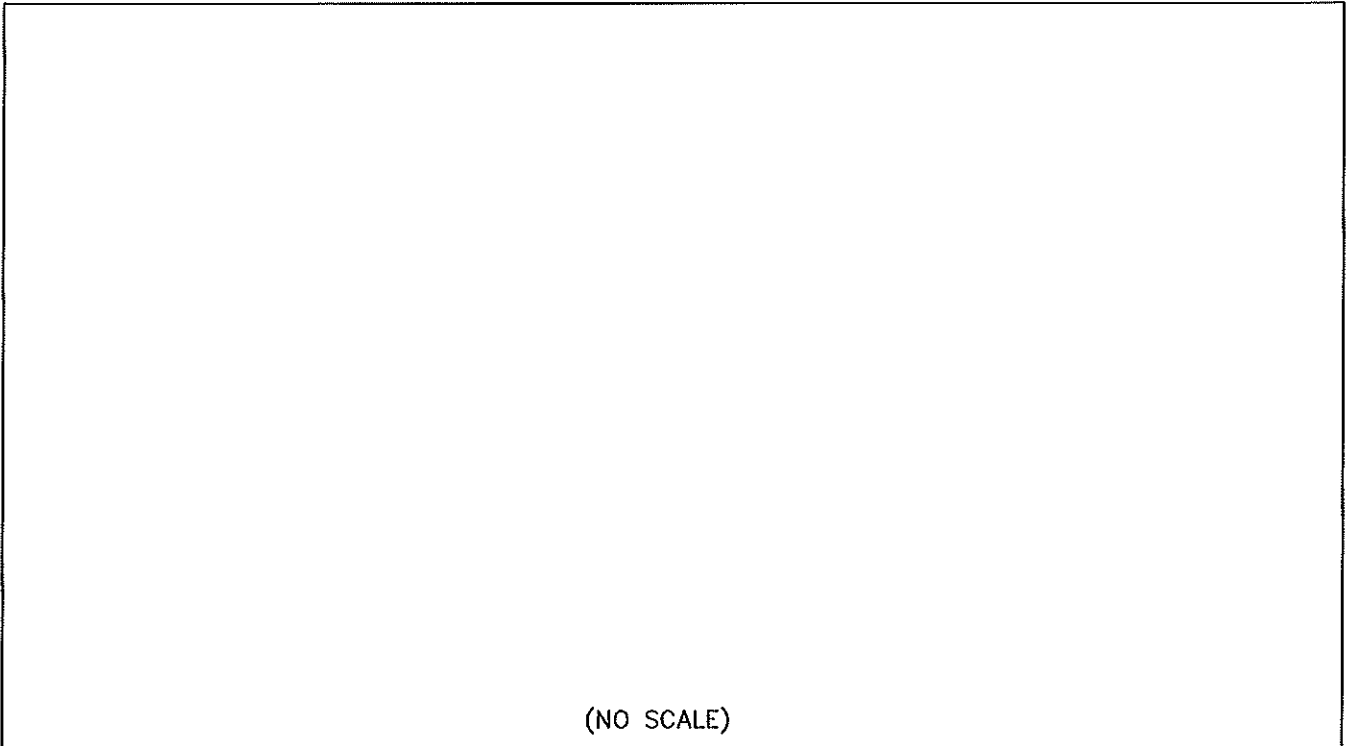
Commission Expires:

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julie B. Repper</i> Director of Environmental Management	Low Pressure Sewer Service Location Worksheet	Detail S-13.4
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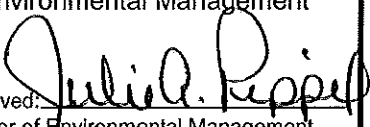
PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO. _____ OF _____
 MAIN LOCATION: STREET/EASEMENT _____ MAIN STATION: _____
 PROPERTY OWNER NAME: _____ UNIT TYPE: _____
 PROPERTY OWNER ADDRESS: _____ MANUFACTURER: _____
 _____ DATE INSTALLED: _____
 CONTRACTOR: _____ SINGLE _____ DOUBLE _____

SIZE & TYPE TEE	SIZE & TYPE SERVICE PIPE	SIZE & TYPE TANK	TOP ELEV & DEPTH	SIZE & TYPE PUMP(S)	IMPELLER SIZE	SERIAL NO.

SKETCH PROFILE AND PLAN VIEWS SHOWING MAIN, SERVICE, VALVES, TANK, CONTROL PANEL, UNDERGROUND UTILITIES, STRUCTURES, STREETS, ETC. SHOW LOCATION TIES, ANGLES, DISTANCES TO ALL PERTINENT ITEMS.



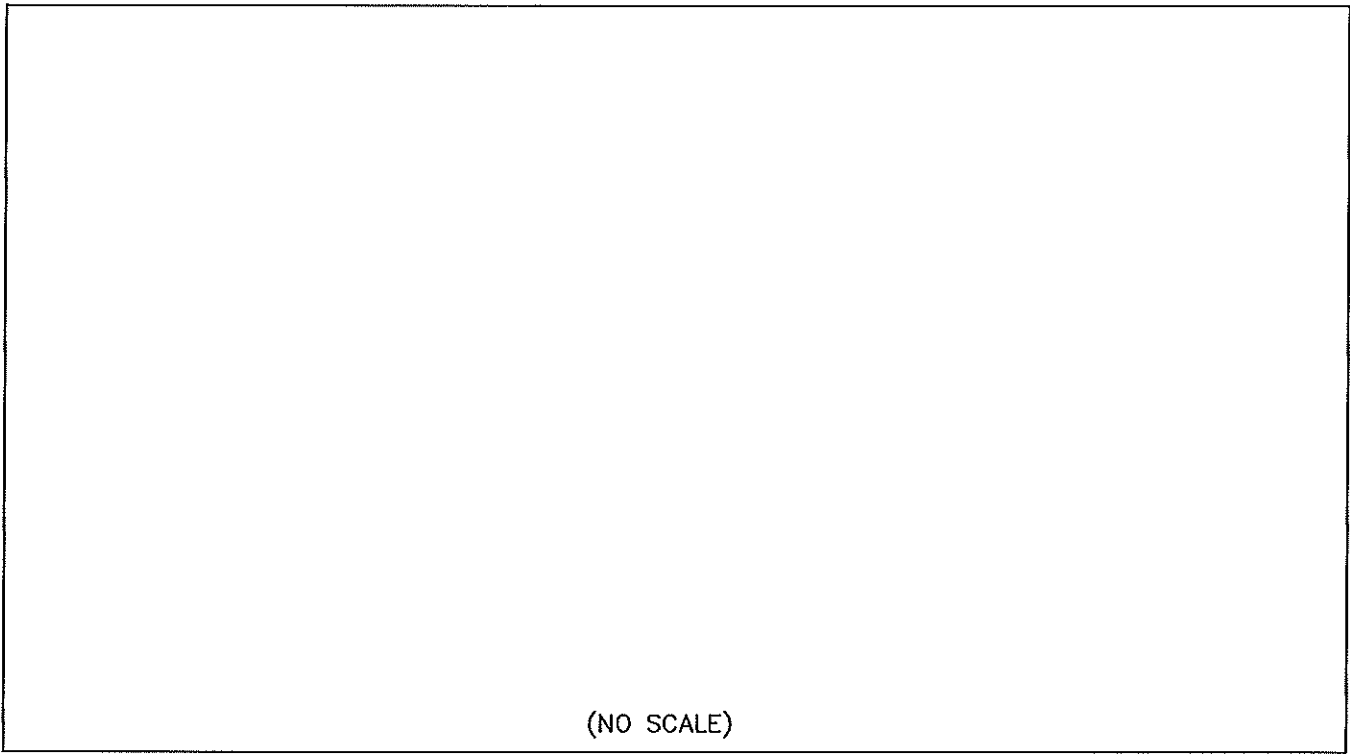
BY: _____ WASHINGTON COUNTY WATER QUALITY _____ CONTRACTOR'S REPRESENTATIVE

_____ REVISED _____ REVISED _____ APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Low Pressure Sewer Service Connection Sheet	Detail S-13.5
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PROJECT NAME: _____ PROJECT NO: _____
 PROPERTY ADDRESS: _____ DRAWING NO. _____ OF _____
 PROPERTY OWNER NAME: _____ UNIT TYPE: _____
 PROPERTY OWNER ADDRESS: _____ MANUFACTURER: _____
 _____ DATE INSTALLED: _____
 CONTRACTOR: _____ SINGLE _____ DOUBLE _____

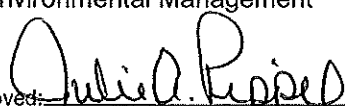
SIZE & TYPE CONDUIT	WIRE SIZE	SIZE & TYPE DIRECT BURIAL	AVERAGE DEPTH	LENGTH PANEL TO TANK	MANUFACTURE & TYPE BRANCH CIRCUIT

SKETCH PLAN VIEW SHOWING TANK, ELECTRIC SERVICE,
 CONTROL PANEL, UNDERGROUND UTILITIES, STRUCTURES,
 STREETS, ETC. SHOW LOCATION TIES, ANGLES, DISTANCES TO ALL PERTINENT ITEMS.



AMOUNTS PERTAINING TO WORK COMPLETED THIS PERIOD, REVIEWED AND APPROVED.

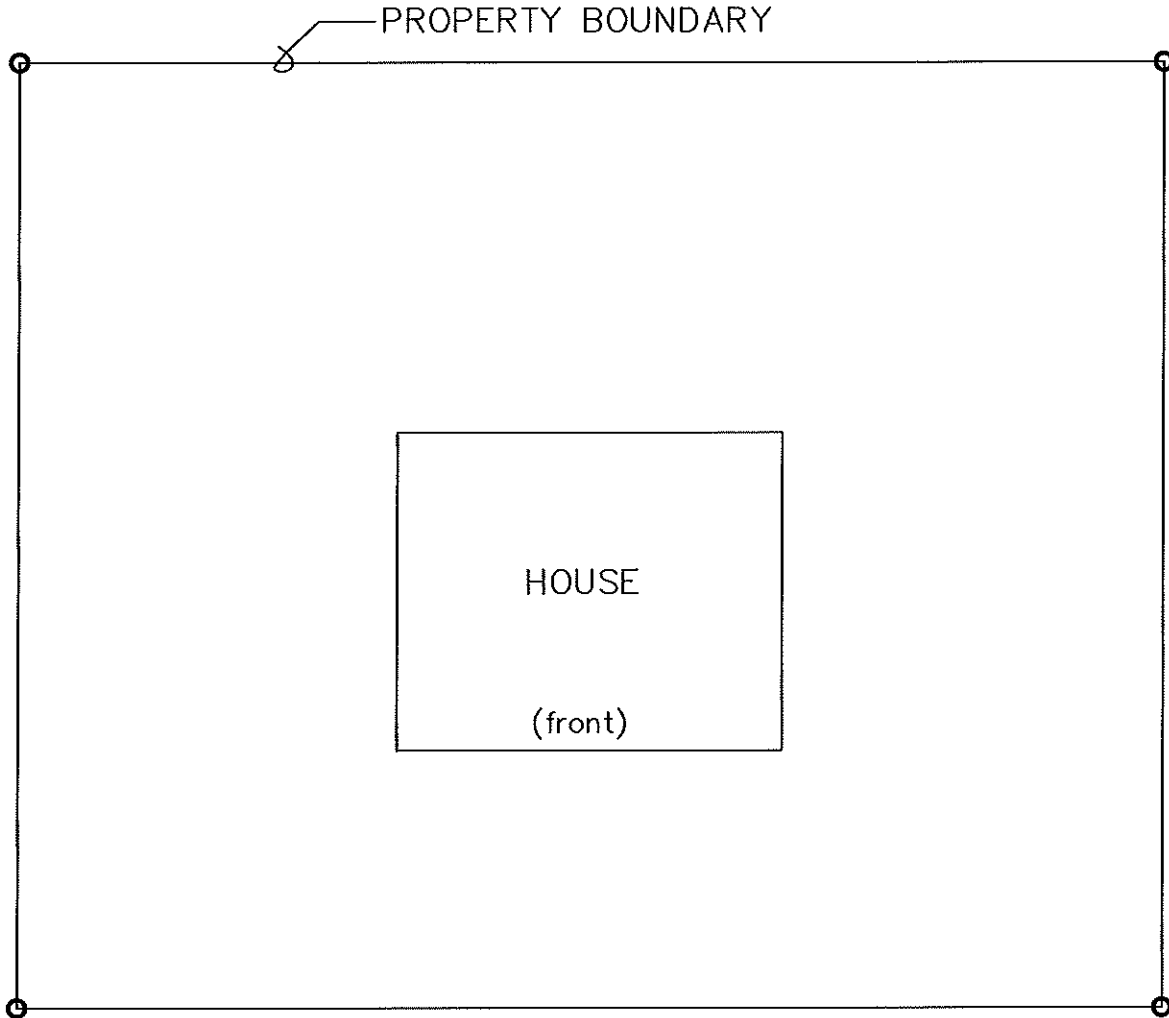
BY: _____ WASHINGTON COUNTY WATER QUALITY _____ CONTRACTOR'S REPRESENTATIVE

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management  Approved: _____ Director of Environmental Management	Sewer Service Electrical Connection Sheet	Detail S-13.6
--	---	--	-----------------------------

NAME: _____

ADDRESS: _____

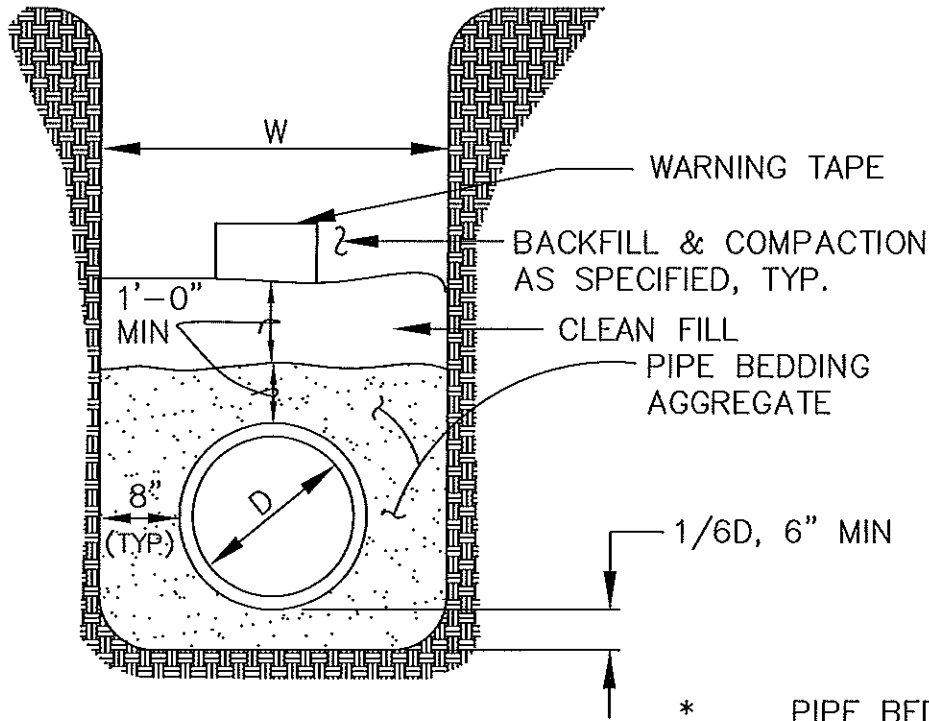
PLEASE SKETCH & LABEL: Pertinent information to show the general arrangement of your house with the street, and the location of the sewer pipe exiting the house. For example, label the "front", show a 2nd street if a corner lot, show driveway, shed, fence, trees, etc. Also show your septic tank & tile field, if known. Show dimensions to building corners, trees, fences, etc., measured approximately to the nearest foot.



STREET: _____

NO SCALE

REVISOR	Washington County, MD Div. of Environmental Management	On-Site Sewage Disposal Sketch Plan	Detail S-13.7
REVISOR	Approved: <i>Julio R. Pappalardo</i>		
APPROVED	Director of Environmental Management		



GRANULAR BEDDING & BACKFILL

* PIPE BEDDING AGGREGATE

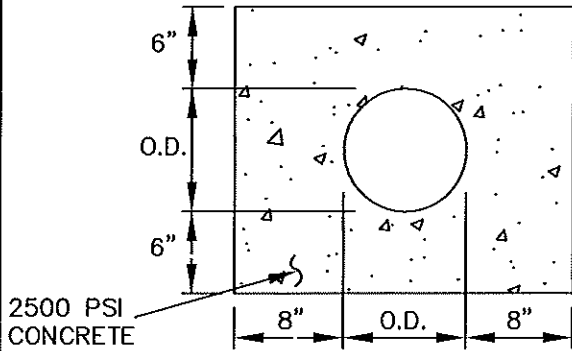
D = 4" AND LARGER - SHA GRADED CRUSHER RUN CR-6

D = 1-1/2" THROUGH <4" - SHA GRADED B-10

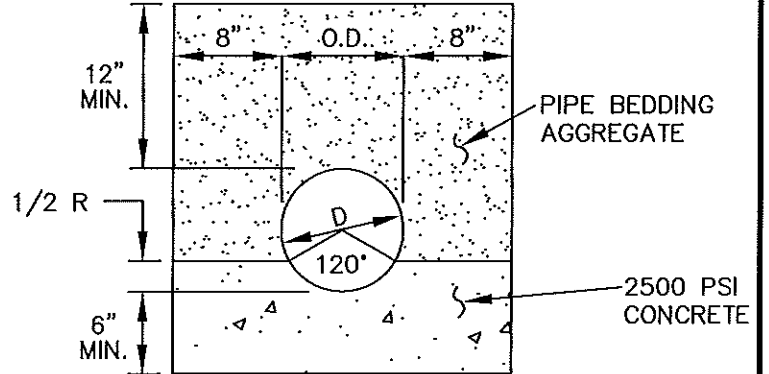
D = LESS THAN 1-1/2" - STONE DUST

* = NOMINAL PIPE DIAMETER (INCHES)

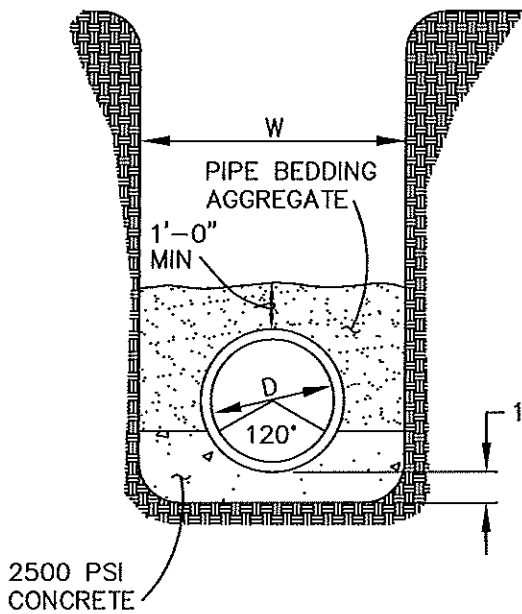
REVISIONS _____ REVISOR _____ APPROVED _____	Washington County, MD Div. of Environmental Management <i>Julia A. Poppe</i> Approved: _____ Director of Environmental Management	STANDARD TRENCH WIDTH & STONE BEDDING	Detail SW-1.1
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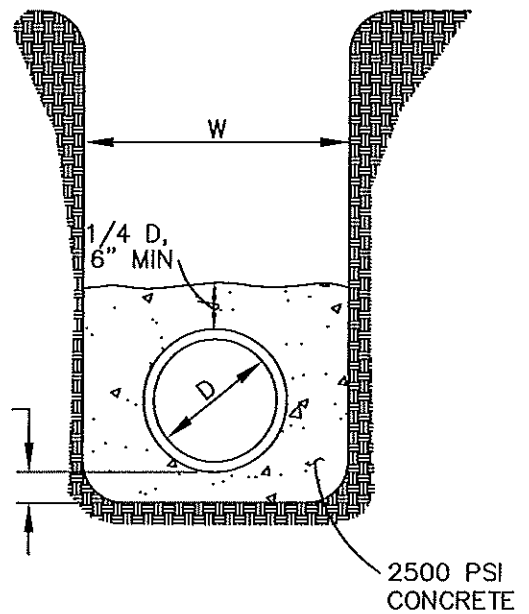
CONCRETE ENCASEMENT



LOW CRADLE



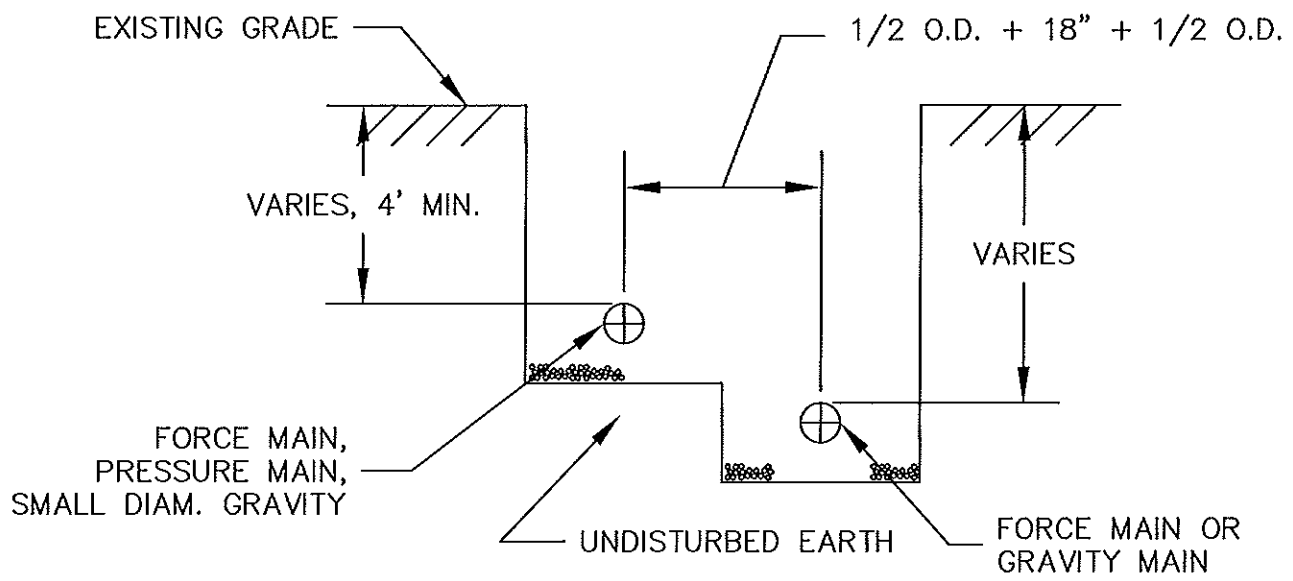
LOW CRADLE



CONCRETE ENCASEMENT

NO SCALE

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Pappalardo</i></p> <p>Director of Environmental Management</p>	<p>Concrete Cradles and Encasement</p>	<p>Detail</p> <p>SW-1.2</p>
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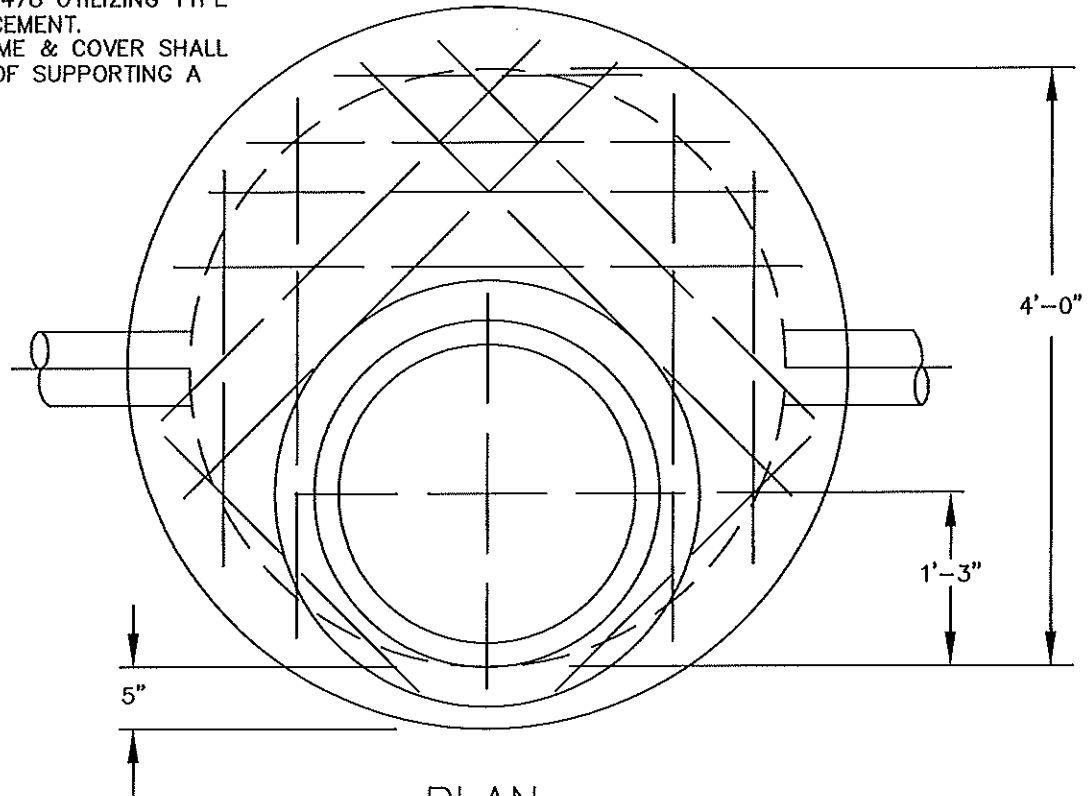


NO SCALE

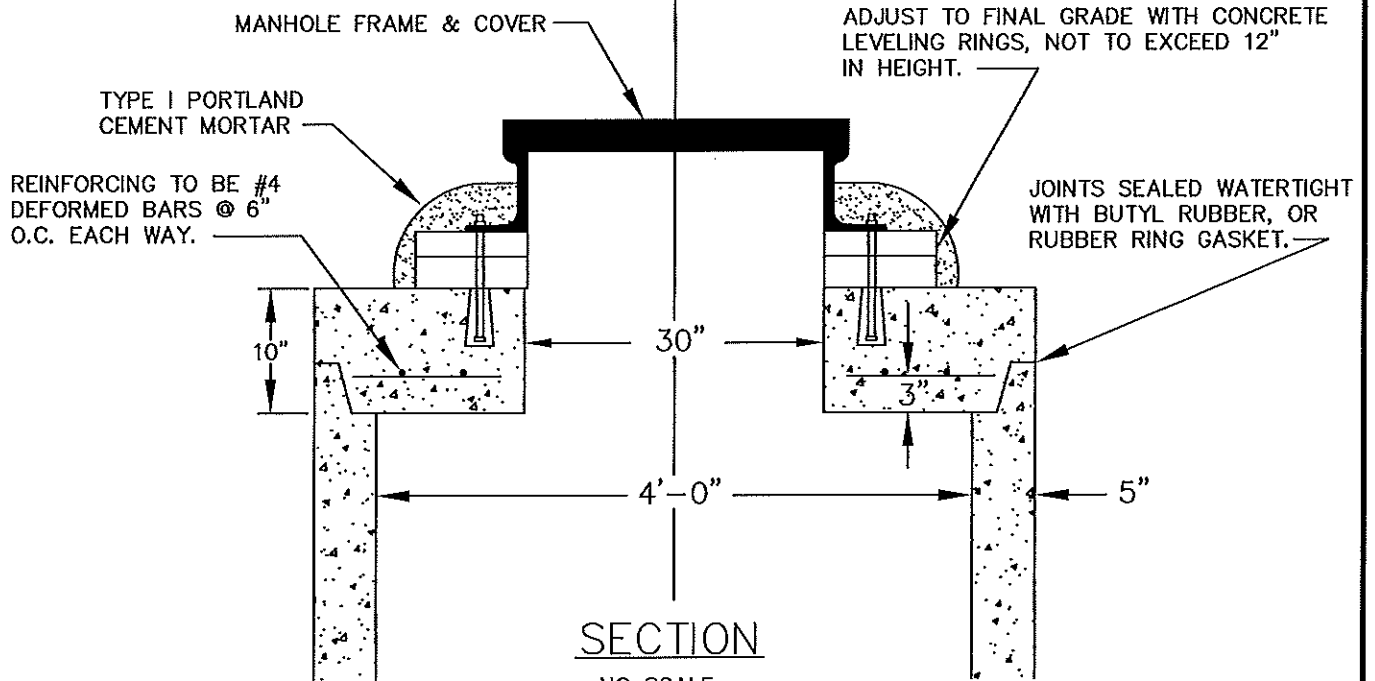
<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julie Reppel</i></p> <p>Director of Environmental Management</p>	<p>TRENCH DETAILS</p> <p>PARALLEL LINES</p>	<p>Detail</p> <p>SW.1-3</p>
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NOTES:

1. MANHOLE FRAME & COVER SHALL BE PLACED AS SHOWN.
2. PRECAST MANHOLE SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 UTILIZING TYPE II PORTLAND CEMENT.
3. MANHOLE FRAME & COVER SHALL BE CAPABLE OF SUPPORTING A H₂O LOADING.



PLAN



SECTION

NO SCALE

REVISÉ
REVISÉ
APPROVED

Washington County, MD Div. of Environmental Management

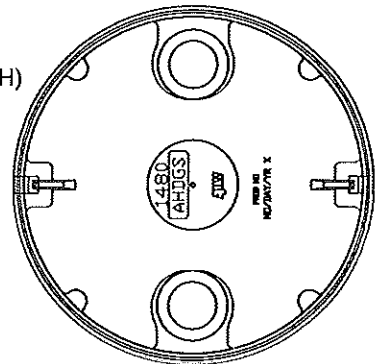
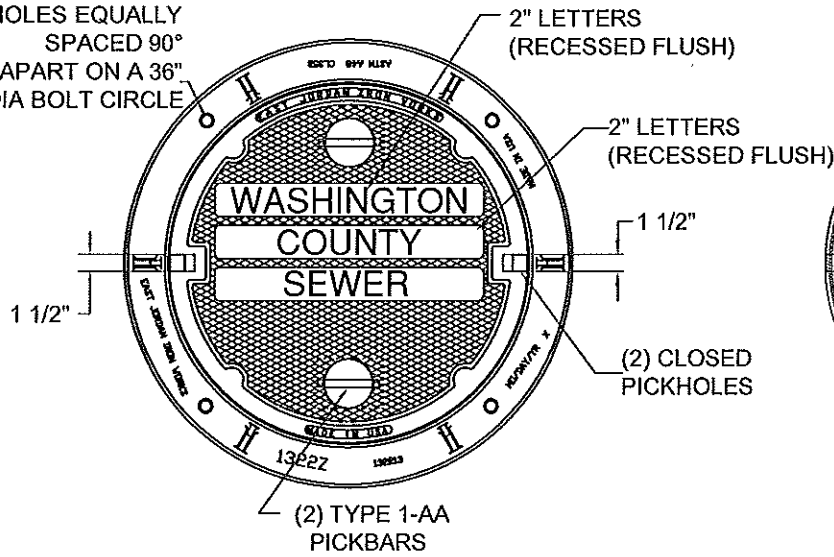
Approved: *Julia A. Pappas*
Director of Environmental Management

Flat Top Manhole Section
Precast Manhole

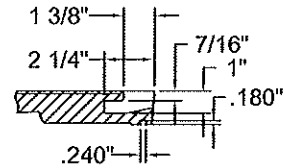
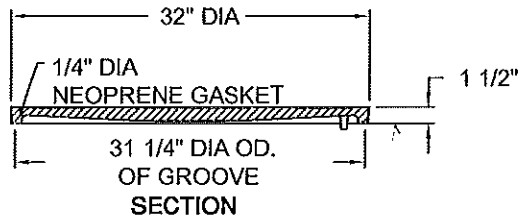
Detail

SW-2.2

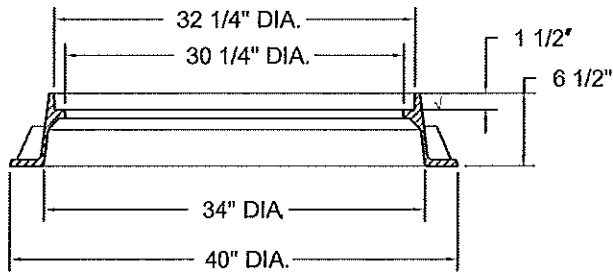
(4) 1" DIA BOLT HOLES EQUALLY SPACED 90° APART ON A 36" DIA BOLT CIRCLE



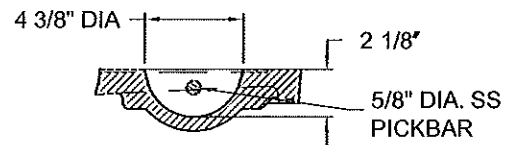
BOTTOM VIEW OF COVER



PICKHOLE & GASKET DETAIL



SECTION



PICKBAR DETAIL

REVISIONS

 REVISION

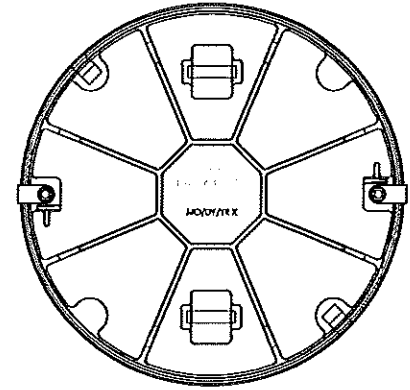
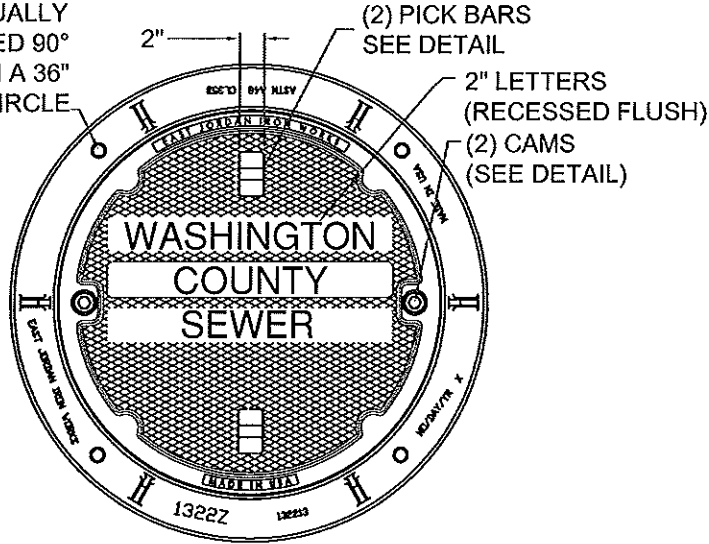
 APPROVED

Washington County, MD Div. of Environmental Management
 Approved: *Julia A. Pappas*
 Director of Environmental Management

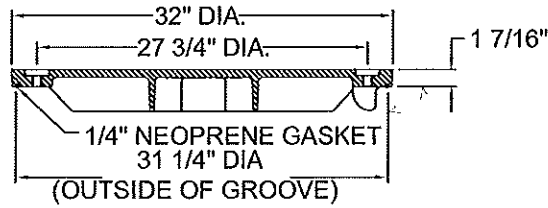
Standard Manhole Frame & Cover

Detail
 SW-2.6

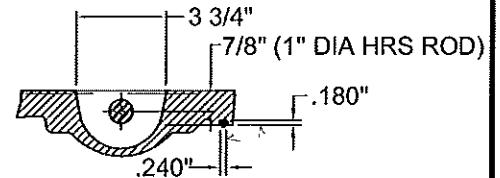
(4) 1" DIA BOLT HOLES EQUALLY SPACED 90° APART ON A 36" DIA BOLT CIRCLE



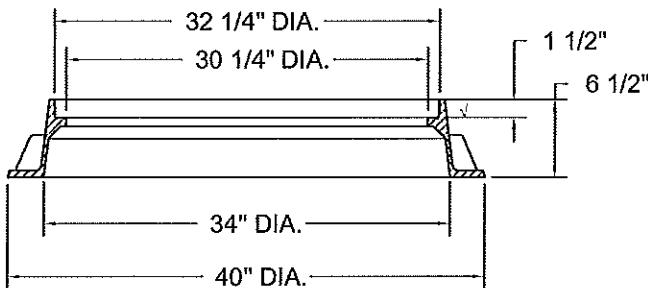
BOTTOM VIEW OF COVER



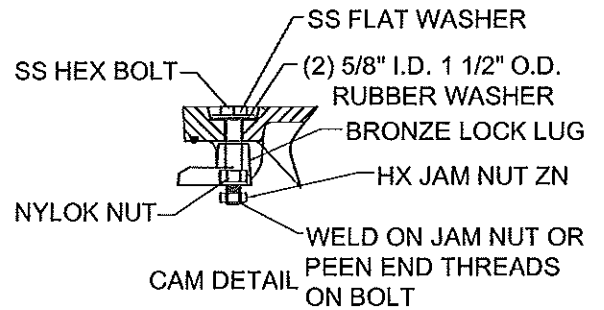
SECTION VIEW



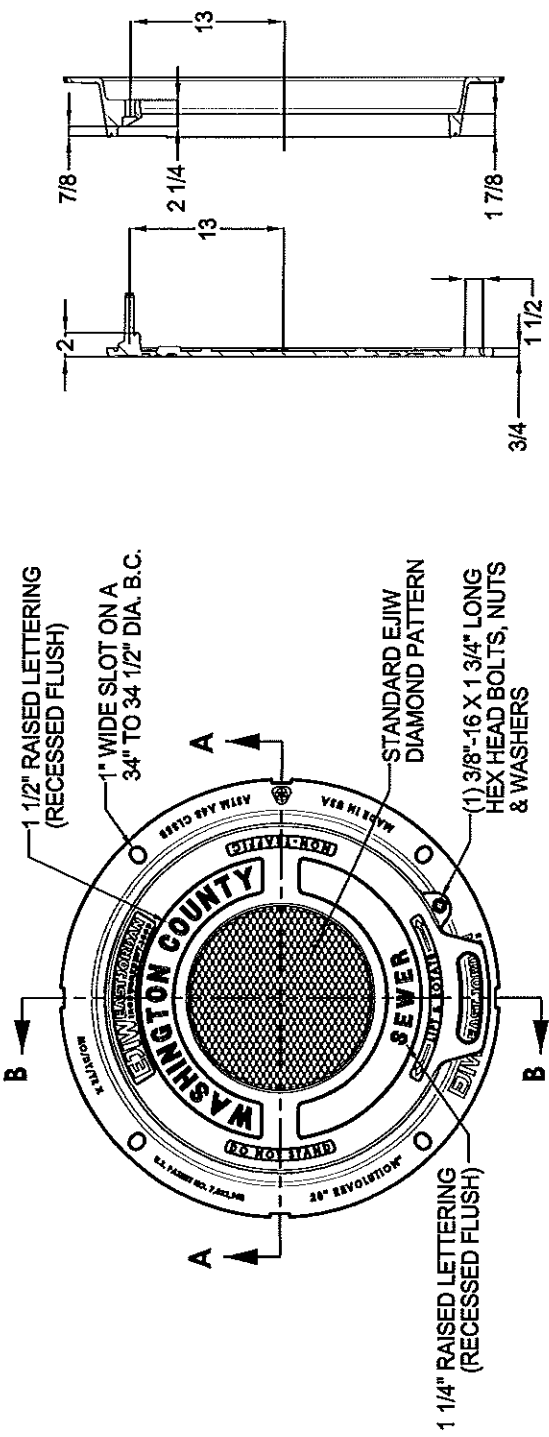
PICKBAR & GASKET GROOVE DETAIL



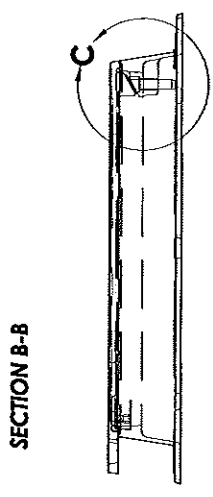
SECTION



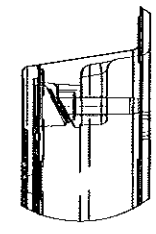
REVISIONS _____ REVISOR _____ APPROVED _____	Washington County, MD Div. of Environmental Management Approved: <i>Julio A. Lopez</i> Director of Environmental Management	Standard Water Tight Manhole Frame & Cover	Detail SW-2.7
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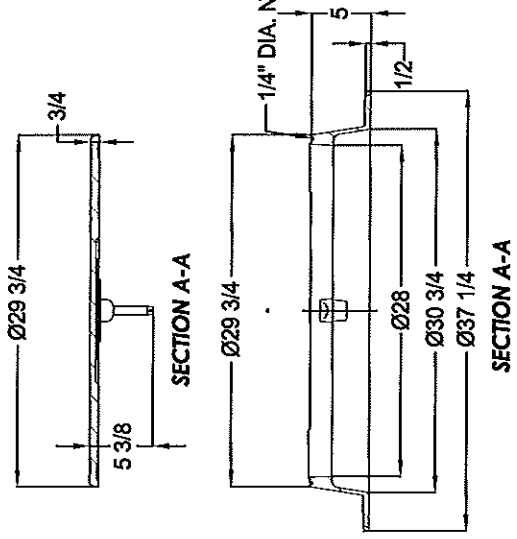
SECTION B-B
SCALE 1 : 15



SECTION B-B



VIEW C



SECTION A-A

SECTION A-A

Washington County, MD Div. of
Environmental Management

Approved: *Judith A. Piper*
Director of Environmental Management

Detail

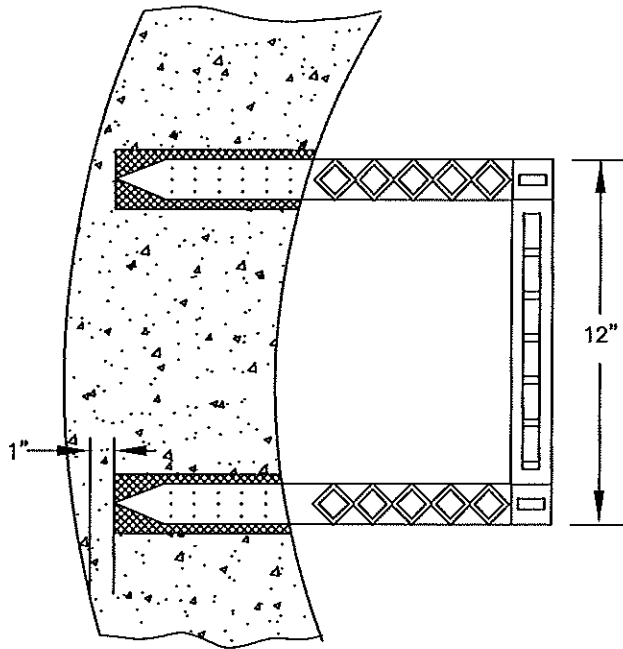
SW-2.8

Non-Traffic Bearing Manhole
Frame & Cover

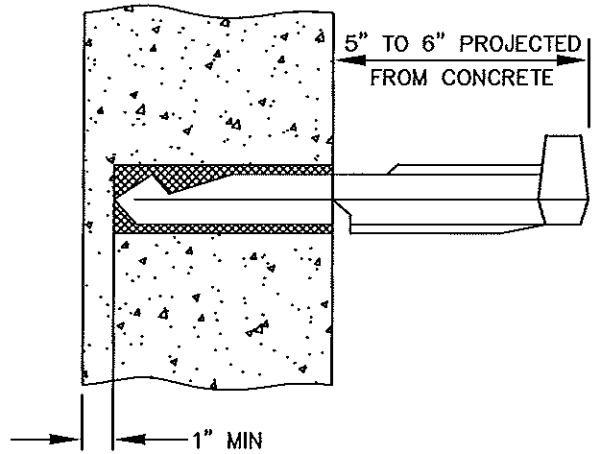
REVISED
REVISED
APPROVED

NOTES:

1. STEPS SHALL BE INSTALLED AS PER MANUFACTURER'S REQUIREMENTS BY MANHOLE MANUFACTURER.
2. WHEN STEPS ARE TO BE INSTALLED ON SITE, MANHOLE SECTIONS SHALL HAVE APPROVED INSERTS PROVIDED AND INSTALLED AS PER INSERT MANUFACTURER'S SPECIFICATIONS.
3. MANHOLES TO BE LINED WITH HDPE LINER, SHALL NOT HAVE STEPS INSTALLED.

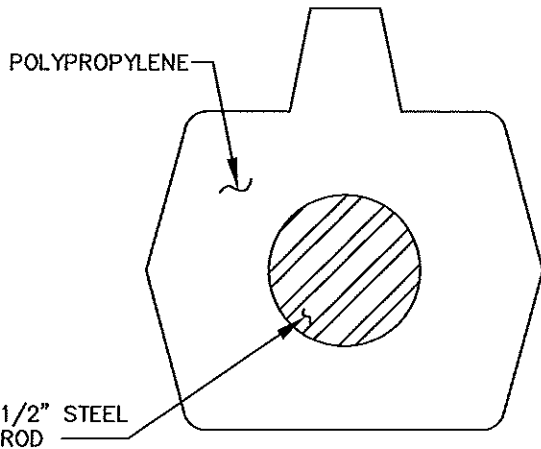


PLAN

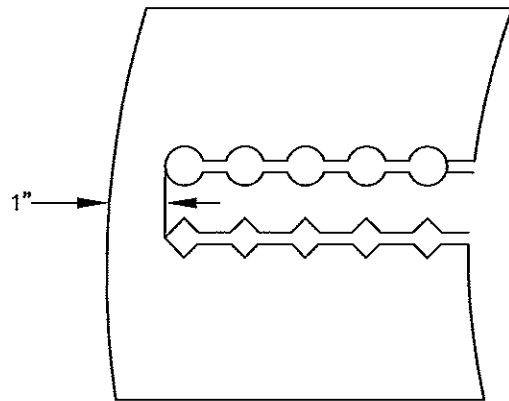


PROFILE

COATED STEP



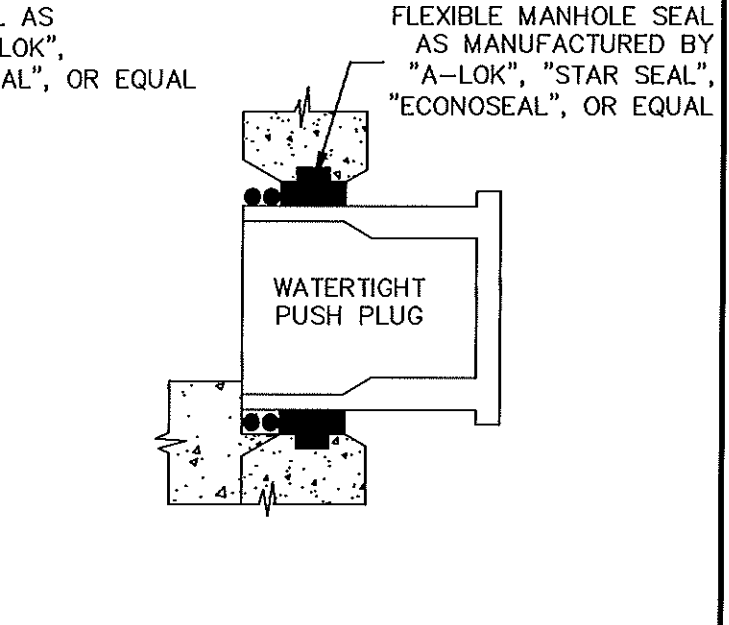
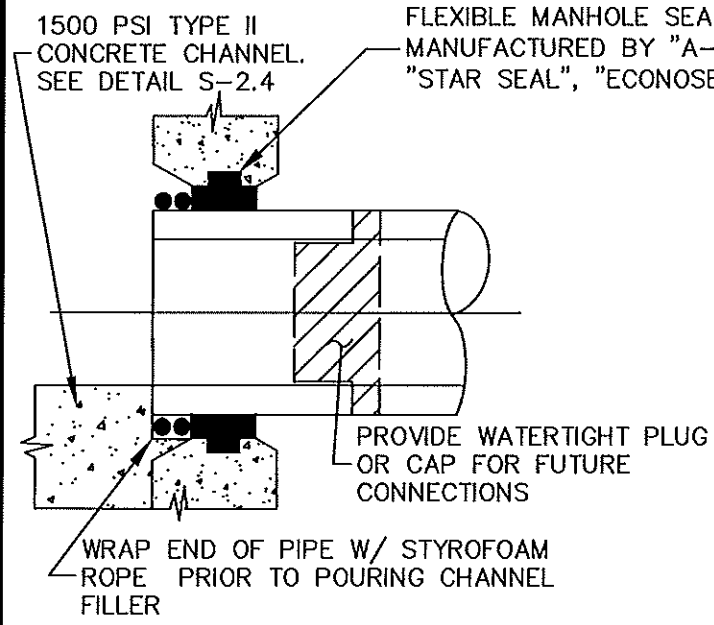
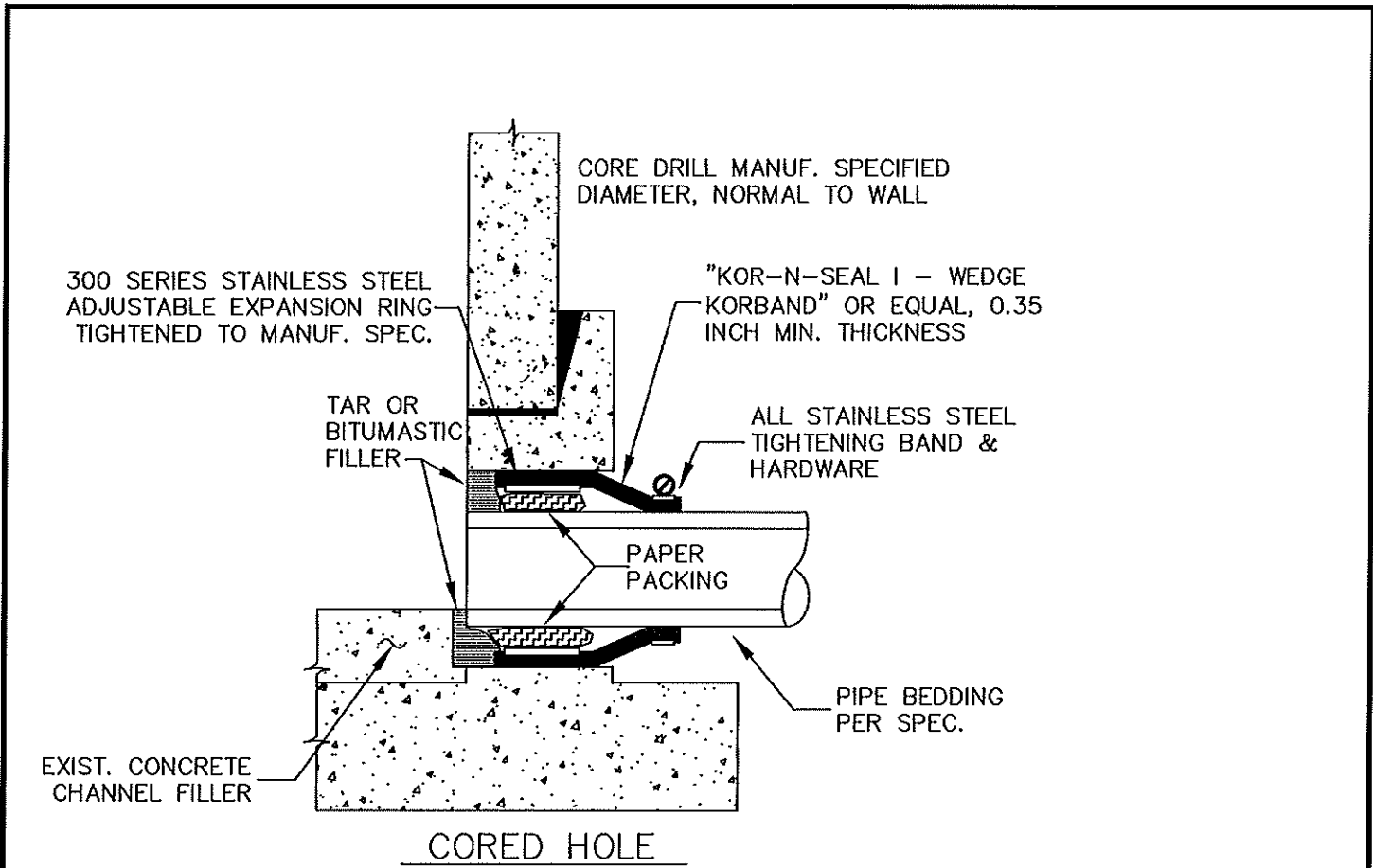
SECTION



INSERT

NO SCALE

<p>REVISÉ</p> <hr/> <p>REVISÉ</p> <hr/> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Poppel</i> Director of Environmental Management</p>	<p>Standard Manhole Steps</p>	<p>Detail</p> <p>SW-2.9</p>
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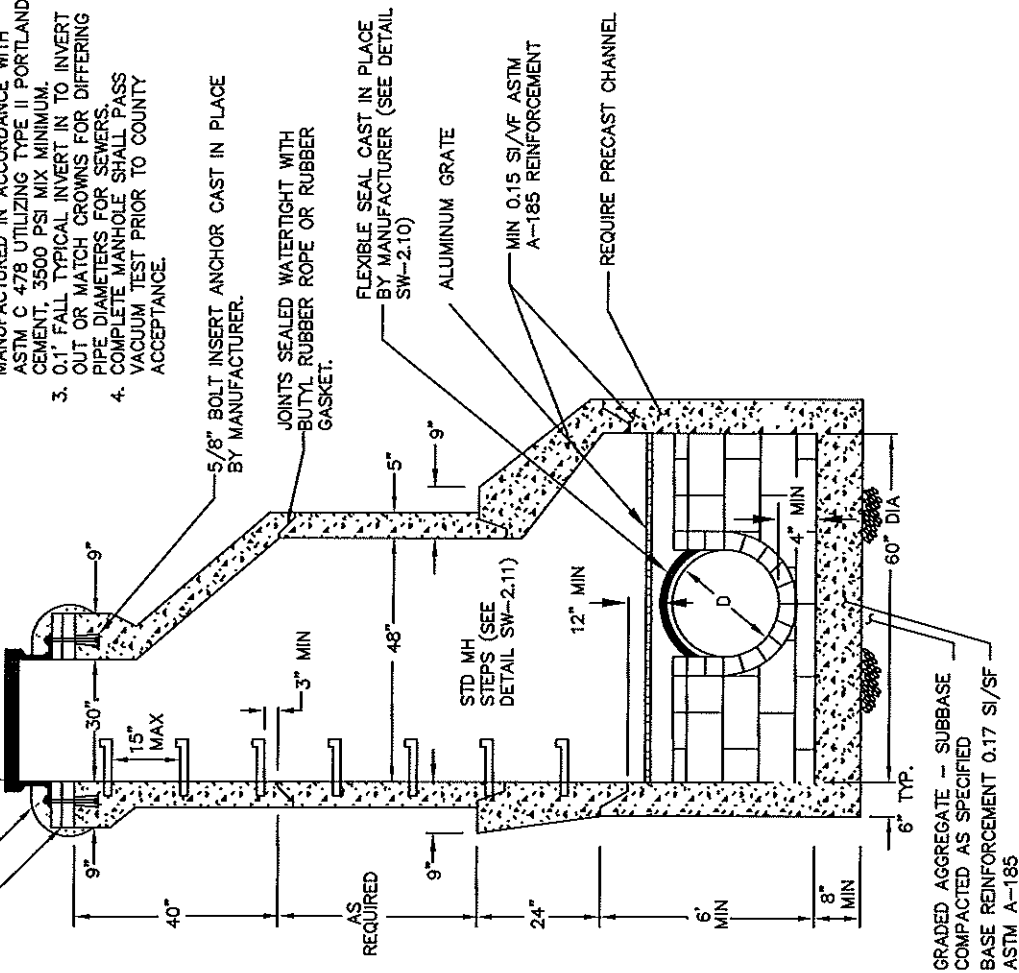


NO SCALE

<p>REVISD</p> <p>REVISD</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Lopez</i> Director of Environmental Management</p>	<p>Manhole Pipe Connections</p>	<p>Detail</p> <p>SW-2.10</p>
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- NOTES:
1. SEWER BRICK CHANNEL DOES NOT APPLY TO WATER FACILITY MANHOLE.
 2. PRECAST MANHOLE SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478 UTILIZING TYPE II PORTLAND CEMENT, 3500 PSI MIX MINIMUM.
 3. 0.1" FALL TYPICAL INVERT IN TO INVERT OUT OR MATCH CROWNS FOR DIFFERING PIPE DIAMETERS FOR SEWERS.
 4. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.

ADJUST TO FINAL GRADE WITH CONCRETE LEVELING RINGS, NOT TO EXCEED 12" UTILIZING ONLY PORTLAND TYPE II CEMENT MORTAR. CHARGE WITH PORTLAND CEMENT MORTAR MANHOLE FRAME & COVER



NO SCALE

60" INSIDE DIA. MANHOLE - GRATING NOTES:
 CONTRACTOR SHALL PROVIDE ALUMINUM GRATING ON ALL 60" INSIDE DIA. MANHOLES. GRATING SHALL BE INSTALLED WITH TOP OF PLATFORM 8" ABOVE TOP OF PIPE. GRATING SHALL BE MINIMUM 2" ALUMINUM PLANK WITH RECTANGULAR, CIRCULAR OR DIAMOND PUNCH. ENDS SHALL BE Banded WITH MINIMUM 1/8" FLAT BAR. ALLOW CLEARANCE OF 1/4" BETWEEN SIDES AND ENDS OF GRATING PLANKS. GRATING PANELS, SUPPORT STRUCTURE AND ANCHOR BOLTS, ETC., SHALL BE DESIGNED FOR MINIMUM 100 POUNDS PER SQ. FT. UNIFORM LOADING. GRATING SHALL BE FABRICATED IN PANELS THAT ARE REMOVABLE AND ABLE TO PASS THROUGH MANHOLE FRAME OPENING. PANELS SHALL COVER ENTIRE 60" DIA. AREA OF MANHOLE. AT LEAST ONE PANEL OVER THE MAIN FLOW CHANNEL SHALL HAVE A FOLDING/HINGED OR DROP DOWN HANDLE FOR LIFTING AND REMOVAL OF PANEL. SUPPORT STRUCTURE SHALL BE FABRICATED OF ALUMINUM OR STEEL. ALL STEEL SHALL RECEIVE ONE COAT OF PRIMER AND ONE COAT OF BLACK BITUMINOUS PAINT TO PROTECT AGAINST CORROSION. ANCHOR BOLTS SHALL BE STAINLESS STEEL. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS BEARING THE APPROVAL AND SEAL OF AN ENGINEER LICENSED TO PERFORM ENGINEERING WORK IN THE STATE OF MARYLAND, FOR REVIEW AND ACCEPTANCE BY THE OWNER.

Washington County, MD Div. of Environmental Management

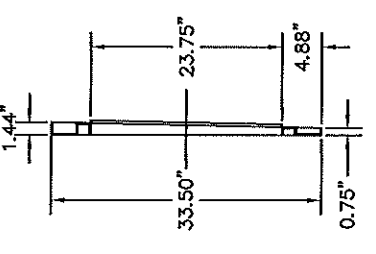
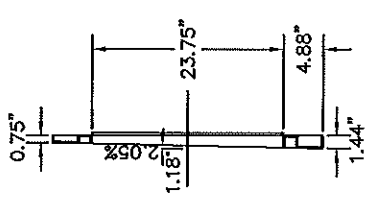
Approved: *Julia A. Boyd*
 Director of Environmental Management

REVIS
 REVIS
 APPROV

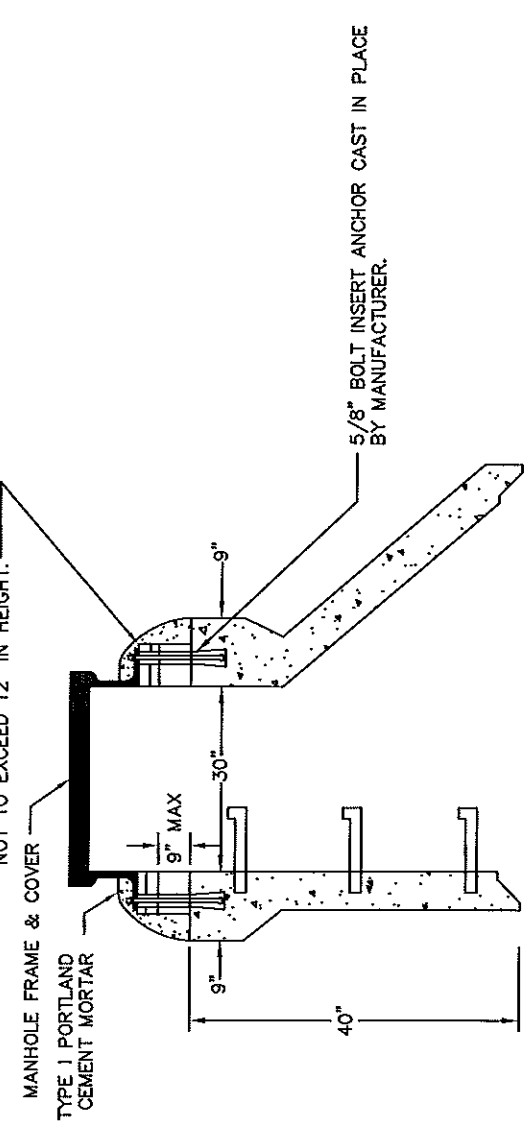
60" Dia. Precast Concrete Manhole

Detail

SW-2.11



ADJUST TO FINAL GRADE WITH CONCRETE LEVELING RINGS OR HDPE ADJUSTABLE GRADE RINGS, NOT TO EXCEED 12" IN HEIGHT.



DESCRIPTION

PLASTIC INJECTION MOLDED ADJUSTMENT RING MOLDED FROM HIGH DENSITY POLYETHYLENE AS DEFINED IN ASTM SPECIFICATION D1248

ACTUAL RESIN PROPERTIES WILL VARY ALLOWING FOR THE UTILIZATION OF A MAXIMUM PERCENT OF RECYCLED MATERIAL

THE PERCENT OF POST CONSUMER WASTE TO INDUSTRIAL WASTE WILL VARY WITH AVAILABILITY AND PROPERTY RETENTION NEEDS

COLOR, SHAPE, AND UNIFORMITY WILL VARY WITH THE MIX OF THE POST CONSUMER AND INDUSTRIAL WASTE MATERIALS

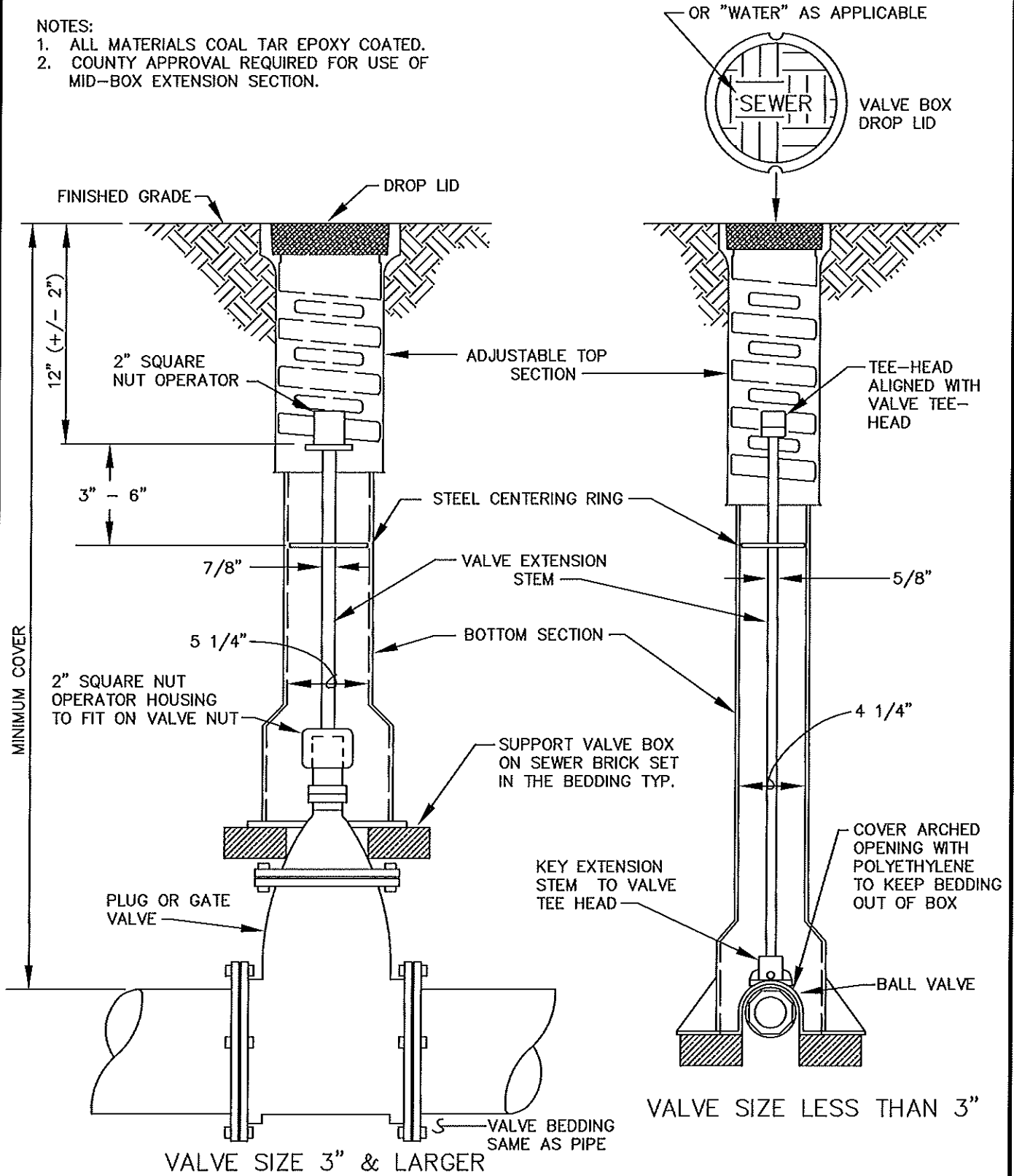
DIMENSIONS SHOWN ARE NOMINAL - ACTUAL SIZE WILL VARY WITHIN ALLOWABLE TOLERANCE AND REQUIRED FIT

NO SCALE

<p>REVISION</p> <p>REVISION</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>David L. Lopez</i> Director of Environmental Management</p>	<p>HDPE Adjustable Grade Ring</p>	<p>Detail</p> <p>SW-2.13</p>
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NOTES:

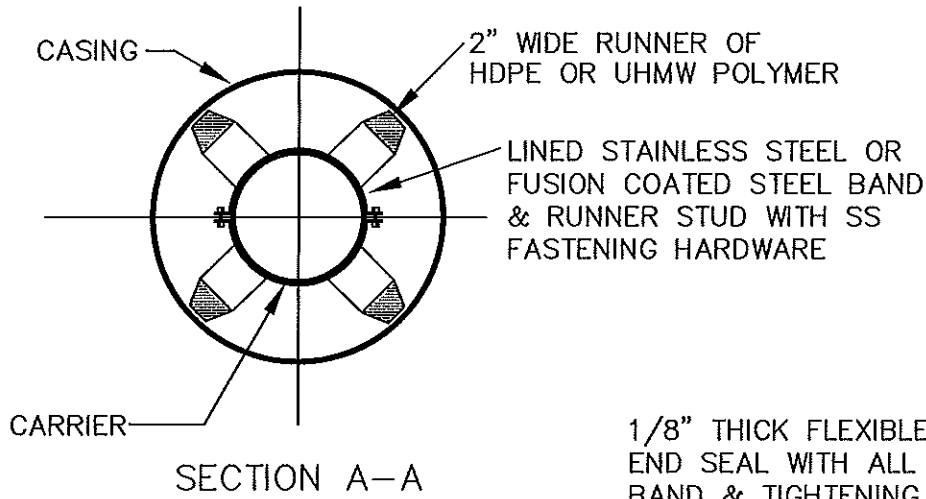
1. ALL MATERIALS COAL TAR EPOXY COATED.
2. COUNTY APPROVAL REQUIRED FOR USE OF MID-BOX EXTENSION SECTION.



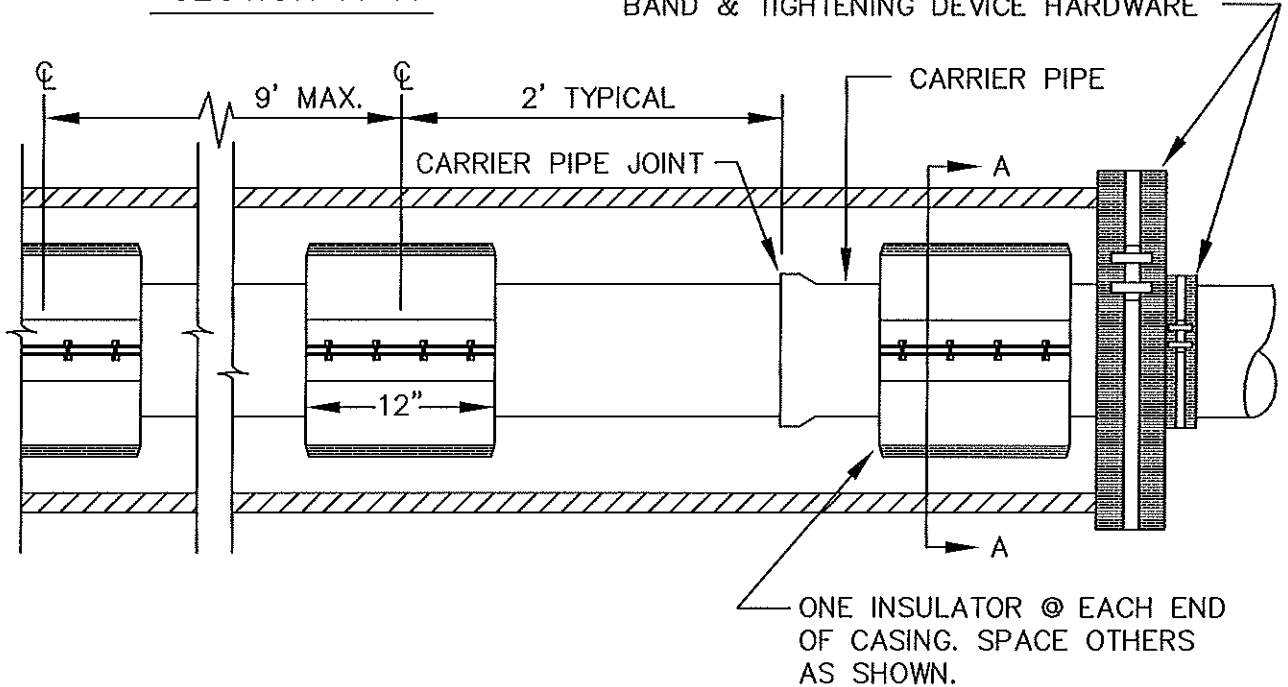
REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julio A. Pappas</i> Director of Environmental Management	<h2>Valve & Box Installation</h2>	Detail <h1>SW-7.1</h1>
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PIPE INSULATOR SHALL CENTER THE CARRIER PIPE & FIT TO RESTRAIN AGAINST MOVEMENT

NOMINAL DIAMETER	
MAIN	CASING
4"	10"
6"	14"
8"	16"
10"	18"
12"	20"
15"/16"	24"
18"	26"



1/8" THICK FLEXIBLE RUBBER CASING END SEAL WITH ALL STAINLESS STEEL BAND & TIGHTENING DEVICE HARDWARE



NOTES:

1. WELD JOINTS SHALL BE CONTINUOUS & WATERTIGHT. PIPE SHALL BE A139 GRADE 36.
2. WALL THICKNESS FOR ALL CASING SIZES SHALL BE STANDARD 0.375 INCH MIN
3. ALL PIPES JOINTS INSIDE CASING PIPE SHALL BE RESTRAINED WITH MECHANICAL RESTRAINTS

NO SCALE

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia B. Pappas</i> Director of Environmental Management	Steel Pipe Encasement For Water & Sewer Mains	Detail SW-9.1
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SECTION I: TO BE COMPLETED BY CONTRACTOR (ATTACH TO EACH COPY OF SUBMITTAL)

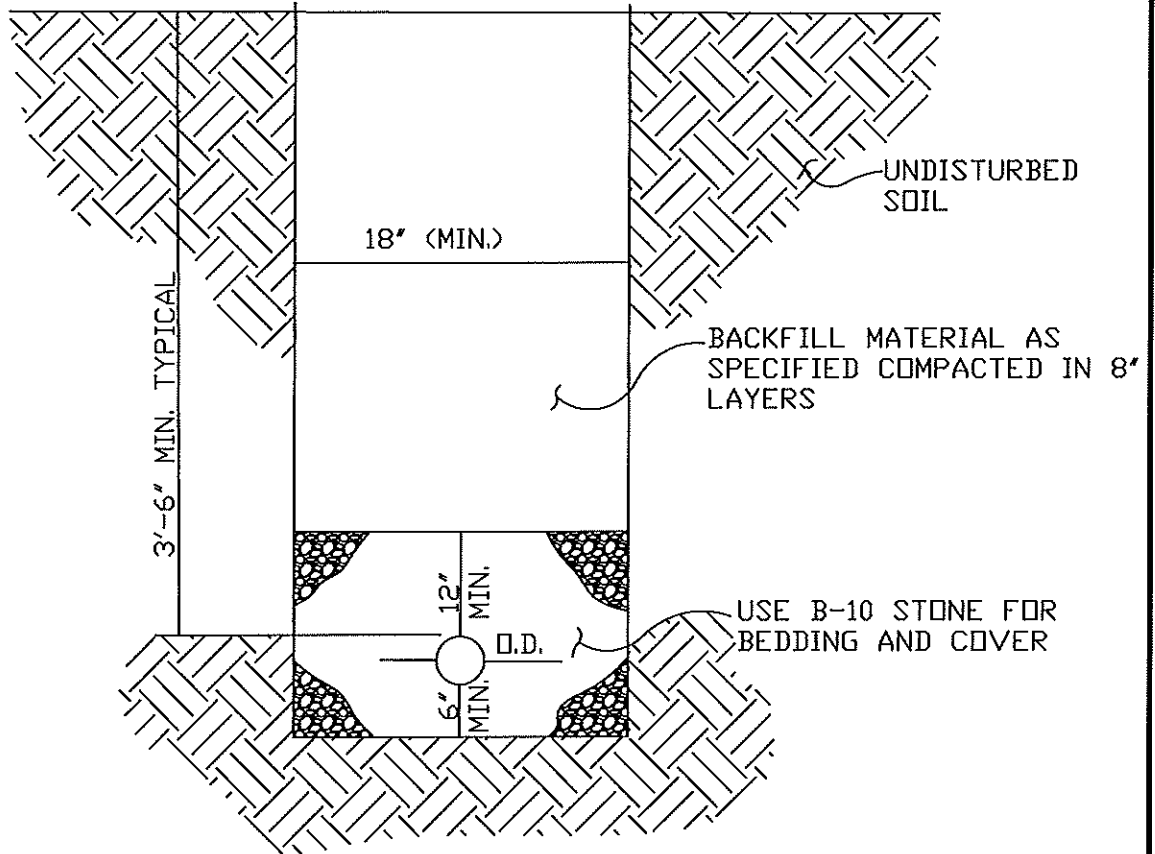
PROJECT: _____ PROJECT NO.: _____
_____ SUBMITTAL NO.: _____
CONTRACTOR: _____ DATE: _____
ADDRESS: _____ SHEET 1 OF _____
_____ CONTACT PERSON: _____ PHONE: () _____
SPECIFICATION REFERENCE: _____
DRAWING(S) REFERENCE: _____
SPECIFIC APPLICATION/USE: _____
_____ PRODUCT NAME: _____
MODEL/TYPE/SERIES: _____ FOR SIZE(S): _____
MODEL/TYPE/SERIES: _____ FOR SIZE(S): _____
MANUF.: _____ SUPPLIER: _____
PHONE: () _____ PHONE: () _____

SECTION II: TO BE COMPLETED BY WASHINGTON COUNTY WATER QUALITY DEPARTMENT

COMMENTS: _____

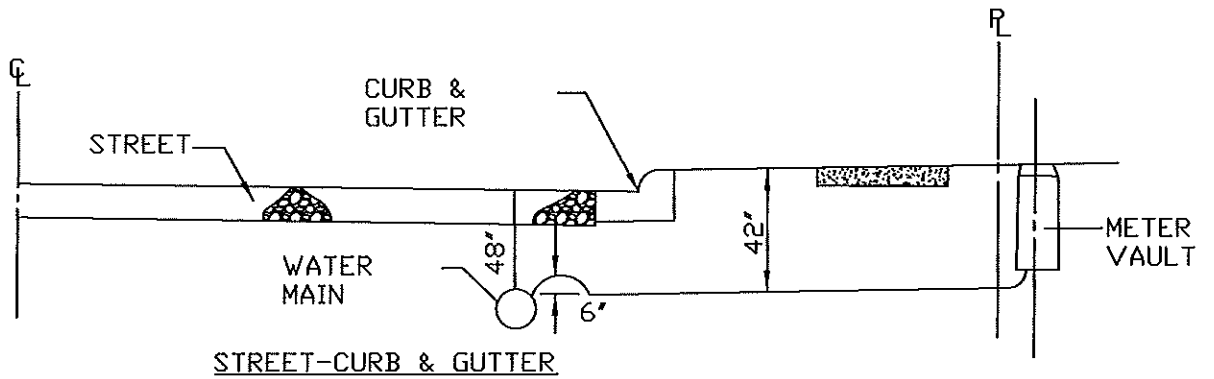
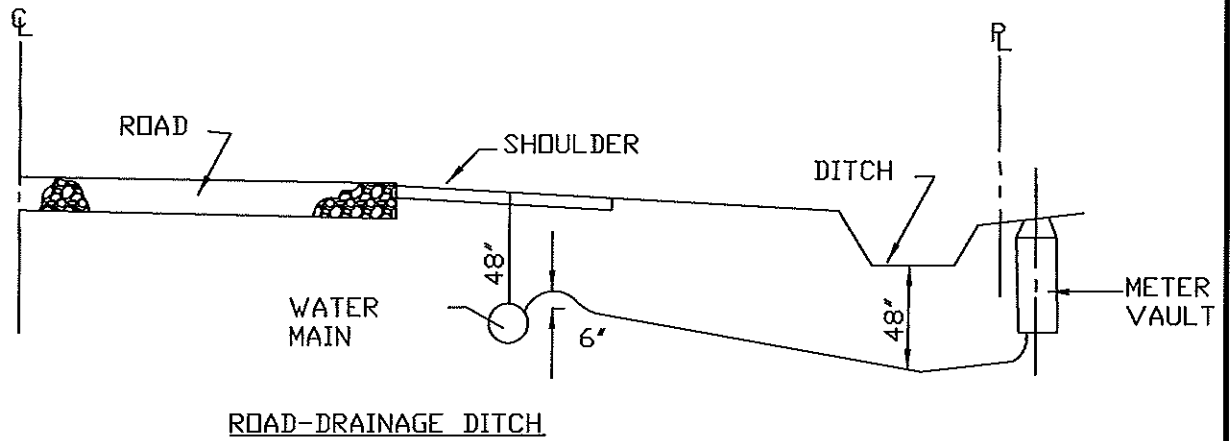
_____	APPROVED
_____	APPROVED AS NOTED
_____	REVISE & RESUBMIT
_____	NOT AS SPECIFIED
BY: _____	DATE: _____

REVISOR	Washington County, MD Div. of Environmental Management	Shop Drawing Cover Sheet	Detail	
REVISOR	Approved: <i>Julia A. Pappas</i>			SW-12.1
APPROVED	Director of Environmental Management			



1. TRENCH WALLS SHALL BE VERTICAL 18" ABOVE TOP OF PIPE.
2. ALL BACKFILL IN STABILIZED AREAS COMPACTED TO 95% MAX. DENSITY PER A4SHTD T-180 METHOD D.

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management <i>Julia Lippie</i> Approved: _____ Director of Environmental Management	SERVICE CONNECTION TYPICAL TRENCH DETAIL	Detail W-10.1
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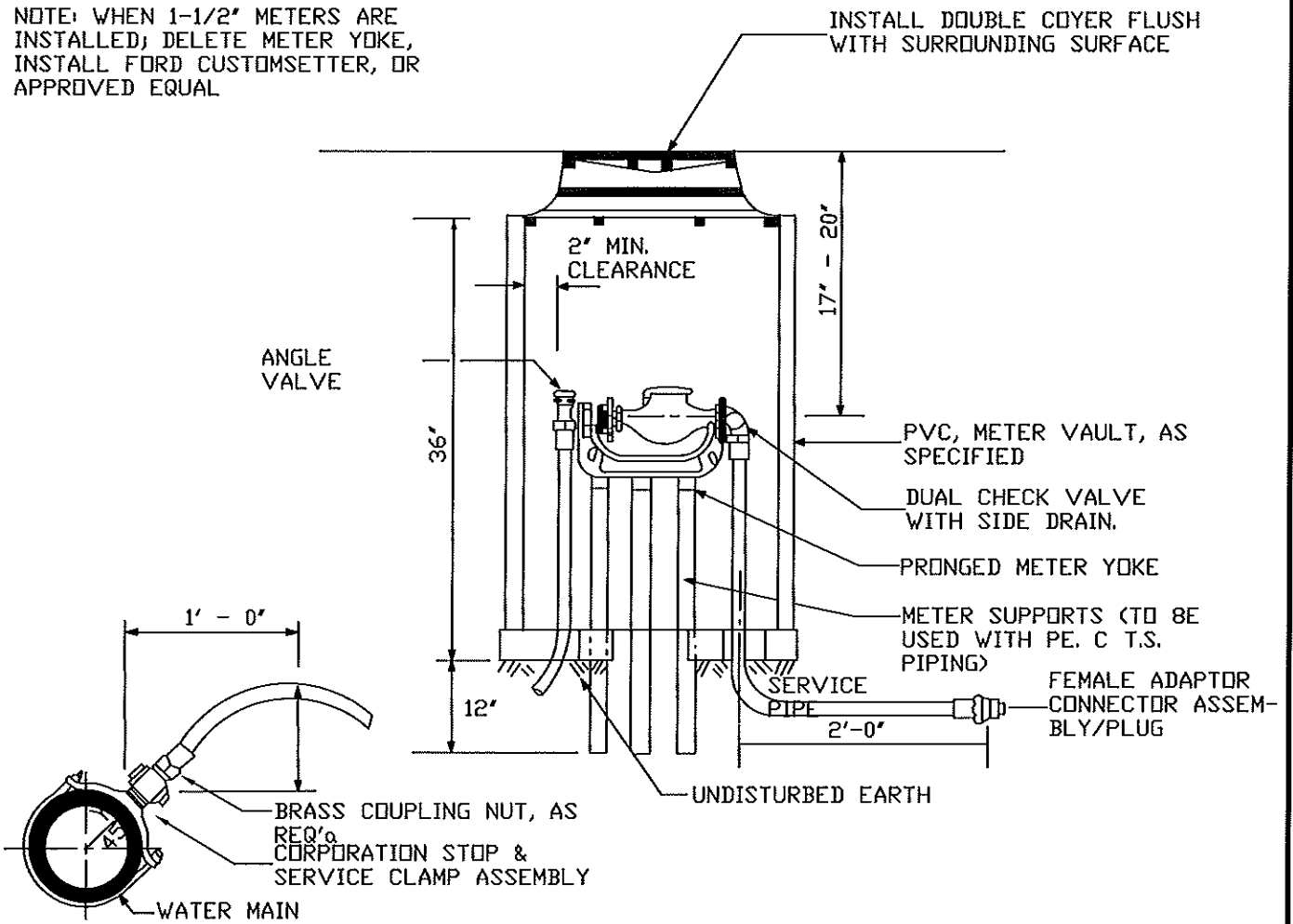


NOTES:

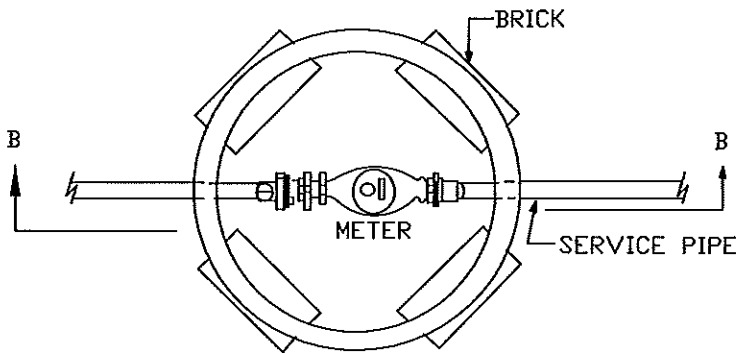
1. METER VAULTS SHALL BE PLACED AT OR NEAR THE PROPERTY LINE
2. METER VAULTS SHALL IN NO CASE BE PLACED IN A STEEP SLOPE, EXPOSING THE FRONT OF THE METER VAULT, NOR SHALL THEY BE INSTALLED IN STEEP SLOPES AT A SHARP ANGLE.
3. CORPORATION STOP TO BE LEFT ON, ANGLE VALVE OFF.

REVISÉD	Washington County, MD Div. of Environmental Management	WATER METER LOCATION	Detail
REVISÉD	Approved: <i>Julia A. Peppé</i>		W-10.2
APPROVED	Director of Environmental Management		

NOTE: WHEN 1-1/2" METERS ARE INSTALLED; DELETE METER YOKE, INSTALL FORD CUSTOMSETTER, OR APPROVED EQUAL



SECTION B - B

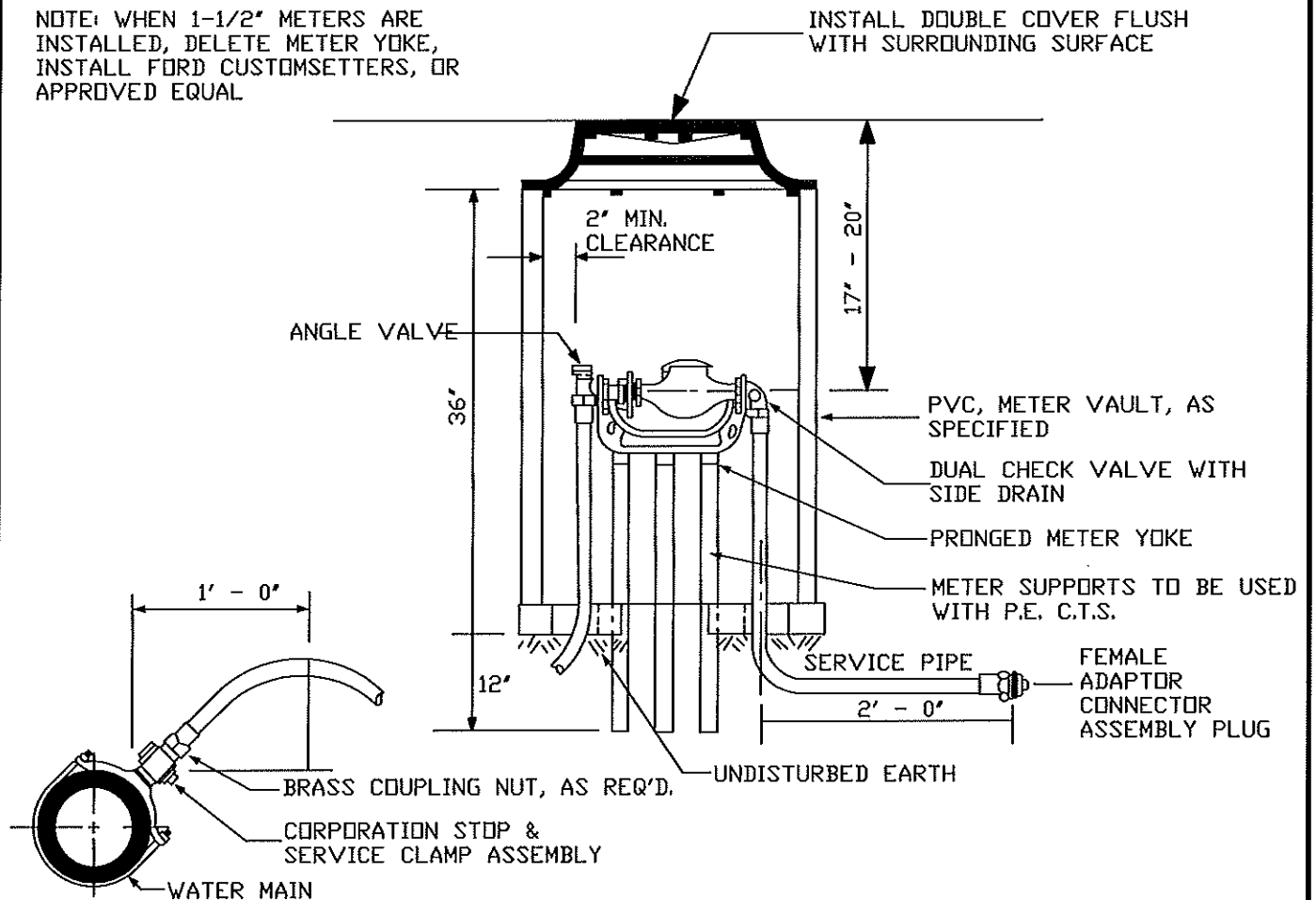


PLAN

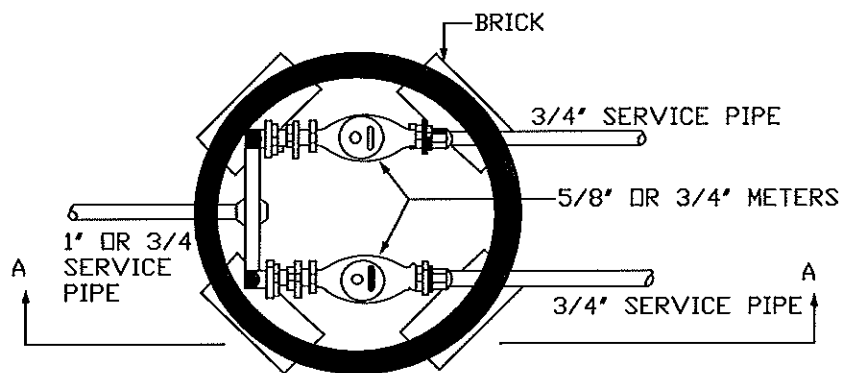
SERVICE PIPE DIAMETER	METER SIZE	VAULT SIZE
3/4"	5/8"	24"
1"	3/4"	24"
1 1/4"	1"	36"
2"	1 1/2"	36"

REVISIONS _____ REVISD _____ APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Peppie</i> Director of Environmental Management	METERED DOMESTIC SERVICE INSTALLATION	Detail W-10.3
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NOTE: WHEN 1-1/2" METERS ARE INSTALLED, DELETE METER YOKE, INSTALL FORD CUSTOMSETTERS, OR APPROVED EQUAL



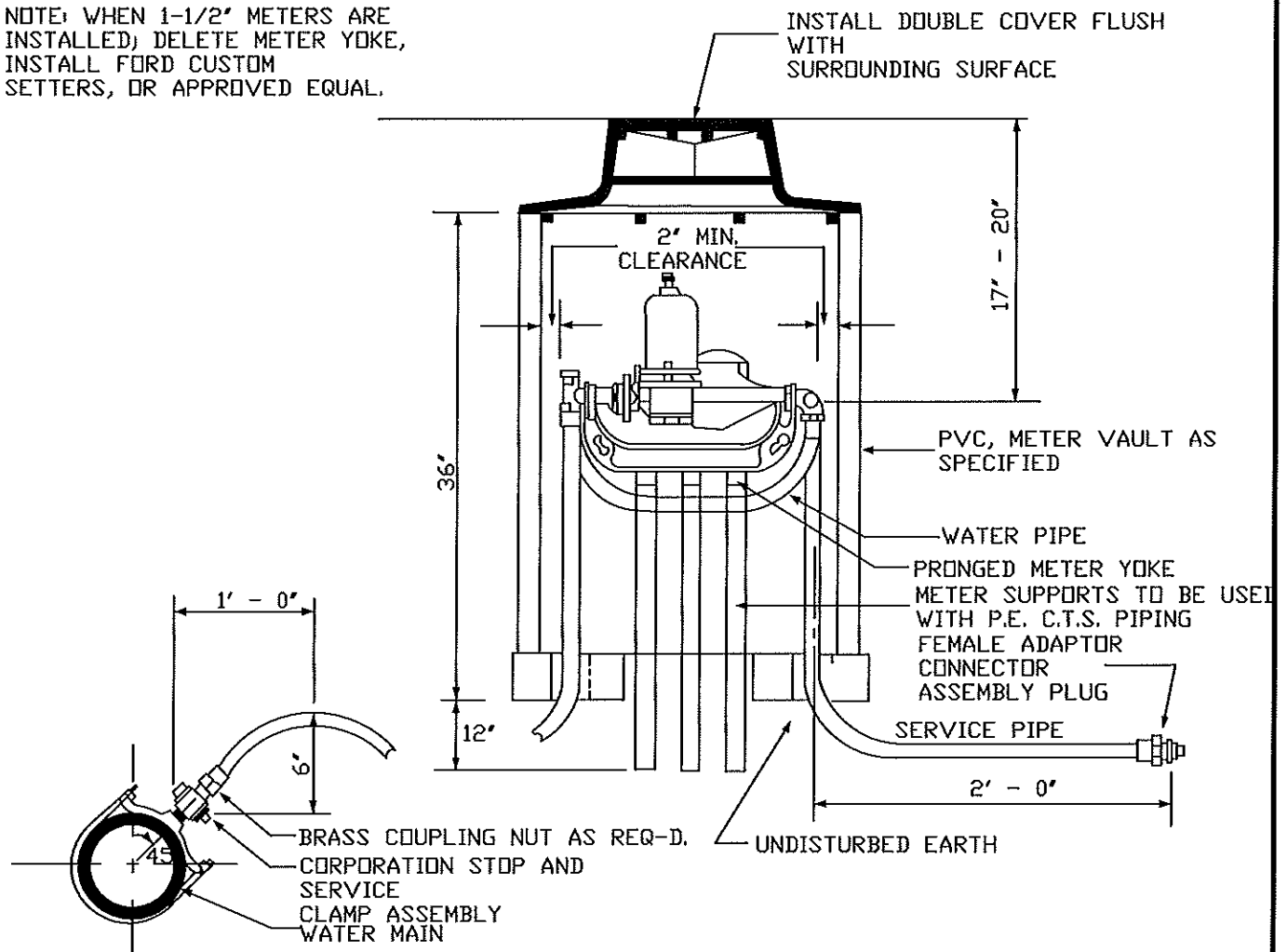
SECTION A-A



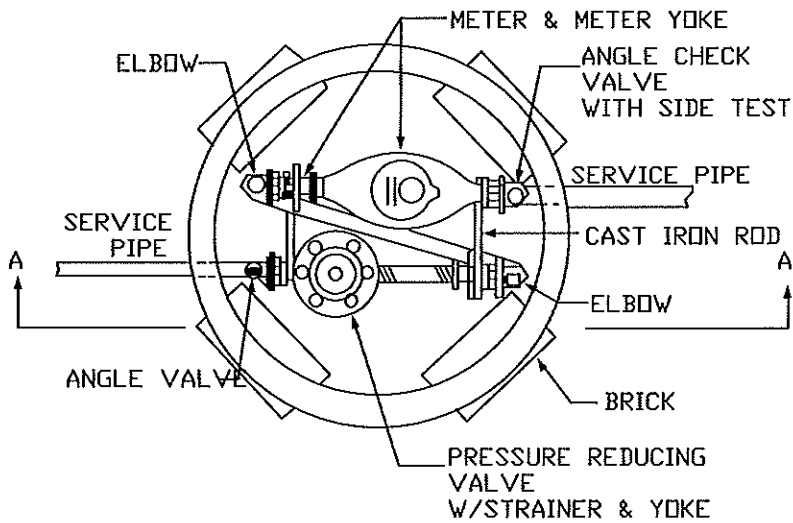
NOTE: MINIMUM VAULT SIZE SHALL BE 36"

<p>REVISID</p> <p>REVISID</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia A. Pippel</i></p> <p>Director of Environmental Management</p>	<p>METERED DOMESTIC SERVICE TWIN SETTING</p>	<p>Detail</p> <p>W-10.4</p>
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NOTE: WHEN 1-1/2" METERS ARE INSTALLED; DELETE METER YOKE, INSTALL FORD CUSTOM SETTERS, OR APPROVED EQUAL.



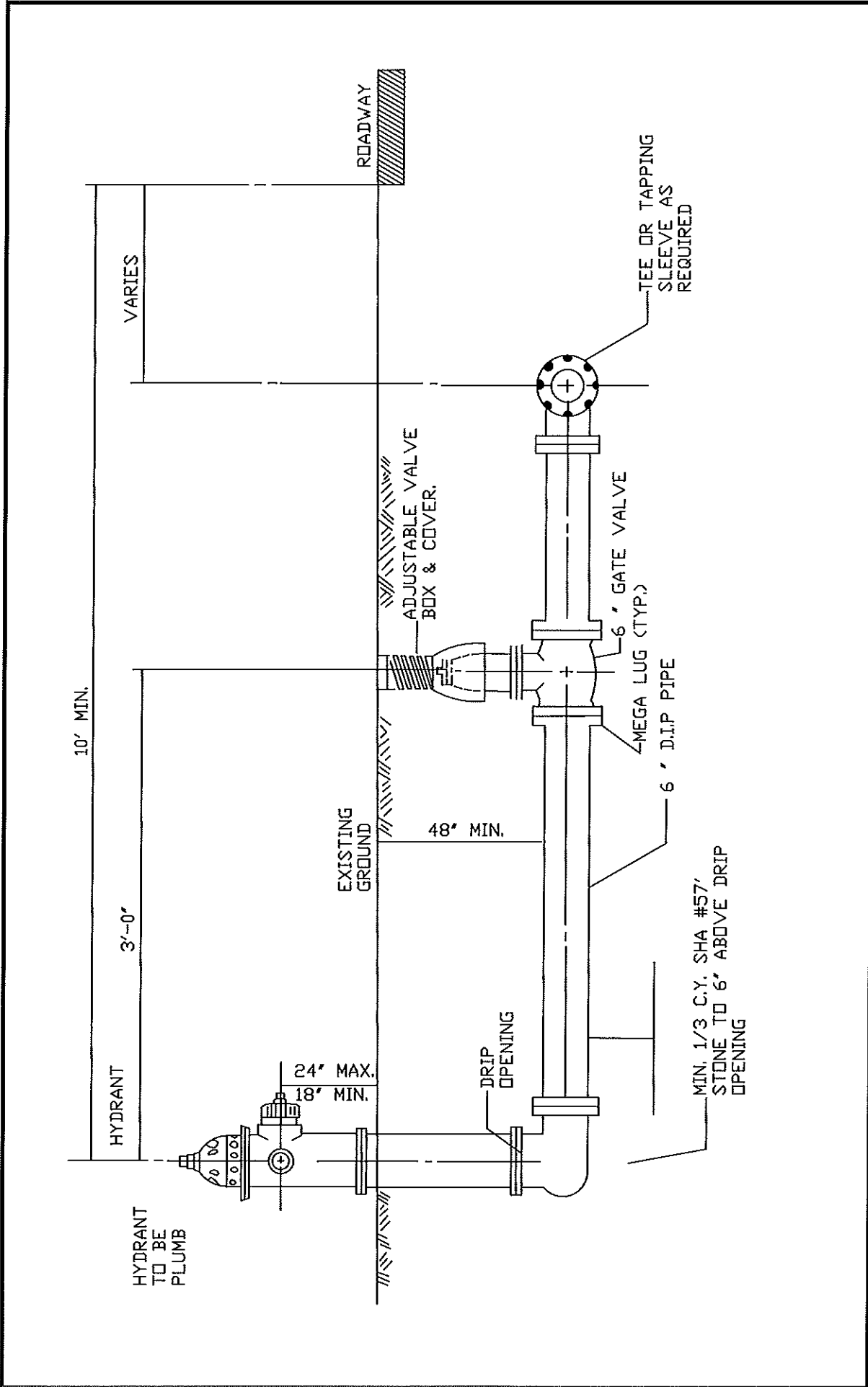
SECTION A-A



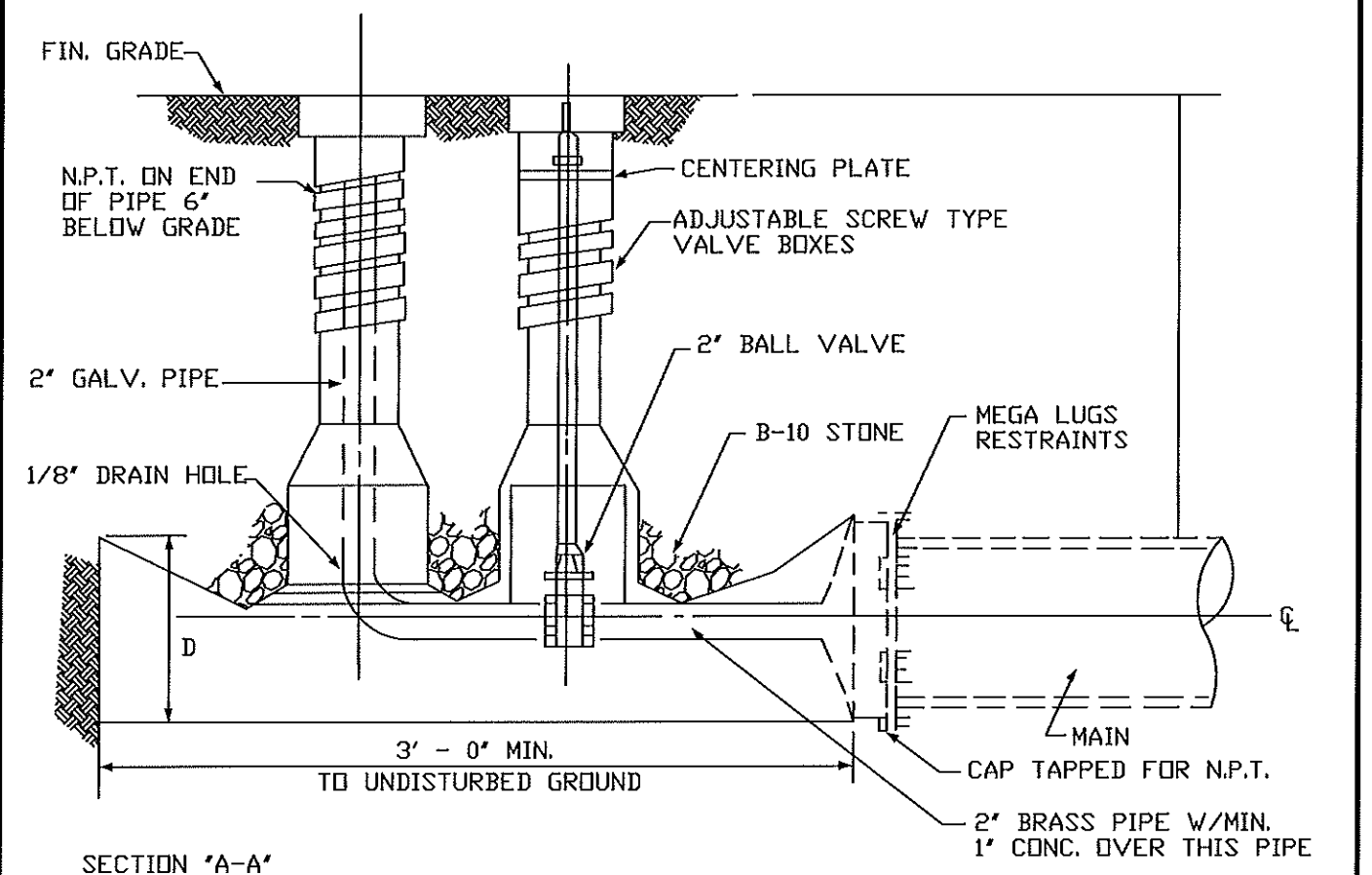
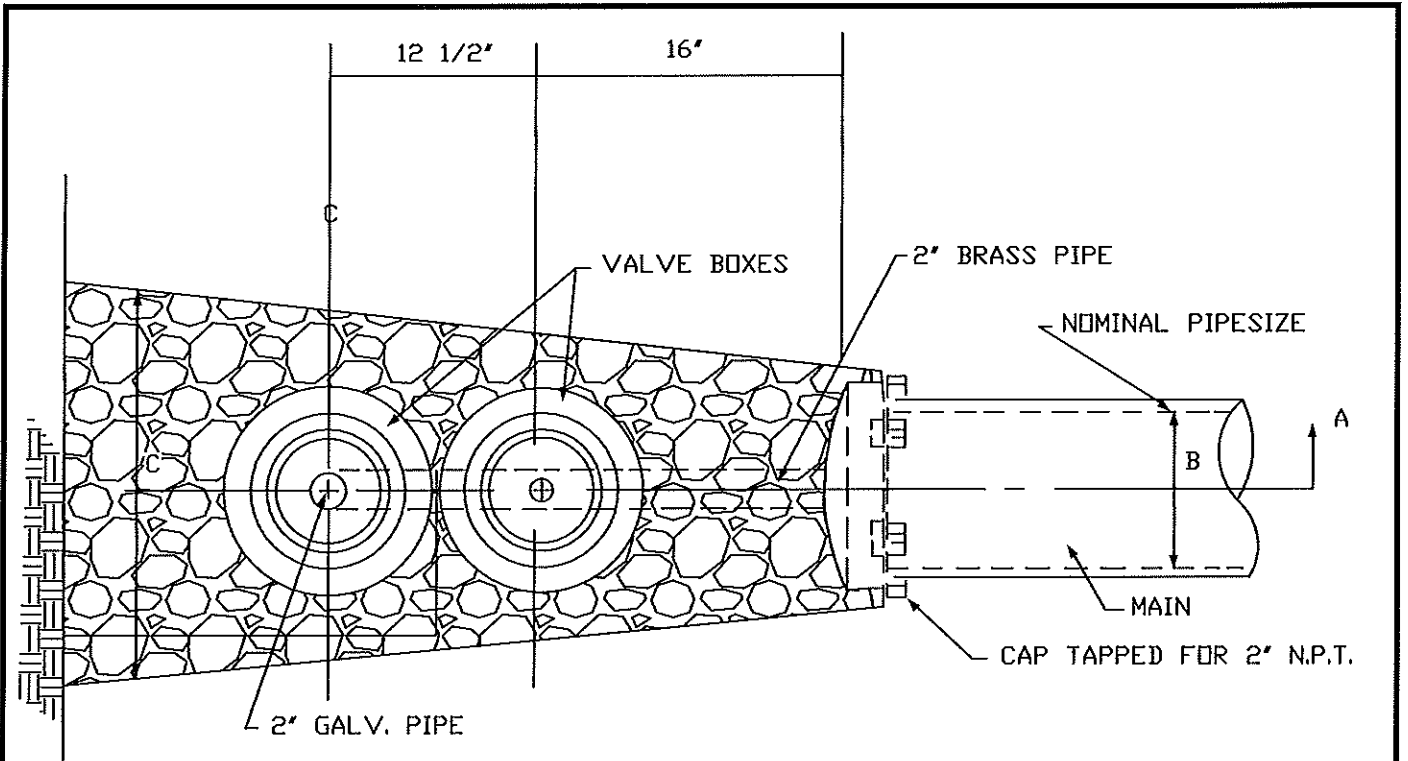
PLAN

SERVICE PIPE DIAMETER	METER SIZE	PRV SIZE	VAULT SIZE
3/4"	5/8"	3/4"	24"
1"	3/4"	1"	24"
1 1/4"	1"	1 1/4"	36"
2"	1 1/2"	1 1/2"	36"

REVISIONS _____ REVISOR _____ APPROVED _____	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Ruppel</i> Director of Environmental Management	METERED DOMESTIC SERVICE WITH PRESSURE REDUCING VALVE	Detail W-10.5
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W-10.6 Detail	TYPICAL HYDRANT SETTING	Washington County, MD Div. of Environmental Management Approved: <i>Julio P. Pappalardo</i> Director of Environmental Management
_____ REVISED _____ REVISED _____ APPROVED		

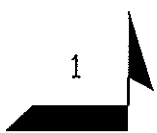
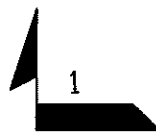


REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia A. Peppie</i> Director of Environmental Management	2" BLOW OFF ASSEMBLY	Detail W-10.7
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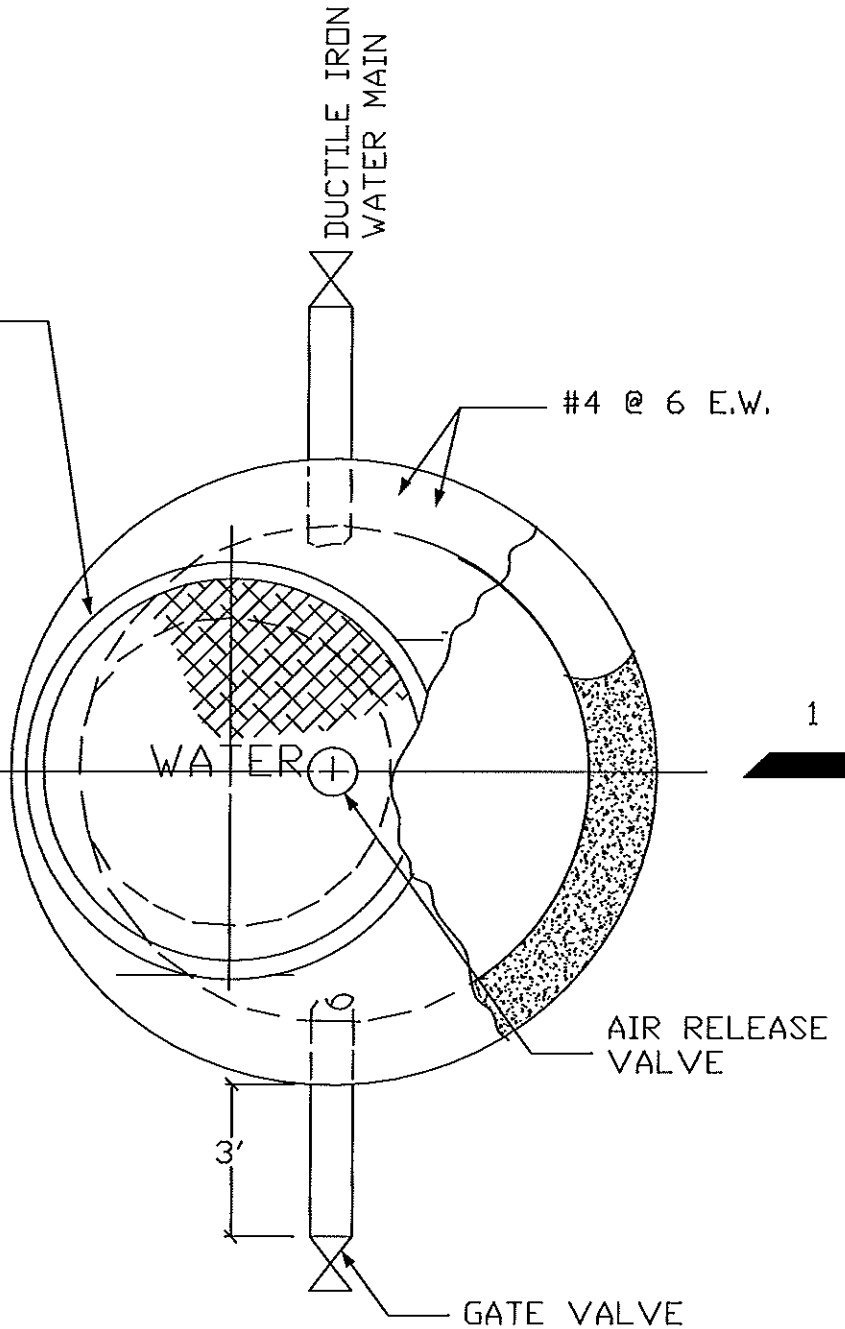
30" STD. MANHOLE FRAME
& COVER - SEE DETAILS
S-2.6

DUCTILE IRON
WATER MAIN

#4 @ 6 E.W.

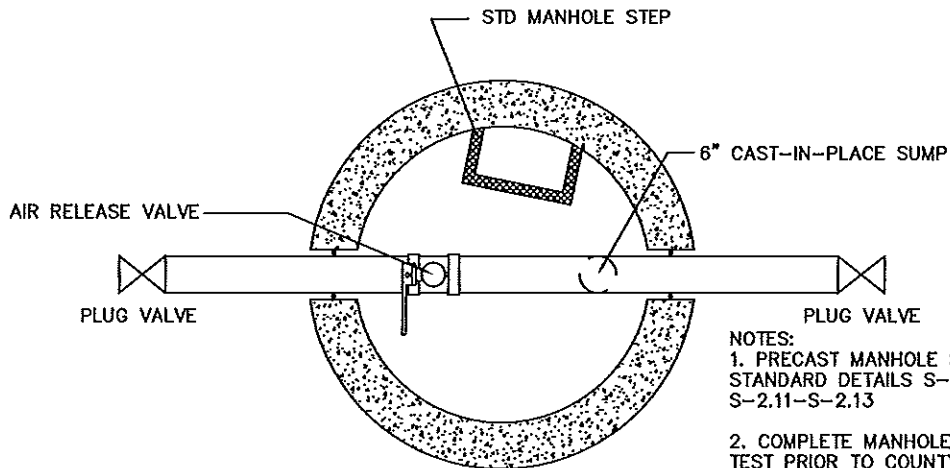


SEE SHEET W-10.9 FOR
SECTION 1-1



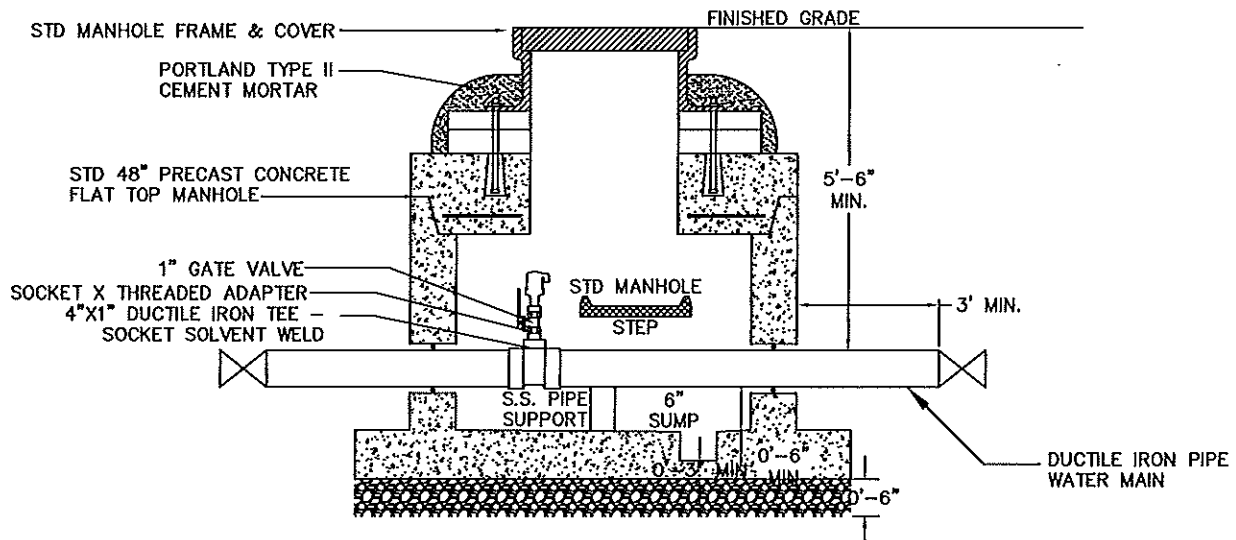
PLAN

REVISIONS	Washington County, MD Div. of Environmental Management	AIR RELEASE AND VACUUM VALVE PIT PLAN	Detail W-10.8
REVIS	Approved: <i>Julie A. Ruppel</i>		
APPROVED	Director of Environmental Management		



PLAN
NO SCALE

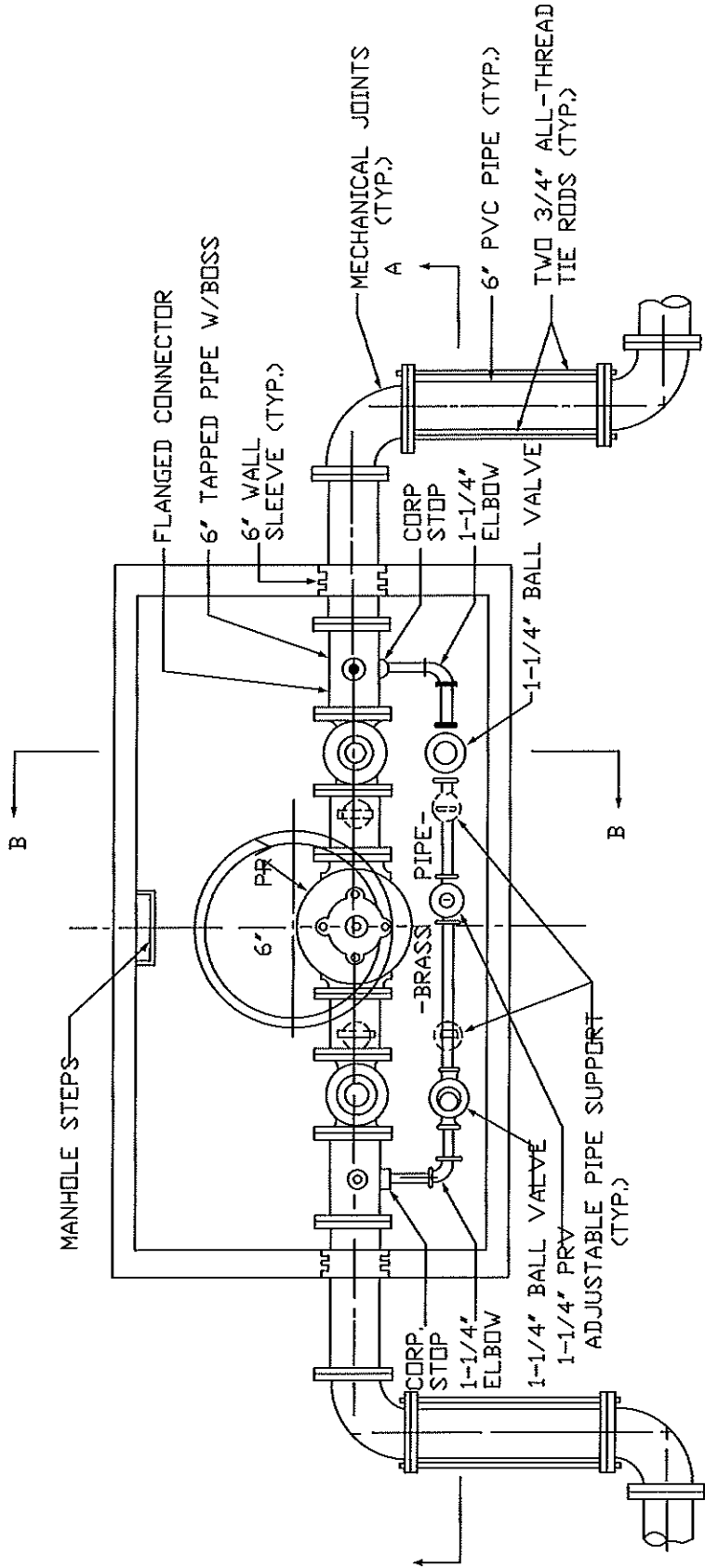
- NOTES:
1. PRECAST MANHOLE SHALL COMPLY WITH STANDARD DETAILS S-2.1-S-2.4, S-2.11-S-2.13
 2. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
 3. VALVES SHALL BE ORIENTED AS SHOWN IN PLAN VIEW. AIR RELEASE VALVE IS NORMALLY OPEN.
 4. AIR VALVE SHALL BE EITHER AN AIR RELEASE, OR AN AIR & VACUUM VALVE, AS SPECIFIED ON THE DRAWINGS,
 5. ALL VAULT PIPING SHALL BE BRONZE UNLESS OTHERWISE NOTED.



SECTION
NO SCALE

- NOTES:
1. PRECAST MANHOLE SHALL COMPLY WITH STANDARD DETAILS S-2.1-S-2.4, S-2.11-S-2.13.
 2. COMPLETE MANHOLE SHALL PASS VACUUM TEST PRIOR TO COUNTY ACCEPTANCE.
 3. VALVES SHALL BE ORIENTED AS SHOWN IN PLAN VIEW. AIR RELEASE VALVE IS NORMALLY OPEN.
 4. ALL VAULT PIPING SHALL BE DUCTILE IRON SOCKET SOLVENT WELD UNLESS OTHERWISE NOTED.
 5. THE A.R.V. SHALL BE TAPPED INTO THE CROWN OF PIPE.

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julia Lopez</i></p> <p>Director of Environmental Management</p>	<p>AIR RELEASE & VACUUM VALVE PIT SECTION 1-1</p>	<p>Detail</p> <p>W-10.9</p>
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PLAN

NOTES:

1. ENTIRE 1-1/4" BYPASS LINE SHALL HAVE THREADED BRASS PIPES AND FITTINGS. ALL OTHER INTERIOR PIPE AND FITTINGS SHALL BE D.I. OR C.I. FLANGED.
2. 1-1/4" BRASS PIPE SHALL BE SEAMLESS RED BRASS PIPE, EXTRA STRONG, CONFORMING TO ASTM B-43.
3. 1-1/4" BALL VALVES SHALL BE FORD METER BOX COMPANY B11-555 WITH HB-67 MANHOLE OR EQUAL
4. FITTINGS SHALL BE ANSI B16-15 CAST BRONZ, THREADED, 125 LBS.

Washington County, MD Div. of
Environmental Management

Approved: *David L. Rapp*
Director of Environmental Management

REVISED

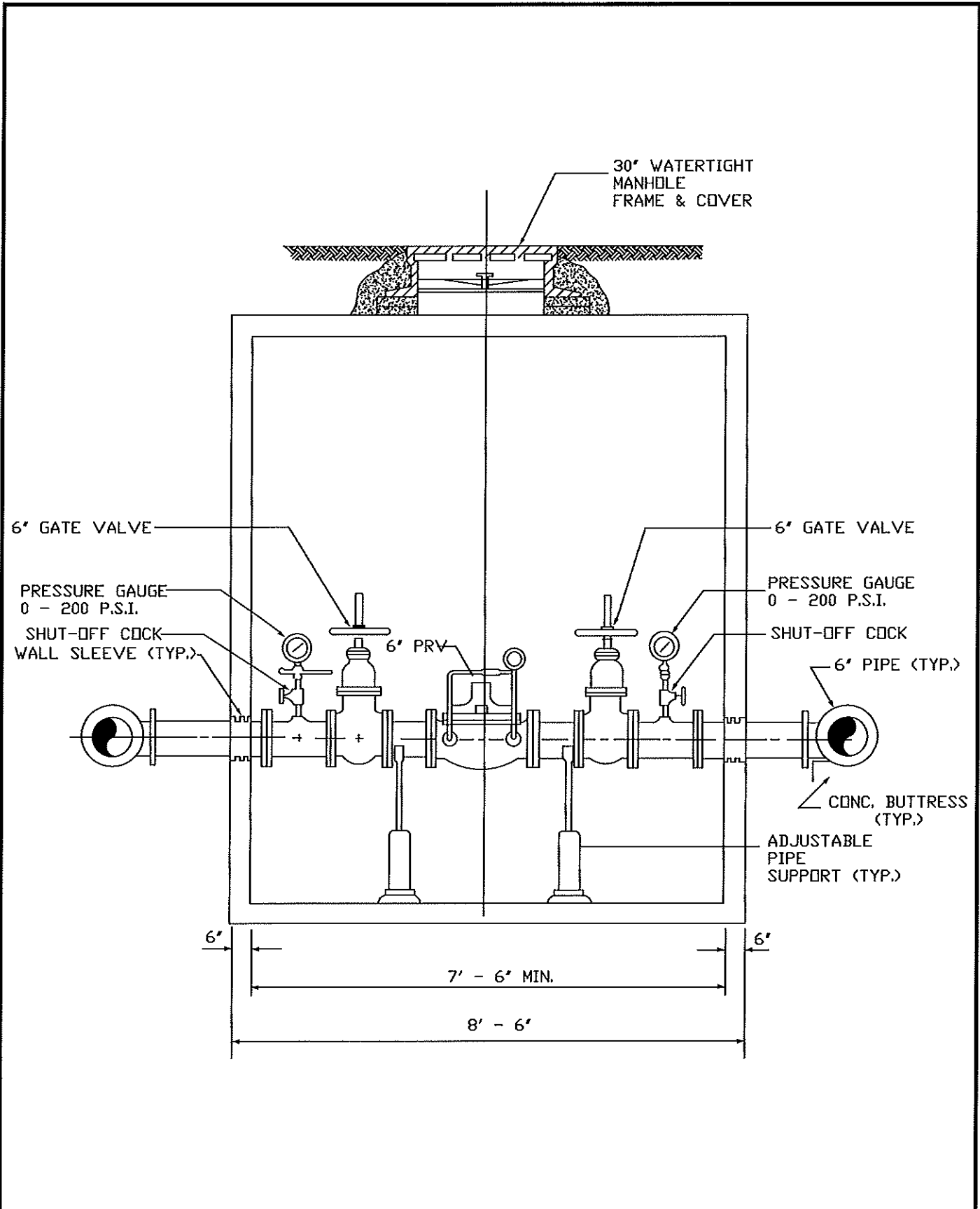
REVISED

APPROVED

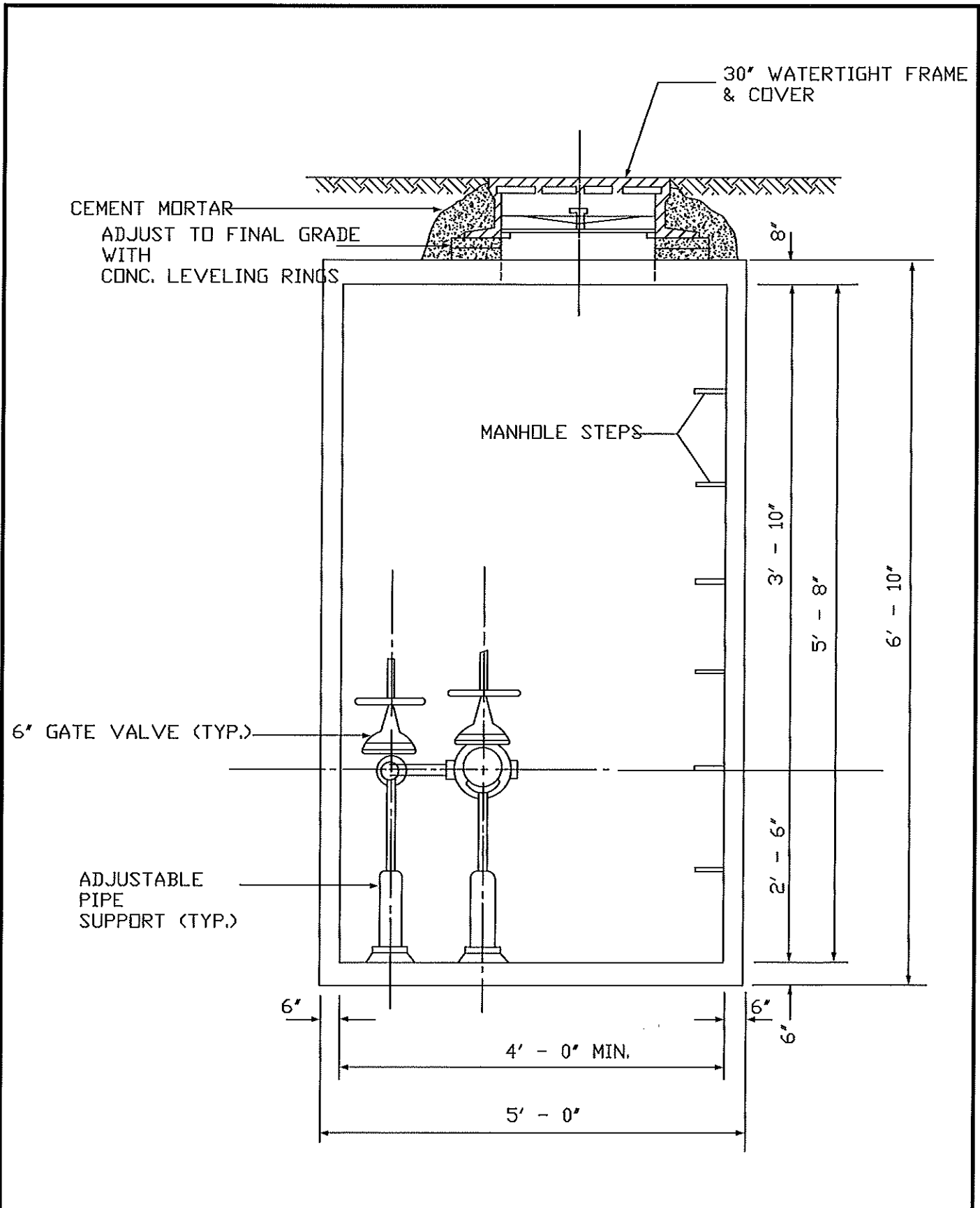
PRESSURE REDUCING VALVE ASSEMBLY AND VAULT
PLAN VIEW

Detail

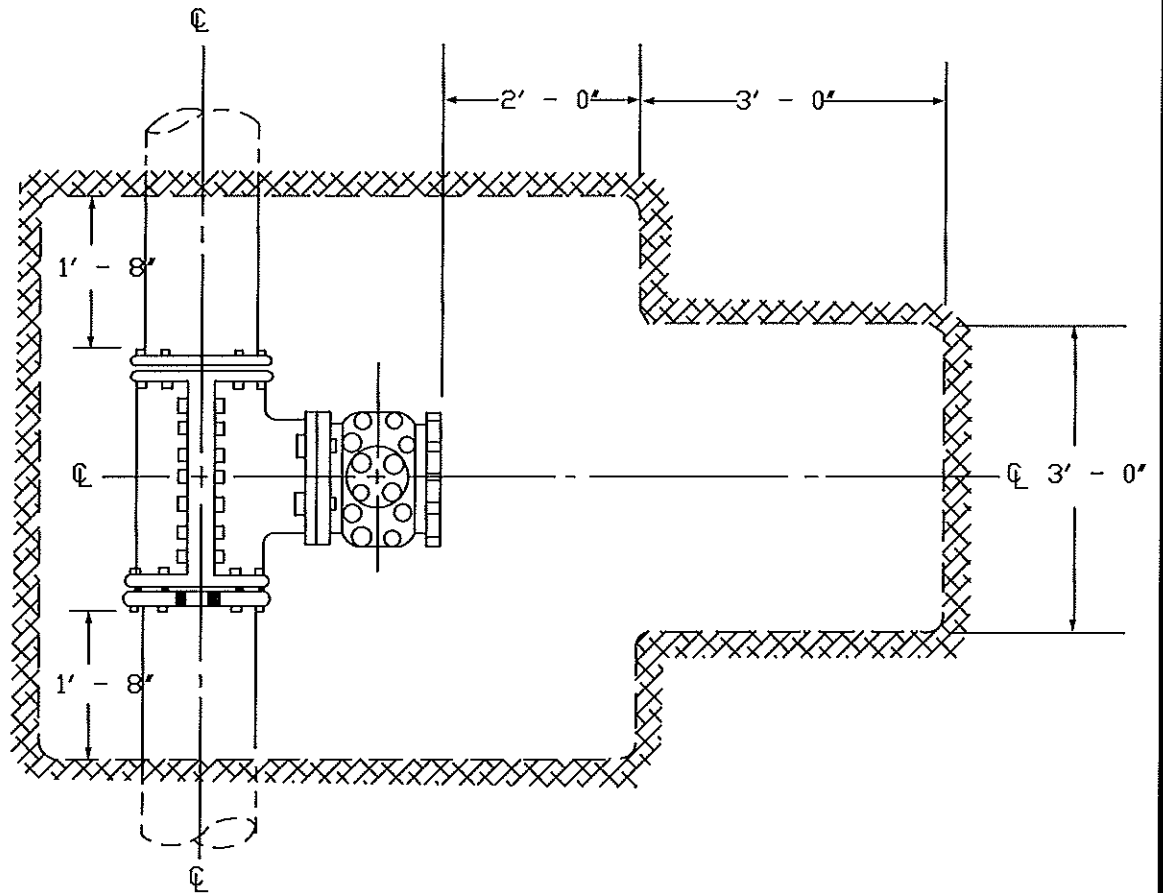
W-10.10



<p>REVISÉ</p> <p>REVISÉ</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Ruppel</i> Director of Environmental Management</p>	<p>PRESSURE REDUCING VALVE ASSEMBLY AND VAULT SECTION A - A</p>	<p>Detail</p> <p>W-10.11</p>
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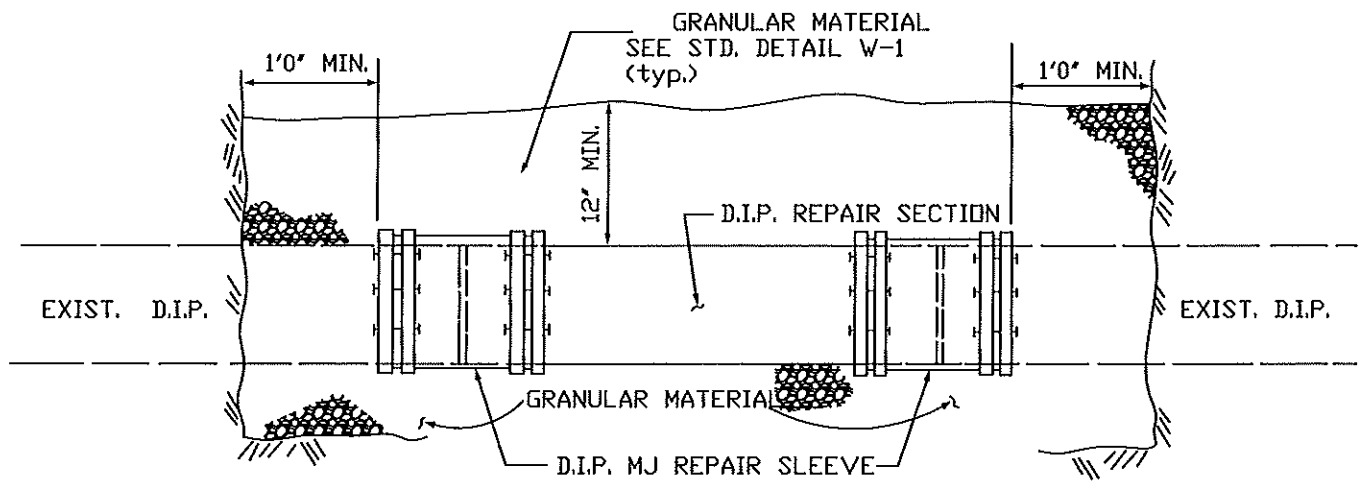


<p>REVISÉ</p> <p>REVISÉ</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julius B. Pepper</i> Director of Environmental Management</p>	<p>PRESSURE REDUCING VALVE ASSEMBLY AND VAULT SECTION B - B</p>	<p>Detail</p> <p>W-10.12</p>
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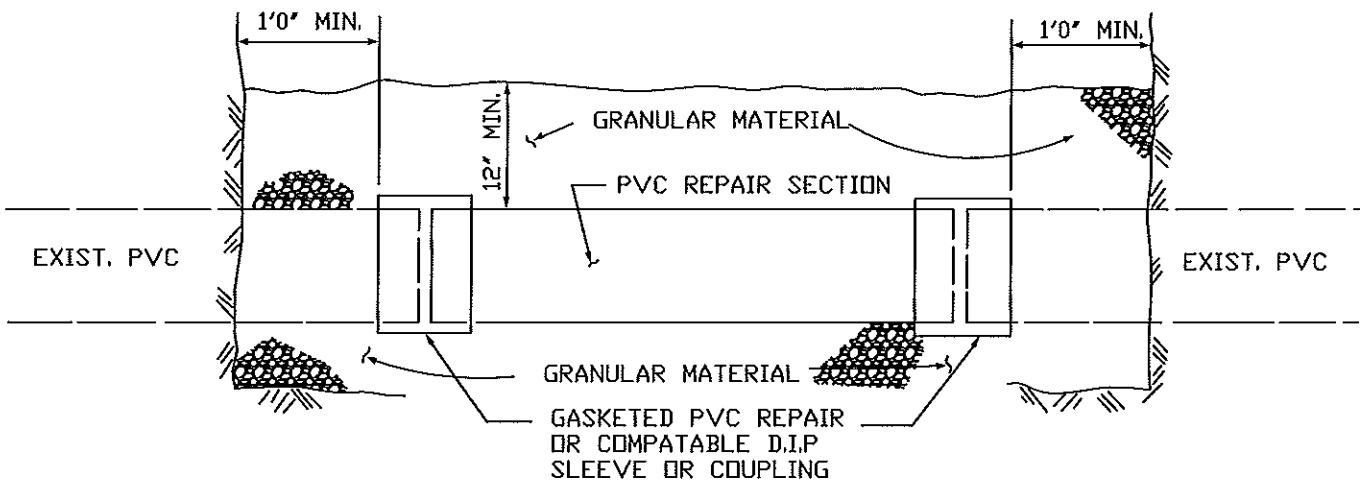


NOTE: ALL DIMENSIONS ARE MINIMUM REQUIRED.

REVISED <hr/>	Washington County, MD Div. of Environmental Management	<h2 style="text-align: center;">TAPPING SLEEVE AND VALVE</h2>	Detail
REVISED <hr/>	Approved: <i>Julie A. Pappas</i>		<h1 style="text-align: center;">WV-10.13</h1>
APPROVED <hr/>	Director of Environmental Management		



EXISTING DUCTILE IRON PIPE REPAIR



EXISTING PVC PIPE REPAIR

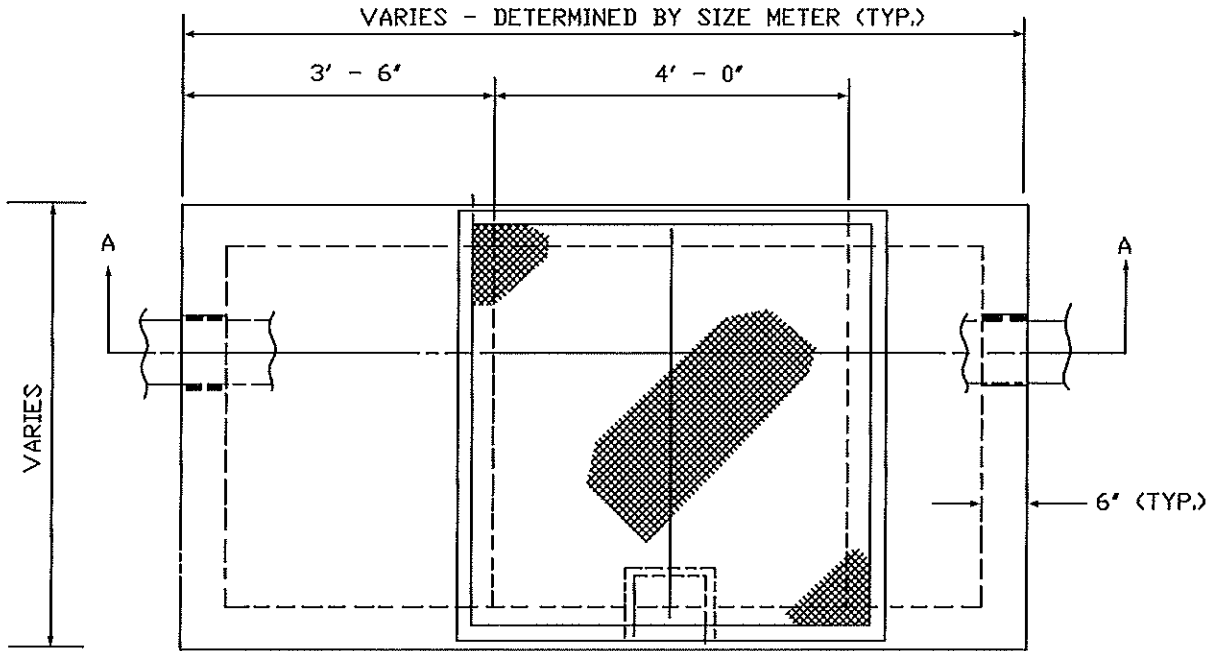
NOTES:

FIELD CUTTING OF PIPE SHALL BE DONE IN A SATISFACTORY MANNER WHICH WILL LEAVE A SMOOTH END AT RIGHT ANGLES TO THE AXIS OF THE PIPE.

PIPE LENGTH BEING INSTALLED SHALL ABUT AGAINST THE NEXT

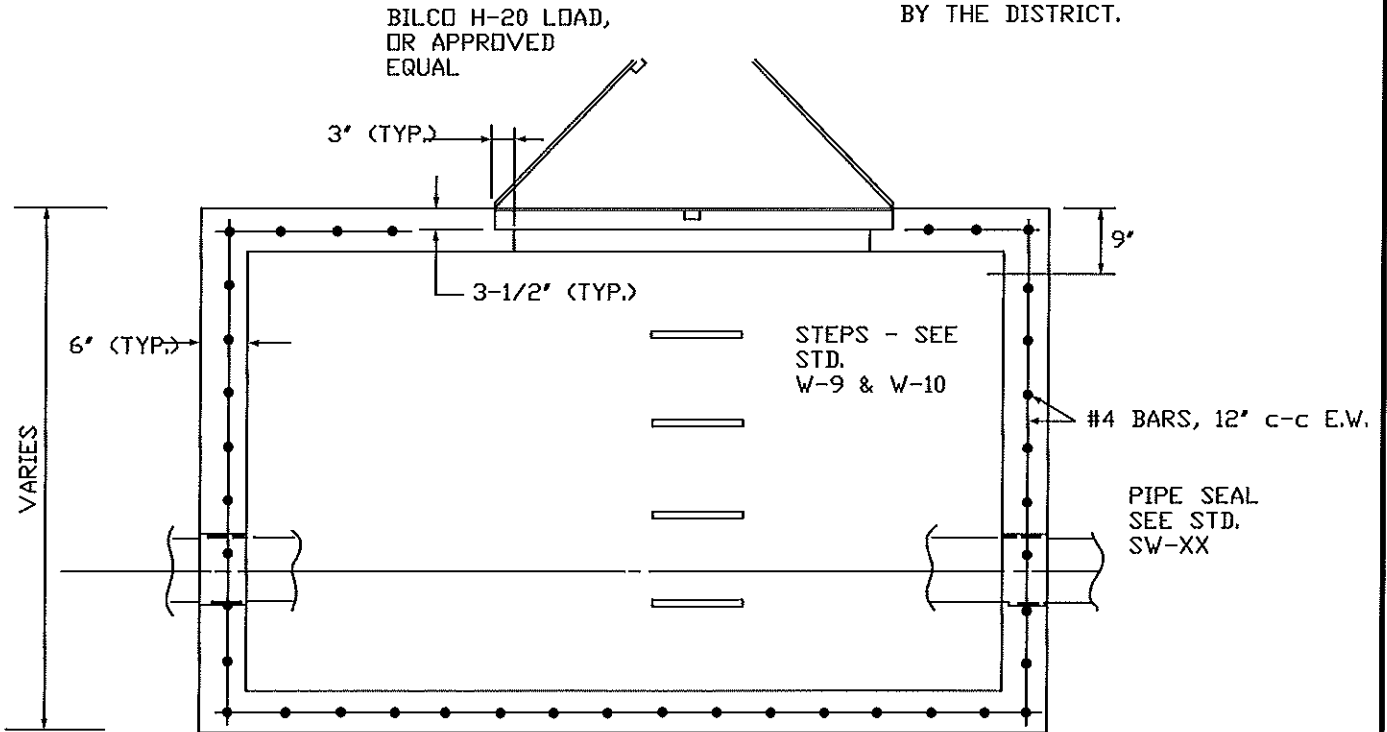
IN SUCH A MANNER THAT THERE SHALL BE NO SHOULDER OR UNEVENNESS OF ANY KIND ALONG THE INSIDE OF THE PIPE.

REVISED REVISED APPROVED	Washington County, MD Div. of Environmental Management Approved: <i>Julia R. Pappalardo</i> Director of Environmental Management	REPAIR OF EXISTING WATER MAINS	Detail W-10.14
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PLAN VIEW

NOTE: INDIVIDUAL DESIGN TO BE SUBJECT TO THE APPROVAL BY THE DISTRICT.



PROFILE

<p>REVISIONS</p> <p>REVISOR</p> <p>DATE</p> <p>APPROVED</p>	<p>Washington County, MD Div. of Environmental Management</p> <p>Approved: <i>Julio A. Pappalardo</i> Director of Environmental Management</p>	<p>TYPICAL METER VAULT (2" METERS AND LARGER)</p>	<p>Detail</p> <p>W-10.15</p>
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WASHINGTON COUNTY DEPARTMENT OF WATER QUALITY
WASHINGTON COUNTY, MARYLAND

SERVICE CONNECTION
CONSTRUCTION REPORT

PROJECT: _____

SUBDISTRICT _____

STREET OR LOCATION _____

CONTRACTOR _____

DATE INSTALLED _____

CONTRACT DWG. NO. _____

OWNERS' NAME _____

IDENTIFICATION NO. _____

TAPPED STA. on MAIN _____

MAILING ADDRESS _____

SIZE & TYPE MAIN	SIZE & TYPE SERVICE PIPE	SIZE & TYPE METER	SIZE & TYPE METER VAULT	TYPE METER LID	EXCAVATION LENGTH	LAYING LENGTH

METER NO. _____

METER READING _____

SKETCH PROFILE VIEW OF MAINLINE, CONNECTION, ANGLES, DISTANCES, OTHER
UNDERGROUND
UTILITIES, STRUCTURES, ETC.

SKETCH PLAN VIEW OF CONNECTION TO METER SHOWING ANGLES, STATIONING, DISTANCES,
LOCATION OF OTHER UTILITIES OR STRUCTURES WITH TIES, ETC.

AMOUNTS PERTAINING TO WORK COMPLETED THIS PERIOD, REVIEWED & APPROVED.

BY _____

INSPECTOR

CONTRACTOR'S REPRESENTATIVE

REVISIONS	Washington County, MD Div. of Environmental Management	SERVICE CONNECTION CONSTRUCTION REPORT	Detail W-10.17
REVISIONS	Approved: <i>Julia L. Pappas</i>		
APPROVED	Director of Environmental Management		