

WOODMEN HILLS

METROPOLITAN DISTRICT



**8046 Eastonville Road
Falcon, CO 80831
Phone: (719) 495-2500**

Water and Wastewater System Standard Specifications

Adopted: March 24, 2011

Revisions:

October 2013

October 2015

March 2020

December 2021

March 2023

TABLE OF CONTENTS

SECTION 1.0 – GENERAL STANDARDS

Page

1.1	Purpose	1
1.2	Revisions, Amendments, or Additions	1
1.3	Effect of Specifications	1
1.4	Authority	1
1.5	Interpretation of Specifications	1
1.6	Definitions.....	1
1.7	Abbreviations.....	2
1.8	Reference Specifications.....	3
1.9	Requirements to Extend, Construct, or Modify System	3
1.9.1	Request for Development Information.....	3
1.9.2	Preliminary Review for Large Projects.....	3
1.9.3	Request for Recovery Contract.....	4
1.9.4	Plan Format, Submission, Review, and As-Builts	4
1.9.5	Preconstruction Meeting.....	6
1.10	Construction Matters	6
1.10.1	Conflicts Between Plans and Specifications.....	6
1.10.2	Construction Procedure.....	6
1.10.3	Surveying	7
1.10.4	Placing Survey Lines	7
1.10.5	Inspection	7
1.10.6	Abandonments, Material Recovery, and Reuse of Installed Materials.....	8
1.10.7	Warranty and Acceptance	8

SECTION 2.0 – WATER SYSTEM DESIGN STANDARDS

2.1	General	10
2.1.1	Deviation from Standard.....	10
2.1.2	Easements	10
2.1.3	Colorado Department of Health Regulations	10
2.2	Hydraulics.....	10
2.2.1	Sizing of Water Mains.....	10
2.2.2	Sizing of Services.....	10
2.3	Water Mains	11
2.3.1	Locations	11
2.3.2	Material.....	11
2.3.3	Corrosion Protection	11
2.3.4	Profile	11
2.3.5	Looping.....	11
2.4	Valves	11
2.4.1	Location.....	11
2.5	Appurtenances.....	12
2.5.1	Blow-off Valves.....	12
2.5.2	Air-Release Valves.....	12
2.5.3	Pressure-Reducing and Regulating Valves	12
2.5.4	Fire Hydrants	12
2.6	Separation from Pollution Sources	12
2.7	Casing	12
2.8	Fire Lines	12

2.9	Water Main Crossings	13
2.9.1	Asbestos Cement Water Main.....	13
2.9.2	Irrigation Ditch Crossings.....	13
2.9.3	Final Inspection	13

SECTION 3.0 – WATER SYSTEM INSTALLATION STANDARDS

3.1	General Construction	14
3.1.1	Start of Construction.....	14
3.1.2	Protection of Existing Underground Facilities	14
3.1.3	Detours – Traffic Control.....	14
3.2	Excavation	14
3.2.1	Safety.....	14
3.2.2	Construction Stakes	15
3.2.3	Trench Width.....	15
3.2.4	Overexcavation.....	15
3.2.5	Blasting.....	16
3.2.6	Sheeting and Bracing	16
3.3	Pipe Bedding and Laying	16
3.3.1	Select Bedding Material.....	18
3.3.2	Laying of Pipe.....	19
3.3.3	Length of Pipe.....	20
3.3.4	Fittings.....	20
3.3.5	Service Connections	20
3.4	Backfill and Compaction	20
3.5	Valve Installation	22
3.5.1	Valves.....	22
3.5.2	Valve Boxes.....	22
3.6	Fire Hydrant Installation	22
3.6.1	Installation.....	22
3.6.2	Anchorage.....	22
3.6.3	Drainage	23
3.6.4	Hydrant Protection in Corrosive Soils	23
3.7	Blow-off Installation	23
3.8	Air-Release Valve Installation	23
3.9	Pressure-Reducing Valve Installation	24
3.10	Disinfection	24
3.11	Hydrostatic Testing	24
3.11.1	General	24
3.11.2	Procedure	25
3.11.3	Allowable Leakage	25
3.12	Water Meter Installation	26
3.12.1	General	26
3.12.2	Inside Water Meter Installations.....	26
3.12.3	Water Meter Pit Installations (Other than Residential).....	26
3.12.4	Combined Domestic and Fire Line Water Meters	27

SECTION 4.0 – WATER SYSTEM MATERIAL STANDARDS

4.1	Material Specifications – General	28
4.2	Pipe	28
4.2.1	Polyvinyl Chloride (PVC) Pipe	28
4.2.2	Ductile Iron Pipe	28
4.3	Fittings	28
4.4	Valves	28
4.4.1	12-inch Diameter and Smaller – Gate Valves	28
4.4.2	14-inch Diameter and Larger – Butterfly Valves	29
4.5	Fire Hydrants	30
4.5.1	General	30
4.5.2	Acceptable Brands	30
4.5.3	Size of Hydrant	31
4.5.4	Type of Hydrant	31
4.5.5	Inlet Connection	31
4.5.6	Main Valve Assembly	31
4.5.7	Operating Shaft Nut	31
4.5.8	Pumper Nozzle and Cap	32
4.5.9	Hose Nozzles and Caps	32
4.5.10	Color	32
4.5.11	Location	32
4.5.12	Hydrant Pressure and Temperature Monitoring Specifications	32
4.6	Pressure-Reducing Valves	34
4.7	Air-Release Valves	34
4.8	Thrust Blocks	34
4.9	Precast Concrete Vaults and Manholes	34
4.10	Services	35
4.10.1	General	35
4.10.2	Service Lines	35
4.10.3	Corporation Stops and Curb Stops (or Valves)	36
4.10.4	Meters	36
4.10.5	Backflow Preventers	37

SECTION 5.0 – WASTEWATER SYSTEM DESIGN STANDARDS

5.1	Quality of the Collection System	38
5.2	Sizing of Collection Mains	38
5.3	Layout of the Collection System	38
5.4	Manholes	39
5.4.1	Manhole Sizes	39
5.4.2	Changing Pipe Size	39
5.4.3	Intersections	39
5.4.4	Manhole Channels	39
5.4.5	Manhole Rings and Covers	40
5.4.6	Drop Manholes	40
5.5	Minimum Sewer Depth	40
5.6	Slopes	40
5.7	Construction Tolerances	41
5.8	High-Velocity Protection	41
5.9	Relation to Water Mains	41
5.10	Stub-outs from Manholes	41
5.11	Inverted Siphons	42
5.12	Stream and Drainage Channel Crossings	42

5.13	Crossings Under Railways and Highways	42
5.14	Aerial Crossings	42
5.15	Metering Manholes.....	42
5.16	Pumping Facilities.....	43
5.17	Force Mains.....	44
5.18	Underdrain System.....	44

SECTION 6.0 – WASTEWATER SYSTEM EXCAVATION & SITE STANDARDS

6.1	Earthwork Defined.....	45
6.2	Traffic Control.....	45
6.3	Caution in Excavation	45
6.4	Excavation to Line and Grade.....	45
6.5	Trenching and Excavation Operations.....	45
6.6	Blasting.....	46
6.7	Dewatering	47
6.8	Pipe Bedding	47
6.9	Select Bedding Material	48
6.10	Backfill and Compaction	49
6.11	Cleanup	49
6.12	Surface Restoration and Maintenance	49

SECTION 7.0 – WASTEWATER SYSTEM PIPE-LAYING STANDARDS

7.1	Handling of Materials.....	51
7.2	Inspection and Preparation of Pipe and Fittings.....	51
7.3	Cutting and Fitting of Pipe	51
7.3.1	Pipe Joint Lubrication.....	51
7.3.2	Pipe Alignment and Grade	51
7.3.3	Temporary Bulkheads	52
7.3.4	Frost	52
7.3.5	Lowering of Material into the Trench.....	52
7.4	Laying of Pipe.....	52
7.5	Ductile Iron Pipe.....	52
7.6	Polyvinyl Chloride Pipe	53
7.7	Manholes	53
7.8	Bridging and Encasement of Pipe	54
7.9	Encasement or Sleeve Pipe	54
7.10	Corrosion Protection Systems	54
7.11	Cleaning	56
7.12	Compaction Tests	56
7.13	Infiltration and Exfiltration Tests.....	56
7.14	Deflection Test	57
7.15	TV Inspection.....	57
7.16	Vacuum Testing for Concrete Sewer Manholes.....	57
7.17	Manhole Rim Elevations.....	58
7.18	Service Line Inspection	59

SECTION 8.0 – WASTEWATER SERVICE STANDARDS

8.1	Wastewater Taps	60
8.2	Excavations	60
8.3	Abandoning Existing Connections	60
8.4	Individual Service Pumps.....	60

8.5	Wastewater Service Line Ditches	60
8.6	Inline Wye.....	60
8.7	Installation Method	60
8.8	Slope.....	60
8.9	Alignment.....	61
8.10	Cleanouts	61
8.11	Connecting Clamps.....	61
8.12	Repair and Replacement of Existing Service Lines	61
	8.12.1 Responsibility.....	61
	8.12.2 Surface Restoration and Maintenance.....	61

SECTION 9.0 – WASTEWATER SYSTEM MATERIALS STANDARDS

9.1	Polyvinyl Chloride Pipe and HDPE Pipe – 4-inch Through 24-inch Diameter....	62
9.2	Ductile Iron Pipe.....	62
9.3	Polyethylene Encasement Material	63
9.4	Concrete	63
9.5	Concrete Reinforcement.....	64
9.6	Precast Reinforced Concrete Manhole Sections	64
9.7	24-inch Diameter Manhole Ring and Cover.....	64
9.8	Steel Pipe Fabrication.....	65

SECTION 10.0 – WELLS AND WELL SITES

10.1	General Standards for Well Sites.....	67
10.2	Typical Components of Wells.....	68
10.3	Typical Well Site Components	68
10.4	Well Site SCADA Services.....	69

Appendices:

Appendix A – Request for Deviation Form

Appendix B – District Signature Blocks

Appendix C – District General Notes

Appendix D – Grease Interceptor Standards

*Appendix E – Policy and Process for Third Party to Drill or Fund a New
Well Based on District Water Rights*

Standard Drawings

Water

<u>No.</u>	<u>Title</u>
W-1	Fire Hydrant Locations
W-2	Fire Hydrant Installation
W-3	Fire Hydrant Specifications
W-4	Fire Hydrant Backflow and Meter Configuration
W-5	Valve Installation and Location
W-6	Valve Box Installation
W-7	Polyethylene Wrap
W-8	Bonding Joint & Anode Installation
W-9	Insulator Installation
W-10	Tracer Wire Installation Details
W-11	Thrust Block Data
W-12	Thrust Blocks Required for Taps
W-13	Restrained Pipe Length (ft) with Mechanical Joint Restraints
W-14	Typical Trench Cross Section
W-15	Typical Common Service Trench Section
W-16	Maximum Pipeline Deflection Data
W-17	Pipe Cutting
W-18	Concrete Reverse Anchor for Mechanical Joint Restraints
W-19	Lowering Detail – Utility Crossing 30” & Smaller
W-20	Lowering Detail with Casing Utility Crossing Greater than 30”
W-21	Pipe Bridging Detail
W-22	Temporary Blow-off Assemblies – 4”, 6”, and 8” Mains with Mechanical Joint Plug
W-23	Temporary and Permanent Blow-off Assemblies for Mains 12” and Greater
W-24	Blow-off Assembly Dimension Data for Mains 12” and Greater
W-25	Pipe Tapping Detail
W-26	Cul-de-Sac Blow-off Detail
W-27	Flange – Lug Detail
W-28	Applications for Mechanical Joint Restraints
W-29	Pressure Relief Station
W-30	8” Size Pressure Regulator Station
W-31	6” Size Pressure Regulator Station
W-32	Standard Concrete Vault for Valve Installation (Precast)
W-33	Standard Concrete Vault for Valve Installation (Cast-in-Place)
W-34	Protecting Tie Rods
W-35	Tapping Detail – 3/4” Through 2”
W-36	Typical Installation for Service Line and Stop Box
W-37	Installation for Service Line with Sleeve Under a Utility
W-38	Typical Service Line Trench – Common Ditch for Water/Sewer
W-39	Water Meter Loop for 3/4" Through 1” Meters
W-40	3/4” Through 1” Service Line/Meter Pit Installation
W-41	Irrigation Service 3/4” and 1” Meter Installation
W-42	1-1/2” & 2” Irrigation Meter Installation
W-43	Utility Service Locations
W-44	Easement & Separation Standards – Water/Sewer Mains
W-45	Air/Vac Pressure Valve Pit

Wastewater

<u>No.</u>	<u>Title</u>
WW-1	Typical Trench Cross Section
WW-2	Precast Manhole
WW-3	Sanitary Sewer Main Cleanout
WW-4	Sanitary Sewer Service Connection
WW-5	Typical Utility Locations
WW-6	Pipe Bridging Detail
WW-7	Shallow Sanitary Sewer Line Protection/Encasement
WW-8	Pipe Cutting
WW-9	Polyethylene Pipe Wrap
WW-10	Bonding Joint & Anode Installation
WW-11	Maximum Pipeline Deflection Data
WW-12	Grease Interceptor
WW-13	Sand/Oil Interceptor
WW-14	Grease Separator = 250 lbs.
WW-15	Grease Separator = 500 lbs.
WW-16	Kor-N-Seal Boot Detail
WW-17	Utility Service Locations
WW-18	Easement & Separation Standards – Water/Sewer Mains

SECTION 1.0 – GENERAL STANDARDS

1.1 Purpose

These Woodmen Hills Metropolitan District Water and Wastewater System Standard Specifications (the "Specifications"), as they may be amended from time to time, are to provide guidance to Developers, Engineers, Contractors, Builders, and other interested parties with respect to the design and construction of Water and Wastewater System improvements within the District's Service Area. These Specifications contain technical data for the design and specifications for the installation of the Water and Wastewater Systems within the District and its Service Area.

The purpose of these Specifications is to assure consistency in the design, as well as quality and uniformity in the installation of Water Mains, Wastewater Lines, and appurtenances within the District and its Service Area.

1.2 Revisions, Amendments, or Additions

These Specifications may be revised, amended, or added to as deemed prudent, in the sole discretion of the District. If a vendor or Engineer wishes to submit a product or method of installation not covered by these Specifications, he/she may do so by submitting it to the District Manager with the backup information required.

It is the goal of the District to review and approve water system plans and materials in the light of community values. Value engineering that can be shown to benefit the Developer, the District, ratepayers, and future users of the system will be considered.

1.3 Effect of Specifications

These Specifications including any revisions, amendments, or additions shall be binding and in effect immediately upon adoption by the District Board of Directors. All parties using this document are responsible for determining that they have the most recent changes by contacting the District Manager. These Specifications are made a part of and incorporated into the District's Rules and Regulations.

1.4 Authority

These Specifications are implemented by the Enterprise Directors, under the authority of the District's Board of Directors.

1.5 Interpretation of Specifications

These Specifications are composed of criteria for engineering design, District procedures and policies, construction and material specifications, and standard drawings. The interpretation of any section or the contradiction between sections, when applicable, shall be made by the District. Requests for interpretation shall be submitted in writing to the District Manager. The interpretation issued by the District shall be binding and controlling in its application.

1.6 Definitions

In addition to the definitions provided in the District's Rules and Regulations, the meaning of the terms used herein shall be as follows:

- A. Conditional Acceptance – Shall occur upon recommendation by the District Engineer and concurrence by the respective Operations Director for conditional acceptance of the Water Mains and/or Wastewater Lines, and upon provision to the District of all appropriate easements

for the maintenance and operation of such facilities, payment of all fees and charges due hereunder, submission of As-Built Drawings, statement of costs, completion of an appropriate bill of sale dated subsequent to the expiration of the 24-month warranty period, and compliance with any other applicable requirements contained herein, the District shall conditionally accept the systems.

- B. Collection Main – Shall mean a twelve-inch (12") or smaller diameter pipe and appurtenances receiving wastewater being a part of the Wastewater System.
- C. Consulting Engineer – Shall mean the Developer's authorized utility design Engineer.
- D. Contractor – Shall mean any person, firm, or corporation authorized by the District to perform work and to furnish materials within the District.
- E. Developer – Shall mean any person, corporation, partnership, joint venture, local governmental entity, or other entity.
- F. Distribution Main – Shall mean a ten-inch (10") or smaller diameter pipe and appurtenances receiving potable water and conveying it to individual Service Lines.
- G. Extensions – Shall mean District Wastewater and Water System extensions within the Service Area of the District. Shall further be defined as "District Mains."
- H. Inspector – Shall mean the person(s) duly authorized by the District to enforce these Specifications.
- I. Interceptor Main – Shall mean a Wastewater Pipeline larger than twelve-inch (12") and appurtenances receiving wastewater being a part of the Wastewater System. Interceptor Mains are not allowed to be tapped with individual services.
- J. Service Lines (Water) – Shall mean the pipe, line, or conduit from the Water Main to an individual house or other structure.
- K. Service Line (Sewer) – Shall mean the Wastewater Line extending from the premises up to and including the connection to the public Wastewater Main.
- L. Service Stub (Sewer) – Shall mean the Wastewater Service Line from the Main to a point inside the property.
- M. Transmission Main – Shall mean a twelve-inch (12") or larger diameter pipe and appurtenances receiving potable water and conveying it to Distribution Mains.
- N. Water Main or Main – Shall mean any water pipe, line, or portion thereof, owned, or to be transferred for ownership by the District.
- O. Water System – Shall mean all Mains, together with all appurtenances, materials, equipment, and property receiving potable water and conveying it to individual consumers.
- P. Wastewater System – Shall mean Mains, together with all appurtenant and necessary manholes, services, taps, pump stations, associated materials, property, and equipment collecting wastewater from individual customers.

1.7 Abbreviations

- A. ANSI – American National Standards Institute
- B. ARV – Air-release vacuum breaker valve
- C. ASTM – American Society for Testing and Materials
- D. AWWA – American Water Works Association
- E. DIP – Ductile iron pipe

- F. GPM – Gallons per minute
- G. PRV – Pressure-reducing and regulating valve
- H. PSI – Pounds per square inch
- I. PSIG – Pounds per square inch gauge
- J. PVC – Polyvinyl chloride
- K. WHMD – Woodmen Hills Metropolitan District

1.8 Reference Specifications

These standard Specifications, listed below, shall be incorporated into these Specifications as it is bound herein. Should a conflict arise between these Specifications, a written request for clarification shall be made to the District.

- A. State Department of Highways, Division of Highways, State of Colorado. Standard Specifications for Road and Bridge Construction, 1991.
- B. Manual of Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Latest Edition and Revisions Thereto.
- C. ASTM, American Society for Testing & Materials, 1916 Race St., Philadelphia, PA 19103.
- D. AWWA, American Water Works Association, 6666 West Quincy Ave., Denver, CO 80235.
- E. Site Application Process, The Code of Colorado Regulations 19CR6,6-96.

1.9 Requirements to Extend, Construct, or Modify System

1.9.1 Request for Development Information

- A. Development information may be obtained at the office of Woodmen Hills Metropolitan District, located at 8046 Eastonville Rd, Falcon, Colorado 80831, between the hours of 8:00 a.m. and 4:00 p.m. on weekdays (holidays excluded), or by written request directed to the Enterprise Directors.
- B. Questions concerning these Specifications may be directed to the District via telephone or through a pre-arranged meeting between the hours of 8:00 a.m. and 4:00 p.m., weekdays (holidays excluded), or by written request directed to the District Manager.

1.9.2 Preliminary Review for Large Projects

The District shall establish, and may amend from time to time, procedures to be followed by applicants for extensions of District Mains. These procedures shall include all requirements for paperwork, submittals, engineering design, construction, and acceptance.

Where a project is large in scale, a preliminary submittal shall be made by the applicant, including an overall or master plan showing the area to be developed and any other adjoining proposed developments by the Owner/Developer. Large or difficult areas may require extensive study and analysis. The District will return to the applicant its requirements for the following:

- A. Points of connection to existing facilities
- B. Off-site facilities required
- C. General locations of Mains to be installed
- D. Size of Mains required

1.9.3 Request for Recovery Contract

If, in the sole opinion of the District, an increase in line size is necessary in order to provide an acceptable level of service to the Developer parcel or other customers within the District, the Developer may be required to provide oversized pipelines and/or facilities. The cost for the "oversizing" of such pipelines and/or facilities shall be borne solely by the Developer. The basis for such costs shall be the difference in unit prices between the maximum line size which is the Developer's responsibility and the actual size to be constructed. The cost for the design and preparation of contract documents for these "oversized" pipelines shall be the sole responsibility of the Developer. If the District determines that it will construct the facilities, the Developer shall submit payment for the cost. The District will not issue a notice of award until such payment has been made. The District may collect fees or charges in the sole discretion of the Board from other customers served by the "oversized" facilities and may, in the sole discretion of the Board, reimburse the Developer for all or a portion of the oversizing costs incurred by the Developer.

A request for recovery shall include the following:

- A. Contract holder's name and address
- B. Proof of payment to contractors, engineer, attorney, construction director, etc.
- C. Easements granted
- D. Permits issued
- E. Conditional acceptance
- F. Bill of sale
- G. Map of Service Area, and
- H. Detailed cost summary

For a complete list of the required items and policy details, refer to the recovery agreement policy and the District Rules and Regulations.

1.9.4 Plan Format, Submission, Review, and As-Builts

- A. The Developer or the Consulting Engineer shall submit to the District two (2) sets of design drawings for review. Construction of any portion of system improvements shall not begin until design drawings have been approved by the District's Engineer. A set of approved drawings and a copy of these Specifications shall be available at the job site while system improvements are under construction. Subsequent to initial approval, any design changes shall also be submitted to the District for review and approval.

Where any easements are required other than those being platted, legal descriptions should be submitted to the District Engineer for review. Legal descriptions shall also include a sketch outlining the boundaries. The Developer/Owner shall provide an updated commitment for title insurance, prepared by a title company approved by the District, in accordance with the District Rules and Regulations.

- B. Drawings shall be twenty-four inches by thirty-six inches (24" x 36") overall. North shall be to top or right of sheet. Scale shall be one inch equals fifty feet (1" = 50') horizontal, one inch equals five feet (1" = 5') vertical. The cover sheet shall show the location map and proposed system plan indicating street names, pipe sizes, valves, fire hydrants, manholes, and all appurtenances. System shall also indicate the development name, name and address of the Developer, and the Consulting Engineer with Colorado P.E. seal and an index of

sheets. After approval by the District, half-size reproductions may be used for general purposes or in the field.

Drawings must contain both plan and profile of all lines with the exception of water distribution lines (10" or less) where profiles are not necessary if the design includes street plans and grades. Drawings shall contain adequate design information to include all lowerings and adjacent facilities, (including but not limited to drainage facilities, grading, and other utility crossings). Drawings must include District General Notes (included in the Appendix), District signature blocks, manholes, crossings, and all appurtenances. A utility plan shall show the location of all services.

Other elements of drawings must include the following:

1. Proposed plat showing location and dimensions of dedicated streets, alleys, rights-of-way, and easements.
2. Lots and blocks.
3. All existing and proposed curb, gutter, and pedestrian ramps.
4. Sidewalk locations with respect to property lines.
5. All existing or proposed utilities which cross or may conflict with District installations to include size, type, and horizontal and vertical location.
6. All existing or proposed obstructions such as vaults, catch basins, traffic islands, etc.
7. Drawings must be prepared from actual field surveys referenced to land corners or other survey control points and be of sufficient accuracy such that the facilities can be accurately staked for installation and can be readily located after installation for maintenance and operation. All elevations shall be NGVD '83.
8. Sufficient adjacent area to give the relation of new facilities to existing facilities.
9. Proposed grading and drainage facility plans.
 - i. Two (2) complete sets of drawings and any special project conditions shall be submitted to the District for review. Normal review time will be two (2) weeks. Drawings are reviewed by both engineering and operations. One (1) marked set of the submittals will be returned to the applicant. If desired, a review conference may be scheduled. When revisions are required, two (2) sets of revised drawings shall be resubmitted to the District for subsequent review. When acceptable, the District Engineer will approve drawings (said approval indicating conformity with the Specifications and the District's Rules and Regulations) and return one approved set of the submittal. After approval and signature, four (4) sets of fully signed documents must be provided to the District. The Consulting Engineer shall also submit the design on CD in AutoCAD (or an AutoCAD-convertible format) as well as in PDF form.
 - ii. Prior to any construction, the Contractor must schedule a preconstruction meeting with the District's Engineer. The preconstruction meeting must occur a minimum of seventy-two (72) hours in advance of commencing work. See Section 1.9.5 herein regarding preconstruction meetings.
 - iii. Upon completion of construction and prior to acceptance, one (1) complete set of project as-builts and a CD in electronic format of the same, in AutoCAD and PDF, indicating all changes from original approval, shall be submitted to District Engineer. If no changes have been made during construction, the sheet shall so indicate. The as-built drawing and CD must contain the Consulting Engineer's as-built approval signature.

- iv. Unless construction commences within six (6) months from the date of plan approval, approval shall become null and void.

1.9.5 Preconstruction Meeting

Prior to beginning any work on the project, the Developer shall schedule a preconstruction meeting through the Water Operations Manager or District Engineer with at least seventy-two (72) hours' notice to the following:

- A. The Water Operations Managers;
- B. The Contractor having on-site authority;
- C. A representative of the Owner or Construction Manager;
- D. The Consulting Design Engineer and Soils/Testing Engineer;
- E. All existing utilities that will be involved in the project;
- F. El Paso County Department of Transportation, or the appropriate City and/or State agency having right-of-way jurisdiction;
- G. District Engineer;
- H. District Inspector;
- I. Any third-party easement holder (if applicable); and
- J. Any other parties required by the District Engineer

1.10 Construction Matters

1.10.1 Conflicts Between Plans and Specifications

When a conflict occurs between or within standards, specifications, and drawings, a final interpretation shall be made by the District Engineer pursuant to these Specifications, subject to the following criteria:

- A. Addenda and modifications to the drawings and specifications take precedence over the original documents.
- B. Should there be a conflict within the Specifications or on the drawings, the District Engineer shall decide which stipulation will provide the best installation and this decision shall be final.
- C. In the drawings, calculated dimensions shall take precedence over scaled dimensions and noted material over graphic indication.

1.10.2 Construction Procedure

Following final approval of the plan(s), the applicant may proceed with construction. In addition to all construction requirements contained in other portions of these Specifications, the applicant and the Contractor shall observe the following:

- A. The applicant shall secure and pay for all licenses and permits required for the system extension;
- B. Materials needed to complete work shall be on hand so that the project may proceed without delay;
- C. Adequate provisions for notification of customers who may suffer outages must be developed.
- D. Outages shall be kept to a minimum; and,

- E. Mains and Service Stubs shall be tested to the satisfaction of the Inspector.
- F. The use of hydrant meter assemblies (provided by WHMD with a deposit from the Contractor) shall be installed per detail drawing contained herein.

1.10.3 Surveying

Line and grade for Mains and appurtenances shall be established by a professional Engineer or by a land surveyor licensed to practice in the State of Colorado. All work shall be done in a professional manner using the same degree of skill and knowledge customarily employed by other professionals performing the same or similar services in the State of Colorado. Correct alignment and grade-staked alignment and elevations by the Inspector do not relieve the design Engineer in any manner from the responsibility for field errors. Sufficient lines must be staked to ensure continual work progress. Under no circumstances shall pipe be installed without line and grade stakes set by the Developer's Engineer or surveyor and approved by the Inspector.

When a District Main is to be installed outside of the public street right-of-way, within an easement or right-of-way dedicated for utility Main installations, the limits of the easement or right-of-way shall be marked with permanent monuments placed by a licensed surveyor, and the pipeline route shall be marked with buried pipeline markers when required. The Owner/Developer shall be responsible to provide restoration and landscaping adequate to prevent erosion caused by surface runoff. Landscaping and restoration construction shall be designed in such a manner that minimum future maintenance will be required. A landscaping and restoration design plan shall be submitted with the plan for approval and will be subject to the same guarantee, as described in these Specifications.

1.10.4 Placing Survey Lines

Hubs and stakes shall be set on an offset line to mark the location of the centerline of the Main. Centerline hubs and stakes may be used in addition to the offset hubs and stakes; however, they may not be set in place of the offset hubs and stakes. Notations on field stakes shall match approved plan and profile sheets.

Survey points shall be set a maximum distance of twenty-five feet (25') apart. All appurtenances and manholes shall be staked for location and grade. Points of curvature, points of tangency of curves, and points on the curve shall be staked. Property corner stakes or monuments shall be placed prior to construction and shall include all changes in direction and not exceed 100 feet between on-line stakes. This will include all permanent easements as well as interior property lines. All stakes shall be flagged to increase their visibility. Survey staking may be modified with the agreement of the Design Engineer, Contractor, and the District.

1.10.5 Inspection

- A. New installation, replacement, or relocation of existing facilities or any other work involving the District System shall be inspected and approved by an Inspector.
- B. After receipt of plans approved by the District, the Contractor shall give at least forty-eight (48) business hours' notice to the District's Inspector at (719) 495-2500 prior to beginning construction. No construction shall commence sooner than forty-eight (48) hours after receipt of approved plans, nor shall construction begin prior to arrival of a District Inspector at the project site. **All overtime work conducted before or after regular business hours or on District holidays shall be at the expense of the Contractor and coordinated with the Inspector forty-eight (48) hours in advance.**

- C. All materials used shall be subject to the inspection and approval of the Inspector at all times. The Inspector has the right to perform any testing deemed necessary to ensure compliance of the materials with these Specifications. No materials shall be used before being inspected or approved by the Inspector. Failure or neglect on the part of the Inspector to condemn or reject inferior materials or work shall not be construed to imply their acceptance should their inferiority become evident at any time prior to completion of a twenty-four (24) month warranty period. Materials rejected by the Inspector shall be immediately removed from the project site.

1.10.6 Abandonments, Material Recovery, and Reuse of Installed Materials

A. Abandonment/Material Recovery

1. The District owns all existing parts of the Water and Wastewater System and any removed pipe, equipment, and or other materials can be claimed as property of the District.
2. If and when materials and/or equipment must be removed from the existing system, the Inspector will determine if the District wishes to maintain ownership.
3. Generally, pipe materials are not maintained. However, valves, fittings, special equipment, manhole rings and covers will often be reclaimed by the District. If and when so directed by the Inspector, such items removed shall be delivered to the District shop at 8046 Eastonville Rd.
4. If the Inspector elects not to claim any removed items, they may become the property of the Contractor who must remove the items from the site.

B. Reuse of Installed Materials

1. Used sewer pipe and manholes may not be reinstalled and/or reused.
2. Water pipe that has been installed and used cannot generally be reused except in unusual circumstances and only by permission of the Inspector. If and when water pipe is allowed to be reused, the Inspector must review and approve each piece of pipe prior to reinstallation. Gaskets must be replaced with new gaskets.
3. If an Inspector approves the reuse of any fitting, hydrant, and/or valve, that unit must be examined and approved by the Inspector as well. Again, all gaskets must be replaced with new gaskets.
4. If an Inspector approves the reuse of any sewer ring and/or cover, that unit must be examined and approved by the Inspector as well. Any and all Ram-Nek or sealants must be removed and reapplied with new material.

1.10.7 Warranty and Acceptance

The Developer, or the Contractor on behalf of the Developer, shall warrant the constructed facilities for a period of twenty-four (24) months after conditional acceptance. Conditional Acceptance will be granted by the District when the following conditions have been met by the Developer to the satisfaction of the District:

- A. The entire Water System improvement has been constructed, pressure tested, disinfected, flushed, and the required number of negative standard bacteriological water tests results have been received from the laboratory.
- B. The entire Wastewater System improvement has been constructed, pressure tested, vacuum tested, jet cleaned, and TV'd. The District can perform this work at an expense to the Contractor.

- C. All necessary approvals of design on construction, contracts, and agreements have been fully executed and delivered to the District. It should be noted that if lines are in future rights-of-ways which are not yet recorded, the Owner/Developer must grant an easement to the District for operation and maintenance prior to either conditional acceptance or final acceptance, in accordance with the District's Rules and Regulations. Platting can occur over said easements.
- D. The project statement and certification of costs, and bill of sale, are submitted in tabular form listing pipe sizes, footage for different sizes, and appurtenances with quantity, and are presented to the District.
- E. Record drawings have been presented to the District, in printed hard copy and AutoCAD and PDF files on CD.
- F. During the warranty period, the Developer, or Contractor on behalf of the Developer, shall repair or correct all deficiencies which become known in a timely manner when notified by the District.
- G. Final acceptance by the District will be by letter at the end of the warranty period, provided deficiencies have been corrected or repaired in a manner satisfactory to the District.
- H. If a cost recovery or reimbursement agreement is applicable, it should be executed prior to final acceptance.

SECTION 2.0 – WATER SYSTEM DESIGN STANDARDS

2.1 General

2.1.1 Deviation from Standard

These design criteria shall be adhered to for all Water Main facilities to be installed within the District insofar as practical. If any deviation from these criteria is desired, a request must be submitted to the District in writing. See attached Deviation Request in Appendices.

The request will be evaluated and the decision of the District shall be adhered to for the design of the project.

2.1.2 Easements

All public Water Mains and appurtenances not installed in public rights-of-way shall be installed in easements, in accordance with the District's Rules and Regulations. The minimum width of an easement shall be twenty feet (20'). The Water Main shall not be closer than five feet (5') to the edge of the easement.

Depending on depth, size, and nature of water facilities, more easement width may be required.

Easements must be conveyed to the District pursuant to the District's form of easement.

2.1.3 Colorado Department of Health Regulations

It is not intended that any regulations promulgated by the Colorado Department of Health pertaining to public water systems be annulled by these design criteria. When the Department of Health regulations are more stringent, they shall take precedence.

2.2 Hydraulics

2.2.1 Sizing of Water Mains

All Water Mains shall be sized in accordance with the following:

- A. Flow velocity shall not exceed two feet (2') per second on a peak demand day.
- B. Flow velocity shall not exceed five feet (5') per second on a peak demand day during fire flow conditions. Fire flow requirements shall be determined by the Fire Protection District and submitted to the District in writing.
- C. Minimum design pressure shall be thirty-five (35) PSI. Maximum design pressure shall be one hundred and twenty (120) PSI for all flow and static conditions.
- D. Minimum diameter of Water Mains is eight inches (8") wherever fire hydrants are connected. Smaller lines may be accepted only where no fire hydrants are located upon approval by the District Engineer.

2.2.2 Sizing of Services

Service Lines, taps, and meters shall be sized in accordance with AWWA manual (M22), Sizing Water Service Lines and Meters. The standard size for a single-family residence is one-inch (1") polyethylene line with a 5/8-inch meter and meter setting. One-inch (1") HDPE is comparable to a 3/4-inch copper Service Line, although only CTS HDPE Blue Service Lines will be used.

2.3 Water Mains

2.3.1 Locations

- A. Water Mains shall generally be installed ten feet (10') east of center line in north-south streets, and ten feet (10') north of center line in east-west streets. The foregoing shall be adhered to insofar as practical on curved streets. Where curbed medians are proposed, the Water Main shall be under the pavement, no closer than five feet (5') to the edge of concrete curb and/or gutter.
- B. Any request for deviation from the above shall be noted in the design request submittal to the District Engineer, including where public Water Mains are proposed to be installed in easements.
- C. Water Mains shall be designed for a minimum of five feet and six inches (5'-6") and a maximum of six feet and six inches (6'-6") of cover, except where another utility causes a conflict, in which case the Water Main shall be lowered as necessary. For water distribution lines, lowerings of two feet (2') or less shall be accomplished by deflection if possible. Lowerings in excess of two feet (2') shall require a formal lowering with fittings.

2.3.2 Material

All water piping shall be C900 DR18 (unless otherwise noted). Certain instances may call for the use of other DR ratings or ductile iron pipe.

2.3.3 Corrosion Protection

Whenever metal pipe is proposed, the pipe shall be double bonded, poly wrapped, and cathodically protected. The drawing notes must include the required anode sizing and spacing. Where PVC pipe is used with Ductile Iron Fittings, those fittings must be individually wrapped and cathodically protected.

2.3.4 Profile

All proposed Water Main drawings shall include a profile view which also shows the proposed finished surface above the Water Main, and elevations and stations of all fittings shall be noted. Elevation of the pipe flow line shall be noted. Storm sewer shall be shown on all plans.

2.3.5 Looping

Dead-end Mains are discouraged. Looping shall be designed in the project proposed and a provision will be made for looping as the Mains are extended for adjacent projects. A minimum number of ten (10) taps are allowed on dead-end Mains. A maximum length of 1,000 feet is permitted on dead-end Mains where looping cannot be accomplished.

2.4 Valves

2.4.1 Location

- A. Valves shall be placed at locations so as to least disrupt service should it be necessary to close a valve.
- B. In general, five hundred feet (500') shall be the maximum spacing on Distribution Mains. However, in distribution areas, valves should be clustered at intersections and block lengths should be taken into account. Depending on line size, and nature of land use, valve spacing on transmission lines may vary from 1,000 feet up to 2,500 feet. "Pup" sections from fittings to valves shall be 30 inches long, minimum. All crosses shall have four (4) valves and all tees three (3) valves.

- C. A valve shall always be provided where a Main will be extended in the future to facilitate connecting to the existing Main without disrupting service. There shall be a twenty-foot (20') stub past the valve to facilitate ease of connection.
- D. Additional valves may be required at major stream or roadway crossings to isolate the crossing.
- E. Wherever a Water Main is installed in an easement, a valve may be required at each right-of-way line that intersects the Water Main.

2.5 Appurtenances

2.5.1 Blow-off Valves

Blow-off valves shall be provided at all dead ends that do not have a fire hydrant at the end of the Main.

2.5.2 Air-Release Valves

Air-release valves in manholes shall be provided at all high points along transmission lines where services aren't present.

2.5.3 Pressure-Reducing and Regulating Valves

Pressure-reducing and regulating valves in concrete vaults shall be provided as necessary to control the pressure within the allowable range.

2.5.4 Fire Hydrants

The location of fire hydrants shall be as approved by the controlling fire protection agency. Fire authority signature is required on water plans. A fire hydrant may serve as a blow-off valve on a dead-end main if said main is 8 inches or greater.

2.6 Separation from Pollution Sources

In general, Water Mains shall be designed to have ten feet (10') horizontal separation from possible sources of pollution. When the horizontal separation is not achievable, then the Water Main shall be designed so that the bottom of the Water Main is two feet (24") above the top of any sewer pipe. When two feet (2') of vertical separation cannot be achieved, then the Water Main will be constructed in twenty-foot (20') sections of ductile iron with no joints on the sewer pipe. The twenty-foot (20') section shall be centered above the sewer pipe with ten feet (10') to each joint. When separation cannot be achieved, casing may be used upon written request to the District Engineer for consideration.

The foregoing separation provision applies to fire hydrants as well as to Water Mains.

2.7 Casing

Where required by a highway authority or private utility, casing pipe for the Water Main shall be installed for the crossing as directed by the highway authority or private utility. Valves may be required near or on each side of the casing.

2.8 Fire Lines

Private fire lines and fire sprinkler system connections shall be provided with backflow preventers and check valves to preclude reverse flow into the distribution system, which could cause contamination of the system.

Fire lines and fire sprinkler systems containing antifreeze (propylene glycol) must be equipped with an approved reduced-pressure zone (RPZ) valve for cross-connection control (CCC).

2.9 Water Main Crossings

2.9.1 Asbestos Cement Water Main

In general, regarding any new excavation under an existing asbestos cement Water Main, the asbestos cement Main in question will be replaced with the same size, poly wrapped, class 52 DIP or PVC pipe coupled at each end with a Romac coupling or approved equal. The new replacement line will be installed from undisturbed bank to undisturbed bank and properly compacted. The same size valves will be installed on both ends, at the District's discretion. The Contractor responsible for the excavation will supply all labor and materials and shall be responsible for the disposal of the asbestos cement pipe being replaced.

2.9.2 Irrigation Ditch Crossings

In general, any excavation through an existing irrigation ditch will require written permission from the ditch owner. Clay dams and/or other designs may be required to assure against leaking or “piping” within the ditch bank.

2.9.3 Final Inspection

The crossing will be given a final inspection by the District before backfilling. Contractors will also give the District a two (2) year written warranty for work performed in accordance with the District's Rules and Regulations.

SECTION 3.0 – WATER SYSTEM INSTALLATION STANDARDS

3.1 General Construction

3.1.1 Start of Construction

Contractors shall not begin construction of public Mains without an approved plan and a preconstruction meeting. Construction of water services or extension shall not proceed without obtaining approval of the Water Operations Manager. Backfilling of water services shall not be initiated until the installation has been inspected and approved by the Inspector.

3.1.2 Protection of Existing Underground Facilities

It shall be the responsibility of the Contractor to verify the existence and location of all underground facilities along the route of work. The omission or the inclusion of facility locations on the plans is not to be considered as the nonexistence of or a definite location of existing underground facilities.

Whenever, in the opinion of the District, it is necessary to explore and excavate to determine the location of underground utilities and structures which may interfere with construction, the Contractor shall make the exploration and excavations for such purpose.

The Contractor will take the necessary precautions to protect existing facilities from damage due to his operations. All damage to the facilities will be repaired at the Contractor's expense, and all claims for disruption will be settled by the Contractor at his expense.

3.1.3 Detours – Traffic Control

Traffic control, signing, detours, and utilization of existing streets require approval by the controlling right-of-way authority. Contractors and/or Developers must obtain adequate permitting and approvals from the controlling agency.

3.2 Excavation

3.2.1 Safety

The disturbed area due to construction shall be confined within the construction limits as required in the specifications or as shown on the plan. The length of trench to be opened at one time may be limited when, in the opinion of the Inspector, such limitation is necessary. The amount of open or unfilled trench shall not exceed five hundred linear feet (500'), unless ordered by the Inspector. Failure to comply with this requirement shall be cause for shut down of the entire project until such backfilling is accomplished.

The sides of the trench shall be sloped or braced and the trench drained so that workmen can work safely and efficiently. All work must be done in a dry trench and no water will be permitted to discharge down the pipe previously laid. The discharge from groundwater pumps shall be laid to the approved natural drainage channel(s) or storm sewer. All OSHA regulations pertaining to trenching must be followed.

In all cases where the Water Main alignment is located so that space and access is very limited with respect to the safety and welfare of adjoining buildings, such as property lines between houses, the Contractor shall discontinue open trench excavation and shall jack and/or auger a liner pipe in place for an adequate length to safeguard against settlement and damage to these adjacent structures. All jacking methods and materials must be approved by the Inspector. Sheet piling and bracing as later described may be approved by the Inspector as an alternative.

Pits of adequate size to accommodate necessary equipment shall be excavated, braced, and drained so that workers can work safely and efficiently.

3.2.2 Construction Stakes

All work shall be constructed in accordance with lines and grades shown on the approved drawings and as established by the Engineer. These lines and grades may be modified by the Consulting Engineer only after approval by the Water Operations Manager and/or District Engineer.

The Contractor shall give the Consulting Engineer sufficient notice of his need for the establishment of line and grade so that the Consulting Engineer may have time to provide the same. The Consulting Engineer shall set all vault and manhole rim stakes at the finished-street-grade elevation. After lines and grades for any part of the work have been given by the Consulting Engineer, the Contractor will be held responsible for the proper execution of the work to such lines and grades, and all stakes or other marks given shall be protected and preserved by him until he is authorized by the Inspector to remove them. The Contractor shall, at his own expense, correct any mistakes which may be caused by their unauthorized disturbance or removal. The Inspector may require that work be suspended at any time when, for any reason, such marks cannot be properly followed.

Line and grade stakes shall be set for each fitting and grade point shown on the drawings and at intervals necessary to maintain the pipe slope when so indicated on the drawings.

The method and equipment used to establish and check line and grade of the pipe shall be approved by the Inspector prior to the start of work.

3.2.3 Trench Width

The trench width at the top of the excavation may vary depending upon the depth of the trench and the nature of material encountered. However, the maximum allowable width of trench is defined in the attached detailed drawings.

For trench widths greater than specified above, the Contractor may propose alternate strength-of-pipe to depth-of-cover relationships other than those specified. Such proposals must be submitted to the District Engineer for approval in writing and with pertinent pipe strength and soil weight data at least fourteen (14) days prior to the desired construction date. The trench bottom shall be brought to grade to provide a uniform and continuous bearing, as well as support for the pipe on solid and undisturbed ground at every point between bell holes.

3.2.4 Overexcavation

Care must be taken to avoid overexcavation. Should any overexcavation exceeding two inches (2") be encountered, the material added shall be moistened and compacted to the satisfaction of the Inspector, or granular material placed with hand tools.

If, when dry, the bottom at subgrade is soft and, in the opinion of the Inspector, cannot support the pipe, a further depth shall be excavated as directed by the Inspector and refilled to pipe bedding grade as required under the above paragraphs, or other approved methods shall be adopted to ensure a firm foundation for the pipe. The class or type of material which is to be used for refilling up to pipe grade shall be foundation material consisting of squeegee or bedding material as defined herein. In the case of rock excavation, the excavation shall be carried to a minimum depth of six inches (6") below grade. This material will be removed and the trench backfilled with granular material to give a suitable subgrade.

All excavated material shall be piled within the construction limits or in a location obtained by the Contractor in a manner which will not endanger the work and will avoid obstructing

sidewalks, driveways, and fire hydrants. Gutters shall be kept clear or other satisfactory provisions made for street drainage at all times.

3.2.5 Blasting

Blasting will be permitted for portions of the work which may be expedited thereby, provided that a written permit is given by the municipal authority having jurisdiction. The Inspector shall have the right to limit the use of explosives or to order the discontinuance of any blasting methods which, in his opinion, endanger any part of any public or private property, the safety of inhabitants of the area, or the traveling public.

The Contractor shall enlist the services of a professional explosives Engineer. In addition to other insurance requirements, Contractor shall provide the District with sufficient blasting insurance as may be directed by the District.

All blasting shall be in accordance with the Explosive Statutes of Colorado. In addition to other insurance requirements, Contractor shall provide the District with sufficient blasting liability insurance as may be directed by the District.

Blasting shall be performed in such a manner that no damage will result to any building, structure, pipeline, or facility on or off the site of the work, or above or below ground line. Any damage caused as a result of blasting shall be repaired to the satisfaction of the property owner and the District at the Contractor's expense.

3.2.6 Sheeting and Bracing

The Contractor, to confine his work within the construction limits and to prevent the disturbing or settlement of adjacent road surfaces, foundations, structures, utility lines, or railroad tracks, shall furnish and place all sheeting and bracing necessary for safe conditions and to prevent damage and delay to the work. The Contractor shall be responsible for the strength and sufficiency of all sheeting and bracing.

Any damage to the work or to adjacent structures or property caused by settlement water or earth pressures, slides, cave-ins, or other reasons due to failure or lack of sheeting and bracing or improper bracing, or through negligence or fault of the Contractor in any manner shall be repaired by the Contractor at his expense without delay.

If, in the opinion of the Inspector, the sheeting and bracing at any point is deemed to be inadequate or improperly constructed, he may require additional sheeting and bracing be placed at the Contractor's expense. This shall not be construed to relieve the Contractor of sole responsibility of jobsite supervision.

Bracing shall be arranged so as to provide ample working space so as not to interfere with the work, and so as not place any strain on the structures being constructed, until such structures are, in the opinion of the Inspector, of sufficient strength to withstand such strain. No sheeting and bracing shall be removed until the construction has proceeded far enough to provide ample strength for its safe removal.

Sheeting or bracing may be left in place in the trench at the discretion of the Contractor. Any sheeting or bracing left in place shall lie approximately ten feet (10') from the surface and the cutoff portion removed, unless the Inspector gives permission to leave it in place.

3.3 Pipe Bedding and Laying

It is expected that the trench excavation will provide suitable bedding and backfill material. Wet, soft, or frozen material; asphalt and concrete chunks; cinder ashes, refuse, vegetable, or organic material; or boulders, rocks, or other deleterious substances shall not be used for bedding or backfill.

If the excavated material is not suitable for bedding or backfill as determined by the Inspector, suitable material shall be hauled in and utilized, and the rejected material hauled away and disposed.

If native material is not suitable for bedding, six inches (6") of squeegee sand shall be placed on the trench bottom for support under the pipe and compacted. Bell holes shall be dug deep enough to provide a minimum of two inches (2") of clearance between the bell and bedding material.

All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, the bedding material (squeegee sand) shall be carefully placed and tamped under the haunches of the pipe and in the previously-dug bell holes.

"Tamping" is herein defined as the act of placing approved bedding material under the haunches of pipe, paying particular attention to voids, bell holes, and sling holes. The purpose of tamping is to ensure uniform support for the pipe.

A. Pipes

Unless select bedding material is required, all pipelines shall be bedded by hand, from the bottom of the trench to the centerline of the pipe with sand, gravel, or other approved material placed in layers of three inches (3") and compacted. Bedding material shall be deposited in the trench for its full width on each side of the pipe, fittings, and appurtenances simultaneously.

The pipe shall be bedded by approved mechanical methods from the centerline of the pipe, fittings, and appurtenances to a depth of twelve inches (12") above the top of the pipe. Special care shall be used in placing this portion of bedding so as to avoid disturbing the pipe.

PVC pipe shall be installed in accordance with ASTM D2321 and the Manufacturer's recommendations, unless otherwise specified herein.

DIP pipe shall be installed in accordance with AWWA C600 and the Manufacturer's recommendations, unless otherwise specified herein.

The trench shall be backfilled by approved mechanical methods from twelve inches (12") above the pipe to the grade shown on the plans or specified herein.

All main lines (PVC and ductile iron) shall be installed with coated #12 tracer wire with test stations at intervals no greater than five hundred feet (500').

Valve boxes can be used at intersections and Service Stubs.

Install split-bolt housing to protect split-bolt wire nut and tracer wire in buried applications. Housing shall be made of high-impact polypropylene and be filled with a dielectric silicone gel.

- Max. Voltage: 50V
- Wire Range: #14-10 Steel Core Tracer Wire
- Split-bolt size not to exceed 1.0" tall by 0.8" wide by 0.7" deep
- Wrap all tracer wire split-bolt connectors or exposed wire using *linerless rubber splicing tape*, making sure to seal all ends to prevent moisture penetration.

B. Structures

Backfill and fill within three feet (3') adjacent to all structures and for full height of the walls shall be selected non-swelling material. It shall be relatively impervious, well graded, and free from stones larger than three inches (3"). Material may be job excavated, but selectivity will be required.

No backfilling will be allowed in freezing weather except by permission of the District. No additional backfill will be allowed over any frozen material already in the trench.

3.3.1 Select Bedding Material

When indicated on the plans or drawings or when, in the opinion of the Inspector, select bedding material is required, preparation and installation shall be as follows:

A. Installation of Bedding and Pipe

After completion of the trench excavation and proper preparation of the foundation, six inches (6") of bedding material shall be placed on the trench bottom for support under the pipe and compacted. Bell holes shall be dug deep enough to provide a minimum of two inches (2") of clearance between the bell and bedding material.

All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade, and the joint is made, the bedding material shall be carefully placed and tamped under the haunches of the pipe and in the previously-dug bell holes.

If approved by the District, fines from the trench wall and soil pile may be used to provide uniform support for the pipe. No rock or stone larger than allowed by the sieve analysis, or any other detrimental substance, shall be placed closer to the pipe than six inches (6"). The District reserves the right to require the use of select bedding material at any time.

For ductile iron and polyvinyl chloride pipe, the limits of bedding shall be from six inches (6") below the bottom of the pipe to twelve inches (12") above the top of the pipe.

B. Bedding Material

The bedding material shall be a clean squeegee sand, free of corrosive properties, and shall conform to the following gradation limits when tested by means of laboratory sieves:

Squeegee Sand

Sieve Size	Total Percent Passing by Weight
3/8 inch	100
No. 200	0 – 5

C. Foundation Material

Foundation material shall be uniformly graded, washed rock conforming to the following sieve analysis. A minimum of twelve inches (12") of foundation material shall be placed below the pipe to the trench bottom.

Foundation Material

Sieve Size	Total Percent Passing by Weight
2 inch	95 – 100
1/2 inch	10 – 30
#4	0 – 5

D. Flowable Fill

At the District's option and on a case-by-case basis, utility trench backfill meeting the requirements in the table below may be used in lieu of native backfilling in any excavation

regardless of width or depth. Concrete-slurry type, full-depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

Flowable Fill

Ingredient	lbs/cubic yard
Cement	42 (0.47 sack)
Water	325 (43 gallons or as needed)
Coarse Aggregate (Size # 57)	1,700
Sand (ASTM C-33)	1,845

3.3.2 Laying of Pipe

Proper implements, tools, and facilities satisfactory to the Inspector shall be provided and used by the Contractor for the safe and convenient execution of the work.

Pipe materials shall be unloaded and distributed on the job in a manner approved by the Inspector. In no case shall materials be thrown or dumped from the truck.

Before lowering and while suspended, the pipe shall be inspected for defects to detect any cracks. Any defective, damaged, or unsound pipe shall be rejected and removed from the job site.

All foreign matter or dirt shall be removed from the inside of the pipe before it is lowered into its position in the trench, and it shall be kept clean by approved means, as determined by the Inspector, during and after laying. All openings along the line of Water Main shall be securely closed as directed, and in the suspension of work at any time, suitable plugs shall be placed to prevent earth or other substances from entering the pipe.

Pipes shall be laid to a true line and at uniform rates of grade between grade points as shown on the plans. Fine grading, to the bottom of the trench, shall proceed ahead of the pipe laying. Overexcavation for a stable trench shall be six (6) inches with backfill consisting of pea gravel or select import bedding. Overexcavation for a stable trench on long transmission lines shall be 12 inches with backfill consisting of pea gravel, select import bedding, or native soil if deemed acceptable by the geotechnical report. Caution tape shall be installed three (3) feet above pipe.

Bell holes shall be provided for the pipe bells. The pipe shall be supported along its bottom as required by these Specifications and throughout its length except for the minimum distance necessary at the bell holes. Bell holes shall be adequate to make the joint, but no larger than necessary so that maximum support will be provided for the pipe. The remainder of the pipe shall be surrounded as required by the appropriate bedding shovel placed and hand tamped, to fill completely all spaces under and adjacent to the pipe.

No pipe shall be laid in water or when trench conditions are unsuitable for such work.

When connecting to existing Water Mains, the Contractor shall take every precaution necessary to prevent dirt or debris from entering the existing lines. The Inspector may stop work if adequate protection is not being provided from groundwater, or other debris which might enter the pipeline.

When the design of a waterline indicates laying the pipeline on a radius, it may be accomplished in only one of two ways.

- A. With smaller diameter PVC pipe, the line can actually be laid along a radius using the natural bending properties of the pipe, as long as the radius conforms to the Manufacturer's recommendations.
- B. When laying DIP, the deflection in any bell/spigot cannot exceed the deflections allowed herein.

MJ straight couplings may be used by the Contractor to lay a pipeline to a certain radius using the deflections allowed herein.

Bend fittings should be used only where shown on the drawings or as approved by the Inspector.

High deflection PVC couplings are not allowed.

3.3.3 Length of Pipe

The length of pipes for curvilinear Water Mains shall be determined by the radius using joint deflection not exceeding the Manufacturer's recommendations. See also "Laying of Pipe."

3.3.4 Fittings

Fittings shall be installed where shown on the plans. Pipes shall be cut as necessary to install fittings at the proper locations. Fittings shall be provided with restraint and/or thrust blocking as necessary per these Specifications. Fittings shall be supported by a minimum of six inches (6") of granular bedding (which can be native sand if deemed suitable) extending to the spring line of the pipe, and a minimum of eighteen inches (18") from the centerline of each fitting. Fittings may be supported by native sand, if suitable. Blocking is not permitted.

3.3.5 Service Connections

No Service Lines shall be installed until front property corners have been located. Service Lines for each property shall be a minimum of five feet (5') off of the property pin and on the opposite side of the driveway.

Length of Service Line from the Main to the house will be limited as follows:

1"	125'
1-1/2"	175'

Lengths greater than one hundred and seventy-five feet (175') need an Engineer's design for sizing. The design must be submitted in writing to the District Engineer for approval.

All service connections to Mains shall be made in the top one-half (1/2) of the pipe. Tapping of Mains for service connections shall only be accomplished with the use of an approved tapping machine and tapping saddle; **Romac 202 BS Tap saddle, or approved equal.**

3.4 Backfill and Compaction

No backfilling will be allowed until the pipe installed conforms to the specified requirements.

Accepted on-site bedding or granular material shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench to a height of six inches (6") above the crown of the pipe. Accepted on-site bedding or granular material shall be shovel placed and hand tamped to fill completely all spaces under and adjacent to the pipe.

All backfill shall be compacted to a minimum of ninety-five percent (95%) of standard proctor density at optimum moisture, ASTM D-1557, by tamping or other means approved by the Inspector. If the controlling right-of-way authority requires a greater compaction requirement, the requirement of the controlling right-of-way authority shall control. Tests shall be conducted on compacted materials as directed by the Inspector and/or right-of-way authority. Jetting, puddling, or ponding

will not be used except where approved by the District. Sufficient cover over the pipeline will be hand tamped to prevent flotation of the pipe.

Backfill for Water Main trenches shall be suitable earth, free from rocks over three inches (3") in diameter, large roots, and excessive sod or other vegetation.

Backfilling and compacting shall be done as thoroughly as possible so as to prevent settlement. Depositing of the backfill shall be done so the impact of falling material will not injure the pipe or structures. Grading over and around all parts of the work shall be done as directed by the Inspector.

Backfilling shall be done in lifts of uniform layers not to exceed the depth shown in the compaction chart and each lift shall be completely compacted over the full width of the excavated area.

Compacting shall continue until the specified relative compaction has been attained. Three feet (3') of material over the top of the pipe shall be required before a vibratory or sheepsfoot roller is operated over the pipe.

Compaction Chart

<u>Compaction Type</u>	<u>Maximum Loose Soil Lift Height (ft)</u>	
	<u>Sands</u>	<u>Plastic Soil</u>
Vibratory Roller (Vibro-Plus CK-10) or approved equal	4.0	Not allowed
Sheepsfoot (150 PSI Minimum)	Not allowed	2.0
Vibratory Sheepsfoot (Essick Vf-54T) or approved equal	4.0	2.0
Button Head Pneumatic	0.5	0.5
Plate Temper	1.0	1.0
Plate Vibrator	1.0	Not allowed

Succeeding layers of backfill may contain coarse materials but shall be free from large pieces of rock, frozen material, concrete, roots, stumps, tin cans, rubbish, and other similar articles whose presence in the backfill, in the opinion of the Inspector, would cause settlement of the trench or damage to the pipe. No stone larger than six inches (6") in diameter shall be placed within three feet (3') of the pipe.

Wherever select material exists in place in the upper four feet (4') of the finished grade of the paved or traveled portions of the street or roadway, is removed by the trench excavation, the Contractor shall replace said material (or material of equal quality) as backfill in the upper four feet (4') of the finished grade. Where select material does not exist in place as described above, the material available from other excavations on the project may be used.

Special compaction shall be done around all valve boxes and vaults, manholes, curb boxes, water services, other structures, and utilities by the use of pneumatic tampers, plate tampers, or plate vibrators with lifts not to exceed those shown in the compaction chart.

Water service trenches must be compacted in the same manner as Water Main trenches. All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified

or shown in the plans. Backfill shall begin as soon as practical after the pipe has been placed and shall thereafter be carried on as rapidly as the protection of the balance of the work shall permit.

Compaction tests at the expense of the Contractor shall be conducted by an independent testing laboratory to a depth not greater than two feet (2') above the pipe. One test shall be conducted for each run or every four hundred feet (400'), whichever is greater, or as required by the controlling authority. Copies of each compaction test report will be given to the Inspector and the District prior to approval.

3.5 Valve Installation

3.5.1 Valves

Valves shall be handled in such a manner as to prevent any injury or damage. All joints shall be thoroughly cleaned before installation.

Valves shall be located at the points on the Mains as indicated on standard drawings, unless specified otherwise by the District Engineer.

Valves shall be set and joined to the pipe in the same manner as laying and joining mechanical joint pipe.

Valves shall be set in such a manner that the valve stems are plumb. Valves shall be supported by a minimum of six inches (6") of granular bedding (which can be native sand if deemed suitable) extending to the spring line of the pipe, and a minimum of eighteen inches (18") from the centerline of each fitting. Valves may be supported by native sand, if suitable. Blocking is not permitted.

3.5.2 Valve Boxes

A valve box shall be provided for every valve. Valve boxes shall be 6850 heavy-duty valve box, slip-type, or approved equal. It shall not transmit shock or stress to the valve, and shall be centered and plumb over the operating nut of the valve, with the top of the box set to the required elevation. It will be the responsibility of the Developer or his Contractor to ensure that valve boxes are plumb and brought to the proper elevation. Tracer wire shall be ran along the outside of the valve box until the uppermost section where it will be run inside the valve box.

Paving of any street requires that all existing valve boxes be located and prepared for final raising to finish street surfaces as shown on the standard drawings. Prior to paving, a final inspection is required. Inspections should be requested twenty-four (24) hours in advance.

Mud plugs must be installed in all valve boxes.

3.6 Fire Hydrant Installation

3.6.1 Installation

All hydrants shall be staked for location and grade. Final location and grade shall be in accordance with the approved drawings. All hydrants shall stand plumb and be installed as indicated on standard drawing. Each hydrant shall be connected to the Main by a six-inch (6") branch line. An independent six-inch (6") gate valve shall be installed on each fire hydrant branch. No Service Line connections shall be installed between the fire hydrant and the fire hydrant control valve. Tracer wire shall be extended from the Main to the lateral.

3.6.2 Anchorage

The bowl of each hydrant shall be well braced against the unexcavated earth at the end of the trench with a concrete thrust block. The bottom of the hydrant bowl and the hydrant valve shall be supported with an eighteen by eighteen by four-inch (18" by 18" by 4") precast concrete

blocking slabs. Anchor tees shall be used on all new installations, and stainless steel tapping saddles with valves shall be used to install hydrants on existing installations.

Whenever a fire hydrant is installed at the termination point of a Main extension (such as in a cul-de-sac), tie rods and concrete reverse anchors will be required for both the fire hydrant valve (which in this case is also a line valve on the Main) and the fire hydrant lateral or branch line connected to the fire hydrant. See standard drawing. Additional concrete anchors may be required at the direction of the Inspector.

If bends are needed to bring a hydrant to a desired horizontal or vertical position, special concrete reverse anchors, anchor pipe, and/or all-thread tie-back rods (or a combination of all of these) along with a riser may be required. In any case, a riser may be required which is no longer than two feet (2').

It will be the Contractor's responsibility to set the safety flange at the proper grade.

The hydrant valve will be fitted with a "Mega Lug" or "One Bolt" fitting. Reverse anchors and all-thread will no longer be used, except in such cases as the Inspector deems necessary.

3.6.3 Drainage

Wherever a hydrant is set, drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench to at least twelve inches (12") above the barrel flange of the hydrant, and to a minimum distance of twelve inches (12") around the elbow.

The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be six inches (6"). The minimum amount of rock placed shall be one-third (1/3) of a cubic yard, and shall be a well-graded gravel cobble or crushed rock free of dirt. The rock shall be surrounded on all sides by a permeable Mirafi fabric to prevent the migration of soil into the drain rock area.

3.6.4 Hydrant Protection in Corrosive Soils

All ductile iron branch lines and hydrants shall be protected. All pipe, rods, and fittings, from finished ground level on the hydrant barrel up to and including the tee, shall be encased in poly wrap. The type of polyethylene and manner in which it is to be installed shall conform to these Specifications. Bedding material shall be as specified in these Specifications. All fire hydrants shall be cathodically protected with a 17-lb. anode.

3.7 Blow-off Installation

All dead ends on new Mains shall be closed with cast-iron plugs or caps. Such dead ends shall be equipped with suitable concrete anchors and blow-off facilities.

The Contractor shall furnish, install, or remove temporary blow-offs at locations shown on the drawings or designated by the District. See standard drawing. The Contractor shall install permanent blow-offs where indicated on the drawings. A permanent blow-off is defined as one which will be left in place at the completion of all proposed installations. Refer to standard drawing.

3.8 Air-Release Valve Installation

Combination air-relief-vacuum breaker valves shall be installed at all high points on twelve-inch (12") and larger Water Mains. The valves shall be installed in forty-eight-inch (48") diameter concrete manholes with manhole rings and covers as shown in the standard drawings. The valves shall be tapped into the top of the Water Main with a one-inch (1") tap.

The pipe stem between the Water Main and the air-release valve shall contain a gate valve to isolate the air-release valve for maintenance purposes. Pipe and fittings shall be threaded galvanized iron, standard weight; gate valve shall be bronze and have hand wheel.

3.9 Pressure-Reducing Valve Installation

Pressure-reducing and regulating valves shall be installed where directed by the District Engineer. The valve, piping, and appurtenances shall be installed in reinforced concrete vaults with access cover in the roof. The access cover shall be set to proposed final surface elevation and shall be adjusted for paving, if necessary. All piping shall be supported within the vault to permit removal of components for servicing.

3.10 Disinfection

Pipe extensions shall be chlorinated in accordance with AWWA Standard C651, "Disinfecting Water Mains", prior to being put into service. The chlorination of the finished pipeline shall be done prior to installation of any service taps. Before filling the pipe with water, the pipe shall be clean and free of debris to the satisfaction of the Inspector. Disinfection by chlorination of the pipe shall be performed prior to the District's acceptance. The chlorinating agent and method of application shall be approved by the District Engineer in accordance with AWWA Standard C651. The Contractor shall provide material for disinfection of Water Mains. Granular calcium hypochlorite must be used for disinfection.

After the calcium hypochlorite has been placed in the pipeline by the Contractor, disinfection must be completed within ten (10) calendar days. Should disinfection not be completed within this period, the District will void this method of chlorination and require that the Main be disinfected by mobile gas chlorinator, or slug method, at the expense of the Contractor.

After the pipe is filled with water and chlorine at less than one foot/second (1 FPS), and unless approved otherwise by the Inspector, the chlorinated water shall be held in contact with the pipe for twenty-four (24) hours. At the end of the twenty-four (24) hour period, the water in the pipeline shall be tested by the Inspector to ensure a residual chlorine content of not less than fifty (50) mg/l. The pipeline shall then be thoroughly flushed to remove the heavily chlorinated water. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Samples of water shall be collected for bacteriological examination and residual chlorine content testing before the pipe is put into service. Testing of bacteriological evaluation and sampling shall be performed by a District employee.

A new Main will be released for the tapping of services when disinfection has been completed, bacteriological testing has been done, it is acceptable to the Water Operations Manager, and the Main has been flushed and charged.

3.11 Hydrostatic Testing

3.11.1 General

No hydrostatic tests shall be made on any portion of the pipeline until field-placed concrete has had adequate curing time.

The Inspector shall be notified twenty-four (24) hours in advance of testing. **All testing shall be made in the presence of the Inspector.**

Only the following methods are acceptable for supplying potable water for hydrostatic testing:

- a. Water may be taken from a nearby pressurized water source which has been previously chlorinated, tested, and accepted, such as a fire hydrant.
- b. Water may be delivered to the site in a chlorinated water tank having a minimum capacity of three hundred (300) gallons. The water tank shall be used exclusively for the transportation of potable water.
- c. Any previously tested, chlorinated, and accepted Water Main which is pressurized and is to serve the new Main extension may be tapped on the pressurized side of the closed valve.

In any event, the method of supplying water as well as the source of water for hydrostatic testing shall be as approved by the Inspector. Use of barrels, sanitary or otherwise, to supply water for hydrostatic testing is strictly prohibited.

All Water Mains shall be hydrostatically tested in the field to a minimum pressure of two hundred (200) PSI **for no less than two (2) hours.**

3.11.2 Procedure

The pipeline shall be properly backfilled and shall be in a state of readiness for testing. All bulkheads, pumps, taps, and appurtenances necessary to fill the pipeline and maintain the required pressure shall be in place. The pipeline shall be filled with water and the test pressure shall be applied to the pipeline by means of a continuously-operating pump equipped with a bypass valve for regulating pressure. When filling the pipeline, it shall be filled at a rate which will not cause any surges, nor will it exceed the rate at which the air can be released.

All air in the line shall be properly purged. Fire hydrants are preferred for purging air in lines. Where blow-offs or hydrants are not available or are not effective in purging air from the line, the Inspector shall require a tap (at the Contractor's expense) to purge the line. The location and size of tap shall be at the Inspector's discretion.

Upon achieving test pressure, the pressurizing pump shall be turned off and disconnected from the pipeline.

While the test pressure is maintained, an examination shall be made of the pipeline in general, and any leaks shall be repaired. Any pipe or fitting found to be faulty shall be removed and replaced. No leakage is allowed through the bonnet of the line valve. Any valve leaking through the bonnet shall be repaired in place or removed and replaced. Cutting and replacing pavement, excavating, and backfilling may all be necessary parts of locating and repairing leaks discovered by pressure testing of pipe.

Tests shall be conducted with fire hydrant valves open and the hydrants shut off. After all visible leaks have been stopped, the full test pressure shall be maintained for two (2) continuous hours.

3.11.3 Allowable Leakage

At completion of the test, the pipeline shall be returned to exactly 200 PSI internal pressure and the amount of water metered into the pipeline. At the discretion of the Inspector, a leakage test is not required for water pipe sections less than twelve inches (12") or less than 200 feet in length. The method of metering shall be a volumetric measurement taken from a tank no greater than fifty-five (55) gallons. Under no conditions shall an excess of five (5) PSI be lost during the two-hour test. Allowable leakage (that amount used to refill the pipeline) in gallons per hour per one thousand feet (1,000') of pipe for each section between line valves for mechanical joint or push-on joint pipe shall not exceed the following rates:

Avg. Test Pressure	Pipe Size – inches (Gallons)						
	4	6	8	12	16	20	24
PSI	4	6	8	12	16	20	24
250	0.47	0.71	0.95	1.42	1.90	2.37	2.85
225	0.45	0.68	0.90	1.35	1.80	2.25	2.70
200	0.43	0.64	0.85	1.28	1.70	2.12	2.55
175	0.40	0.59	0.80	1.19	1.59	1.98	2.38
150	0.37	0.55	0.74	1.10	1.47	1.84	2.21

If testing indicates a leakage rate in excess of the rates above, the pipeline will not be accepted. The pipeline shall be repaired, re-chlorinated, and retested as described in this section until all test requirements are met.

3.12 Water Meter Installation

3.12.1 General

- A. The acceptable location for five-eighths-of-an-inch (5/8") through one-inch (1") water meters shall be limited to the inside of a building, unless otherwise approved. Locations for one-and-one-half inch (1-1/2") or larger water meters shall be approved by the District prior to installation of the water meter loop.
- B. Water meter locations selected shall provide adequate protection against freezing.

3.12.2 Inside Water Meter Installations

- A. Inside residential water meter locations must be in the basement or other lowest level of the residence excluding the crawl space. A floor drain is to be located by the inside water meter unless otherwise approved by the District.
- B. Inside five-eighths-of-an-inch (5/8") through one-inch (1") water meter locations shall be such that the water meter is unobstructed on one side; i.e., easily accessible for reading or servicing with a minimum of eight inches (8") clearance around the remainder of the meter. Meter locations shall not require stooping or crawling to gain access to the meter.
- C. Inside five-eighths-of-an-inch (5/8") thru one-inch (1") water meter loop installations shall include an inlet and outlet valve, as shown on standard drawings. Inlet and outlet valves shall be full port, handle-operated ball valves which shall be installed to close in the clockwise direction.
- D. Plans for inside water meter loop (to include support) installations for one-and-one-half inch (1-1/2") and larger water meters shall be submitted to the District for approval prior to installation of the meter loop, and should be similar in design to the meter loop piping and support shown on standard drawings, except that the bypass piping may also be extended under or over the meter and that adequate meter loop support may require a different design.

3.12.3 Water Meter Pit Installations (Other than Residential)

- A. The location of the meter pit for three-quarters-of-an-inch (3/4") and one-inch (1") water meters will be located within an easement near the property line. If a problem arises on the location, the decision will be determined by the District.
- B. The only pit acceptable to the District for three-quarters-of-an-inch (3/4") meters is a PVC pit, or approved equal, twenty-four inches (24") inside diameter by approximately thirty-six inches (36") in height, with a composite lid, frost-proof cover. See standard drawing and the accompanying notes. For one-inch (1") meters, the acceptable pits are the standard size, except twenty-four inches (24") in diameter, thirty-six inches (36") in height, with a frost-proof cover. See standard drawings and accompanying notes. Regulators or sprinkling system devices are not acceptable in either the twenty-inch (20") or the twenty-four-inch (24") pit.
- C. The meter loop in the pit (one-inch (1") water meters) must be with a copper setter with an inlet valve only; Ford Series V-82. The copper setter will be installed so that the loop is seventeen inches (17") below the top of the meter pit lid. See standard drawings and accompanying general notes.

- D. The location of the meter pit for one-and-one-half inch (1-1/2") or larger water meters shall be approved in the field by the Inspector.
- E. Meter pits for water meters one-and-one-half inch (1-1/2") or larger must be enough to accommodate meter, meter bypass, all valves, and piping. See standard drawings and accompanying general notes.
- F. All pits housing a meter one-and-one-half inch (1-1/2") or larger will have a twelve-inch (12") wide metal ladder installed in the pit. Wooden ladders will not be accepted.
- G. Meter pits must have an approved ring and cover of sufficient size (twenty-five-and-one-half inches (25-1/2") minimum) opening for installation and removal of the meter.
- H. Meter loop (one-and-one-half inch (1-1/2") and two inches (2")) must sit on the floor of the pit, not on the riser. The maximum depth of the meter pit shall be five feet and six inches (5'-6"). The minimum depth of the pit shall be four feet and six inches (4'-6"). See standard drawings and accompanying general notes.
- I. Water meter loops one-and-one-half inch (1-1/2") and larger must have both inlet and outlet valves.
- J. Water meters one-and-one-half inch (1-1/2") and larger may be required to have a bypass around the meter of sufficient size to supply the property while the meter is being serviced. This requirement shall be at the discretion and direction of the District. Contact the District prior to construction of meter loops of this size. See standard drawings and accompanying general notes.
- K. When a bypass is allowed with a meter installation, the pressure-regulator valve shall not be bypassed.
- L. Plastic pipe between the Water Main and the curb stop shall be one-inch (1") Crestline CE Blue HDPE, SDR 9, two hundred (200) PSI with stainless steel stiffeners.

3.12.4 Combined Domestic and Fire Line Water Meters

- A. Only meters approved by the National Board of Fire Underwriters shall be installed in water lines providing both domestic and fire demands. Requests to install a fire line and/or meter in a water line are handled in the same manner as a water line extension.
- B. Unless otherwise approved by the District, combined domestic and fire line meters must be installed in a pit large enough to accommodate the meter, meter bypass, and all valves and piping, all in accordance with standard drawings and accompanying general notes.
- C. The location of the meter pit must be approved by the District in advance of construction.
- D. Meter pits must have an approved aluminum frame and aluminum locking lid of sufficient size (twenty-five-and-one-half inches (25-1/2") minimum) opening for installation and removal of the meter.
- E. The meter loop (three inches (3") through six inches (6")) must sit on the floor of the pit, not on the riser. The maximum depth of the meter pit (inside dimension) shall be eight feet (8'). The minimum depth of the meter pit (inside dimension) shall be seven feet (7'). See standard drawing and accompanying general notes. For meter loops eight inches (8") through ten inches (10"), refer to standard drawing.
- F. Water meter loops for combined domestic and fire line water meters must have both inlet and outlet valves.
- G. Water meters must have a bypass around the meter of sufficient size to supply the property while the meter is being serviced. See standard drawings.

SECTION 4.0 – WATER SYSTEM MATERIAL STANDARDS

4.1 Material Specifications – General

All materials incorporated into the construction of the Water System shall be new and of first-class quality. Used, damaged, sunburned, or imperfect materials will not be permitted and shall be removed from the job site by the Contractor when so directed by the Water Operations Manager, District Engineer, or Inspector.

The Contractor shall be responsible for storing material at the job site in a manner to prevent damage or contamination of the material. Security is the Contractor's responsibility. The District is not responsible for loss of material from the job site.

4.2 Pipe

4.2.1 Polyvinyl Chloride (PVC) Pipe

- A. All Water Mains shall be either C-900 PVC, DR18, DR14, ductile iron pipe, or HDPE 4710 DR-13.5 through DR-9. Material for pipelines in excess of twenty-four inches (24") in diameter must be approved by the District Engineer.
- B. Coated #12 tracer wire must be used.

4.2.2 Ductile Iron Pipe

- A. DIP may be used for waterline through thirty inches (30").
- B. Shall meet requirements of AWWA Standard C151.
- C. Pipe class shall be a minimum of C1 350 for all sizes, unless otherwise specified on the approved drawings.
- D. Joints shall be "push-on single gasket" type meeting requirements of AWWA Standard C111.
- E. Cement-mortar lining shall be provided meeting the requirements of AWWA Standard C104.
- F. If not delineated on the approved plans, all ductile iron pipe shall have cathodic protection using double No. 6 wire bonding with seventeen pound (17 lb.) anodes every four hundred feet (400') and nine pound (9 lb.) anodes on each fitting.
- G. Pipe shall be poly wrapped.

4.3 Fittings

Fittings for all pipe shall be cement-mortar-lined ductile meeting the requirements of AWWA Standards C104 and C110 and C153 for short body ductile iron and shall have nine pound (9 lb.) anodes on each fitting. **PVC fittings are not allowed.**

All fitting shall be restrained mechanical joint with blue through-bolts.

4.4 Valves

4.4.1 12-inch Diameter and Smaller – Gate Valves

- A. Valves shall conform to the latest revision of AWWA Standard C509/C515 covering resilient seated gate valves for water supply service.

- B. The sealing rubber shall be permanently bonded to the wedge per ASTM D429.
- C. Valves shall be supplied with O-ring seals at all pressure-retaining joints. No flat gaskets shall be allowed.
- D. The valves shall be non-rising stem (NRS) opening by turning left (counterclockwise) or right (clockwise) and provided with a 2" square operating nut or handwheel with the word "open" and an arrow to indicate the direction to open.
- E. Stems shall be cast copper alloy with integral collars in full compliance with AWWA. All stems shall operate with copper alloy stem nuts independent of wedge and of stem (in NRS valves).
- F. Stems shall have two (2) O-rings located above the thrust collar and one O-ring below. Stem O-rings shall be replaceable with valve fully opened and subjected to full pressure. The stems shall also have two (2) low torque Delrin bearings located above and below the stem collar to reduce friction during operation.
- G. Valves 4" and larger shall accept a full-size tapping cutter.
- H. The body, bonnet and O-ring plate shall be fusion-bond epoxy coated, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 and be NSF 61 Certified.
- I. Each valve shall have Manufacturer's name, pressure rating, and year in which it was manufactured cast in the body.
- J. Valve bonnet to body retaining bolts will be hexagonal head and nut conforming to ANSI B18.2.1. Metric size and/or socket head cap screws or bolts will not be allowed.
- K. Plastic disc or wedge guides will not be allowed.
- L. Upper bolt holes on MJ connection valves 4"-12" shall incorporate closed elliptical design, no open slots.
- M. 100% coated wedge with encapsulation of wedge completed by the Manufacturer.
- N. End connections shall conform to AWWA Standard C111.
- O. All valves shall be installed with a cast-iron valve box of the three (3) piece type to the finished grade. Tyler Slip-Type, six-inch (6") cast-iron valve box assembly series 6855, or approved equal.
- P. Valves shall open clockwise (Open Right) on potable water lines and open counterclockwise (Open Left) on raw water lines.
- Q. If the dimension from final grade to the operating nut exceeds six (6) feet, a valve extension shall be installed.

4.4.2 14-inch Diameter and Larger – Butterfly Valves

- A. All butterfly valves shall be of the rubber-seated, tight-closing type. They shall meet or exceed AWWA Standard C504, latest edition, Class 150 or Class 250. All valves shall be M&H 4500/1450 butterfly valves.
- B. Both ends shall be AWWA C111 mechanical joint or per flanged ASME B16.1 (or as otherwise noted on plans and specs).
- C. Valve shafts shall be ASTM A276 Type 304 stainless steel for C1150 or ASTM A564 Type 630 stainless steel for C1250. Each valve shaft shall be of a one-piece design for valves 12 inches and smaller and a two-piece design for valves 14 inches and larger. Valve shafts shall have a minimum diameter extending through the valve bearings and into the valve

disc as specified in AWWA C504. All valve shafts must meet or exceed the minimum connection torque requirement set forth in AWWA C504.

- D. Valve body and vane shall be high-strength Ductile Iron to ASTM A536 with ASTM A276 Type 316 stainless steel body seats.
- E. Rubber valve seats shall be a full-circle, 360-degree seat not penetrated by the valve shaft. Valve seat shall be EPDM.
- F. The valve seat will be attached to the valve vane by Type 304 stainless steel self-locking fasteners. The valve seat must be easily field adjustable and replaceable without any special tools or lengthy curing time.
- G. Valve shaft seals shall be of the chevron-type for 3"-24" and O-ring type for 30 inches and larger utilizing the same elastomer as specified for the valve seats and the intended service. All valve shaft seals must be easily field replaceable.
- H. Valve actuator shall be of the traveling nut type, sealed and lubricated for underground or in-plant service. Operator shall be capable of withstanding an overload input torque of 450 ft-lbs. at full-open or full closed position without damage to the valve operator. Operators for valves 14 inches and larger must have a 304 stainless steel external stop limiting device and travel adjustment. The travel adjustments must be able to be operated without removing the valve from the line. All valve actuators must be sized per AWWA C504. Certification of proof of design and torque requirements shall be submitted to the Owner upon request.
- I. Hand crank, hand wheel or chain wheel – All manual operators for service other than underground shall have a position indicator and shall be totally enclosed and permanently lubricated. Actuators shall be designed to produce the required operating torque with a maximum rim pull of 80 lb. on hand wheel or chain wheel and a maximum input of 150 ft. lb. on operating nuts.
- J. Cylinder – Cylinder operator shall be of the base mounted configuration. Cylinder barrel shall be of molybdenum disulfide-lined glass fiber reinforced epoxy tubing, to provide a corrosion-free, self-lubricated high-strength barrel. Rod seal shall be of urethane, molybdenum disulfide filled to provide a self-lubricated, long life seal.
- K. The valve interior and exterior surfaces shall be coated in accordance with the latest revisions of AWWA C504 and must be NSF 61 Certified.

4.5 Fire Hydrants

4.5.1 General

All fire hydrants shall be designed and manufactured in strict compliance with AWWA Standard C502 (latest edition) for *Dry Barrel Fire Hydrants*. All references made in this specification are to the above standard unless otherwise noted.

Fire hydrants shall be UL listed and FM approved.

Fire hydrants shall be tested in accordance with AWWA C – 502 and UL/FM requirements.

Fire hydrants shall be manufactured (cast, machined, assembled and tested) in the United States and in full compliance of the American Iron and Steel requirement.

4.5.2 Acceptable Brands

Kennedy Guardian (K81D, K81A and K81AM), or approved equal.

4.5.3 Size of Hydrant

Hydrants shall have a Main valve opening size of five-and-one-quarter inches (5-1/4") and shall have a five-and-one-half-foot (5-1/2') bury depth unless otherwise approved by the District Engineer.

4.5.4 Type of Hydrant

All hydrants shall be the traffic model type. Hydrants shall be the three-way type with one (1) pumper nozzle and two (2) hose nozzles, all located on the same horizontal plane.

Fire hydrants shall be of the traffic model breakaway type, designed with the breaking rings mounted on the top of the lower barrel flange for ease of inspection and replacement and to include two (2) breaking ring straps for alignment.

Breakable stem coupling shall be designed to break cleanly, leaving the lower portion of the coupling in place to accept a short disassembly wrench. Pins for the coupling shall be stainless steel and of the one-piece spring-loaded design with no need for clevis pins, nuts or other retainers for ease of maintenance.

Fire hydrants must be compatible with existing pressure and temperature monitoring system

4.5.5 Inlet Connection

Hydrant base shall be provided with a mechanical joint inlet to accommodate six-inch (6") diameter pipe, all in accordance with AWWA Standards. Incorporated into the base shall be two (2) lugs for rodding or strapping of pipe. Fire hydrant laterals shall be of the same material as the main line.

4.5.6 Main Valve Assembly

Main valve of the hydrant shall be five-and-one-quarter-inch (5-1/4") diameter compression type which closes with water pressure.

Main valve shall be synthetic rubber reinforced with a steel insert and retained on the lower stem by a bottom plate utilizing a nylon lock design to eliminate the need for a lock washer.

The valve assembly shall include one (1) or more drain valves which work automatically with the Main valve and drain the barrel when the Main valve is in the closed position.

O-ring seal shall be provided between upper and lower barrels and provide full 360° adjustment of upper barrel and O-ring grooves shall be of a dove-tail design.

Fire hydrant shoe shall have two (2) bronze lined external drain holes located below the elbow nuts and bolts.

The seat shall be a bronze ring threaded to a bronze insert in the hydrant shoe, with O-ring seals.

Pressure activated drain valve assembly shall be aluminum bronze with a single drain valve facing which is retained by a pin for ease of replacement and automatically compensates for wear due to use.

All parts of the Main valve assembly shall be so designed that removal of the assembly from the barrel is accomplished without excavation.

4.5.7 Operating Shaft Nut

Operating nut shall be of a one-piece bronze construction, with a top loading method of introducing grease to the hydrant by way of a recessed zerk or grease fitting in the top of the operating nut. The operating nut shall have two (2) channels through the threads to provide

lubrication between the threads of the stem and the operating nut. There shall be two (2) ports on the upper portion to provide lubrication for the thrust washer.

A thrust washer shall be supplied between the operating nut and the stem lock nut to facilitate operation.

The hydrant shall open by turning the operating nut to the right in a clockwise direction and shall have an arrow on top of the bonnet to designate the direction of opening.

4.5.8 Pumper Nozzle and Cap

The pumper nozzle shall be four-and-one-half-inch (4-1/2") nominal diameter with six (6) threads per inch. Threads shall be right hand. See standard drawing.

Nozzle caps shall be furnished with security chains with one end of each securely attached to the upper barrel section of the hydrant.

Hydrant cap/bonnet shall be of a one-piece design creating a water tight cavity without the use of gaskets.

A dirt shield shall be provided to protect the operating mechanism from dirt and moisture buildup.

Nozzles shall be of the tamper resistant type, insertion with O-ring seals and stainless steel retaining screws (clockwise 1/4-turn for removal).

4.5.9 Hose Nozzles and Caps

The two (2) hose nozzles shall be two-and-one-half-inch (2-1/2") nominal diameter with seven-and-one-half (7-1/2) threads per inch. Threads shall be right hand. See standard drawing.

Each hose nozzle shall include a nozzle cap with nut and security chain, and shall be removed by turning counterclockwise as described in Sections 4.5.7 and 4.5.8 above.

4.5.10 Color

The upper exposed section of the hydrant above ground shall be painted Rustoleum 659 yellow or approved equal. The buried portion of the hydrant shall be given a bituminous coating in accordance with Section 10-8.1 of AWWA Standard CI 10.

4.5.11 Location

Where possible, fire hydrants shall be located in the northeast quadrant of the intersection. See standard drawing for typical installation. The location of all fire hydrants shall have the written approval of the appropriate Fire Protection District.

4.5.12 Hydrant Pressure and Temperature Monitoring Specifications

Pressure and monitoring system shall be installed on a hydrant for every 150 homes, 2,500 ft. of Water Main, or every twenty (20) hydrants - whichever comes first.

Device must include the following:

- Must have water resistant and hardwired information access point internally within the fire hydrant.
- Fire Hydrant must be completely, and fully operational once unit is installed and not require the need to shut water supply off, make modifications and then recharge to obtain normal operation.

- Dry Barrel Hydrant Version - Must receive electronic reading through the Main valve assembly utilizing a waterproof conduit (Poly Tubing) and compression fittings from which the wiring is run from sensors to the motherboard, battery and cellular antenna just beneath the hydrant bonnet which is above ground approximately 2'6" above grade.
- Must utilize an OEM spool piece to accomplish OEM installation requirements and maintain the robust integrity of the hydrant as required to meet UL and ULFM approval.
- Device and all components must meet UL and ULFM requirements and have proper documentation to prove such.
- Must be able to accept multiple layers of paint and maintain the OEM level of communication success.
- All power must be supplied to the motherboard from within the same housing as the motherboard via a Lithium-Ion battery utilizing an integrated Male x Female wire harness.
- Battery must have a minimum 5-year battery life when used with the factory default settings/parameters.
- Battery must be field replaceable utilizing the same connection as OEM without requiring any modifications.
- Must not require power supply below grade.
- Must not require WiFi or Bluetooth for communication or operation.
- Must have communication capability to allow for remote firmware upgrades and data uploads using cellular technology.
- Must have functionality across all platforms, desktop, laptop, tablet, mobile device or smart phone.
- Must have hosted software, which is user friendly and allows end user/client to migrate files directly from host to their water management software via CSV or Flat File to use with SCADA or similar utility infrastructure management software.
- Must be able to recognize and alert end user client via email or text utilizing cellular signal of thresholds (events) within the clients set parameters within one (1) minute. Time is based on adequate cellular reception.
- Must have minimum capabilities of reading every 5-seconds, 15-min averages and 12-hour uploads.
- Other capabilities: alarm threshold violation reads of 40 reads per second for 30 seconds for three (3) consecutive cycles before returning to its normal read cycle of 5 seconds, 15-minute averages, and 12-hour uploads.
- Must have the capability for future expansion within the device housing (2 shell components once assembled on hydrant) for future additional technologies currently in R&D for release.
- Must not interfere or utilize the nozzles or ports in any way.
- Must be available in both OEM preinstalled NEW hydrants and as retrofit kits utilizing ONLY OEM components for the hydrants listed herein.
- Must allow for normal operation of hydrant in hot or cold climate without flow restrictions or any other byproduct that would prohibit full operation. Hydrant must be fully functional in below freezing conditions.

- Must have water contacting the sensors under pressure while being utilized at the same time for fire or other utility applications.
- Manufacturer must have been in business for over 5-years, and manufacturing and marketing hydrant device for a minimum of 3-years.

4.6 Pressure-Reducing Valves

Pressure-reducing and regulating valves shall be of a type capable of maintaining pre-adjusted downstream pressures, varying rates of flow, and upstream pressure without causing water hammer. Valves shall be piston type, not spring operated, with flanged-end connection, and shall be installed in concrete valve vaults of sufficient size so as to provide adequate maintenance and operation. Valves shall have gate valves and pressure gauges on both upstream and downstream sides and shall have bypasses with smaller pressure-reducing and regulating valves to handle minimum flows as determined by the District Engineer. All gate valves in the vaults shall be capable of being operated from above ground by use of two-inch (2"), square-valve keys. Cla-Val or approved equal are acceptable.

4.7 Air-Release Valves

Valves shall be combination air-release and vacuum valves. These shall be installed at each high point on all twelve-inch (12") and larger Water Mains and at all other locations as directed by the District Engineer.

Air-release and vacuum breaker valves shall be located in precast concrete manholes in accordance with the standard drawings, and shall automatically release air from the lines when the lines are being filled with water, and shall admit air into the lines when water is being withdrawn in excess of the inflow.

Valves shall be iron body with bronze trim. Floats shall be stainless steel. One-inch (1") valves shall be installed. Oil the stem between the pipe and release valve, or as shown in the standard drawing.

Pipe and fittings used in the release valve system shall be galvanized steel, standard weight, and connections shall be threaded. Gate valves shall be bronze, threaded, and shall have hand wheels.

Acceptable manufacturers are Apco, Crispin, and Clow.

Four-inch (4") vents are required for ARVs less than two inches (2"), and six-inch (6") vents are required for two-inch (2") ARVs.

4.8 Thrust Blocks

Concrete thrust blocks may be installed on a case-by-case basis (in lieu of or in addition to pipe restraining per these Specifications) at all tees, plugs, bends, and fire hydrants in accordance with the standard drawings.

Where thrust blocks are used in conjunction with eight (8) mil thick polyethylene as a bond breaker, care shall be taken not to block weephole outlets, cover bolts, nuts, clamps, or other fittings or to make them inaccessible. Size of thrust block, type of concrete, and dimensions shall be in accordance with the details in standard drawings. Concrete shall be three thousand (3,000) PSI strength at twenty-eight (28) days.

4.9 Precast Concrete Vaults and Manholes

All butterfly valve and ARV manholes, pressure-reducing valve vaults, meter vaults, and other vaults shall be precast or poured-in-place concrete. Design of manholes and vaults shall be for H-20 traffic loading and shall include aluminum rungs, cast-iron rings, and covers of a pattern approved by the District Engineer, with the word "WATER" cast thereon, and shall be in accordance with the details

in standard drawings. Floors in concrete vaults shall have a minimum two percent (2%) slope toward the sump pit.

4.10 Services

4.10.1 General

Hydrostatic testing, approved bacteriological testing, and conditional acceptance of the Water Mains must be made prior to the installation of any water taps.

Water Service Line locations shall be shown on the utility plans submitted to the District, and shall be located ten feet (10') up from the downhill lot line. Service Lines shall be installed in a continuous straight line. Service Lines shall be as close to ninety degrees (90°) from Main line as possible. Tap saddles will be required. Service Lines in driveways are not permitted. Tap saddles shall be Romac 202 BS or approved equal. HDPE Service Lines shall be installed horizontally in a "snake-like" configuration to allow for both expansion and contraction of the line in the trench.

4.10.2 Service Lines

- A. All residential Service Lines shall consist of a corporation stop at the Main, continuous plastic pipe to a curb stop at the property line, and continuous plastic pipe up through the slab or floor of the structure in compliance with the latest building code. Meter pits are not permitted on residential services. Residential Service Lines shall be a minimum of one-inch (1") diameter. Plastic pipe will be Crestline CE Blue HDPE pipe DR9, two hundred (200) PSI with stainless steel stiffeners. One-inch (1") HDPE is comparable to a three-quarter-inch (3/4") copper Service Line, although only HDPE Service Lines will be used.
- B. HDPE Service Lines shall be the same size from the corporation stop to the curb stop. Then, if necessary, the size of the Service Line may be increased or reduced only after the curb stop to the meter by one size. HDPE Service Lines shall be installed horizontally in a "snake-like" laying configuration, to allow for both expansion/contraction movement of the pipe in the trench. The HDPE Service Line shall consist of one (1) piece of continuous pipe from the corporation stop to the curb stop, no fittings or connections are allowed. The curb stop may not be placed under concrete or paved driveway areas. If the Service Line needs to be extended to accommodate moving the curb stop out of a concrete or paved area, only butt fusion may be used on HDPE pipe to extend the Service Line pipe to the new location of the curb stop.
- C. Water and sewer Service Lines may be installed as depicted in the drawings.
- D. Tracer wire, as specified herein, shall be extended from the Main to the foundation of the house/structure. Tracer wire shall be extended up the curb stop box per 4.10.2.I below.
- E. Service Lines other than residential shall have meters installed inside the building and shall consist of a corporation stop at the Main, polyethylene to a curb stop, and polyethylene pipe to a point outside the foundation of the structure, in compliance with the latest building code. Meter pits are discouraged but may be approved on a case-by-case basis.
- F. The meter fitting and water meter are part of the service. Service Lines larger than two inches (2") shall be ductile iron or polyvinyl chloride and shall have a gate valve at the Water Main.
- G. No portion of the building electrical system and/or ground may be attached to the Service Line or internal plumbing such that current may be induced into or from the piping system.
- H. Meter vaults shall be concrete and shall have aluminum covers and rings. Meter shall sit in center of vault with same size gaskets with five-eighths-of-an-inch by (5/8") two-inch (2") stainless steel bolts and nuts. All lines shall have a minimum of five-and-one-half feet (5-

1/2 ft) of cover, and shall be bedded and backfilled in accordance with these Specifications. Water Service Lines shall be a minimum of one-inch (1") diameter.

- I. No flares will be allowed on one-and-one-half-inch (1-1/2") to two-inch (2") installations. Ford pack joint fittings are permitted. Compression fittings either "Q" style or "-22" are acceptable. "Ay" compression fittings are allowed.
- J. Meter pits shall have MS 2024308 meter cans. Standard will be 30" although 36" and 48" are acceptable when situation permits. Meter domes shall be 20" standard aluminum with inner lid, and cast-iron top with two-inch (2") hole in center. All meters in a pit shall be placed twelve inches (12") from the bottom of the inner lid for frost protection.
- K. All water and sewer service locations shall be clearly stamped in the curb with an "S" for sewer and a "W" for water.
- L. Only 3/4" and 1" curb stop boxes shall have a one-and-one-half-inch (1-1/2") Schd. 40 PVC pipe telescoped inside with a bell end to fit over the top of the curb stop valve. Tracer wire shall be extended up the inside of curb stop box but outside the one-and-one-half-inch (1-1/2") Schd. 40 PVC pipe. Service Lines greater than 1" in diameter shall not incorporate 1-1/2" Schd. 40 PVC pipe inside of valve box.

4.10.3 Corporation Stops and Curb Stops (or Valves)

Corporation stops and curb stops shall meet the requirements of AWWA Standard C800. Curb stops shall include a curb box installed at the right-of-way line.

Corporation stops shall be Ford FB-1001 or Macdonald 4701B.

Curb stops shall be:

Ford	A.Y. McDonald
B46-333 – 3/4"	MCD 76100-(22 or Q) 3/4"
B46-444 – 1"	MCD 76100-(22 or Q) 1"
B46-666 – 1-1/2"	MCD 76100-(22 or Q) 1-1/2"
B46-777 – 2"	MCD 76100-(22 or Q) 2"

For lines larger than two inches (2"), curb stop valves shall be resilient seated and epoxy coated inside and out.

4.10.4 Meters

A. General

1. All water supplied by the District to a property must be metered. The only exceptions are fire lines.
2. All water meters shall be installed and furnished by the District at the expense of the property owner and shall become the property of the District.
3. Water meters will be serviced and maintained by the District.
4. One-and-one-quarter-inch (1-1/4") meters are not permitted.

B. Meters up to one-and-one-half inch (1-1/2"):

1. Shall be Badger Brass Recordall® Disc Series Meters.
2. Shall be furnished with District's AMR system.
3. Shall be calibrated and furnished to indicate gallons.

C. Meters two inches (2") and larger:

1. Shall be compound meters in cast-iron housing with a disc meter to record small flows and a turbine to record large flows.
2. Shall be calibrated and furnished to indicate gallons.

4.10.5 Backflow Preventers

All backflow prevention devices and installations will be per the District's standard details (attached) and the District's Rules and Regulations.

SECTION 5.0 – WASTEWATER SYSTEM DESIGN STANDARDS

5.1 Quality of the Collection System

The purpose of these Specifications is to ensure that only proven, high-quality materials are installed using first-class workmanship. Determination of the best materials and construction methods are based upon lowest life-cycle costs. Sizing and layout of the system are parts of the total consideration of design, operation, and maintenance of a Wastewater Collection System that yields optimum quality service at the lowest total cost to the Customer.

5.2 Sizing of Collection Mains

The District reserves the right to size Mains to provide service for projected future needs. All Mains shall be sized large enough to provide for sanitary sewer service for the entire basin area requesting service and shall meet the following requirements:

- A. No public sewer shall be less than eight inches (8") in diameter with the exception of small service areas where six-inch (6") sewers may be used with the approval of the District.
- B. No Service Line shall be less than four inches (4") in diameter.
- C. All sewer lines shall be sized to flow at seventy-five percent (75%) of the end area of the pipe or less during peak wet weather flow periods.

5.3 Layout of the Collection System

Width Requirements for District Main Installations

All District Mains shall be installed in dedicated public street rights-of-way. When the District determines it is not possible or feasible for an installation to be made in a dedicated street, the installation shall be made in a right-of-way or easement. The conditions under which such an exception will be allowed will be determined for each individual case, and only rights-of-way and easements which conform to the requirements of the District will be accepted. The minimum width right-of-way or easement which will be accepted by the District is twenty feet (20'). Depending on size of Main and depth, additional width may be required.

Dedicated Streets

Pipe alignment shall be parallel to property lines. Normal practice is to lay the pipe on the center line of the street. In any case, pipe alignment shall always be within an established roadway, between the limits of the curb and gutter. Installation of curvilinear pipelines in sizes eight inches (8") through eighteen inches (18") is acceptable and necessary to obtain the standard location of Sewer Mains. Curvilinear sewers must be designed and constructed using a uniform slope between manholes and shall have a center line radius of one hundred feet (100') or greater. The necessary curvature shall be attained by deflection at joints not to exceed the Manufacturer's recommendations or three-degree (3°) preformed joints or couplings. Field bending of pipe shall not be permitted.

When streets and subdivisions fall in hillside overlay zones or areas with unique characteristics as identified by the Developer and the District, the Developer and his Engineer shall meet with the District to address concerns of pipeline materials, pipe alignment, pipeline access, landscape restoration, and surface monumentation.

Sewer Main Alignments

Three-degree (3°) pre-manufactured fittings may be used to accomplish the curvature without exceeding individual deflections specified. The maximum deflection at any joint shall not exceed one-half (1/2) of the Manufacturer's recommendation.

Molded three-degree (3°) fittings shall be composed of the same material and meet the same PVC standard as forth for the pipe material. Bends shall be plain end by bell and be laid in the same direction as the pipe-laying operation.

Sewer Collection Lines (sizes 8" thru 12") (Full laying length 13.5 feet)	8-inch Laying Radius (feet)	10-inch Laying Radius (feet)	12-inch Laying Radius (feet)
Without Fittings	875 min.	985 min.	1,150 min.
With 3-degree bend at every fourth joint	N/A	N/A	1,000 to 1,150
With 3-degree bend at every third joint	750 to 875	750 to 875	750 to 875
With 3-degree bend at every second joint	450 to 750	450 to 750	450 to 750

Sewer Service Lines shall be a minimum of four inches (4") in diameter and shall be placed approximately in the middle of the lot and extended into the lot per Detail WW-17.

5.4 Manholes

Manholes shall be installed at the end of each line, at all pipeline intersections, changes in grade, changes in size, alignment (except curvilinear sewers) and at distances of not greater than four hundred feet (400'). Manholes must also be located to allow unassisted access by District maintenance vehicles. Lines and manholes located in areas where access (in the opinion of the District) is not possible will be reviewed on a case-by-case basis.

5.4.1 Manhole Sizes

The inside diameter (I.D.) of the manhole shall not be less than the following:

<u>PIPE SIZE (in)</u>	<u>MANHOLE DEPTH (ft)</u>	<u>MANHOLE SIZE (I.D.)</u>
8" and 10"	0' to 12'	60"
12" to 18"	13' to 19'	60"
24" and larger	20' to 25'	72"

5.4.2 Changing Pipe Size

When sewers are changed in size at a manhole with no intersecting sewers, the manhole invert shall be designed with a one-tenth of one foot (0.1') drop through the manhole.

5.4.3 Intersections

Pipelines deflecting thirty degrees (30°) or less shall have one-tenth of one foot (0.1') drop in the invert through the manhole. Pipe deflections greater than (30°) and less than (90°) shall have three-tenths of one foot (0.3') drop in the invert through the manhole. Changes in direction at intersections shall not be greater than ninety degrees (90°). Ninety-degree (90°) manholes are generally discouraged and should only be implemented when no other options are available. The slope through the manholes shall not be less than the most restrictive slope of the pipe in or out of the manhole. Intersecting pipelines at manholes with greater than one (1) pipe size difference shall be designed to match crown elevations. Pipelines passing straight through manholes without changes in grade and alignment shall be laid through the manhole.

5.4.4 Manhole Channels

The flow channel shall be made to conform its slope and shape to that of the sewer pipe and wherever possible shall use the lower one-half (1/2) of the sewer pipe of the invert of the

open channel. The completed channel shall be U-shaped, coming up as high as the top of the largest pipe. At intersections with other lines, channels shall be formed with a curve to minimize turbulence.

5.4.5 Manhole Rings and Covers

Manhole rings and covers shall conform to the attached detail sheets for ring and cover designs. All manholes located outside of dedicated street or alley rights-of-way will be designed and constructed with a locking-type cover and the ring bolted to the concrete cone. Depending on the manhole location, the District may require “self-sealing” bolt-down lids.

Grade adjustment rings between the ring, cover, and the concrete cone cap shall not exceed eight inches (8”) and shall be sealed with conceal mastic between each ring.

Manhole lids shall have hole inside the lid for removal. All manholes shall have an inflow protector insert (IPI) per Section 9.7.

5.4.6 Drop Manholes

Drop manholes with a minimum of five-feet (5') diameter will be permitted only in special conditions where District approval has been granted.

5.5 Minimum Sewer Depth

In general, Main line sewers should be designed deep enough to drain basements and to prevent freezing. No public Mains shall be less than five-and-one-half feet (5-1/2') deep measured from the top of the pipe. Sewer lines less than five-and-one-half feet (5-1/2') and greater than fourteen feet (14') shall be given special consideration and reviewed by the District on a case-by-case basis concerning pipe material and bedding requirements.

5.6 Slopes

All sewers should be designed to transport sewage flows at mean velocities of two feet per second (2 FPS) at seventy-five percent (75%) of the pipe end area based on a roughness coefficient of thirteen one-thousandths (0.013).

The slope between manholes shall be uniform. Due to practical constructability and construction tolerances, the minimum slope of a Wastewater Main shall be 0.5%. Slopes less than 1.04% are not recommended and will be reviewed on a case-by-case basis with consideration given to topography, existing outfall elevation, velocity, and capacity.

Slopes less than 1.04% shall be built with DIP or SDR 26 PVC. SDR 26 PVC installed with slopes between 0.5% and 1.04% require select bedding and are subject to additional construction requirements.

The District may require the use of restrained joint pipe on sections where the Wastewater Main is located outside of paved areas and slope stability is a concern.

Minimum allowable slopes per pipe size are as follows:

8”	0.50%
10”	0.35%
12”	0.29%
15”	0.23%
18”	0.17%
24”	0.13%
30”	0.11%

5.7 Construction Tolerances

Vertical construction tolerances for pipe installation shall be one-tenth of a foot (0.10') per one hundred feet (100') of pipe or per manhole run, whichever horizontal distance is greater. Vertical construction tolerances for pipe installation shall be such that no reduction of required flow rate below ultimate peak flow results, and that the pipe slope does not fall below the minimum slope for the size of pipe used.

In circumstances where it may not be feasible or practical to place pipe at the minimum slope, the Contractor may increase the pipe size to the nearest pipe size that will provide an equal flow quantity at an acceptable slope or have continuous on-site surveying for the setting of each joint of pipe. This option must be approved by the District prior to start of construction.

Horizontal construction tolerances shall be one foot (1.0'), plus or minus, from the design centerline of the pipe.

5.8 High-Velocity Protection

In the case of sewers where the slopes are such that over seven percent (7%) grades are attained, special provisions shall be made to prevent displacement by erosion and shock. Such high-velocity protection shall be shown on the detail drawings and approved by the District Manager.

5.9 Relation to Water Mains

Sewers shall be located a minimum of ten feet (10') horizontally from existing or proposed Water Mains, and the sewer pipe shall be a minimum of eighteen inches (18") clear distance vertically below the Water Main. If this clear distance is not feasible, the crossing must be designed and constructed so as to protect the Water Main. Such crossings shall meet Colorado Department of Public Health and Environment (CDPHE) requirements and shall be approved by the District.

Minimum protection shall consist of the installation of an impervious and structural sewer as follows:

- A. One length of pipe at least fourteen feet (14') long centered over or under the Water Main. Joints between the existing sewer pipe and the new sewer pipe shall be made with a manufactured adapter approved by the District and made specifically for such joining.
- B. Existing concrete or vitrified clay pipe shall be protected with a fully-reinforced concrete encasement. Encasement shall be at least six inches (6") thick and extend a distance of ten feet (10') on either side of the Water Main.
- C. Deviations from the fourteen-inch (14") and ten-foot (10') standards require specific District approval of the crossing. If an approved waiver includes less than a one-foot (1') vertical separation, an annular space shall be provided between the two (2) pipelines.

To create the annular space, a biodegradable cardboard or soft-foam rubber shall be used as a spacer of length equal to or greater than the larger pipe diameter of the two (2) pipe crossings. No crossing shall be made where the vertical clear separation is less than six inches (6").

In all cases, suitable backfill or other structural protection shall be provided to preclude settling or failure of the higher pipe. Depending on pipe material, pier supports may be used.

5.10 Stub-outs from Manholes

Stub-outs from manholes shall not be allowed except for lines which will be extended in the future. Designs to complete the manhole run shall be submitted for review to ensure proper grade and alignment of future construction. Future extension of stub-outs shall be of like material, using the

same grade and alignment as designed. No service connections will be permitted on stub-outs. Maximum “stub” on sewer lines shall be one stick of pipe.

5.11 Inverted Siphons

Inverted siphons shall have not less than two (2) barrels of ductile iron pipe with a minimum pipe size of six inches (6"), and shall be provided with necessary appurtenances for flushing and maintenance. Sufficient head shall be provided and pipe sizes selected to provide velocities of at least three feet per second (3 FPS) for average flow. The inlet and outlets shall be arranged such that the normal flow can be diverted to either barrel for cleaning and maintenance.

5.12 Stream and Drainage Channel Crossings

All stream and drainage channel crossings shall be ductile iron pipe encased in reinforced concrete. Crossings of proposed channel bottoms shall be supported by reinforced concrete caissons drilled a minimum of five feet (5') into impervious soil or twenty feet (20'), whichever is less. In the absence of impervious soils, caissons shall extend twenty feet (20') below the invert of the sewer Main. A fifteen-foot (15') splash pan consisting of eighteen-inch (18") to twenty-four-inch (24") grouted rip-rap shall be placed downstream tapering from six feet (6') deep at the crossing to three feet (3') deep at the end to prevent erosion. All stream and channel crossings shall be reviewed and approved by the District Engineer.

5.13 Crossings Under Railways and Highways

Crossings under railways and highways will consist of pipe laid inside steel pipe conduits, which are jacked or placed by an approved method underneath the track or roadway. The steel conduit pipe shall be placed horizontally through the ground at substantially the grade of the sewer, with due allowance for the bells of the carrier pipe. As the pipe is moved along, the earth shall be excavated from the face and removed so that it will not be necessary to force the pipe through solid ground. The conduit shall be of the sizes shown on the plans. In any case, the conduit diameter shall be a minimum of twelve inches (12") larger than the carrier pipe. After the conduit has been completed, the carrier pipe shall be placed inside and blocked in exact position and grade with approved insulating skids. Each end of the conduit shall then be plugged tight around the ductile iron or steel carrier pipe and the conduit pipe.

5.14 Aerial Crossings

All aerial crossings shall be constructed as shown on the detail sheets. Each aerial crossing shall be reviewed, modified, and approved by the District depending on its location, size, and clearances.

5.15 Metering Manholes

Metering pits for the purpose of metering wastewater flows shall be prepared and submitted to the District Engineer for his review and approval. All metering pits shall include, but not necessarily be limited to, the following:

- A. The Parshall Flume shall be installed as per the flume's Manufacturer's recommendations with the following criteria and standard detail as minimum guidelines to ensure the proper functioning of the flume:
 - Upstream pipe sections equal to a minimum of twenty-five (25) pipe diameters shall have a slope not less than that required by Section 3 of the Specifications without bends, drops, or flow junctions to ensure subcritical flow.
 - The downstream pipe sections shall have slope greater than the upstream pipe to ensure supercritical flow.

- The flume itself shall be grouted into the block out at zero percent (0.0%) slope, as shown on the standard detail.
 - The flume shall be made of corrosion-resistant materials and supplied with a Manufacturer's rate curve. Shop drawings shall be submitted to the District Engineer for review and approval prior to installation.
- B. Concrete vault or minimum six feet (6') I.D. manhole.
- C. Flow measurement, totalizing, and recording devices.
- D. The metering pit shall have a suitable and safe means of access.
- E. Flow level sensor and transmitter if required. The flow sensor shall be of a non-intrusive type and shop drawings for the level sensor and transmitter shall be submitted to the District Engineer for review and approval prior to installation.
- F. Manhole ventilation: The District Engineer may require that the control manhole be vented if it is determined that it is needed to protect the monitoring equipment and ensure proper function of said equipment.

5.16 Pumping Facilities

Pumping facilities may be allowed on Mains in the District Collection System only where specifically authorized by the District. The District will prohibit the installation of pumping facilities where, in its opinion, such installations would be injurious to the operation, or future operation of the District's Wastewater Collection System.

All proposed pumping facilities shall be considered as a special feature and will be dealt with on an individual case basis. All proposed pumping stations and force Mains shall be approved by the State of Colorado.

A basis for design for all wastewater pumping stations shall have the following features:

- A. Wastewater pumping stations shall not be subject to damage by flooding. A suitable superstructure, located off the right-of-way of streets and alleys shall be provided and be readily accessible.
- B. Wastewater pump stations shall be of the dry well type.
- C. Wet and dry wells, including their superstructure, shall be completely separated.
- D. At least two (2) pumps must be provided. If only two (2) pumps are provided, they shall have the same capacity. Each shall be able to handle flows in excess of the expected maximum flow.
- E. Adequate ventilation shall be provided for all pump stations to mechanically ventilate the dry well. Wet well vents shall be provided. There shall be no interconnection between the dry well and the wet well ventilating systems.
- F. Liquid level controllers shall be located so as not to be affected by flows entering the station. In small stations with duplicate units, provisions shall be made to alternate the pumps in use.
- G. Pumping stations shall be equipped with suitable devices for measuring, recording, and totalizing sewage flow and power consumption.
- H. Power supply shall be available from at least two (2) independent generating sources, or emergency power equipment shall be provided. Automatic starting of emergency power equipment shall be provided.
- I. Alarm systems shall be provided for all pumping stations. The alarm shall activate in cases of pump station malfunction.

- J. On-site retention for all wastewater pumping stations shall be provided. The size and capacity of on-site retention will be determined by pump station size, distance from Wastewater Treatment Plant, and location of pump station site, etc.

5.17 Force Mains

All proposed pumping stations and force Mains shall be approved by the State of Colorado. Force Mains and all their appurtenances shall be designed and tested to conform to potable water line criteria and the following minimum requirements:

- A. *Velocity*. A design average flow velocity of at least two feet per second (2 FPS) shall be maintained.
- B. *Air-relief valves*. An automatic air-relief valve shall be placed at high points in the force Main to prevent air locking.
- C. *Termination*. The force Main should enter the gravity sewer system at a point not more than two feet (2') above the flow line of the receiving manhole.
- D. *Design pressure*. The force Main and fittings, including reaction blocking, shall be designed to withstand normal pressure and pressure surges (water hammer).
- E. *Design Friction Losses*. Friction losses through force Mains shall be based on the Hazen-Williams formula or other acceptable method. When initially installed, force Mains will have a significantly higher "c" factor. The higher "c" factor should be considered.
- F. *Separation from Water Mains*. The separation from Water Mains shall be the same as gravity sanitary sewer lines.
- G. *Identification*. Where force Mains are constructed of material which might cause the force Main to be confused with potable Water Mains, the force Main shall be appropriately identified.

5.18 Underdrain System

The District does not allow for the installation of any underdrains.

SECTION 6.0 – WASTEWATER SYSTEM EXCAVATION & SITE STANDARDS

6.1 Earthwork Defined

Earthwork shall include all clearing, grubbing, grading, excavation, fill, backfill, excess excavation, bedding material, on-site material, and surface restoration as may be required to complete the work.

6.2 Traffic Control

Traffic control, signing, detours, and utilization of existing streets require approval by the controlling right-of-way authority. Contractors and/or Developers must obtain adequate permitting and approvals from the controlling agency.

6.3 Caution in Excavation

The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities and structures, both known and unknown, may be determined. Contractor shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.

The District cannot guarantee the accuracy of underground utilities and structures as shown on plans and will not be responsible for any damage that may occur during construction.

Whenever, in the opinion of the District, it is necessary to explore and excavate to determine the location of underground utilities and structures that may interfere with construction, the Contractor shall make the explorations and excavations for such purposes.

6.4 Excavation to Line and Grade

All excavations shall be made to the lines and grades as established by the approved drawings and these Specifications. Pipe trenches shall be excavated to the depth required to provide a uniform and continuous bearing and support for the pipe on solid undisturbed ground at every point between bell holes. Bell holes shall be provided at each pipe joint to permit the joint to be made properly. Any part of the bottom of the trench excavated below the specified grade shall be corrected with approved material and thoroughly compacted as directed by the District. The finished grade of the trench shall be prepared accurately by means of hand tools. Deviation from line and grade may be allowed when approved by the Inspector, in accordance with these Specifications.

6.5 Trenching and Excavation Operations

The trench shall be excavated in a manner which will allow the pipe to be installed to the alignment and depth required. The trench shall be excavated only so far in advance of the pipe laying as is necessary to expedite the work.

- A. *Trench width.* All existing asphalt or concrete surfacing shall be cut vertically in a straight line and removed from the job site prior to starting the trench excavation. This material shall not be used in any fill or backfill.

The trench shall be excavated so that a minimum clearance of six inches (6") shall be maintained on each side of the pipe for proper placement and densification of the bedding or backfill material. Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least six inches (6") below and on each side of all pipe and fittings. The specified minimum clearances are the minimum clear distances that will be permitted between any part of the pipe and appurtenances being installed and any part, projection, or point of such rock, boulder, or stone.

The maximum bottom of trench width, measured at the top of the pipe, shall be the outside diameter plus forty inches (40"), regardless of the type of pipe, type of soil, depth of excavation, or the method of densifying the bedding and backfill.

Trenches may be of such extra width, when required, to permit necessary supports, sheeting or bracing, and handling of specials.

- B. *Trench support.* The trench shall be adequately supported and the safety of workers provided for, as required by the most recent standards adopted by OSHA Standards Board. Sheeting and shoring shall be utilized where required to prevent any excessive widening or sloughing of the trench, which may be detrimental to human safety, the pipe, appurtenances being installed, existing utilities, existing structures, or to any other existing facility or item.

Trench support is the sole responsibility of the Contractor. The District Inspector's presence in no way implies approval of trench support methods being utilized.

- C. *Excavated material.* Excavated material shall not be placed closer than two feet (2') from the top edge of the trench. Heavy equipment should not be used or placed near the sides of the trench unless the trench is adequately braced.

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing traffic. Hydrants under pressure, valve lid covers, valve boxes, or other utility controls shall be left unobstructed and accessible until the work is completed.

- D. *Excavation for structures.* Except as otherwise dictated by construction conditions, the excavation shall be of such dimensions as to allow for the proper installation and removal of concrete forms or precast structures, and to permit the construction of the necessary pipe connections. Care shall be taken to ensure that the excavation does not extend below established grades. If excavation is made below such grades, the resulting excess shall be filled in with approved material deposited in horizontal layers not more than six inches (6") in thickness after being compacted, as directed by the District.
- E. *Excavation in poor soil.* If the bottom of the excavation at subgrade is found to be soft or unstable, or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that, in the opinion of the Inspector, cannot satisfactorily support the pipe or structure, then the Contractor shall further excavate and remove such unsuitable material to the width and depth specified by the Inspector.
- F. *Protection of existing structures and utilities.* Adequate protection, temporary support, and maintenance of all underground and surface structures, utilities, and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his expense and under the direction of the District. Any structures, utilities, or obstructions disturbed or damaged shall be restored or replaced by the Contractor upon completion of the project.

6.6 Blasting

In general, blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted and a copy presented to the District. All explosives and appurtenances shall be transported, handled, stored, and used in accordance with the laws of the local, state, and federal governments, as applicable.

All blasting shall be controlled so as not to damage any existing structure or facility. The protection of life and property and all liability for blasting shall be placed solely on the Person or Persons conducting the blasting operation. The hours of blasting shall be fixed by the Inspector in accordance with the permit of the local authority.

Owners or occupants of nearby structures or facilities, within a minimum distance of five hundred feet (500'), must be notified in writing by the Contractor at least seventy-two (72) hours in advance of blasting. The notice shall state the date, the time of blasting, and who is responsible for the

blasting. The District shall be notified a minimum of forty-eight (48) hours in advance of any blasting.

Blasting shall be controlled to avoid making any excavation unduly large or irregular, and so as not to shatter the rock on the bottom or sides of any excavation or surface upon or against which concrete is to be placed. If, in the opinion of the District, blasting is liable to damage rock foundations or supports, concrete, other utilities, or structures, all blasting shall be terminated and excavation shall be continued by jack-hammering, barring, wedging, or other methods.

6.7 Dewatering

All pipe trenches or structure excavation shall be kept free from water during pipe laying and other related work. The method of dewatering shall provide for a completely dry foundation at the final lines and grades of the excavation.

Dewatering may require a construction dewatering permit from the CDPHE.

Dewatering shall be accomplished by the use of well points, sump pumps, rock or gravel drains placed below subgrade foundations, or subsurface pipe drains. All water shall be disposed of in a suitable manner without being a menace to public health or causing public inconvenience. The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe flotation. When pipe is installed in a casing or tunnel longer than thirty (30) pipe diameters, the pipe inside and casing or tunnel shall be secured so flotation does not occur when the pipe is empty.

Water shall not be allowed to rise until any concrete has set and the forms have been removed. Water shall not be allowed to rise unequally against unsupported structural walls.

6.8 Pipe Bedding

It is expected that the trench excavation will provide suitable bedding and backfill material. Wet, soft, or frozen material, asphalt and concrete chunks, cinder ashes, refuse, vegetable or organic material, boulders, rocks, or other deleterious substances shall not be used for bedding or backfill.

If the excavated material is not suitable for bedding or backfill as determined by the Inspector, suitable material shall be hauled in and utilized, and the rejected material hauled away and disposed.

Six inches (6") of squeegee or ¾" crushed rock shall be placed on the trench bottom for support under the pipe and compacted. Squeegee or ¾" crushed rock are the only materials to be used for pipe bedding, no native is allowed for pipe bedding.

Bell holes shall be dug deep enough to provide a minimum of two inches (2") of clearance between bell and bedding material. All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, bedding material (squeegee sand) shall be carefully placed and tamped under the haunches of the pipe and in the previously-dug bell holes.

"Tamping" is herein defined as the act of placing approved bedding material under the haunches of pipe, paying particular attention to voids, bell holes, and sling holes. The purpose of tamping is to ensure uniform support for the pipe.

- A. *Pipes.* Unless select bedding material is required, all pipelines shall be bedded by hand, from the bottom of the trench to the centerline of the pipe, with sand, gravel, or other approved material placed in layers of three inches (3") and compacted. Bedding material shall be deposited in the trench for its full width on each side of the pipe, fittings, and appurtenances simultaneously.

The pipe shall be bedded by approved mechanical methods from the centerline of the pipe, fittings, and appurtenances to a depth of twelve inches (12") above the top of the pipe. Special care shall be used in placing this portion of bedding so as to avoid disturbing the pipe.

PVC pipe shall be installed in accordance with ASTM D2321 and the Manufacturer's recommendations, unless otherwise specified herein.

DIP pipe shall be installed in accordance with AWWA C600 and the Manufacturer's recommendations, unless otherwise specified herein.

The trench shall be backfilled by approved mechanical methods from twelve inches (12") above the pipe to the grade shown on the plans or specified herein.

- B. *Structures.* Backfill and fill within three feet (3') adjacent to all structures and for full height of the walls shall be selected, non-swelling material. It shall be relatively impervious, well graded, and free from stones larger than three inches (3"). Material may be job excavated, but selectivity will be required. No backfilling will be allowed in freezing weather except by permission of the District. No additional backfill will be allowed over any frozen material already in the trench.

6.9 Select Bedding Material

When indicated on the plans or drawings or when, in the opinion of the Inspector, select bedding material is required, preparation and installation shall be as follows:

- A. *Installation of bedding and pipe.* After completion of the trench excavation and proper preparation of the foundation, six inches (6") of bedding material shall be placed on the trench bottom for support under the pipe and compacted. Bell holes shall be dug deep enough to provide a minimum of two inches (2") of clearance between the bell and bedding material.

All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade, and the joint is made, the bedding material shall be carefully placed and tamped under the haunches of the pipe and in the previously-dug bell holes.

If approved by the District, fines from the trench wall and soil pile may be used to provide uniform support for the pipe. No rock or stone larger than allowed by the sieve analysis, or any other detrimental substance, shall be placed closer to the pipe than six inches (6"). The District reserves the right to require the use of select bedding material at any time.

For ductile iron and polyvinyl chloride pipe, the limits of bedding shall be from six inches (6") below the bottom of the pipe to twelve inches (12") above the top of the pipe.

- B. *Bedding material.* Bedding material shall be a clean squeegee sand, free of corrosive properties, and shall conform to the following gradation limits when tested by means of laboratory sieves:

Squeegee Sand

Sieve Size	Total Percent Passing by Weight
3/8 inch	100
No. 200	– 5

- C. *Foundation material.* Foundation material shall be uniformly graded, washed rock conforming to the sieve analysis below. A minimum of twelve inches (12") of foundation material shall be placed below the pipe to the trench bottom.

Foundation Material

Sieve Size	Total Percent Passing by Weight
2 inch	95 – 100
1/2 inch	10 – 30
#4	0 – 5

- D. *Flowable fill*. On a case-by-case basis and at the District's option, utility trench backfill meeting the requirements in the table below may be used in lieu of native backfilling in any excavation, regardless of width or depth. Concrete-slurry type, full-depth backfill will not be allowed within the public right-of-way. Compaction and testing of utility trench backfill will not be required if material meeting the following specification is used:

Flowable Fill

Ingredient	lb./cubic yard
Cement	42 (0.47 sack)
Water	325 (43 gallons or as needed)
Coarse Aggregate (Size # 57)	1,700
Sand (ASTM C-33)	1,845

If approved by the District, fines from the trench wall and soil pile may be used to provide uniform support for the pipe. No rock or stone larger than that allowed by the sieve analysis, or any other detrimental substance, shall be placed closer to the pipe than six inches (6"). The District reserves the right to require the use of select bedding material at any time.

6.10 Backfill and Compaction

No section of Wastewater Main, Wastewater Main appurtenance, or Wastewater Main structure shall be backfilled until the Inspector has examined and approved that section of the installation. Backfill is defined as the material placed from twelve inches (12") above the pipe to grade. **All backfill and compaction within the public right-of-way shall be in conformance with the excavation permit granted by the District Engineer or the controlling authority.**

Satisfactory compaction reports shall be submitted to the controlling authority prior to the completion of the project. The controlling authority (city, county, state) shall specify the exact number and locations of tests required. Railroad, airport, and other private or special situations will require investigation and research to determine exact requirements and regulations.

All water required for backfill and compaction operations can be furnished from a designated fire hydrant near the project. The Contractor will be charged in accordance with the current cost for construction water. However, the Contractor will be responsible for furnishing all required personnel, valving, hose and other equipment needed to deliver the water to the desired location on the project. The District will designate the fire hydrant to be used and must be notified when water is required.

6.11 Cleanup

Upon completion of the work, all rubbish, unused materials, concrete forms, and other like materials shall be removed from the job site. All excess excavation shall be disposed of as specified and the areas shall be left in a state of order and cleanliness.

6.12 Surface Restoration and Maintenance

- A. *Surfaced areas*. The Contractor shall obtain the necessary permits and remove pavement and road surfaces as part of the trench excavation. As a minimum, cuts in a public right-of-way shall be required to be restored per the conditions of the excavation permit issued by the District Engineer or the controlling authority. The Contractor shall restore all pavement, sidewalks, curbing, gutters,

or other surface structures removed or disturbed as part of the work to a condition meeting the standards of the governing authority, and shall furnish all incidental labor and materials.

- B. *Unsurfaced areas.* All surface areas' cuts shall be restored to a condition equal to that prior to construction.
- C. *Damaged surfaces and property.* If any pavement, street, shrubbery, sod, rock, fences, poles, or other property and surface structures have been damaged, removed, or disturbed by the Contractor (whether deliberately or through failure to carry out the requirements of the controlling agency or the specific directions of the District, or through failure to employ usual and reasonable safeguards), such property and surface structures shall be replaced or repaired, to the original condition, at the expense of the Contractor.

SECTION 7.0 – WASTEWATER SYSTEM PIPE-LAYING STANDARDS

7.1 Handling of Materials

Pipe and fittings shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall such material be dropped. If, however, any part of the coating or lining is damaged, the replacement or repair of the damaged pipe shall be done to the satisfaction of the District. Any pipe or fittings that are not acceptable to the District shall be removed from the job site immediately. All pipe-handling equipment and pipe-handling methods shall be approved by the District in conjunction with the methods and equipment recommended by the Manufacturer.

7.2 Inspection and Preparation of Pipe and Fittings

Before placing pipe in the trench, each pipe or fitting shall be thoroughly cleaned of all foreign material, kept clean at all times thereafter, and carefully examined for cracks and other defects before installation. Bell ends and spigot ends are to be examined with particular care. Defective pipe or fittings shall be laid aside for inspection by the Inspector who will prescribe corrective repairs or rejection.

All lumps, blisters, and excess coatings shall be removed from the bell-and-spigot end of each pipe and fitting, and the outside of the spigot and the inside of the bell shall be wire brushed and wiped clean, dry, and free from oil and grease before the pipe or fitting is installed. Dirt and any other material must be removed from the barrel of the pipe before installation.

7.3 Cutting and Fitting of Pipe

Pipe shall be cut, whenever necessary, to conform to location of fittings, line, or grade. All cuts shall be straight and true, and in a workmanlike manner so as to leave a smooth end without damaging the pipe or its cement lining. All burrs shall be removed from the ends of cut pipe, and the end lightly rasped or filed. All tools used in cutting pipe shall be approved by the District.

7.3.1 Pipe Joint Lubrication

Joint lubricant shall be supplied by the pipe Manufacturer and approved by the District. Joint lubricant shall be non-toxic and water soluble.

7.3.2 Pipe Alignment and Grade

In laying pipe, the intent is to lay to set line and grade. Fittings and manholes shall be installed at staked locations and elevations.

When laying pipe on curves, the intent is to lay to the staked alignment. The pipe shall be kept in alignment by placing all deflecting joints or bends on the curve. Short lengths shall be used as necessary to accomplish the curvature without exceeding individual deflections specified. The maximum deflection at any joint shall not exceed one-half (1/2) of the Manufacturer's recommendation.

The Engineer may use eleven-and-one-fourth-degree (11.25°) bends on a case-by-case basis as approved by the District. These bends shall be shown on the design plans and staked in the field. At no time shall eleven-and-one-fourth-degree (11.25°) bends be used to reduce the radius below the minimum of one hundred feet (100').

Any changes in alignment and grade must be authorized by the Inspector and shall be approved by the District. Pipe shall be laid up grade with the bell ends facing in the direction of laying, unless directed otherwise by the District. Where pipe is to be installed on a grade of ten percent (10%) or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe up grade.

7.3.3 Temporary Bulkheads

Whenever the pipe is left unattended, temporary plugs shall be installed at all openings to isolate existing pipelines from new construction until accepted by the District. Temporary plugs shall be of such design as to prevent water, debris, children, and animals from entering the pipe. All temporary plugs shall be provided by the Contractor and approved by the Inspector.

7.3.4 Frost

No pipe or appurtenant structure shall be installed upon a foundation into which frost has penetrated, or at any time when the Inspector deems there is danger of ice formation or frost penetration at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

7.3.5 Lowering of Material into the Trench

Proper implements, tools, and facilities satisfactory to the District shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, and manholes 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 Wastewater Main materials and their protective coatings and linings. Under no circumstances shall Wastewater Main materials be dropped or dumped into the trench.

If damage occurs to any pipe, fitting, manhole, or Wastewater Main accessories in handling, the damage shall be immediately brought to the attention of the Inspector. The Inspector shall prescribe corrective repairs or rejection of the damaged items.

7.4 Laying of Pipe

All pipe-laying methods shall conform to the Manufacturer's recommendations for laying pipe. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Inspector may require that, before lowering the pipe into the trench, a heavy, tightly-woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.

As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced home with a slow, steady pressure, without jerking or jolting movements, and brought to correct line and grade. The pipe shall be secured in place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space. No wooden blocking shall be left at any point under the pipeline.

No pipe shall be laid when, in the opinion of the District, trench conditions are unsuitable.

7.5 Ductile Iron Pipe

Push-on joint. Immediately before two (2) lengths of ductile iron pipe, the inside of the bell, outside of the spigot end, and the rubber gasket shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign mater. The rubber shall be flexed inward and inserted in the gasket recess of the bell socket. Since different manufactured brands of pipe require different types of gaskets, the Contractor shall exercise caution to ensure that the correct type of gasket is used.

A thin film of approved gasket lubricant shall be applied to either the inside face of the gasket, the spigot end of the pipe, or both.

The spigot end of the pipe shall be placed in the bell end with care to prevent the joint from contacting the ground. Pipe furnished without a depth mark on the spigot end shall be marked

before assembly to ensure insertion to full depth of the joint. The pipe shall be kept in straight alignment and the joint shall be completed by pushing the pipe home with slow, steady pressure without jerking or jolting movements, by using a forked tool, jack-type tool, or other device approved by the District Engineer. If pipe is pushed home with a backhoe bucket, a wooden shield must be placed between the backhoe bucket and the end of the pipe. The spigot end of field-cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured.

<u>Bolt Size</u>	<u>Ft. Lbs.</u>
5/8"	40-60
3/4"	75-90
1"	85-100
1-1/4"	105-120

Nuts spaced one hundred and eighty degrees (180°) apart shall be tightened alternately in order to produce equal pressure on all parts of the gland.

7.6 Polyvinyl Chloride Pipe

Upon completion of joining push-on joint pipe, an inspection shall be made to assure that the gasket is correctly aligned in the gasket recess of the bell socket and not twisted or turned.

When laying pipe on curves, the intent is to lay to the staked alignment. The pipe shall be kept in alignment by placing all deflecting joints or bends on the curve. Short lengths shall be used as necessary to accomplish the curvature without exceeding individual deflections specified. The maximum deflection at any joint shall not exceed one-half (1/2) of the Manufacturer's recommendation.

- A. *Elastomeric gasket joint.* Immediately before joining two (2) lengths of PVC pipe, the inside of the bell or coupling, the outside of the spigot, and the elastomeric gasket shall be thoroughly cleaned to remove all foreign material.

Lubrication of the joint and rubber gasket shall be done in accordance with the pipe Manufacturer's specifications.

Care shall be taken that only the correct elastomeric gasket, compatible with the annular groove of the bell, is used. Insertion of the elastomeric gasket in the annular groove of the bell or coupling must be in accordance with the Manufacturer's recommendations. Pipe that is not furnished with a depth mark shall be marked before assembly to ensure that the spigot end is inserted to the full depth of the joint.

The spigot and bell or coupling shall be aligned and pushed until the reference line of the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion. Upon completion of joining the pipe, an inspection shall be made to ensure that the gasket is correctly aligned in the gasket recess of the bell socket and not twisted or turned.

- B. *Pipe storage.* Pipe stored outside and exposed to sunlight for more than thirty (30) days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover pipe. Air circulation shall be provided under the covering.
- C. *Handling of pipe in cold weather.* PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling and installing PVC pipe during cold weather.

7.7 Manholes

Manholes shall be precast and shall be constructed in accordance with these Specifications. Precast manholes shall be made **watertight** after installation or construction by use of approved methods.

All dimensions, locations, and elevations shall be coordinated by the Developer and Contractor and meet the requirements of the District.

All manholes shall be constructed to meet H.S. 20-44 traffic loading conditions and three hundred pounds per square foot (300 PSF) surcharge load.

Tracer wire coming into manholes shall have a two-foot (2') hanging length inside the manhole.

The District may require installation of a precast manhole base when weather or field conditions warrant.

For cast-in-place manhole bases on existing pipe, a gasket must be installed on all existing pipe penetrations within the outside extents of the cast-in-place base.

The base shall be placed on compacted or undisturbed earth. A reducing ring or cone shall be set on an eight-inch (8") adjustment ring.

All joints, manhole rings, and cones shall be made watertight by installation of Ram-Nek or approved equal material in the joint.

Barrels shall be wrapped with RU116 - RUBR-NEK External Joint Wrap (or approved equal) and coated.

The manhole ring shall be set on the cone on a full bed of Ram-Nek.

7.8 Bridging and Encasement of Pipe

Under certain conditions, when the Wastewater Main is to be installed over or under an existing or proposed utility or structure, the District may require bridging or encasement of the proposed wastewater pipe.

If, in the opinion of the District Engineer, there exists the possibility of settlement of the pipe being installed over an existing utility or structure, then bridging of the pipe shall become necessary. This condition shall also apply to other underground utilities or structures being installed over existing Wastewater Mains. The District Engineer shall determine the size and location of the concrete bridging.

Under certain conditions, the District may require complete encasement of Wastewater Mains with concrete. The District Engineer shall determine the size, length, and location of these encasements.

7.9 Encasement or Sleeve Pipe

Wherever it is necessary to provide an encasement or sleeve for the Wastewater Main, the Wastewater Main shall not be inserted into the encasement or sleeve pipe without providing insulating skids for each joint of the Wastewater Main. Insulating skids shall be of a type such as the "PSI custom pull on (Model C)" or approved equal.

Encasement pipes shall be protected both inside and out with corrosion-resistant materials having a bituminous base. Encasement or sleeve pipe size, length, type, and sidewall thickness will be determined by the District.

7.10 Corrosion Protection Systems

The determination of the corrosiveness of the soil through which a Wastewater Main passes and the need for protection will be made and determined by the District. If metal pipe is required to be used, it must be protected against corrosion. All required corrosion protection shall be provided by the Contractor and the material shall be made up of all or part of the following:

- A. *Polyethylene encasement material.* The pipe, fittings, and appurtenances shall be wrapped in polyethylene, in accordance with Standard Drawing WW-12 Polyethylene material, and shall conform to page MS-04 of the materials specifications.
- B. *Coatings.* Metal pipe and other appurtenances may require protective, corrosion-resistant coating. The following are approved for exterior use only:

- Roskote A-51 Mastic
- American Blackline Product #101 – Non-Fibrous Roof Coat
- Asphaltic Base Roofing Tar

Coatings must be of a consistency that is applicable by brush and cannot contain asbestos fiber. In all cases, the Contractor must provide the Inspector an MSDS on the product to be used prior to application.

- C. *Bonding joints.* All pipelines that require protection will be bonded at every joint and/or coupling. Bonding shall be accomplished by thermo-welding straps or wire across each joint or coupling. The Contractor shall furnish all material required for bonding.
- D. *Anodes.* Installation of seventeen pound (17 lb) magnesium anodes may be required for additional protection to the pipeline. All anodes shall be furnished and installed by the Contractor in conformance with these Specifications.
- E. *Test stations.* Required electrolysis test stations will be provided and it shall be the Contractor's responsibility to install the test station.
- F. *Dissimilar materials.* Cathodic protection and insulation shall be installed as required by the District. Particular care shall be taken to insulate between dissimilar materials.
- G. *Insulating joints.* Whenever it is necessary to join pipe of dissimilar metal, or when designated by the District, a method of insulating against the passage of electrical current, approved by the District Engineer, shall be provided. Special care shall be exercised during the installation of these joints to prevent electrical conductivity across the joints.
- H. *Polyethylene encasement material.* Whenever designated by the District, the metallic pipe and all appurtenances shall be wrapped in polyethylene. The polyethylene encasement shall prevent contact between the pipe and bedding material, but is not intended to be a completely air-tight and watertight enclosure.

Prolonged exposure to sunlight will eventually deteriorate polyethylene film. Exposure to sunlight shall be kept to a minimum.

The polyethylene shall have a minimum thickness of eight (8) mils and conform to the Materials Specification in MS-13 from AWWA C105.

A two-inch (2") wide, ten (10) mil thickness polyethylene pressure-sensitive tape shall be used to close seams, secure to pipe, or hold overlaps.

Damage to polyethylene-wrapped pipe in the trench prior to and during backfill shall be repaired to the satisfaction of the District.

- I. *Insulating from concrete.* Areas of metal pipe and appurtenances which are to be in contact with concrete-bridging blocks or encasement shall be protected against corrosion prior to installing concrete. The following types of protection systems are acceptable:
1. Application of a cold-applied coating.
 2. Application of a cold-applied primer and corrosion-resistant pipe wrap with a minimum fifty percent (50%) overlap similar to the primer and pipe wrap manufactured by the Protecto Wrap Company (or approved equal).

Other proposed protection systems may be accepted following review and approval of the District and the District Engineer.

7.11 Cleaning

Prior to acceptance of each section of sewer Main (from manhole to manhole), the Contractor shall, at Contractor's expense, jet rod and/or vac each section. Larger sewers shall be cleaned by other appropriate methods approved by the Inspector. All dirt and debris shall be prevented from entering the active sewer system by means of watertight plugs or other methods approved by the Inspector.

7.12 Compaction Tests

Compaction tests at the expense of the Contractor shall be conducted by an independent testing laboratory, see Section 5 of these Specifications. One test shall be conducted for each manhole run, or every four hundred feet (400'), whichever is greater, or as required by the controlling agency. Copies of each compaction test report will be given to the Inspector prior to approval.

7.13 Infiltration and Exfiltration Tests

Infiltration and exfiltration tests conducted by and at the expense of the Contractor shall be performed on 100% of the project.

The allowable infiltration or exfiltration rate shall not exceed fifty (50) gallons per inch of diameter per mile of pipe, per day **to include manholes**.

Air Tests. The Contractor shall perform these tests with suitable equipment specifically designed for air testing sewers. A suitable gauge shall be used for readings not to exceed 15 PSI maximum reading. The gauge shall be located at the surface.

The air test shall be made when the sewer is clean. The pipe, or section of pipe to be tested, may be wetted before the air test. The line shall be plugged at each manhole with pneumatic balls. Low-pressure air shall be introduced into the plugged line until the internal air pressure reaches four (4.0) PSIG greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two (2) minutes shall be allowed for the air temperature to stabilize before readings are taken and the tuning is started.

The portion of Main (including stubs) being tested shall pass if it does not lose air at a rate to cause the pressure to drop from three and six-tenths (3.6) to three (3.0) PSIG (greater than the average back pressure of ground water that may submerge the pipe) in less time than listed below:

PIPE DIAMETER (inches)	MINIMUM ALLOWABLE TIME
	(Minutes & Seconds) 3.6 – 3.0 PSIG Pressure
4	0-50
6	1-10
8	1-40
10	2-00
12	2-20
15	3-00
18	3-40
21	4-10
24	4-50

If the installation fails this test, the testing equipment shall be used to determine the location of the pipe leak. All service plugs shall be secured in place to prevent displacement during testing operations.

If results of these tests are not satisfactory, the Contractor, at his expense, will make the necessary repairs or pipe replacement until the Inspector is satisfied that the leakage requirements are being met.

7.14 Deflection Test

Flexible conduits shall be tested by the Inspector. Representative samples will be tested to ensure initial deflection does not exceed five percent (5%) of the inside diameter of the pipe.

Failure of representative sections to pass the deflection limits will result in additional sections being tested at the discretion of the Inspector.

If the results of this test are not satisfactory, the Contractor at his expense will make the necessary repairs or pipe replacement until the Inspector is satisfied that the deflection requirements are being met.

7.15 TV Inspection

The District Inspector shall inspect by closed circuit television, all new public Mains for deficiencies prior to any service connections being made.

The District Inspector may require that the Contractor add water to the pipeline prior to TV inspection to help identify deficiencies.

All deficiencies found during the TV inspection shall be promptly corrected by the Contractor in accordance with these rules.

An electronic copy of the CCTV inspection shall be made available to the District upon completion.

7.16 Vacuum Testing for Concrete Sewer Manholes

All manholes shall be vacuum tested with District staff present prior to CCTV inspection.

This test method covers procedures for testing precast concrete manhole sections (and other manholes, existing or in-situ) when using the vacuum test method to demonstrate the integrity of the installed materials and the construction procedures.

This test method is used for testing concrete manhole sections utilizing mortar, mastic, or gasketed joints. This test method is intended to be used as a preliminary test to enable the installer to demonstrate the condition of the concrete manhole.

Contractor must follow OSHA requirements for confined spaces.

Contractor must use his own equipment for vacuum testing.

Each manhole shall be vacuum tested after backfilling.

- A. All lift holes and any pipes entering the manhole are to be plugged and sealed. A vacuum will be drawn and the vacuum drop over a specified time period is used to determine the acceptability of the manhole (reference D and E below).
- B. The values recorded are applicable only to the manhole being tested and at the time of testing, and the recorded information, reported on the *Vacuum Testing Result* form, at the end of this section.
- C. Preparation of the Manhole

1. Care shall be taken to affect a seal between the vacuum base and the manhole rim. Pipe plugs shall be secured to prevent movement while the vacuum is drawn.
2. All pipes entering the manhole shall be temporally plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

D. Typical Field Test Procedure

1. The test head gauge shall be placed at the top of the manhole or in accordance with the Manufacturer's recommendations.
2. A vacuum of ten (10) in. of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to nine (9) in. of mercury.
3. The manhole shall pass if the time for the vacuum reading to drop from ten (10) in. of mercury to nine (9) in. of mercury meets or exceeds the values indicated in the table below.
4. If the manhole fails the initial test, necessary repairs shall be made by a submitted, approved method to the District Inspector. The manhole shall then be retested until a satisfactory test is obtained.

Woodmen Hills Metropolitan District
Manhole Vacuum Test Log 2021

Inspected By: _____ Location: _____
Date: _____ Contractor: _____

5-Foot I.D.	➤ 75 Seconds
6-Foot I.D.	➤ 90 Seconds
7-Foot I.D.	➤ 105 Seconds
8-Foot I.D.	➤ 120 Seconds
10-Foot I.D.	➤ 150 Seconds

- E. Minimum test time for all manholes is 60 seconds. Greater lengths of time shall be at the discretion of the Inspector.

7.17 Manhole Rim Elevations

All manholes constructed shall have rim elevations set at final street, trail, or sidewalk grades, except in non-traffic areas where the rims shall be set at six inches (6") above the existing ground. Following the construction of curb and gutter in new streets or completion of manholes in streets with existing curb and gutter, the Engineer will measure and certify all manhole rim elevations for proper grade. At no time shall the total of grade adjustment rings exceed eight inches (8"). Any manhole rims that do not meet the following policy for manhole adjustment will be promptly adjusted, except within state and federal jurisdiction or rights-of-way.

- A. *Responsibility.* The applicant requesting approval for extension of Wastewater Collection Lines shall be responsible for assuring sanitary sewer manholes are adjusted to final paving grade and are cleaned of dirt and construction debris. The applicant shall also ensure that:
1. Such work is completed within the time periods noted below.
 2. All work is completed in compliance with these Specifications and all District requirements.
 3. Such work has been inspected by the District.

4. Such work will be free of mechanics liens, judgment liens, or other valid and enforceable liens.
- B. *Required adjustments.* Manhole adjustments and cleaning must be completed within sixty (60) days following placement of paving. If street paving is not completed or manholes are not adjusted within one (1) year of the preliminary acceptance date, the District will extend the warranty period for one (1) additional year during which manhole adjustments must be completed as indicated above.
- C. *Location of manholes to be adjusted.* The District will attempt to provide surface location of manholes requiring adjustment within two (2) working days of request for location.
- D. *Opening and entry permit and inspection.* The person or corporation performing the adjustment work must apply for a manhole opening and entry permit two (2) working days prior to beginning work and must notify the Inspector designated on the permit when the work is ready for inspection. The designated Inspector will perform the inspection within two (2) working days of the request for inspection and will provide the permittee a notice of acceptance or rejection of the work. Correction of rejected terms must be completed within the time frame noted by the Inspector.
- E. *Failure to perform adjustments.* Failure of the applicant for Wastewater Collection extension to adjust the manholes in accordance with the requirements of this policy will result in the District exercising any combination of the following rights:
 - i. Withholding approval of additional connection permits within the project area
 - ii. Extension of the warranty period until adjustments are completed
 - iii. Performing the necessary manhole adjustments and cleaning work by contract or with District personnel and billing the expense plus administration, legal, overhead and other applicable expenses to the applicant

7.18 Service Line Inspection

Service stubs and building sewer lines shall not be backfilled until approval is given by the District Inspector. Any deficiencies noted by the Inspector shall be corrected by the Contractor prior to calling for reinspection. The Contractor and builder or Developer will be notified in writing by the Inspector of all deficiencies requiring correction.

After approval is given for Service Stubs or building sewers, the Contractor shall commence backfilling in accordance with these Specifications, as soon as practical.

SECTION 8.0 – WASTEWATER SERVICE STANDARDS

8.1 Wastewater Taps

Single saddle tap allowed on existing mains. Multiple saddle taps on existing mains must be approved by the District on a case by case basis. No wastewater taps shall be made unless property corners are clearly marked so measurements of taps can be made at the time of tapping. All four-inch (4") Wastewater Service Lines must be connected to Main and are not allowed to tie into manholes. Services larger than four inches (4") must be reviewed and approved by the District's Engineer.

8.2 Excavations

Excavation of the tapping hole is the responsibility of the plumber or pipeline Contractor.

8.3 Abandoning Existing Connections

Where an existing Wastewater Service is to be abandoned, the owner of the property shall be totally responsible for expenses. The Contractor shall expose the connection to be abandoned two feet (2') inside the property line unless otherwise specified by the District. Services found to be unacceptable shall be capped at the public Main. The District shall inspect the work prior to backfilling of the excavation. If a service stub-out is over five (5) years old, the District can elect to have it removed and abandoned in place at the expense of the landowner.

8.4 Individual Service Pumps

Where conditions require external installation of individual pumps to service a structure, the Contractor shall submit a set of shop drawings detailing the installation, and shall include:

- A. A site map showing the location of all the facilities to be installed including the location of the tap to the public Wastewater Main.
- B. Equipment to be installed, including the number and type of pumps, controls, alarms, and valves.

8.5 Wastewater Service Line Ditches

Wastewater Service Line ditches must enter lots as close to ninety degrees (90°) to the street as is practical and not at an extreme angle unless otherwise approved. Standard location for the Service Line is center of lot unless in a hillside overlay zone and/or approved by the District.

8.6 Inline Wye

Wastewater Service Lines shall be constructed with an approved Wastewater Service inline wye.

8.7 Installation Method

All Wastewater Service Lines shall be installed using the same methods as the public Main.

8.8 Slope

Wastewater Service Lines shall be installed at the following minimum slopes:

4" PVC	2.08% or 1/4" per foot
4" Ductile Iron	1.04% or 1/8" per foot
6" Pipe	1.04% or 1/8" per foot

8.9 Alignment

Changes in alignment for Service Lines shall be accomplished with preformed bends not to exceed forty-five degrees (45°). When changes in direction exceed forty-five degrees (45°), a two-foot (2') section of pipe shall separate the fittings necessary to make the needed change of direction. All services shall be extended ten feet (10') inside the property line or easement line, and be marked with a two-by-four (2 x 4) post.

8.10 Cleanouts

All Wastewater Service Lines shall have dual cleanouts five feet (5') away from the foundation and every one hundred feet (100'). All cleanouts shall be constructed with standard fittings and have a screw cap located at the ground or paving surface.

8.11 Connecting Clamps

All Wastewater Service Line-connecting clamps shall have the "UPC" designation and be made for the pipeline materials used.

8.12 Repair and Replacement of Existing Service Lines

8.12.1 Responsibility

The property owner is responsible for the repair and maintenance of the Wastewater Service Line from the house or other building to the public main.

Plumbing or pipeline Contractor's responsibility. The plumbing or pipeline Contractor shall make the necessary excavations, barricade all excavations in accordance with the barricading instructions of the governing body, make the necessary repairs, and contact the District for inspection.

8.12.2 Surface Restoration and Maintenance

- A. *Surfaced areas.* The Contractor shall obtain the necessary permits and remove pavement and road surfaces as part of the trench excavation. **At a minimum, cuts in a public right-of-way shall be required to be restored per the conditions of the excavation permit issued by the controlling authority.**

The Contractor shall restore all pavement, sidewalks, curbing, gutters, or other surface structures removed or disturbed as part of the work to a condition meeting the standards of the governing authority, and shall furnish all incidental labor and materials.

- B. *Unsurfaced areas.* All surface cuts shall be restored to a condition equal to that prior to construction.
- C. *Damaged surfaces and property.* If any pavement, street, shrubbery, sod, rock, fences, poles, or other property and surface structures have been damaged, removed, or disturbed by the Contractor (whether deliberately or through failure to carry out the requirements of the controlling agency or the specific directions of the District, or through failure to employ usual and reasonable safeguards), such property and surface structures shall be replaced or repaired to the original condition, at the expense of the Contractor.

SECTION 9.0 – WASTEWATER SYSTEM MATERIALS STANDARDS

9.1 Polyvinyl Chloride Pipe and HDPE Pipe – 4-inch Through 24-inch Diameter

General. All polyvinyl pipe shall be manufactured in accordance with ASTM Standard D3034, *Polyvinyl Chloride (PVC) Sewer Pipe and Fittings*, and ASTM Standard F679 *Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings* with the following additional requirements or exceptions:

- A. *Size of pipe.* This specification shall cover polyvinyl chloride pipe in four-inch (4"), six-inch (6"), eight-inch (8"), ten-inch (10"), twelve-inch (12"), fifteen-inch (15"), and eighteen-inch (18") nominal diameters. Pipe larger than eighteen-inch (18") diameter shall be reviewed and approved on a case-by-case basis.
- B. *Joint type.* Pipe joints shall be made using an integral bell with an elastomeric gasket push-on type joint or using machined couplings of a sleeve type with rubber ring gaskets and machined pipe ends to form a push-on type joint.
- C. *Class and type.* All sizes of pipe shall be SDR35 or PS 46.
- D. *Pipe length.* Each length of pipe will be a standard laying length of twelve-and-one-half feet (12.5').
- E. PVC materials shall be made from class I2364C, 12454C, or 12454B virgin compounds as defined in ASTM F679 or ASTM D3034.
- F. Elastomeric gaskets shall conform to ASTM D32 or ASTM F477.
- G. Force Main pipe shall be either C-900 PVC, DR14, ductile iron pipe, or HDPE 4710 DR-11 through DR-9.

9.2 Ductile Iron Pipe

General. All ductile iron pipe shall be manufactured in accordance with AWWA Standard C151, *Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Line Molds, for Water or Other Liquids*, with the following additional requirements or exceptions:

- A. *Size of Pipe.* This specification shall cover ductile iron pipe in four-inch (4"), six-inch (6"), eight-inch (8"), twelve-inch (12"), sixteen-inch (16"), twenty-inch (20"), twenty-four inch (24"), thirty-inch (30"), and thirty-six-inch (36") nominal diameters.
- B. *Joint Type.* "Push-on Single Gasket" type conforming with applicable requirements of AWWA Standard C111 *Rubber-Gasket Joints for Cast-Iron and Ductile Iron Pressure Pipe and Fittings*.
- C. *Class and Type.* Pipe furnished under this specification shall conform to the following pressure classes as shown in AWWA Standard C-150, at a minimum:

Size	Pressure Class (PSI)	Equivalent Thickness (In.)
4" Diameter	Class 350	0.25
6" Diameter	Class 350	0.25
8" Diameter	Class 350	0.25
12" Diameter	Class 350	0.28
26" Diameter	Class 330	0.34
20" Diameter	Class 300	0.36
24" Diameter	Class 250	0.37
30" Diameter	Class 200	0.38
36" Diameter	Class 200	0.42

Higher pressure class pipe will be required when the District determines that excessive dead-load or other conditions warrant increased wall thickness.

- D. *Pipe Length.* Pipe furnished under this specification will have normal laying lengths of either eighteen feet (18') or twenty feet (20').
- E. *Material Strength.* Iron used in the manufacture of pipe furnished under this specification shall have 60/42/10 physicals.
- F. *Cement-Mortar Lining.* Pipe furnished under this specification shall have standard thickness cement-mortar linings in accordance with AWWA Standard C 104/A21/4, *Cement-Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water.*

9.3 Polyethylene Encasement Material

General. A polyethylene encasement material shall be manufactured in accordance with AWWA Standard C105, *Polyethylene Encasement for Gray and Ductile Case Iron Piping for Water and Other Liquids*, with the following additional requirements or exceptions:

- A. *Materials.* The raw material used to manufacture polyethylene film shall be Type 1, Class A Grade E-I, in accordance with ASTM Standard Designation D-1248.
- B. *Physicals.* The polyethylene film shall meet the following test requirements:

Tensile Strength	1200 PSI minimum
Elongation	300% minimum
Dielectric Strength	800 V/Mil Thickness minimum
Thickness 0.008" (Nominal with minus tolerance. Not exceeding ten percent (10%) of nominal.)	(8) mils minimum
Melt Index	0.4 maximum

9.4 Concrete

- A. *Materials.* Cement. All cement used shall be Portland Cement acceptable under the "Standard Specifications and Tests for Portland Cement," ASTM Designation C-150 of the ASTM and conform to the latest ACI 318 building code requirements. Cement used shall be Type II.
- B. *Aggregates.* All the fine and coarse aggregates shall meet soundness requirements, deleterious substance limits, and grading limits as set forth in the latest edition of "Standard Specifications for Concrete Aggregates," ASTM Designation C-33. The limits for deleterious substances and physical property requirements of the coarse aggregates shall be selected for the applicable class designation from those listed under severe weathering regions, Table 3, ASTM Designation C-33. The maximum size aggregate that is practical for the structure design and placing conditions shall be used in the concrete.
- C. *Water.* The water used in all concrete shall be free from objectionable quantities of silt, organic matter, alkali, salts, and other impurities.
- D. *Admixtures.* An air-entraining agent shall be used in all concrete. The agent used shall conform to "Standard Specification for Air-Entraining Admixtures for Concrete," ASTM Designation C-260. The amount of air-entraining agent shall be such as will affect the entrainment of five percent (5%) plus or minus one percent (+ or – 1%) of volume of the concrete.

A water reducing admixture (WRA) may be used unless otherwise noted by the District. The admixture shall conform to ASTM Designation C-494 for Type A, or Type D chemical

admixture, shall contain no calcium chloride, and shall be compatible with the cement being used.

- E. The Contractor shall be responsible for any difficulties arising or damages occurring as a result of the selection and use of any admixture such as a delay, difficulty in concrete placing, or damage to concrete during form removal.
- F. *Concrete quality.*
 - 1. All cast-in-place concrete shall have a minimum twenty-eight (28) day compressive strength of three thousand (3,000) PSI and maximum slump of four inches (4").
 - 2. All precast concrete shall have a minimum compressive strength of four thousand (4,000) PSI.
 - 3. Unless otherwise directed, the concrete shall be consolidated with suitable mechanical vibrators operating within the concrete. Vibrators shall be so manipulated as to work the concrete thoroughly around the reinforcement and imbedded fixtures, and into corners and angles of the forms. The vibration at any point shall be sufficient to accomplish consolidation, but not prolonged to the point where segregation occurs.
 - 4. Testing. When determined necessary by the District, field control tests consisting of aggregate gradation tests, slump tests, air content tests, and making compression test cylinders shall be performed by qualified personnel in the presence of the Inspector.

9.5 Concrete Reinforcement

- A. *General.* Reinforcements shall be accurately formed and shall be free from loose rust, scale, and contaminants which reduce bond.

Unless otherwise shown on the drawings or specified herein, all requirements shall conform to the latest ACI Standard 318 and the Uniform Plumbing Code.

Reinforcements shall be accurately positioned on supports, spacers, hangers, or other reinforcements and shall be secured in place with wire ties or suitable clips.

- B. *Material.* All deformed reinforcing bars shall conform to ASTM Standard A-615, minimum grade 60.

9.6 Precast Reinforced Concrete Manhole Sections

General. All precast, reinforced manhole sections shall be manufactured in accordance with ASTM Standard C478, *Precast Reinforced Concrete Manhole Sections*, with the following additional requirements or exceptions:

- A. *Size.* This specification shall cover precast, reinforced manhole sections in five-foot (5') and six-foot (6') nominal inside diameters.
- B. *Joint type.* Manhole joints shall be made using male and female ends so that, when assembled, they make a continuous and uniform manhole.
- C. *Joint sealant.* Manhole joints shall be watertight using "Ram-Nek," or approved equal, and installed on each 'bench' of grooved joint, resulting in two (2) parallel layers of sealant.

9.7 24-inch Diameter Manhole Ring and Cover

- A. *General.* All twenty-four-inch (24") manhole ring and covers shall be manufactured to meet H-20 traffic load conditions and have a minimum inside ring clearance of twenty-two-and-one-eighths inches (22-1/8").

- B. *Material.* All rings and covers shall be cast-iron, manufactured in accordance to ASTM Designation A48, Class 30, or better.
- C. The manhole lid shall be drilled with a one-half-inch (1/2") hole, six inches (6") off center to the right of the word "SEWER."
- D. Depending on the location of the manhole, the District will require "self-sealing" lids or "self-sealing," bolt-down lids. Deater Foundry 1257B or approved equal.
- E. *Manufacturer.* All manhole assemblies shall be stamped with the name and model identification of the approved Manufacturer.
- F. The *IPI* and components shall be manufactured from corrosion-proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid, as well as other gases associated with wastewater collection systems.

The insert body shall be manufactured to the dimensions as shown on the contract drawings to allow easy installation in the manhole frame.

Relief Valve. The gas relief valve shall be designed to relieve at a pressure of one (1) PSI or less. The venting tube shall be capable of sealing out dirt and small debris. The valve shall be recessed into the bottom center of the insert so that it is protected and will not be broken by any movement of the cover over the valve. This valve configuration will allow the shallowest practicable insert design, eliminating unnecessary water retention or weight accumulation. The valve shall be easily removed for water drainage should inspection be required immediately after or during rainstorm.

Lift Strap. The insert shall have a lift strap attached to the body. Attachment of the lift strap to the insert body shall be in a recess to prevent contact with manhole cover during removal and replacement of the manhole cover.

Sizing. The IPI shall be manufactured to fit the manhole frame rim from which it hangs. Specific field measurements may be required prior to production of the insert.

Installation. The manhole frame rim shall be cleaned of all dirt or debris before placing the insert upon the rim. The insert shall be fully seated around the manhole frame rim to retard water from seeping between the insert and the manhole frame rim.

9.8 Steel Pipe Fabrication

- A. *General.* All steel pipe, fittings, and specials shall be fabricated in accordance with AWWA Standard C200, *Steel Water Pipe 6-Inches (6") and Larger*, AWWA M-11 Steel Pipe Manual, and the requirements on the drawings.

The District requirements for nominal diameter of fabricated steel pipe shall be as follows:

4-inch through 12-inch	- I.D. (Inside Diameter)
14-inch through 30-inch	- O.D. (Outside Diameter)
32-inch and larger	- I.D. (Inside Diameter)

Complete shop drawings shall be submitted to the District for approval prior to any fabrication.

- B. *Material.* All material used shall be acceptable under the Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality, ASTM Designation A283, Grade C or D. Mill pipe shall meet ASTM A53 or A139.

Steel pipe, fittings, and specials shall be fabricated to the sizes, dimensions, and shapes as indicated on the drawings. Specified pipe shall be to the nominal inside or outside diameter of the pipe as indicated above. All pipe shall have a wall thickness of at least one-half inch (1/2").

- C. *Protective coatings.* All steel pipe, fittings, and specials shall be prepared, primed, lined, coated, painted, or wrapped, as specified on the drawings.

SECTION 10.0 – WELLS AND WELL SITES

10.1 General Standards for Well Sites

- A. All sites will either be selected by the District or approved by the District. The District shall consider impact to land use as much as feasible.
- B. Well sites may be deeded sites or exclusive easements, unless otherwise agreed to in writing by WHMD.
- C. Well sites will be a minimum of four thousand square feet (4,000 sf), minimum dimensions eighty feet by fifty feet (80' x 50'). The site will be landscaped with ground cover only.

Unless otherwise determined, ground cover shall be assumed to be natural grass and/or base course.

The site must have no vertical structures or vertical landscaping within the 80' by 50' minimum area. Vertical structures and/or landscaping may exist within the well site as long as the 80' by 50' clearances are provided.
- D. Well sites may or may not be fenced at the decision of the WHMD. Type of fencing will be determined by the District.
- E. Well site access shall be provided from a public ROW and shall be a minimum of twenty-five feet (25') in width. Access may be deeded coincidental with the well site or via exclusive easement.
- F. Roadway access shall be a minimum of six inches (6") of class 6 base course or better and shall be a minimum width of fourteen feet (14'). Roadways and well sites shall be afforded positive drainage. Minimum turning radius measured at the centerline shall be thirty feet (30').
- G. Fencing requirements and specifications will be determined by the District. Where fencing is required, a lockable sixteen-foot (16') gate shall be provided.

It may be determined, at the discretion of the District, that the fencing may occupy a smaller footprint than the 80' by 50' dimensions. In such case, the fencing must be removable, but the vertical structure clearance must be maintained to the full 80' by 50' dimensions.
- H. All wells shall have a twenty-foot (20') clear distance in all directions. Each site must contain room for three (3) separate wells even if not initially designed or constructed.
- I. Well sites shall not be within any floodplain.
- J. All well sites and well site plans shall be reviewed and approved by the District.

K. Note to land-use planners:

It should be noted that each well site will incorporate a small superstructure, which often requires a *Location Approval of a Utility and/or a Regional Building* permit. These processes can be very time extensive if not considered in the overall land-use planning effort.

- L. Upon request, the District will furnish an approximate electric load data sheet to others for the purpose of planning power needs for wells.
- M. The District may use a site for joint use for other water system facilities such as booster pumping, storage, treatment, and/or system control. Where joint use is employed, the required site size will likely increase.

It is also possible that groundwater return system may accompany a well site as well.

10.2 Typical Components of Wells

The specifications, equipment manufacturers, sizes, materials, design, and installation of specific wells vary from site to site and will be determined solely by the District. Typical major components include:

- A. Surface pipe
- B. Stainless steel casings, centering devices
- C. Stainless steel screens
- D. Gravel/sand pack
- E. Pitless adapter
- F. Drop pipe and drop cord
- G. Submersible pump and motor with Allen Bradley VFD
- H. Electrical controls, WHMD SCADA system
- I. Down-hole pressure transducer for continual drawdown measurement.
- J. Concrete well pad

10.3 Typical Well Site Components

The following are the major components of a well site. The specifications, equipment manufacturers, sizes, materials, and installation can vary from site to site and will be determined solely by the District at its discretion.

- A. Concrete vault containing meters, isolation valves, piping, sampling, discharge pressure monitoring, PRV release systems, sand testers, access systems, sump evacuation, lighting, etc. Generally, one vault is needed per site and will handle up to three (3) wells from different formations.
- B. *Piping between wells and vault.* This is consistent with piping specifications included in Sections 2.0, 3.0, and 4.0.
- C. *Piping from vault to Main raw water collection system at site boundary.* This is consistent with piping specifications included in Sections 2.0, 3.0, and 4.0.
- D. Site isolation valves, risers, etc.
- E. *Superstructure.* A small superstructure is required to reside near or above the concrete vault. The structure will have a concrete foundation. The structure may be of varying materials and/or design. The structure will house the SCADA system, antennas, VFD's, electrical, lighting, site security system, and controls, and may also require heat. **It should be noted that the superstructure requires a building permit.**
- F. *Landscaping and grading.* Landscaping is limited to ground cover within the minimum site. If additional landscaping is desired for aesthetics, land-use requirements, etc., the site must accommodate that outside the minimum boundaries. The Developer and/or others are responsible for providing additional site and design if needed.
- G. *Vehicle access, grading plan, and any site drainage systems.* **Drainage reports, plans, and/or erosion control plans may require review and approval by others.**
- H. Electrical service, conduits, transformers, and pads.
- I. Fencing gates if/where required.
- J. Three-phase site power.

10.4 Well Site SCADA Services

All WHMD well sites and wells require remote monitoring and control facilities. The SCADA requirements must be consistent with District licensing, hardware, software, and other SCADA criteria. The minimum data requirements are:

A. Digital Reporting/Alarms

1. Well(s) on-off
2. Well(s) failure to start/stop
3. Control structure low temperature
4. Control structure security
5. Telemetry failure
6. Water on floor
7. High/low discharge pressure

B. Continuous Reporting

1. Well(s) flow rate
2. Well(s) drawdown
3. Well(s) VFD monitoring
4. Well(s) totalization
5. Discharge pressure

Appendix A

**REQUEST FOR DEVIATION
WATER AND WASTEWATER SYSTEM STANDARD SPECIFICATIONS**

PRODUCT NAME: _____

PRODUCT DESCRIPTION: _____

DISTRIBUTOR'S NAME: _____

DISTRIBUTOR'S ADDRESS: _____

DISTRIBUTOR'S PHONE NUMBER: _____

MANUFACTURER'S NAME: _____

MANUFACTURER'S ADDRESS: _____

MANUFACTURER'S PHONE NUMBER: _____

- Give current standard that this product complies with (ASTM, AWWA, etc.).
- Attach any product information that the manufacturer wishes considered.
- Attach list of current users of this product that we can contact.
- Review of this product by the District does not guarantee its acceptance or use in the wastewater system. A test section or project maybe required prior to general acceptance or use.

Appendix B

WATER AND SEWER MAIN EXTENSIONS

Any changes or alterations affecting the grade, alignment, elevation, and/or depth of cover of any water or sewer mains or other appurtenance shown on this drawing shall be the responsibility of the Owner/Developer. The Owner/Developer shall be responsible for all operational damages and defects in installation and material for mains and services from the date of approval until final acceptance is issued.

Signed _____ Date _____
Owner/Developer

Print Name _____

DBA _____

Address _____

FIRE AUTHORITY APPROVAL

The number of fire hydrants and hydrant locations shown on this water installation plan are correct and adequate to satisfy the fire protection requirements as specified by the Fire District serving the property noted on the plans.

Fire Protection District _____

Signed _____ Date _____
Fire Protection District

DISTRICT APPROVALS

The Woodmen Hills Metropolitan District recognizes the design engineer as having responsibility for the design and has limited its scope of review accordingly.

**WOODMEN HILLS METROPOLITAN DISTRICT
WATER DESIGN APPROVAL**

Date: _____ **By:** _____

PROJECT NO. _____

In case of errors or omissions with the water design as shown on this document, the standards as defined in the "Rules and Regulations for Installation of Water Mains and Services" shall rule.

Approval expires 180 days from Design Approval.

The Woodmen Hills Metropolitan District recognizes the design engineer as having responsibility for the design and has limited its scope of review accordingly.

**WOODMEN HILLS METROPOLITAN DISTRICT
WASTEWATER DESIGN APPROVAL**

Date: _____ **By:** _____

PROJECT NO. _____

In case of errors or omissions with the water design as shown on this document the standards as defined in the “Rules and Regulations for Installation of Wastewater Mains and Services” shall rule.

Approval expires 180 days from Design Approval.

Appendix C

WOODMEN HILLS METROPOLITAN DISTRICT GENERAL NOTES

General

1. All utility construction to be conducted in conformance with the current Woodmen Hills Metropolitan District (WHMD, the District) Specifications.
2. All plans on the job site shall be signed by the District and the District's Engineer. Any revision to the plans shall be so noted with the old drawing marked 'not valid.'
3. All stationing is centerline unless otherwise noted. All elevations are centerline unless otherwise noted.
4. All materials and workmanship shall be subject to inspection by the District. The District reserves the right to accept or reject any such materials and workmanship that does not conform to its standards and specifications.
5. All over-lot grading must be completed to within one (1) foot of final grade prior to installation of water and wastewater infrastructure.
6. All water and sewer service locations shall be clearly marked on either the curb head or the face of the curb, with an "S" for sewer and a "W" for water.
7. Ductile iron pipes, including fittings, valves, and fire hydrants, shall be wrapped with polyethylene tubing, double bonded at each joint, and electrically isolated. Bonding and anode connections shall be thoroughly coated with bituminous coatings.
8. All ductile iron pipe less than twelve inches (12") and fittings shall have cathodic protection using two (2) no. 6 wires with 17 lb. magnesium anodes every 400 feet and 9 lb. magnesium anodes at each fitting. All ductile iron pipe twelve inches (12") and greater and fittings shall have cathodic protection using two (2) no. 6 wires with 17 lb. magnesium anodes every 300 feet and 9 lb. magnesium anodes at each fitting.
9. All pipe material, backfill, and installation shall conform to the applicable specifications of the District, Colorado Department of Transportation, El Paso County Department of Transportation, Colorado Springs Utilities, and the geotechnical engineer.
10. Compaction tests shall be 95% standard proctor as determined by ASTM D698, unless otherwise approved by the District or higher standard as imposed by another agencies having right-of-way jurisdiction. This shall include all valves, fire hydrant runs, water & sewer service lines, and manholes. All reports shall be submitted to the District for review and approval.
11. The location of all existing utilities shown on the drawings are approximate only. The location of all utilities shall be field verified prior to commencing construction activities. The District shall be notified of any deviations to the line and/or grade as depicted on the plans. Contractor shall submit to the District and the engineer of record a report of the field-verified information prior to the start of construction.
12. All bends shall be field staked prior to the start of construction.
13. Bends, deflection, and cut pipe lengths shall be used to hold horizontal alignment of sewer and water lines to no more than 0.5' from the designed alignment. Construction stakes to be at twenty-five feet (25') intervals along curves to ensure location of pipeline construction.
14. At all locations where cap and stub is noted on drawings, provide a plug at the end of the pipe joint nearest the specified station. Provide a reverse anchor at all water line plugs.

15. All unused, salvaged water utility material shall be returned to the Metropolitan District as requested.
16. At the contractor's expense, all utility mains shall be supported and protected such that they shall function continuously during construction operations. Should a utility main fail as a result of the contractor's operation, it shall be replaced immediately by the contractor or by the District at full cost of labor and materials to the contractor/developer.
17. Pumping or bypass operations shall be reviewed and approved by both the District and the District engineer prior to execution.
18. The contractor shall replace or repair damage to all surface improvements, including but not limited to fences, landscaping, curb and gutter, and/or asphalt that may be caused during construction.
19. All contractors working on or near a water or sewer facility (to include service lines) shall have liability insurance naming the District as an additional insured and shall provide a current copy of workers compensation insurance on file with the District. No work can proceed without current certificates on file at the Districts' office.
20. The contractor shall notify the District and all affected utility companies adjacent to the proposed utility construction a minimum of 48 hours and a maximum of 96 hours prior to the start of construction. A weekly construction meeting shall be required with the contractor, District engineer and all other parties as deemed necessary by the District.
21. Commencement of construction of water/sewer systems within Metropolitan District:
 - a) Prior to the start of construction, a preconstruction meeting is required a minimum of 48 hours in advance of commencement of work. A representative of the owner or developer, a representative of the contractor, and design engineer are required to attend. Contact the District to schedule the preconstruction meeting. No preconstruction meeting can be scheduled before four (4) signed/approved plan sets are received by the District.
 - b) The contractor is required to notify the District a minimum of 48 hours and a maximum of 2 weeks prior to the start of construction. The contractor shall also notify affected utility companies at least 48 hours prior to the start of construction adjacent to the known utility lines.
22. Testing of facilities:
 - a) The contractor shall notify the District a minimum of 48 hours and a maximum of 96 hours prior to the start of any testing.
 - b) All sections of water line are to meet the following pressure testing requirements
 - Test 100% of all lines.
 - Must pass pressure test to 200 PSI for two hours (unless otherwise approved on the plans).
 - c) All sanitary sewer facilities are to meet the following testing requirements:
 - All lines shall be jet cleaned prior to vacuum or pressure testing.
 - All manholes shall be vacuum tested with District staff present prior to CCTV inspection.
 - Sewer mains to be pressure tested prior to CCTV inspection.
 - All lines shall be CCTV inspected and video shall to be submitted to the District for review and approval.

23. Preliminary acceptance shall be defined as the point in time that the District accepts the facility for use. All surface improvements and restoration shall be completed within 30 days of commencement. Should the Contractor fail to complete all surface improvements and restoration within 30 days of commencement of service, the District, at their discretion, may elect to complete the improvements at the Contractor's cost.
24. Final acceptance by the District of any line or system shall not occur until completion of final asphalt layers and/or final completion and/or restoration of all surface improvements. The warranty period for all facilities prior to final acceptance shall be **24 months** commencing after preliminary acceptance.
25. Acceptance
- a) The District may give preliminary acceptance once all of the tests on all the lines have been completed and a walk-through has occurred.
 - b) A second acceptance may occur once the first lift of asphalt goes down and a second walk-through of the system occurs. If all facilities are clean and accessible, a final acceptance may occur (the District may require cleaning and re-video of the system, depending on the severity of the contamination).
26. All water and sewer mains, including service lines, shall have "as-built" drawings prepared and approved prior to preliminary acceptance by the District.
27. All commercial/business developments shall have an eight inch (min.) water main looped through the proposed property with gate valves located where the main enters the property line. An eight-inch sewer main shall be installed for service to commercial/business developments, and a manhole shall be located where the main enters the property. The end of the mains shall be marked with the appropriate colored carsonite marker along with tracer wire.
28. After review and approval of plans for the extension of lines, facilities, and/or services, construction must have commenced within 18 months for residential subdivisions and 12 months for any commercial installations.
29. Inspection fees: Call the District (719-495-2500) for fee schedule.

Water System Installation Notes

30. All water and force main pipe shall be AWWA C900 PVC, or approved equal, pressure class 200. All water and force main fittings shall have mechanical restraints and thrust blocks. All water and force main pipe shall have a minimum cover depth of five-and-one-half (5.5) feet.
31. All water valves associated with the potable water system shall be open clockwise. All valves installed in landscaped areas and/or not within paved streets shall be marked with carsonite markers. All valves associated with the raw water system shall be open counterclockwise and marked with carsonite markers as applicable.
32. The Developer or his engineer shall locate all fire hydrants and service stub-outs for future development. Any required realignment, horizontal or vertical, shall be at the expense of the developer. Fire hydrant location shall be reviewed and approved by the applicable Fire Authority.
33. Fire hydrants shall be open right with 7/8" x 7/8" square tapered along with service caps. Lubrication type: Grease. Acceptable brand is Kennedy Guardian (K81D, K81A, and K81AM). Each fire hydrant location shall also be used as test station.
34. All main lines (PVC & ductile iron) shall be installed with coated #12 tracer wire with test stations at intervals no greater than five hundred feet (500') (valve boxes can be used at intersections and service stubs).

35. Contractor shall make connections to existing water line without shutdown, or else notify the District of any service shutdowns necessary to connect to existing lines.
36. Irrigation services shall have a stop-and-waste curb stop valve installed along with tracer wire extending back to the main line.
37. Commencement of use of water lines and/or systems:
 - a) No water facility shall be placed in service until after the completion of all pressure testing, flushing, Bac-T testing, and compaction testing, and as-built drawings are submitted and approved by the District.
 - b) No water facility shall be placed in service until all service lines are completed and the first lift of asphalt is completed over the line. In the case where no asphalt is to be placed over the line, surface improvements shall be completed prior to use of the facility.
 - c) All easements (platted or deeded) are dedicated, executed by the District, and recorded.

Wastewater System Installation Notes

38. Sanitary sewer lengths are MH center – MH center. All sanitary sewer pipes shall be SDR 35 PVC or approved equal. Sewer lines may not exceed 7% grade for any size without prior approval of the District. All newly constructed residential sanitary sewer taps shall use pre-manufactured, inline PVC push-on wyes. Single saddle tap allowed on existing mains. Multiple saddle taps on existing mains must be approved by the District on a case by case basis
39. All sanitary sewer manholes shall be wrapped with RU116 - RUBR-NEK joint wrap, or approved equal, and coated.
40. All sewer lines must be bedded with squeegee or $\frac{3}{4}$ " crushed rock.
41. Commencement of use of sewer lines and/or systems:
 - a) No sanitary sewer facility shall be placed in service until the completion of all jet cleaning, pressure testing, vacuum testing, CCTV inspection, and compaction testing, and as-built drawings are submitted and approved by the District.
 - b) No sanitary sewer facility shall be placed in service until all service lines are completed and the first lift of asphalt is completed over the line. In the case where no asphalt is to be placed over the line, any required surface improvements shall be completed prior to use of the facility.
 - c) All necessary easements (platted or deeded) are dedicated, executed by the District, and recorded.
 - d) Downstream plug can be removed once the first lift of asphalt is down and the above requirements are met.

The above guidelines are subject to change at any time.

Appendix D

Grease Interceptor Standards

A. General

A grease interceptor shall be installed when, in the judgment of the District Manager, it is necessary for the proper handling of liquid wastes containing grease or solids, which may be harmful to or cause obstruction of the publicly-owned treatment works, or interfere with the operation of the treatment works and its mains.

All food preparation establishments shall install a grease interceptor to all drains from the kitchen, food preparation, and dishwashing areas. Fixtures to be connected include, but are not limited to, scullery sinks, pot and pan sinks, dishwashing machines, soup kettles, and floor drains located in areas where grease-containing materials may exist. When deemed necessary by the District, garbage disposals may be required to be connected to an approved interceptor.

Toilets, urinals, and similar fixtures shall not waste through the interceptor. All waste shall enter the interceptor through the inlet pipe only.

Installation of an interceptor will not be required of facilities that do not cook the food that is served and/or do not wash equipment or utensils associated with preparation or service of cooked foods.

B. Approval

The size, type, and location of each interceptor shall be approved and inspected by the District, in accordance with District standards regarding interceptors. Except where otherwise specifically permitted, no wastes other than those requiring separation shall be discharged into any interceptor. One (1) set of plans, including complete mechanical and plumbing sections shall be submitted to the District for approval prior to construction. Such plans shall include the size, type, and location of each interceptor.

C. Design

All interceptors for grease and heavy solids shall be so designed and located as to be readily accessible for cleaning and shall have a water seal of not less than six inches (6"). Interceptors shall be constructed in accordance with the design specifications contained herein, shall be approved by the District Manager, and shall have a minimum of two (2) compartments with fittings designed for grease retention. There shall be a minimum of two manholes to provide access for cleaning and inspection of all fixtures and compartments of the interceptor; a minimum of one (1) per ten feet (10') of interceptor length. In the case of smaller or circular interceptors, where it is not practical to install two (2) manholes, a single manhole shall be located so as to permit entrance to the first compartment and inspection to the second. All areas of the second compartment shall be accessible for cleaning.

D. Location

All interceptors shall be readily accessible for inspection, servicing, and maintaining in proper working condition. The use of ladders or the removal of bulky equipment in order to inspect or service interceptors shall constitute a violation of accessibility. Where feasible, all interceptors shall be located outside of the facility served. Interceptors may not be installed in any part of a building where food is handled. Location of all interceptors shall be approved by the District Manager and shall be shown on the approved building plan.

E. Maintenance

Interceptors shall be maintained by regularly-scheduled removal of the accumulated grease and solids. This maintenance shall be performed before the retention capacity of twenty-five percent (25%) of the

interceptor. Failure to clean the interceptor at twenty-five percent (25%) or more of capacity shall incur a \$500.00 penalty for discharging grease into the sanitary sewer system. Records of maintenance shall be maintained on site and be available for inspection during regular business hours.

F. Sizing Criteria

When determining the minimum size of the interceptor required, the following shall be considered:

The minimum acceptable volume shall not be less than seven hundred fifty (750) gallons. With a dishwasher, it shall not be less than one thousand (1,000) gallons.

The size of the interceptor shall be based on maximum number of meals served at the maximum periods of the day (either breakfast, lunch, or dinner). Volume, in gallons, of the interceptor shall be two-and-one-half ($2\frac{1}{2}$) gallons multiplied by the maximum number of meals served during the busiest period of the day.

An alternate method of determining the size of the grease interceptor is to multiply seating capacity times a turnover constant of one and six tenths (1.6) times two-and-one-half ($2\frac{1}{2}$) gallons. Seating capacity can be approximated, using ten (10) square feet of dining area per person (volume = seating capacity x 1.6 x $2\frac{1}{2}$ gallons).

When the above methods are not feasible, an appropriate volume may be determined by multiplying the total rate of flow, in gallons per minute, from each fixture required to be connected to the interceptor times a minimum retention time of not less than fifteen (15) minutes, with the resulting volume expressed in gallons.

<u>TYPE OF FIXTURE</u>	<u>RATE OF FLOW (GPM)</u>
Floor drain/sink	10
Restaurant kitchen sink	15
Single-compartment scullery sink	20
Three-compartment sink	35
2 single-compartment sinks	25
2 double-compartment sinks	35
Restaurant dishwasher	
Up to 30-gallon capacity	15
30- to 50-gallon capacity	25
50- to 100-gallon capacity	40
Garbage disposal/grinder	35

G. Variances

Variances to the above standards and criteria shall be valid only when the discharge from the user is in compliance with the District's regulations.

In the event that a variance to the minimum size requirement is granted, in no case shall the retention capacity of the trap be less than one hundred pounds (100 lb.). The minimum inspection/cleaning frequency of any indoor trap shall be monthly, and a written record of all inspections or maintenance shall be maintained on site.

Appendix E

Policy and Process for Third Party to Drill or Fund a

New Well Based on District Water Rights

The following is an outline of the process for third-party-funded wells to be constructed within or for the Woodmen Hills Metropolitan District (WHMD). Third parties have the option of self-performing the entire process, but will be responsible for all costs of District reviews, approvals, oversight, and inspection. The District has the sole authority to select manufacturer, specifications, and design of systems and dictate acceptability. If third-party performance is desired, a minimum deposit of \$20,000 is required, and must be increased at each point at which the account drops below \$5,000. While the option exists, allowing the District to perform is likely to have significant savings.

The District provides this approach in order to streamline systems, ensure continuity in systems and equipment, and save time and money. The District simply performs these activities at cost; it does not create or generate any profit.

It is the responsibility of the third party to plan, coordinate, fund, and assure three-phase power is extended to the site and an adequate power drop/service is provided for the well site. The third party is responsible for all costs associated with provision of power from the providing utility. The District will provide an approximate load data sheet for proposed well sites if/when requested.

Phase One: Planning and Permitting

1. Submit letter of request to drill a well. Letters must be accompanied by an initial deposit of \$8,000 to be used for legal, engineering, and administrative costs associated with preliminary planning and permitting of the well. Letter must state the number, location, and formation for each well desired. Multiple wells may be drilled under the same deposit if on a single site.
2. Adequate lands must be legally granted to the District. Underlying water rights must be in place and owned by the District. The developer must submit an accurate legal description of the site, along with ties to section corners and adjacent land uses. Normally, a final plat or proposed final plat may suffice. Any information supplied in AutoCAD format will potentially result in some savings of engineering and/or legal costs.
3. The District will respond in writing as to approval or denial. In the case of denial, the reasons for said denial will be enumerated. The District's response will include approximate timing of permitting. Each and every permit may vary in timing, process, and other factors. The adequacy of the initial deposit may or may not complete the entire permitting process. If the District is aware of circumstances that might require longer timing and or costs, the third party will be notified. **Note: While the District has substantial knowledge of general depth, yields, formation thicknesses, and permissivity, the location and nature of actual physical water are unknown. There is no guarantee of yield, recovery, or thickness of aquifer on any well permitted or drilled.**
4. Once a well permit or permits are obtained, the District will notify the third party. An additional deposit will then be required of \$10,000 per actual well, plus \$15,000 per well site, for the purpose of actual design implementation. Example: 2 new wells on a new well site – \$35,000. One new well on an existing developed well site – \$10,000.

Note: Any remaining funds from prior phases are credited.

Phase Two: Well Site and Well Design:

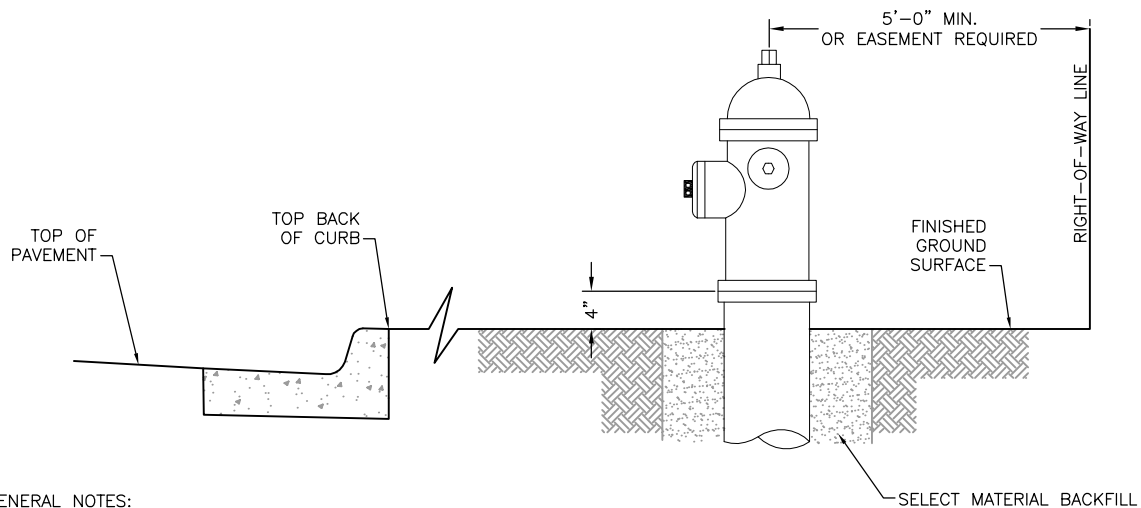
1. If the third party wishes to proceed, the District will commence actual design of wells and well-site elements. The third party will be notified of approximate timing. The developer is expected to provide a site survey with accurate property pins set on the well-site boundary. Pins may be temporary at this point. The developer is wholly responsible for accurate definition of the site. Failure could result in a significant loss of time and money.

2. The funds deposited will be used by the District to complete the well-site design and actual well design. Note actual well design will include preliminary specification of completion equipment. However, completion equipment will not be confirmed until after well-test-pump procedures.
3. If additional funds are required, the third party will be notified for additional deposit.
4. Upon completion of the well site and well design, the third party will receive notice of intent to bid. The third party then has 180 days to provide project funding. This will take the form of letter of credit, issued in the District's name and/or cash deposited with the District. A value will be set forth for each well and/or well site by the District. Any remaining funds left over from prior phases are credited. Well permits are valid only for a finite period and require action to maintain. Once the District gets close to the permit expiration date, the third party risks losing prior efforts and having to reperform certain efforts, if the project goes unfunded. If the well or site is unfunded 180 days prior to expiration, the District does not guarantee on-time completion.

Phase Three: Well and Well Site Construction:

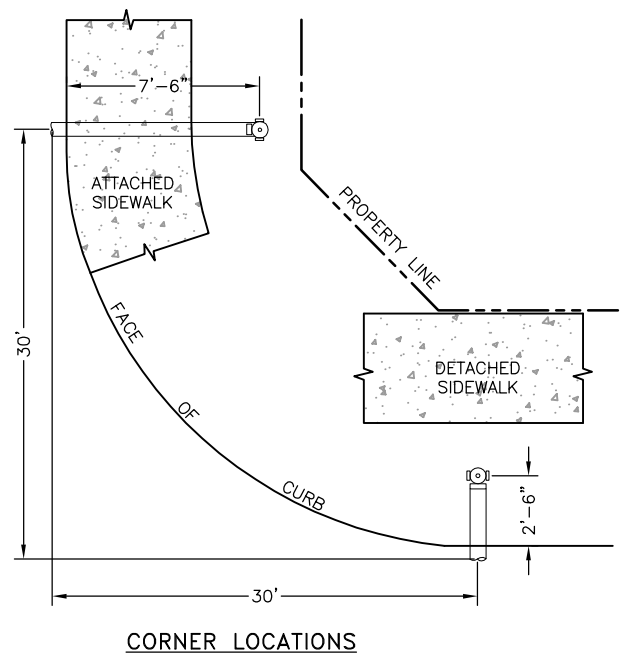
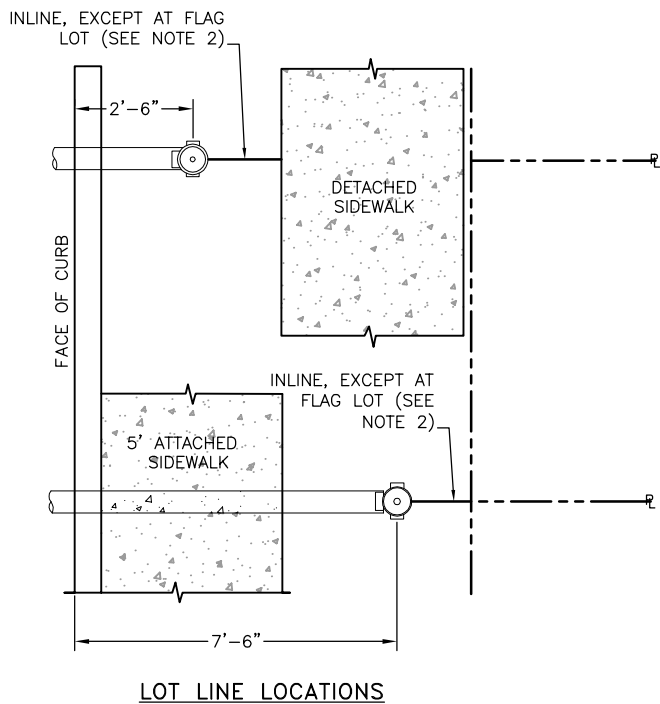
1. The District will bid the project in no more than four parts. Once the final bid amounts are known, the third party is given a 10-day period to accept or reject the cost.
2. Note: All parts cannot be bid upfront.
3. If rejected, any remaining funds will be returned and the project is then mothballed. If bids plus expected soft costs exceed the values provided through deposited cash or letter of credit, the third party has the option to reject or deposit the additional funds. The District cannot guarantee actual bid values, which vary based on market conditions. The same 10-day period applies to the addition of funds.
4. If approved by the third party, construction is commenced and overseen by the District. Construction sequencing may vary from site to site, but it is typical that actual well drilling and test pumping will be the initial effort.
5. The third party will be given an additional 10-day option of again considering rejection of further efforts after the completion of the well pumping test and reporting of potential yield by the District. Water quality reports are usually 30 to 45 days behind the test pump, but may also be considered in option to proceed. Water quality may potentially impact the cost of treatment. At the completion of the well test pumping, the completion equipment specified will be adjusted or verified by the District.
6. Upon third party approval to proceed, well completion and well-site equipment will be constructed per plan or any adjustments that become evident based on test pumping and quality testing. This will include all permitting, approvals, and construction necessary to connect the well and/or wells to raw water lines at the well-site boundary or within.
7. The District will perform all oversight, inspection, testing, and acceptance of the system. Within 60 days of acceptance, the District will provide an accounting of expenditures, and return any funds remaining except for and up to \$5,000 per well. The \$5,000 cash bond or letter of credit will remain open for a period of 12 months after acceptance for any post-construction needs. At the end of the 12-month period, any remaining funds are disbursed.

Standard Drawings – Water



GENERAL NOTES:

1. HYDRANT NOZZLE SHALL BE POSITIONED AT RIGHT ANGLES TO THE CURB. IF NO CURB OR SIDEWALK EXISTS, NOZZLE SHALL BE PLACED AT RIGHT ANGLES TO STREET OR ALLEY.
2. HYDRANTS INSTALLED AT FLAG LOT LINES SHALL BE OFFSET 3 FEET FROM THE LOT LINE (AWAY FROM STEM).
3. HYDRANTS WILL BE PLACED A MINIMUM OF 5 FEET FROM ANY UTILITY OR DRAINAGE STRUCTURE.
4. EASEMENTS MUST BE PROVIDED FOR ANY PUBLIC HYDRANT WHICH IS CLOSER THAN 5 FEET TO THE RIGHT-OF-WAY LINE.
5. ANY HYDRANTS BEING INSTALLED WITH CONDITIONS OTHER THAN THOSE MENTIONED AND/OR DETAILED BELOW WILL REQUIRE SIGNED APPROVAL FROM THE DISTRICT AND THE FIRE DEPARTMENT.

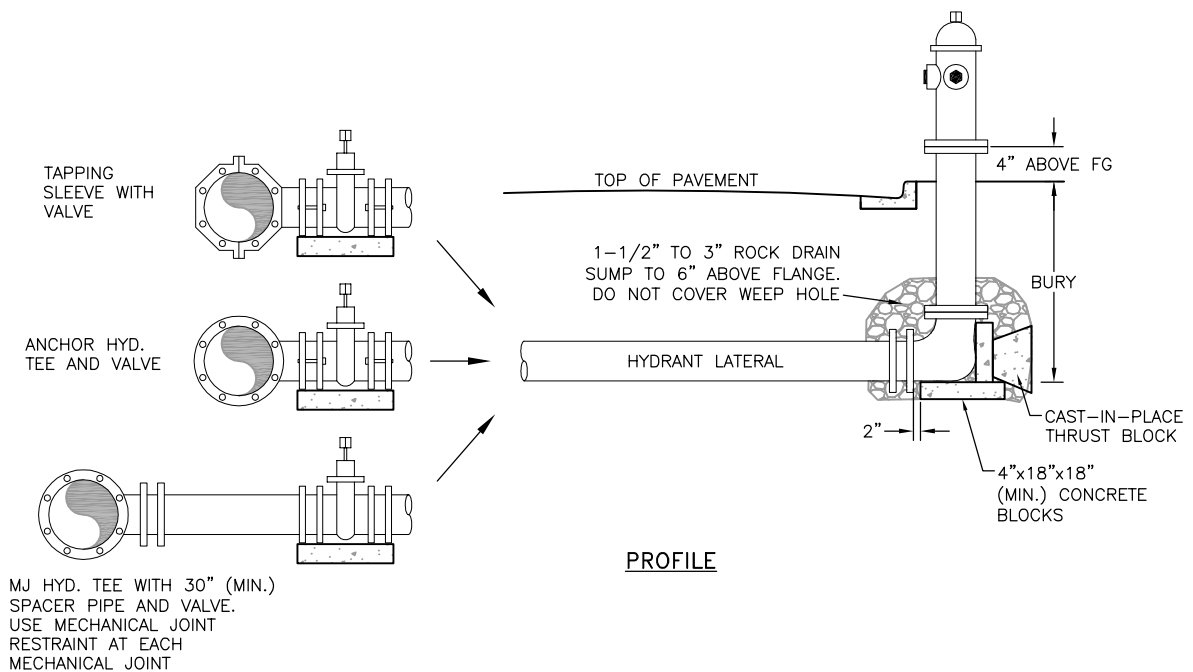
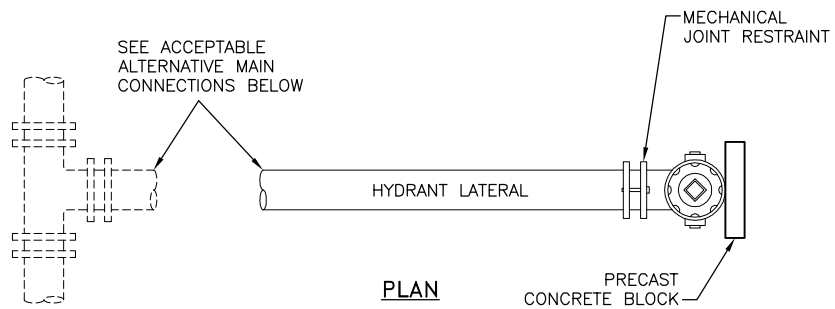


FIRE HYDRANT LOCATIONS

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS



FIRE HYDRANT INSTALLATION

Drawn: GGM/SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

Revised:

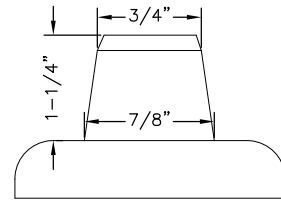
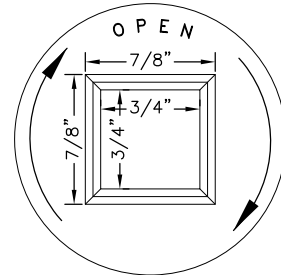
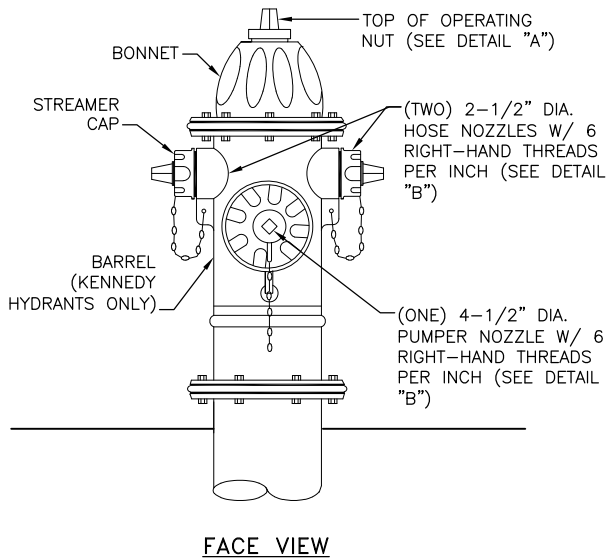
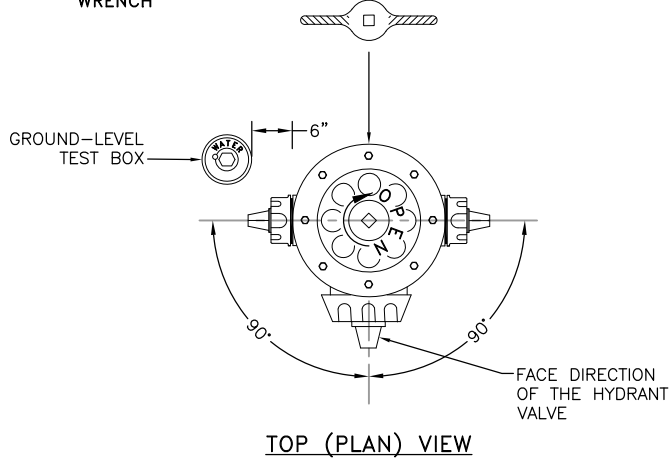
Revised:



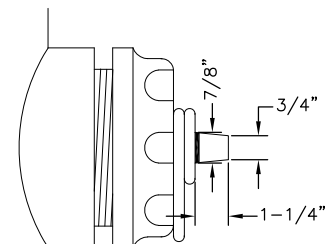
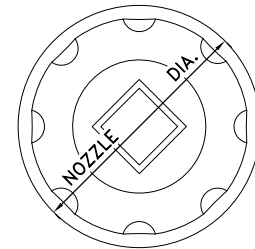
WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-2

TAPERED SQUARE NUT, USE ONLY DEFINITE PURPOSE HYDRANT WRENCH THAT EXACTLY FITS THE NUT. DO NOT USE A GENERIC HYDRANT WRENCH WITH ADJUSTABLE CORNER BOLT. DO NOT USE A CRESCENT WRENCH OR PIPE WRENCH



DETAIL "A" - OPERATING NUT



DETAIL "B" - NOZZLE DETAIL

FIRE HYDRANT SPECIFICATIONS

Drawn: GGM

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

Revised:

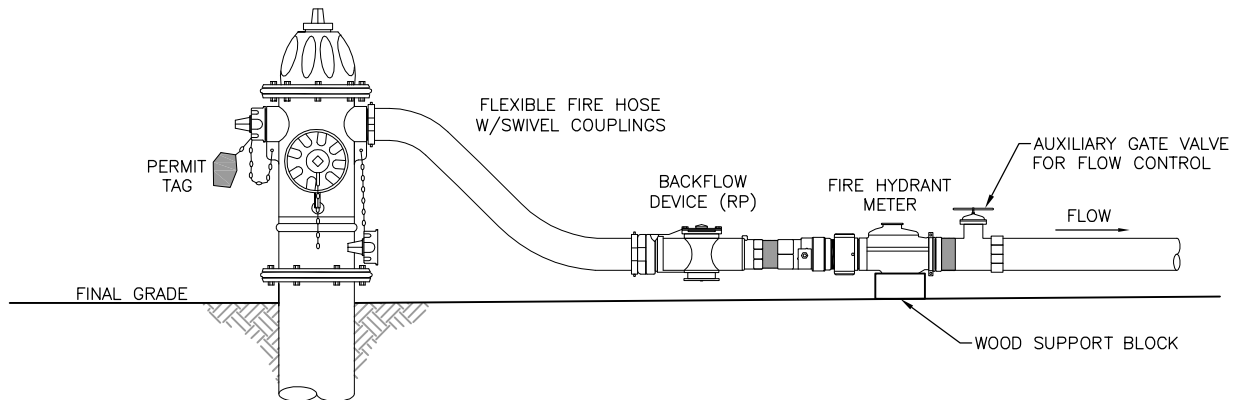
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-3

TAPERED SQUARE NUT WRENCH



ASSEMBLY SEQUENCE

SCALE: N.T.S.

NOTES:

1. FLUSH HYDRANT BEFORE CONNECTING BACKFLOW AND METER CONFIGURATION.
2. HYDRANTS SHALL BE FULLY OPENED WHEN IN USE; DO NOT THROTTLE HYDRANT FLOW WITH THE HYDRANT STEM VALVE. FLOW SHALL BE CONTROLLED WITH THE OUTLET GATE VALVE ONLY.
3. WHERE BALL VALVES ARE PROVIDED FOR ISOLATION AND TESTING OF THE RP, THE HANDLE SHALL BE REMOVED FROM THE VALVES. THESE VALVES ARE ONLY TO BE USED IN SERVICING AND TESTING RP AND SHALL NOT BE USED TO CONTROL HYDRANT FLOWS, AND SHALL BE IN THE FULL OPEN POSITION AT ALL TIMES DURING HYDRANT FLOWS.
4. USE OF HYDRANT REQUIRES A PERMIT AND ADHERENCE TO ALL TERMS AND CONDITIONS OF THE PERMIT AND ASSOCIATED REQUIREMENTS. CONTACT THE DISTRICT AT (719) 495-2500.
5. USE OF A HYDRANT WITHOUT A BACKFLOW PREVENTION DEVICE IS IN VIOLATION OF THE DISTRICT'S CODE FOR CROSS-CONNECTION CONTROL. ALL HYDRANT CONNECTIONS REQUIRE A REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTER (RP) TYPE PER COLORADO PRIMARY DRINKING WATER REGULATION. KEEP THE RP CENTER DISCHARGE OUTLET AT LEAST 12 INCHES ABOVE GRADE.
6. CONTRACTOR SHALL USE A HYDRANT WRENCH WITH TAPERED, SQUARE BOX DESIGNED SPECIFICALLY FOR DISTRICT FIRE HYDRANTS TO OPERATE THE FIRE HYDRANT. NO OTHER TYPE OF WRENCH SHALL BE USED.

FIRE HYDRANT BACKFLOW AND METER CONFIGURATION

Drawn: SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

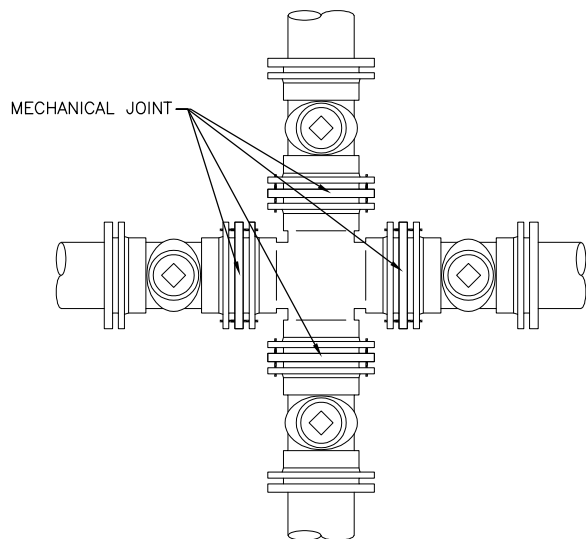
Revised:

Revised:

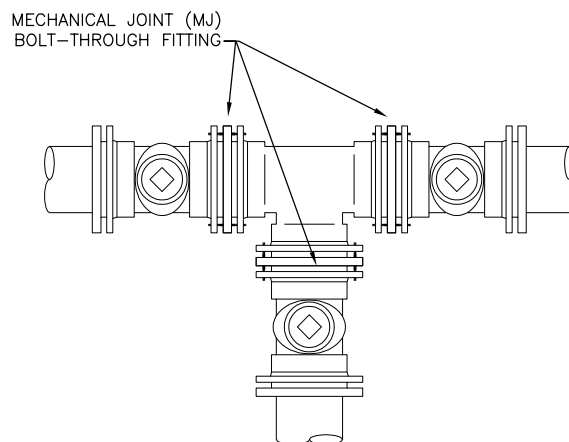


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

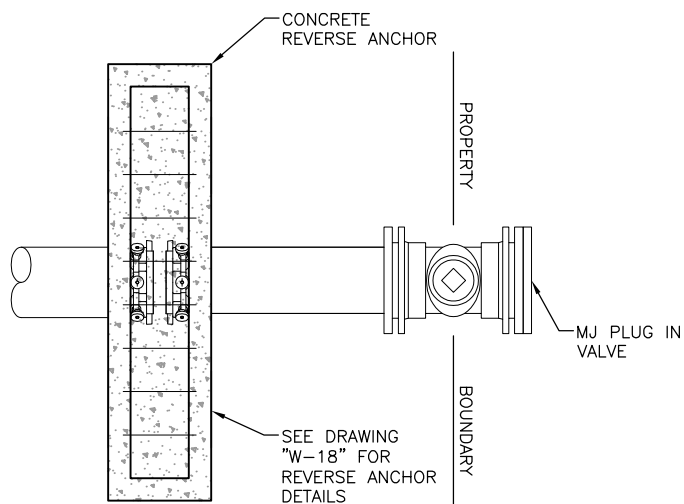
W-4



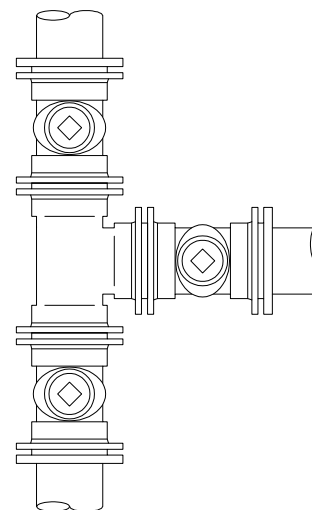
CROSS OR TEE W/
ANCHOR PIPES



CROSS OR TEE W/ MJ
Bolt-Through Fittings



AT END-OF-LINE USE
REVERSE ANCHOR WITH
TIE BACK RODS



WITH MJ ANCHOR TEE

GENERAL NOTES:

1. ON ANY VALVE INSTALLATION NEAR A FITTING, THE VALVE SHALL BE ANCHORED BY RODS, REVERSE ANCHOR, AND MECHANICAL JOINT RESTRAINTS. 3/4" ALL-THREAD RODS SHALL BE USED WITH FIG. 7 BOLTS OR APPROVED DUCTILE TIE LUGS FOR DEAD-END VALVES AND/OR PLUGS. ALL METALLIC COMPONENTS SHALL BE WRAPPED IN POLYETHYLENE TUBING.
2. ANCHOR PIPE OR FOSTER COUPLINGS MAY BE SUBSTITUTED FOR SPACER PIPE AND RODS.
3. THE CONCRETE REVERSE ANCHORS USED SHALL BE SIZED AS INDICATED ON DRAWING "W-18".
4. SEE DRAWINGS "W-13" AND "W-28" FOR APPLICATION OF MECHANICAL JOINT RESTRAINTS.
5. SEE DRAWING "W-6" FOR VALVE BOX INSTALLATION.

VALVE INSTALLATION & LOCATION

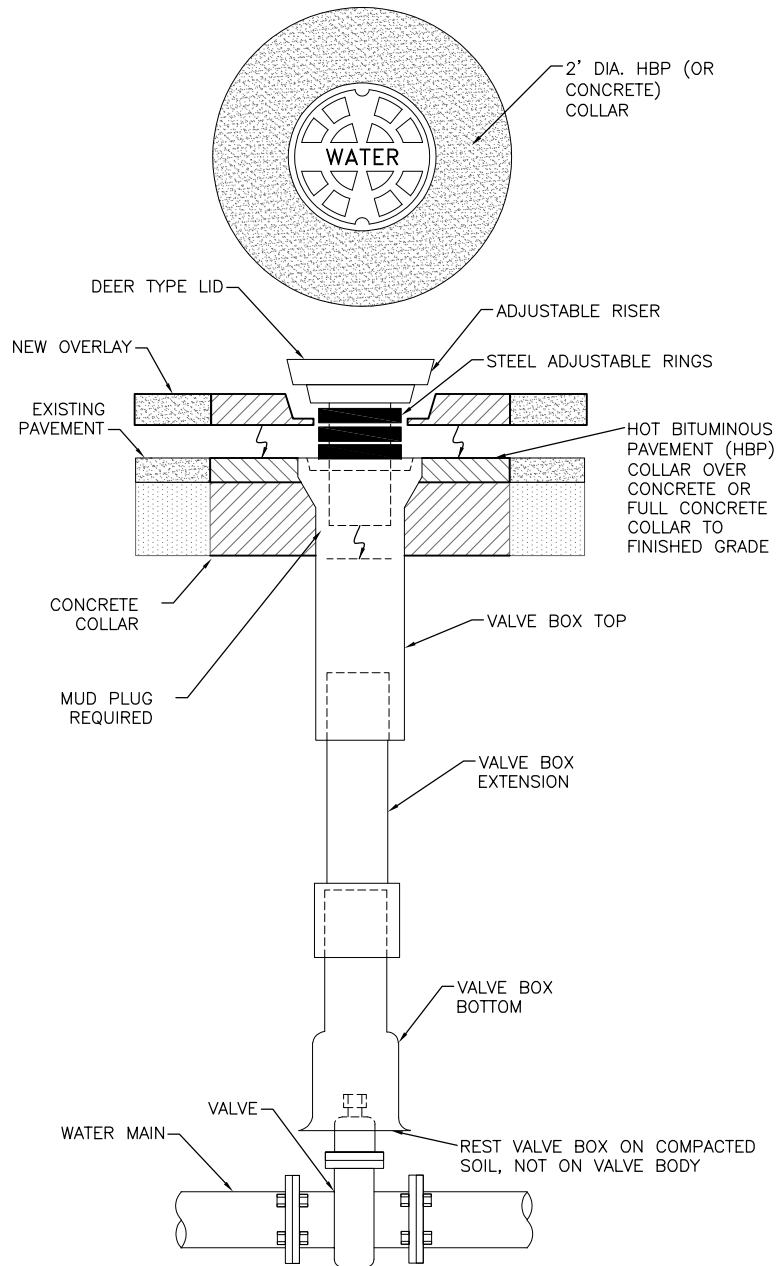
Drawn: GGM
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-5



NOTES:

1. SLIP-TYPE 5-1/4" I.D. SHAFT TYLER PIPE SERIES 664-A OR EQUIVALENT, APPROVED BY THE DISTRICT.
2. MAIN AND FIRE HYDRANT VALVES AND VALVE BOXES SHALL BE LOCATED IN AND UNDER THE DRIVING SURFACE OF THE STREET, NOT IN THE CURB PAN, CURB, OR BEHIND THE CURB.
3. SEE DRAWING "W-10" FOR TRACER WIRE INSTALLATION AT VALVE BOXES.

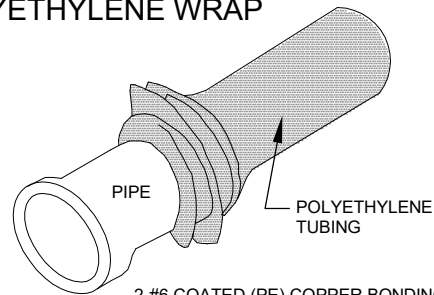
VALVE BOX INSTALLATION

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

FIELD INSTALLATION OF POLYETHYLENE WRAP

STEP 1:

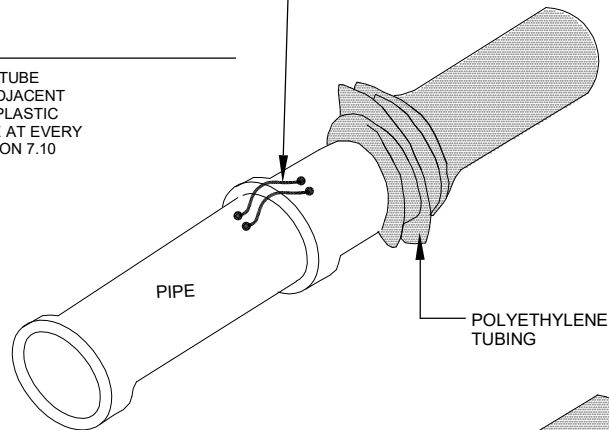
PLACE TUBE OF POLYETHYLENE MATERIAL ON PIPE PRIOR TO LOWERING IT INTO TRENCH.



2-#6 COATED (PE) COPPER BONDING WIRE THERMOWELDED TO PIPE, BOTH ENDS, OR BONDING STRAP THERMO WELDED TO PIPE. NO COMMON WELDS ALLOWED

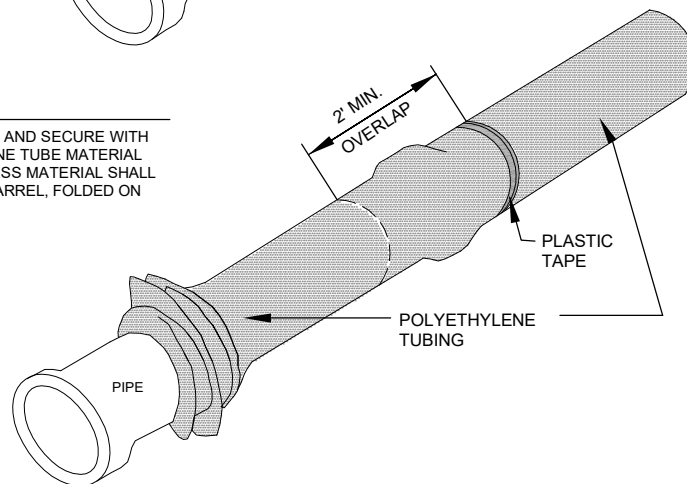
STEP 2:

PULL TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO END AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE. INSTALL BONDING STRAP OR WIRE AT EVERY JOINT OF PIPE PRIOR TO WRAPPING AS PER SECTION 7.10 OF THE STANDARD SPECIFICATIONS.



STEP 3:

OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF PIPE, AND TAPED IN PLACE.



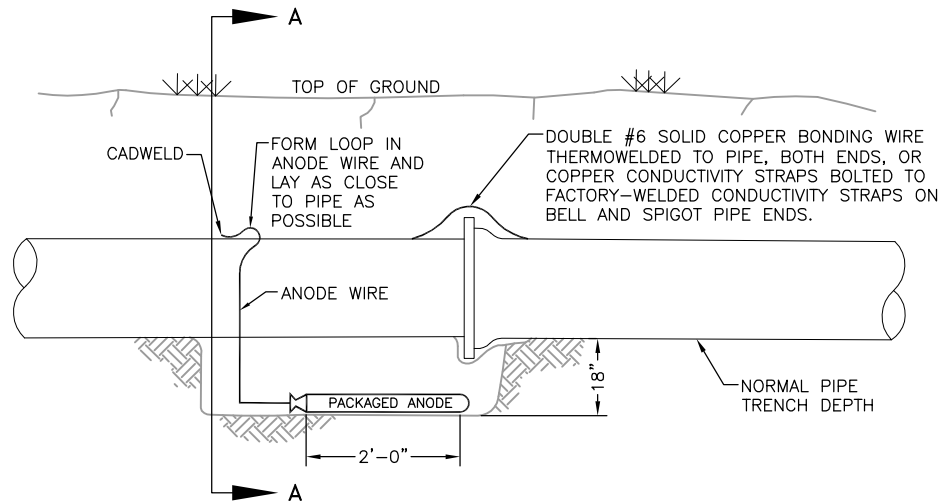
POLYETHYLENE WRAP

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

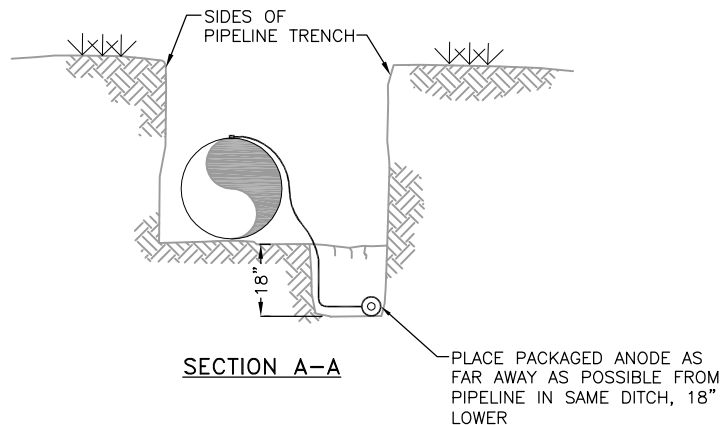


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-7



ELEVATION



SECTION A-A

NOTES:

1. CADWELD CONNECTION TO BE PRIMED AND COATED CAREFULLY. PACKAGED ANODE SHOULD BE COVERED WITH FINE SOIL CONTAINING NO ROCKS OR DIRT CLUMPS, TAMPED.
2. WHEN ANODES ARE REQUIRED WITH METAL FITTINGS AND APPURTENANCES TOGETHER WITH PVC PIPE INSTALLATION, THE ANODES SHALL BE PLACED AND ATTACHED TO THE METAL IN SAME MANNER AS SHOWN ON THIS DRAWING. 9LB. ANODES CAN BE USED ON METAL FITTINGS 12" AND LESS IN DIAMETER AND 17LB. ANODES FOR METAL FITTINGS GREATER THAN 12" DIAMETER WHEN USING PVC PIPE.
3. PACKAGED ANODE TO BE WETTED AND COVERED WITH SOIL PRIOR TO BACKFILLING.

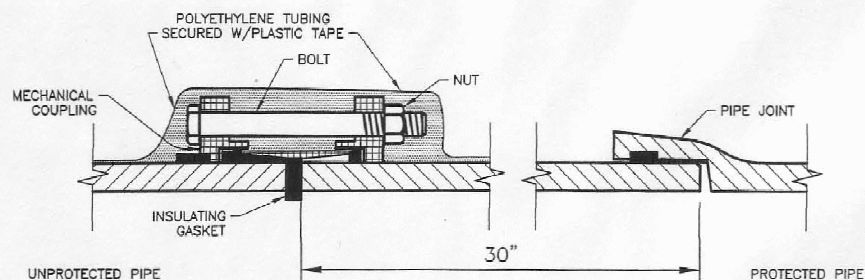
BONDING JOINT & ANODE INSTALLATION

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

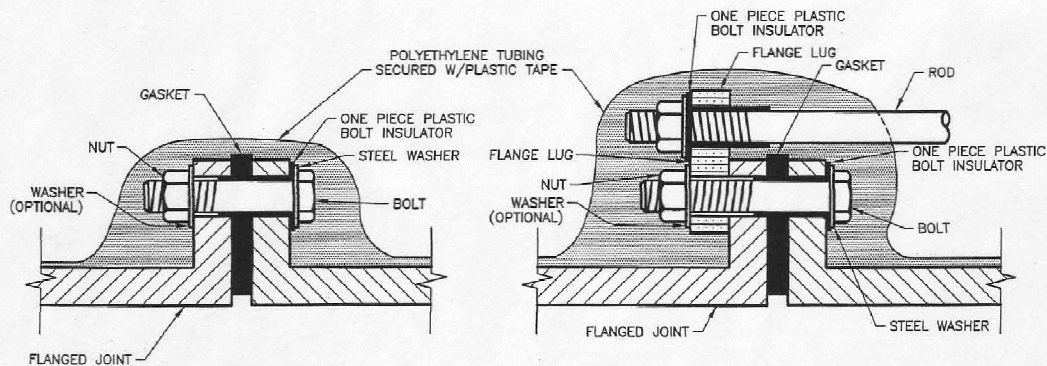


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-8



INSULATED MECHANICAL COUPLING



INSULATED FLANGE JOINT

INSULATED TIE BACK ROD

NOTE:

TEST WIRES TO BE USED WHEN REQUIRED.

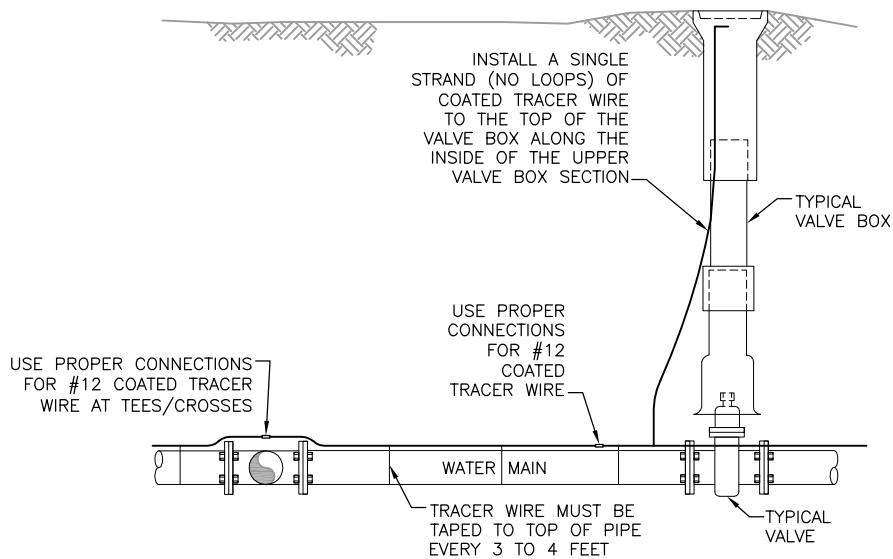
INSULATOR INSTALLATION

Drawn: GGM
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS



General: Housing is to protect split bolt wire nut and tracer wire in buried applications.

Specifications. Housing shall be made of high impact polypropylene and be filed with a dielectric silicone gel.

Aqua Housing 69105

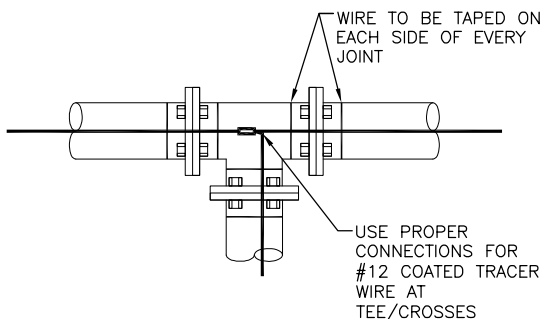
Max. Voltage: 50V

Housing: High Impact Polypropylene

Sealant: Dielectric Silicone Gel

Wire Range: #14-10 Solid Copper; #14-10 Steel Core Tracer Wire

Split bolt size not to exceed 1.0" tall by 0.8" wide by 0.7" deep



Visilock Housing 98010

Max. Voltage: 100V

Temperature Rating: -40°C - 90°C (194°F)

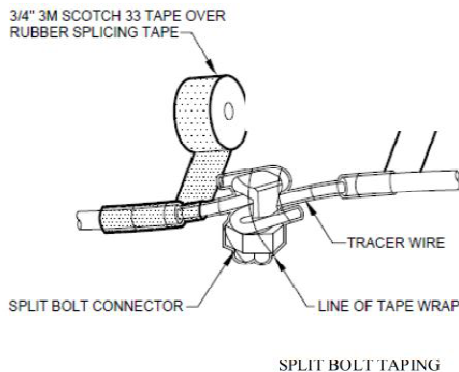
Measurements: See specification sheet for complete product measurements

Wire Range:

#8 - 1/0 (.363" - .625" O.D.)

#12 - #4 (.305" - .443" O.D.)

Amperage not to exceed maximum temperature of the conductor



1. Wrap all Tracer Wire split bolt connectors or exposed wire using 1" 3M Scotch 130C Linerless Rubber Splicing Tape making sure to seal all ends to prevent moisture penetration.

TRACER WIRE INSTALLATION DETAILS

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

Scale: N.T.S.

Revised:

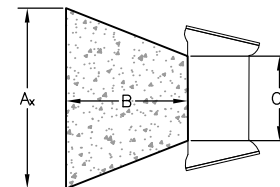
WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-10

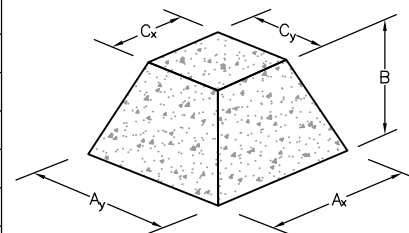
THRUST BLOCK DIMENSIONS & VOLUMES – PVC & DIP 250 psi

MAIN SIZE (IN.)	TYPE OF FITTING	MINIMUM BEARING SURFACE AREA (ft ²)	MINIMUM A _x (ft)	MINIMUM A _y (ft)	MINIMUM C _x (ft)	MINIMUM C _y (ft)	MINIMUM B	APPROXIMATE VOLUME (yd ³)
4	11.25° BEND	1.00	1.00	1.00	0.25	0.33	2.00	0.25
4	22.5° BEND	2.00	2.00	1.41	0.21	0.33	22.00	0.25
4	45° BEND	3.50	3.50	1.87	0.42	0.33	2.00	0.25
4	TEE & DEAD END	4.75	4.75	2.18	0.67	0.33	4.75	0.25
6	11.25° BEND	2.00	2.00	1.41	0.25	0.50	2.00	0.25
6	22.5° BEND	3.75	3.75	1.94	0.38	0.50	2.00	0.25
6	45° BEND	7.25	7.25	2.69	0.58	0.50	2.00	0.25
6	TEE & DEAD END	9.50	9.50	3.08	0.83	0.50	2.00	0.50
8	11.25° BEND	3.25	3.25	1.80	0.34	0.67	2.00	0.25
8	22.5° BEND	6.50	6.50	2.55	0.48	0.67	2.00	0.25
8	45° BEND	12.50	12.50	3.57	0.67	0.67	2.00	0.50
8	TEE & DEAD END	16.25	16.25	4.64	1.08	0.67	2.00	0.75



THRUST BLOCK DIMENSIONS & VOLUMES – PVC (Maximum Static Pressure = 170 psi)

MAIN SIZE (IN.)	TYPE OF FITTING	MINIMUM BEARING SURFACE AREA (ft ²)	MINIMUM A _x (ft)	MINIMUM A _y (ft)	MINIMUM C _x (ft)	MINIMUM C _y (ft)	MINIMUM B	APPROXIMATE VOLUME (yd ³)
12	11.25° BEND	4.75	2.18	2.18	0.43	1.00	2.00	0.25
12	22.5° BEND	9.25	3.04	3.04	0.64	1.00	2.00	0.50
12	45° BEND	18.00	4.92	3.66	1.00	1.00	2.00	0.75
12	TEE & DEAD END	23.50	6.42	3.66	1.46	1.00	2.48	1.00
16	11.25° BEND	8.00	2.83	2.83	0.44	1.33	2.00	0.50
16	22.5° BEND	16.00	4.27	3.75	0.66	1.33	2.00	0.75
16	45° BEND	31.00	8.27	3.75	1.00	1.33	3.64	1.75
16	TEE & DEAD END	40.50	10.80	3.75	1.92	1.33	4.44	3.00



THRUST BLOCK DIMENSIONS & VOLUMES – DIP (Maximum Static Pressure = 250 psi)

MAIN SIZE (IN.)	TYPE OF FITTING	MINIMUM BEARING SURFACE AREA (ft ²)	MINIMUM A _x (ft)	MINIMUM A _y (ft)	MINIMUM C _x (ft)	MINIMUM C _y (ft)	MINIMUM B	APPROXIMATE VOLUME (yd ³)
12	11.25° BEND	6.75	2.60	2.60	0.43	1.00	2.00	0.50
12	22.5° BEND	13.50	3.69	3.66	0.64	1.00	2.00	0.50
12	45° BEND	26.25	7.17	3.66	1.00	1.00	3.09	1.50
12	TEE & DEAD END	34.25	9.36	3.66	1.46	1.00	3.95	2.25
16	11.25° BEND	11.75	3.43	3.43	0.44	1.33	2.00	0.50
16	22.5° BEND	23.25	6.20	3.75	0.66	1.33	2.77	1.00
16	45° BEND	45.50	12.13	3.75	1.00	1.33	5.57	4.00
16	TEE & DEAD END	59.50	15.87	3.75	1.92	1.33	6.98	6.50

NOTES:

1. THE MINIMUM BEARING SURFACE AREAS SHOWN ARE BASED ON A MAX STATIC PIPE PRESSURE OF 170/250 POUNDS PER SQUARE INCH PLUS A SAFETY FACTOR OF 1.5 AND AN ALLOWABLE SOIL BEARING CAPACITY OF 1,500 POUNDS PER SQUARE FOOT. BEARING SURFACE AREA IS ROUNDED UP TO THE NEAREST 0.25 SQUARE FEET. REFERENCE AWWA M-23 AND M-41.
2. THE DESIGN ENGINEER IS RESPONSIBLE FOR VERIFYING ASSUMPTIONS BASED ON ACTUAL SITE CONDITIONS. IF SITE CONDITIONS VARY FROM THE ASSUMPTIONS, THE DESIGN ENGINEER SHALL PROVIDE A SITE-SPECIFIC DESIGN IN ACCORDANCE WITH AWWA M-23, PVC PIPE – DESIGN AND INSTALLATION AND AWWA M-41, DUCTILE-IRON PIPE AND FITTINGS. SITE-SPECIFIC DESIGNS INCLUDING GEOTECHNICAL INFORMATION SHALL BE SUBMITTED TO THE DISTRICT FOR REVIEW.
3. THE MINIMUM BEARING SURFACE AREA AND APPROXIMATE VOLUME OF CONCRETE SHALL BE SHOWN ON THE CONSTRUCTION PLANS FOR ALL CONCRETE THRUST BLOCKS. SEE SECTION 9.4 FOR CONCRETE REQUIREMENTS. SEE SECTION 4.8 FOR THRUST BLOCK REQUIREMENTS.
4. THE APPROXIMATE VOLUMES SHOWN ARE BASED ON THE MINIMUM BEARING SURFACE AREA AND THE MINIMUM TRENCH DIMENSIONS. THE APPROXIMATE VOLUME IS ROUNDED UP TO THE NEAREST 0.25 CUBIC YARDS.
5. THESE CHARTS MAY ONLY BE USED IF THE BLOCK HEIGHT (A_y) IS EQUAL TO OR LESS THAN ONE-HALF THE TOTAL DEPTH (H_t) FROM THE FINISHED GRADE TO THE BOTTOM OF THE BLOCK. THE MINIMUM DIMENSIONS SHOWN ARE BASED ON A PIPE DEPTH OF 5.5 FEET.
6. A SITE-SPECIFIC DESIGN SHALL BE REQUIRED FOR PIPES LARGER THAN 16 INCHES OR MAX STATIC PIPE PRESSURES GREATER THAN 250 POUNDS PER SQUARE INCH. THE DESIGN ENGINEER HAS THE OPTION OF PROVIDING A SITE-SPECIFIC DESIGN FOR PIPES SMALLER THAN 16 INCHES OR MAX STATIC PRESSURES LESS THAN 250 POUNDS PER SQUARE INCH.
7. ALL CALCULATIONS SHALL BE PROVIDED TO THE DISTRICT FOR REVIEW.

THRUST BLOCK DATA

CONCRETE THRUST BLOCKS

WATER MAIN AND TAP SIZE COMBINATIONS WHICH REQUIRE A
CONCRETE THRUST REACTION BLOCK BEHIND THE MAIN AT THE
TAPPING SLEEVE OR SADDLE.

ALL WATER MAINS



INDICATES CONCRETE THRUST BLOCK REQUIRED

		MAIN SIZE (INCHES)															
		4	6	8	10	12	14	16	18	20	22	24	26	28	30	36	42
TAP SIZE (INCHES)	4																
	6																
	8																
	10																
	12																
	14																
	16																
	18																
	20																
	22																
	24																

ANY THRUST REACTION BLOCK REQUIREMENTS FOR WATER MAIN AND
TAP SIZE COMBINATIONS OTHER THAN THOSE SHOWN ABOVE WILL
REQUIRE SPECIAL DESIGN APPROVAL BY THE DISTRICT.

THRUST BLOCKS REQUIRED FOR TAPS

Drawn: GGM/SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

Revised:

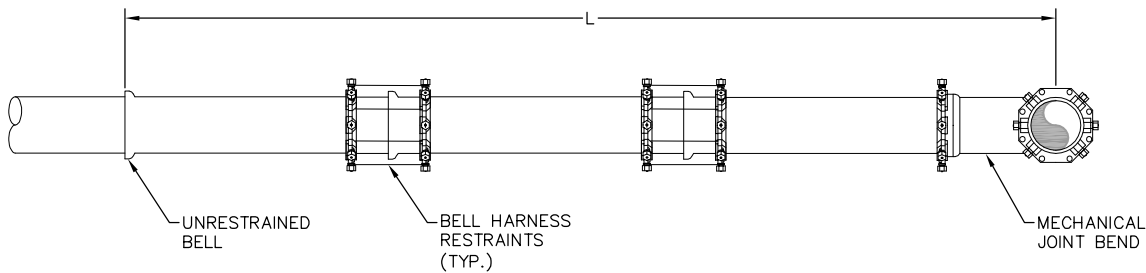
Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-12

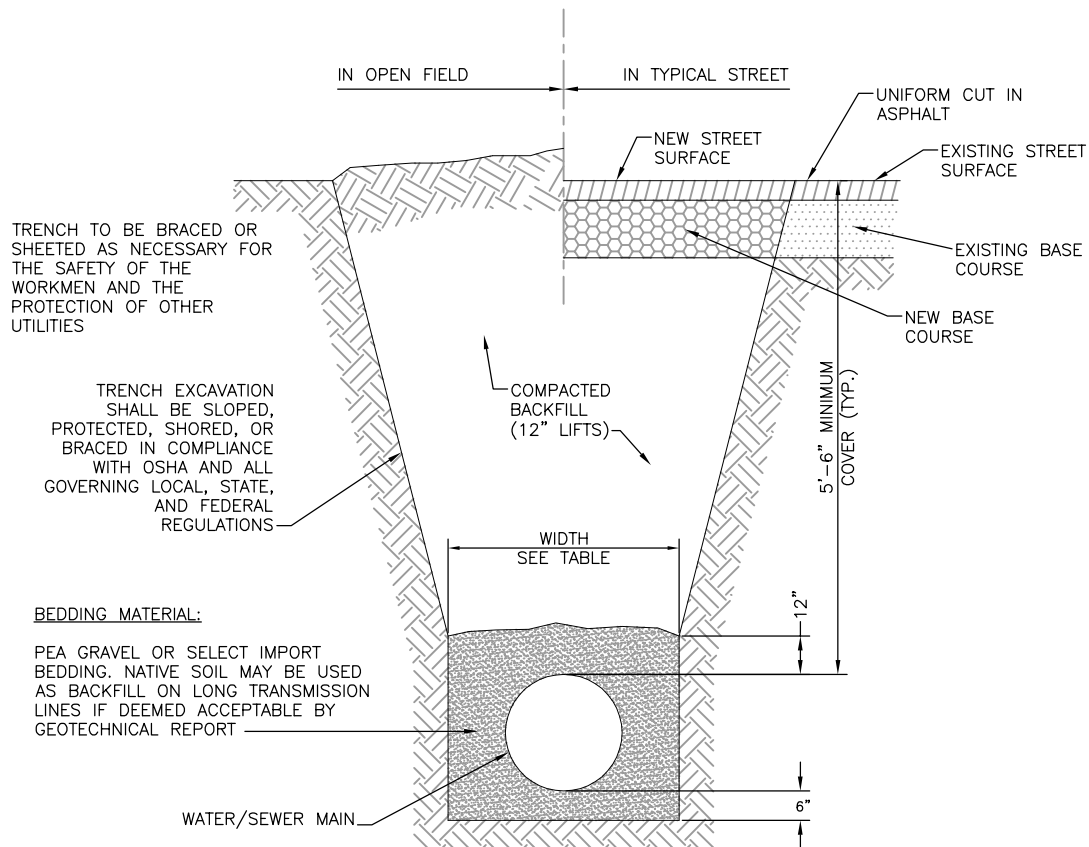
	L = MINIMUM RESTRAINED PIPE LENGTH									DEAD-END VALVE OR PLUG, TO INCLUDE INLINE VALVES (SEE NOTE 7)		
PIPE DIAMETER	45° BEND			22-1/2° BEND			11-1/4° BEND					
MAX. STATIC PRESSURE (PSI)	<100	100-150	150-200	<100	100-150	150-200	<100	100-150	150-200	<100	100-150	150-200
6-INCH DUCTILE IRON AND PVC	6	9	12	3	5	6	2	3	3	49	73	97
8-INCH DUCTILE IRON AND PVC	8	12	16	4	6	8	2	3	4	63	94	125
12-INCH DUCTILE IRON AND PVC	12	17	23	6	8	11	3	4	6	89	133	177
16-INCH DUCTILE IRON AND PVC	15	22	29	7	11	14	4	5	7	USE CONCRETE REVERSE ANCHOR	USE CONCRETE REVERSE ANCHOR	USE CONCRETE REVERSE ANCHOR
20-INCH DUCTILE IRON AND PVC	18	26	35	9	13	17	4	6	8			
24-INCH DUCTILE IRON AND PVC	20	30	40	10	15	20	5	7	10			
30-INCH DUCTILE IRON AND PVC	24	36	48	12	18	24	6	9	12			
36-INCH DUCTILE IRON AND PVC	28	42	56	14	20	27	7	10	14			



NOTES:

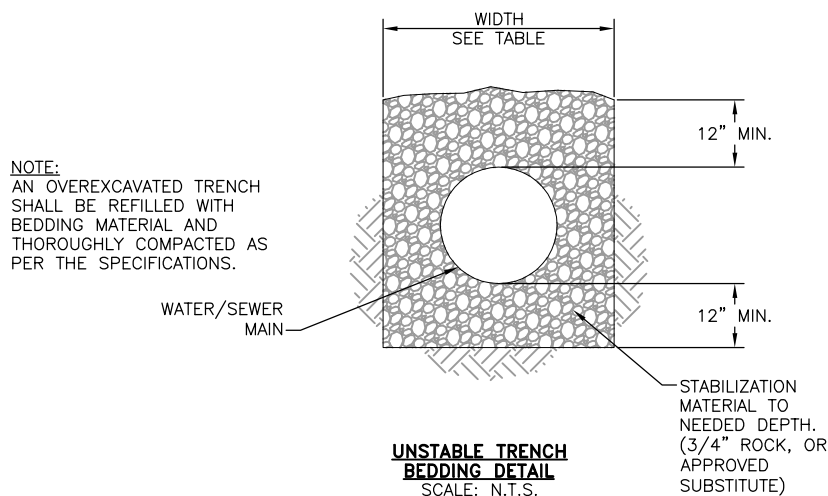
1. PRESSURE GREATER THAN 200 PSI REQUIRES SPECIAL DESIGN APPROVED BY THE DISTRICT.
2. LENGTH IS BASED ON MINIMUM 5 FEET OF GROUND COVER AND COMPACTED SOIL. IF THE DEPTH IS LESS THAN 5 FEET, RESTRAINED LENGTH MUST BE DESIGNED BY THE DESIGN ENGINEER.
3. RESTRAINED PIPE LENGTH APPLIES TO CONDITION WHERE NO CONCRETE THRUST REACTION BLOCK IS PRESENT.
4. CALCULATIONS ARE BASED ON POORLY-GRADED SANDS, GRAVEL, AND GRAVEL-SAND MIXTURE, LITTLE OR NO FINES, TYPE 4 BEDDING CONDITIONS - "PIPE BEDDED IN SAND, GRAVEL, OR CRUSHED STONE TO A DEPTH OF 1/8 PIPE DIAMETER (4" MIN.)." FACTOR OF SAFETY 2:1.
5. FIGURES ARE BASED ON DIP WRAPPED IN POLYETHYLENE MATERIAL.
6. USE CRA FOR DOWN-TURNING BENDS.
7. RESTRAINED LENGTH FOR DEAD END MAY BE USED AT THE DISCRETION OF THE DISTRICT.

RESTRAINED PIPE LENGTH (FT) W/ MECHANICAL JOINT RESTRAINTS



TYPICAL TRENCH SECTION
SCALE: N.T.S.

PIPE DIAMETER	MINIMUM WIDTH	MAXIMUM WIDTH
4"	2'-2"	3'-0"
6"	2'-2"	3'-0"
8"	2'-2"	3'-0"
10"	2'-4"	3'-0"
12"	2'-6"	3'-6"
18"	2'-10"	3'-9"
24"	3'-2"	4'-3"



TYPICAL TRENCH CROSS-SECTION

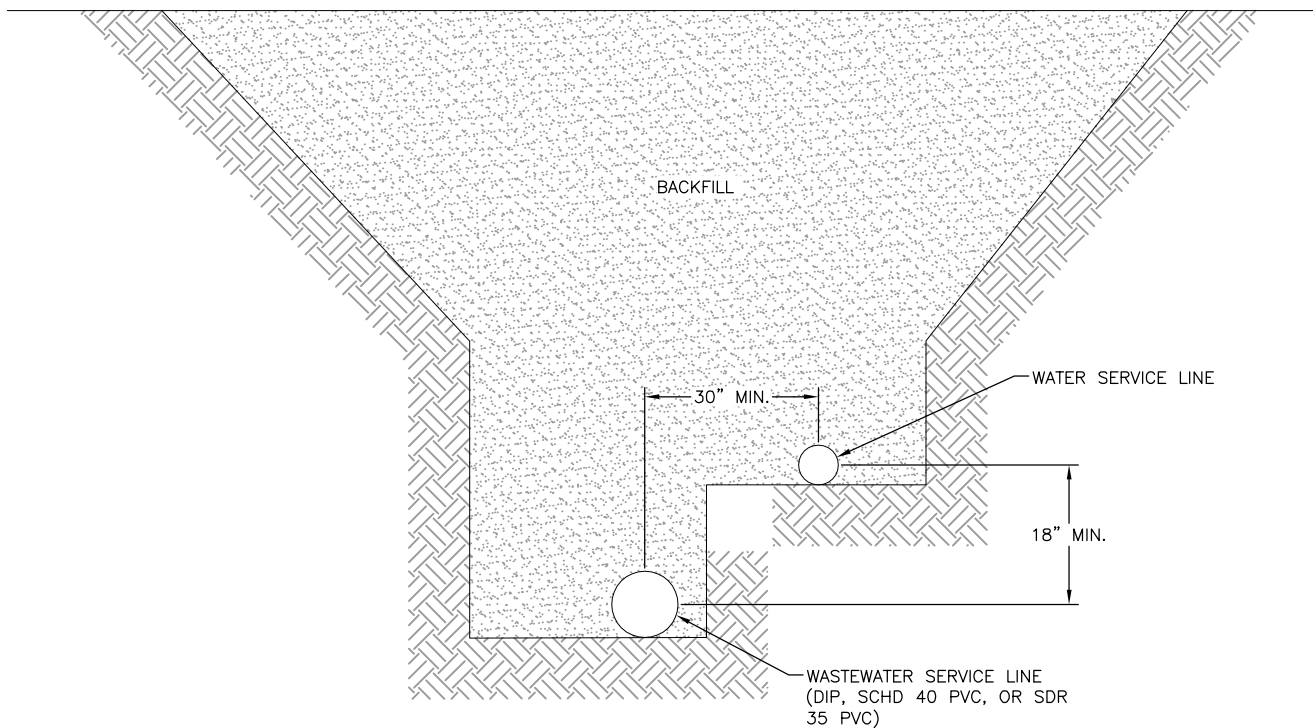
Drawn: GGM/SKG
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-14



TYPICAL COMMON SERVICE TRENCH SECTION

Drawn: GGM

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

Scale: N.T.S.

Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

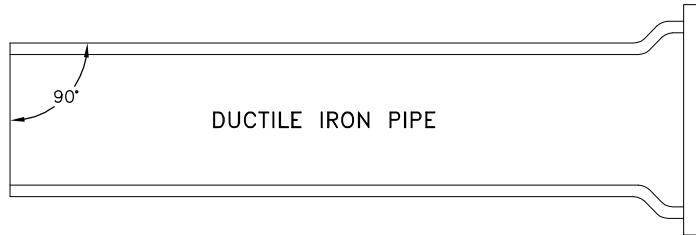
W-15

MAXIMUM DEFLECTION
PER SLIP JOINT OF D.I.P.

PIPE DIAMETER			MFRS. DEFL.	DESIGN DEFLECTION (80% MAX.)			APPROX. RADIUS FOR DEFLECTING CURVES WITHOUT BENDS	
I.D. (IN)	O.D. (IN)	O.D. (FT)		MAX. DEFL. DIST.		20'L	18'L	
				(1)	(2)			
4"	4.80"	.400'	5'00"00"	4'00"00"	16"	15"	286'	258'
6"	6.90"	.575'	5'00"00"	4'00"00"	16"	15"	286'	258'
8"	9.05"	.754'	5'00"00"	4'00"00"	16"	15"	286'	258'
10"	11.10"	.925'	5'00"00"	4'00"00"	16"	15"	286'	258'
12"	13.20"	1.100'	5'00"00"	4'00"00"	16"	15"	286'	258'
14"	15.30"	1.275'	3'00"00"	2'24'00"	10"	9"	477'	430'
16"	17.40"	1.450'	3'00"00"	2'24'00"	10"	9"	477'	430'
18"	19.50"	1.625'	3'00"00"	2'24'00"	10"	9"	477'	430'
20"	21.60"	1.800'	3'00"00"	2'24'00"	10"	9"	477'	430'
24"	25.80"	2.150'	3'00"00"	2'24'00"	10"	9"	477'	430'
30"	32.00"	2.666'	2'30"00"	2'00"00"	8"	7"	573'	516'
36"	38.30"	3.192'	2'00"00"	1'36'00"	6"	6"	716'	645'
42"	44.50"	3.708'	2'00"00"	1'36'00"	6"	6"	716'	645'

(1) 20'L = NORMAL 20-FOOT JOINT LAYING LENGTH
(2) = NORMAL 18-FOOT JOINT LAYING LENGTH

MAXIMUM PIPELINE DEFLECTION DATA



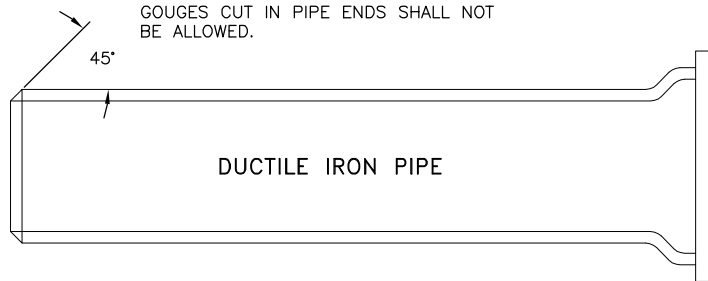
MECHANICAL JOINT CONNECTION

PIPE MUST BE CUT AT RIGHT ANGLES TO LONGITUDINAL CENTERLINE IN ALL CASES.

PIPE ENDS SHALL BE FREE OF BURRS.

MORTAR LINING SHALL BE FLUSH WITH PIPE END.

GOUGES CUT IN PIPE ENDS SHALL NOT BE ALLOWED.



SLIP JOINT CONNECTION

PIPE CUT IN STRAIGHT LINE AND BEVELED AT 45° ANGLE ON END.

GENERAL NOTES:

1. ALL PIPE CUTTING EQUIPMENT AND PIPE CUTS MUST BE APPROVED BY THE WATER AND SANITATION DISTRICT INSPECTOR.
2. ALL PIPE ENDS TO BE USED IN INSTALLATION SHALL BE DRESSED SMOOTH TO THE SATISFACTION OF THE INSPECTOR PRIOR TO INSTALLATION.
3. AT THE REQUEST OF THE CONTRACTOR MAKING THE INSTALLATION, THE DISTRICT WILL MAKE PIPE CUTS, PROVIDED THE CURRENT FEE PER CUT IS PAID AND 24-HOUR NOTICE IS GIVEN (THE CURRENT FEE IS SUBJECT TO CHANGE.)
4. ALL DIP DELIVERED TO JOB SITE MUST BE NEW MATERIAL.

PIPE CUTTING

Drawn: SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

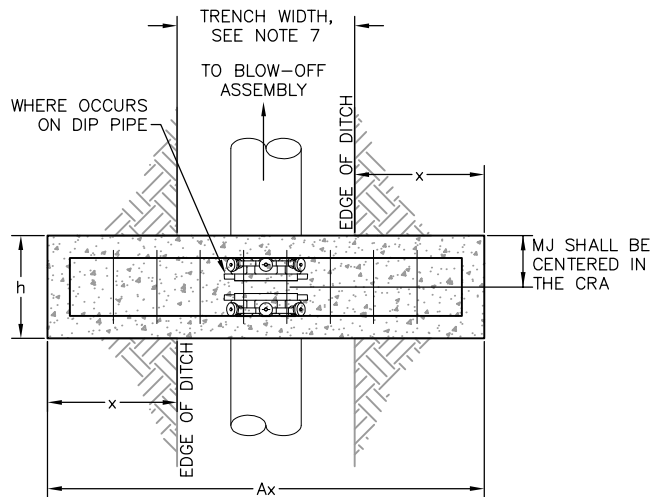
Revised:

Revised:

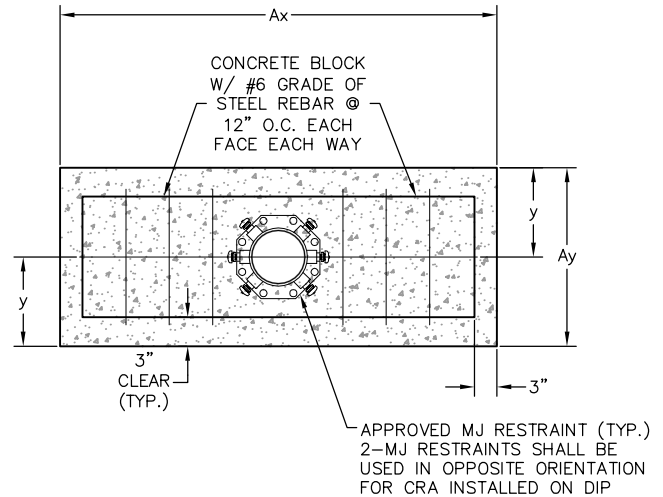


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-17



PLAN
DEAD-END OR
REVERSE ANCHOR



ELEVATION
DEAD-END OR
REVERSE ANCHOR

DIAMETER (in)	PRESSURE (psi)	x (in)	Ax (in)	y (in)	Ay (in)	Ab (sf)	h (in)	Vol (cy)
4	250	12	72	12	28.80	6.80	18	1.0
6	250	18	84	12	30.90	9.73	18	1.0
8	250	36	120	12	33.05	18.53	18	1.5
12	170	36	120	15	43.20	24.60	18	2.0
12	250	48	144	18	49.20	36.80	24	3.75
16	170	54	156	18	53.40	44.05	24	4.25
16	250	60	168	24	65.40	60.50	36	8.5

NOTES:

1. THE MINIMUM BEARING SURFACE AREAS SHOWN ARE BASED ON A MAX. STATIC PIPE PRESSURE OF 170/250 POUNDS PER SQUARE INCH PLUS A SAFETY FACTOR OF 1.5, AND AN ALLOWABLE SOIL BEARING CAPACITY OF 1,500 POUNDS PER SQUARE FOOT. FOR HDPE, ADDITIONAL ASSUMPTIONS INCLUDE A MAX 50°F TEMPERATURE CHANGE AND A POISSON RATIO OF 0.45. REFERENCE AWWA M-23, M-41, AND M-55.
2. THE DESIGN ENGINEER IS RESPONSIBLE FOR VERIFYING ASSUMPTIONS BASED ON ACTUAL SITE CONDITIONS. IF SITE VARIES FROM THE ASSUMPTIONS, THE DESIGN ENGINEER SHALL PROVIDE A SITE-SPECIFIC DESIGN THAT SHALL BE IN ACCORDANCE WITH AWWA M-23, PVC PIPE DESIGN AND INSTALLATION, AND AWWA M-41, DUCTILE IRON PIPE, AND FITTINGS. SITE-SPECIFIC DESIGNS USING GEOTECHNICAL INFORMATION SHALL BE SUBMITTED TO THE DISTRICT FOR APPROVAL.
3. THE MINIMUM LATERAL BEARING SURFACE AREA (Ab) AND APPROXIMATE VOLUME OF CONCRETE (Vol) SHALL BE SHOWN ON THE CONSTRUCTION PLANS FOR ALL CONCRETE REVERSE ANCHORS.
4. THE APPROXIMATE VOLUMES SHOWN ARE BASED ON THE MINIMUM DIMENSIONS IN THE TABLE. THE APPROXIMATE VOLUME IS ROUNDED UP TO THE NEAREST 0.25 CUBIC YARDS.
5. A SITE-SPECIFIC DESIGN SHALL BE REQUIRED FOR PIPES LARGER THAN 16 INCHES OR MAX. STATIC PIPE PRESSURES GREATER THAN 250 POUNDS PER SQUARE INCH. THE DESIGN ENGINEER HAS THE OPTION OF PROVIDING A SITE-SPECIFIC DESIGN FOR PIPES SMALLER THAN 16 INCHES OR MAX. STATIC PRESSURES LESS THAN THE PRESSURE LISTED IN THE TABLE.
6. COAT RODS WITH EPOXY POLYAMIDE COATING, 10 MILS THICK, MIN.
7. A TRENCH WIDTH OF 4 FEET AND 6" BEDDING UNDER THE PIPE ARE ASSUMED FOR BEARING CALCULATIONS, (Ax, Ay, AND y).
8. THE DESIGN ENGINEER SHALL ENSURE THE CONSTRUCTION OF THE CONCRETE REVERSE ANCHOR SHALL NOT CONFLICT WITH OTHER UTILITIES.
9. DUCTILE IRON FITTINGS AND PIPE SHALL BE WRAPPED IN POLYETHYLENE TUBING WHERE ADJACENT TO CONCRETE.

CONCRETE REVERSE ANCHOR FOR MECHANICAL JOINT RESTRAINTS

Drawn: GGM/SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

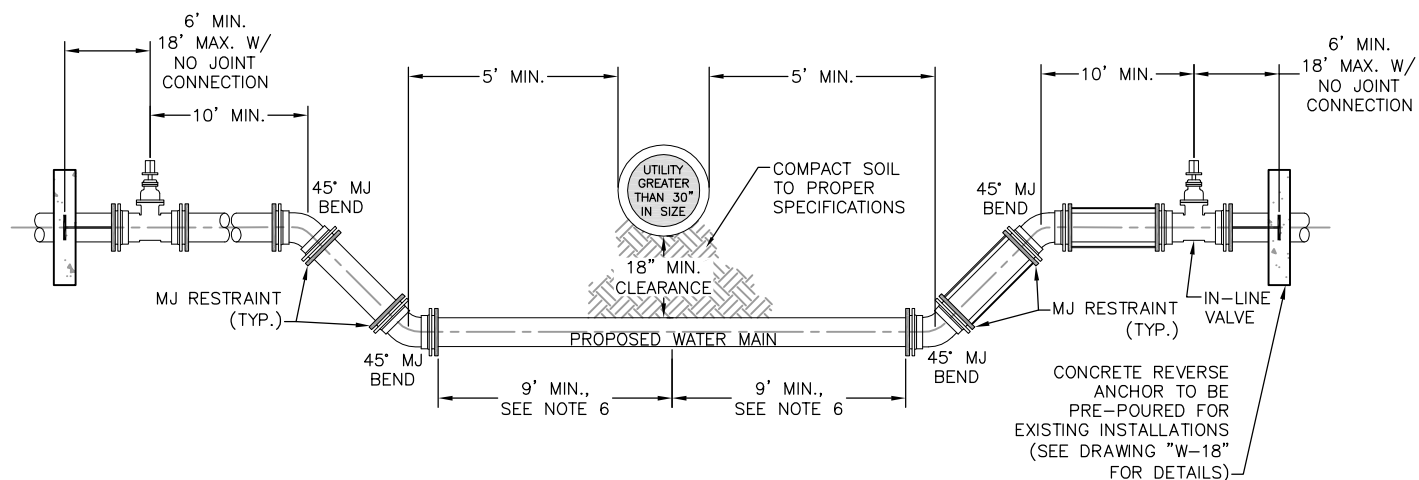
Revised:

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-18



NOTES:

1. ALL DUCTILE IRON FITTINGS AND PIPE SHALL BE CATHODICALLY PROTECTED.
2. ALL FITTINGS SHALL HAVE MJ RESTRAINTS.
3. EXAMPLE CAN VARY DUE TO SITE CONDITIONS AND DISTRICT INSPECTOR'S DIRECTION.
4. RESTRAINED JOINTS ARE REQUIRED WITHIN LOWERING.
5. NO TAPS OR TEES ARE ALLOWED WITHIN THE LOWERING.
6. WHERE WATER MAIN CROSSES UNDER STORM SEWER, WASTEWATER, OR NON-POTABLE WATER INFRASTRUCTURE, A MINIMUM OF 9 FEET IS REQUIRED BETWEEN THE CENTERLINE OF THE CROSSING AND THE FIRST JOINT.

LOWERING DETAIL – UTILITY CROSSING 30" & SMALLER

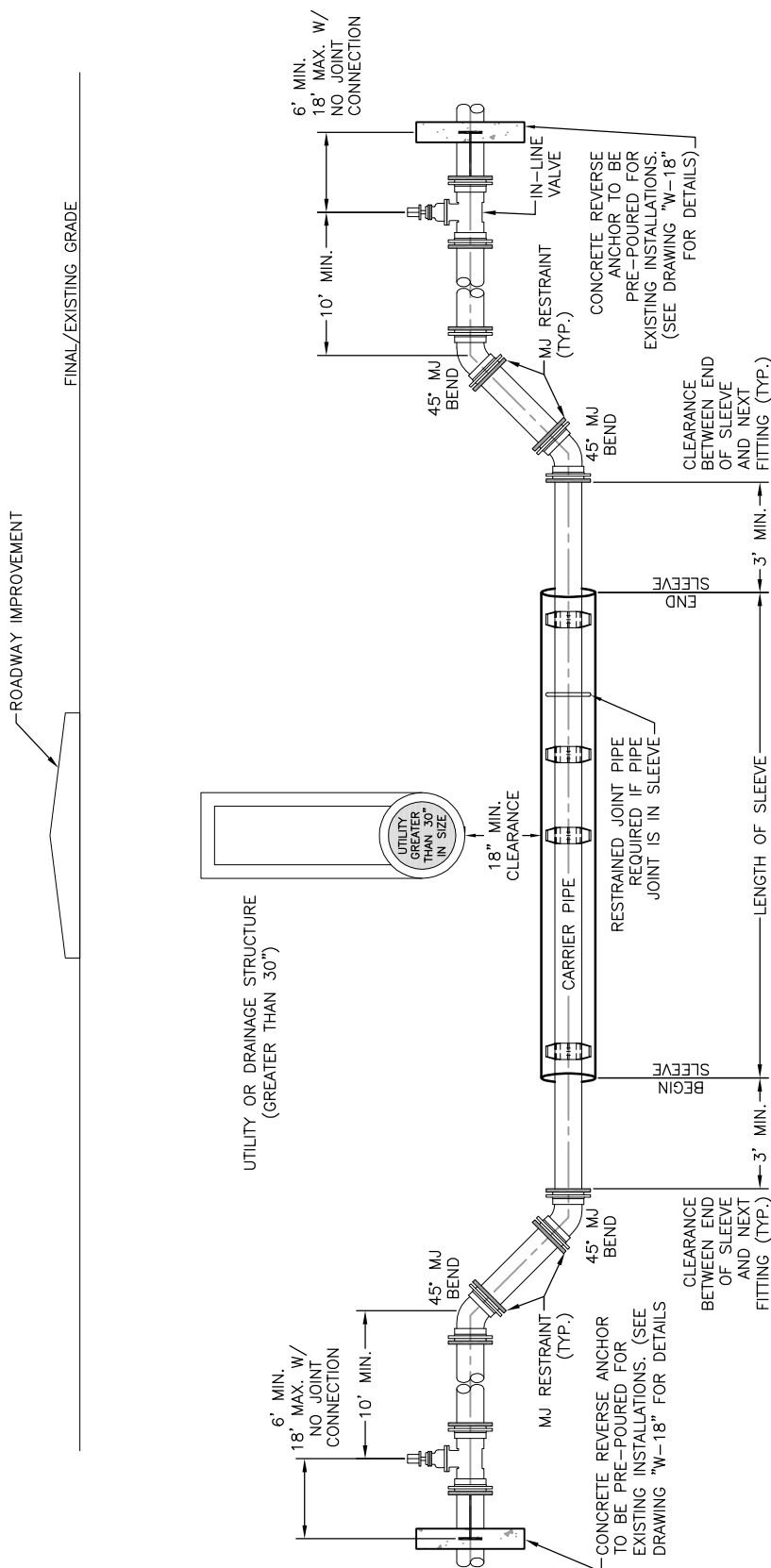
Drawn: SKG
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-19



NOTES:

1. 3/4" ALL-THREAD TO BE USED FROM VALVE TO REVERSE ANCHOR AND FROM UPPER BEND TO VALVE.
2. IF A JOINT IS LOCATED BETWEEN ANY FITTINGS INCORPORATED INTO THE LOWERING, BELL/JOINT RESTRAINTS MUST BE USED.
3. CASING PIPE MUST BE CLEAN AND FREE OF ALL DIRT AND DEBRIS BEFORE INSTALLING CARRIER PIPE AND BEFORE INSTALLING END SEALS.
4. CARRIER PIPE SHALL BE DIP, UNLESS OTHERWISE APPROVED.
5. FURNISH AND INSTALL JOINT BONDING, POLYETHYLENE TUBING, AND 17 LB. MAGNESIUM ANODE ON DIP LOWERING PER STANDARD SPECIFICATIONS.
6. FURNISH AND INSTALL ONE 17 LB. MAGNESIUM ANODE PER 20 FEET OR LESS OF CASING PIPE.
7. ENTIRE LENGTH OF LOWERING (FROM VERTICAL BEND TO LOWER VERTICAL BEND) SHALL REST ON 18" MINIMUM OF 3/4" ROCK BELOW CASING AND UP TO SPRINGLINE OF CASING AND CARRIER PIPE.

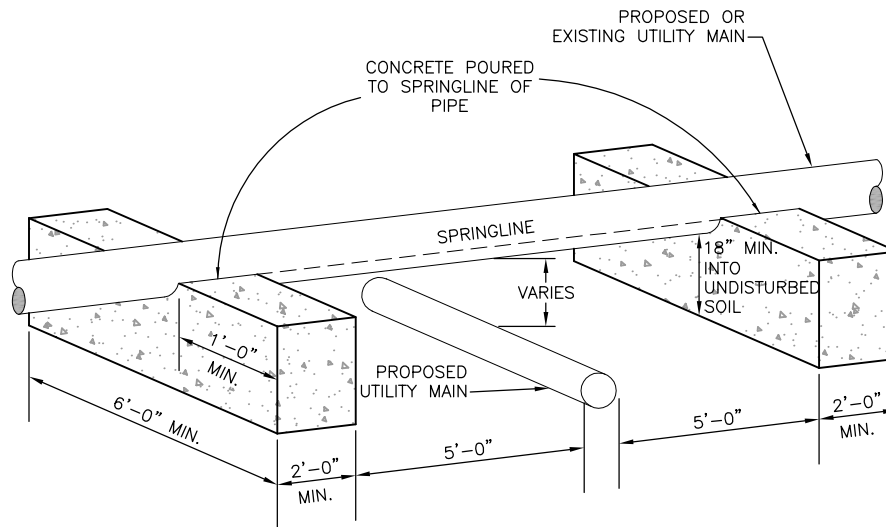
LOWERING DETAIL W/CASING UTILITY CROSSING GREATER THAN 30"

Drawn: SKG	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-20



NOTES:

1. CONCRETE BLOCKS TO BE REINFORCED WITH #6 REBAR SET ON 12" CENTERS.
2. NO JOINTS OF UTILITY MAIN SHALL BE ALLOWED BETWEEN CONCRETE BRIDGING BLOCKS.

PIPE BRIDGING DETAIL

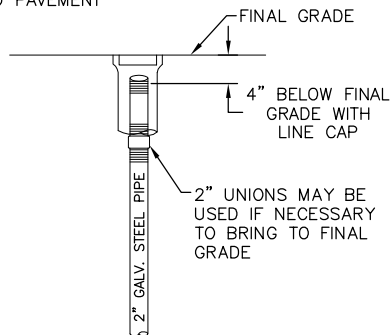
Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



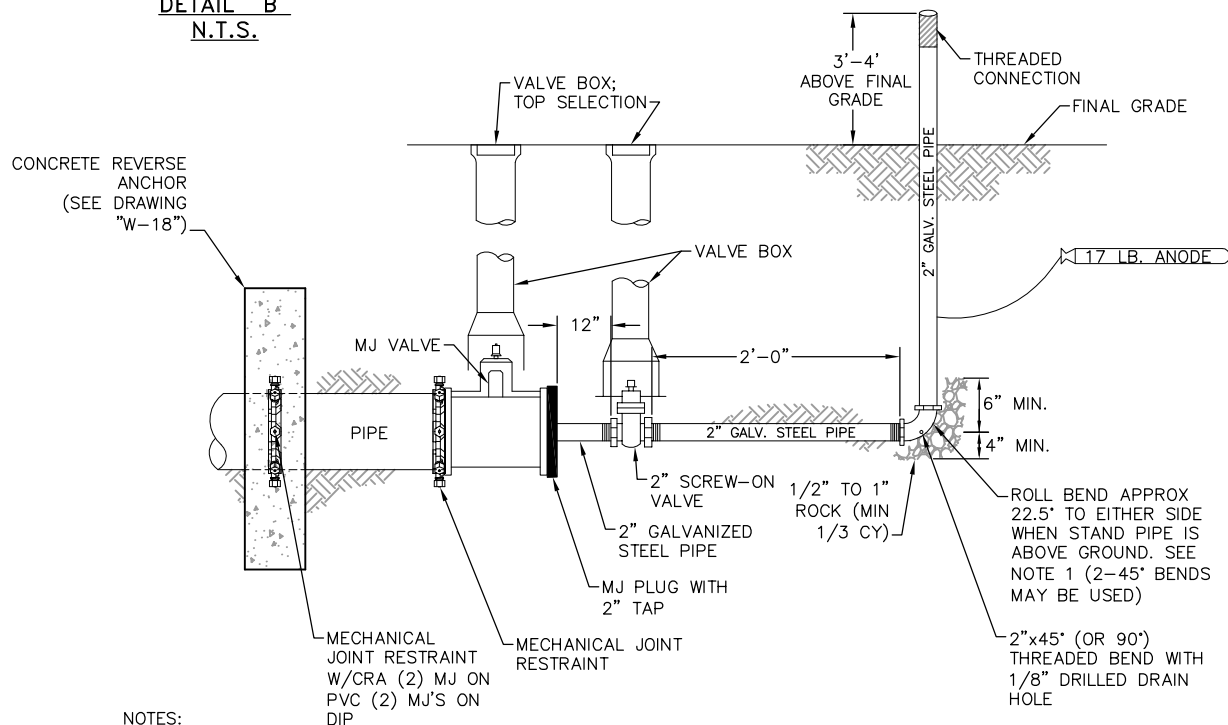
WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-21

NOTE:
USE DETAIL "B" WHEN
INSTALLING TO PAVEMENT
ELEVATION



DETAIL "B"
N.T.S.



NOTES:

1. IF APPROPRIATE LOCATION FOR DISCHARGED WATER CANNOT BE REACHED BY ROLLING THE BEND, ADDITIONAL BENDS MAY BE REQUIRED BY THE DISTRICT INSPECTOR.
2. COAT TIE RODS, BEAM, AND GALVANIZED STEEL PIPE WITH EPOXY POLYAMIDE COATING, 10 MILS THICK, MIN.
3. ENTIRE BLOW-OFF ASSEMBLY MUST BE ADEQUATELY SUPPORTED, CONCRETE PAVER STONES MAY BE REQUIRED.
4. PIPE DOPE APPROVED FOR USE IN POTABLE WATER SYSTEMS MUST BE USED ON ALL THREADED FITTINGS.
5. TEMPORARY BLOW-OFF VALVE ASSEMBLIES SHALL BE INSPECTED BY THE DISTRICT INSPECTOR PRIOR TO BACKFILL. BACKFILL COMPACTION TO BE SAME AS PIPE COMPACTION SPECIFICATIONS.
6. 2" GALVANIZED PIPE MUST BE RATED TO 250 PSI AND CONFORM TO NSF-61 SPECIFICATIONS.
7. THE DISTRICT INSPECTOR MAY REQUIRE TIE-BACK RODS IN ADDITION TO THE MJ RESTRAINTS DEPENDING ON FIELD CONDITIONS AND SYSTEM PRESSURES.

TEMP BLOW-OFF ASSEMBLIES - 4", 6", & 8" MAINS W/MJ PLUG

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

Scale: N.T.S.

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-22

BLOW-OFF ASSEMBLY SIZING

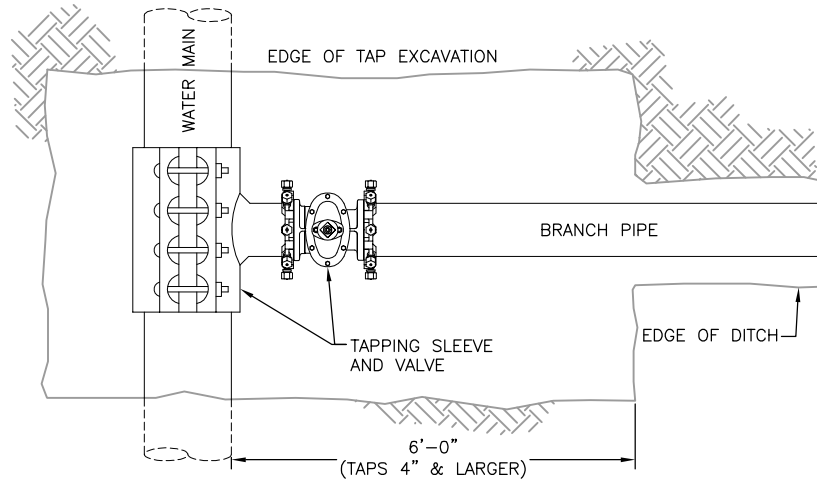
MAIN PIPE DIA. (IN.)	STATIC PRESSURE RANGE (P.S.I.)	DIMENSIONS FROM DRAWING "W-23"				
		"A" (IN)	"B" (IN)	"C" (W-SHAPE)	"D" ROD SIZE (IN)	"E" BLOW-OFF PIPE SIZE (IN)
12	<100 101-150 151-200 201-250	36	10	W10 x 15	5/8	2
		36	10 1/4	W10 x 19	3/4	2
		36	10 1/8	W10 x 22	7/8	2
		36	10 1/8	W10 x 22	1	2
16	<100 101-150 151-200 201-250	40	12 1/4	W12 x 26	7/8	4
		40	12 1/4	W12 x 26	1	4
		40	12 1/4	W12 x 26	1 1/8	4
		40	12 1/2	W12 x 35	1 1/4	4
18	<100 101-150 151-200 201-250	42	12 1/4	W12 x 26	1	4
		42	12 1/2	W12 x 35	1 1/4	4
		42	12	W12 x 40	1 3/8	4
		42	12	W12 x 45	1 1/2	4
20	<100 101-150 151-200 201-250	44	12 1/4	W12 x 26	1	4
		44	12 1/2	W12 x 35	1 1/4	4
		44	12	W12 x 40	1 3/8	4
		44	12	W12 x 45	1 1/2	4
24	<100 101-150 151-200 201-250	48	12 1/2	W12 x 35	1 1/4	6
		48	12	W12 x 40	1 1/2	6
		48	12	W12 x 53	1 1/4*	6
		48	12	W12 x 53	1 1/8*	6
30	<100 101-150 151-200 201-250	54	12 1/4	W12 x 50	1 1/8*	6
		54	12 1/4	W12 x 58	1 3/8*	6
		54	12 1/8	W12 x 65	1 1/2*	6
		54	12 1/4	W12 x 72	1 5/8*	6
36	<100 101-150 151-200	60	12 1/4	W12 x 58	1 1/4*	8
		60	12 1/4	W12 x 72	1 1/2*	8
		60	12 3/4	W12 x 96	1 3/4*	8

NOTES:

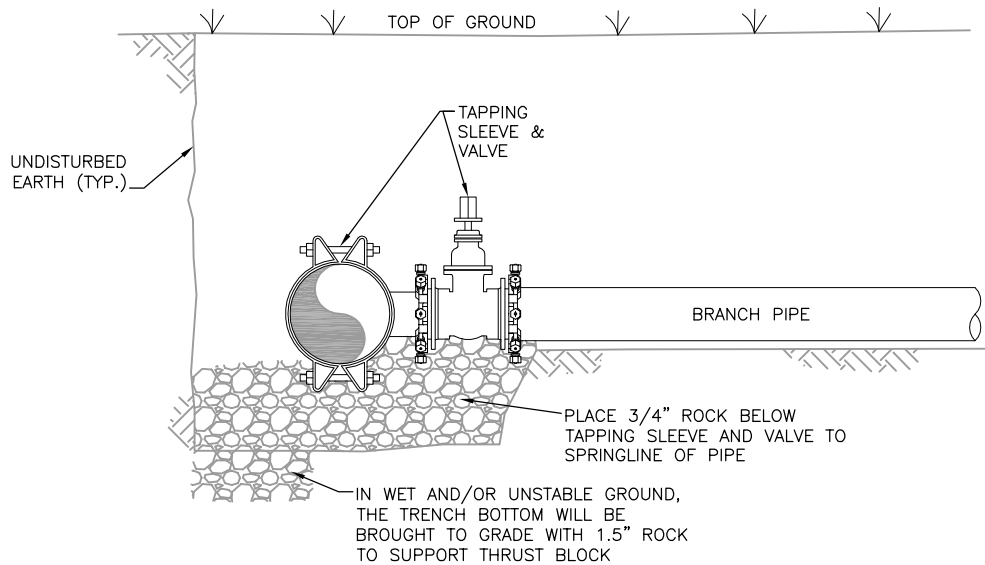
1. ALL W-SHAPES FABRICATED FROM A36 STEEL.
2. ALL RODS SHALL BE MIN. GRADE A307 EXCEPT WHERE NOTED AS *. THESE SHALL BE MINIMUM STRENGTH EQUAL TO ASTM A325 RODS.
3. A 50% SURGE FACTOR HAS BEEN INCLUDED IN DESIGN.
4. FOR SIZES AND PRESSURES GREATER THAN THOSE SHOWN, SPECIAL DESIGN IS REQUIRED, APPROVED BY THE DISTRICT.

BLOW-OFF ASSEMBLY DIMENSION DATA FOR MAINS 12" +

Drawn: GGM	Revised: DECEMBER 2021		WATER & WASTEWATER SYSTEM STANDARD SPECIFICATIONS	<h1 style="margin: 0;">W-24</h1>
Date: MARCH 2011	Revised:			
Scale: N.T.S.	Revised:			



PLAN VIEW
N.T.S.



PROFILE VIEW
N.T.S.

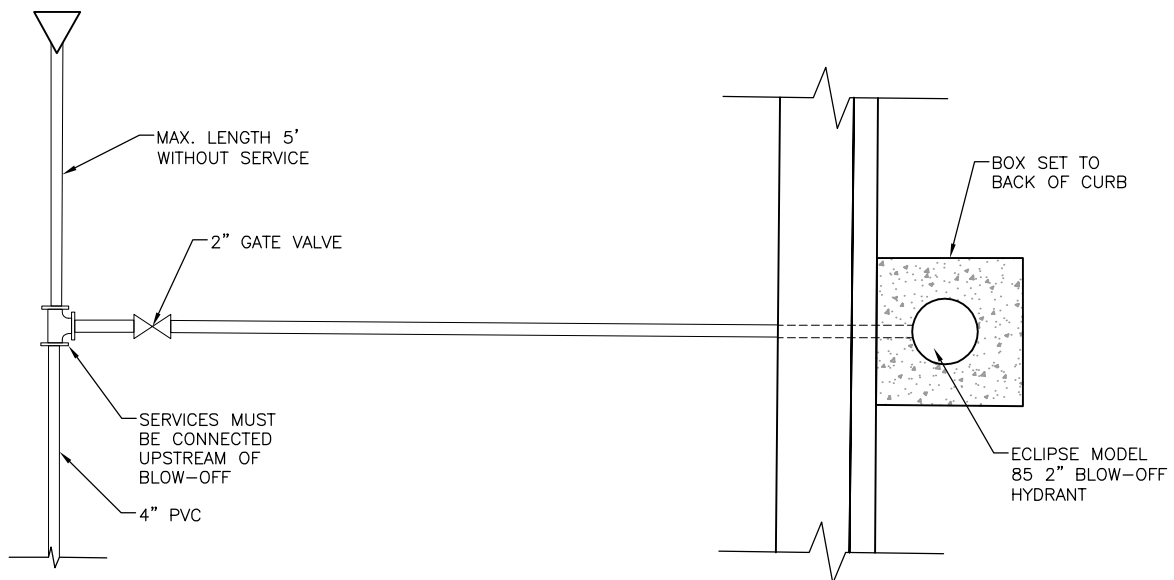
PIPE TAPPING DETAIL

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

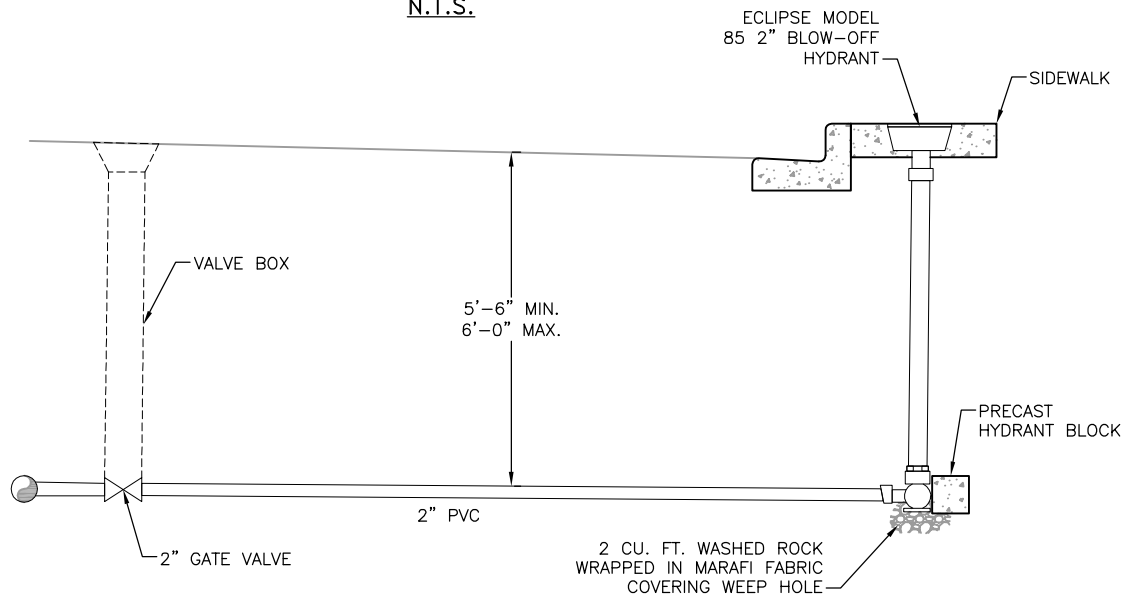


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-25



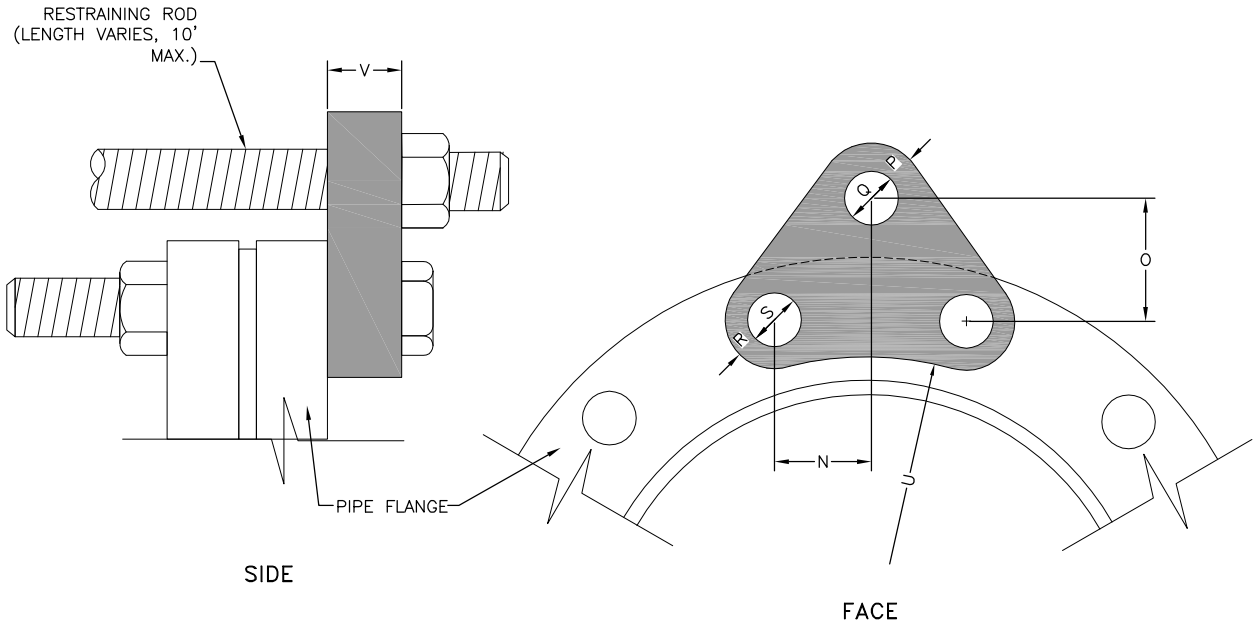
PLAN VIEW
N.T.S.



PROFILE VIEW
N.T.S.

CUL-DE-SAC BLOW-OFF DETAIL

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



PIPE DIA. (IN.)	PRESS. CLASS (PSI)	"N" (IN.)	"O" (IN.)	H.S. ROD			M.S. ROD			"R" (IN.)	"S" (IN.)	"U" (IN.)	"V" (IN.)	NO REQ'D (EA)
				"P" (IN.)	"Q" (IN.)	ROD DIA. (IN.)	"P" (IN.)	"Q" (IN.)	ROD DIA. (IN.)					
6	150	1-15/16	2-1/4	1	7/8	3/4	1	7/8	3/4	7/8	7/8	3-3/4	3/4	2
	300	1-3/8	2-3/4	1	1	7/8	1	1	7/8	7/8	7/8	4-7/16	1	
8	150	2-1/4	2-3/4	1	7/8	3/4	1	7/8	3/4	1	7/8	4-7/8	3/4	2
	300	1-11/16	2-7/8	1	1	7/8	1	1	7/8	1	1	5-1/2	1	
12	150	2-3/16	2-3/4	1-1/4	1-1/8	1	1-1/4	1-1/8	1	1-1/8	1	7-1/4	7/8	2
	300	1-3/4	3-3/4	1-3/8	1-1/4	1-1/2	1-3/8	1-3/8	1-1/4	1-1/4	1-1/8	7-5/8	1-1/4	
16	150	2-1/16	2-3/4	1-1/2	1-3/8	1-1/4	1-1/2	1-3/8	1-1/4	1-1/4	1-1/8	9-3/8	1-1/8	3
	300	1-3/4	4-1/4	1-1/2	1-1/2	1-3/8	1-1/2	1-1/2	1-3/8	1-1/2	1-3/8	9-7/8	1-1/2	
18	150	2-1/4	2-1/2		1-1/8	1		1-1/8	1		1-1/8	10	1-1/8	4
	300	1-7/8	3-3/4	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2	1-3/8	10-3/16	2	4
20	150	2-5/8	1-15/16		1-1/8	1		1-1/8	1		1-1/4	11-1/8	1-1/4	4
	300	2	3-1/16	1-3/8	1-9/16	1-1/2	1-3/8	1-9/16	1-1/2	1-3/8	1-3/8	10-1/2	2-1/2	4
24	150	2-5/16	2-5/8		1-1/8	1		1-1/8	1		1-3/8	13-1/4	1-1/4	6
	300	2-5/16	3-1/8	1-1/2	1-9/16	1-1/2	1-1/2	1-9/16	1-1/2	1-1/2	1-5/8	12-1/2	2-1/4	6

NOTES:

1. M.S. MEANS MILD STEEL ROD, ASTM STANDARD DESIGNATION A-36. NUTS SHALL BE ASTM STANDARD DESIGNATION A-307
2. H.S. MEANS HIGH STRENGTH STEEL ROD, ASTM STANDARD DESIGNATION A-193 GRADE B-7. NUTS SHALL BE ASTM STANDARD DESIGNATION A-193 GRADE 2-H.

FLANGE – LUG DETAIL

Drawn: GGM

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

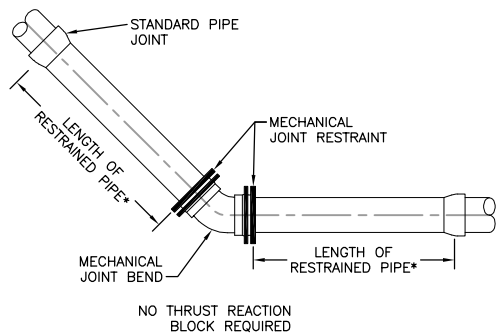
Revised:

Revised:

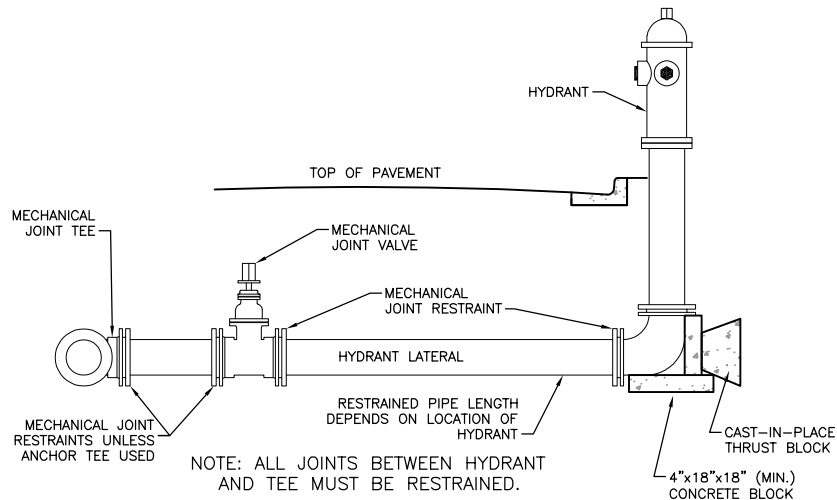


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

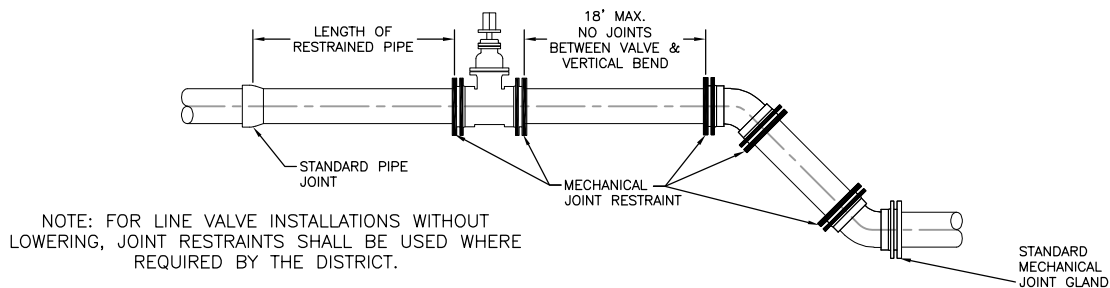
W-27



INSTALLATION FOR BENDS



INSTALLATION FOR BENDS



NOTE: FOR LINE VALVE INSTALLATIONS WITHOUT LOWERING, JOINT RESTRAINTS SHALL BE USED WHERE REQUIRED BY THE DISTRICT.

INSTALLATION FOR LINE VALVE & LOWERING

NOTES:

1. MECHANICAL JOINTS SHALL BE APPROVED ACCORDING TO MATERIAL SPECIFICATION FOR DIP AND PVC PIPE.
2. LENGTH OF PIPE REQUIRING JOINT RESTRAINT SHALL BE DETERMINED FROM CHART ON DRAWING W-13.
3. RESTRAINED JOINT PVC PIPE SHALL NOT BE USED FOR LOWERINGS.
4. IF A JOINT IS LOCATED BETWEEN ANY FITTINGS INCORPORATED INTO THE ASSEMBLY, BELL/JOINT RESTRAINTS MUST BE USED.

APPLICATIONS FOR MECHANICAL JOINT RESTRAINTS

Drawn: GGM

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

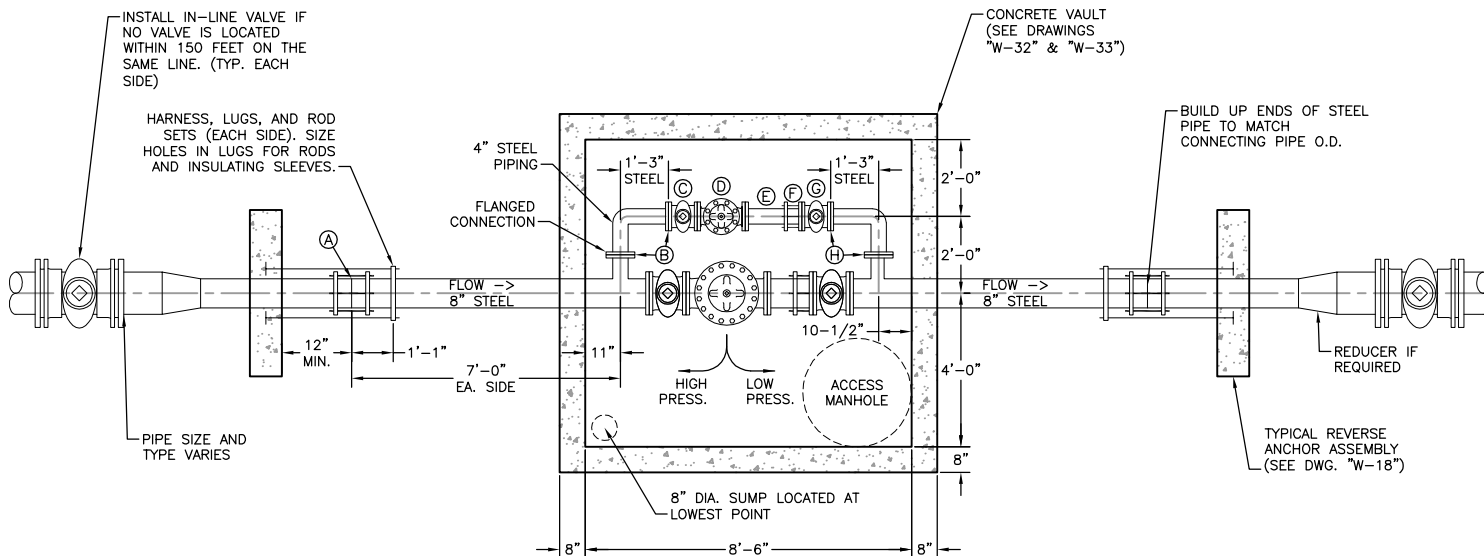
Revised:

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

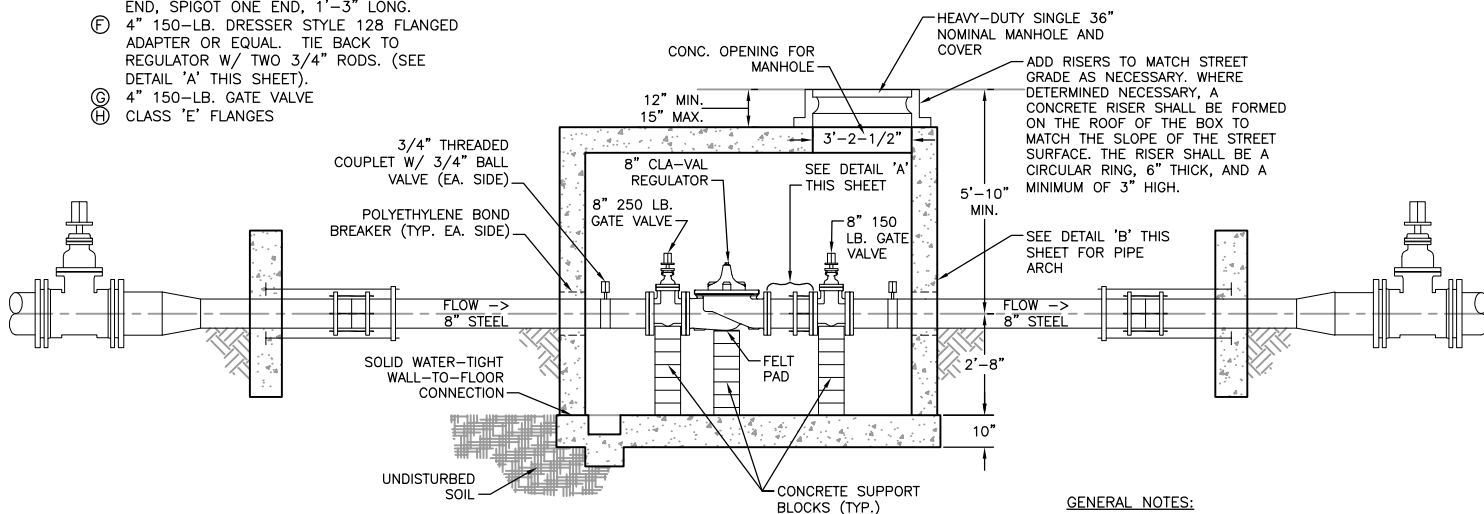
W-28



PLAN LEGEND

- (A) 8" STYLE 39 DRESSER COUPLING, OR EQUAL
- (B) 300-LB. FLANGES
- (C) 4" 250-LB. GATE VALVE
- (D) 4" 250-LB. CLA-VAL REGULATOR
- (E) 4" STEEL FITTING, 300-LB. FLANGE ONE END, SPIGOT ONE END, 1'-3" LONG.
- (F) 4" 150-LB. DRESSER STYLE 128 FLANGED ADAPTER OR EQUAL. TIE BACK TO REGULATOR W/ TWO 3/4" RODS. (SEE DETAIL 'A' THIS SHEET).
- (G) 4" 150-LB. GATE VALVE
- (H) CLASS 'E' FLANGES

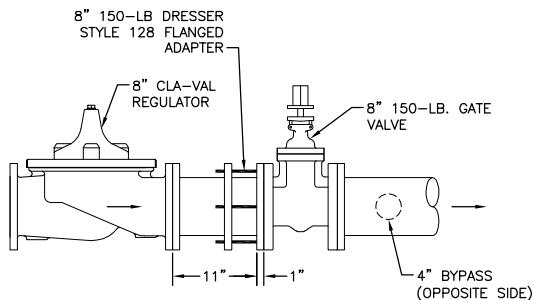
PLAN VIEW N.T.S.



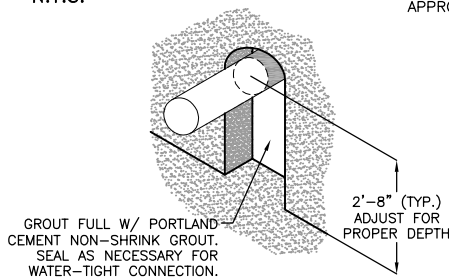
PROFILE VIEW N.T.S.

GENERAL NOTES:

1. CONCRETE VAULTS SHALL MEET ALL CRITERIA AS OUTLINED ON STANDARD DRAWINGS W-32 & W-33.
2. ALL REGULATOR INSTALLATIONS LARGER THAN 8-INCH SHALL BE SPECIALLY DESIGNED AND APPROVED BY THE DISTRICT.



DETAIL 'A' - FLANGED ADAPTOR
N.T.S.



DETAIL 'B' - PIPE ARCH
N.T.S.

8" SIZE PRESSURE REGULATOR STATION

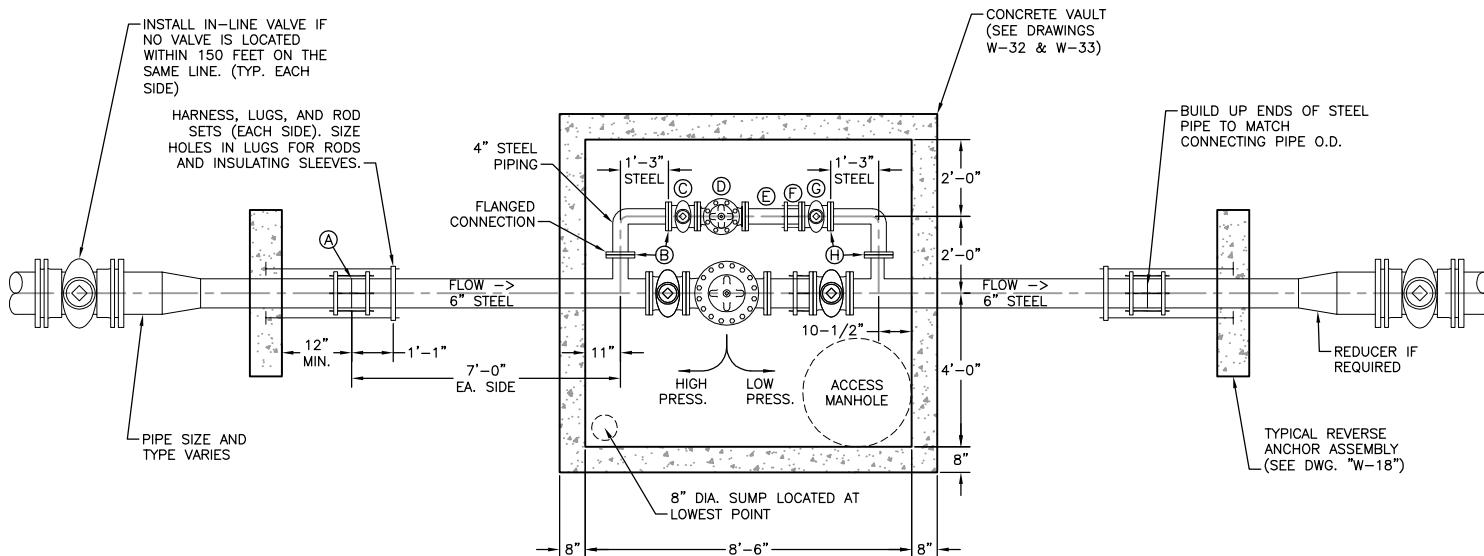
Drawn: GGM
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

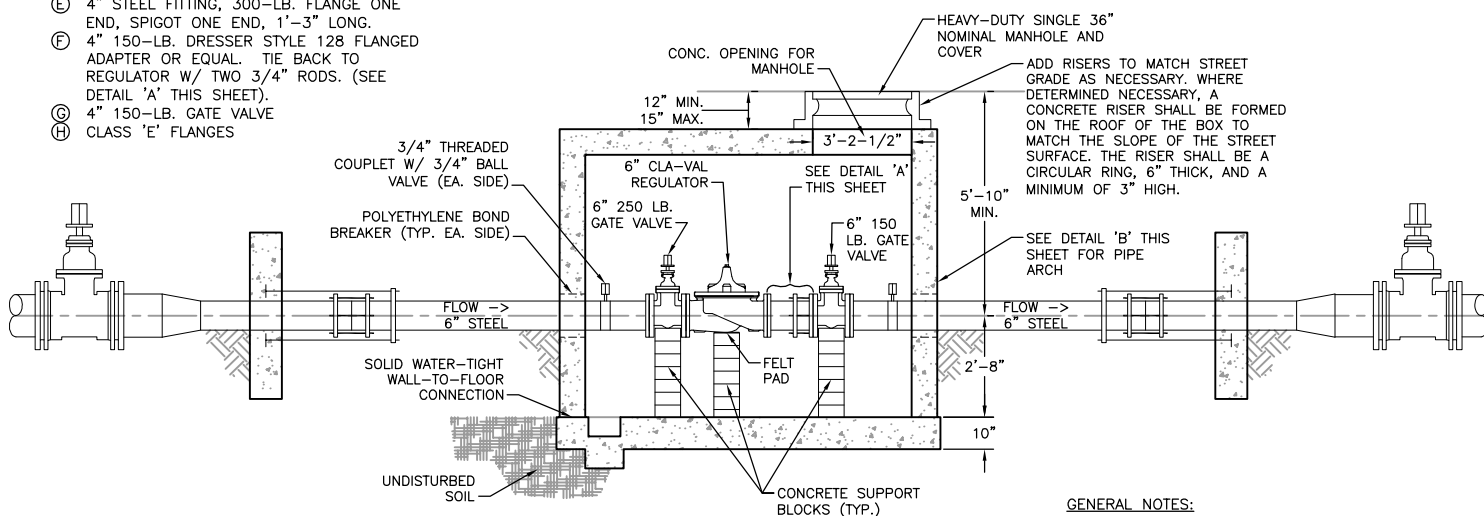
W-30



PLAN LEGEND

- (A) 6" STYLE 39 DRESSER COUPLING, OR EQUAL
- (B) 300-LB. FLANGES
- (C) 4" 250-LB. GATE VALVE
- (D) 4" 250-LB. CLA-VAL REGULATOR
- (E) 4" STEEL FITTING, 300-LB. FLANGE ONE END, SPIGOT ONE END, 1'-3" LONG.
- (F) 4" 150-LB. DRESSER STYLE 128 FLANGED ADAPTER OR EQUAL. TIE BACK TO REGULATOR W/ TWO 3/4" RODS. (SEE DETAIL 'A' THIS SHEET).
- (G) 4" 150-LB. GATE VALVE
- (H) CLASS 'E' FLANGES

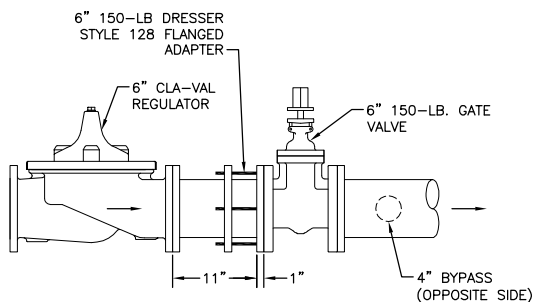
PLAN VIEW
N.T.S.



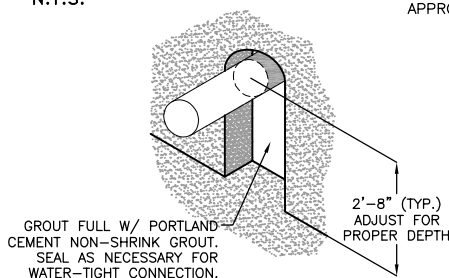
PROFILE VIEW
N.T.S.

GENERAL NOTES:

1. CONCRETE VAULTS SHALL MEET ALL CRITERIA AS OUTLINED ON STANDARD DRAWINGS W-32 & W-33.
2. ALL REGULATOR INSTALLATIONS LARGER THAN 8-INCH SHALL BE SPECIALLY DESIGNED AND APPROVED BY THE DISTRICT.



DETAIL 'A' - FLANGED ADAPTOR
N.T.S.



DETAIL 'B' - PIPE ARCH
N.T.S.

6" SIZE PRESSURE REGULATOR STATION

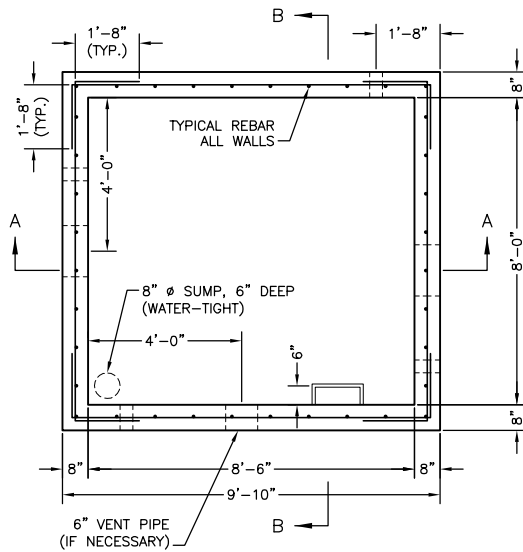
Drawn: GGM
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:

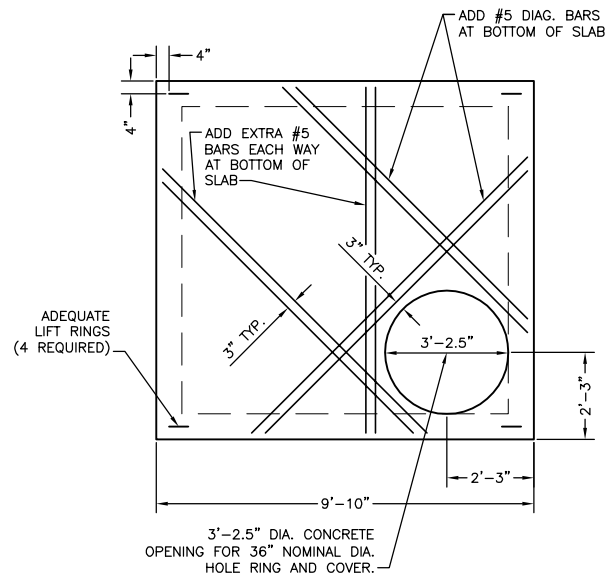
WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

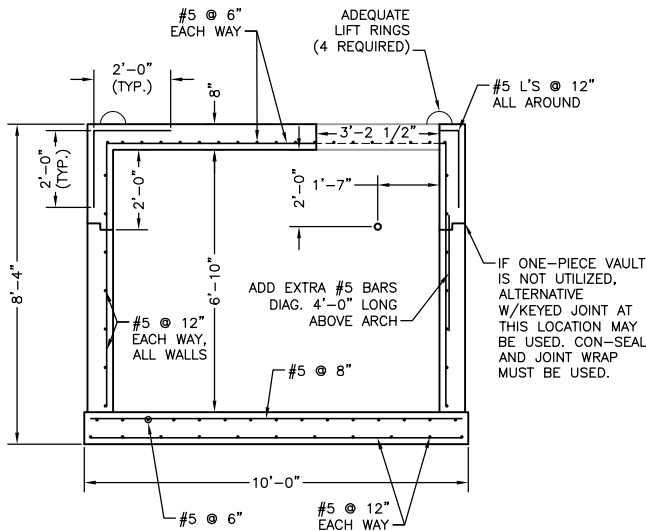
W-31



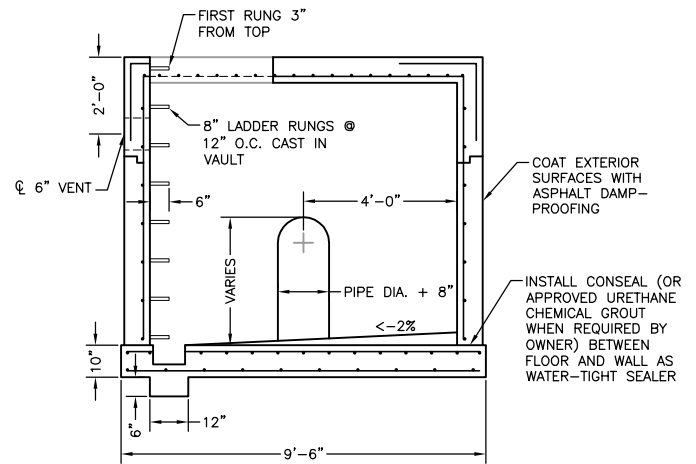
PLAN VIEW
N.T.S.



ROOF PLAN
N.T.S.



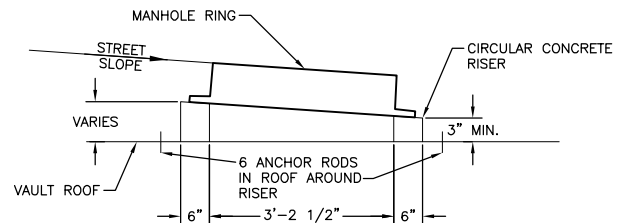
SECTION A-A
N.T.S.



SECTION B-B
N.T.S.

NOTES:

- ALL CONCRETE WORK SHALL COMPLY WITH DISTRICT STANDARD SPECIFICATIONS AND LATEST A.C.I.-318 CODE.
- MINIMUM CONCRETE CLEARANCES FOR REBAR:
 - 3" WHERE POURED AGAINST EARTH
 - 2" WHERE FORMED AND THEN EXPOSED TO GROUND OR WEATHER FOR #6 OR LARGER. 1.5" FOR #5 AND SMALLER.
 - 1" WHERE EXPOSED TO INTERIOR SURFACES
- ALL VAULTS SHALL BE CONSTRUCTED TO MEET HS20-44 TRAFFIC LOADING CONDITIONS AND 300 PSF SURCHARGE LOAD.



DETAIL A
CONCRETE RISER FOR MANHOLE
N.T.S.

STAND. CONC. VAULT FOR VALVE INSTALLATION (PRECAST)

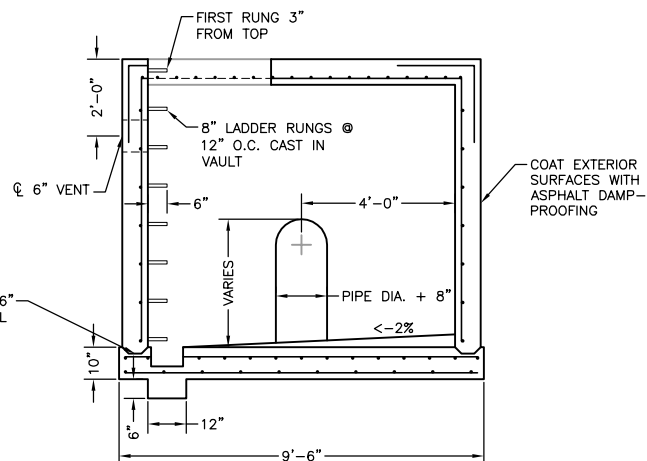
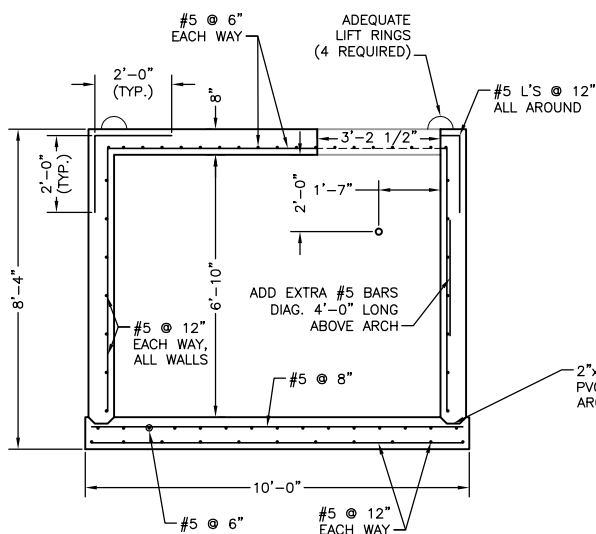
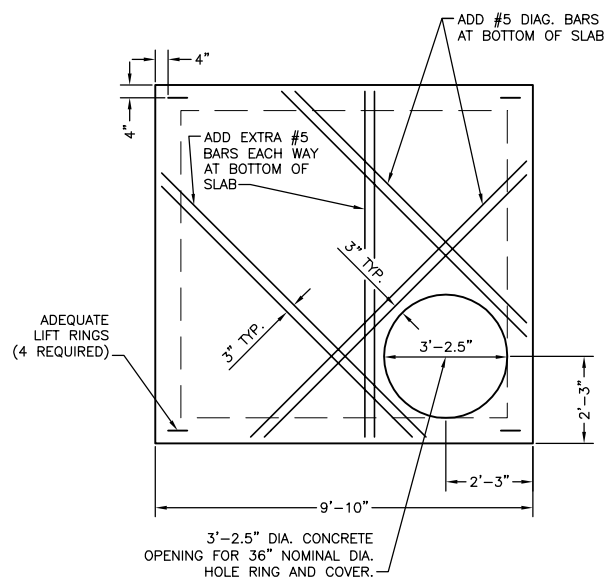
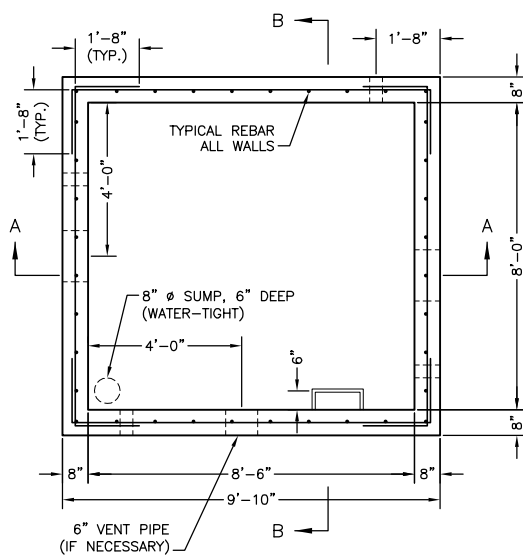
Drawn: GGM
Date: MARCH 2011
Scale: N.T.S.

Revised: DECEMBER 2021
Revised:
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-32



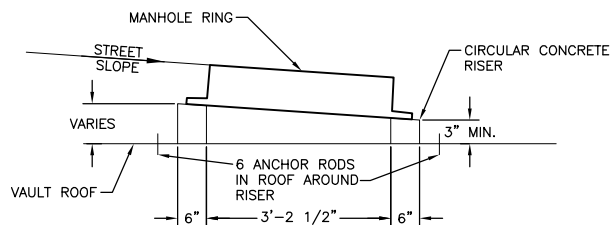
SECTION A-A
N.T.S.

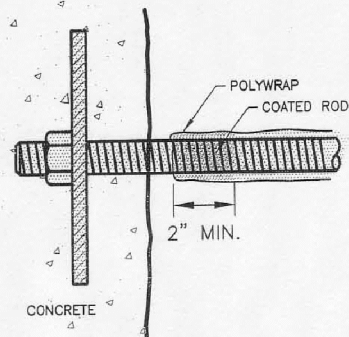
SECTION B-B
N.T.S.

DETAIL A
CONCRETE RISER FOR MANHOLE
N.T.S.

- NOTES:

1. ALL CONCRETE WORK SHALL COMPLY WITH DISTRICT STANDARD SPECIFICATIONS AND LATEST A.C.I.-318 CODE.
2. MINIMUM CONCRETE CLEARANCES FOR REBAR:
 - 3" WHERE POURED AGAINST EARTH
 - 2" WHERE FORMED AND THEN EXPOSED TO GROUND OR WEATHER FOR #6 OR LARGER, 1.5" FOR #5 AND SMALLER.
 - 1" WHERE EXPOSED TO INTERIOR SURFACES
3. ALL VAULTS SHALL BE CONSTRUCTED TO MEET HS20-44 TRAFFIC LOADING CONDITIONS AND 300 PSF SURCHARGE LOAD.

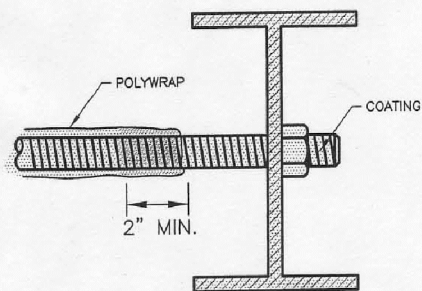




NO SCALE

METAL IN CONCRETE:

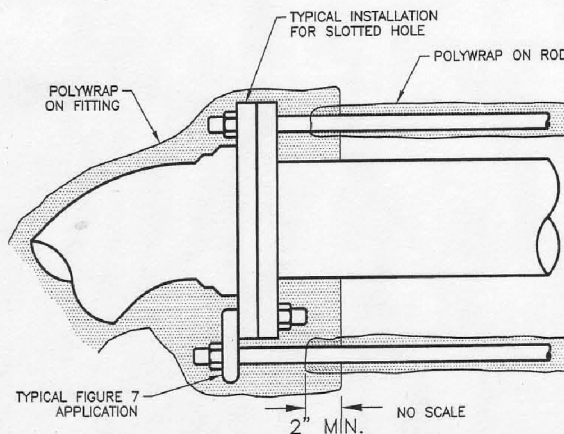
1. COAT METAL PARTS WHERE IN CONTACT WITH CONCRETE, EXTENDING COATING SEVERAL INCHES BEYOND THE CONCRETE.
2. POLYWRAP THE ROD, OVERLAPPING THE POLYWRAP AND THE COATING A MINIMUM OF 2".
3. SECURE POLYWRAP TO THE ROD USING 2" WIDE, 10-MIL POLYETHYLENE PRESSURE-SENSITIVE TAPE.



NO SCALE

ROD THROUGH I-BEAM:

1. COAT ENTIRE I-BEAM.
2. COAT NUT AND ROD, EXTENDING COATING SEVERAL INCHES BEYOND THE BEAM.
3. POLYWRAP THE ROD, OVERLAPPING THE COATING A MINIMUM OF 2".
4. SECURE POLYWRAP WITH TAPE.



NO SCALE

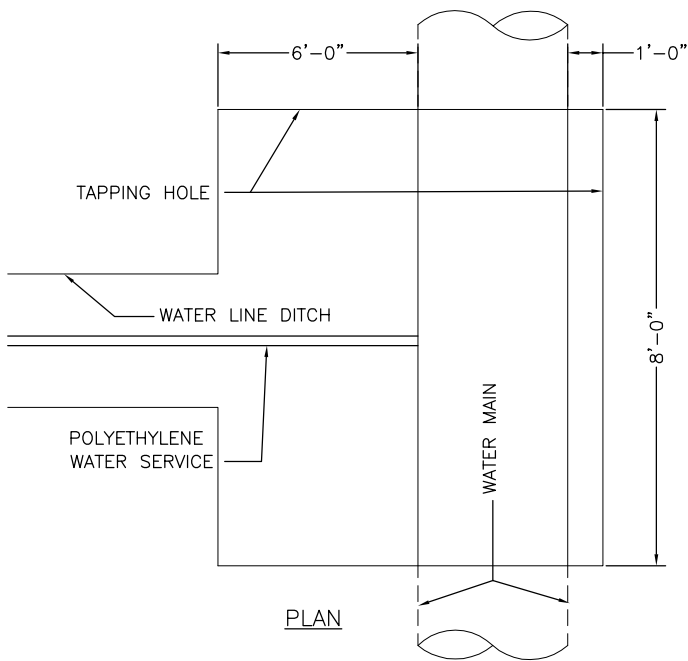
RODS IN MJ FITTING:

1. POLYWRAP THE ROD AND SECURE WITH TAPE.
2. POLYWRAP THE FITTING, OVERLAPPING THE POLYWRAP ON THE ROD A MINIMUM OF 2" AND SECURE WITH TAPE.

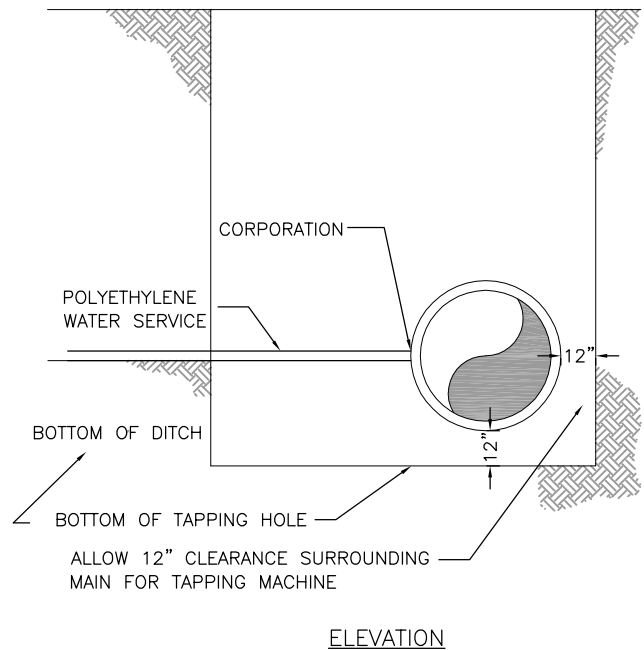
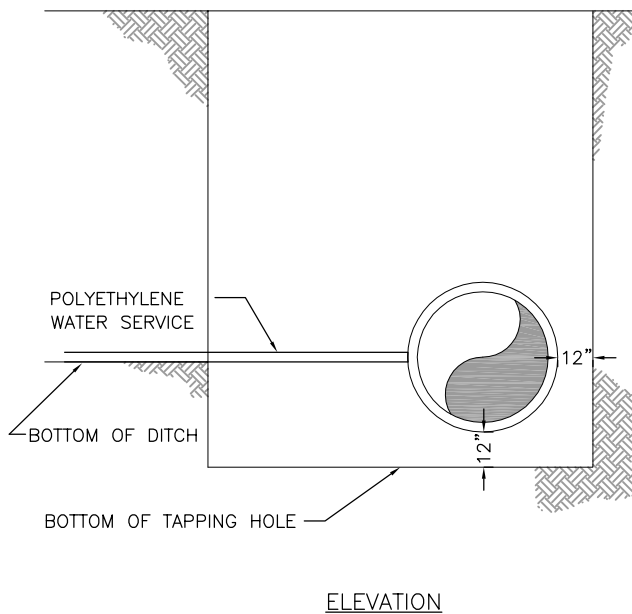
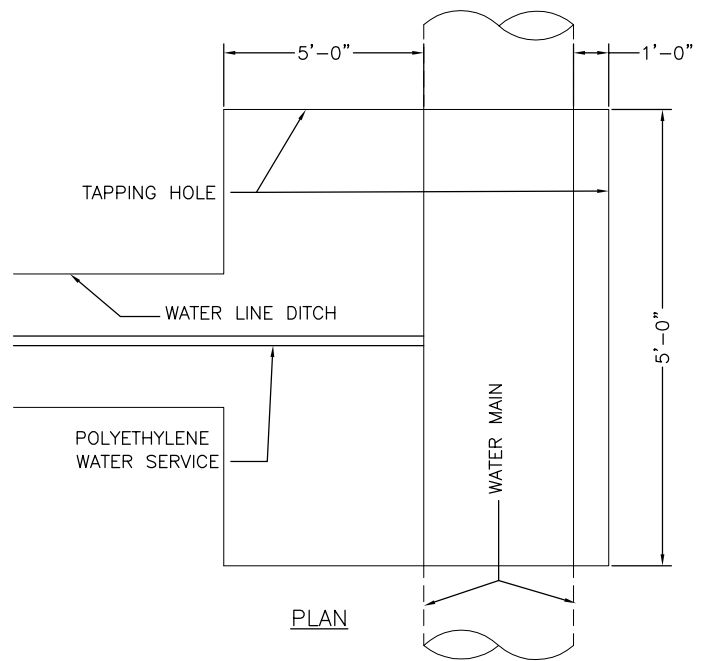
PROTECTING TIE RODS

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

SERVICE TAPS 1-1/2"
& 2" TAPPING SADDLE



SERVICE TAPS 3/4" &
1" CORPORATION ONLY



NOTES:

1. DIRECT TAPS TO THE WATER MAIN SHALL BE MADE ONLY WHEN APPROVED BY THE DISTRICT. ALL TAPS SHALL USE TAPPING SADDLES. TAPPING SADDLES SHALL HAVE TWO BRASS BANDS AND A BRASS CORPORATION CONNECTION.
2. POLYETHYLENE SERVICE LINE SHALL BE INSTALLED IN A SNAKE-LIKE FASHION FROM MAIN LINE TO WATER METER.

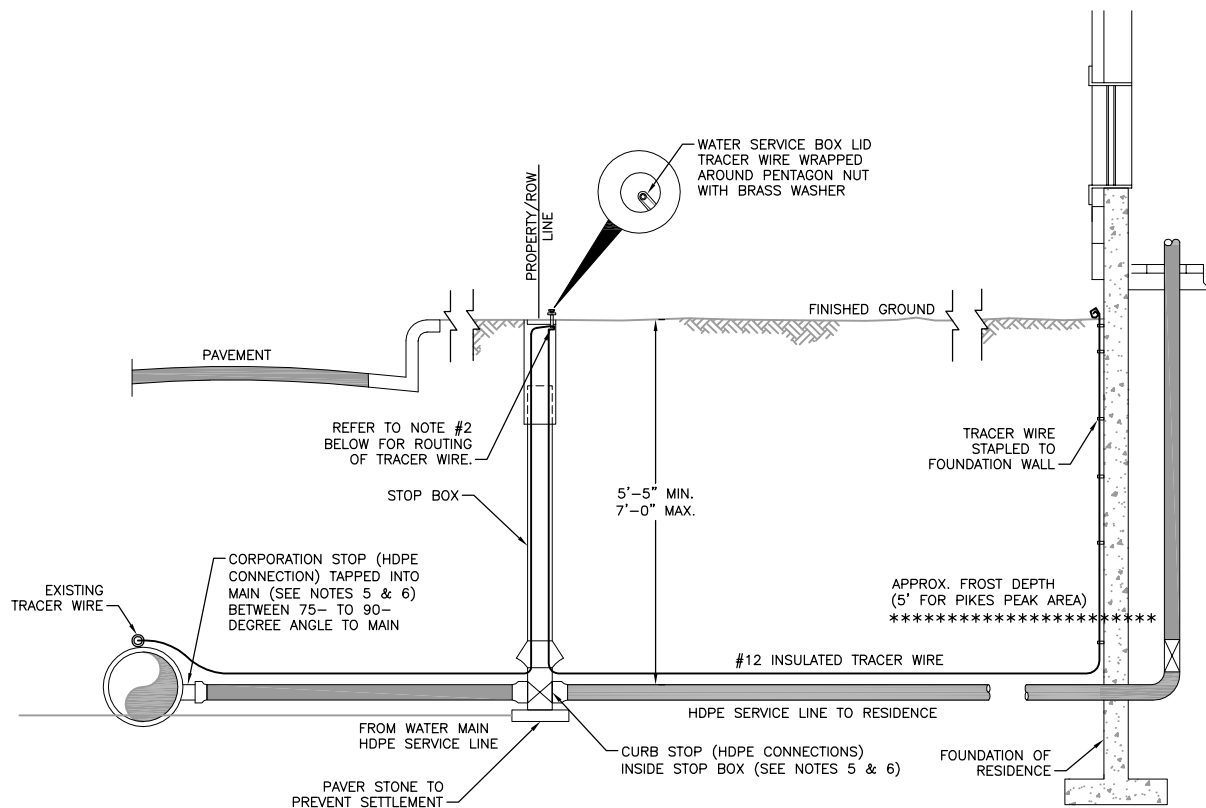
TAPPING DETAIL – 3/4" THROUGH 2"

Drawn: SKG	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-35



WATER SERVICE LINE NOTES:

1. NO. 12 INSULATED TRACER WIRE SHALL BE PLACED ALONG SERVICE LINE AND SHALL BE A CONTINUOUS (WITHOUT SPLICES) LENGTH.
2. WHEN A NEW PLASTIC SERVICE IS CONNECTED TO A PVC MAIN, THE SERVICE LINE TRACER WIRE SHALL BE CONNECTED TO THE MAIN'S TRACER WIRE WITH A SPLIT-BOLT CONNECTOR. THE TRACER WIRE IS THEN TAPED ALONG THE SERVICE LINE IN AT LEAST 3 LOCATIONS NOT TO EXCEED 10'. ALL CURB STOP BOXES SHALL HAVE A 1-1/2" DIAMETER SCHD 40 PVC PIPE TELESKOPE INSIDE WITH A BELL END TO FIT OVER THE TOP OF THE CURB STOP VALVE. TRACER WIRE SHALL BE EXTENDED UP THE INSIDE OF CURB STOP BOX BUT OUTSIDE THE 1-1/2" SCHD 40 PVC PIPE. TRACER WIRE SHALL BE WRAPPED AROUND CURB STOP BOLT UNDER A BRASS WASHER. THE WIRE WILL THEN BE ROUTED BACK DOWN INSIDE THE CURB BOX AND OUTSIDE THE SCHD 40 PVC, AND TAPED AGAIN TO THE SERVICE LINE UNTIL IT REACHES THE POINT WHERE THE SERVICE LINE ENTERS THE BUILDING. AT THIS POINT, THE TRACER WIRE WILL BE STAPLED TO THE FOUNDATION WALL THEN TURNED BACK TO FORM A ONE-INCH-LONG HOOK AND WRAPPED WITH 4" FILLER TAPE AND THEN 3/4" ELECTRICAL TAPE FOR PROTECTION AT THE SURFACE.
3. TO ASSIST IN PE PIPE LOCATING, A 9-LB. ANODE SHOULD BE CONNECTED TO THE END OF THE TRACER WIRE AND THE WATER MAIN TRACER WIRE EVERY 1,000 FEET ALONG THE LENGTH OF THE WATER MAIN. THE NEW ANODE WILL BE ATTACHED TO THE WATER SERVICE/WATER MAIN TRACER WIRE WITH A SPLIT-BOLT CONNECTOR. THE CONNECTOR IS TO BE WRAPPED FIRST WITH A 4" FILLER TAPE AND THEN 3/4" ELECTRICAL TAPE FOR PROTECTION AGAINST CORROSION.
4. THE APPROPRIATE CLEARANCES BETWEEN ANODES AND STEEL PIPES OR OTHER STRUCTURES MUST BE MAINTAINED PER WATER LINE EXTENSION & SERVICE STANDARDS.
5. BRASS FITTINGS, CORP. STOP, AND CURB STOP SHALL BE WRAPPED WITH WAX TAP FOR PROTECTION PER THE WATER LINE EXTENSION & SERVICE STANDARDS.
6. STIFFENERS SHALL BE INSTALLED WITHIN THE HDPE SERVICE LINE AT THE CONNECTION POINTS OF THE FITTINGS.

TYPICAL INSTALLATION FOR SERVICE LINE & STOP BOX

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

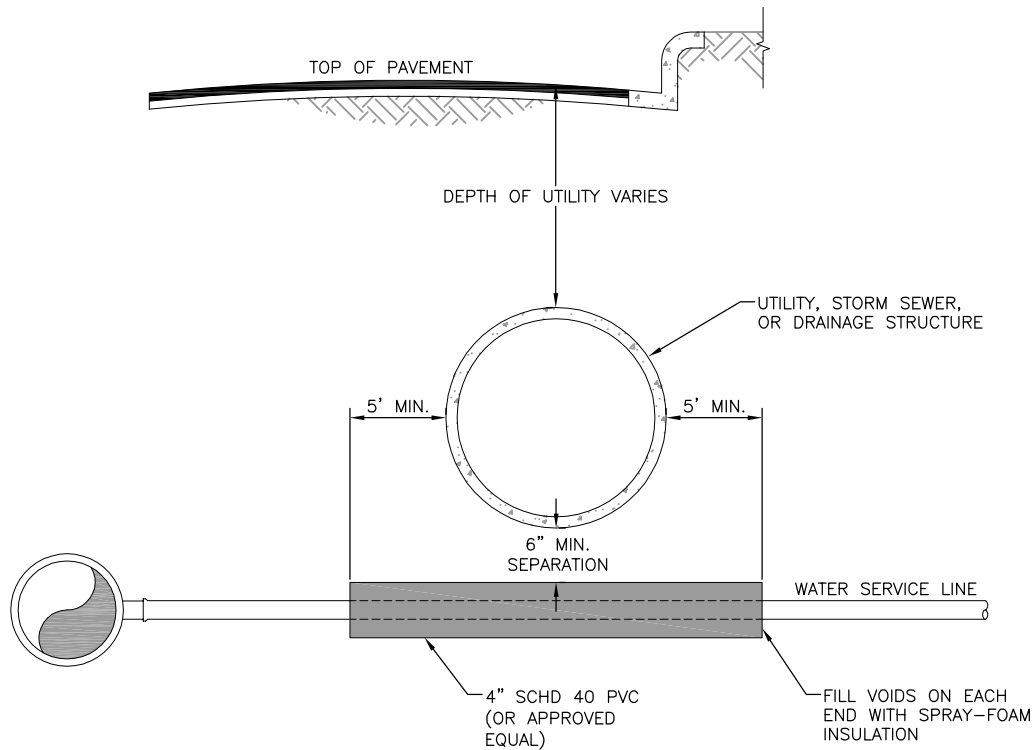
Scale: N.T.S.

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-36



NOTES:

1. SHOULD ANY SITUATION BE ENCOUNTERED THAT DOES NOT MEET STANDARDS, NOTIFY DISTRICT INSPECTOR.
2. REFERENCE SECTION 2 OF THESE STANDARDS FOR CROSSING DESIGN INFORMATION.
3. A SLEEVE IS REQUIRED WHERE SEPARATION IS LESS THAN 18" FROM BOTTOM OF UTILITY TO TOP OF WATER SERVICE OR WHERE THE UTILITY IS 30" OR GREATER IN SIZE.
4. PROVIDE WATERTIGHT SEAL ON BOTH ENDS OF SLEEVE.
5. IF THE SERVICE IS LOCATED WITHIN STORM SEWER BEDDING, IT SHALL BE SLEEVED THROUGH THE BEDDING A MINIMUM OF 5' EITHER SIDE REGARDLESS OF DEPTH.
6. WHERE COMPACTION CANNOT BE ACHIEVED, FLOWFILL SHALL BE USED.

INSTALLATION FOR SERVICE LINE W/ SLEEVE UNDER A UTILITY

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

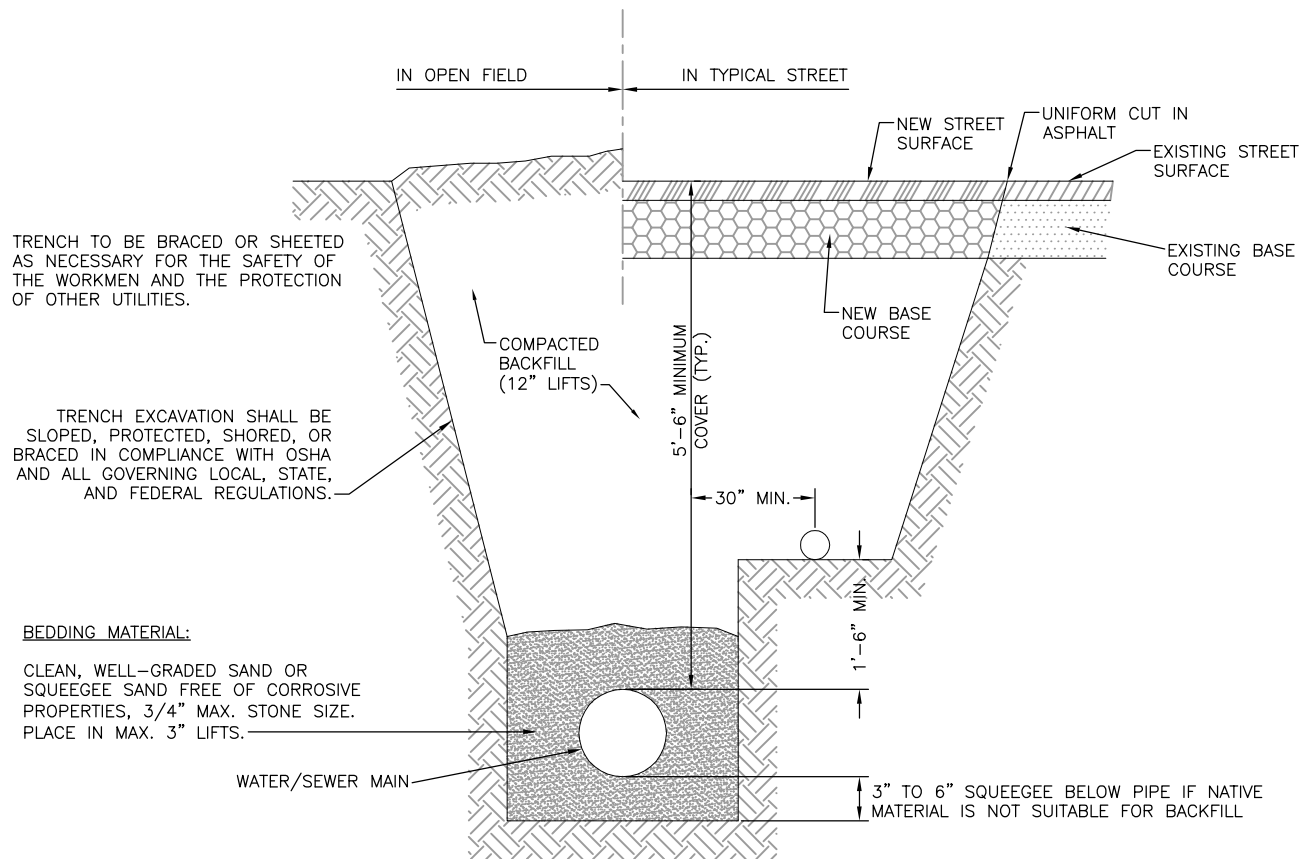
Scale: N.T.S.

Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

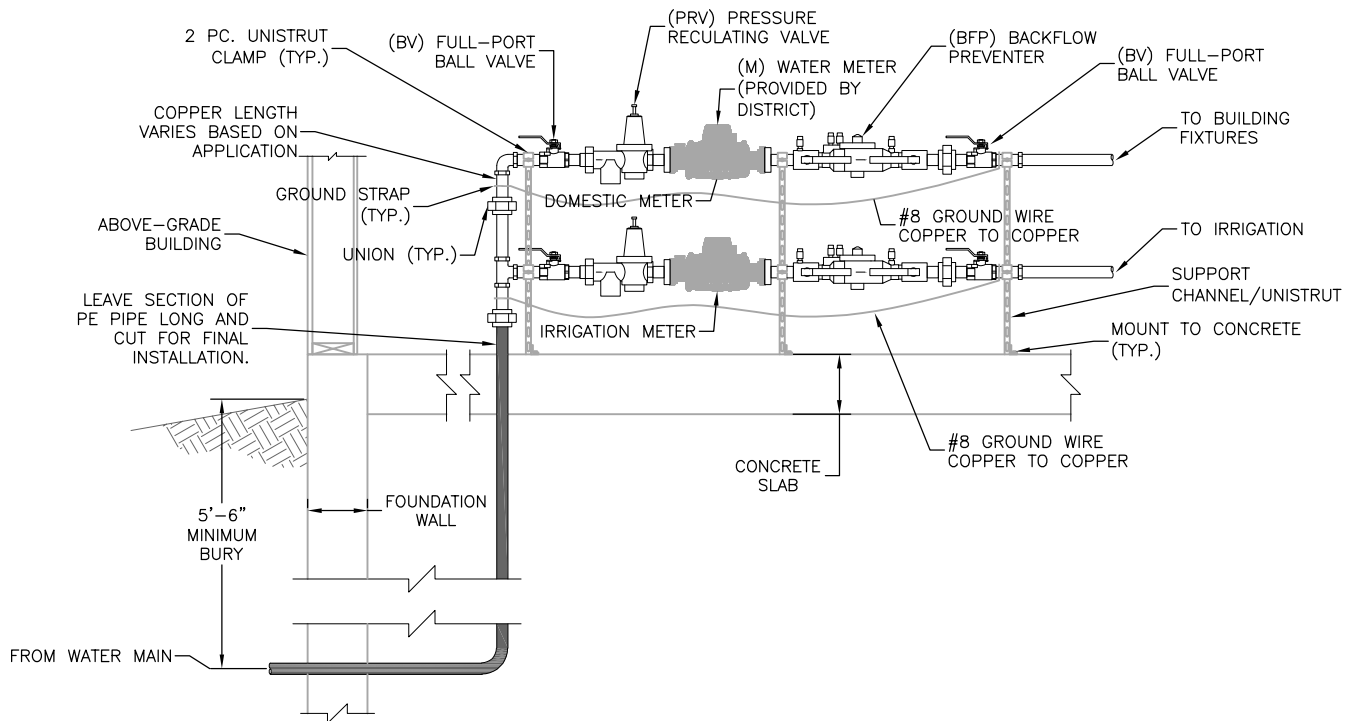
W-37



NOTES:

1. SPECIFIC CASE-BY-CASE APPROVAL BY THE DISTRICT SHALL BE REQUIRED PRIOR TO INSTALLATION OF WATER AND SEWER SERVICES IN A COMMON TRENCH.
2. USE OF COMMON TRENCH FOR WATER AND SEWER SERVICES SHALL NOT BE PERMITTED IN PUBLIC RIGHT-OF-WAY OR BETWEEN THE WATER CORPORATION STOP AND CURB STOP.
3. ALL MATERIALS AND INSTALLATION SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS AND ANY OTHER APPLICABLE CODE OR REGULATION.

TYP. SERVICE LINE TRENCH – COMMON DITCH FOR WATER/SEWER

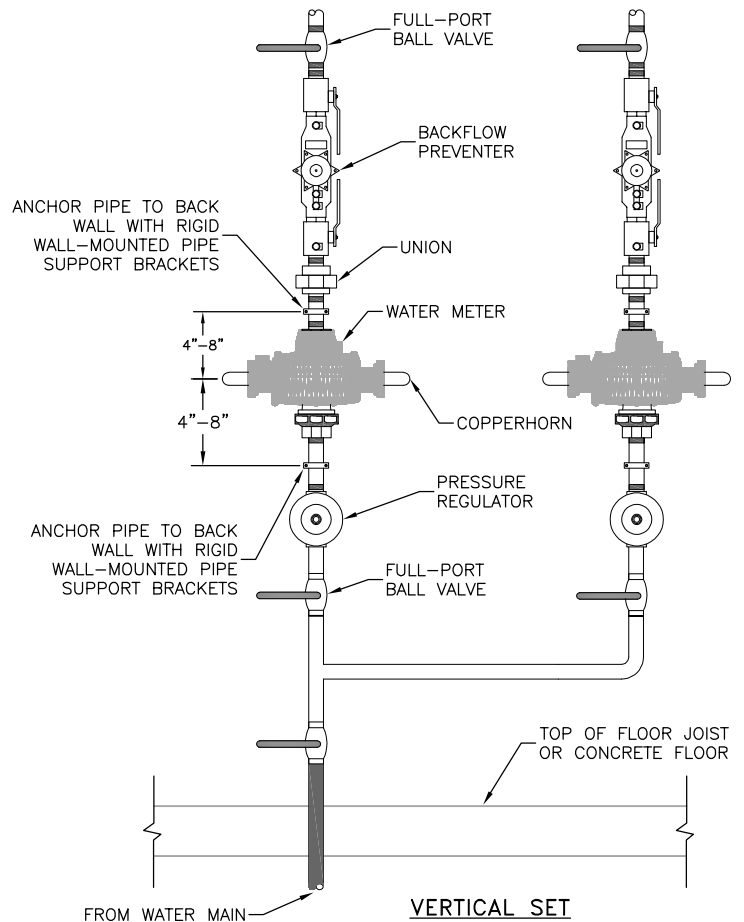


METER SIZE	METER LENGTH*	WITH TAIL PIECE
5/8" (3/4" SHORT) METER	7.5"	12"
3/4" METER	9"	13-1/2"
1" METER	10-3/4"	15"
1-1/2" METER	12-5/8"	
2" METER	15-1/4"	

* CHECK METER LENGTH BEFORE INSTALLATION

NOTES:

- IN THE INTEREST OF SPACE CONSERVATION IT IS PERMISSIBLE TO INSTALL PIPING VERTICALLY DOWNSTREAM OF THE METER INCLUDING THE CHECK VALVE. THE PRESSURE REGULATOR ON THE INLET SIDE OF THE METER MAY BE INSTALLED IN A HORIZONTAL OR VERTICAL POSITION.
- A SECOND PRESSURE REGULATOR MAY BE INSTALLED ON THE DEMAND SIDE OF THE METER DOWNSTREAM FROM A BRANCH SUPPLYING AN IRRIGATION SYSTEM IF REQUIRED. THE IRRIGATION SYSTEM BRANCH MUST BE DOWNSTREAM OF THE METER, CHECK VALVE, AND BALL VALVE.
- ONLY MINIMAL SEPARATION IS ALLOWED BETWEEN FITTINGS UPSTREAM OF THE METER TO ALLOW PROPER INSTALLATION OF THE REQUIRED FITTINGS AS DEPICTED IN THESE DRAWINGS AND SPECIFICATIONS. IN NO CASE SHALL SEPARATION BE GREATER THAN NECESSARY WHICH COULD ALLOW A BRANCH, TEE, OR OTHER FITTING UPSTREAM OF THE METER THAN WHAT IS DEPICTED AND SPECIFIED HEREIN.
- THE METER PIPE MUST BE SECURED BEFORE AND AFTER THE INLET AND OUTLET VALVES TO A SOLID UPRIGHT SUCH AS THE UNISTRUT OR 1/2" ALL-THREAD (OR MOUNTED BI-LATERALLY) AND ANCHORED TO THE FLOOR AND CLAMPED TO THE HORIZONTAL PIPING.
- BANDING OR GROUND STRAPS MUST BE INSTALLED AROUND METER LOOP ON COPPER LINES (COPPER TO COPPER).
- IF HDPE ENTERS STRUCTURE THROUGH SLAB, IT MUST BE ANCHORED AFTER THE TRANSITION FITTING ON THE COPPER TUBING.
- MINIMUM SIZE = 1" HDPE CTS PIPE PER DISTRICT SPECIFICATIONS.



WATER METER LOOP FOR 3/4" THROUGH 2" METERS

Drawn: GGM

Revised: DECEMBER 2021

Date: MARCH 2011

Revised: APRIL 2023

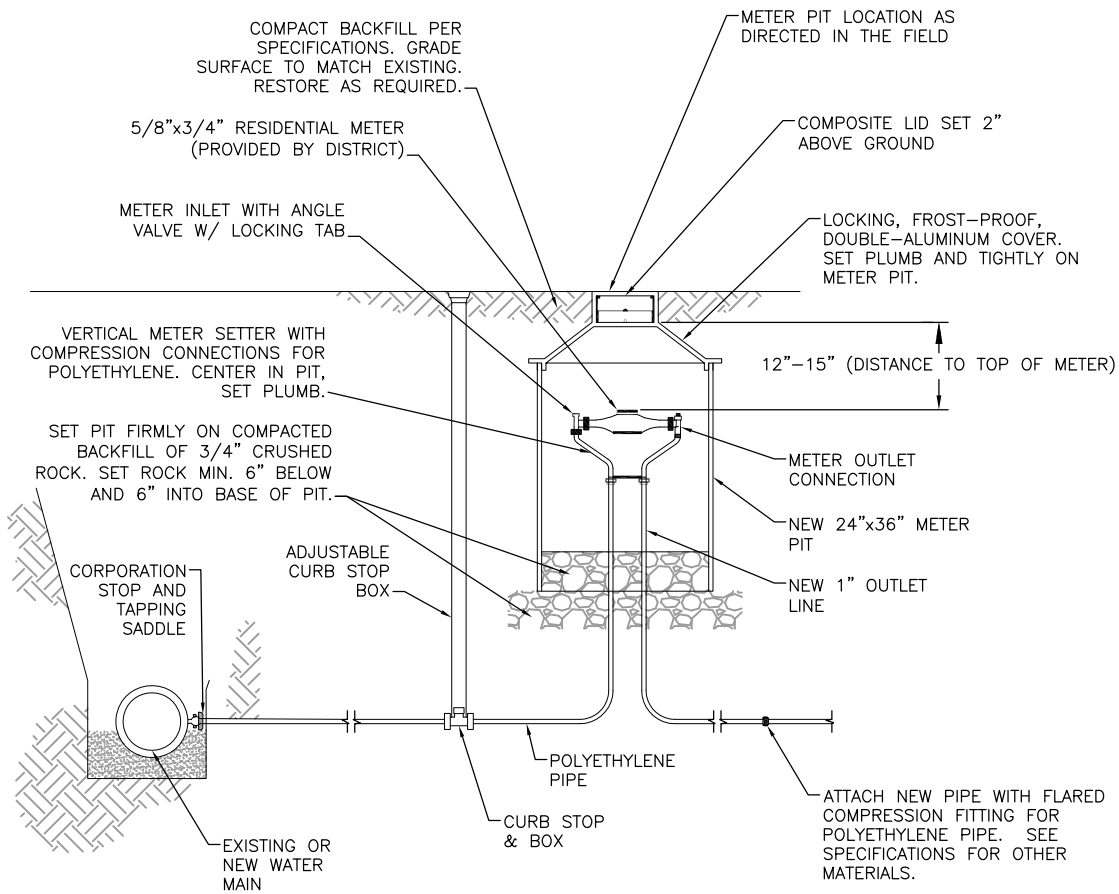
Scale: N.T.S.

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-39



METER PIT SETUP
N.T.S.

3/4"–1" SERVICE LINE/METER PIT INSTALLATION

Drawn: GGM

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

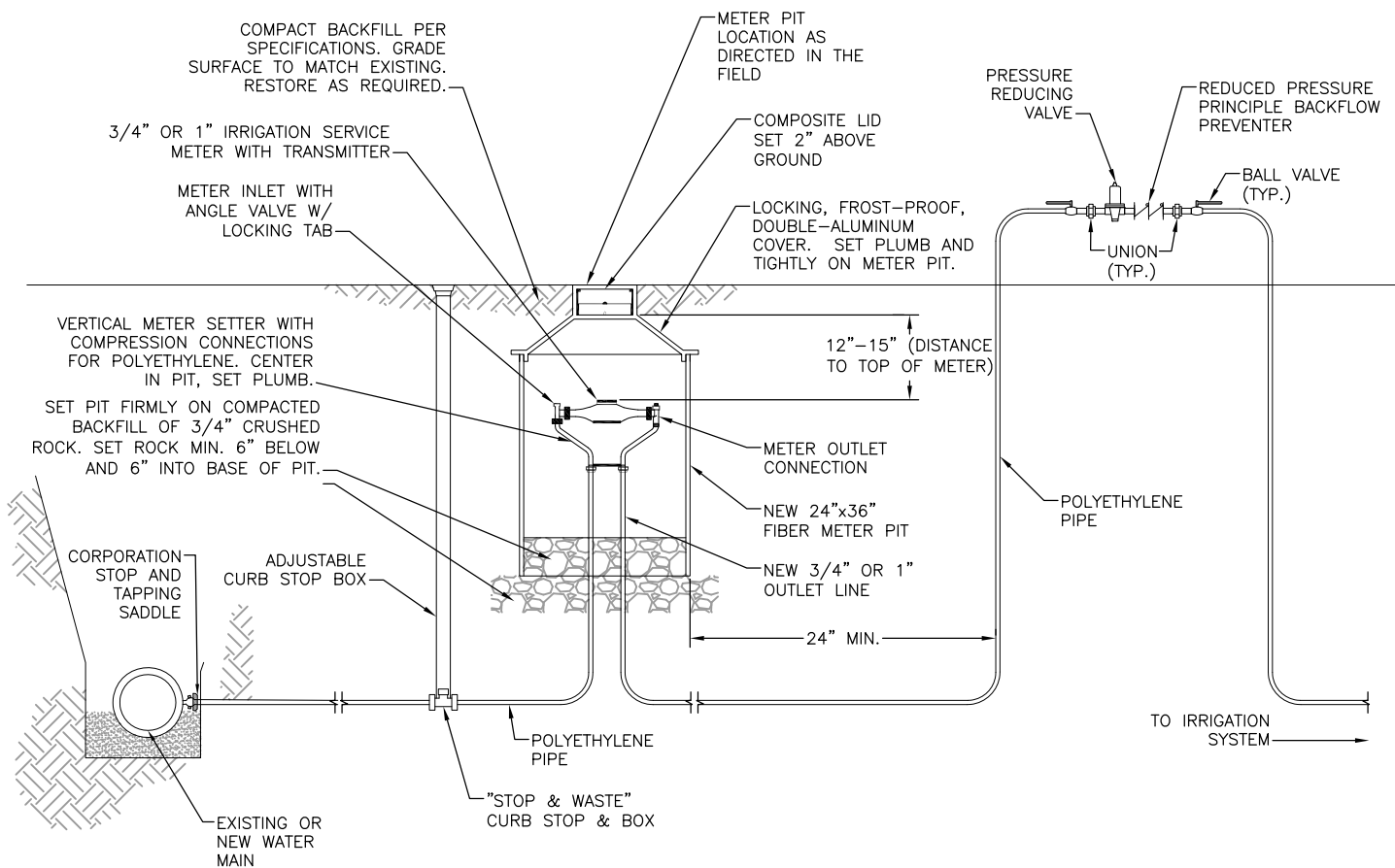
Revised:

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-40



METER PIT SETUP
N.T.S.

IRRIGATION SERVICE 3/4" & 1" METER INSTALLATION

Drawn: GGM

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

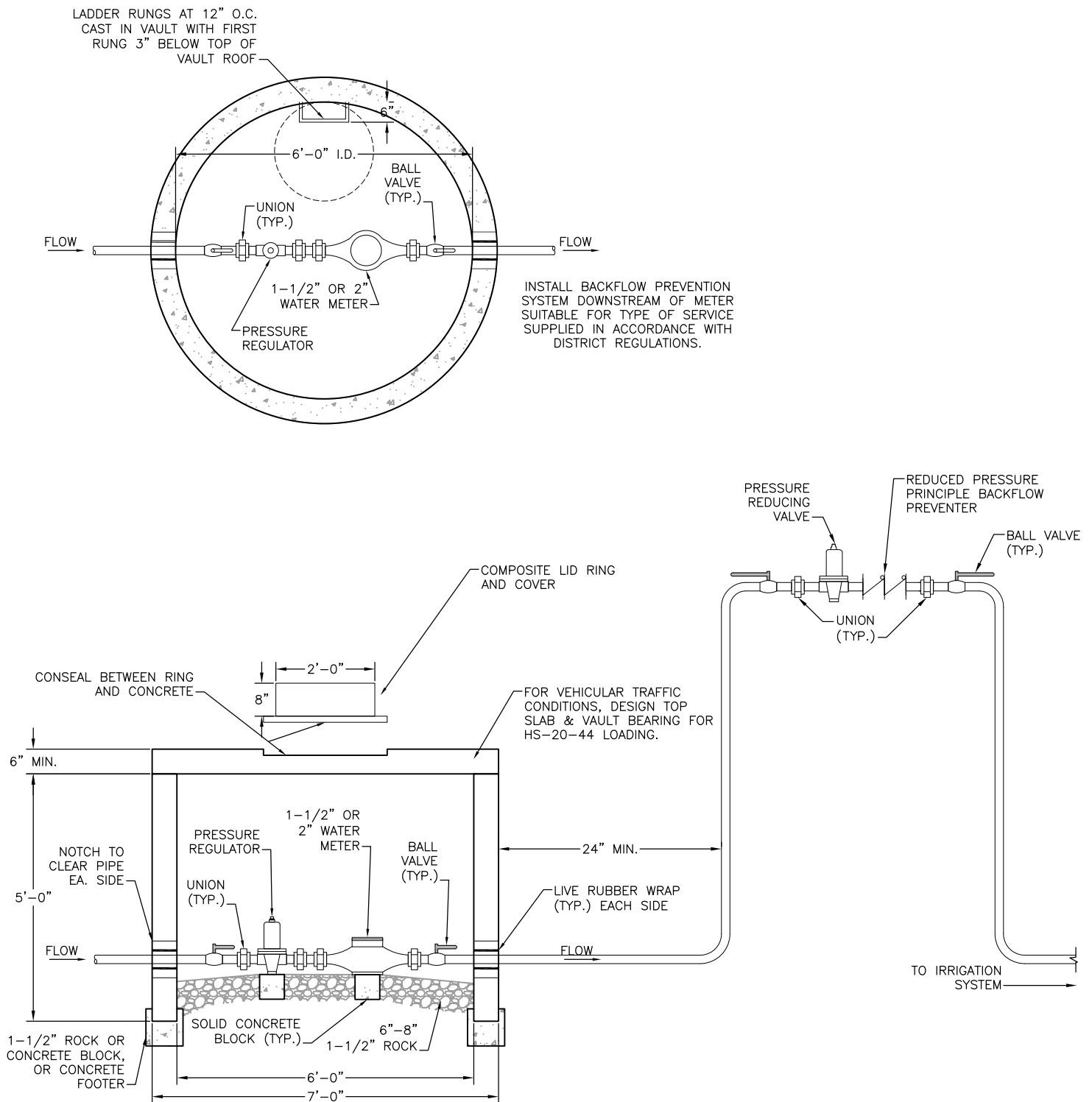
Scale: N.T.S.

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-41



1-1/2" & 2" IRRIGATION METER INSTALLATION

Drawn: TLM/SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

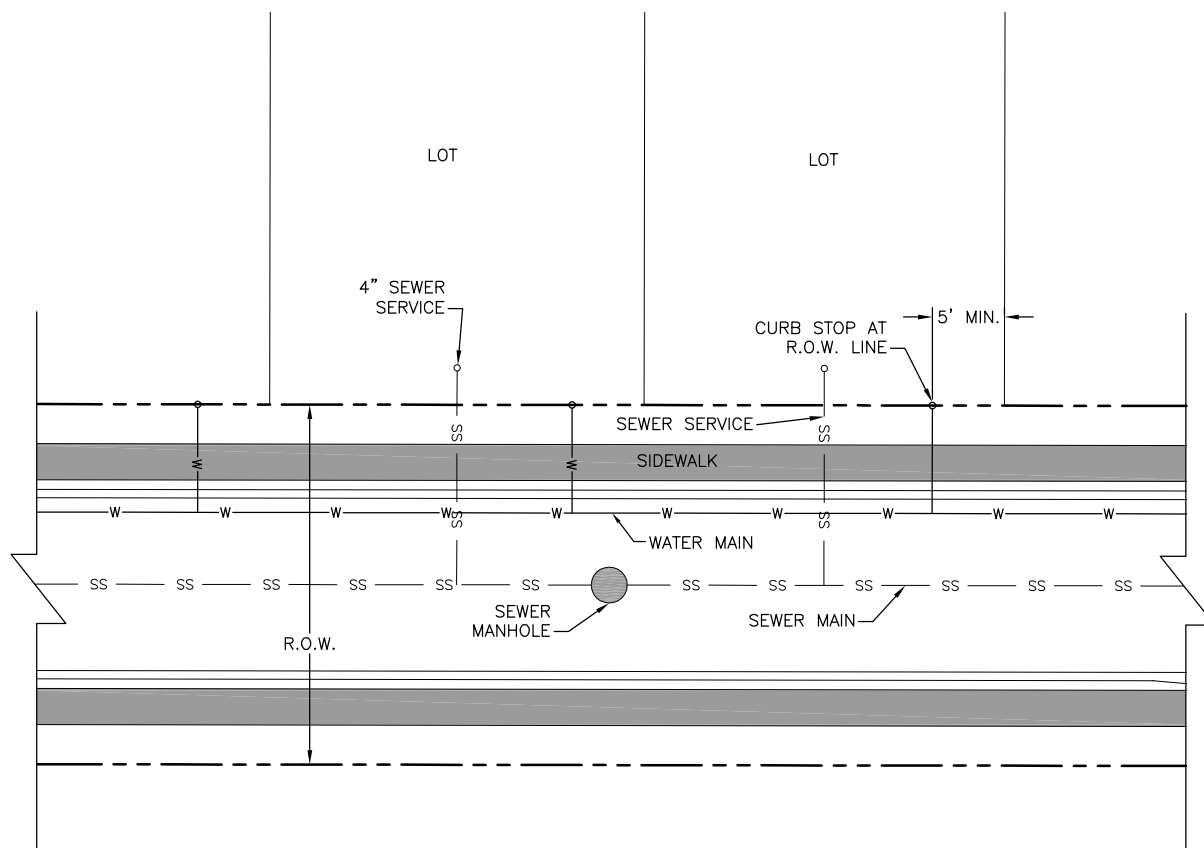
Revised:

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-42



NOTES:

1. SEWER SERVICE TO BE PLACED APPROXIMATELY IN THE MIDDLE OF THE LOT AND EXTENDED 10 FEET PAST R.O.W.
2. SERVICES SHALL BE MARKED WITH 2"x4" POST AT TERMINATION POINT FOR LOCATION DURING CONNECTION TO RESIDENCE. POSTS SHALL BE SPRAY PAINTED BLUE FOR WATER AND GREEN FOR SEWER.

UTILITY SERVICE LOCATIONS

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

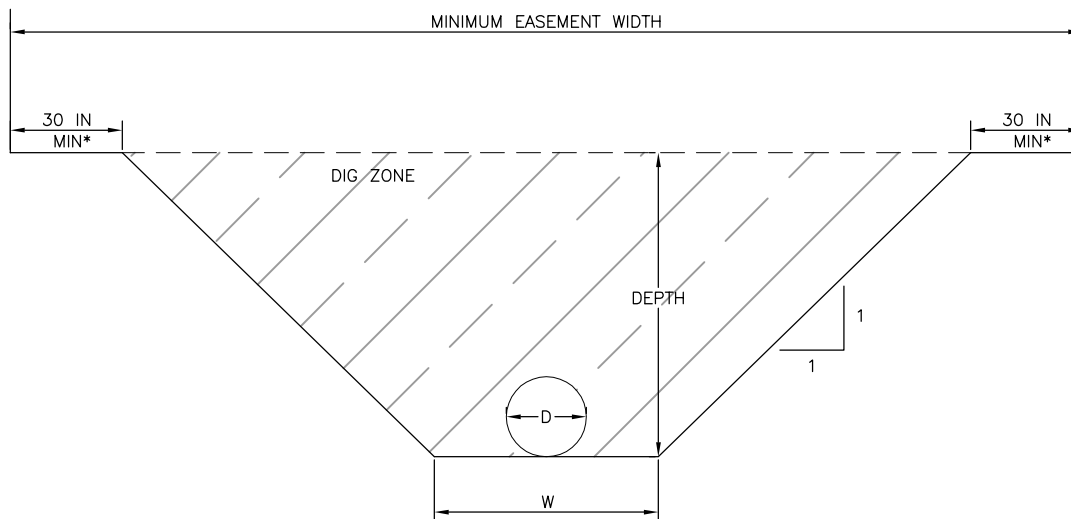
Scale: N.T.S.

Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

W-43



PIPE DIAMETER D	MINIMUM W
≤ 12 IN.	3 FT.
≤ 18 IN.	4 FT.
≤ 24 IN.	5 FT.
≤ 30 IN.	6 FT.

NOTES:

1. MINIMUM EASEMENT = 20 FT.
2. TYPICAL WATER ≤12 IN. WITH 5 FT COVER = 20 FT.
3. NO OTHER UTILITY IN DIG ZONE.
4. POTABLE WATER TO SEWER 10 FT MINIMUM HORIZONTAL.
5. MINIMUM CLEAR DISTANCE BETWEEN WH LINE = 30".
6. MINIMUM CLEAR DISTANCE BETWEEN WH LINE AND OTHER = 5 FT.
7. *SIDE SETBACK OF 30" MAY BE APPLIED EACH SIDE OR 5' ON SINGLE SIDE AS LONG AS DIG ZONE IS WITHIN EASEMENT.

EASEMENT & SEPARATION STANDARDS – WATER/SEWER MAINS

Drawn: GGM

Revised: DECEMBER 2021

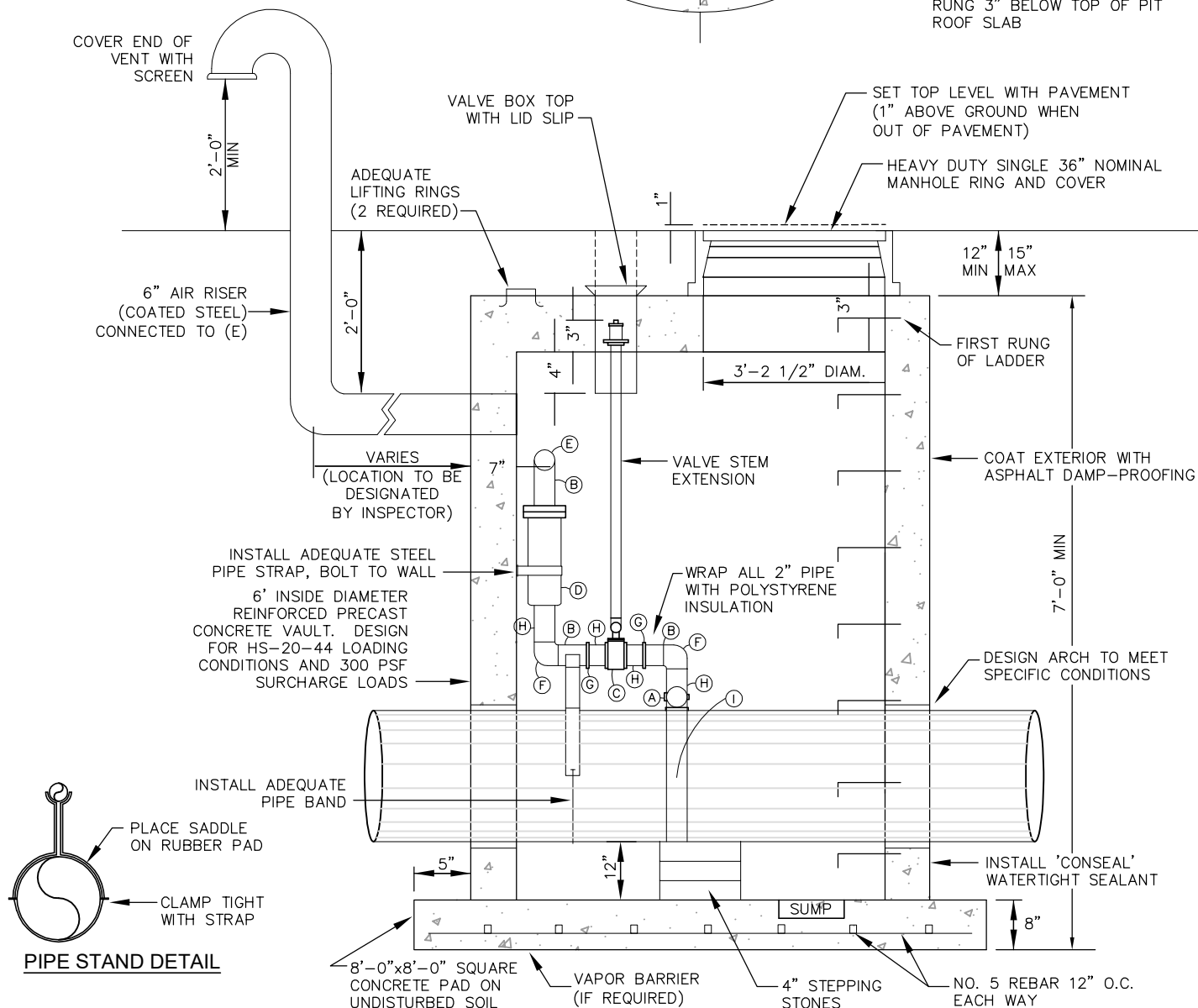
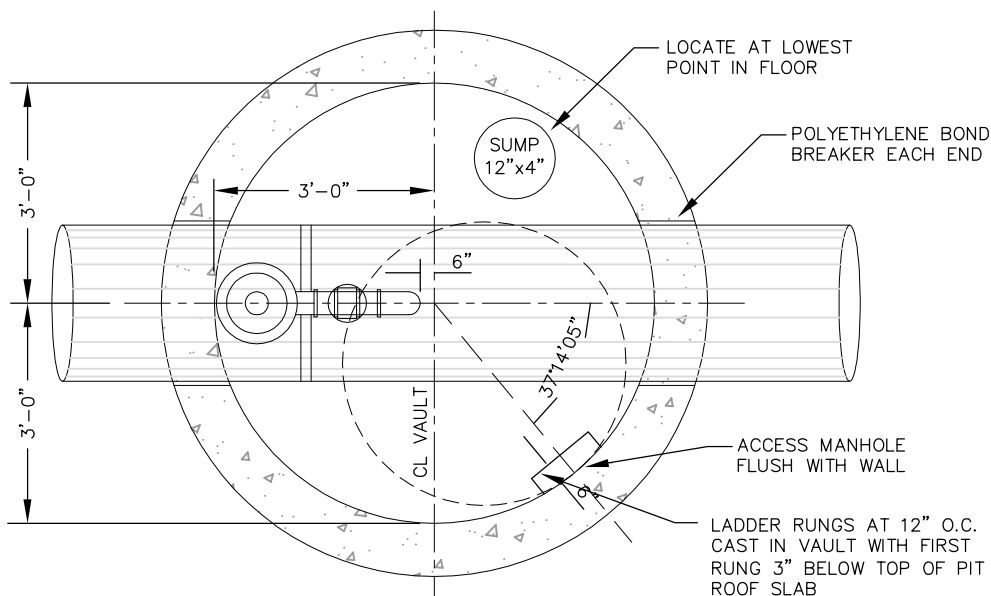
Date: MARCH 2011

Revised:

Scale: N.T.S.

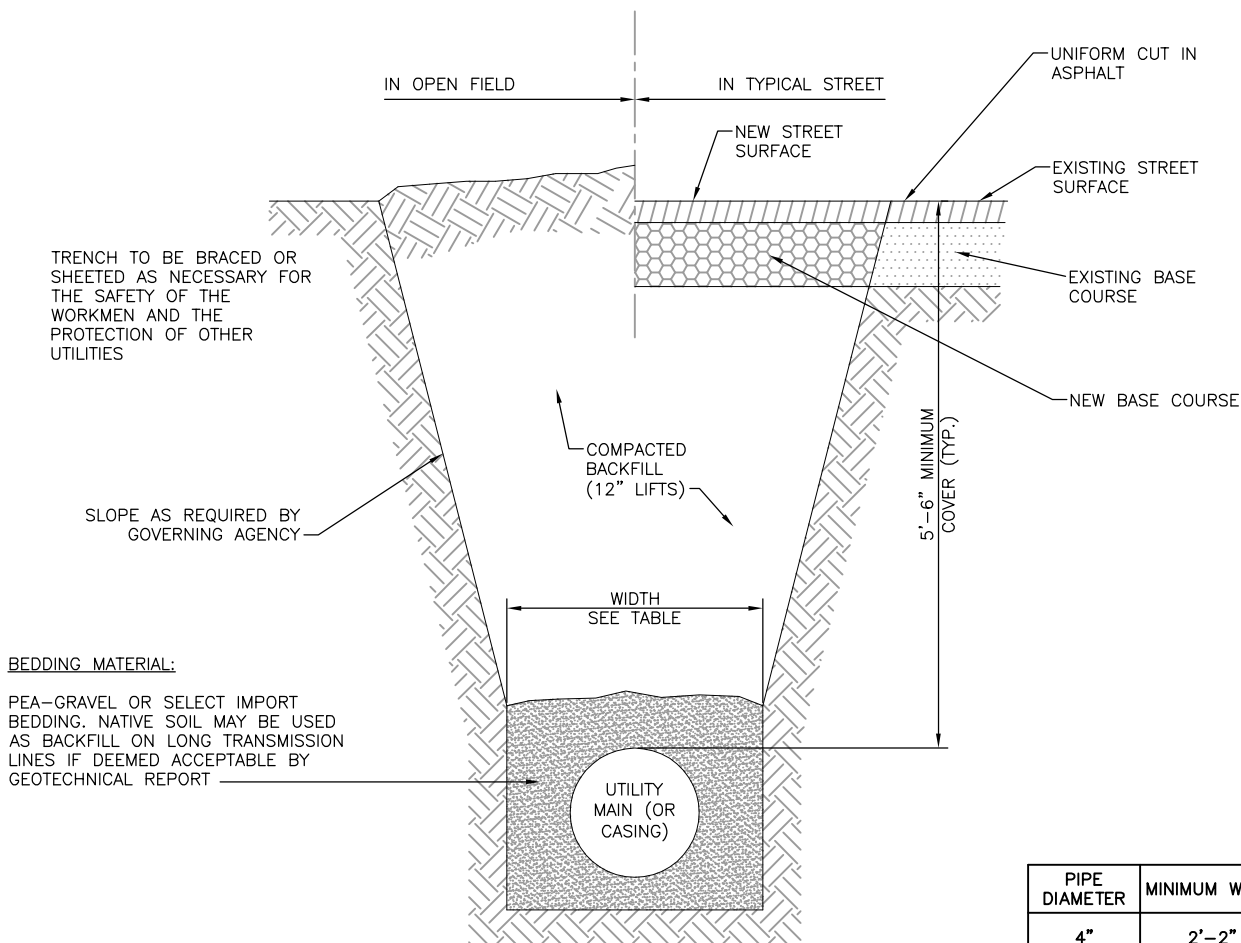
Revised:

- ① 2" CORPORATION—TAPERED THREADS INLET WITH 2" FEMALE IRON PIPE OUTLET (MUELLER OR FORD)
- ② 2" CLOSE—THREADED BRASS NIPPLE
- ③ 2" THREADED GATE VALVE WITH STANDARD OPENING NUT
- ④ 2" THREADED INLET VAL—MATIC AIR/VACUUM COMBINATION AIR VALVE, MODEL 202C
- ⑤ 2"x90" PLASTIC ELBOW
- ⑥ 2"x90" BRASS THREADED ELBOW
- ⑦ 2" QUICK COUPLER
- ⑧ 2" THREADED BRASS NIPPLE
- ⑨ 2" ROMAC MODEL 202BS TAPPING SADDLE

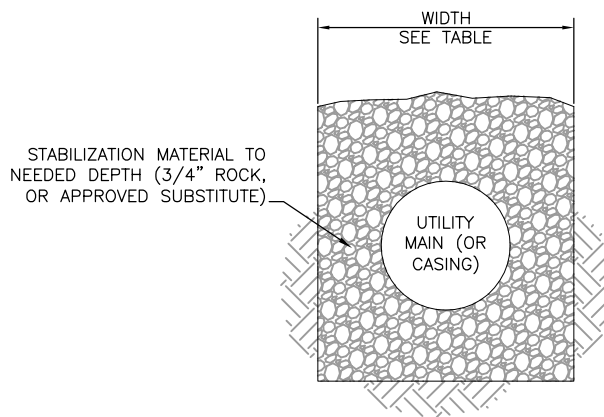


Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

Standard Drawings – Wastewater



TYPICAL TRENCH DETAIL
SCALE: N.T.S.



UNSTABLE TRENCH DETAIL
SCALE: N.T.S.

NOTE:

1. AN OVER-EXCAVATED TRENCH SHALL BE REFILLED WITH BEDDING MATERIAL AND THOROUGHLY COMPACTED AS PER THE SPECIFICATIONS.

PIPE DIAMETER	MINIMUM WIDTH	MAXIMUM WIDTH
4"	2'-2"	3'-0"
6"	2'-2"	3'-0"
8"	2'-2"	3'-0"
10"	2'-4"	3'-0"
12"	2'-6"	3'-6"
18"	2'-10"	3'-9"
24"	3'-2"	4'-3"

TYPICAL TRENCH CROSS SECTION

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

Scale: N.T.S.

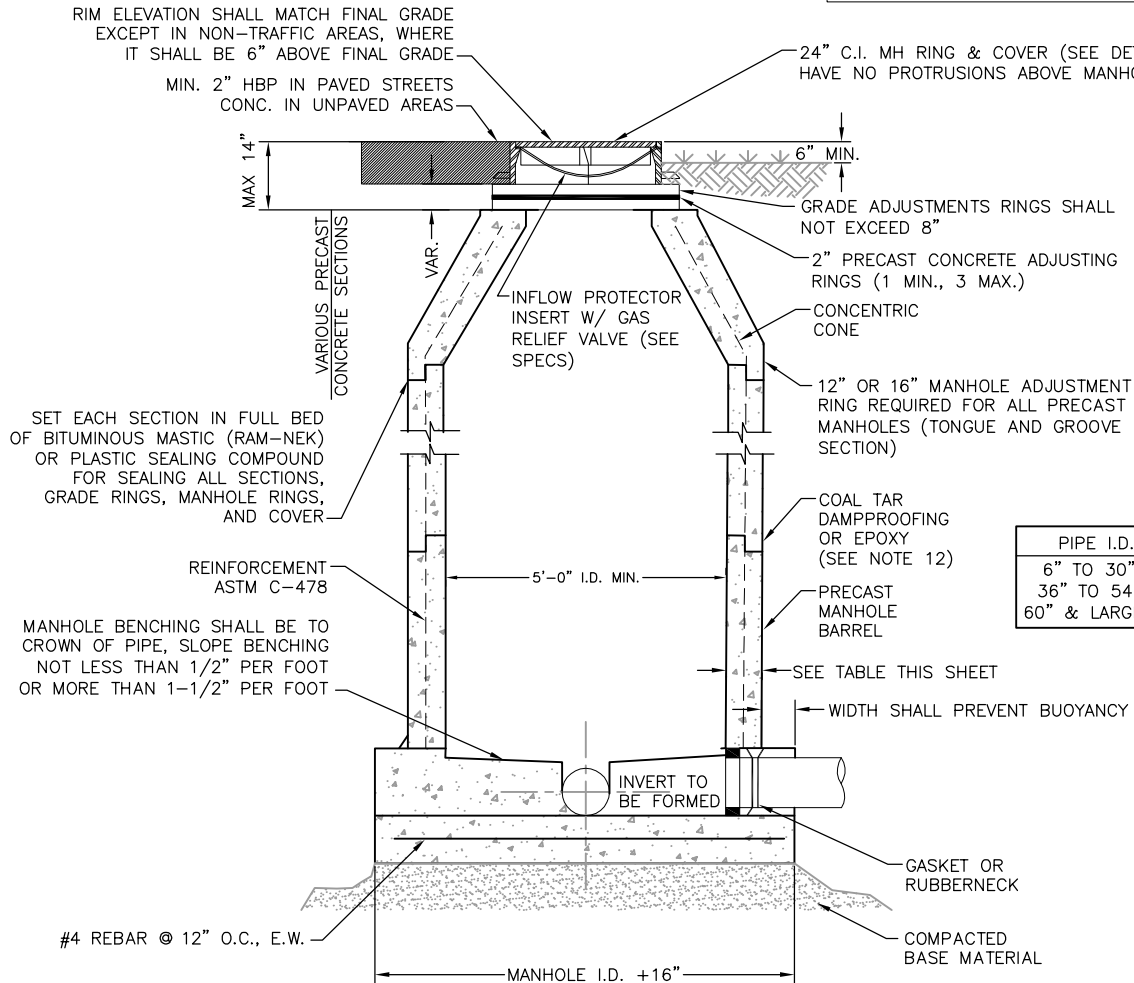
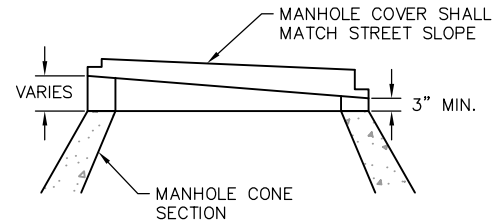
Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-1

CONCRETE RISER FOR MANHOLE



PIPE I.D.	MANHOLE I.D.	WALL
6" TO 30"	5'-0"	6"
36" TO 54"	6'-0"	7"
60" & LARGER	SPECIAL DESIGN	

NOTES:

- ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF NOT LESS THAN 4,000 PSI @ 28 DAYS AND DESIGNED FOR HS-20 LOADING CONDITIONS.
- ALL CONCRETE SHALL BE MECHANICALLY VIBRATED.
- FOR CAST-IN-PLACE MANHOLES, DO NOT DROP CONCRETE A DISTANCE OF MORE THAN 5' UNLESS APPROVED BY THE DISTRICT.
- 3/4" CRUSHED ROCK REQUIRED UNDER BASE TO A DEPTH OF 6" UP TO SPRINGLINE OF PIPE, 2'-3' RADIUS AROUND BASE.
- ALL STEPS SHALL BE REMOVED FOLLOWING CONSTRUCTION.
- STRUCTURAL REINFORCEMENT SHALL COMPLY TO ASTM C-478 AND SHALL BE STAMPED ON THE OUTSIDE OF THE MANHOLE.
- SHAPING FOR SMOOTH MANHOLE INVERTS MUST BE DONE BY FORMING/SHAPING CONCRETE BASE.
- PRECAST SECTIONS TO CONFORM TO ASTM C-478.
- STUB-OUTS SHALL EXTEND A MINIMUM OF 6' PAST MANHOLE O.D. AND BE SATISFACTORILY PLUGGED.
- CONCRETE MANHOLES MAY BE POURED IN PLACE ONLY WITH PRIOR DESIGN AND INSPECTION APPROVAL.
- ALL MORTAR GROUT SHALL BE MIXED WITH TYPE V CEMENT.
- APPLY COAL TAR EPOXY DAMP-PROOFING TO ALL EXTERIOR CONCRETE SURFACES.
- CENTER REINF. IN BASE, POUR BELOW PIPE O.D. AT FL.
- ALL EXTERIOR JOINTS SHALL RECEIVE BUTYL RUBBER JOINT WRAP. REFER TO SPECIFICATIONS.
- MANHOLE RIMS SHALL HAVE A HOLE IN LIEU OF A NOTCH FOR REMOVAL.

PRECAST MANHOLE

Drawn: GGM/SKG

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

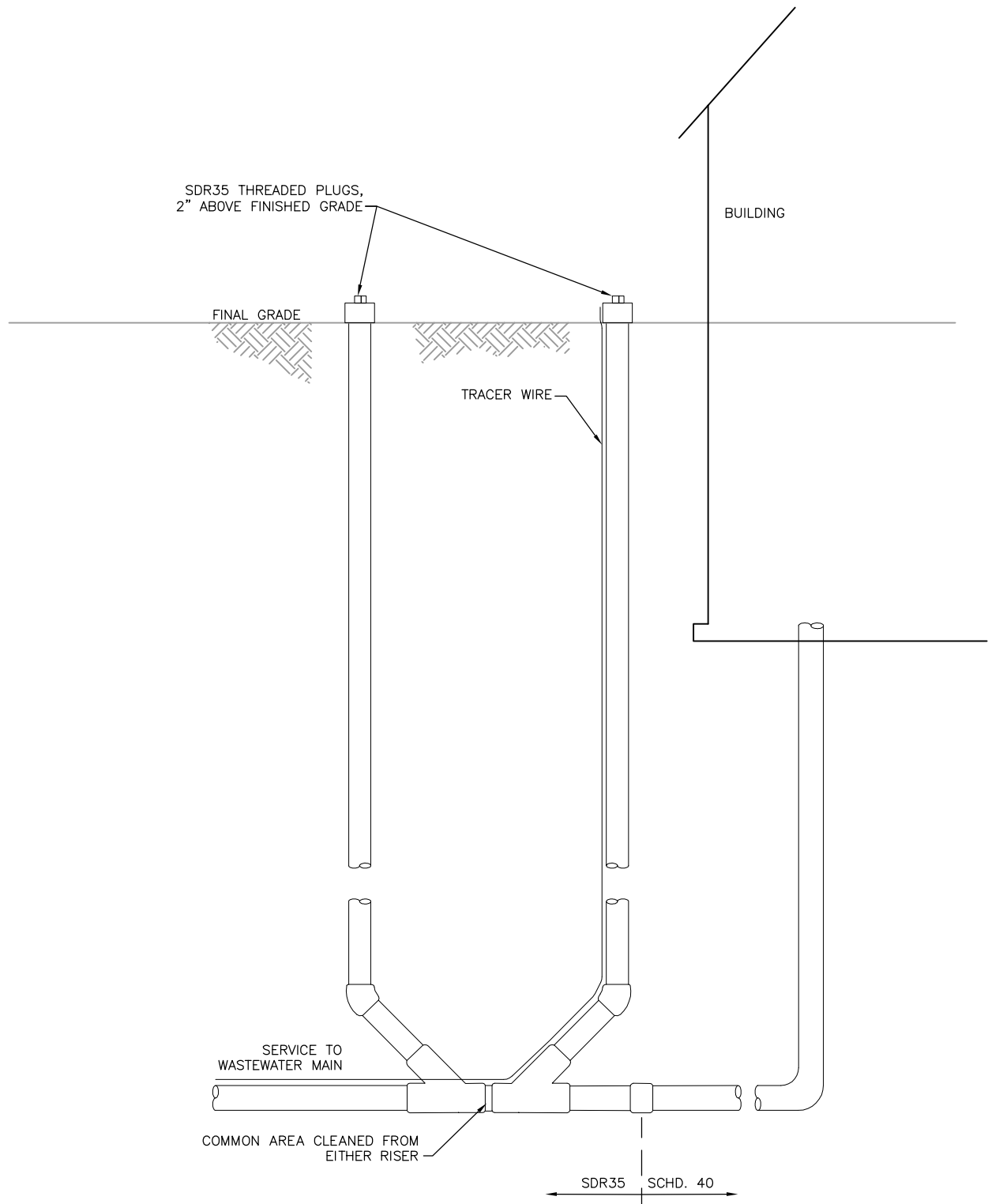
Revised:

Revised:

WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-2

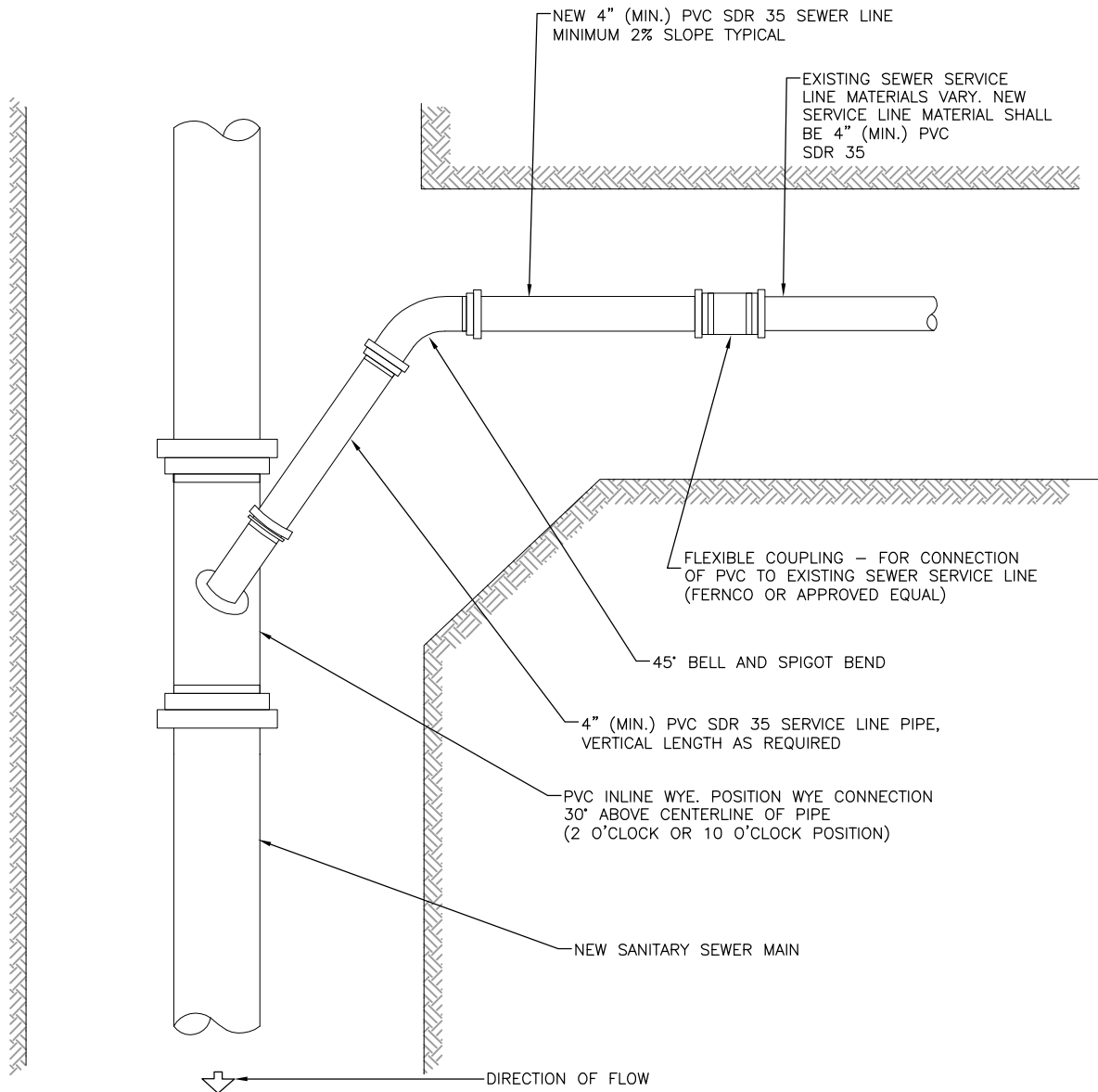


NOTES:

1. THE DIAMETER OF THE WASTEWATER SERVICE LINE SHALL NOT BE GREATER THAN 8 INCHES.
2. THE MAXIMUM DEPTH OF THE WASTEWATER SERVICE LINE SHALL NOT BE GREATER THAN 14 FEET MEASURED FROM FINAL GRADE TO THE WASTEWATER PIPE INVERT.

RESIDENTIAL SEWER TWO-WAY CLEANOUT

Drawn: SKG	Revised: DECEMBER 2021	WOODMEN HILLS METROPOLITAN DISTRICT  WATER & WASTEWATER SYSTEM STANDARD SPECIFICATIONS	WW-3
Date: MARCH 2011	Revised:		
Scale: N.T.S.	Revised:		



SANITARY SEWER SERVICE CONNECTION

Drawn: GGM

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

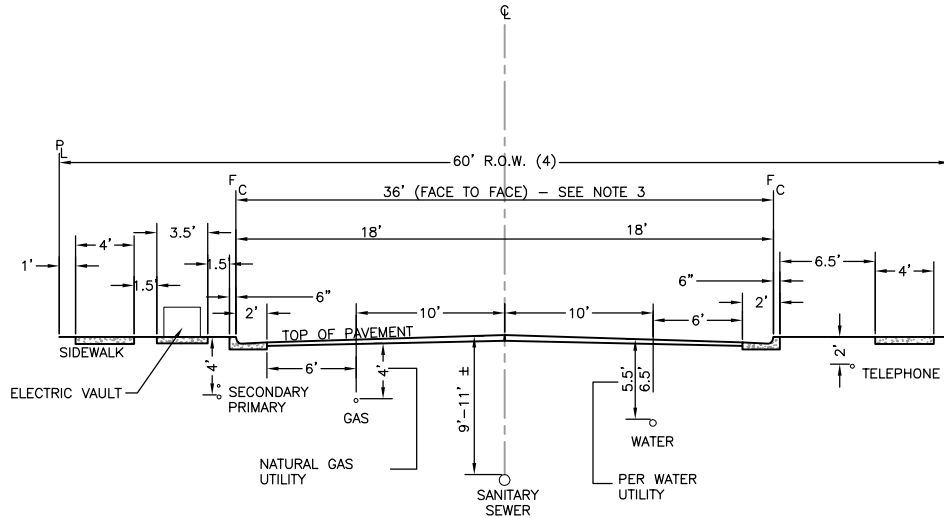
Revised:

Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-4

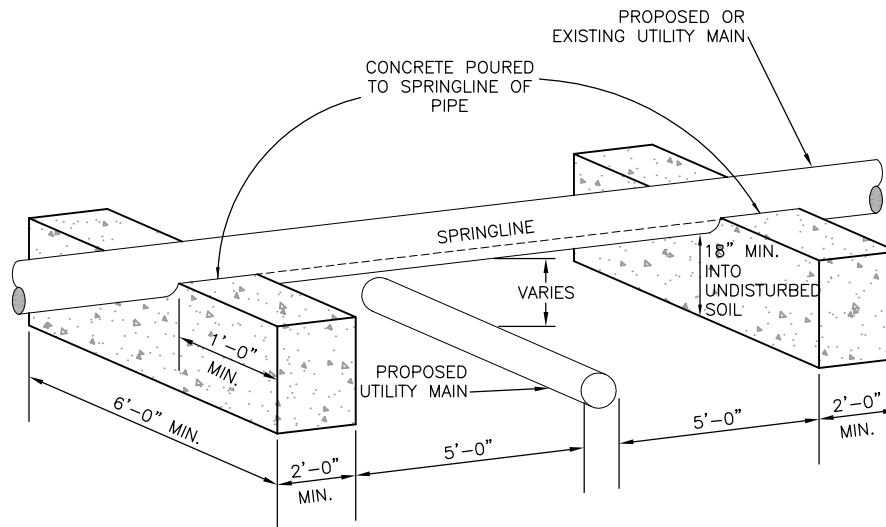


**TYPICAL CROSS SECTION
UTILITIES LOCATION**

GENERAL NOTES

1. STORM SEWERS SHALL MAINTAIN A 10' CLEAR SEPARATION FROM WATER.
2. ELECTRIC CONDUITS SHALL BE ON THE OPPOSITE SIDE OF THE STREET FROM WATER.
3. FOR 40'-WIDE STREET SECTIONS, MAINTAIN WATER 10 FEET FROM SANITARY SEWER AT STREET CENTERLINE.
4. FOR 50'-WIDE RIGHT-OF-WAY (ROW), A 5'-WIDE SIDEWALK AND UTILITY EASEMENTS ARE REQUIRED ADJACENT TO THE STREET ROW. FIVE FOOT (5') WIDE ATTACHED SIDEWALK IS USED WITH ELECTRIC UTILITIES BEHIND WALK-IN EASEMENT.

TYPICAL UTILITY LOCATIONS



NOTES:

1. CONCRETE BLOCKS TO BE REINFORCED WITH #6 REBAR SET ON 12" CENTERS.
2. NO JOINTS OF UTILITY MAIN SHALL BE ALLOWED BETWEEN CONCRETE BRIDGING BLOCKS.

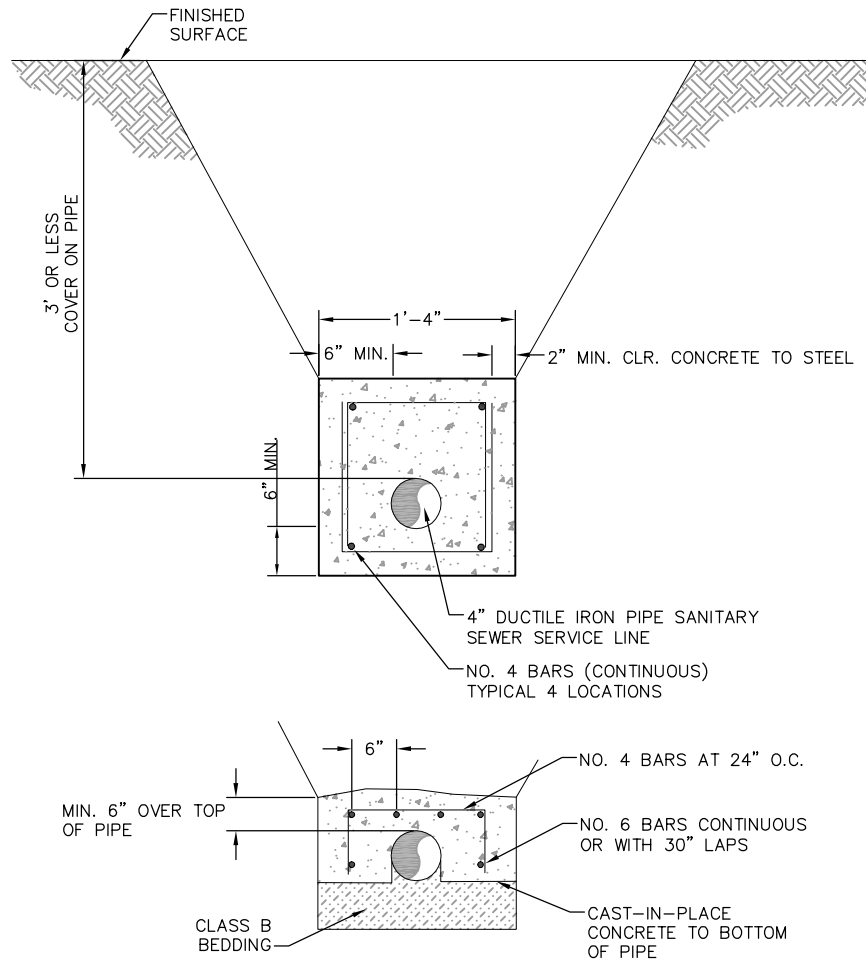
PIPE BRIDGING DETAIL

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-6



REINFORCED CONCRETE PIPE CAP

NOTES:

1. DUCTILE IRON PIPE WITHOUT CONCRETE ENCASEMENT MAY BE PERMITTED BY THE DISTRICT IF FINAL PIPE COVER IS MORE THAN 3 FEET.
2. CONCRETE ENCASEMENT PER THIS DRAWING IS REQUIRED WITH DUCTILE IRON PIPE WHERE FINAL PIPE COVER IS 3 FEET OR LESS.
3. IF THE CONCRETE ENCASEMENT IS REQUIRED ON A SANITARY SEWER SERVICE LINE, THE PROPERTY OWNER/CUSTOMER IS COMPLETELY RESPONSIBLE FOR OPERATION, MAINTENANCE, AND REPLACEMENT OF ANY SEWER SERVICE LINE FROM THE DISTRICT'S SEWER MAIN TO THE STRUCTURE SERVED.
4. THE DISTRICT MAY ACCEPT CONCRETE CAP FOR PIPE PROTECTION IN SPECIAL CONDITIONS.
5. WRAP PIPE WITH PIPE INSULATION TO A THICKNESS OF ONE (1) INCH.

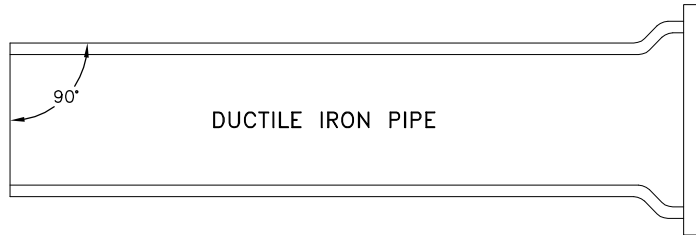
SHALLOW SANITARY SEWER LINE PROTECTION/ENCASEMENT

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-7



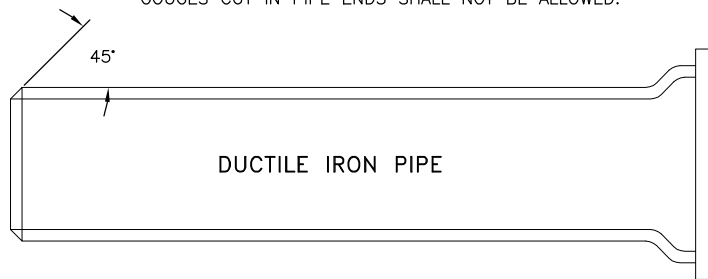
MECHANICAL JOINT CONNECTION

PIPE MUST BE CUT AT RIGHT ANGLES TO LONGITUDINAL CENTERLINE IN ALL CASES.

PIPE ENDS SHALL BE FREE OF BURRS.

MORTAR LINING SHALL BE FLUSH WITH PIPE END.

GOUGES CUT IN PIPE ENDS SHALL NOT BE ALLOWED.



SLIP JOINT CONNECTION

PIPE CUT IN STRAIGHT LINE AND BEVELED AT 45° ANGLE ON END.

GENERAL NOTES:

1. ALL PIPE-CUTTING EQUIPMENT AND PIPE CUTS MUST BE APPROVED BY THE WATER AND SANITATION DISTRICT INSPECTOR.
2. ALL PIPE ENDS TO BE USED IN INSTALLATION SHALL BE DRESSED SMOOTH TO THE SATISFACTION OF THE INSPECTOR PRIOR TO INSTALLATION.
3. AT THE REQUEST OF THE CONTRACTOR MAKING THE INSTALLATION, THE DISTRICT WILL MAKE PIPE CUTS, PROVIDING THE CURRENT FEE PER CUT IS PAID AND 24-HOUR NOTICE IS GIVEN (THE CURRENT FEE IS SUBJECT TO CHANGE).
4. ALL DIP DELIVERED TO JOB SITE MUST BE NEW MATERIAL.

PIPE CUTTING

Drawn: GGM

Date: MARCH 2011

Scale: N.T.S.

Revised: DECEMBER 2021

Revised:

Revised:



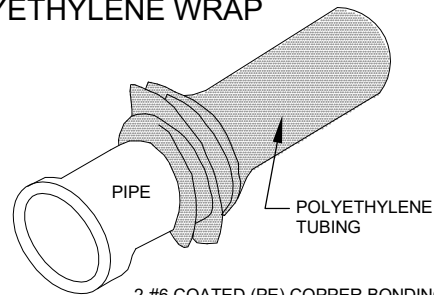
WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-8

FIELD INSTALLATION OF POLYETHYLENE WRAP

STEP 1:

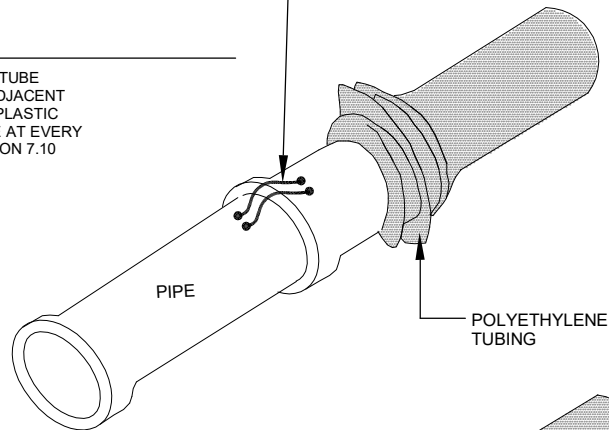
PLACE TUBE OF POLYETHYLENE MATERIAL ON PIPE PRIOR TO LOWERING IT INTO TRENCH.



2-#6 COATED (PE) COPPER BONDING WIRE THERMOWELDED TO PIPE, BOTH ENDS, OR BONDING STRAP THERMO WELDED TO PIPE. NO COMMON WELDS ALLOWED

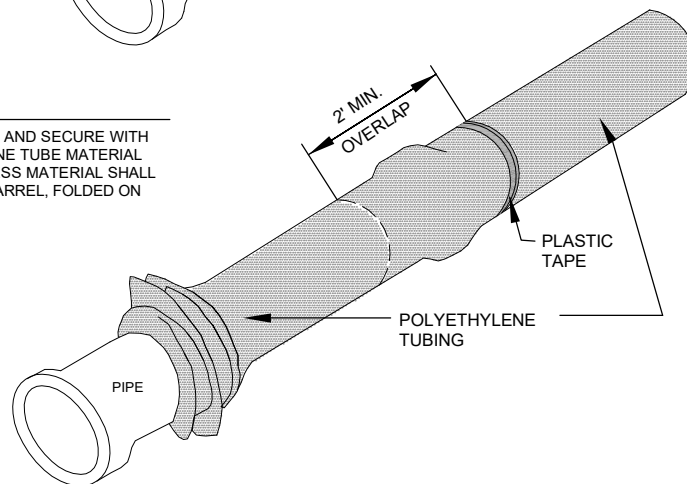
STEP 2:

PULL TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO END AT JOINT. FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE. INSTALL BONDING STRAP OR WIRE AT EVERY JOINT OF PIPE PRIOR TO WRAPPING AS PER SECTION 7.10 OF THE STANDARD SPECIFICATIONS.



STEP 3:

OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED ON TOP OF PIPE, AND TAPED IN PLACE.



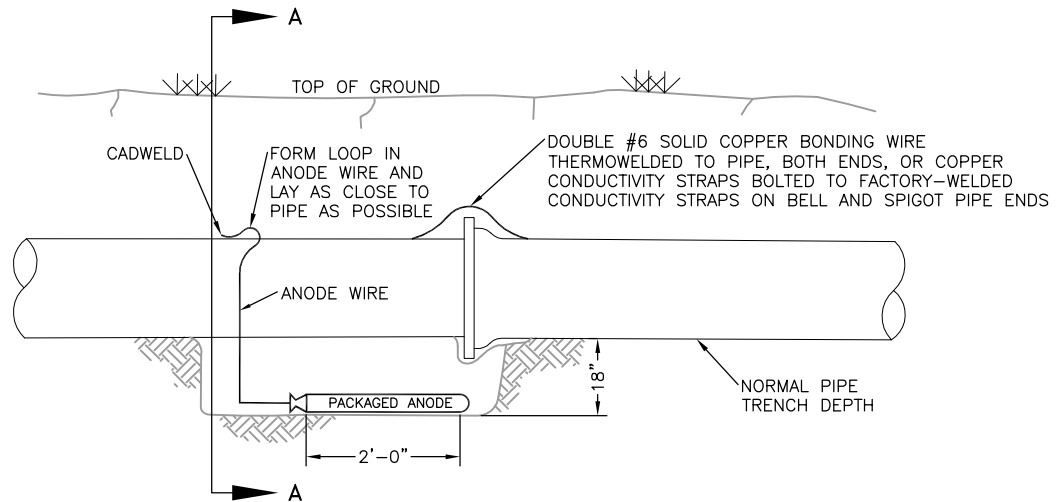
POLYETHYLENE PIPE WRAP

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:

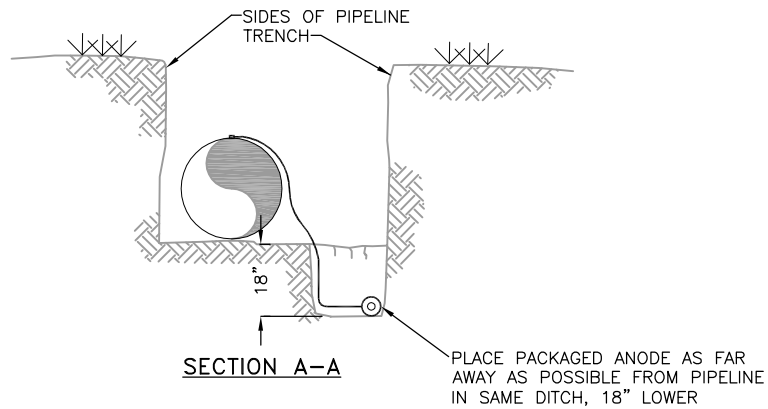


WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-9



ELEVATION



SECTION A-A

NOTES:

1. CADWELD CONNECTION TO BE PRIMED AND COATED CAREFULLY. PACKAGED ANODE SHOULD BE COVERED WITH FINE SOIL CONTAINING NO ROCKS OR DIRT CLUMPS, TAMPED.
2. WHEN ANODES ARE REQUIRED WITH METAL FITTINGS AND APPURTENANCES TOGETHER WITH PVC PIPE INSTALLATION, THE ANODES SHALL BE PLACED AND ATTACHED TO THE METAL IN SAME MANNER AS SHOWN ON THIS DRAWING. 9 LB. ANODES CAN BE USED ON METAL FITTINGS 12" AND LESS IN DIAMETER AND 17 LB. ANODES FOR METAL FITTINGS GREATER THAN 12" DIAMETER WHEN USING PVC PIPE.
3. PACKAGED ANODE TO BE WETTED AND COVERED WITH SOIL PRIOR TO BACKFILLING.

BONDING JOINT & ANODE INSTALLATION

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

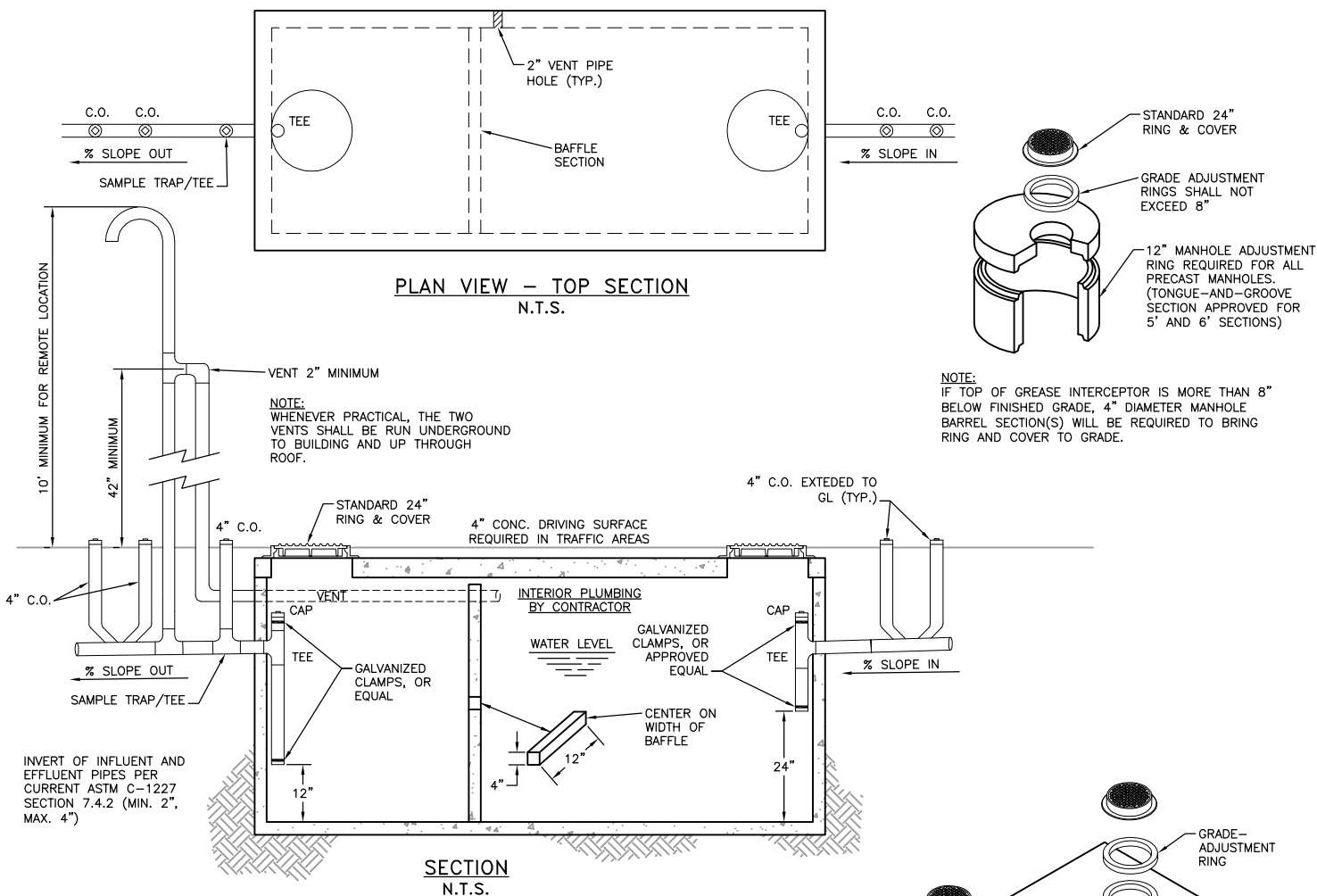
WW-10

MAXIMUM DEFLECTION
PER SLIP JOINT OF D.I.P.

PIPE DIAMETER			MFRS. DEFL.	DESIGN DEFLECTION (80% MAX.)			APPROX. RADIUS FOR DEFLECTING CURVES WITHOUT BENDS	
I.D. (IN)	O.D. (IN)	O.D. (FT)		MAX. DEFL. DIST.		20'L	18'L	
				(1)	(2)			
4"	4.80"	.400'	5'00"00"	4'00"00"	16"	15"	286'	258'
6"	6.90"	.575'	5'00"00"	4'00"00"	16"	15"	286'	258'
8"	9.05"	.754'	5'00"00"	4'00"00"	16"	15"	286'	258'
10"	11.10"	.925'	5'00"00"	4'00"00"	16"	15"	286'	258'
12"	13.20"	1.100'	5'00"00"	4'00"00"	16"	15"	286'	258'
14"	15.30"	1.275'	3'00"00"	2'24'00"	10"	9"	477'	430'
16"	17.40"	1.450'	3'00"00"	2'24'00"	10"	9"	477'	430'
18"	19.50"	1.625'	3'00"00"	2'24'00"	10"	9"	477'	430'
20"	21.60"	1.800'	3'00"00"	2'24'00"	10"	9"	477'	430'
24"	25.80"	2.150'	3'00"00"	2'24'00"	10"	9"	477'	430'
30"	32.00"	2.666'	2'30"00"	2'00"00"	8"	7"	573'	516'
36"	38.30"	3.192'	2'00"00"	1'36'00"	6"	6"	716'	645'
42"	44.50"	3.708'	2'00"00"	1'36'00"	6"	6"	716'	645'

- (1) 20'L = NORMAL 20-FOOT JOINT LAYING LENGTH
(2) 18'L = NORMAL 18-FOOT JOINT LAYING LENGTH

MAXIMUM PIPELINE DEFLECTION DATA



TYPICAL GREASE INTERCEPTORS

SIZE (GAL.)	USE	LENGTH	WIDTH	HEIGHT
800	NON-TRAFFIC	96"	48"	73"
1000	NON-TRAFFIC	102"	58"	73"
1000	TRAFFIC	96"	72"	87.5"
1500	NON-TRAFFIC	126"	68"	73"
1500	TRAFFIC	162"	84"	65"
2250	NON-TRAFFIC	144"	78"	79"
2500	TRAFFIC	162"	84"	103"
3500	TRAFFIC	162"	84"	103"
5000	TRAFFIC	162"	84"	147"

APPROX. SIZE OF GREASE INTERCEPTORS
CHECK WITH MANUFACTURER FOR CORRECT DIMENSIONS AND INVERTS

NOTES:

1. TO BE READ IN CONJUNCTION WITH DISTRICT WASTEWATER SPECIFICATIONS AND INTERNATIONAL PLUMBING CODE.
2. SPECIFIC SIZE APPLICATION OF THE GREASE INTERCEPTOR TO BE DETERMINED BY DISTRICT.

GREASE INTERCEPTOR

Drawn: GGM

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

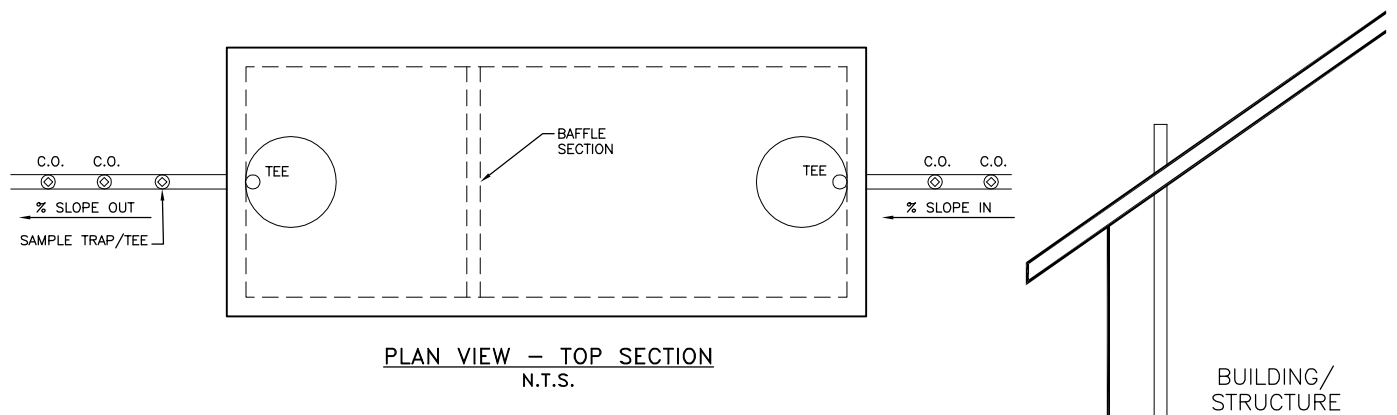
Scale: N.T.S.

Revised:

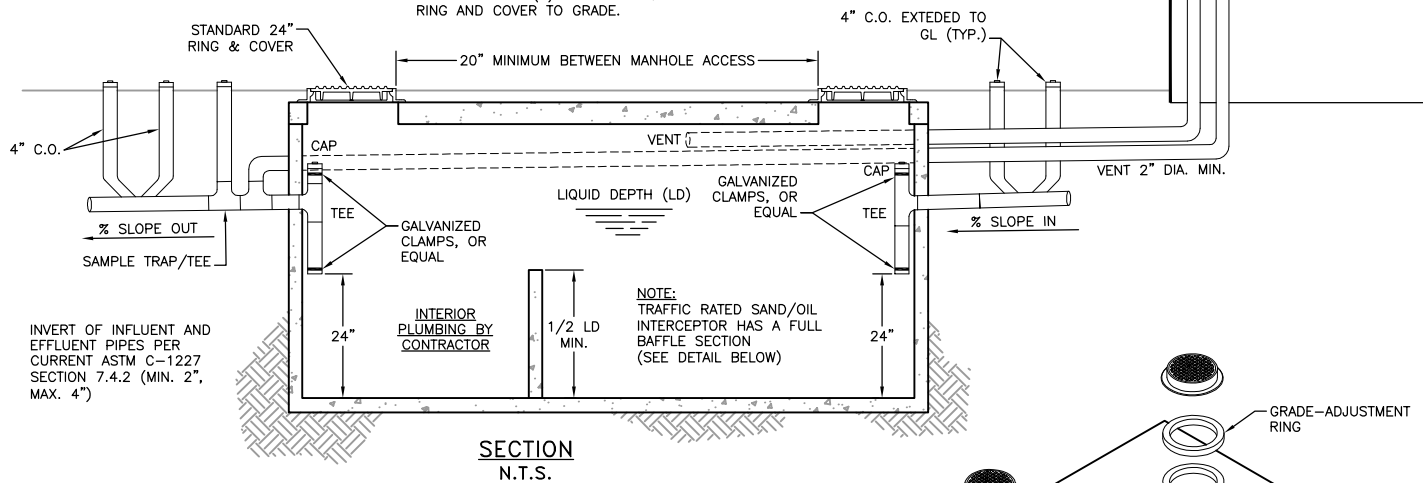
WOODMEN HILLS
METROPOLITAN DISTRICT

WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-12



NOTE:
IF TOP OF GREASE INTERCEPTOR IS MORE THAN 8"
BELOW FINISHED GRADE, 4" DIAMETER MANHOLE
BARREL SECTION(S) WILL BE REQUIRED TO BRING
RING AND COVER TO GRADE.



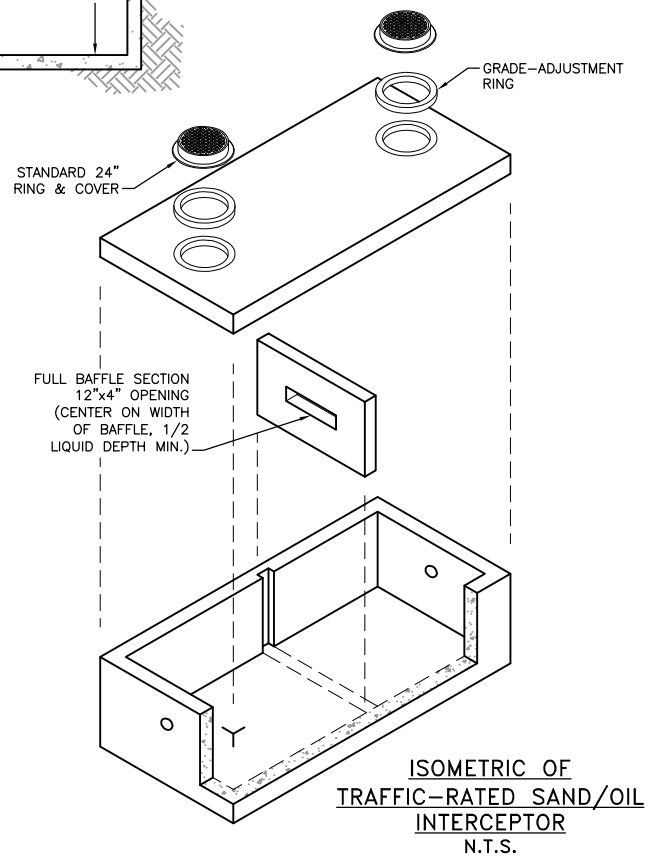
TYPICAL SAND/OIL INTERCEPTORS

SIZE (GAL.)	USE	LENGTH	WIDTH	HEIGHT
500	TRAFFIC	72" OD x 74" (ID=60")		
1000	NON-TRAFFIC	102"	58"	77"
1000	TRAFFIC	96"	72"	86"
1500	NON-TRAFFIC	126"	68"	77"
1500	TRAFFIC	162"	84"	64"
2250	NON-TRAFFIC	144"	78"	82"
2500	TRAFFIC	162"	84"	102"

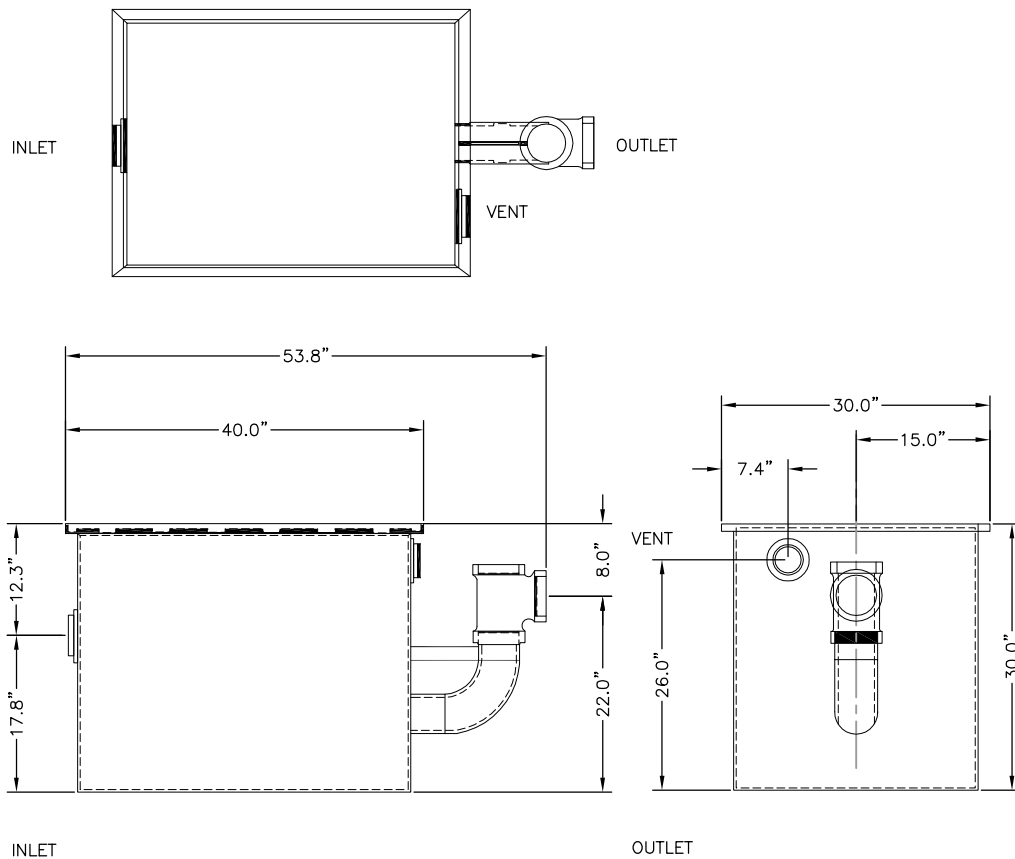
APPROX. SIZE OF SAND/OIL INTERCEPTORS
CHECK WITH MANUFACTURER FOR CORRECT DIMENSIONS AND INVERTS

NOTES:

1. TO BE READ IN CONJUNCTION WITH DISTRICT WASTEWATER SPECIFICATIONS AND INTERNATIONAL PLUMBING CODE.
2. SPECIFIC SIZE APPLICATION OF THE GREASE INTERCEPTOR TO BE DETERMINED BY DISTRICT.
3. INTERIOR PIPING TO BE STRAPPED AT BOTTOM WITH GALVANIZED CLAMPS, UNISTRUT, OR EQUAL.
4. VENTS SHALL BE CONSTRUCTED ON THE OUTSIDE OF THE TANK.



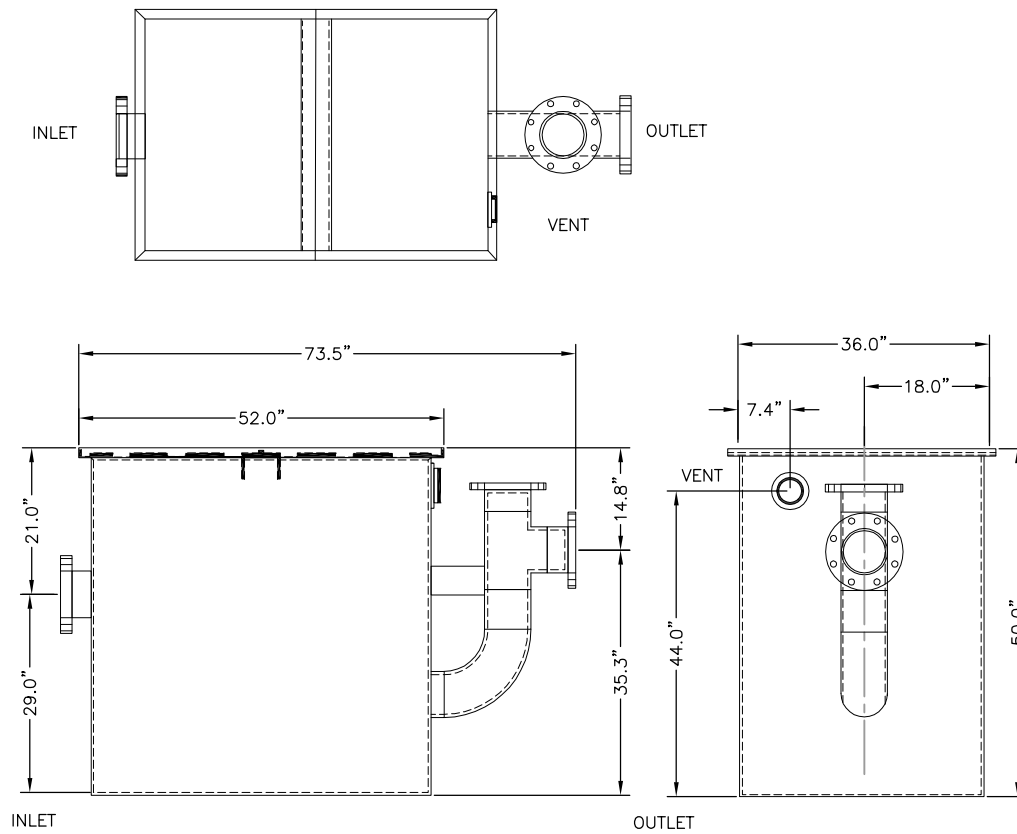
SAND/OIL INTERCEPTOR



SPECIFICATIONS:

ALL WELDED $\frac{1}{4}$ " STEEL SEPARATOR, 85-GALLON STATIC CAPACITY, 4.0" TAPPED INLET/OUTLET WITH 3.0" TAPPED INTERNAL VENT CONNECTION, 250 LBS GREASY SLUDGE CAPACITY, VISIBLE DOUBLE-WALL OUTSIDE TRAP SEAL, SEPARATOR PLATE AND REMOVABLE FILTER SCREEN, REMOVABLE $\frac{3}{8}$ " NONSKID DIAMOND TREADPLATE COVERS FOR FLUSH-WITH-FLOOR INSTALLATION SUITABLE FOR PEDESTRIAN TRAFFIC SECURED WITH STAINLESS FLAT HEAD SCREWS, HEAVY DUTY LEAK-PROOF GASKET, OPEX SHOP COAT COATING INSIDE AND BITUMINOUS COATING OUTSIDE. ROCKFORD MODEL GIS-50 OR APPROVED EQUIVALENT.

GREASE SEPARATOR = 250 LBS



SPECIFICATIONS:

ALL WELDED $\frac{1}{4}$ " STEEL SEPARATOR, 225-GALLON STATIC CAPACITY, 6.0" COMPANION FLANGE INLET/OUTLET WITH 3.0" TAPPED INTERNAL VENT CONNECTION, 500 LBS GREASY SLUDGE CAPACITY, VISIBLE DOUBLE-WALL OUTSIDE TRAP SEAL, SEPARATOR PLATE AND REMOVABLE FILTER SCREEN, REMOVABLE $\frac{3}{5}$ " NONSKID DIAMOND TREADPLATE COVERS FOR FLUSH-WITH-FLOOR INSTALLATION SUITABLE FOR PEDESTRIAN TRAFFIC SECURED WITH STAINLESS FLAT HEAD SCREWS, HEAVY DUTY LEAK-PROOF GASKET, OPEX SHOP COAT COATING INSIDE AND BITUMINOUS COATING OUTSIDE. ROCKFORD MODEL GIS-70 OR APPROVED EQUIVALENT.

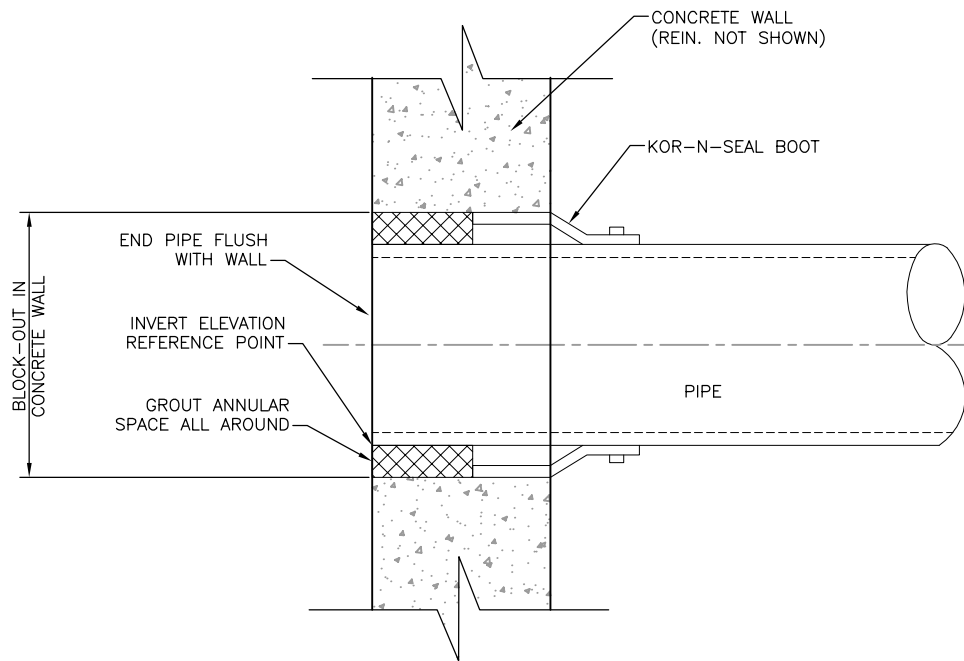
GREASE SEPARATOR = 500 LBS

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-15



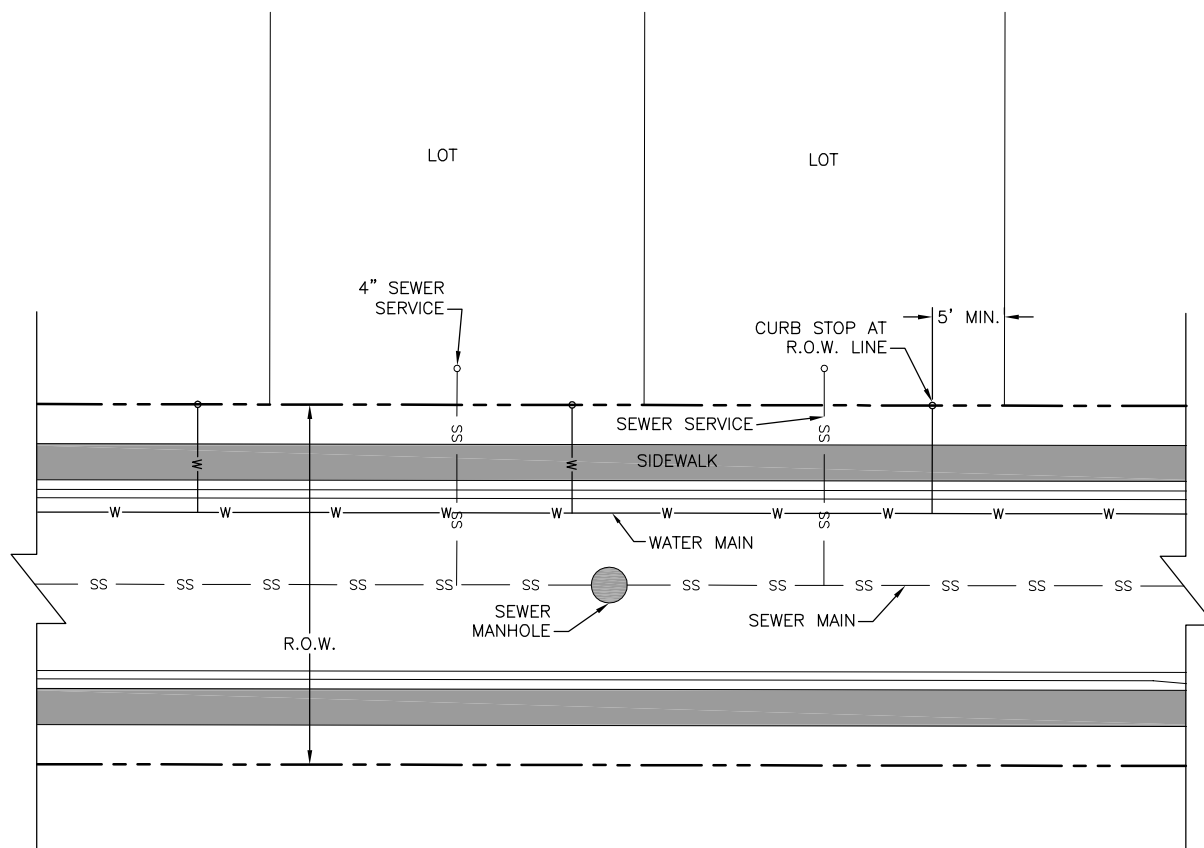
KOR-N-SEAL BOOT DETAIL

Drawn: GGM	Revised: DECEMBER 2021
Date: MARCH 2011	Revised:
Scale: N.T.S.	Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-16



NOTES:

1. SEWER SERVICE TO BE PLACED APPROXIMATELY IN THE MIDDLE OF THE LOT AND EXTENDED 10 FEET PAST R.O.W.
2. SERVICES SHALL BE MARKED WITH 2"x4" POST AT TERMINATION POINT FOR LOCATION DURING CONNECTION TO RESIDENCE. POSTS SHALL BE SPRAY PAINTED BLUE FOR WATER AND GREEN FOR SEWER.

UTILITY SERVICE LOCATIONS

Drawn: GGM/SKG

Revised: DECEMBER 2021

Date: MARCH 2011

Revised:

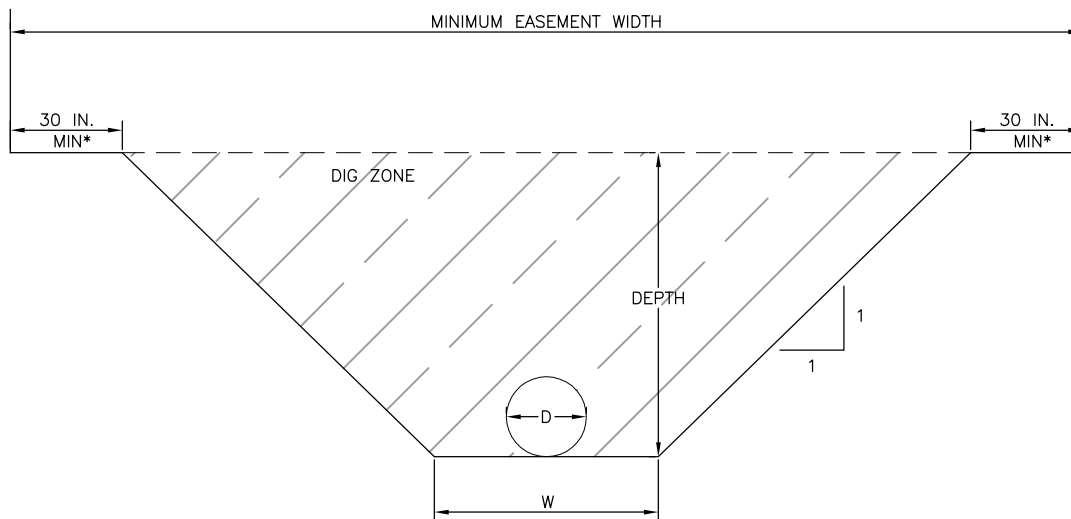
Scale: N.T.S.

Revised:



WATER & WASTEWATER SYSTEM
STANDARD SPECIFICATIONS

WW-17



PIPE DIAMETER D	MINIMUM W
≤ 12 IN.	3 FT.
≤ 18 IN.	4 FT.
≤ 24 IN.	5 FT.
≤ 30 IN.	6 FT.

NOTES:

1. MINIMUM EASEMENT = 20 FT.
2. TYPICAL WATER ≤12 IN. WITH 5 FT COVER = 20 FT.
3. NO OTHER UTILITY IN DIG ZONE.
4. POTABLE WATER TO SEWER 10 FT MINIMUM HORIZONTAL.
5. MINIMUM CLEAR DISTANCE BETWEEN WH LINE = 30".
6. MINIMUM CLEAR DISTANCE BETWEEN WH LINE AND OTHER = 5 FT.
7. *SIDE SETBACK OF 30" MAY BE APPLIED EACH SIDE OR 5' ON SINGLE SIDE AS LONG AS DIG ZONE IS WITHIN EASEMENT.

EASEMENT & SEPARATION STANDARDS – WATER/SEWER MAINS

Drawn: GGM
 Date: MARCH 2011
 Scale: N.T.S.

Revised: DECEMBER 2021
 Revised:
 Revised:



WATER & WASTEWATER SYSTEM
 STANDARD SPECIFICATIONS

WW-18