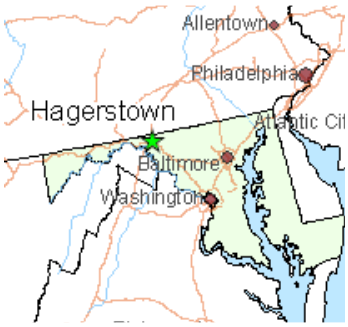
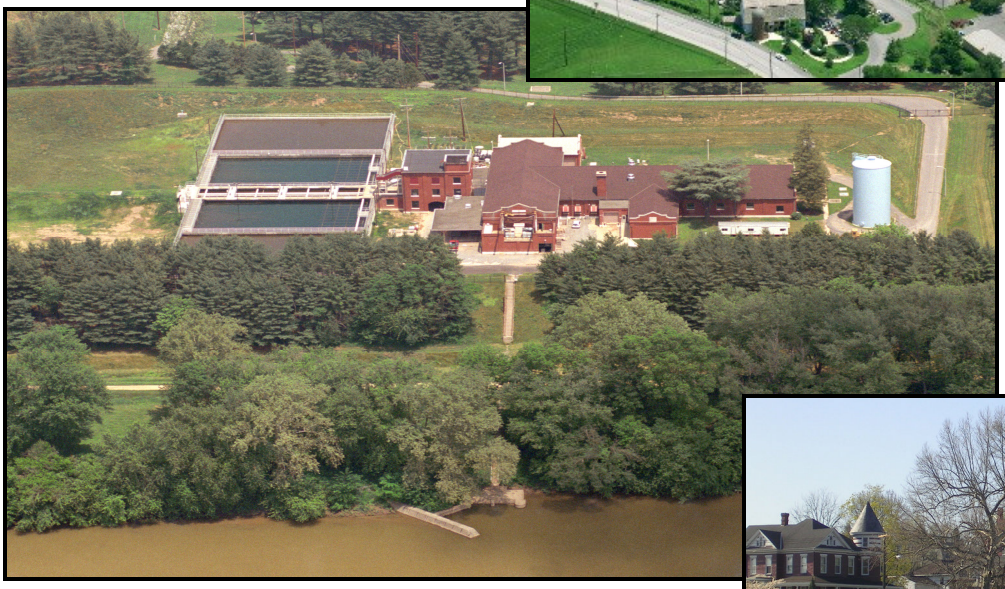
CITY OF HAGERSTOWN

WATER AND **WASTEWATER** STANDARDS AND SPECIFICATIONS





Utilities Department
Water and Wastewater Divisions
Engineering
One Cleanwater Circle
Hagerstown, MD 21740
(301) 739 – 8577 ext. 650

August 2013

THIS PAGE LEFT INTENTIONALLY BLANK

TABLE OF CONTENTS

Page

SECTION 1 INTRODUCTION AND GENERAL INFORMATION

SECTION 2 WATER DIVISION

Page

SECTION 3 WASTEWATER DIVISION

Page

SECTION 4 INSPECTIONS, TESTING, AS-BUILTS AND BONDING

REFERENCES

STANDARD DETAILS

General

Water

STANDARD DETAILS (Continued)

Wastewater

WW101 Trenching, Encasement, and Cradle
WW102 Manhole Frame and Cover
WW103 Manhole Cover Grade Ring
WW104 Precast Concrete Manhole
WW105 Option 1: Inside Drop Manhole Connection
WW106 Option 2: Outside Drop Manhole Connection
WW107 Precast Concrete Shallow Manhole
WW108 Manhole Steps
WW109 Plans of Typical Manhole Flow Channels
WW110 Precast Manhole Pipe Connections (Gaskets)
WW111 Manhole Pipe Connections
WW112 Manhole Future Connections
WW113 Single Sewer House Connection
WW114 Double Wye House Connection
WW115 Built-up Lateral Connection
WW116 Cleanout Assembly
WW117 Typical Cleanout Safety Protection
WW118 Tunnel or Jacking Installation, Type I
WW119 Pipes Through Sleeves, Jacking or Boring Installation Type II, III, and IV
WW120 Receiving Manhole for Force Main or Low Pressure Sewer Discharge
WW121 In-Line Flushing Connection Detail
WW122 In-Line Flushing Connection 1-1/4” Through 4”
WW123 Terminal Flushing Connections
WW124 Compression Repair Coupling for Low Pressure Force Mains
WW125 PVC Pipe Union for Repairing Low Pressure Force Mains
WW126 Joint Restraint for Force Mains
WW127 Buttress for Horizontal 90° M.J. Bends
WW128 Buttress for Force Mains Less Than 90°
WW129 Air and Vacuum Relief Valve and Vault
WW130 Required Grading and Landscaping at Grinder Pump
WW131 Pipe Repair or New Connection Details
WW132 Manhole Abandonment

SECTION 1
INTRODUCTION AND GENERAL INFORMATION

History and Mission

The City of Hagerstown, Water and Wastewater Divisions of the Utilities Department are responsible for the operation, maintenance, administration, planning and engineering of public water and wastewater facilities to service over 40,000 citizens of the

City of Hagerstown and Washington county as well as three wholesale customers. The department is established by the *Code of the City of Hagerstown, Maryland Chapter 238: WATER, and Chapter 240: WATER POLLUTION CONTROL.*

Mission Statement

The Water and Wastewater Divisions of the Utilities Department provide to customers a safe and reliable water supply for both domestic and firefighting purposes at the lowest possible cost. The Water and Wastewater Divisions of the Utilities Department also work to protect public health and the environment through the proper collection and treatment of wastewater and safe disposal of biosolids.

The Department further strives to provide prompt, courteous and accurate responses to customer service requests, as well as, timely review and response to development proposals from potential customers.

Scope and Purpose

The scope and purpose of this Standards and Specifications document is to provide minimum requirements for the design, materials used, and methods of construction for the potable water and wastewater systems located within the rights-of-way and easements of the Departments' jurisdiction. The potable water system includes the installation and servicing of mains, service lines/connections, hydrants, valves, pump

stations and tanks. The wastewater system includes the installation and maintenance of mains, service connections, pump stations and manholes. These Standards also cover all other necessary appurtenances and, in general, any repairs, replacements, relocations, or any other work on public water and/or wastewater systems.

The purpose of these standards and specifications is to provide a concise and comprehensive reference for the requirements of the City of Hagerstown regarding any proposed extension of or in addition to the existing water transmission/distribution and/or wastewater main collection/transportation facilities. Specific requirements have been emphasized to address frequently encountered situations of developers, owners, and engineers.

The scope of these standards and specifications is limited to the administration, design, construction, inspection and testing of any facilities which upon their connection, will ultimately become part of the existing City of Hagerstown water and wastewater systems.

Hagerstown Utilities Department policy information should be referenced for other issues such as allocations, wastewater pump station acceptance etc.

Limitations and Applicability

The Water and Wastewater Standards and Specifications is intended to provide a summary of information, procedures, criteria and practices, which are applicable to the undertaking of public water and wastewater projects within the department jurisdiction. The procedural aspects presented represent current Department practices, which to some degree may be considered fluid as these standards are in continuous evolution, subject to both administrative and legislative action at federal, state, and local governmental levels. The design criteria and engineering practices set forth in this manual shall be considered firm requirements for the development of water and wastewater projects.

The engineering requirements included in this manual are intended to assist land developers and engineers with designing and building public water and wastewater facilities within the City of Hagerstown. Developer projects and capital projects, sponsored by private Developers and the City and County administration, respectively, shall conform to the procedures, requirements and criteria set forth in this manuscript. The manual is not intended to restrict the Designer's opportunity to create innovative, practical and economical designs for water and wastewater system improvements as long as all regulations are met. Rather, it is intended to assist the Designer in completing the projects efficiently and economically within the framework of design parameters established herein as long as all applicable regulations are met.

Definitions

The following definitions are applicable throughout these standards and specifications:

Acceptance - The formal action by the Department accepting the dedication of completed facilities.

Aeration - A process of intimate contact between air and a liquid by mechanical means or natural occurrence.

Air Release Valve (ARV) - A valve that enables air to be removed from a pressure main.

Allocation - The allowable quantity of sewage, water, and wastewater to be discharged into the sanitary wastewater system by any person, firm corporation, or legal entity as determined by the approving authority or in accordance with applicable federal, state, county, or city statutes, ordinances or regulations, the more stringent of which shall govern and control. This can be thought of as the assignment of system capacity to a property based on water consumption and available system capacity and expressed in average gallons per day.

Applicant - An individual owner or owner's developer, builder, engineer, or other authorized representative who applies as the owner's official agent to the Department for water or wastewater service.

Applicant's Engineer - The Engineer licensed by the State of Maryland as a Civil Engineer, retained or employed by the Applicant, under whose direction plans, profiles, and details for the work are prepared and submitted to the Department for review and approval.

Approved - Unless specifically otherwise indicated, this shall mean approval by the Department Engineer or authorized representative.

As-Built Drawings - Final engineering drawings of pipelines, appurtenances, pump stations, etc., which have been updated to accurately reflect the final physical state after construction is completed with accurate field surveyed post construction dimensions and attributes.. Also known as "Record Drawings".

Average Day Demand - The volume of water used in the year divided by 365 days, expressed in gallons or million gallons.

Average Day Rate - The water used during the Average Day Demand expressed in gallons per day (gpd) or million gallons per day (mgd) or divided by 1,440 minutes and expressed in gallons per minute (gpm).

Backfill - Soil or aggregate materials used to fill an excavated trench or other excavation.

Backflow Preventer - A device utilized to protect water supplies from contamination or pollution from the flow of potentially contaminated water back into the supply lines.

Bedding Course - Layer placed over the excavated subgrade in a trench before laying pipe. This is typically graded aggregate base (GAB) or crusher run (CR-6) material.

Building Drain - That part of the lowest horizontal piping of a drainage system which receives the discharge from waste pipes inside the walls of the building and conveys it to the building sewer, beginning 1.5 meters (five feet) outside the thinner face of the building wall. The building drain is owned and maintained by the property owner.

Building Sewer - The sewer from the building drain to the service connection. The building sewer, up to and including the clean out, is owned and maintained by the property owner.

Chlorination - The application of chlorine to water for disinfection.

City - City of Hagerstown, Maryland.

Cleanout - A minimum 6" diameter stand pipe with a brass cap, used as a point of access to a wastewater collection system for insertion of tools, rods, or snakes to effect lateral cleaning.

Collector - Generally a wastewater pipeline used to collect and carry wastewater from individual sources to an interceptor sewer that will carry it to a treatment facility. A wastewater facility that is designed to carry smaller flows from service connections (Typically 8" to 10" diameter pipes).

Collection System - All facilities and processes for collecting and transporting wastewater, including, but not limited to; collectors, interceptors, force mains, manholes, pump stations, and also includes all materials, equipment, and vehicles for proper operation and maintenance.

Combination Air Release Valve (CARV) - A combination air and vacuum valve that enables air to be removed from a pressurized pipe or force main.

Combined System - A combination of a storm drain system and a sanitary wastewater system designed to simultaneously carry both storm and wastewater flow.

Commercial Establishment - Any structure or any portion thereof intended to be used wholly or in part for the purpose of carrying on a trade, business or profession or for social, amusement, religious, educational, charitable or public use and which contains plumbing for kitchen, toilet, testing, washing facilities, etc.

Consulting Engineer - That person or persons, firm, partnership, or corporation legally authorized to practice civil engineering in the State of Maryland who, acting as an agent for a client or developer, prepares or submits improvement plans and/or specifications to the Department for approval. Called a Design Engineer in these Standards.

Contract - The agreement covering the performance of the work and the furnishing of labor, materials, tools, and equipment in the construction of the work. The contract may be in the form of the notice to contractors, proposal, plans, specifications, special provisions, contract or performance bonds, purchase orders, standard terms of conditions, work order forms, or a written agreement.

Contractor - The person or persons, firm, partnership, corporation, or combination thereof, private or municipal, that entered into a contract with the Department, or the owner of private property doing his/her own Work on his/her private property only. For purposes of acceptance and guarantee, Contractor refers to the party that has posted the bonds. For purposes of construction, Contractor refers to any contractor licensed by the State of Maryland to enter into contracts for and to perform the work of installing, repairing, replacing, or relocating water or wastewater facilities under Department jurisdiction.

County - Washington County.

Cross Connection - An unprotected connection between a potable water system used to supply water for drinking purposes and any source or system containing non-potable water or other substance. (Note: prohibited in the Department jurisdiction)

Customer - An owner, developer, builder, engineer, or other authorized representative who accepts responsibility for the customer facilities once they are constructed and accepted by the Department.

Department - The City of Hagerstown Utilities Department, Water and Wastewater divisions.

Department Engineer - The Engineer of the Hagerstown Utilities Department, Water and Wastewater divisions or his/her authorized agent.

Design Engineer - That person or persons, firm, partnership, or corporation legally authorized to practice civil engineering in the State of Maryland who, prepares or submits improvement plans and/or specifications to the Department for approval. (AKA "Designer", "Consulting Engineer", "Consultant")

Developer - Any person, or persons, firm, partnership, corporation, or combination thereof, which is financially responsible for the construction of approved water or wastewater facilities within the Department.

Disinfection - Destruction of the harmful and objectionable microorganisms by means of chemicals, irradiation, or other methods.

Distribution Mains - Water mains connecting the transmission mains to the water house connections. The distribution mains provide area wide fire protection and potable water to customers. Generally, the distribution mains will be in a grid or branched configuration.

Domestic Waste - Any solid, liquid, or gaseous substance containing only human wastes and/or household wastes discharged, permitted to flow or escaping from any residential, industrial, manufacturing, commercial, institutional or business establishment.

Double House - Two residential living units constructed side by side with a common bearing or dividing wall. (AKA – Duplex)

Double Wye Connection - A connection whereby two building sewers are connected to the same service lateral.

Double Service Connection - Water service connection serving two adjacent lots with a double meter setting.

Duplex - Two residential living units in one building constructed up and down, side by side or front and rear. (AKA – double house)

Easement - A recorded document by which the land owner gives the Department or the public permanent rights to construct, operate, and maintain a pipeline across private or other property.

Exfiltration - Liquid wastes and liquid carried wastes which unintentionally leaks out of a wastewater pipe system and into the environment.

Floatation - The process of buoyancy affecting a structure below grade.

Force Main - The pressurized conveyance pipeline that carries wastewater from a pump station into a gravity flow system.

Foundation Stone - Clean well-graded stone, authorized by the Department, used to strengthen and/or provide support to an otherwise weak subgrade. Foundation stone is placed, and the subgrade improved before bedding stone is placed.

Freeboard - The vertical distance between the maximum liquid level and the top of the sides of a conduit, reservoir, or tank.

Gravity Pipeline - The conveyance pipeline that carries wastewater using natural gravity flow.

Grease - The residues of fats, detergents, waxes, free fatty acids, calcium and magnesium soaps, mineral oils, and certain other non—fatty materials which tend to separate from water and coagulate as floatables or scums.

HDPE - High Density Polyethylene

Industrial Establishment - Any structure intended to be used wholly or in part for the manufacturing, fabricating, processing, testing, cleaning, laundering, or assembly of any product, commodity or article.

Industrial Waste - The liquid wastes from industrial, manufacturing processes, trade, or business as distinct from wastewater (domestic waste).

Improvement Plans - Drawings of all potable water, wastewater mains, services, and appurtenances which are included under Department jurisdiction for the proposed project. Prior to construction, the Department Engineer must approve Improvement Plans.

Infiltration - The water entering a wastewater system, including service connections, from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections or manhole walls.

Infiltration Rate - The rate at which soil will accept water. Commonly known as the percolation rate or acceptance rate of water flow into the existing or proposed wastewater collection system.

Inflow - Storm water directly entering wastewater collection systems through the openings of manholes, through defects in the pipes, or through street connections or gutter downspouts connected to the system.

Inspector - An employee or agent of the Department engaged to observe and record field compliance with design criteria, plans, and construction standards.

Interceptor - Generally a wastewater pipeline designed to carry higher flows and intended primarily to transport wastewater from one location to another, typically from collector to truck pipelines.

Lateral - Wastewater: A wastewater pipe that discharges into a wastewater main and has no other common wastewater tributary to it, it collects wastewater from individual homes or other structures and carries it to the nearest collector wastewater pipe or manhole. Water: That portion of the street service connection running from the main across the street to supply water to more than one individual building.

Lift Station - A pumping facility that pumps wastewater through a short length of force main into the nearest manhole, such that wastewater can again flow by gravity.

Low Pressure Sanitary Sewer (LPSS) - An alternative system to the conventional gravity wastewater system, used for the collection and disposal of wastewater by use of small diameter pressure piping, grinder pumps and other appurtenances such as air/vacuum release valves, flushing connection units, etc.

Main - All water and wastewater pipelines dedicated for public use in the Department's system, excluding services and laterals. Also known as "Main Lines, or Pipelines". For wastewater, the principal public wastewater pipeline to which branch wastewater pipes and sub mains are tributary.

Marking Tape - Warning tape buried above a pipeline or attached directly to a pipe for the purpose of identifying the pipe. Also known as "Warning Tape".

Manhole - A structure (appurtenance) in a wastewater collection system with the purpose of permitting workers or equipment to enter or leave the system.

Manhole Inserts - Basin type device placed in the top of a manhole to prevent surface and storm waters from entering into the wastewater system.

May - Is permissive.

Owner - The legal holder of property, material. etc. Any holder of legal title, contract purchaser or lessee of property for which service is requested from the Department. The record owner of real property, residence, or business.

pH - The logarithm of the reciprocal of the weight of hydrogen ions in grams per liter of solution.

Pipe Casing - A pipe that encases a water or wastewater pipe, used to separate the water or wastewater pipe from undesirable conditions or to enable construction using a trenchless method.

Plumbing Code - The plumbing code as utilized by the City of Hagerstown Engineering and Code Administration Department. International Plumbing Code 2006 by International Code Council, shall be known as the "Hagerstown Plumbing Code."

Pretreatment - Any process whereby undesirable constituents in the water, waste, wastewater, including but not limited to soluble organics, toxic materials, heavy metal ions, color and turbidity, nutrients, refractory materials, oils, grease and immiscible liquids, acids and alkalis, organic and inorganic solids, excessive temperatures, pathogenic wastes and radioactive isotopes, are reduced to levels deemed acceptable by the Department before these wastewaters are admitted to the wastewater collection system.

Private Dwelling or Living Unit - A structure or dwelling intended to be used as a single-family residence or an apartment intended to be used as a single-family residence or any other single-family living unit.

Private Wastewater Maintenance Agreement - An agreement that is recorded against lots or parcels that allow them to maintain and use privately owned and operated wastewater facilities. These facilities must be designed and constructed in accordance with the Department's Standards. These agreements shall be reviewed by the Department Engineer.

Pump Station - Typically, a pumping facility that pumps wastewater longer in order to convey it into a gravity system. Alternatively, a point where wastewater is lifted to a higher elevation when the continuance of the wastewater pipeline at reasonable slopes would involve excessive depths of trench, or that raises wastewater from areas too low to drain into available collection pipelines.

Record Drawings - The final, post-construction drawings that accurately represent the final condition of the project. Also Known as As-Built drawings.

Regulatory Agency - Those public agencies legally constituted by the State of Maryland to protect health and water quality.

Runoff - Flow of water along the surface of the ground or other natural or manmade surfaces including, but not limited to, pedestrian walkways, streets, playground surfaces, and grassy slopes or other landscaped areas.

Scum - The layer or film of foreign matter that rises to the surface of water or wastewater and is formed there. A residue deposited on top of the ledge of a wastewater, channel, or wet well at the water surface. A mass, of solid matter that floats on the surface.

Sedimentation - The process of settling and depositing suspended matter carried by wastewater, by gravity. Sedimentation usually occurs when the velocity of the wastewater is reduced below the point at which it can transport the suspended material.

Select Backfill - Material used in the backfilling of an excavation, selected for desirable compaction or other characteristics. CR-6, Graded aggregate base, etc. All aggregates should be 6" or smaller.

Service Assembly - pipes and fittings between the Department's main and the meter. Also known as "Service Connection"

Service Connection -

(Wastewater) That portion of the wastewater pipeline (lateral) between the wastewater main and the curb line, existing or proposed, to which the building sewer is connected.

(Water) Service pipelines within public roads or rights-of-way connecting the distribution mains to individual homes, buildings or facilities for both consumptive use and on site fire protection.

Service Line - The pipe and fittings between the Department's water main and the meter or between the wastewater main and cleanout.

Sewage - Any combination of the water carried domestic and/or industrial wastes from various customers including residences, business buildings, institutions, or industrial establishments, together with such groundwater, surface water and storm water as may be present. Also known as wastewater.

Sewage Solids - The non-liquid portion of sanitary sewage consisting of such things as feces, other organic matter, trash, grit, etc.

Sewer - An older term for wastewater.

Sewerage - A comprehensive term which includes facilities for collecting, intercepting, pumping, transporting, treating, and disposing of sewage.

Shall - Is mandatory.

State - The State of Maryland.

Structures - Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

Subcontractor - An individual, firm, or corporation having a direct contract with the Contractor or with any other subcontractor for the performance of a part of the Work at the site.

Subgrade - Surface or elevation remaining after completing the trench excavation or, the top surface of a backfill (stone or soil) immediately below the pipe conduit or pipe bedding, as applicable.

Transmission Mains - Large diameter water mains that convey water from the supply source to the storage facilities and the distribution mains.

Transition Manhole - The manhole that a force main ties into and where the gravity wastewater system begins.

Trench Rock Excavation - Removal and satisfactory disposal of all unsuitable materials, which, in the opinion of the Department Engineer, cannot be excavated except by drilling, wedging, jack hammering, blasting, or hoe ramming. It shall consist of undecomposed stone, hard enough to ring under hammer. All boulders containing a volume of more than ½ cubic yard and/or solid ledges, bedded deposits, unstratified masses and conglomerations of material so firmly cemented as to possess the characteristics of solid rock which cannot be removed without systematic drilling, blasting, or hoe ramming will be classified as rock.

Trunk - A wastewater main pipeline that serves many tributary branches and serves a large territory. Under normal conditions this pipeline carries high flow rates.

Unauthorized Discharge - Any release of waste waters that violates the regulations of the Department or any applicable Federal, State, or local statutes, regulations, ordinances, and contracts.

Warning Tape - Tape that is laid a specified distance above a buried pipe, typically one (1) foot for water mains and (2) foot for wastewater mains, for the purpose of warning that there is a buried pipeline below.

Wastewater - The used water and water-carried solids from a community that flow into a treatment plant. Storm water, surface water, and ground water filtration also must be included in the wastewater that enters a plant. The term "SEWAGE" usually refers to household wastes, but this word is being replaced by the term "WASTEWATER".

Watercourse - A channel in which a flow of water occurs, either continuously or intermittently.

Work - Any and all obligations, duties, and responsibilities necessary to the successful completion of the project assigned to or undertaken by a Contractor including all labor, materials, equipment, and other incidentals, and the furnishing thereof.

Abbreviations

Whenever in these Standards the following abbreviations are used, they shall be defined as listed below:

AASHTO - American Association of State Highway and Transportation Officials
ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
AWWA - American Water Works Association
AB - Aggregate Base
ABS - Acrylonitrile-Butadiene-Styrene
ADWF - Average Dry Weather Flow
ANSI - American National Standards Institute
ASTM - American Society for Testing and Materials
BM - Bench Mark
BMP - Best Management Practices
CARV - Combined Air and Vacuum Release Valve
CC&Rs - Covenants, Codes and Restrictions
CCTVI - Closed Circuit Television Inspection
CF - Cubic Feet
CFR - Code of Federal Regulations
CIOD - Cast Iron Outside Diameter
CIP - Cast In Place
CL - Center Line
C/O - Clean out
CPVC - Chemical-Resistant Polyvinyl Chloride
Deg - Degree
Dia - Diameter
DIP - Ductile Iron Pipe
DIPRA - Ductile Iron Pipe Research Association
DR - Dimension Ratio
DWF - Dry Weather Flow
Dwg - Drawing
DWV - Drain Waste and Vent
e.g. - For example
Elev - Elevation
ESD - Equivalent Single Family Dwellings
EP - Edge of Pavement
ES - Extra Strength
FA – Foster Adapter
FH – Fire Hydrant
FL - Flow Line
FM - Force Main
FPS - Feet per second
gal - Gallons
gpm - Gallons per Minute
gpcd - Gallons per capita per day
gpd - Gallons per Day
HDPE - High Density Polyethylene
H.L. - Hydraulic Line
HOA - Hand Off Auto
hp - Horse Power
ID - Inside Diameter
I/I - Inflow and Infiltration
IEEE - Institute of Electrical and Electronics Engineers
KW - Kilowatts

lb - Pound
LF - Linear Foot
LPI - Lightning Protection Institute
LWL - Low Water Level
Max - Maximum
MDE – Maryland Department of the Environment
MDSHA – Maryland State Highway Department
MDOT - Maryland Department of Transportation
MGD - Million Gallons per Day
MH - Manhole
Mi - Mile
Min - Minimum
NAD - North American Datum
NEC - National Electric Code
NEMA - National Electrical Manufacturers' Association
NEPA - National Environmental Protection Agency
NFPA - National Fire Protection Association
NPCA – National Precast Concrete Association
NPSHA - Net Positive Suction Head Available
NPSHR - Net Positive Suction Head Required
NPT - National Pipe Thread
NSF - National Sanitation Foundation
OC - On Center
OD - Outside Diameter
OIP - Operator interface Panel
OSHA - Occupational Safety and Health Administration
RCP - Reinforced Concrete Pipe
R/W - Right of Way
PACP - Pipeline Assessment and Certification Program
PPI - Plastic Pipe Institute
PPM - parts per million
PSI - pounds per square inch
PSIG - pounds per square inch gauge
PVC - Polyvinyl Chloride
PF - Peaking Factor
PLC - Programmable Logic Controller
PUE - Public Utilities Easement
PVC - Polyvinyl Chloride
PWWF - Peak Wet Weather Flow
SCADA - Supervisory Control And Data Acquisition
SD - Storm Drain
SDR - Standard Dimension Ratio
SF - Square Foot
Sq - Square
SS - Sanitary Sewer
SWPPP - Storm Water Pollution Prevention Plan
TDH - Total Dynamic Head
TVI - Television Inspection
UL - Underwriters Laboratory Inc.
UPS - Uninterruptible Power Supply
UV - Ultraviolet
V - Velocity
VCP - Vitrified Clay Pipe
WEF - Water Environment Federation
W/ - With
(W) - Water
(WW) - Wastewater
Yd - Yard

System Descriptions

Water

The Water Division of the Department of Utilities provides water treatment and distribution to all residential, commercial, institutional, and industrial customers in the Hagerstown area. The City owns and operates two potable water treatment plants: the R.C. Willson Plant and the W.M. Breichner Plant. The Willson Plant draws its water from the Potomac River in Williamsport, and is the City's main source of water. It has a maximum treatment capacity of 20 MGD, with a permitted treatment volume of 15 MGD. The Breichner plant draws its water from Edgemont Reservoir near Smithsburg, and is primarily used to supplement production during high demand periods and when system maintenance reduces available supplies from the Willson Plant. The Breichner Plant has a maximum treatment capacity of 4.5 MGD and a permitted treatment volume of 700,000 gpd.

The City's water distribution system is comprised of approximately 400 miles of water mains. Currently, there are over 2,000 fire hydrants throughout the distribution system, used for both fire suppression and system maintenance. Hagerstown produces an annual average of approximately 11 MGD of water, almost all of which was drawn from the Potomac River.

Wastewater

The Wastewater Division of the Department of Utilities provides wastewater collections, conveyance, and treatment service to all customers within the City's corporate boundaries, as well as portions of Washington County

Within Hagerstown's corporate boundaries, wastewater flows through approximately 153 miles of City-owned wastewater pipelines and 23 pumping stations, and is treated at the Hagerstown Wastewater Treatment Plant (WWTP). The WWTP is located on Antietam Creek near Frederick Street, and has a current design capacity of 8.0 million gallons per day (MGD), with an annual average flow in 2012 of 7.04 MGD. Treated effluent is discharged into an unnamed tributary of Antietam Creek.

Site Design

Improvement Plans

Work necessary for the installation of mains, services, and appurtenances to provide water and/or wastewater services shall be shown on the Improvement Plans. The Improvement Plans shall be prepared under the direction of, and signed by, a currently registered professional engineer in the State of Maryland.

Improvement Plans showing the proposed work shall be submitted to the Department for approval. Included with this submittal, calculations requested by the Department Engineer to verify the design of any portion of the potable water, or wastewater systems may be required. Calculations shall be based on methods generally accepted by the engineering profession and shall be neatly and legibly done in such form as to enable them to be readily checked. Calculations shall be signed and stamped by a State of Maryland registered civil engineer. In addition, literature and technical data concerning any of the materials and equipment to be used shall be furnished to the Department Engineer upon request. Improvement Plans shall comply with the following requirements. Exceptions for small projects may be granted subject to the discretion of the Department Engineer. The plans shall include but not be limited to the following:

1. During plan checking, submit two (2) sets of full size Improvement Plans, with a minimum drawing size of 22 inches by 34 inches.

2. All Water and Wastewater mains shall be shown in plan and profile with services and laterals in plan. First floor elevations shall be shown where critical to the design.

3. Existing conditions including topography, existing structures, trees, utilities, etc.

4. All existing and proposed fire hydrants, valves, and other miscellaneous appurtenances shall be shown for water systems. Private, commercial and other non-department fire hydrants and other appurtenances shall be specifically distinguished.

5. All existing and proposed vaults, backflow preventers, valves and other miscellaneous appurtenances shall be shown for water systems.

6. All existing and proposed manholes, cleanouts, and other miscellaneous appurtenances shall be shown for wastewater systems.

7. All existing and proposed pump stations, potable water mains, storm and sanitary wastewater pipes in the vicinity of any proposed potable water facilities shall be shown.

8. All existing and proposed easements shall be shown.

9. Plan and profile drawing scale shall be at least 1 inch equals 50 feet.

10. An overall plan view of the entire proposed potable water and wastewater pipeline system shall be provided and shown on one sheet with a drawing key for subsequent plan and profile sheets.

11. Improvement Plans shall include a location map showing the area to be served relative to established public roads.

12. Improvement Plans shall include a note that states: “Work shall comply with the Standard and Specifications, and Drawings of The City of Hagerstown Utilities Department, Water and Wastewater Divisions.”

13. Improvement plans shall include standard certifications blocks:
    Developer Certification
    SCAP (Sewer Capacity Allocation Program) Certification (for City Sewer projects)

    Note: Please see templates at the end of this section.

14. When service utilities and layouts are not presented clearly on Improvement Plans, Department may require enlarged details to be provided.

15. Utility poles, street lights and trees shall be specifically identified on Improvement Plans.

16. All pumping stations shall be shown along with plan and profile views.

17. Details shall be provided for all design features of the project including trenching, appurtenances, and other significant features.

18. Tax Map information, property lines, ROW lines, etc. shall be shown

19. Accurate information shall be required and testing pitting shall be used where the depth of existing utilities cannot be determined with accuracy,

    Other specific information to be included can be found in the Water and Wastewater sections respectively.

The Department cost of reviewing the first two (2) Improvement Plan submittals is considered covered by the standard design review fees. Additional Improvement Plan submittal reviews will be charged to the Applicant on the basis of the footage of proposed pipeline.

Once a development project has been approved by the Department Engineer, then three (3) full size prints (for water only), one (1) mylar copy and one (1) digital vectorized file on CD of Improvement Plans shall be submitted to the Department. The digital vectorized files shall be in AutoCAD 2000 drawing format. Drawing units shall be decimal with a precision of 0.00. Angles shall be in decimal degrees with a precision of 0.00. All objects and entities in layers shall be colored by layer. All layers shall be named in English. Abbreviations are acceptable. All submitted map drawings shall use the Global Coordinate System of USA, Maryland, NAD 83 Maryland State Plane, and U. S. foot. No changes shall be made to the approved Improvement Plans unless approved and re-signed by the Department Engineer. In the case of an approved change, all submitted sheets affected by the change shall be replaced. Only the title sheet and pertinent sheets related to the water and wastewater systems within the full plan set are required.

Note: For Water and Wastewater City projects (5) Five full size print sets are required

During construction, one (1) completed set of Improvement Plans shall be kept on site at all times. At the completion of all Work, Applicant shall submit Record (As-built) Drawings in digital vectorized form on a CD-ROM and (1) one set of hard copies of the drawings. The digital files shall conform to the format mentioned above.

Phasing

If the construction of the utilities within a development is to be phased, the Designer shall provide a phasing plan showing the phasing and timing of the construction of the utilities. The phasing plan shall be signed and sealed by a professional engineer registered in the State of Maryland.

During each phase of the development, the public water and wastewater systems must be able to support the design flow requirements noted in the specifications. The Designer shall provide calculations (computer simulations) for each phase of the development. The water system must be capable of supporting the maximum day demand rate plus a two-hour fire flow while maintaining the normal required pressure for each phase of the development.

Two copies of the comprehensive utility plan, phasing plan, and engineering report shall be provided to the department

The comprehensive utility plan and phasing plan shall have standard water and wastewater title blocks with approval signature lines. Following approval, the comprehensive utility plan and phasing plan cannot be revised without the authorization of the Department. Revisions to the comprehensive utility plan and phasing plan will require a reevaluation by the Designer of the design flows and the ability of the proposed water and sewer systems to meet Design Manual requirements. Changes to the comprehensive utility plan and phasing plan shall be noted in the revision blocks.

Allocation Information

Provide a note on the plans regarding the allocation. Existing Allocation = ___ gpd
Proposed Allocation = ___ gpd, Additional Allocation = ___ gpd. Where the blanks will contain the appropriate values of the allocation requests.

Expiration of Approval

Plans are to be resubmitted after one year, regardless of the number of previous submittals will be deemed “expired”. “Expired” plan checks resubmitted will be subject to current design requirements.

Signature Blocks

Standard certification and signature blocks shall be included and are as follows:

Water and Wastewater Service:

CITY OF HAGERSTOWN UTILITIES DEPARTMENT – WATER AND WASTEWATER DIVISIONS

This approval is for the design and layout of the proposed water and wastewater system improvements. All water and wastewater system improvements shall be constructed to the standards in effect at the time of construction. This approval does not guarantee availability of water or wastewater service. Water and wastewater service is available subject to conformance with all policies and standards in effect at the time of application for service, payment of fees and approval of the water and/or wastewater service application. The Water Division does not guarantee a specific water pressure or flow at any meter or fire hydrant. This approval is valid for a period of one year.

_____ _____

(Signature) (Date)

Water Only:

CITY OF HAGERSTOWN UTILITIES DEPARTMENT – WATER DIVISION

This approval is for the design and layout of the proposed water system improvements. All water system improvements shall be constructed to the standards in effect at the time of construction. This approval does not guarantee availability of water service. Water service is available subject to conformance with all policies and standards in effect at the time of application for service, payment of fees and approval of the water service application. The Water Division does not guarantee a specific water pressure or flow at any meter or fire hydrant. This approval is valid for a period of one year.

_____ _____

(Signature) (Date)

OWNER/DEVLOPERS: SEWER CAPACITY LIMITATION

The allocation of sewer capacity to provide sewer service for lot(s) shown hereon is subject to the Sewer Capacity Allocation Program (SCAP) which establishes provisions for the specific allocation of a maximum number of gallons per year for all properties to be served by the by the Hagerstown Wastewater Treatment Plant. Approval of this preliminary plat/site plan is subject to available sewer capacity permits. The approval of a specific number of gallons of required sewer allocation for commercial subdivisions/infill or redevelopment expansions will require verification of the proposed need and/or documentation relative to comparable use. The approval of this plat/site plan is not a guarantee of sewer service, but an indication that the water and wastewater infrastructure plans for the development/site plan have been approved by the City's Utilities Department. Application for wastewater service may be made at final plat/site plan submission. This SCAP limitation may affect the timing of approval of any or all sewer permits.

_____ _____

(Signature) (Date)

Excavation, Trenching, and Restoration

General

Trench excavation shall consist of all excavation involved in the grading and construction of the water or wastewater pipelines as shown on site improvement plans. The Contractor shall perform all excavation of every description and of whatever substances encountered, to depths indicated on the Improvement Plans or as otherwise specified or required. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the Department, the pipe or duct can be safely and properly installed and backfill can be properly compacted in such tunnel sections.

If blasting is necessary, the Contractor shall notify the Department and provide the blasting schedule and procedures, and obtain a blasting permit. All reasonable precautions in protecting life and property shall be observed. Trench excavation should only be conducted after pipe and other necessary materials are delivered to the work site.

Holes and depressions for bells or couplings shall be excavated after the trench bottom has been graded and embedment material placed, and shall be only of such length, depth, and width as required for properly making the particular type of joint. Over excavations shall be backfilled with the same material as the bedding zone.

The trench bottom shall be of even grade such that it will provide uniform bearing and support for each section of pipe and shall be free of clods, rocks, and excess spoil material. Grades shall be transferred from ground surface to the bottom of the trench by experienced workers using not less than three (3) consecutive grade points in common so that variations from a straight grade can be readily detected.

a. All excavation required will be unclassified as to character of materials, under various depth classifications and shall include and cover all materials encountered in the excavation whether dry or wet and regardless of the character of the material.

b. The contractor shall excavate, protect, refill, repave, and return to its original condition all excavations that may be necessary for completion of the work.

c. Excavation shall normally be open cut. Trenches may be in general, excavated and refilled either by machinery or by hand as the contractor may elect. **Should tunneling, directional drilling or other equivalent methods be utilized, test pits are required.**

Trench Width

The width of unsheathed trenches should not be greater than sixteen (16) inches plus the exterior diameter of the pipe barrel, nor less than six (6) inches plus the exterior pipe diameter. Where shoring is required, the width of trench shall be increased only sufficiently to accommodate the sheeting or shoring. Whenever the maximum allowable trench width is exceeded for any reason, the Contractor shall pay particular attention upon backfilling to achieve optimum consolidation.

a. Trenches shall be excavated to the necessary width and depth as shown on the trench and refill detail sheets. **{See DETAILS W1, W2, and WW101}**

b. Trenches shall be excavated so as to provide a uniform bearing and support for the pipe, fittings and appurtenances, on solid and undisturbed ground at the specified grade. Any part of the trench which may be excavated below the specified grade shall be corrected with aggregate

[Graded aggregate base (GAB), crusher run (CR-6), MD 57, or B10 Stone], or approved equal material and compacted by tamping or compactor to the satisfaction of the Department.

Trench Depth

Unless specifically authorized by the Department Engineer, trench depth shall always allow a (42") minimum cover over all water mains and (48") minimum cover for wastewater mains.

Maximum Length of Open Trench

No greater length of trench in any location shall be left open, in advance of the completed structure placed therein, than shall be authorized or directed. The Department shall be empowered, at any time, to require the backfilling of open trenches over completed pipelines or structures if, in it's judgment, such action is necessary, and the Contractor shall thereby have no claim for extra compensation even though to accomplish this backfilling he or she is compelled temporarily to stop excavation or other work at any place.

Unless otherwise specified or directed by the Department, the maximum length of open trench shall be one (1) block, four-hundred (400) feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is shorter. The distance is the collective length of any location, including open excavation, pipe laying and appurtenant construction and backfill, that has not been temporarily resurfaced. Failure by the Contractor to comply with the limitations specified herein may result in an order to halt progress of the Work until compliance has been achieved.

If work is stopped on any trench, for any reasons except by order of the Department, and the excavation is left open for an unreasonable length of time in advance of construction, the Contractor shall, if so directed, backfill such trench at their own cost, and shall not again open this trench until he or she is ready to complete the structure therein. If the Contractor shall refuse or fail to backfill such trench completely within 48 hours after said notice, the Department shall be authorized to do the work, and the Department shall charge the expense thereof to the Contractor, and retain the same out of any monies retained by bonding or to become due him under the contract.

The excavation of all trenches, except those for water house connections, shall be fully completed at least 25 feet in advance of pipe laying, unless otherwise authorized.

No trenches shall remain open overnight unless covered by steel plates capable of sustaining expected wheel loads. Safety fence and/or barriers shall be placed along side all open trenches and maintained to provide traffic and pedestrian safety at all times

Unsuitable Material on Bottom of Trench

Where, in the opinion of the Department, the bottom of the excavation will not afford the pipe a firm and uniform bearing because of rock, hardpan, shale, or any other material which cannot be readily excavated, the Contractor shall excavate a minimum of six (6) inches below the bottom surface grade of the pipe, refill the trench with pipe embedment material specified herein, and consolidate and reshape the trench bottom to the required section and grade.

Where the material at the bottom of the excavation is of soft, plastic, or unstable material, or is otherwise considered unsuitable for the support of the pipe, the Contractor shall over excavate to an additional depth as required by the Department Engineer. Backfill to the required grade with 1-1/2 inch crushed drain rock (or approved equal) wrapped in geotextile filter fabric, with twelve (12) inch overlaps, to afford the pipe a firm and uniform bearing. The Contractor shall consolidate and reshape trench to required section and grade.

Over Excavation or Inaccurate Trimming

Wherever, due to over excavation or inaccurate trimming caused by carelessness in operation of the Contractor's equipment or workers or other reasons, the contractor will be responsible for correcting the over excavation.

Pipe Embedment

Pipe embedment material shall be free of vegetable matter and other deleterious substances and shall be of such nature that it can be compacted to form a firm, stable base. Pipe embedment material shall be Class I or Class II material per ASTM D2321 with a minimum of 95% Proctor density. Angular embedment material shall be no larger than 0.75 inches and rounded rock shall be no larger than 1.50 inches. Also, the maximum particle size should be no greater than 10% of the pipe's diameter. Aggregates shall conform to the grading and quality requirements of Section 901-aggregates of the MDSHA standards and specifications for construction and materials. Typically, dirty crusher run (DCR-6) is utilized as the aggregate material.

Bedding and Backfill

a. Outside of Traffic Area **{See DETAILS W2 and WW101}**

1) The main pipe, fittings and appurtenances shall be bedded by hand, or approved mechanical method, from 6 inches below the pipe to 24 inches above the pipe with aggregates as defined above or approved equal. Bedding material shall be deposited in the trench for its full width of each side of the pipe, fitting or appurtenance. Bedding shall be placed in layers not to exceed twelve (12) inches and compacted by tamping or vibrating compactor to 95% Proctor density.

2) From 24 inches above the pipe to the final grade, excavated trench material containing stones no greater than 6 inches in diameter may be used as backfill material, unless otherwise specified.

b. Within Traffic Area **{See DETAILS W1 and WW101}**

1) The main pipe, fittings and appurtenances shall be bedded from 6 inches below the pipe to the spring line of the pipe with approved aggregates as defined above in Pipe Embedment paragraph. Bedding material shall be deposited in the trench for its full width of each side of the pipe, fitting or appurtenance.

2) When pipe is constructed within the road, street, driveway or parking lot, granular backfill in the form of aggregates as defined above is required for the full depth of backfill. Backfill shall be placed in layers not to exceed twelve (12) inches and compacted by tamping or vibrating compactor to 95% Proctor density.

3) Granular backfill is also required for the full depth of backfill where the trench is outside of the pavement but the nearest trench wall is within 5 feet of the edge of pavement.

4) Pipe trenches shall be restored upon completion of pipe line or appurtenance installation. When necessary, trenches may be restored temporarily with cold patch asphalt. When weather permits, temporary patches must be restored permanently within 7 days. Restoration scheduling and completion shall be in accordance with the City Engineering office.

Warning tape shall be installed during the back fill process. For Water pipelines the warning tape shall be installed one (1) foot above the pipeline. For Wastewater pipelines the warning tape shall be placed two (2) feet above the pipeline.

Restoration

All removed, damaged, demolished or otherwise disturbed site improvements shall be restored to as good or better condition than existed prior to construction unless otherwise indicated on the plans.

Traffic, Roads, and Drainage

All street work, traffic control, and stormwater management shall be in accordance with the requirements of the City's Department of Engineering which is cognizant on these issues.

During progress of work, sidewalks and crossings shall be kept open for the passage of pedestrians unless otherwise authorized.

Roads and private entrances shall not be unnecessarily obstructed, and unless the Department shall authorize the complete closing of a road, the Contractor shall take such measures, at their expense, to keep the road open for traffic.

All sidewalks, roadways and private property shall be kept clear of excessive dust, dirt, mud or other excavated material. The Department shall be empowered to require the cleaning and/or repairing of any area, if in it's judgment such action is necessary for the safety and accommodation of traffic and the public.

It will be the Contractor's responsibility to supply his own traffic control as required by the particular location and/or jurisdiction.

Drainage and Pumping

Dewatering for the installation of structures and pipelines shall commence when groundwater is first encountered and shall be continuous until the excavation is backfilled. Soil erosion and sediment controls shall be used at all times.

Cutters and drains shall be kept open at all times for surface drainage and the Contractor shall be responsible for all diversion of drainage flows.

The Contractor shall keep all excavation free from water at their own expense while work is in progress. He or she shall dispose of water removed in such a manner as not to cause injury to public health, to public and private property and any impediment to the use of streets by the public.

Removal of Pavement

Before excavation of any portion of the trench in paved areas, the Contractor shall cut through the paving to the underside of the base at both edges of the trench in such a manner that paving within the area of the trench shall be completely separated from the adjoining paving.

The Contractor shall remove paving for such width only as is necessary for the excavation of the trench, and in the event he or she removes the paving for a greater width than is deemed necessary, or in case he or she removes or disturbs any paving on account of settlement, slides, cave-ins or through movement of equipment, the Contractor shall make repairs.

Equipment

See Maryland State Highway Administration Permit and/or Washington County Roads Permit or City of Hagerstown Roads Permit whichever shall be applicable.

Easements

Easements shall be avoided where a reasonable alternate solution exists. Unless there are physical limitations, wastewater and water pipelines should be installed within the public street right-of-way. When easements are required, there shall be careful consideration of how the pipeline is to be maintained and/or replaced, if necessary.

All manholes and valves within easements shall be accessible by conventional maintenance vehicles traveling over paved roads or driveways unless otherwise approved. Thus, manholes and valves within private property are discouraged and subject to special approval by the Department Engineer. Service laterals should not be connected to a main line within an easement unless specifically approved by the Department Engineer.

Easements and Dedication

There shall be a utility easement of 20 feet width minimum provided for all proposed water and wastewater pipelines. Wider easements may be required for larger pipe sizes than 18 inch.

Easements through proposed subdivisions for future possible water and/or wastewater service to adjacent property shall be dedicated with the subdivision as required by the Department.

Obstructions within Easements

Structures and permanent improvements are generally not allowed in utilities easements. The Improvement Plans should clearly indicate any known buildings, block walls, streetlights, trees, or other obstructions within a proposed easement. Such items are contrary to Department policy and require special approval from the Department Engineer.

Pipe Location in Easement

Pipelines shall generally be placed in the center of easements and only in unusual circumstances shall a pipeline be approved which is closer than five (5) feet from the easement edge. Unless specifically otherwise approved by the Department Engineer, the line shall be straight without horizontal bends or deflections.

Easement Location

The full easement width shall be on one lot or property in such manner that walls, trees, or permanent improvements will not obstruct access to Department facilities. Where this requirement cannot be met without interfering with existing buildings, easements may straddle lot lines providing approval is received from the Department Engineer and the wastewater or water pipeline is not located on the lot lines.

Separation of Water and Wastewater Mains (Parallel)

1) Under normal conditions water mains shall be laid at least 10 feet horizontally from a wastewater or wastewater manhole. The distance shall be measured edge-to-edge.

2) Under unusual conditions when local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a wastewater line or wastewater manhole provided that:

a) The bottom of the water main shall be at least 18 inches above the top (crown) of the wastewater main.

b) Where this vertical separation cannot be obtained, the wastewater line shall be sleeved with Class 52, ductile iron water pipe, pressure tested in place without leakage prior to backfilling.

c) The wastewater manhole shall be of watertight construction and vacuum tested in place.

d) The length of the water main pipe sections shall be centered at the point of crossing so that the joints shall be equidistant and as far as possible from the wastewater main.

Crossings

Under normal conditions, water mains crossing wastewater mains shall be laid to provide a separation of at least 18 inches between the bottom of the water line and the top of wastewater mains whenever possible.

Under unusual conditions when local conditions prevent a vertical separation of 18 inches, the following construction shall be used:

a) Wastewater mains passing over or under water mains shall be sleeved with Ductile Iron, Steel, or PVC sleeves with boots on the ends.

b) Water mains passing under wastewater mains shall be protected by providing:

- A vertical separation of at least 18 inches between the bottom of the wastewater main and the top of the water main.

- Adequate structural support for the wastewater pipelines to prevent excessive deflection of the joints and the settling on and breaking of the waterline.

Additionally, No water pipeline shall pass through or come in contact with any part of a wastewater manhole.

Separation from other Utilities

A two (2) foot horizontal separation from the outside of water/wastewater pipes and the most outside surface of any storm sewer, gas, electric, street lights or telephone line is required and none of these other utilities should lay directly below or above any extent of the water or wastewater pipeline except for crossings where a (1) foot vertical separation is required.

For a storm sewer crossing, a minimum separation of 12 inches measured from edge to edge shall be provided and the wastewater main should be encased.

Where the wastewater pipeline is installed parallel to a storm drainage structure, there should be at least 5 feet horizontally between them.

Other General Information

Structures on Water or Wastewater Pipelines

Structures shall not be located above water or wastewater pipelines or within their associated easements.

Tracer Wire

All plastic piping shall be installed with a continuous, insulated, solid #8 gauge copper wire for locating purposes by means of an electronic line tracer.

The wire insulation shall be solid color, number 8 gauge UF (Underground Feeder per National Electric Code Article 339) solid tracer wire must be taped along all pipes. Sections of wire shall be spliced together using connectors or other approved method UL listed to 486D for use with direct burial. Twisting the wires together is not acceptable.

Tracer Wire Continuity Test

Prior to connection to existing mains and final paving, the contractor is required to conduct continuity testing of all tracer wire installed on plastic pipelines (PVC, HPDE). Tests can be conducted using either applied resistance or voltage. All testing is to be conducted in the presence of a Department Inspector. If the wire is broken, the Contractor shall repair or replace it.

Thrust Blocks and Joint Restraints

Thrust blocks and joint restraint (Megalugs/field lock gaskets) or approved equal shall be used in conjunction with all mechanical joint bends and fittings in all new pressure pipeline installations. Thrust blocks may be eliminated if restrained pipe joints have been engineered. Engineering calculations, if required, must be submitted with construction drawings. However, in general, all pipelines over 10" in diameter always require both thrust blocks and joint restraint.

SECTION 2
WATER DIVISION

Introduction

Responsibility of the Designer regarding Water Mains

This chapter addresses the selection and use of design criteria and practices applicable to the design of water system projects in the Departments jurisdiction (Includes the City of Hagerstown and joint service areas (JSA) within Washington County). The subject matter discussed includes the layout of piping systems, selection and employment of pipeline materials and the use of appurtenances. While the requirements described for the various aspects of design will include and cover the majority of conditions encountered, there is no intention to relieve the Designer of responsibility to recognize when conditions are not favorable for the application of standards. The Designer must be continually alert to conditions that cannot be satisfied by the application of these standard criteria.

Limitation of Topics Presented in this Section

It is not possible to include in this manual all features of design and drafting, which are necessary to accomplish the development of construction documents for all projects. The topics addressed are limited to those that will help the Designer perform most engineering tasks in an efficient manner and comply with Department practice. Although it is the Designer's responsibility to exercise professional judgment in the acceptance or use of the standards or features of design included herein, the Designer shall recognize that they are given to assist in the development of the project in the manner preferred by the department. Deviations from the design standards must be brought to the attention of the Department. Waivers of the design manual must be justified to the Department, in writing, from an engineering evaluation, which includes consideration of life cycle costs and maintenance requirements. Approval or denial of the waiver requests will be by return letter signed by the Department.

WATER MAIN DESIGN CRITERIA

General

The sizing of major components of the department water supply system such as transmission mains, major distribution mains, storage facilities and booster pumping facilities are generally the responsibility of the Designer with supervision and approval by the Department. The Master Plan generally shows the major existing and planned supply system components. The Designer shall be familiar with and design in accordance with the Master Plan. Generally, the Designer will be selecting distribution mains of 12-inch diameter and smaller and often will be required to provide the minimum size mains meeting the design criteria to meet pressure and flow demands.

The water design criteria presented herein shall apply to Developer Projects as well as City funded Capital Projects within the Departments jurisdiction.

The hydraulic design of water mains shall be in accordance with Pipeline Design for Water and Wastewater, ASCE, 1975, or latest edition thereof, and the additional guidelines and criteria in this document as well as applicable AWWA standards. For hydraulic computations required, the design professional shall first submit the design flows for the site to the Department. The Department will then supply the design professional with the residual pressure(s) or elevation(s) at a point(s) on the City's distribution system nearest the proposed site. The design professional will use this elevation to begin the hydraulic design of any distribution main extensions and onsite service connections.

All water pipe, fittings, gate valves, fire hydrants, blow-offs and other appurtenances shall be installed in accordance with the requirements of the American Water Works Association (AWWA), these Construction Standards, and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times

Pre-Design Meeting

Prior to commencing any work, the Designer is encouraged to schedule a pre-design meeting with the department, or other appropriate agency, to discuss any topics that are particularly important in the development of the Engineering Report and subsequent design of the project. Pertinent topics may include any of the following:

1. Sizing of major water supply components
2. Development of population projections and water demand
3. Applicable plumbing codes
4. Route selection and location of the pipe in the public right-of-way
5. Interaction with, and crossings of, other known utilities, particularly if those utilities employ cathodic protection systems
6. Methods of crossing roads, railroads, and streams
7. Pipe materials and appurtenances
8. Pipe access
9. Future extensions
10. Identification of any storage facilities in the network to be affected by the project
11. Requirement for new or upgrading of existing telemetry systems
12. Approved materials and appurtenances.

For Developer Projects which require minor extensions of the public water systems, the pre-design meeting may take the form of a preliminary water plan showing the general layout of the utilities in relation to the proposed development. The plans shall be accompanied by a letter report, which shall include general information about the project, design criteria used, alternatives investigated and the cost estimates for all alternatives. The plans are to be submitted after the concept plan for the development has been approved by the City of Hagerstown planning department.

Information regarding the City of Hagerstown Planning Department and Planning Commission can be found at http://www.hagerstownmd.org or by email at planning@hagerstownmd.org

Engineer's Report for Water Systems

1. Requests for extensions of water mains shall be accompanied by an engineer's report, which shall present the following information as applicable:

a. A description of the nature and extent of the area to be served. Water mains should be designed to serve the entire service area of which the subdivision or development is a part.

b. An appraisal of the future requirements for service, including existing and potential connections, provisions for extending the system to include additional area. The engineer should take into consideration flow rates that may be derived for different zoning and land use classification that exists or could exist in the area of development.

c. Present and estimated future water consumption values should be used as the basis of design.

d. Alternate plans - Where two or more solutions exist for providing public water supply facilities, and each is feasible and practicable, the report shall discuss the alternate plans and give reasons for selecting the one recommended.

e. Current flow and pressure data shall be presented and utilized for design.

f. Water modeling shall be required when mains are not looped, when the fire flow test(s) indicate an insufficient "available flow", and for all proposed waterline extensions to serve residential subdivisions, or at the request of the Department.

Water Main Sizing

Water mains shall be sized using the Hazen-Williams or Darcy-Weisbach formula. The design criteria to be used to determine the sizes of the mains in the distribution system shall be the values for the following parameters:

1. Design water demand.
2. Pipe friction factor of pipe material.
3. Maximum velocity.
4. Minimum and maximum residual pressure in the main.

Each water main reach shall be sized to provide sufficient flow and pressure to meet at all times domestic, commercial demand, and fire flow. Water mains designed to serve future development shall also include capacity for future demands. Capacity for future demands shall be as determined by the Department Engineer in accordance with the Water Master Plan.

Table 3-5
System Design and Model Calibration Criteria

Criteria	Value
Minimum Pressure under ADD, MDD, and Peak Hour conditions	40 psi
Minimum Pressure under fire flow conditions	20 psi
Maximum Pressure	150 psi
Minimum Commercial Fire Flow and Duration	3,000 gpm for 3 hrs.
Minimum Residential Fire Flow and Duration	1,500 gpm for 3 hrs.
Maximum Velocity	10 fps
Maximum Headloss under MDD conditions	2 ft./1000 ft.
Difference between field-measured and predicted hydraulic grade	± 10 ft.
Difference between field-measured and predicted static pressure in fire flow tests	± 10 psi
Difference between field-measured and predicted AFF	± 20%

Figure 1. Water main system design criteria from the Water Master Plan.

Design Flows and Pressures

Service connections, distribution mains and transmission mains shall be sized in accordance with the City's Water Master Plan.

Design Water Demand

Water demand for the development shall be based on the maximum daily demand. Each pipe main reach shall be sized to supply maximum daily water demand of all the service connections being served by the reach based on the Water Master Plan criteria.

Fire Flow Requirements

Fire flow requirements for the water distribution system shall be set forth by the department using recommendations from state and local fire marshals. For preliminary designs, fire flow requirement shall be in accordance with the Water Master Plan. Industrial and medium-to-large commercial developments shall require special evaluation on a case-by-case basis by fire department personnel using procedures as outlined in the Insurance Services Office publication, "Fire Suppression Rating Schedule," Edition 6-80.

Pipe Friction Factor

There are many factors and conditions affecting pipe friction factors and much research has been conducted to determine the amount of friction losses in pipe. Pipe friction factors vary over a wide range and designers and engineers will select different values based on individual judgment of the design conditions. For uniformity of design in the Department, the values to be used in the calculation for the pipe friction factor are the following:

Pipe Formula	**Cement Lined Ductile Iron Pipe**
Hazen Williams "C"	120
Absolute Roughness, ft	0.000008

Maximum Velocity

Water mains shall be designed in accordance with the SYSTEM DESIGN CRITERIA section of the Water Master Plan.

Flow and Pressure Data

The Department provides pressure and flow data from it's database and performs pressure and flow tests when absolutely required. The design engineer should provide the area and coordinate with the department to obtain this information.

Minimum Size

Minimum size of water mains shall be eight (8) inches. Upon review and approval, the Department Engineer may allow the use of a 4" main in small cul-de-sacs or dead ends with no fire flow requirements or hydrants. Six inch (6") stubs are allowed for fire hydrants in some cases as well.

Location of Mains and Appurtenances

Water mains and their appurtenances shall be located in areas accessible to Department personnel and maintenance vehicles and equipment for maintenance, repair, and servicing at all times. Mains shall be located within public right-of-way and easements. Water mains shall be located with the required horizontal and vertical separations from wastewater pipelines in conformance with Section 1- (Easements, Separation) of these specifications.

Street Location

Water mains laid in streets shall be located about ten (10) feet from the street centerline and no closer to the face of curb than three (3) feet. In any case, mains shall be located so that excavation and repair of the main or its appurtenances will not encroach on private property (unless the main is located within a recorded easement).

Parking strips and Planting Strips

Designer shall minimize the water main and service connections in parking and planting strips which are typically located between the curb and sidewalk.

Meter Placement {See DETAIL G001}

Meters should not be placed in or within 3 feet of driveways areas. Traffic load bearing frames and covers shall be utilized if no alternative is available.

Hydrant Placement {See DETAIL W005}

Generally, hydrants shall be located to provide adequate fire flow to all structures and areas in the development and at the dead end of each main. The local Fire Authority has ultimate responsibility for the location of hydrant placement on commercial or private property where no easement exists. Hydrants shall be located at minimum every five hundred (500) feet.

Hydrants should be installed near the street curb (18” from face of curb), and shall be accessible to fire trucks, and protected from traffic. For open section streets the hydrants should be located in an accessible location beyond the ditch lines and in an access easement (if required). Hydrants should be located four (4) feet or more from a utility pole, traffic control box, or fixed object or structure.

Depth and Minimum Cover {See DETAILS W001 and W002}

Water mains installed below ground shall be provided with a minimum 3.5 foot (3’-6”) minimum cover.

Looping

Looping of water mains provides a grid layout or network of piping that provides increased reliability of a water supply system. Looping allows reaches to be supplied from each end of the reach, allows confining loss of service due to pipe breaks to small sections by valving, and allows repair and expansion of the system with minimum service disruption to customers. At loop connections, tee or cross fittings shall be used and valves installed at the main or branches. Cross fittings shall have four (4) valves; tee fittings shall have (3) three valves. Water mains should be interconnected or loop-connected so that as a guideline no reach exceeds the following length:

Pipe Size	**Maximum Unconnected Reach**	
	Residential Area	**Commercial Area**
8-10 inch	1,200 feet	800 feet
12 inch and larger	1,500 feet or as required by Water Master Plan	1,200 feet

Horizontal and Vertical Curves

In curved streets, the main shall follow the street curvature, and the alignment shall be planned to minimize crossing the street centerline. In general, horizontal and vertical curves shall be formed by deflecting the joints, or by the use of fittings. **Transitions shall be designed in the most gradual and flow efficient manner possible.**

Curves for Ductile Iron Pipe

The allowable joint deflection for a ductile iron pipe joint to make a curve alignment shall be in accordance with **DETAIL W003**.

Valving

Valves are located in the distribution system to facilitate repair, maintenance, servicing, and extension of the system. Valves are also used to isolate sections where serious leakage or line breakage may occur that may cause property damage and loss of a large volume of water, if not repaired promptly.

Valves shall be located on all branches of the transmission mains, so that each distribution loop can be isolated.

In addition, on long distribution mains, valves should be installed at a minimum of one per thousand (1,000) feet of pipeline.

All taps to existing mains shall be provided with tapping valves and shall only be made by the department.

Each fire hydrant shall be provided with an isolating valve.

All valve boxes are to be raised to grade prior to final paving.

Combination Air Release and Vacuum Relief Valves

The water distribution system shall be designed to minimize high points where air can accumulate. All high points in the distribution system shall be provided with combination air release and vacuum relief valves. The air release valves shall not allow the accumulation of entrapped air at the high point, which will restrict water flow. The vacuum valves shall allow air to enter the pipe and prevent its potential collapse due to the formation of a vacuum condition caused by rapid withdrawal of water. Typical small distribution mains (4" to 12") should have the typical 2-inch combination air-vacuum valves. Larger water main pipelines should have valves which are engineered and sized to compensate for the size of pipe and the length of run.

Vent lines from air release and vacuum relief valves shall be the same size as the valve outlet and shall run from valve to discharge without traps. The vent line shall be as short as possible and with not more than four (4) elbows. The vent shall terminate with the opening covered by a stainless steel bug screen. The base of the vent shall be provided with concrete buttress for stability.

The need for the installation of air relief valves should be minimized. Generally, a pre cast concrete enclosure or equivalent shall be provided to house the valving components.

{See DETAIL W015}

Blowoff Valves

Blowoffs should be installed at low points and dead ends. Blowoffs shall be designed to empty sections of the main to periodically remove silt and to repair or maintain appurtenances that cannot be serviced under pressure. Blowoff sizing shall be as follows:

Pipe Size	Blowoff Size
8-24 inch pipe	2-inch blowoff

Note: For pipelines larger than 24-inch, blowoff shall be designed by an engineer to allow for proper velocity and flow.

Blowoffs should also be provided at all temporary dead end terminations for phased construction of water pipelines.

{See DETAIL W006}

Backflow Prevention

Backflow prevention devices shall be installed in the branch or service line supplying water to residential, commercial, or institutional customers where a potential exists for back-siphonage of water into the distribution main. Backflow preventers shall be installed downstream of the customers water meter. Backflow preventers shall be installed for all commercial services.

Backflow prevention is required by Maryland State Code as well as the Hagerstown Plumbing Code and care should be taken to meet all applicable regulations.

Connections to Existing Water Mains

The minimum water service line shall be one 1 inch for residential developments (1" for double meter connections). The service for homes requiring residential fire service shall be one (1) inch minimum, or as required by the local Fire Authority. Service connections, up to two (2) inches on existing mains shall be made by wet taps using service saddles.

Each service connection shall have a corporation stop.

Wet tapping shall be made with a tapping sleeve when the branch is greater than two (2) inches. The tapping sleeve shall be provided with a tapping valve.

Tapping of mains shall be made by the Department using materials and equipment especially designed for tapping water mains for water supply. All taps for mains shall be provided with thrust blocking and joint restraint as specified herein.

Fire Lines

All commercial fire lines shall have an accessible and clearly marked valve at the main and an approved fire and domestic combo meter or under some circumstances a double detector check. The detector meter shall be supplied with a radio read. Dedicated fire lines shall be provided for buildings and establishments as required by the local Fire Authority and be separated from the domestic line within the vault.

Meters and Vaults **{See DETAILS W016 - W019}**

A vault sheet shall be completed and submitted for all water vaults.

All piping within the vault shall have flanged joints. A mechanical coupling or mechanical joint solid sleeve shall be included in the vault piping, for the removal of the valve, pipe and fittings within the vault. A mechanical coupling requires special pipe restraints. A mechanical joint solid sleeve requires the joints to be restrained, using Megalugs or retainer glands. The Designer shall determine the appropriate form of restraint based on the pressure rating requirements for each type of restraining joint and the vault detail.

Standard Vault Details are provided for meter installations for 4" and greater meter installations. The inside dimension of the vaults shall be determined by the dimensions of the piping assembly (valves, pipes and fittings) that is required in the vault. The vaults for valves larger than 24-inches shall be designed as poured in place concrete vaults, giving the option to the owner to provide pre-cast vaults. On the profile, the Designer must determine the invert of the pipeline using the design depth shown on the details for the valve vaults. The valve shall be restrained in the closed position.

Thrust Blocks and Joint Restraints

Thrust blocks and Mechanical Joint Restraints (Megalug) or Field Lock gaskets shall be provided for all of the following features: unrestrained bends, tees, crosses, reducers, dead ends, fire hydrants, joints near and in casings, as well as where pipe changes in directions of more than 11-1/4 degrees occurring on any plane, and where indicated on the Improvement Plans or as required by the Department Engineer. Generally, restraint is required for all joints in the first 20' of pipe line from the feature.

Thrust blocks shall be designed to resist the thrust reaction forces at the bends or fittings whose magnitude will depend on the pipe diameter and internal pressures, and allowance for water hammer. Thrust blocks shall be designed to transfer and distribute the thrust forces to the undisturbed soil surface. Surface bearing capacity of soil shall be as determined and recommended by a soil investigation or report. In the absence of a soil investigation or report, the soil bearing capacity shall be as determined by the Department Engineer. Thrust blocks shall be designed with a minimum factor of safety of 1.25, and shall be provided in accordance with the Standard **DETAILS W009 though W014**.

In addition to thrust blocks, restrained joints, tie rods, or other methods of anchoring the pipes may be provided, and such alternate methods shall be subject to the approval of the Department Engineer. If used, all tie rods shall be stainless steel.

WATER SYSTEM MATERIALS

General

All pipe, fittings, valves, hydrants, and other related materials used in the construction of additions to the water distribution system must comply fully with the specifications and requirements of the Department. All water line installations shall be new and unused pipe, pipe fittings and valves of the size, type and character outlined in the following specifications. ALL materials shall have been manufactured within the previous year and have invoices to show the purchase and purchase date etc.

All products used in the water distribution system must comply with the requirements of NSF/ANSI 61 and applicable AWWA standards.

Whenever proprietary equipment is specified "or approved equal" is implied. All proposals for substitution shall be submitted in writing to the Department for approval.

Materials listed in these standards and specifications represent the absolute minimum requirements acceptable for the use by the Department. Specifically, the Department has reviewed and consulted the appropriate standards writing agency with a view to determine what materials most suit the specific design criteria, maintenance needs, and cost requirements.

All pipe, fittings, and other related materials used in the construction of pipelines shall be in full compliance with the written specifications and details of the Department's latest modifications or revisions.

Where a manufacturers' name is used in these specifications, it is used to designate a minimum standard of quality based on the specific design characteristics of the manufacturer specified, not limited to, but including, material quality, flow characteristics, interchangeability, design features, inventory, warranty, maintenance costs, and service.

Equality evaluation shall be determined not solely on whether a product is capable of doing an adequate job, but rather if a product will perform the specific job specified, as well as meeting the additional specific requirements set forth herein.

The Department will determine whether a product shall be approved as an equal and shall have final approval.

Any product not specified in the latest modifications or revisions of the Departments written specifications and details, must have approval before shipment to projects within the Departments jurisdiction.

Representative samples of materials, intended for the incorporation in the specifications of the Department, may be required to be submitted for examination, and/or test.

A written point-by-point detailed comparison to material currently specified shall be submitted with any points of exceptions noted.

Written warranties, along with certifications of material compliances, shall be required for all materials submitted for review.

No set time limits shall be given for material review, however the Department will strive to provide timely reviews.

Any product shipped to projects without prior approval shall be deemed unresponsive to the Departments authority, and shall be removed and replaced by approved materials at no cost to the Department. Furthermore, any product shipped without prior written approval, shall be rejected.

Pipe

Pipe shall be ductile iron Class 52 (CL 52), centrifugally cast in 18 or 20 foot nominal lengths, conforming to ASA A21.5I-1965 (AWWA C151) and shall be Griffin, Atlantic States or approved equal.

Push-on joints shall conform to ASA A21.11-1964 (AWWA C-111) titled "American Standard for Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings," complete with bolts, nuts, glands, and plain rubber gaskets. All pipe shall be double thickness cement-mortar lined in accordance with ASA A21.4-1964 (AWWA C104-64) titled "American Standard for Cement-Mortar Lining for Cast-Iron Pipe and Fittings for Water," with an approved bituminous coating inside and outside.

All pipe 2" and smaller shall be type "k" soft copper (ASTM B88).

Pipe Fittings

All fittings 4" through 12" shall be Class 350 Short Body mechanical joint ductile iron produced in strict accordance with all applicable terms and provisions of ANSI/AWWA C153/A21.53 and ANSI/AWWA C111/A21.II. Fittings shall be Tyler/Union (Domestic), InFact corp. Foster Adapter or approved equal.

All fittings greater than 12" shall be mechanical joint ductile iron Class 250 produced in strict accordance with ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11.

All fittings 4" and larger shall be complete with bolts, nuts , glands, and plain rubber gaskets, and shall be cement-mortar lined in accordance with ASA A-21.4-1964 (AWWA C104-64) titled "American Standard for Cement- Mortar Lining for Cast-Iron Pipe and Fittings for Water," with an approved bituminous coating inside and outside.

All fittings 2" and smaller shall be brass standard 125 Class and in accordance with ASTM B62 and also conforming to ANSI/AWWA C800 for type “K” soft copper.

All compression adaptors (2-part couplings) for 2" and smaller shall be Ford, Mueller or approved equal. All 3-part couplings used to join sections of copper pipe shall be Ford, Mueller or approved equal.

Push-On Restrained Joints

Push on restrained joint gaskets shall have a minimum rating pressure of 350 PSI for pipe sizes under 24” in diameter (250 PSI for larger sizes) and shall be in accordance with AWWA C151. They shall be FIELD LOK 350® or approved equal. Restrainted Joints shall be Snap-lok or approved equal

Gate Valves

Gate Vales shall be resilient wedge valves, 250 PSI. They shall conform to ANSI/AWWA C509 specifications. The valve interior shall be epoxy coated on all surfaces. Valves shall be manufactured by American Flow Control, or approved equal. Valves shall Open Right.

Roadway Valve Boxes

All roadway valves boxes shall be heavy duty cast iron, screw extension type complete with cover. The word "WATER" shall be cast on the cover. The box shall be of such length as will be adapted, without full extension, to the proper finished street grade. All boxes shall be Bingham and Taylor, Tyler-Union (domestic) or approved equal.

Combination Air Release and Air/Vacuum Relief Valves

The air and vacuum combination valves shall be manufactured and tested in accordance with American Water Works Association Standard (AWWA) C512. When requested, the manufacturer shall provide test certificates, dimensional drawings, parts list drawings, and operation and maintenance manuals. The manufacturer of shall demonstrate a minimum of five (5) years experience in the manufacture of air valves.

The valve body shall be threaded with NPT inlets and outlets. The body inlet connection shall be hexagonal for a wrench connection. The valve shall have two additional NPT connections for the addition of gauges, testing, and draining. The cover shall be bolted to the valve body and sealed with a flat gasket. Resilient seats shall be replaceable and provide drop tight shut off to the full valve pressure rating. Floats shall be unconditionally guaranteed against failure including pressure surges. Mechanical linkage shall provide sufficient mechanical advantage so that the valve will open under full operating pressure. Simple Lever Designs shall consist of a single pivot arm and a resilient orifice button. Compound Lever Designs shall consist of two levers and an adjustable threaded resilient orifice button. The valve body and cover shall be constructed of ASTM A126 Class B cast iron for working pressures up to 300 psig. Higher pressure rated valves shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. The orifice, float and linkage mechanism shall be constructed of Type 316 stainless steel. Non-metallic floats or linkage mechanisms are not acceptable. The orifice button shall be Viton for simple lever valves and Buna-N for compound lever designs. An optional vacuum check on the outlet shall be provided when specified to prevent air from re-entering the system during negative pressure conditions. Optional body materials include ASTM A216 Grade WCB cast steel, ASTM A351 Grade CF8M stainless steel, and ASTM B584 Alloy C83600 cast bronze.

Valves shall be Factory Mutual, and Underwriters Laboratories Listed. Air Release Valves shall be as manufactured by Val-Matic or approved equal.

Tapping Sleeves and Tapping Valves

Note: Tapping is performed exclusively by the Department

Mechanical joint tapping sleeve: shall have mechanical joint end seals (or equal) conforming to AWWA C111, with outlet flange conforming to AWWA C207, class D with ANSI 150 lb. drilling recessed for tapping valve. Stainless steel tapping sleeve shall be 304 stainless steel, outlet flange conforming to AWWA C207 Class D, ANSI 150 lb. drilling recessed for tapping valve. Bolts shall be high strength 18-8 stainless steel with heavy hexagon nuts conforming to

ANSI/AWWA C111 / A21.11. Gasket material shall be grade 30 or approved equal, and shall have a smooth inside taper for uniform seating. Sleeves shall be manufactured by JCM Industries Inc., or approved equal in accordance with ANSI/AWWA C223-07, AWWA Standard for Fabricated Steel and Stainless Steel Tapping Sleeves

Tapping valves shall be resilient wedge valves, 250 PSI. They shall conform to AWAA C-509 specifications. Valves shall have a machined seating service to provide positive sealing with a predictable number of turns. The valve interior shall be epoxy coated on all surfaces. All valves shall open right. All valves shall be M.J. joint unless specified different. All nuts and bolts will be stainless steel ANSI Type 304 on bonnet and packing gland.

Tapping valve shall conform to the same specifications as gate valves herein described, except that one connecting end shall be flanged with recess to match the tapping sleeve. Tapping Valves shall be manufactured by American Flow Control or approved equal.

Fire Hydrants

Fire hydrants shall conform to the requirements to those presently used as standard by the City. They shall have a mechanical joint fitting and shall be open left, and shall be as supplied by American Flow Control (B-84-B). Fire Hydrants (FHs) shall be manufactured in accordance with AWWA Standard C502, UL listed and FM approved. FHs shall be rated for a working pressure of 250 PSI (test pressure 500 PSI). Hydrants shall be warranted by manufacturer against defects in materials and workmanship for a period of not less than 10 years. The manufacturing facility must have current ISO certification.

Hydrants shall be three way type and hose and pumper nozzle and cap shall be Hagerstown Standard **{See DETAIL W004}**.

ALL FIRE HYDRANTS WITHIN A DEVELOPMENT SHALL BE PRODUCED BY THE SAME MANUFACTURER

Warning Tape

Plastic warning tape to be installed in all water line trenches shall be 6 inches wide (or double row of 3” wide for detectable marking tape), blue in color, and black lettering with: "CAUTION - WATER LINE BURIED BELOW".

Corporation Stops and Meter Settings *(provided by the Department)*

All corporation stops along with meter settings (valves, fittings, yokes, etc.) are to be provided directly by the Department.

Vaults

All Vaults shall be A.C. Miller Concrete Products Precast or Semler produced in accordance with the Hagerstown shop drawings or approved equal. No chips, cracks, or other defects are permitted on or in the installed vault. Vaults shall be water tight and have drainage provisions in cases where runoff or ground water intrusion may be problematic.

{See DETAIL W019}

Pipe Restraints

Pipe Joint Restraint Devices of the wedge-action lug-type mechanical joint (MJ) retainer glands and the split, full-circle grip-ring type with High Strength Low Alloy (HSLA) threaded thrust rods and nuts and stainless steel clamping bolts and nuts. Restraint devices shall have a working pressure rating that equals or exceeds the pressure rating of the pipe on which they are used. Restraint glands shall be designed for use with and conform to the applicable requirements of ANSI / AWWA C111. Restraint gland product identification shall have traceability. Restraint glands shall have a minimum safety factor of 2:1. Restraint devices shall accept out of round pipe. Mechanical Joint restraints shall be listed by Underwriters, and have Factory Mutual approval. Specialty tools will not be required for installation. Pipe restraint device shall restrain pipe conforming to the requirements of ANSI/AWWA/C151/A21.51. Ductile Iron Pipe gripping wedges shall be heat treated and hardened to a BHN range of 370-470. Pipe restraint device shall restrain pipe manufactured to AWWA C900 / C905 and have working pressure ratings equal to the pressure rating of the pipe on which they are used. Restraint glands shall conform to the requirements of ASTM 1674. Restraint glands shall be Ford Meter Box Uniflange ™, Ebaa Iron, Megalug ™, Tyler / Union TUFGrip™ Restraint or approved equal.

Polyethylene

Polyethylene shall be Tensile Strength: 3,600-PSI, Elongation: 800%, Dielectric Strength: 800 V/mil thickness, Impact Resistance: 600g min., Tear: 2,550 gf min., Thickness: 0.008 IN. (8 MIL), Color: Black in accordance with ANSI/AWWA C105/A21.5-99

Casing Spacers and End Seals

Casings shall be std gauge steel. Casing spacers shall be coated steel or stainless steel with stainless steel bolts and nuts. End seals shall be the neoprene or rubber type with stainless steel bands.

{See DETAIL W008}

WATER SYSTEMS CONSTRUCTION METHODS

Scope

The Contractor shall furnish all labor, tools and equipment necessary and shall install the pipeline together with fittings and appurtenances at the joints and to the line, grade and elevations shown on the drawings or as designated by the Department and as specified herein.

General Requirements

The interior of the pipe shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. The full length of each section of pipe shall rest solidly upon the pipe bed with recesses excavated to accommodate bells and joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench or weather conditions are unsuitable for the work except by permission of the Department. Water shall be kept out of the trench until the joint has been completed. When work is not in progress open ends of pipe and fittings shall be securely closed so that no trench water or other substance will enter the pipes or fittings. Any section of pipe found to be defective before or after laying shall be replaced with approved pipe without additional expense to the Department.

Transportation and Delivery of Pipe

During loading, transportation, and unloading, every precaution shall be taken to prevent injury to the pipe. Cars, trucks or trailers used for transportation of pipe shall be provided with padded holsters carried to fit the outside of the pipe. Padding, sufficiently thick and stiff to prevent scoring of coating, shall be used under the chains. Pipe shall not be placed directly on rough ground, but shall be supported in an approved manner which will protect the coating against injury whenever stored at trench site or elsewhere. Rolling the pipe on the coated surface will not be permitted, but the pipe may be rolled on sleepers in contact with only the base ends of the pipe.

Laying Pipe

For normal pipe bedding, the bottom of the trench shall be tamped to provide firm bearing for the full length of pipe barrel. A depression shall be dug to accommodate the bell end of pipe.

{See DETAILS W001 and W002}

No pipe or fittings shall be installed until sufficient trench has been completely excavated to assure that no unforeseen obstructions of any kind are likely to be encountered. No pipe or fittings shall be brought into position until the preceding length has been thoroughly bedded and secured in place. The excavation in which pipe is being laid shall be kept free from water and no joint shall be made under water. No pipe shall be installed where the coating or lining shows cracks or other defects. Such cracked coating or lining shall be repaired to the satisfaction of the Department or a new undamaged-pipe shall be installed.

No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when the Department shall deem that there is danger of the formation of ice or the penetration of frost at the bottom of the excavation, unless all required precautions as to the minimum length of

open trench and promptness of refilling are observed.

The pipes and fittings shall be thoroughly cleaned before they are laid and shall be kept clean until the acceptance of the completed work. Each length of pipe or fittings in water mains shall, just before being lowered into the trench, be placed on blocks or other supports.

Each section of pipe shall be accurately laid to the required line and grade and shall have a firm bearing for the full length of the section except at sling holes and at holes for making up field joints. In placing pipe in the trench, the pipe shall be held by one or more slings to balance and shall not be dragged on the bottom of the trench, but shall be supported by the sling or slings while being fitted to the adjoining pipe sections. The pipe shall be securely held in position by partial backfilling between field joints in such manner as not to interfere with the required work at the joints.

The ends of pipe shall abut against each other in such a manner that there shall be no shoulder or unevenness on the inside of the main. Whenever a pipe or fitting requires cutting to fit in the line or to bring it to the required location, the work shall be done in a satisfactory manner without damage to the pipe so as to leave a smooth end. Cutting shall be done by means of an approved type of mechanical cutter. No deflection of joints to effect a change in direction will be allowed, except by permission or direction, or as shown on the drawing. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Any section of pipe found to be defective before or after laying shall be replaced with sound pipe without additional expense to the Department.

When necessary, a short pipe shall be provided to locate fittings in accordance with the contract drawing. When closures must be cut in the field, the work shall be done in a satisfactory manner to provide a smooth end.

Jointing Pipe

All pipes, fittings and valves and joining thereof shall be done by experienced pipe layers, to the satisfaction of the Department.

Rubber seal slip-on type joints (Tyton® and Field Lok®) shall be installed in accordance with the manufacturer's instructions. **{See DETAIL W003 for Joint Details}**

Prior to making up mechanical joints, the bells, spigots and rubber gaskets shall be thoroughly washed with soapy water (if necessary the bells and spigots shall be cleaned first with wire brush). All cast iron glands shall be slid over the spigot, followed by a rubber gasket, thoroughly soaped, with its tapered side facing the bell. The rubber gasket shall be forced into position with the fingers until it is flush with the face of the bell; the gland shall be slid against the face of the rubber gasket and the bolts inserted and made finger tight. Nuts shall be tightened. Bolts shall be drawn up evenly on alternate sides, beginning at the top, keeping the gland parallel to the face of the bell at all times. Extreme care shall be taken to tighten the nuts to the specified tension without over-tightening. Bell hole excavation may be required to allow proper wrench movement.

Restraining Joints

Mechanical Joint Restraints (e.g. Megalug®) or Field Lok® gaskets should be provided for all of the following features: unrestrained bends, tees, crosses, reducers, dead ends, fire

hydrants, joints near and in casings, as well as where pipe changes in directions of more than 11-1/4 degrees occurring on any plane, and where indicated on the Improvement Plans or as required by the Department Engineer. Generally, restraint is required for all joints in the first 20' of pipe line from the feature.

{See DETAIL W009}

Buttresses and Anchorages

Buttresses may be required behind caps, horizontal bends, and branches, and anchorages should be placed beneath all vertical bends. These buttresses and anchorages shall be concrete or concrete and steel as required. They shall extend to solid undisturbed soil and shall be constructed in accordance with the buttress detail sheets attached hereto. Buttresses shall be so placed that the joints will be accessible for repair.

{See DETAILS W010-W014}

Field Welding

All field welding for casings or other applications shall be performed in accordance with the latest accepted standards of good practice of the American Welding Society by operators who are qualified under standard qualification procedures of the American Welding Society.

Setting Roadway Valves Boxes

A valve box shall be carefully placed over the bonnet of each gate valve flush with the top of the finished surface of the street or at such elevation as the plans or Department shall direct. It shall be set plumb. In tamping/compacting the backfill around the box, special care shall be taken as to avoid settlement. Any box which is found out of plumb, not set level to grade, or which is not firmly supported, shall be dug up and reset in a satisfactory manner. All valve boxes are to be raised to grade prior to final paving. Maximum of one, 2" or less, insert for valve box raising. No inserts in new construction.

Vaults

Vaults shall be set plum and level on minimum 6" bedding of clean aggregate. Top slap shall be removable and set 6" above final grade. Contractor shall complete all bore holes and seal penetrations upon completion with epoxy grout. Vaults shall be water tight upon completion.

Air and Vacuum Release Valves

The installation of all air release valves shall be in accordance with the standard detail.

{See DETAIL W015}

Polyethylene Wrapping

When required by the Department Engineer or as shown on the plans and details, metal (ductile iron, valves, fittings, copper, brass, etc.) pipe and appurtenances should be wrapped in 8-mil minimum thickness polyethylene encasement with ends taped off with vinyl pipe wrap tape.

SECTION 3
WASTEWATER DIVISION

Introduction

The purpose of these wastewater standards and specifications is to provide a concise and comprehensive reference for the requirements of the City of Hagerstown regarding any proposed extension of or addition to the existing wastewater collection/ transportation facilities. Specific requirements have been emphasized to answer frequently encountered operations of developers, owners, and engineers. The scope of these standards and specifications is limited to the administration, design, construction, inspection, and testing of any facilities which upon their connection, will ultimately become part of the existing Hagerstown Wastewater System.

Responsibility of the Designer regarding Waste Water Mains

This chapter addresses the selection and use of design criteria and practices applicable to the design of waste water system projects in the Departments jurisdiction. The subject matter discussed includes the layout of piping systems, selection and employment of pipeline materials and the use of appurtenances. While the requirements described for the various aspects of design will include and cover the majority of conditions encountered, there is no intention to relieve the Designer of responsibility to recognize when conditions are not favorable for the application of standards. The Designer must be continually alert to conditions that cannot be satisfied by the application of these standard criteria. In the preparation of the design documents, the Designer shall take into account such matters as environmental impact, maintenance of pedestrian and vehicular traffic, maintenance of existing and proposed utility services, constructability, system maintenance and shall produce the overall most cost-effective design.

Limitation of Topics Presented in this Section

It is not possible to include in this manual all features of design and drafting, which are necessary to accomplish the development of construction documents for all projects. The topics addressed are limited to those that will help the Designer perform most engineering tasks in an efficient manner and comply with Department practice. Although it is the Designer's responsibility to exercise professional judgment in the acceptance or use of the standards or features of design included herein, the Designer shall recognize that they are given to assist in the development of the project in the manner preferred by the department. Deviations from the design standards must be brought to the attention of the Department. Waivers of the design manual must be justified to the Department, in writing, from an engineering evaluation, which includes consideration of life cycle costs and maintenance requirements. Approval or denial of the waiver requests will be by return letter signed by the Department.

WASTEWATER MAIN DESIGN CRITERIA

General

The sizing of major components of the City wastewater collection and conveyance system such as major pumping stations, force mains and interceptor wastewater mains are generally the responsibility of the Design Engineer and the Department. The Master Plan shows the major existing and planned wastewater collection and conveyance system components. The Designer shall be familiar with and design in accordance with the approved Master Plan. The wastewater design criteria presented herein shall apply to both Developer and Capital Projects.

The hydraulic design of wastewater collection systems shall be in accordance with Gravity Sanitary Wastewater Design and Construction, Second Edition (ASCE Manuals and Reports on Engineering Practice No. 60 / WEF Manual of Practice No. FD-5), or latest edition thereof, and the additional guidelines and criteria in this document as well as applicable ASCE/WEF standards. All wastewater pipe, manholes, and other appurtenances shall be installed in accordance with the requirements of the Maryland Department of the Environment (MDE), these Construction Standards, and as recommended by the manufacturer. These Construction Standards and manufacturer's guidelines shall be present at the construction site at all times.

When hydraulic computations are required, the design professional shall first submit the design flows for the site to the Department. The Department will coordinate with the designer on the invert elevations of the nearest connection points to the existing wastewater collection system. The design professional will use this elevation to begin the hydraulic design of any collection main extensions and onsite service connections.

The following minimum requirements are considered acceptable to the City of Hagerstown in the collection of wastewater from residential and nonresidential customers. Deviation from these may be allowed if in accordance with sound engineering standards, and if the deviation will not increase the likelihood of a system failure or impact the level of service provided to existing customers on the City of Hagerstown collection system. When the City of Hagerstown standards differ from state and/or federal regulations, the most stringent requirement shall apply.

All drawings, specifications, and engineer’s reports submitted for approval shall be prepared by or under the supervision of a licensed professional engineer legally qualified to practice in Maryland. The front cover of the engineer's report, each sheet of the drawing set, and each sheet of specifications submitted for review shall bear the signed imprint of the seal of the licensed professional engineer who prepared or supervised the preparation, and shall be signed with an original signature and date.

The engineer shall be responsible for obtaining the review and necessary approvals of all drawings and specifications by applicable City, County, State and Federal agencies having jurisdiction. Copies of such approvals shall be submitted to the Hagerstown Utilities Department at the time of final approval.

The developer is required to design and construct his/her system, properly sized and at an appropriate location, to permit future extensions to be made at the limits of the subdivision or development in question.

The City of Hagerstown has a wastewater systems use section in the City Code that regulates discharges to the collection system. Waste from commercial/industrial users requires pretreatment prior to discharge to the collection system and a pretreatment application must be completed.

Restaurants, bakeries, and other facilities involved in the preparation of food have the potential to discharge oil and grease to the sanitary wastewater system. It is the discharger's responsibility to install and properly maintain such a pretreatment system to ensure that oil and grease are not discharged to the wastewater system in accordance with the Hagerstown City Code. Oil/water separators, where required, shall be shown on the plans and shall comply with the requirements of the Plumbing Code.

Any Contractor that will perform wastewater system work must have an applicable contractor's license.

Pre-Design Meeting

Prior to commencing any work, the Designer is encouraged to schedule a pre-design meeting with the Department or other appropriate agency to discuss any topics, which are particularly important in the development of the Engineering Report and subsequent design of the project. Pertinent topics may include any of the following:

1. Preliminary or prior reports prepared by the City/County, if applicable
2. Development of population projections and wastewater flows
3. Sizing of major system components
4. Applicable plumbing codes
5. Limit of project and future extension, if planned
6. Route selection and location of pipe in public right-of-way
7. Pipe materials and appurtenances
8. Design criteria to be used
9. Both design constraints due to and from anticipated interaction with existing utilities
10. Soil conditions that may affect infiltration and inflow in pipes and appurtenances
11. Bedding requirements
12. Special topographic conditions affecting design such as slopes, streams, floodplain and stream crossings
13. Special permitting issues created by the presence of wetlands, rare and endangered species, historical and/or archaeological artifacts
14. Easement requirements
15. Conditions affecting traffic maintenance and control

For Developer Projects which require minor extensions of the public wastewater systems, the pre-design meeting may take the form of a preliminary wastewater plan showing the general layout of the utilities in relation to the proposed development. The plan shall be accompanied by a letter report, which shall include general information about the project, design criteria used, alternatives investigated and the cost estimates for all alternatives. The plan shall be submitted after the concept plan for the development has been approved by the City of Hagerstown planning department.

Information regarding the City of Hagerstown Planning Department and Planning Commission can be found at http://www.hagerstownmd.org or by email at planning@hagerstownmd.org

Engineer's Report for Wastewater Systems

Requests for extensions of wastewater mains should be accompanied by an engineer's report, which shall present the following information as applicable:

1. A description of the nature and extent of the area to be served. Wastewater pipelines are to be designed to serve the entire service area of which the subdivision or development is a part. Elevation of the wastewater system must be designed such that future extensions can serve the entire area that naturally drains toward the system.

2. An appraisal of the future requirements for service, including existing and potential connections, provisions for extending the system to include additional area. The engineer should take into consideration flow rates that may be derived for different zoning and land use classification that exists or could exist in the area of development.

3. Average daily flow and peak hourly flow.

4. Design flow and capacity for each pipe segment.

The plans shall provide for future connections by extending mains to the exterior boundaries of the development. The collection system developed shall be compatible with the City of Hagerstown Planning department's comprehensive plan.

Comprehensive Wastewater Studies

A Comprehensive Wastewater Study is a plan to provide wastewater service to a specific portion of the areas served by the department. A comprehensive wastewater study will fully describe the area to be served by the local collection and trunk facilities, and will fully describe the facilities necessary to provide service to that area. The approved wastewater study will become part of the organizational knowledge and historical documentation used by the Department for future planning.

A Wastewater Study shall be submitted and approved if the Department determines there is a possibility that any of the following exist.

- Upstream or adjacent areas might require wastewater service through the subject property.
- Downstream wastewater capacity is limited.
- It may not be possible to serve the project and / or surrounding area with gravity wastewater service.
- Interim wastewater facilities may be required.
- Off-site wastewater facilities (such as pump stations) may be required.

When a Wastewater Study is required, it shall be submitted and approved prior to submittal and approval of project improvement plans and prior to final approval of the subdivision/improvement plans.

General Requirements
In order to develop a Wastewater Study the minimum information that must be accumulated and presented includes an analysis of the regional setting, topographic information of the area to be served (delineated on the map and discussed), any specific projects that precipitated the study, relevant assumptions and special conditions, existing and proposed development, existing and proposed wastewater infrastructure, ultimate development within the study area, and hydraulic grade line at the point of discharge into major facilities.

Flows
The flows generated within each sub-service area of the sub-area plan will be calculated in accordance with the procedures contained in these standards unless otherwise specified by the Department Engineer.

Study Map
The method of providing wastewater service to the entire service area, including pipe sizes, lengths, slopes, and inverts, shall be shown to the extent necessary to determine the requirements within the subject property. All areas to be serviced through the project site, per the City Comprehensive Plan, must be included in the project flows.

Study Slopes
The minimum slopes for gravity pipe shall be determined using the design parameters outlined herein (see size and slope following). If the proposed pipe alignment will be in an existing or planned road and the study identifies accurate locations for manholes, then the fixed minimum slopes may be used. If the proposed pipe alignment will be across undeveloped land and will be using nodes at a set spacing, then the minimum schematic slope shall be used.

Whenever alternative solutions involve different types of facilities such as a gravity system versus a pumped system, cost comparisons are more truly representative when analyzed to include capital, operation and maintenance costs on a life cycle basis, using reasonable interest rates. Current construction costs shall be adjusted and projected to the planned construction year as indicated in the project schedule with consideration of the effects of current inflation rates. The factors used in these projections shall be clearly stated.

Flow Requirements

1. Residential

    a. Residential uses includes; single family homes, duplexes, townhouses, or apartment/condominiums.

    b. Average daily flow shall be based on 200 gallons per day per unit.

2. Nonresidential

   a. The proposed flow for commercial, industrial or other nonresidential uses shall be as determined by the engineer/owner per allocation criteria and reviewed and approved by the Department Engineer. In order to minimize under or over allocation the design engineer shall consult with the owner to arrive at an accurate estimate flow. The ideal proposed flow in the case of retail chains should be based on comparable data from other chain establishments of the same size and use. The minimum flow is 200 gallons/day.

   b. For considering development of surrounding areas where land is zoned for industrial or commercial usage, and to insure adequate capacity upon development, design shall be based on an average daily flow of 2,000 gallons per day per acre or as indicated by the Department Engineer.

3. Peak flow - lateral and collector wastewater mains

   For a Lateral (a wastewater pipeline that has no other common wastewater pipelines discharging into it.) or a collector (a wastewater main that receives flow from one or more laterals.) the minimum peak design flow should be 400 percent of the average design flow.

4. Peak flow - Trunk and interceptor wastewater mains

   For a Trunk (a wastewater pipeline that receives flow from one or more sub-main wastewater pipelines.) and Interceptors (wastewater mains that receive wastewater flow from a number of gravity mains, trunk wastewater mains, force mains, etc.) the Minimum peak design flow should be 300 percent of the average design flow.

5. Pipe shall be sized to be able to carry the peak flow with infiltration at a flow depth of 70%.

6. Infiltration shall be 300 gpd/ in. diam/mile and 2000 gallons per day per gross acre. This allowance shall be increased for wet areas and lines with many stubs.

Pipe Alignment

Wastewater pipelines shall be designed in the most cost effective alignment dictated by conditions specific to the site. However, it is preferred that mains be located in the center of the street for areas within the corporate limits, The County Engineer requires manholes to be located in the shoulder of county roads. Unless there is no practical alternative wastewater pipelines shall not be located under concrete islands.

Normally all wastewater mains should run straight from manhole to manhole. Curved wastewater pipelines may be permissible for pipelines over 24" in diameter. The allowed radius (minimum 200 feet) is computed for deflected straight pipe by the following equation:

$$R = \frac{L}{t\frac{\Delta}{n}} - \frac{D}{2} + t$$

Where: R Radius of Curvature (ft)
Δ = Total Deflection of Curve (Radius)
n = Number of Radius Pipe Sections
D = Inside Diameter of Pipe (ft)
t = Wall Thickness of Pipe (ft)
L = Standard Wastewater Pipe Length (ft)

Curves for PVC Pipe (where permitted – e.g. force mains)
PVC pipe shall not be deflected or bent into a curve without the approval of the Department Engineer. If approved, PVC pipe may be bent in a true arc throughout its length. The maximum allowable bending offset for PVC pipe Class 200 shall be in accordance with the following:

Pipe Size	**Maximum Deflection per 20 ft Pipe Length Inches**	**Minimum Bending Radius, ft.**
4”	23	100
6”	16	150
8”	12	200
10”	9	250
12”	8	300

Note: Per CertainTeed (Mfg) pipe.

Curves for HDPE Pipe (where permitted)
Heat fused HDPE pipe may be cold bent during installation. Allowable bend radius shall be as specified below:
HDPE DR Minimum Allowable Bend Radius
DR 11.0 Greater than 25 Times Pipe O. D.
DR 13.5 Greater than 25 Times Pipe O. D.

If heat fused tees, bells, or flanges are located in the bend zone, the minimum bend radius shall be increased to one hundred (100) times the outside diameter of the pipe.

Wastewater Pipeline Location

Mains shall be located to provide service to each lot within a subdivision. All mains shall be installed in dedicated roadways, public rights-of-way, or utility easements dedicated to the City of Hagerstown.

All manholes proposed within areas where vehicles travel should be located either on the centerline of the road or center of the traveling lane.

All lateral service connections shall provide a cleanout between the curb and sidewalk or at the edge of the public rights-of-way or easement. Lateral piping shall be extended to the property line/curb line for all new service connections.

Laterals and building sewers shall not be located parallel to the road right-of-way and should always run directly to the wastewater main.

Every effort should be made to locate wastewater mains outside of flood prone areas. Wastewater pipelines and/or manholes shall not be located in drainage ditches, or pass under stormwater detention facilities.

Wastewater Pipelines on Steep Grades

In cases where sanitary wastewater mains are to be constructed on steep grades (20 percent or greater), the main line shall be anchored securely with concrete anchors or other approved means. Suggested minimum anchorage is as follows, but should be determined by the Engineer:

1) Not over 36 feet center to center on grades 20 percent to 35 percent.
2) Not over 24 center to center on grades 35 percent to 50 percent.
3) Not over 16 feet center to center on grades 50 percent and over.

Drop manholes may be considered to reduce excessive slopes.

Wastewater Pipeline Depth

The minimum depth of wastewater pipelines shall be **Four (4) feet** of cover above the top (crown) of the pipe. **{See DETAIL W001}**

When conditions are such that minimum cover can not be achieved, the Department Engineer may consider the alternatives. Such conditions shall be considered on a case by case basis and approval must be obtained in writing from the Department.

Buoyancy

Buoyancy of wastewater mains and manholes shall be considered and flotation of the pipe and manhole shall be prevented with appropriate construction where high groundwater conditions are anticipated.

Size and Slope

No new gravity wastewater mains shall be less than 8 inches in diameter.

Standard sizes of gravity mains shall have nominal diameters of 8 inches, 10 inches, 12 inches, 15 inches, 21 inches, 24 inches, 30 inches and 36 inches.

In general, the pipe diameter of wastewater mains should be continually increasing with increase in tributary flow.

Changes in pipe size or material shall not occur between manholes.

All gravity wastewater mains shall be designed and constructed to give mean velocities, when flowing full, of between 2 and 10 feet per second, based on Manning's formula and using "n" value of 0.013. The minimum velocity requirement is necessary to prevent the deposition of solids. The following are minimum slopes to be provided; however, slopes greater than these are desirable.

Pipe diameter and minimum slope shall be as follows (minimum main diameter shall be 8" and minimum lateral diameter shall be 6")

Diameter (in.)	Minimum Slopes, (ft./100ft)	Recommended Slopes (ft./100ft)
6	1.04	2.08
8	0.5	0.5
10	0.4	0.4
12	0.22	----
15	0.15	----
18	0.12	----
21	0.10	----
24	0.08	0.09
27	0.067	0.08
39	0.058	0.08
36	0.046	0.08

Force Mains shall be sized to produce a minimum flow velocity of 2 feet per second. A pipe diameter of less than 3" will only be considered in the case of LPSS. Detention time as it affects odor production shall be taken into consideration when sizing force mains,

A velocity in excess of 10 feet per second may be permitted with proper consideration of pipe material, abrasive characteristics of the wastewater, turbulence, and thrust at changes in direction.

Site Improvements above Wastewater Components

No structures are permitted to be constructed above any public wastewater mains or within their associated easement. When no practical alternative exists construction within the wastewater easement may be approved in an extreme case with the owner of the proposed facility responsible for encasing the wastewater main with a steel sleeve.

Manholes

Manholes shall be provided at all intersections of gravity wastewater mains, changes in grade, alignment, direction or changes in wastewater line pipe size or pipe line material.

The maximum distance permitted between manholes is 400 feet.

All wastewater pipelines shall have a minimum 0.1 feet drop through the manhole. Where wastewater pipelines change direction, the invert elevation shall drop a minimum of 0.25 feet through the manhole.

Manholes shall be installed at the termination of a wastewater line or at the end of any gravity main that can be extended in the future to serve adjacent properties.

Inflow prevention inserts are required on all manholes.

Watertight manhole frames and covers are to be used whenever the manhole is subject to flooding or is located within the 100-year flood plain.

Manholes located along streams, creeks, or other bodies of water shall be required to be extended above the 100-year flood plain.

Manholes located within an easement shall be extended 10 inches above ground level.

Manholes shall be located in the street shoulder or unpaved areas within existing rights of way where possible. Spaces designated for parking and other areas to which access will be difficult should be avoided.

All 8-inch diameter and larger wastewater main pipelines must be connected to the collection system through a manhole.

The minimum horizontal angle between the upstream and downstream wastewater pipes shall be 90 degrees.

Drop manholes may be used if the invert of the upstream wastewater line is 1 foot or more above the top of the downstream wastewater line leaving the manhole.

Cleanouts and Laterals

Building sewer (lateral) cleanouts (c/o's) shall be located immediately behind the curb or property line**.**

The private portion of the users building drain and building sewer ends at the curb or if no curb, right of way line at which point a 6" cleanout is required.

Minimum pipe diameter is 6" for service connections.

Service connections shall be generally limited to 50 feet in length; longer connections will be considered on a case by case basis.- Lateral connections at the main line shall be made with a "WYE" fitting for new construction.

A double "WYE" connection as shown in the Standard Details may be permitted for the service connection of two private dwellings.

{See DETAILS WW113 though WW114} for Lateral (service connections).

See also the following cross reference:

Chapter 64 (Building) of the Code of the City of Hagerstown P-308.3.2 Clean outs: *Cleanouts shall be located at the property line and shall be installed no further apart than 75 feet. Cleanouts shall be no smaller in size than the line they serve, but never smaller than six inches.*

Infiltration and Inflow Protection

All Manholes and cleanouts shall be located in such a manner as to prevent inflow (surface runoff) from entering the wastewater system. Manhole inserts are required for new installations.

Road, Railroad and Stream Crossings

Major road crossings and railroad crossings shall be encased in steel casing or approved equal. Additional requirements of the regulatory agency responsible for the roadway/railroad shall be met.

Stream crossings shall be encased in steel casing or approved equal. Manholes shall be provided at both ends of the water crossing; the manholes shall be easily accessible and not subject to flooding.

Wastewater Force Mains and Pump Stations

Wastewater pump stations shall be used only when it has been determined to be the only practical way to provide sanitary service and upon approval of the Department.

A detailed engineering report shall be submitted to and approved by the Department.

The design must conform to the minimum standards set forth in the Maryland Department of the Environment Regulations and these standards. At a minimum, the following data shall be provided:

1) Complete design calculations for the pump station and force main, including the head discharge curve.
2) At least two views of the pump station, plan view and cross section, shall be provided.
3) Electric panel detail.
4) Pump and alarm control elevations.
5) Inlet and outlet pipe elevations.
6) Finished grade and foundation elevations.
7) Design pump capacity, horsepower, total dynamic head, manufacturer and model number. Certified system curves shall be provided for one pump and all pumps running as well.
8) Wet well capacity and cycle time.
9) Projected wastewater flow, floatation, flood plain computations, mapping, etc., may be required as part of the construction drawing review process.
10) 480 V, 3 Ph service shall be provided

Pump Stations shall be located at the optimum site to ensure gravity service to as much of the drainage area as possible.

A minimum of one primary and one equal capacity backup wastewater pump operating alternately is required along with associated piping for bypass pumping.

The designer will be required to include odor control measures such as aeration of the wet well, etc.

The design shall provide for continuous operability of the pump station by including an auxiliary stand-by generator that can operate sufficient pumps to deliver the design peak flow, subject to the approval of the Department.

A flow meter shall be provided on the discharge side of all pumps.

All pump stations shall have a SCADA system contact with the Wastewater treatment plant. The telemetered alarm system shall be capable of sending separate signals for conditions including power failure, high wet well, pump failure, seal water failure, flow rate, etc.

Depending on the size of the station or type of user expected to be served, a Comminutor or other type of grinder may be required. It shall be sized for peak flow and placed in an accessible location. A lock-out disconnect switch must be installed within view and above the potential flood level.

A security fence topped with barbed wire and locking gate surrounding the station shall be provided to minimize vandalism and prevent injury to the public. On smaller sites the fence shall be configured to allow maintenance vehicles to stop completely clear of the public way prior to entry.

Particular attention in the design shall be given to safety measures such as: rubber floor mats at electrical panels, back flow prevention for stations served by portable water, hand rails, shaft guards; ventilation, etc.

The general contractor responsible for construction of the pump station shall provide startup service along with the vendors supplying pumps/motors, auxiliary generators, controls, alarm systems, and other equipment as required by the Department.

Other design requirements include, but are not limited to; adequate vehicular & personnel access, pump hoist/crane, waterproofing the structure exterior below grade, adequate lighting, sump pump, sloped wetwell hopper, as well as fiberglass or other corrosion proof grating in wet wells, and in the floor.

Force mains shall be designed with a minimum flow velocity of 2.0 feet per second, and a maximum flow velocity of 10.0 feet per second.

Pressure wastewater pipelines shall be installed at a minimum depth of 4 feet below finished grade and on 6" depth crushed stone or approved equal bedding. Backfill shall be accomplished in the same manner as that for gravity mains and marking tape and tracer wire shall be installed above the pipeline.

Minimum force main size shall be 3-inches in diameter.

A constant grade shall be used where feasible.

Isolation valves shall be provided at appropriate locations should also be provided as required for longer force main pipelines.

Flushing connections should be provided along the pipe line.

Blowoff valves shall be provided at all low spots, combination air release and air/vacuum relief valves shall be located at all high points.

Thrust Blocking and Pipe Restraint is required for force mains.

Marking tape is required for force mains, tracer wire is required for plastic force mains.

Low Pressure Sewer Systems (LPSS) Pipelines

The pipe size shall be 1-1/4” minimum or as indicated on the construction plans.

Valves and fittings shall be installed as required by the manufacturer. Shut off valves shall be installed on the branch side of all tees to which is connected a smaller diameter branch (e.g. 1-1/2 line - 300' length terminating in cul-de-sac).

Restraining pipe movement is not normally required for low pressure wastewater pipes, however, this requirement may be applied in unusual circumstances. (e.g. mains of 4" or greater in diameter)

LPSS shall have air and vacuum relief vales at all high points and blow off valve assemblies at all low points.

Flushing connection shall be located at reasonable intervals though out the system.

Each pump discharge line shall have a check valve outside the canister. A ball valve shall be located at the property line.

All pipe shall be SDR-21 or SDR-26.

Warning tape shall be installed above the L.P.S.S. pipelines and be the same specifications as that for gravity sewers.

Tracer wire shall be installed above the L.P.S.S. pipelines and be the same specifications as that for force mains.

WASTEWATER SYSTEM MATERIALS

General

All pipe, fittings, manholes, cleanouts and other related materials used in the construction of or in additions to the waste water collection system must comply fully with the specifications and requirements of the Department. All wastewater installations shall be made with new and unused pipe, pipe fittings, and appurtenances of the size, type and character outlined in the following specifications. ALL materials shall have been manufactured within the previous year and have invoices to show the purchase and purchase date etc.

Whenever proprietary equipment is specified "or approved equal" is implied. All proposals for substitution shall be submitted in writing to the Department for approval.

Materials listed in these standards and specifications represent the absolute minimum requirements acceptable for use by the Department. Specifically, the Department has reviewed and consulted the appropriate standards writing agency with a view to determine what materials most suit the specific design criteria, maintenance needs, and cost requirements of the Department.

Where a manufactures name is used in these specifications, it is used to designate a minimum standard of quality based on the specific design characteristics of the manufacturer specified, not limited to, but including, material quality, flow characteristics, interchangeability, design features, inventory, warranty, maintenance costs, and service.

Equality evaluation shall be determined not solely on whether a product is capable of doing an adequate job, but rather if a product will perform the specific job specified, as well as meeting the additional specific requirements set forth herein. The Department will be the sole judge as to whether a product shall be approved as an equal.

Any product not specified in the latest modifications or revisions of the Departments written specifications and details, must have approval before shipment to projects within the Departments jurisdiction.

Representative samples of materials, intended for the incorporation in the specifications of the Department, shall be submitted for examination, and/or test.

A written point-by-point detailed comparison to material currently specified shall be submitted with any points of exceptions noted.

Written warranties, along with certifications of material compliances, shall be required for all materials submitted for review.

No set time limits shall be given for material review. It is not the intent of the Department to compromise the current specifications as written.

Any product shipped to projects without prior approval shall be deemed unresponsive to the Departments authority, and shall be removed and replaced by approved materials at no cost to the Department.

Furthermore, any product shipped without prior written approval, shall be rejected.

Gravity Mains

Wastewater pipes shall be polyvinylchloride (PVC) SDR 35 wastewater pipe and shall meet or exceed ASTM D-3034 and/or F-679. Joints shall be gasketed, bell and spigot type with the bell made integral with the pipe.

PVC pipe shall be legibly marked as follows at intervals of five feet maximum; manufacturer's name or trademark, pipe size, PVC cell classification, appropriate legend such as PVC SDR-35 ASTM D-3034, Manufacturer's lot number, date of manufacture, test pressure, and point of origin. Test results shall be available upon request.

All pipe of a given size and material shall be furnished by the same manufacturer.

PVC pipe and fittings shall be produced by an extrusion process and shall be homogeneous throughout, free from cracks, holes, foreign materials, inclusions, ripples, screw memory, or other defects. The pipe and fittings shall be uniform in color. Pipe with blisters, bubbles, cuts, ripples, or scrapes on inside or outside surfaces, or other imperfections which impair the performance or life of the pipe, will be rejected.

All PVC pipe and fittings shall have the National Sanitation Foundation (NSF) seal of approval.

All PVC pipe shall be manufactured by North American Pipe Corp. or approved equal.

Force Mains

Force mains shall be either pressure class PVC (e.g. AWWA - C900, C905, C909), HDPE or approved equal. PVC pressure wastewater pipe and fittings shall be produced from resins meeting the requirements of ASTM D-1784 for Class 12454-B (Type 1, Grade 1, PVC 1120). The criteria for PVC gravity mains in the preceding section regarding marking, defects, etc. shall also apply to force mains.

HDPE Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350-99 with a minimum cell classification of PE34564C. Pipe O.D. sized 4” to 24” shall be available in both steel pipe sized (IPS) and ductile iron pipe sized (DIPS). Pipe O.D. sized 26” to 54” shall be available in steel pipe sized (IPS). Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

The pipe shall have a minimum working pressure rating of 160 psi and shall meet the maximum design operational pressure plus a factor of safety.

D.I.P. may be used in some circumstances. D.I.P. shall conform with Hagerstown water division standards except that Series 431 Perma-Shield ® PL shall be used for the interior coating.

Lateral (Service Connection) Pipe

PVC pipe used for installation of lateral services shall be 6-inch unless otherwise specified and have a minimum wall thickness of SDR 35. All fittings shall be gasketed (2 fittings maximum per application).

Connections to an existing wastewater main shall be made with a cut in Wye fitting with Fernco strongback shielded couplings. Saddles may be allowed in unusual conditions. Saddles shall be LMK Lined Main Tap (LMT) Connection or approved equal. After installation, Saddles shall be positively bonded in place with epoxy mortar to the outside of the host pipe. When the Main is lined the saddle shall be connected to the liner.

Clean Outs

Cleanouts shall be 6" minimum diameter and utilize a Wye connection to the lateral line.

Cleanout assemblies shall be 6-inch cast iron with gaskets or O-rings for sealing to the host pipe and shall utilize a recessed brass screw plug. **{See DETAIL WW116}**

Cleanouts subject to traffic or in the sidewalk area shall have a cleanout frame and cover rated for traffic loads if no alternate location is available.

Maximum of two fittings shall be utilized to make connections.

Pipe Fittings and Couplings

PVC fittings used in a gravity collection system shall be of the same SDR rating (35) as the collection pipe being used.

Fittings are permitted only on service laterals and drop manholes in the gravity collection system. Up to two fittings are allowed per application and they should be 45 or less in degrees total.

Couplings for cut in connections shall be Fernco or approved equal and only utilized when connecting into vitrified clay, ductile iron or concrete pipes.

Fittings used in a force main system shall be mechanical joint and made of ductile iron. Ductile iron fittings shall be class 350 conforming to ASTM A536-72. Nominal thickness of fittings shall be equal to class 52 ductile iron. All fittings shall be cement lined and asphalt emulsion coated.

Valves - Force Main System

Direct Bury Valves

1) All valves shall be resilient seat conforming to requirements of AWWA standard C509. They shall be manual opening, non-rising stem equipped with a 2-inch square operating nut for installation in the vertical position.

2) The valve body shall be made of ductile iron with mechanical joints. The body of the valve shall be epoxy-coated interior and exterior, and have a smooth bottom design.

3) Valve shall open right (clockwise) and be marked as such and seating shall use compression closure.

4) The operating stem shall be a minimum diameter of 7/8 inch with a double O-ring seal. The configuration of the O-rings shall be above and below the thrust collar.

5) Valves must have a minimum 250 psi working pressure and 400 psi test pressure.

Exposed Gate Valves

1) Valves shall meet requirements for direct bury valves with the following exceptions:

- Joints shall be flanged.
- Valve shall be rising stem.
- Valve will be manually opened using a hand wheel.
- Outside-screw-and-yoke (os & y) type.

Combination Air Release and Vacuum Valves

Air Vent (release) shall be float operated and shall incorporate a simple level mechanism to enable the valve to automatically release accumulated air while the system is pressurized and operating.

Combination air release and vacuum valves shall be installed as set forth in the standard detail. **{See DETAIL WW129}**

Air vent shall close drip-tight, incorporating a renewable seat that is field replaceable.

Body and cover of the air vacuum release assembly shall be made of cast iron conforming to ASTM A48, Class 35. All interior parts of the assembly shall be stainless steel.

Valves shall be Val-Matic or approved equal.

Mechanical Joint Pipe Restraints

{See DETAIL WW126}

Pipe Joint Restraint Devices for PVC and Ductile Iron force mains shall be of the wedge-action lug-type mechanical joint (MJ) retainer glands and the split, full-circle grip-ring type with High Strength Low Alloy (HSLA) threaded thrust rods and nuts and stainless steel clamping bolts and nuts. Restraint devices shall have a working pressure rating that equals or exceeds the pressure rating of the pipe on which they are used. Restraint glands shall be designed for use with and conform to the applicable requirements of ANSI / AWWA C111. Restraint gland product identification shall have traceability. Restraint glands shall have a minimum safety factor of 2:1. Mechanical Joint restraints shall be listed by Underwriters, and have Factory Mutual approval. Specialty tools will not be required for installation. Pipe restraint device shall restrain pipe conforming to the requirements of ANSI/AWWA/C151/A21.51. Ductile Iron Pipe gripping wedges shall be heat treated and hardened to a BHN range of 370-470. Pipe restraint device shall restrain pipe manufactured to AWWA C900 / C905 and have working pressure ratings equal to the pressure rating of the pipe on which they are used. Restraint glands shall conform to the requirements of ASTM 1674. Restraint glands shall be Ford Meter Box Uniflange ™, Ebaa Iron, MegaLUG ™, Tyler / Union TUFGrip™ Restraint or approved equal.

Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Design shall be such that restraint shall be increased with increases in line pressure. Bolts and nuts shall be corrosive resistant, high strength alloy steel. The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used or 150 PSI which ever is lesser. Restrainers shall be JCM Industries, Sur-Grip or approved equal.

Pipe stiffeners shall be used in conjunction with restrainers. The pipe stiffeners shall be designed to support the interior wall of the HDPE. The stiffeners shall support the pipes end and control the “necking down” reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed of 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE. Stiffeners shall be by JCM Industries or approved equal.

Manholes

{See DETAIL WW104}

Manholes shall be Precast reinforced concrete capable of sustaining an H-20 loading and meeting standards put forth under ASTM C-478.

Manholes shall have a minimum inside diameter of 48 inches with a Minimum wall thickness of five inches.

Concrete strength shall be 4000 PSI minimum at 28 days.

Manhole bases shall be standard precast manhole with poured in place concrete or monolithic flanged bottom section placed above base layer – CR-6, GAB, clean aggregate, etc.

The base section shall be monolithic to a point 12 inches above the crown of the incoming pipe with a minimum base thickness of 8 inches. The base shall have a diameter 16 inches larger than the barrel of the manhole.

Manhole bench shall slope toward the channel at a rate of fall between 0.5 in./ft. and 1.0 in./ft.

Pipe holes in new manholes shall be properly located and cast in place with appropriate resilient connector (star-seal, press-seal or approved equal). The resilient connector shall meet the requirements of ASTM C-923.

Services into existing manholes may be cored and shall be sealed using press-seal corporation PSX direct drive or approved equal with two stainless steel bands to hold the pipe in place. Connector shall conform fully with the requirements of ASM C 923, ASTM C 1478, and ASTM F 2510.

Cone sections shall be eccentric narrowing from 48 inches to 24 inches inside diameter (or 60 inch to 24 inch for 5 foot manholes).

Flat top sections shall be used in place of a cone section for manholes less than 5 feet deep. The 24-inch access hole shall be offset to allow easy access to steps and shall be reinforced to support H-20 loading.

The exterior of the manhole from the frame and cover down to the cone section shall be coated with parsonpoxy or and minimum epoxy tar coating.

Manhole steps conforming to the applicable provisions of ASTM Specifications C-478 shall be factory built into precast sections. Step spacing and alignment to be maintained uniform and vertical throughout the depth of the manhole and steps should not be more than 16” apart.

Each manhole section shall have not more than two holes for the purpose of handling and laying. These holes shall be sealed with cement mortar.

Joints of the manhole sections shall be of the tongue and groove type; sections shall be joined using methods which meet or exceeds all requirements of ASTM C990 Standard Specification for joints, concrete pipe, manholes and precast box sections, using Preformed Flexible Joint Sealants. Sealing gasket shall be equal to RAM-NEK as manufactured by Henry Company, Sealants Division of Houston, Texas.

All joints, holes, etc., shall be sealed with epoxy grout.

No chips, cracks, or defects shall be allowed.

Manholes shall be supplied by C.R. Semler, inc. (Smithsburg, MD), Frederick Precast (Greencastle, PA), Americast (various locations) or approved equal.

Manhole Frame and Cover

{See DETAIL WW102}

Manhole frames and covers shall conform to ASTM A-48. The words "Hagerstown Wastewater" shall be cast into the cover and shall be plainly visible.

Manhole frames and covers shall be East Jordan Iron Works as manufactured by, E.A. Quirin, or approved equal. Frame and cover shall be bituminous coated

Watertight frames and covers, as applicable, shall be as manufactured by East Jordan Iron Works, or approved equal

Marking Tape

Underground utility marking tape shall be 3" detectable or 6" non-detectable super stretch as supplied by pro-line safety products. Thickness ASTM D2103 6.0 mil, Tensile Strength ASTM D882 4100 psi, Elongation ASTM D822-75b, Color: Green with black lettering, Labeled "Wastewater" or "Sewer Line". Detectable tape should be utilized for force mains.

Comminutor

Comminutors shall be JWC Environmental Muffin Monster™ or approved equal.

L.P.S.S. [Low Pressure Sanitary Sewer] Pipelines

A. Solvent Welded PVC Pipe (1-1/4 inch diameter pipe only or diameter indicated elsewhere in the Contract Documents or approved by the Department.

(a) All 1-1/4 inch pressure wastewater piping shall be solvent welded PVC pipe as manufactured by North American Pipe Corp. or equal.

(b) Solvent welded PVC pipe shall meet the requirements of ASTM D-2241 with standard dimension ratio of 21 (SDR-21) for a working pressure of 200 psi. Bell-end pipe shall also meet the requirements of ASTM D2672.

(c) PVC welding solvent shall be purchased from the pipe manufacturer. It shall be compounded to conform with the socket fit, the weather conditions at the time of installation and make a weld of maximum strength. PVC welding solvent shall meet the requirements of ASTM D-2564.

(d) All 1-1/4 inch PVC couplings for jointing spigot end pipe shall be of the extruded type having a beveled entrance. Couplings shall have a minimum pressure rating of 200 psi

for continuous operation at 73.4 degrees Fahrenheit and be compatible with the pipe being used. The couplings shall be manufactured by the manufacturer of the pipe being used, or in the alternate; shall be approved by the pipe manufacturer for use with their pipe.

(e) All elbows, tees, reducers, and adapters shall have a minimum pressure rating of 200 psi for continuous operation at 73.4 degrees Fahrenheit and be compatible with the pipe being used. Where available, these fittings shall be manufactured by the pipe manufacturer for compatibility with pipe or in the alternate, all such fittings shall be approved by the pipe manufacturer for use with that pipe.

(f) 1-1/4 inch adapters shall be PVC adapters with socket (for solvent weld joint) end connection x female threaded end connection.

B. Gasketed Joint PVC Pipe (1-1/2-inch - 4-inch diameter).

(a) PVC pressure wastewater pipe 1-1/2-inch through 4-inch diameter shall utilize gasket joints. The Contractor shall furnish either integral bell end PVC pipe or spigot end-double bell coupling PVC pipe as manufactured by North American Pipe Corp. or equal.

(b) PVC pipe shall meet the requirements of ASTM D-2241 for SDR-21 (200 psi working pressure) pipe. Joints shall meet the requirements of ASTM D-3139 for push-on joint pipe.

(c) Gasketed joint PVC pipe shall utilize end connections in which provisions are made for thermal expansion and contraction at each joint. Joints shall be elastomeric gasketed joints resulting in pressure tight seals up to full rating of the pipe. Rubber ring gasketing shall consist of an elastomeric ring suitable for long term contact with wastewater and which meets the requirements of F-477 or equal.

(d) Gasketed joint pipe shall have a reference mark around the entire circumference of the pipe on all spigot ends indicating depth to which spigots should be inserted into bells or couplings. Pipe spigot ends shall be beveled to permit proper and easy assembly of the joint:

(e) Couplings for joining spigot end PVC pipe shall be furnished by the pipe manufacturer. They shall have a minimum pressure rating of 200 psi. Insertion depth of the spigot end of the pipe in the coupling shall be controlled by an internal PVC mechanical stop in the coupling which permits thermal expansion and contraction. Coupling method shall allow for half the expansion or contraction of each pipe section to be taken up at each end of the pipe.

(f) Lubricant for the elastomeric gasket shall be supplied by the pipe manufacturer and shall neither support the growth of bacteria nor have deteriorating effect on the PVC pipe and rubber gasket.

(g) All fittings shall have a minimum pressure rating of 200 psi for continuous service at 73.4 degrees Fahrenheit and be compatible with pipe being used. Where available, these fittings shall be manufactured by the pipe manufacturer for compatibility with pipe or in the alternate all such fittings shall be approved by the pipe manufacturer for use with that pipe.

C. Threaded PVC Pipe and Fittings (ail sizes)

All PVC pipe and fittings for threaded end connections shall be Schedule 80 PVC pipe meeting the requirements of ASTM D-1785 and D-2464 as manufactured by CertainTeed Products Corporation, Eslon Thermoplastics Inc., or equal..

Thread sealant shall be of a type which gives a water tight seal yet permits ease of disassembly - Teflon, Fluoroseal, or similar compounds based on tetrafluoreothylene resins shall be used.

D. Valves

(1) Plastic Union Ball Valves

(a) General - The Contractor shall furnish and install PVC plastic union ball valves at service valve assemblies and at other valve locations designated on the Drawings and in the Standard Details. Valves shall be supplied by the same manufacturer and suitable for the conveyance of raw wastewater.

1. PVC union ball valves shall be manufactured of PVC resins meeting the requirements of ASTM D-1784 as manufactured by Asahi/America Inc. or equal.

2. Valves shall be rated for 150 psi pressure tight shutoff service at 70 degrees Fahrenheit and shall have the full port configuration in all sizes, the porting through the ball and valve interior being constant in diameter and shape with straight through flow pattern. There shall be no obstruction to flow through the valve interior.

3. Valves shall have quarter-turn operation and shall be equipped for buried service with a 5-1/4-inch inside diameter valve box. All valves shall be equipped with a single piece, 5/8-inch thick tee head measuring one-inch high x diameter of head. The tee head fitting and adapter pin shall be so designed to withstand the opening and closing torques up to the full pressure rating of the valve without damage to the tee head fitting, adapter, or valve. The tee head shall be so positioned on the valve that the position of the valve port (open or closed) can be determined by viewing the position of the tee head. Tee head and adapter pin shall be of aluminum, brass, stainless steel, or bronze, and shall be supplied by manufacturer of valve.

4. End connections shall be socket type for solvent welding to spigot end PVC pipe. Unions shall be integral with the valve and permit easy removal of both union nuts.

5. Seats shall be of permanently lubricated Teflon and the O-ring seals shall be of ethylene propylene terpolymer (EPDM) or Viton.

6. Valves shall have the maximum C_v values for the valve sizes listed below:

Size	C_v
1/4 - inch	77
I/2 - inch	116
2 - inch	159
2 I/2 - inch	320
3 - inch	390
4 - inch	665

(2) Two Inch wastewater Air/Vacuum Valve and Air Release Valve

(a) General - The Contractor shall furnish and install wastewater air/vacuum and air release valves at all locations designated on the plans and as shown in the Standard Details. All valves shall be supplied by the same manufacturer. The air/vacuum valve shall have a 2-inch NPT inlet and 1-inch NPT outlet. The air release valve shall have a 2-inch NPT inlet, a 5/16-inch venting orifice, and a ½-inch NPT outlet.

1. Wastewater air/vacuum valves shall be designed to permit the unrestricted passage of air from the pressure wastewater or force main during filling or pressurization, and the unrestricted entry of air into the pressure wastewater or force main under vacuum conditions. Wastewater air release valve shall be designed to release small amounts of air under pressure.

2. Wastewater air/vacuum valve shall be recommended for service up to 150 psi.

3. Wastewater air/vacuum valve shall have two stainless steel floats connected together by a stainless steel float guide. The bottom float shall operate the valve and the upper float shall be used to seat against the inlet/outlet port seat. Air release valve float, float guide and internals shall be stainless steel. Stainless steel materials shall meet the requirements of ASTM A-240.

4. An internal baffle shall be provided in the air/ vacuum valve to protect the upper float from direct air flow and shall retain the inlet/outlet port seat in place without distortion, for tight shutoff but permit easy removal and replacement of the seat. The seat of the air/vacuum valve and needle of the air release valve shall be of BUNA—N material.

5. The valve body and cover shall be cast iron meeting the requirements of ASTM A-48 Class 30. The exterior of the valve shall be painted with a rust inhibiting coating. .

6. All internal brass parts shall meet the Requirements of ASTM B-16.

7. Air release and air/vacuum valves shall be installed with a complete set of manufacturer furnished backwash accessories/attachments including 2-inch inlet shutoff valves, 1-inch blowoff valves, ½-inch shutoff valves with quick disconnect coupling for flushing, and a quick disconnect coupling at the transition point

WASTEWATER SYSTEMS CONSTRUCTION METHODS

Preconstruction Requirements

The developer or his/her authorized representative is required to file for local and state permission to construct if the diameter of the wastewater main exceeds 15" or if the work involves a pump station or force main. Within the flood plain of any live stream, etc., a waterway construction permit should be obtained by the developer or his authorized representative; this includes above ground structures as well as wastewater pipelines. The Maryland Department of the Environment (MDE) should be contacted for more information.

For any Street cutting the contractor or other representative of the developer/owner is responsible to file for a permit with either the city, county or state prior to construction.

Additional permits required which are associated with the provision of wastewater service include building, plumbing and use and occupancy permits. A demolition permit may be required depending on conditions. Blasting permits are also required if blasting activities are to be undertaken.

General

The following requirements are regulations pertaining to all wastewater collections system extensions constructed.

Sanitary wastewater systems are to be provided solely for the removal of sanitary wastewater. Under no circumstances shall any roof drains, foundation drains, surface or subsurface drains be either directly or indirectly connected to wastewater pipelines. The following design parameters include an adequate allowance for normal infiltration but will not accommodate the above forbidden connections.

For all Pump Stations, the City of Hagerstown reserves the right to accept or refuse ownership of any pump station. The decision to accept or refuse ownership of any pump station shall be at the discretion of Department.

Pipeline Installation

Trench Excavation - Dewatering, excavation, shoring, sheeting, bracing, backfill material placement, material compaction, compaction testing, and pipe laying requirements and limitations shall be in accordance with the Section 1 General Information.

Pipe Bedding - Unless shown otherwise on the drawings, pipe bedding material shall be 3/4-inch crushed Stone, 57 Stone, B10 stone, Graded Aggregate Base, CR-6 Crusher run or approved equal. Only AASHTO Class A-1 materials should be utilized. The pipe bedding shall be prepared as shown the standard details with close attention to uniformity of materials. There shall be no rock projecting into the required bedding from either side or bottom. The bedding shall be tamped and compacted to a minimum standard proctor compaction of 95%.

Backfill - Backfill shall be placed in 12" lifts and each lift compacted by tamper or compactor to the satisfaction of the Department inspector. There shall be no rock exceeding 6" in diameter.

Site Improvements Above Wastewater pipelines - No site improvements are permitted above the wastewater pipes or within the wastewater easement.

Service Connections - Care shall be exercised in properly bedding the pipe and compacting backfill for the entire length of the service connection.

Existing Rock - Rock encountered during construction of any part of the wastewater facilities must be removed if it encroaches on the required bedding or embedment envelope.

Future Use Manhole Stub - Stubs required by the Department for future connection to manholes shall be provided as shown in **{See DETAIL WW112}**.

Bracing and Shoring - Bracing and/or shoring shall be used to insure safe conditions during after construction. All trenches greater than six feet in depth shall be braced unless benching is utilized. Excavation wall support may be required under certain circumstances for manhole or pump station construction.

Wastewater Line Alignment and Grade - Pipe alignment and setting of gravity pipe grade shall be accomplished by the laser beam and target method. Use of survey level is also acceptable.

Wastewater Warning Tape - Green vinyl tape with the words " CAUTION SEWER LINE BURIED BELOW" imprinted in black every four feet shall be placed two feet above the wastewater line during backfill as indicated in standard details.

All pipe shall be laid without a break, upgrade from structure to structure, with the bell ends of the pipe upgrade. Pipe shall be laid to the line and grade given so as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the low line.

Subgrade at Joints - At each joint in the pipe, the pipe subgrade shall be recessed in firm bedding material so as to relieve the bell of the pipe of all load and to ensure continuous bearing along the pipe barrel.

Cleaning - The interior of the sewer pipe shall be cleaned of all dirt and superfluous materials as the work progresses.

Joints - The mating surfaces of the pipe to be joined shall be wiped clean of all dirt and foreign matter and a lubricant applied that is approved by the pipe manufacturer. Then, with the surfaces properly lubricated, the spigot end of the pipe shall be positioned inside the bell and the joint shoved home. For larger diameter pipe where a lever attachment is required, the necessary precautions shall be taken to insure an undamaged pipe installation.

Pipe Alignment - Unless specified otherwise, pipeline line and grade shall be as shown on the plans. Grade shall be measured along the pipe invert.

Laterals - PVC wyes and house service connections (laterals) shall be furnished and installed along with the wastewater main. Wyes sized as specified on the plans shall be installed for all wastewater house connections (laterals) and for future sewer house connections as shown on the plans. The longitudinal barrel of branch fittings, to be placed in line and grade with the wastewater mains, shall be of the same diameter, quality, and type as specified herein for wastewater main installations. Earthwork and bedding for laterals shall conform to the applicable provisions set forth herein for wastewater mains. Unless otherwise specified, the branch of wye fittings shall be inclined upward at an angle not greater than 45 degrees from a horizontal line.

Manhole Installation

Recommended Installation Procedures for Manholes per NPCA (National Precast Concrete Association).

1. **Lifting Apparatus:** Use approved lifting slings that will adequately lift weight of units. The use of an approved or rate spreader bar is preferred. When lifting manhole bases and risers, make sure chain or cable lengths are long enough to prevent contact with tongue and groove area, and are kept at appropriate lifting angles. Use wooden blocks between sling and manhole wall if necessary.

2. **Recommended Manhole Bedding:** Use a minimum of 6" of approved bedding material compacted to 90% proctor in an area not less than base area but preferably 6" beyond the outside radius on manhole base. The area under incoming and outgoing pipes should be treated the same to prevent shearing of pipes. Local ground conditions may require additional bedding thickness, per Engineer's recommendations.

3. **Setting Manhole Base:** Set manhole base on graded bedding per job specifications making sure boots or pipe openings match design elevations. Level top of manhole base in both directions.

4. **Pipe Connections:** (Per manufacturer's recommendations) check with manufacturer if precast inverts are supplied.

   A. Cast in place gaskets (star seal, press seal or approved equal) should normally be used and installed by the manhole manufacturer. Seal gaps with epoxy mortar.

   B. *Compression Type Connector* - Cut *3/4"* bevel on end of pipe to be inserted into manhole. Clean pipe surface and inside area of connector. Lubricate inside of connector and exterior of area of pipe being inserted with approved lubricant. Center beveled end of pipe into connector. Keeping pipe level, push pipe into connector until pipe is flush with inside of manhole wall or as required per local specifications. Seal gaps with epoxy mortar.

5. **Pipe Stubs:** Any pipe stubs installed in the Manhole must be restrained from movement to prevent blowout resulting from ground water or any testing.

6. **Joint Installation:**

   Ram-Nek Gasket

   A. Apply one brush coat of RAM-NEK Primer to concrete surfaces to be sealed. (Primer is recommended but not required unless conditions are wet).

   B. Remove protective wrapper on one side only of preformed RAM-NEK strip or coil and press firmly to the dry, clean joint surface. Leave the outside wrapper in place to protect the gasket and keep it from stretching.

   C. Remove protective wrapper from RAM-NEK gasket and set next section. Each unit is forced “home” by its own weight, compressing RAM-NEK to tightly pack and immediately seal the joint. “Squeeze out” is visible proof of a watertight joint.

   Butyl Gasket - Use only manufacturer recommended sizes for specific diameters. Clean and inspect tongue and groove surfaces. Surfaces should be free of all dust and debris. On tongue-up manhole, place butyl material next to the vertical surface of tongue. Wrap material completely around unit overlapping ends. Knead the ends together to form a unified splice. Make sure ALL protective paper is removed. Lower bell end of next section making sure steps are aligned (if applicable) into final position. If Bell is up, place butyl material next to vertical surface of groove and follow above procedure.

   Confined 0-Ring - Clean and inspect joint surfaces. Lubricate joint surface liberally. Lubricate O-Ring gasket thoroughly before placing into confined groove space provided. Run a smooth round object between gasket and tongue around entire circumference several times. Lower lubricated end of next section making sure steps are aligned into final position. Keep sections level/plumb while setting to prevent rolling gasket and breaking bell.

   Offset and Prefabricated Gaskets - Install per manufacturer's specifications.

7. **Precast Lift Hole Sealing** (full penetration): Lifting holes shall be sealed by inserting a rubber plug or other approved material, into hole (if supplied) and/or filling with non-shrink mortar from inside & outside then with epoxy tar.

8. **Backfill Procedure:** *before backfilling.* Detecting leaks at this time is easy and repairs are simple. Backfill around manhole equally to prevent tipping. Compact fill in lifts same as standard trench procedure. Backfill material should be clean and free of large rocks.

9. **Testing Procedures:** Refer to NPCA Manhole Vacuum Testing Brochure for vacuum, hydrostatic, and pressure testing where required.

Force Main Installation

PVC force mains should be installed and joined in accordance with the AWWA M23 PVC Pipe - Design and Installation as well as the manufacturer's recommendations and the "Pipe Line" installation section related to gravity mains herein.

HDPE pipe line sections should be installed in accordance with AWWA Manual M55 PE Pipe– Design and Installation. These sections of HDPE pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. Butt Heat fusion of joints shall be in accordance with ASTM D3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.

Main line piping with a diameter of 4" or greater shall incorporate thrust blocking and joint restraint at bends.

PVC Pipe Curvature - Construction of curved reaches of PVC pipe shall not be accomplished by deflecting joints or by beveling pipe ends. Bending of PVC pipe to achieve vertical or horizontal curves without using deflection fittings shall be limited as follows:

Diameter (Inches)	Minimum Radius (Feet)
6	210
8	280
10	350
12	420

Pump Station Construction

Formwork - Forms shall be of sufficient strength and rigidity to keep deflection to a minimum. The Inspector shall approve the formwork prior to concrete placement and within 48 hours thereafter.

Concrete Finishing - Although fine finishing is not essential for concrete construction in pump stations, after consolidation, minimal working of the new concrete surface shall be done. Attention to the wet well inlet area to provide a reasonably smooth flow channel shall be given.

Waterproofing - Prior to backfill the exterior wall below grade shall be waterproofed with a uniform seal coat acceptable to the Department. The wetwell inlet pipe connection shall be constructed in a similar waterproof manner as that in a manhole.

Final Site Grading and Stabilization - The pump station site shall be graded and stabilized to minimize erosion which would make maintenance more difficult and costly.

Landscaping - Pump station sites shall be finished with landscape components placed in such a fashion as not to impede access for maintenance.

SECTION 4
INSPECTION, TESTING, AND ACCEPTANCE

General

Inspection and testing by the Department is intended to facilitate the water and wastewater systems construction and by the availability of inspectors insure the best quality facilities (ultimately dedicated to the City) are constructed in the most cost effective way. This applies to all mains as well as appurtenances in the public right of way.

Any water or wastewater utilities installed as provided for in these Specifications will be subject to inspection during construction by the Department. Authorized representatives of the Department or other state or federal agencies shall have access to the site for inspection at all times. On any system to be accepted for ownership and operation by the department, progress inspections as well as a final inspection will be made to accept or reject the work when completed. Evidence will be documented by the department in writing indicating that installation of the water and wastewater systems have been subjected to and passed leakage, hydrostatic, and disinfection requirements and have passed all other testing criteria as set out in these specifications before acceptance.

Inspection Process

Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The Inspector is not authorized to revoke, alter or waive any requirements of the project, nor is he or she authorized to approve or accept any portion of the complete project.

Preconstruction Conference

A preconstruction conference is recommended prior to the start of work on projects to be dedicated to the Department and for capital projects prior to the issuance of the notice-to-proceed or other authorization to begin work on contracts of $10,000 or greater value. Extraordinary circumstances may dictate meeting prior to commencing certain smaller projects. Those recommended to be present at the conference include the Owner or authorized representative, General Contractor, Architect and/or Engineer, and representatives of Department.

Progress Meetings, Routine Inspections, and Testing

The frequency of meetings, testing and inspection after construction commences is largely dependent on need arising from the progress of work, questions and problems associated with construction details and completion of water and wastewater line sections. While large projects require weekly progress meetings for smaller plant, distribution, or collection system construction jobs ‘one-on-one' communication between the Foreman and Department Inspector usually suffices. A Department Inspector generally visits construction in progress once per day. New water and wastewater systems are tested upon completion and individual failing pipelines

and appurtenances thereafter until each section passes. All new water and wastewater pipe lines and appurtenances (including valves, fittings, pump stations, force-mains, manholes, laterals, and pipes) shall pass the standard air, hydro, vacuum, etc. tests. Progress meetings may be called at any time deemed necessary by Department staff.

For existing water and wastewater infrastructure, television inspection and dye testing of the systems may be conducted as needed (e.g. verifying connections, locating blockage sources, etc.) or as part of the infiltration/inflow reduction program.

Compliance with Standards and Specifications and Design Drawings

The Department Inspector is authorized to call the attention of the Contractor to any failure of the work or materials to conform to the Specifications and Contract. He or she shall have the authority to reject materials or suspend the work until any questions at issue can be referred to and decided by the Department.

Where there is disagreement between the Contractor (or his representative) and the Inspector, such as refusal by the Contractor to use properly approved materials, for performing work not in compliance with Plans and Specifications, and/or refusing to suspend work until problems at issue can be referred to and decided by the Department, the Inspector will immediately direct the Department's attention to the issues of disagreement and if the Contractor still refuses to make corrections, comply or suspend work, the Department will prepare and deliver in writing to the Contractor, by mail or otherwise, a written order suspending the work and explaining the reason for such suspension.

Workmanship and Guarantee Against Leakage

It shall be the responsibility of the Contractor to produce a complete water and or wastewater system in accordance with these specifications by observing proper installation procedure and manufacturer's recommendations to provide a leak proof application.

Defective Work and Stop Work Orders

Any defective work which shows up while conducting tests or before conditional acceptance shall be replaced or repaired by the contractor at his own cost and expense. Any leaks occurring after conditional acceptance but before final acceptance due to either blown joints or cracked pipe or fittings, shall be repaired by the contractor at his own expense. When pipe or fittings are damaged in any respects because of the Contractor's neglect or method of installation, they shall be replaced by other materials at the expense of the Contractor. The actual cost of replacing such material and making such installations will be the responsibility of the Contractor.

The authority for issuance of Stop Work Orders relative to construction of water and/or wastewater facilities is as follows:
1) In City: City Engineer or Department
2) In County: County Engineer

As soon as the Inspector is advised of the delivery of the stop work order, the Contractor shall immediately discontinue work except to stabilize the area and repair defects and any work performed during the Inspectors absence will not be accepted or paid for.

If repairs are needed for the project to meet the Department specifications, the developer shall

be required to make such repairs within 60 days, after written notification by the Department. Should any developer/contractor fail to comply with the specifications and regulations of the Department or fail to correct deficiencies identified by the Department, a hold may be placed on any remaining meters or wastewater taps. When appropriate, approval will not be given on any future proposals by the developer/contractor until all previous projects of the developer are in compliance with these regulations.

As-Built Drawings and Cut Sheets

Prior to the City's acceptance of any water or wastewater facilities the Contractor or Developer shall provide complete and updated reproducible As-Built drawings.

Cut sheets shall be provided prior to construction.

The as-built drawings shall include:

The water system as-builts shall include both plan and profile and shall show locations of pipelines, fire hydrants, valves, tees, bends, service connections, meters, and vaults as well as water main sizes and types of materials.

The wastewater system as-builts shall include both plan and profile and shall show locations of manholes, pipe lines, laterals, c/o locations, pipe line sizes, types of materials, manhole invert/outvert elevations, rim elevations, and line grades.

Elevations shall be based on MD state grid.

One (1) set of 22-inch x 34-inch and one (1) set of 11-inch x 17-inch), one (1) mylar copy and one (1) digital vectorized file on CD of Improvement Plans shall be submitted to the Department. The digital vectorized files shall be in AutoCAD 2000 drawing format.

A completed line extension agreement along with subdivision data describing the water and wastewater systems shall be given to the Department with the as-built data.

WATER LINE TESTING FOR NEW MAINS:

All water mains, fire lines, and appurtenances shall be tested for pressure and leakage and shall be disinfected prior to acceptance by the Department. Testing and disinfection shall be in accordance with applicable Standards such as AWWA Standard 651 for Disinfecting Water Mains except as herein modified.

Preparation

Nominally, one (1) teaspoon of granular chlorine (sodium or calcium hypochlorite granules) should be placed in each length of pipe (approximately 20' intervals). The solution produced shall result in a concentration of 50 ppm to 100 ppm chlorine residual. Sodium hypochlorite [NaOCl] or Calcium hypochlorite [Ca(OCl)2] granules and tablets shall conform to AWWA B300 Standard for Hypochlorites.

Air Removal Devices

All high points capable of trapping air shall be provided with a means of air removal, i.e. air release valve, corporation stop, hydrant, or blow-off. A 3/4" corporation stop shall be provided at the low point of the main as a pressure test connection. All corporation stops for testing and air removal devices shall be provided and installed by the Contractor.

Disinfection

Upon the physical completion of a section of water line, the Contractor shall schedule 24 hours in advance with the Water Department Inspector a time for filling the main for disinfection. Department personnel will slowly fill the main and record the time of filling. The Contractor is responsible for air removal while the main is being filled. This water shall remain in the pipe for at least 24 hours. The chlorine concentration shall be 50 ppm to 100 ppm. Valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service.

Dechlorination

A dechlorination device or neutralizing agent shall be used to remove concentrated chlorine from the water before discharge. Discharges shall not cause or have reasonable potential to cause or contribute to any water quality standard violations.

Flushing

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine measurements taken by Water Department personnel show that concentration in the water leaving the main is no higher than that generally prevailing in the system or is acceptable for domestic use. Flushing shall be performed by the Contractor and coordinated with the Department personnel. The Contractor shall be responsible for water removal and associated run-off of the chlorine solution. This flushing procedure shall also be used to remove any foreign material introduced during installation of the water main.

Pressure Test

All new sections of mains and their associated appurtenances shall be hydrostatically tested to 150 psi (50 psi above static pressure when static pressures exceed 125 psi) for a period of two (2) hours. The gauge used shall have adequate resolution to accurately read the pressure change.

The Contractor shall notify the Department Inspector 24 hours in advance of desired test date and time. (It is recommended the hydrostatic test not be performed for at least 24 hours after flushing to allow unwanted air to escape from the main; the valve used to control filling of the main may be left in the cracked open position by Department personnel to achieve pressurization.

At test time, Department personnel will witness all air removal by the Contractor from all available devices on the main. The fill valve shall then be closed and remain closed until directed otherwise by Water Department personnel. All valves within the test section shall remain in the open position.

The Contractor in the presence of Department personnel shall pressurize the main to the required test pressure and allow to stand for the test duration of two (2) hours.

Acceptable Leakage

Leakage is defined as the amount of water that is required to repressurize the main to within 5 psi of the test pressure (normally 145 psi). The leakage test is run concurrently with the pressure test.

Acceptable leakage for sizes 4" through 12" is 2 gals. per 100 joints for the 2-hour test.

Acceptable leakage for sizes 16" and greater is 4 gals. per 100 joints for the 2-hour test.

Upon successful completion, the Contractor shall promptly backfill any open trenches associated with this test.

Bacteriological Test

Upon successful completion of a hydrostatic and leakage test, and after a residual chlorine test is taken, the Contractor shall notify the Department Inspector who shall in turn notify the Water Department Chemist to perform a bacteriological test. Should additional flushing be required prior to testing, it shall be coordinated with Department personnel. The Department Chemist shall perform a minimum of one (1) total coliform test from the end of main but may require additional tests at his discretion. The maximum contaminant level for this test shall be less than one (1) MPN/100mL.

Failures

One (1) test of each as previously described shall be provided at no additional cost to the Contractor. Should any test fail, the Contractor will be billed for any retest for all costs incurred by the Department.

Valves shall only be operated by Department personnel

Completion of Work

With all tests being acceptable the contractor shall proceed with any work related to the completion of the water main. Should all tests pass, service connection pipelines may be connected/reconnected for use with authorization by the department. Should the bacteriological test fail, new services may be installed but shall not be used until this test is acceptable.

WASTEWATER LINE TESTING FOR NEW MAINS:

Pipe lines and Appurtenances

An air test is required prior to acceptance by the department of all new gravity pipe lines and force mains. 48 hour prior notice is required.

Gravity sewer PVC pipe shall be air tested per ASTM F 1417 – "Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air". Per this specification, testing pressures are regulated between 3.5 to 4.0 psig with a maximum allowable test pressure of 9 psig. It is not recommended that air-testing pressures exceed this limit due to worker safety issues. The gauge shall have adequate resolution to accurately show the change in pressure.

Generally, the pressure within the pipe line section under test (including plugged laterals if applicable) shall be stabilized at 4.0 pounds per square inch (PSI) and held for a minimum of 4 minutes.

If less than a 1 psi drop occurs during the test period, the line section is considered good. Otherwise, the leak shall be isolated and repaired prior to retesting. Occasionally, depending on specific circumstances, the pressure retention criteria in {**Appendix A – Air Test Tables**} will be used to verify the integrity of a waste water line segment. The air test may be waived for less than a full length of pipe.

Flushing and Screening: All completed pipelines shall be flushed in the presence of an inspector from the Department. A screen shall be placed on the downstream end of the pipeline to collect any foreign materials. Flushing flow and velocity shall be sufficient to remove all foreign material from the pipe line.

Video Inspections: Plastic pipes shall be video inspected prior to installation to document they are defect free. After installation and final flushing and screening, all finished pipelines shall be Video Inspected. The recording shall be fully documented with the location, pipe size, manhole, and line identification. The recording shall be in color and of quality and lighting to accurately document the condition of the interior of the pipe. The video shall be recorded onto DVD for documentation by the Department. Typically the Department will conduct the final video inspections. All video inspections shall be made by a certified PACP operator:

Manholes

Vacuum tests shall be conducted on newly constructed manholes following construction & after all connections have been made. Successful testing shall be accomplished before any backfilling operations and after backfilling and completing the installation.

The vacuum test shall be conducted by plugging all incoming and outgoing wastewater pipelines in the manhole at a location beyond the connection of the wastewater pipelines with the manhole. All plugs shall be blocked in place so as not to move during the test. The vacuum testing collar shall be inflated in the frame in accordance with the equipment manufacturer's recommendations.

A vacuum of ten (10) inches of mercury shall be drawn and the vacuum pump turned off and the valve between the vacuum pump and the vacuum gauge shall be turned off. The time period which is taken for the vacuum to fall from ten (10) inches of mercury to nine (9) inches of mercury shall be determined. If the time taken for the vacuum to reduce the ten inches (10") of mercury to nine inches (9") of mercury is less than the time indicated in the following Table, then the manhole work shall be considered not acceptable and shall be rejected. If the time is equal to or exceeds the time indicated below, the manhole work shall be accepted.

Manhole Depth (ft.)	Time (sec)		
Diameter =	48"	60"	72"
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	65
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30 and greater	74	98	121

Contractor shall receive the results of each manhole vacuum test. Such reports shall include a description of the location of the manhole, the time, date and weather of the test, a list of all persons present, the diameter and depth of the manhole and the allowable test results, and the actual test results to be compared with Department Inspector's results. All manholes shall be repaired by Contractor and retested as described above until a successful test is made. After each test, the temporary plugs shall be removed. Once all manholes have been tested, the manholes will be given a field visual inspection. The inspection shall be performed at the discretion of the Department's Inspector during the warranty period following a rainfall sufficient enough to raise the groundwater table above the possible infiltration areas. All leakage problems determined by this inspection shall be corrected by the Contractor within an agreed upon time to the satisfaction of the Department. Where necessary to complete the work, the Contractor shall be responsible for the bypassing and/or blocking of the flow in the manholes and must have prior approval by the Department.

Pressure Wastewater Pipelines

All low pressure pipelines shall be pressure tested using the following procedure:

Contractor shall set up the testing equipment by connecting to PVC pressure wastewater pipelines at test connections, house connections, flushing assemblies, or other approved fittings.

Test pressure shall be 100 PSI at the low point of the system or as indicated on the drawings but the contractor shall not exceed this pressure.

The Contractor shall conduct all, pressure testing with the Inspector in attendance. Contractor shall provide 48 hours notice to Department prior to testing.

Before beginning the pressure test, the contractor shall:

(1) Secure joints and add restraints and/or concrete thrust blocks.

(2) Completely backfill the pipe. (The contractor may pretest pipelines at his own discretion prior to backfill).

(3) Cap or plug ends of test sections and brace caps to withstand thrust developed under test pressure.

(4) Slowly fill section of pipe to be tested with air until completely full and air has been expelled.

(5) Subject test section to the test pressure for a minimum of two hours.

If the pressure then remains within five (5%) percent of the target value, this indicates there is no leakage in the system.

Should test results show displacement, damage, or leakage in excess of allowable amount, the Contractor shall repair the displacement and damage, and eliminate the leakage. He or she shall retest until specified conditions are met, to the satisfaction of the Inspector, at no cost to the Department.

For force mains the recommended maximum test pressure of installed PVC pressure pipe is 1.50 times the anticipated working pressure of the system; however, if the test pressure exceeds the rated pressure, the maximum test pressure should be the rated pressure. In addition, in no case should the test pressure exceed the rating of the valves or fittings, whichever is less.

Tracer Wires for Plastic Pipelines

For all locating tracer wires, the Contractor shall demonstrate to the Department, that the wire is continuous and unbroken through the entire run of the pipe by providing full signal conductivity (including splices) when energizing for the entire run in the presence of the Department Inspector. If the wire is broken, the Contractor shall repair or replace it.

Pump Stations

All pump stations to be dedicated to the City shall be inspected and have all systems operationally tested to the satisfaction of the Department. All discrepancies noted during construction or at the final inspection shall be resolved prior to the City's acceptance of the facility.

The Contractor shall be responsible for providing the clean water to run the pumps and perform the test(s).

1. Preliminary Inspection
A Preliminary Inspection shall be conducted prior to manufacturer start-up. A punch list shall be prepared and all items shall be resolved before the manufacture's start-up.

2. Manufacturer's Start-Up
Prior to the Final Inspection of the lift station equipment, the Contractor shall be responsible for coordinating start-up activities with the pump manufacturer's representative in accordance with the manufacturer's requirements. The Department Inspector and a Collections System Supervisor must be present at the time of manufacturer's start-up. Any deficiencies in equipment and/or workmanship noted during the manufacturer's start-up shall be remedied by the Contractor prior to final inspection. Upon successful completion of the manufacturer's start-up, the manufacturer shall deliver to the Department:

a. Three (3) copies of a letter certifying that all pumping and electrical equipment has been installed and is operating in accordance with manufacturer's requirements;
b. Two (2) sets of Operation and Maintenance Manuals; and
c. One (1) complete set of Spare Parts as specified.

3. Final Inspection
The Contractor shall provide the following pump test equipment and materials:

a. Water to conduct test;
b. Amp/volt meter;
c. Stop watch;
d. Calibrated test gauge to measure operating head. The gauge shall be calibrated in feet of water from 0 to 100 feet in one foot increments; and
e. Manufacturer's pump performance curves.

The department inspector attending the final inspection shall recheck any deficiencies. The Inspector shall then complete a cursory final inspection checklist and observe pump down tests, which shall include the following:

a. Manual check of all level ON-OFF operation, alarm and run lights;
b. Determination of inflow rate (if any);
c. Determination of pump capacity for each pump individually and both/all pumps simultaneously;
d. Determination of pump capacity with force main full. Verification of full force main shall be determined by pressure gauge provided by Contractor. Force main shall be considered full when the line pressure stabilizes; and
e. Plot performance for each pump on pump curves provided by Contractor.

Contractor shall provide all water necessary to conduct the pumping tests, and shall provide a connection for the test gauge on the blind-flanged tee in the valve vault. The stem connection shall be equipped with a plug valve to close the connection after testing is complete. The connection shall be left in place and shall be suitable for use as an air bleed off.

The pumping test results must meet or exceed the design pumping criteria approved by the Department to successfully pass the final inspection. Any deficiencies noted during the final inspection shall be repaired/replaced by the Contractor to the satisfaction of the Department and be re-inspected/retested prior to final acceptance.

Pump stations shall not be taken over by the Department until the daily flow of 7,500 GPD for the average monthly flow has been met.

Final Inspection and Approval

Final Inspection of the water and wastewater facilities shall be conducted only after the Department's receipt of As-built Drawings.

The Final Approval and Acceptance of a subdivision's water and wastewater facilities shall only be granted after final inspection and after proof of dedication is provided to the department.

The department shall have the right to withhold water/wastewater tap permits until the As-built Drawings have been submitted as required.

If the work is free from defects, or after the required repairs have been completed to the satisfaction of the department, a letter of final acceptance will be issued to the applicant and/or his authorized representative. The letter will state that the one year maintenance period has expired and that the department is now the owner of the water and wastewater facilities and is responsible for all future maintenance of these facilities.

Bonding and Performance Period

Bonding shall be provided in the full amount of the contract costs. A bond estimate shall be provided and reviewed, revised if necessary, and approved by the department

For capital projects a bid bond shall be submitted with each bid on contracts which are funded in part or whole by Federal, State or equivalent funding and/or exceed $10,000 in value. The amount of the bid bond shall equal 5% of the bid amount unless otherwise indicated in the information to the bidders. Performance and labor and material payment bonds shall be submitted by the Bidder after he or she receives the Notice of intent to Award. The amount of these bonds shall be individually equal to 100% of the contract (bid) amount, At the conclusion of work and prior to final payment the Contractor shall provide a one year maintenance bond in the amount of 10% of the contract amount.

The cost of all facilities addressed in the bond amount report shall be tabulated in a clear and concise manner and shall be derived from recognized sources. For Developer Projects, estimates shall be based on bid prices provided Contractor/Developer. Cost estimates for the report need not be itemized to the extent usually found in bid proposals, and shall be qualified as to what is included in unit prices so that reviewing agencies are aware of the cost factors used in the estimate.

For developments, the developer shall maintain the improvements in the development for a period of one year from the date the Department issues written conditional approval of the improvements. Thirty days before the end of the maintenance period, the Department shall perform an inspection of the development. The developer shall be notified of the inspection results in writing including a list of deficiencies for immediate correction.

References

The following general references were used in the preparation of these standards and specifications and become part of this document.

Code of the City of Hagerstown, Maryland. Chapter 238 Water, Chapter 240 Water Pollution Control.

City of Hagerstown Planning Department and Planning Commission
http://www.hagerstownmd.org (email at planning@hagerstownmd.org)

Design Guidelines for Sewerage Facilities (State Health Department Technical Bulletin: M-DHME-EHA-S-001).

10 States Standards for Water and Wastewater Facilities.

Pipeline Design for Water and Wastewater, ASCE, 1975, or latest edition.

Handbook of Public Water Systems, HDR Engineering Inc., 2001.

Standards and specifications for construction and materials. Maryland Department of Transportation, State Highway Administration.

Design and Construction of Sanitary and Storm sewers - American Society of Civil Engineers, Manual on Engineering Practice No. 37.

American Society of Civil Engineers (ASCE) and the Water Environment Federation (WEF), Gravity Sanitary Sewer Design and Construction, Second Edition (ASCE Manuals and Reports on Engineering Practice No. 60 / WEF, Manual of Practice No. FD-5).

Design of Wastewater and Stormwater Pumping Stations - MOP FD-4.

AWWA Manual M23 PVC Pipe - Design and Installation.

AWWA Manual M55 PE Pipe - Design and Installation.

Referenced and/or Applicable Standards

AWWA C104 - AWWA Standard for Cement–Mortar Lining for Ductile-Iron Pipe and Fittings.

AWWA C110/A21.10-08 - Ductile-Iron and Gray-Iron Fittings for Water.

AWWA C111/A21.11-07 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

AWWA C151/A21.51-02 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.

AWWA C223 - AWWA Standard for Fabricated Steel and Stainless Steel Tapping Sleeves

AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

AWWA C512 - Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

AWWA C800 - Underground Service Line Valves and Fittings.

NSF/ANSI Standard 61 - Drinking Water System Components.

ASTM A536 - Standard Specification for Ductile Iron Castings.

ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

ASTM C990 - Standard Specification for joints, concrete pipe, manholes and precast box sections, using Preformed Flexible Joint Sealants.

ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

ASTM F794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

ASTM F1336 - Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings.

ASTM F1803 - Standard Specification for Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

ASTM D2321 - Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Pipe.

ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

ASTM F714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

ASTM F894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.

ASTM F1483 - 05 Standard Specification for Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe

ANSI/AWWA C900-07 - AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution

AWWA C905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), For Water Transmission and Distribution

AWWA C909 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In.-24 In. (100 mm-600 mm), For Water Transmission and Distribution

AWWA C907 - Injection-Molded Polyvinyl Chloride (PVC) Pressure Fittings, 4 in. Through 12 in. (100 mm through 300 mm), for Water Distribution

ASTM F714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter

ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

Referenced and/or Applicable Testing Standards

ASTM F1417 – Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

ASTM F2487 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines.