WATER AND SEWER SYSTEM IMPROVEMENT SPECIFICATIONS

DESIGN • CONSTRUCTION • INSPECTION

FOR

BGMU
Bowling Green Municipal Utilities
CONNECTING BOWLING GREEN

801 CENTER STREET BOWLING GREEN, KY 42101 270.782.1200

JANUARY 2007
### Standard Drawings

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SECTION ONE

INTRODUCTION

1.0 PURPOSE

The purpose of this manual is to provide information and guidance to land developers, design engineers, and contractors in the construction of water and sewer facilities that are to become a part of or be connected to the Bowling Green Municipal Utilities Water and/or Sewer System. These regulations and procedures are to be followed by any person or corporation in the development of a residential subdivision or shopping center, or in any development in which the Developer is required to construct facilities that will become an asset to the BGMU system. The ultimate goal of this manual is to insure the protection of the health and welfare of the general public through the use of proper sanitary design features and construction methods.

1.1 AUTHORITY

The Bowling Green Municipal Utilities Board was established by City Ordinance No. 76-8 merging the Electric Place Board and Water and Sewer Commission to be responsible for the acquisition, administration, maintenance, operation and control of the City's electric, water and sewer facilities, and to this end this manual is hereby established.

1.2 REFERENCES

Certain technical aspects concerning construction materials and methods of construction are based on the Kentucky Department of Highways, Standard Specifications for Road and Bridge Construction Edition of 1979, hereafter referred to as Kentucky Department of Highways Specifications of K.D.H.S.

Other standards or specifications referred to are those of the American Society of Testing Materials (ASTM), American Association of State Highway Officials (AASHO), Portland Cement Association (APWA) and the American Water Works Association (AWWA).

Standard drawings showing details of certain improvements, which may be issued by the ENGINEER, shall be complementary to and a part of this manual.

1.3 GENERAL REQUIREMENTS

In order to insure that the design and construction of water and sewer facilities meet generally accepted sanitary engineering design criteria and generally recognized construction methods for such facilities, the OWNER or DEVELOPER of lands in which water and/or sewer lines are to be constructed that are to be connected to become a part of the Bowling Green Municipal Utilities System, must employ a Registered Professional Engineer, Registered in the Commonwealth of Kentucky, as set out in KRS Chapter 322. The OWNER-DEVELOPER shall employ the ENGINEER to:

1. Prepare detailed construction drawings.
2. Provide full-time resident inspection during construction.
3. Certify to the UTILIT Y that the facilities were constructed in accordance with the approved plans and the detailed specifications contained herein.
4. Provide a complete set of 'As-Built' drawings to the UTILIT Y on mylar.

1.4 UTILIT Y'S AUTHORITY

The UTILIT Y, or its designated representative, shall decide questions which may arise as to the quality and acceptability of materials furnished and work performed. The UTILIT Y shall interrupt the intent of these specifications and standard drawings in a fair and unbiased manner.

Nothing contained in these specifications or standard drawings is intended to conflict with any State or Federal Laws or regulations. If any requirement of these specifications or standard drawings are found to be in conflict with a State of Federal law or regulation, then the more stringent requirement of this manual be less stringent that any existing State or Federal law or regulation.

1.5 OBLIGATION OF THE CONTRACTOR

The CONTRACTOR shall perform and complete the work to the satisfaction of the UTILIT Y and in accordance with these specifications. The CONTRACTOR shall conduct his work so as to minimize interference with public and private business and traffic. He shall at his own expense, whenever necessary or required, provide barricades, flagmen, maintain lights, and take other precautions as may be necessary to protect life, property, adjacent buildings and structures. The CONTRACTOR shall be liable for all damages and injuries received or sustained by any person, persons or property in consequence of any neglect in safeguarding the work by any act of neglect or misconduct by him or his agents, subcontractors, employees or workmen.

1.6 COOPERATION

Cooperation with the office of the UTILIT Y concerning construction planning and procedures is required. Reasonable notice shall be given the UTILIT Y, or its representative, prior to beginning any
phase or construction. In no case should such notice be less than 24 hours.

1.7 DEFECTIVE MATERIAL AND WORKMANSHIP

Materials not in accordance with the specifications or defective work may be condemned by the ENGINEER or UTILITY at any time before final approval and acceptance by the UTILITY. Failure by the ENGINEER or UTILITY to condemn defective work shall not be construed as an acceptance of same.

1.8 FINAL INSPECTION

In addition to normal inspection which may be conducted during construction of development improvements, a Final Inspection will be made by a representative of the UTILITY. Final Inspection will be made prior to acceptance of any unit for maintenance by the UTILITY and only after all improvements are completed. As part of the Final Inspection, the UTILITY shall be given a completed set of ‘As-Built’ plans. All sanitary manholes or access openings shall be opened and all facilities shall be cleaned of all dirt, mud and other foreign matter. The OWNER-DEVELOPER shall provide personnel as required to aid in the Final Inspection.

1.9 EXISTING UTILITIES

Special precautions shall be taken by the CONTRACTOR to avoid damage to existing overhead and underground utilities owned and operated by public or private utility companies.

Where existing utilities or appurtenance structures, either underground or aboveground, are encountered, they shall not be displaced or molested unless necessary, and in such case shall be replaced in as good or better condition than found as quickly as possible.

The OWNER-DEVELOPER, or his representatives, shall bear the entire responsibility for locating, avoiding, or repairing damage to said existing utilities.

1.10 PERMITS, EASEMENTS AND RIGHT OF WAY

Unless otherwise required by the agencies involved, the OWNER-DEVELOPMENT shall make application for, obtain and pay for all licenses, permits, easements and right-of-way. The CONTRACTOR shall be required to comply with all State and Municipal ordinances, laws, and/or codes which may apply to same.

1.11 DEFINITIONS

APPROVED--Material, equipment, workmanship, process or method that has been accepted by Bowling Green Municipal Utilities are suitable for the proposed use.

AS-BUILT- A certification by the ENGINEER whose stamp appears on the plans that the measurements, depths, materials, and facilities that are shown on the plans are true and correct are constructed in accordance with the Water System and Sewerage System Improvement Specifications of the Bowling Green Municipal Utilities Board.

CONTRACTOR- The person, firm or corporation with whom the OWNER-DEVELOPER has executed an agreement to perform the utility construction for the project.

ENGINEER- A registered Professional Engineer, registered in the Commonwealth of Kentucky as set out in KRS Chapter 322.

OWNER-DEVELOPER- An individual, group of individuals, partnership, firm, association or corporation that is construction, or having constructed, water and/or sewer facilities that are to become a part of, or be connected to the Bowling Green Municipal Utilities’ Water and/or Sewer System.

RESIDENT INSPECTOR-The ENGINEER or his representative, who is required to be on the job site during any construction of facilities that are to become part of the Bowling Green Municipal Utilities’ Water and/or Sewerage facilities to insure that the facilities are being constructed in accordance with the Water System and Sewerage System Improvement Specifications of the Bowling Green Municipal Utilities Board.

SANITARY SEWER- A pipe or conduit that primarily carries sewage, and to which storm, surface and ground waters are not intentionally admitted.

SHALL-means a mandatory requirement.

UTILITY-Bowling Green Municipal Utilities’ Water and Sewer Division.
SECTION TWO

PROCEDURES

2.1 PURPOSE

The purpose of this section is to establish a working relationship between the OWNER-DEVELOPER, ENGINEER, CONTRACTOR and UTILITY by describing the step by step procedure to be followed by each party in initiating and completing the construction of any utility services that are to be construction of any utility services that are to be connected to or become a part of UTILITY system.

2.2 APPLICATION PHASE

The first step in the procedure is for the OWNER-DEVELOPER to file an application to the Water-Sewer Division of BGMU requesting permission to connect the proposed new facilities to the existing utilities. At this time the OWNER-DEVELOPER must also make a selection in writing, on forms provided by BGMU, as to whether he intends to proceed in a manner which will entitle him to refunds of the cost of the extended facilities as provided under KRS 96.539 and Sections 2.3, 2.5, and 2.9 of these regulations or prefers to recover the cost of the water and sewer utilities through some other method not requiring refunds by BGMU. If the OWNER-DEVELOPER chooses the refund method for a subdivision, it is required that the plat for recordation contain language on the face of it and in prominent lettering that any person who desires to connect to the water and/or sewer mains in that subdivision must pay a privilege fee prior to making the connection. In order to properly coordinate the work with Planning and Zoning, a copy of the application should also be submitted to Bowling Green-Warren County Planning and Zoning Commission to serve as notification of the project. The application form may be obtained from the BGMU main office at 801 Center Street. It is recommended that the OWNER-DEVELOPER engage the services of an ENGINEER in the beginning to assist in preparing the application since much of the information requested must be provided by the ENGINEER.

In addition to the information to be provided on the application form, the following attachments are to be provided.

a. A site plan shall be provided on an 8½ x 11” sheet in sufficient detail to show the location of the proposed development. A portion of an existing city map may be adequate for this purpose.

b. An executed copy of the Agreement between the OWNER-DEVELOPER and the ENGINEER.

Upon receipt of an application, the UTILITY shall evaluate the impact the proposed development will have on the existing facilities. From the estimated water demand and the wastewater flow provided by the OWNER-DEVELOPER'S ENGINEER, the UTILITY shall determine whether the existing water system is adequate to provide service (both domestic and dire protection) and whether the existing sewer system has capacity to receive is available at the time of application does not guarantee nor reserve that capacity indefinitely for that development. Approval of the application by the UTILITY indicates that capacity will be available only to that section of the development that is to be constructed, marketed, and made available for service immediately upon completion of the project proposed in the application. If the UTILITY is capable of providing these services, a letter of conditions shall be issued listing the requirements that must be met in order to obtain acceptance of the proposed facilities by the utility. Should it be determined that capacity for water or sewer service is unavailable, the OWNER-DEVELOPER should contact the Bowling Green-Warren County Health Department to explore alternate solutions.

2.3 DESIGN PHASE

Upon receipt of the letter of conditions from the UTILITY, the OWNER-DEVELOPER may authorize his ENGINEER to prepare plans for the proposed development, in accordance with the requirements contained in the detailed specifications herein.

During the design phase, the ENGINEER shall work closely with the Review Personnel at BGMU to insure that the final product meets all requirements of the UTILITY. There shall be no provisional approval. All plans must show all necessary details before approval is granted.

The ENGINEER shall provide the following design date attached to the plans:

1. Hydraulic calculations for the water system (The OWNER-DEVELOPER or the ENGINEER may obtain pressure readings at or near the point of connection from the UTILITY upon request). A minimum pressure of 30 psi must be maintained at all service connections. All water lines must be looped unless a dead end line is approved by the UTILITY.

2. Design calculations of gravity sewer lines shall show the grade, expected average flow,
and capacity and velocity at peak flows between each manhole.

3. Design calculations of sewage lift stations and force mains shall show pump capacity at design TDH, head loss thru the force main, static head between pump discharge and force main, capacity of wet well and expected frequency of operation. A copy of the manufacturer's pump curve data and specifications must be provided.

Plans prepared by the ENGINEER for the construction of water lines shall be drawn on plan sheets, 24” x 36", to a scale of 1” = 50’ (horizontal) and 1” = 5’ (vertical) and shall contain the following minimum information.

TITLE SHEET

1. Name and address of ENGINEER
2. Name and address of OWNER-DEVELOPER
3. Name of development
4. Vicinity map

PLAN SHEET

1. Topography and layout of development (streets, curb and gutter, sidewalks, drainage headwalls, storm drains, lot lines and utility easements)
2. Pipe material
3. Pipe size
4. Location by station number and type manhole
5. Length of sewer and grade between manhole
6. Invert of sewer at each manhole for both inlet and outlet and the fall within the manhole
7. Location, size and material of house connections
8. Profile of sewer line and other proposed underground facilities
9. Existing facilities, i.e. manholes, line sizes, storm drains, and water lines
10. The statement "All construction shall be in accordance with B.G.M.U. specifications"

Plans prepared by the ENGINEER for the construction of sewer lift stations shall be drawn on plan sheets, 24” x 36", to a scale of 1” = 1.0” and shall contain the following minimum information.

TITLE SHEET

1. Name and address of ENGINEER
2. Name and address of OWNER-ENGINEER
3. Name of development
4. Vicinity map

PLAN SHEET

1. Name of station manufacturer
2. Name of pump manufacturer
3. Number of pumps
4. Pump discharge at design TOH
5. Dimensions, elevations and capacity of wet well
6. Location and type of pump controls
7. Cathodic protection for steel tanks
8. Piping and valve arrangement inside station
9. The statement "All construction shall be in accordance with B.G.M.U. specifications"

2.4 COST ESTIMATE AND PRIVILEGE FEES

Unless the OWNER-DEVELOPER waives the refund provisions of KRS 96.539, the ENGINEER is required to submit to the UTILITY cost estimate for the total project and a proposal as to how privilege fees can be determined in order to attempt to provide for recovery of the costs over a period not to exceed ten years. It is suggested that the privilege fee be based on a formula with the denominator being linear front footage, square footage or service connection numbers and sizes, with the final judgment to be reserved by the UTILITY. The numerator will be the total of all engineering and construction costs, excluding interest.
2.5 REVIEW PHASE

After the completed plans have been reviewed by the OWNER-DEVELOPER with the ENGINEER, and approved by him, two sets shall be submitted to the UTILITY for its review and approval. The OWNER-DEVELOPER should allow a 30-day period for the review time, however, the UTILITY shall conduct its review as expeditiously as possible.

The UTILITY shall review the plans as to the sanitary features of design and that standard specifications contained herein. Any plans submitted that do not completely comply with all requirements of the UTILITY shall be returned to the ENGINEER unapproved with the necessary corrections noted. After all corrections are made, the corrected plans shall be returned to the UTILITY so that each sheet may be stamped "APPROVED". Final written approval shall not be granted from the Kentucky Department for Natural Resources and Environmental Protection.

2.6 BIDDING AND AWARDING OF CONTRACT

If the OWNER-DEVELOPER requests the refund method, bids must be advertised and received in accordance with KRS 45A.365 and are to be opened in the presence of a representative of the ENGINEER, OWNER-DEVELOPER and UTILITY and any bidders who may desire to attend. Subject to joint approval of all three parties, bids may be awarded based on the lowest and/or best bid.

2.7 GENERAL REQUIREMENTS

The Construction phase shall not begin until a written Notice to Proceed from the UTILITY is received by the OWNER-DEVELOPER. When the UTILITY is ready to issue to Proceed, a Pre-Construction Conference will be scheduled and held jointly by the UTILITY and the Planning and Zoning Commission. The OWNER-DEVELOPER shall be responsible to the UTILITY for the proper construction of the facilities. In no case shall the construction of the water and sewer system begin until the rough grade on the streets and drainage ditches are complete.

The utility shall be notified immediately of any conflicts encouraged in the field between the water and sewer facilities and the drainage work.

The ENGINEER shall provide a full-time resident inspector paid for by the OWNER-DEVELOPER to insure that all construction is accomplished in accordance with the approved plans and the standard specifications contained herein. The ENGINEER'S resident inspector shall be on the job anytime the CONTRACTOR is working on the construction of water and/or sewer facilities.

In addition to the inspection, it is requested that the CONTRACTOR or the ENGINEER's resident inspector contact the City Street Department when water or sewer lines have been backfilled under streets so that a representative of that Department may visually inspect the backfill material before final surface is placed on the streets. Any deviation, change, addition or deletion from the approved plans must be approved by the UTILITY in writing before the deviation, change, addition or deletion is made in construction. The ENGINEER shall submit weekly inspection reports to the UTILITY during the construction period. Representatives of the UTILITY shall have the right to enter upon the project site to make periodic inspections of the work in progress.

Upon completion of construction, the CONTRACTOR shall pressure test and disinfect all water lines, and conduct infiltration, exfiltration or air tests on sewer lines as outlined in these standard specifications. Any section of lines that does not pass the prescribed test must be corrected to the satisfaction of the UTILITY and retested until all testing procedures are satisfied. All testing must be conducted in the presence of representatives of the OWNER-DEVELOPER, ENGINEER, CONTRACTOR and UTILITY, except that the ENGINEER may represent the OWNER-DEVELOPER, if authorized by him.

2.8 CERTIFICATIONS OF COMPLETION

Upon completion, the OWNER-DEVELOPER shall state the final total project cost and transfer ownership of the new facilities to the UTILITY and said facilities shall become an asset of the UTILITY.

Upon completion of construction, the ENGINEER shall certify in writing to the UTILITY that the project has been constructed in accordance with the approved plans and the standard specifications contained herein. A complete set of "As Built" drawings on mylar must accompany the ENGINEER's certification.

Upon receipt of these certifications and 'As Built' drawings, the UTILITY shall conduct a final on-site inspection with Engineer or his representative and the Contractor or his representative. At this time, surface features and subsurface features, in as much as possible, will be checked for conformity to approved plans and the standard specifications contained herein. Items not in compliance will be listed on a "punch list" and sent to the Engineer and Owner-Developer. After giving these items their necessary attention, the Engineer shall schedule a pre-inspection. After the final inspection, the utility shall accept the facilities as an extension of the existing public system and deliver water service to and/or accept wastewater from the development.
In the event that the second inspection final approval is not given by the UTILITY, the UTILITY reserves the right to assess a fee for any subsequent re-inspections. This fee will be processed as a work order and invoiced to the Owner-Developer. Final approval will be contingent upon payment of this invoice.

2.9 REFUND AGREEMENT

If the OWNER-DEVELOPER has requested the refund method and has met all the requirements of the UTILITY, a refund agreement will be prepared based on preliminary agreement as covered in Paragraph 2 of this section, stating the exact amount and application of privilege fees, which will be collected by the UTILITY and paid to the OWNER-DEVELOPER on January 1 of each year over a period not to exceed ten years, with total payment not to exceed total project cost. Where the refund agreement is applicable to a subdivision, a copy of refund agreement will be lodged for record in the Miscellaneous Book in the office of the Clerk of the Warren County Courthouse in order to enable prospective purchasers of lots, title examiners and other interested persons to determine from the public records the amount of the privilege fee applicable to any particular lot in the subdivision.
SECTION THREE

WATER MAINS

3.0 PURPOSE

The purpose of this chapter is to outline requirements for proper design, construction, inspection, and final acceptance of potable water mains and appurtenances, customer services connections, and public fire protection systems.

3.1 DESIGN REQUIREMENTS

A complete set of hydraulic computations, in a tabular form, shall be made available to the UTILITY which indicates average and peak flows, ground elevations, elevation of hydraulic grade line and pressures.

3.1.1 SIZE OF WATER MAINS

All water mains shall be designed to carry peak flows and maintain in a minimum line pressure of 30 psi at all points. Design peak flows shall be the greater of the following:

a. Flow determined by the ENGINEER as the instantaneous demand placed upon the system by the development.

b. Flow required for fire protection by Insurance Services Office of Kentucky guidelines.

c. Computed peak flow if development is commercial or industrial.

No water main shall be smaller than that required by Bowling Green Municipal Utilities master plan for expansion, nor shall any water main be smaller than six inches in diameter.

3.1.2 SIZE OF SERVICE PIPE

All service piping shall be one inch minimum diameter. Where greater flows are anticipated than those normally expected for residential services, the service piping shall be designed to maintain 30 psi pressure at peak design flow.

3.1.3 DEPTH OF COVER

All water pipe shall be covered with a minimum of 30 inches of backfill material, measured from the top of pipe to the final finished ground level.

3.1.4 PUBLIC FIRE PROTECTION

The ENGINEER shall follow the current suggested maximum fire protection requirements of the Insurance Services Office of Kentucky in providing for public fire protection.

3.1.5 SEPARATION OF WATER LINES AND SEWERS SEE SECTIONS 4.13

3.2 PIPE MATERIAL

All water mains shall be constructed of ductile iron or polyvinyl chloride (PVC), unless otherwise approved by the UTILITY, except that lines 10 inches and larger shall be ductile iron.

3.2.1 DUCTILE IRON PIPE, FITTINGS AND JOINTS

Ductile cast iron pipe shall conform to the latest AWWA specifications C151 (ANSI A21.51) with standard thickness as designated to AWWA C150. Thickness class shall be noted on the plans by the ENGINEER.

The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C104 (ANSI A21.4). Thickness of the lining shall be as set forth in Sec. 4-10-1 of the aforementioned specifications unless otherwise directed by the UTILITY. The exterior of all pipe, unless otherwise specified, shall receive either a coal tar or asphalt base coating a minimum of one mil thick.

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an eight mil thick polyethylene encasement meeting the requirements of ANSI A21.5. Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation and waste dumps. If such corrosive soils are expected, the ENGINEER shall be responsible for conducting resistivity tests on the soil.

Fittings shall be Mechanical Joint Class 250 conforming to AWWA Specifications. Fittings shall be tar-coated outside and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on or mechanical joint type, conforming to AWWA C11 (ANSI A21.11). Bells for push-on for type-joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket and annular recess of the socket shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled.

Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell with exterior flange and interior recess for the sealing gasket, a pipe or
fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts.

Joints for cast iron fittings shall be mechanical joint type only. All valves for buried service on the water mains shall be of the mechanical joint type.

Mechanical joint plain and bell ends of fittings shall conform to the dimensions set forth in AWWA CI11-72 (ANSI A21.11).

The cleaning and assembly of pipe and fitting joints shall be in accordance with the manufacturer's recommendations.

3.2.2 POLYVINYL CHLORIDE PIPE, FITTINGS AND JOINTS

PVC water pipe shall conform, as a minimum, to ASTM Specifications D-2241, and shall be pressure Class 200. The pipe furnished under ASTM A-2241 shall have a standard dimension ratio not to exceed SDR 21, and shall be rated to a working pressure of at least 200 psi at 73.4 °F.

Fittings shall be cast iron Mechanical Joint Class 250 conforming to AWWA specifications Cl 10 for short body cast iron fittings. Fittings shall be tar-coated outside, and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on type conforming to ASTM D3139 and F4777 requirements for elastometric gasket joints. All jointing material and lubricants shall be non-toxic.

3.2.3 ENCASEMENT PIPE

Encasement pipe shall be steel, plain end, uncoated and unwrapped, have a minimum yield point strength of 35,000 psi and conform to ASTM A252 Grade 2 or ASTM A139 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18-foot lengths.

The wall thickness of the pipe shall be a minimum of 0.250 inches for highway crossings and 0.344 inches for railroad crossings. The diameter of the pipe shall conform to the requirements of the Kentucky Department of Transportation, Bureau of Highways for highway crossings.

3.3 WATER LINE APPURTENANCES

3.3.1 GATE VALES

All gate valves shall be of iron-body resilient-seated gate valves with nonrising stems, and suitable for water working pressures of 200 psi. Valves shall be of standard manufacture and of the highest quality both as to materials and workmanship.

All gate valves shall be furnished with mechanical joint end connections, unless otherwise approved by the UTILITY.

All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

Each underground gate valve shall be installed in a vertical position with a valve box, as shown in Drawing WD-1. Where a valve is installed at a depth that positions the operating nut more than three feet below the proposed finished grade, valve nut extensions shall be installed. Gate valves set with valve boxes shall be provided with a two-inch square operating nut and shall be opened by turning to the left (counterclockwise). Gate valves for installation in meter vaults shall be flanged ANSI B 16.1 Class 125 and hand wheel operating.

All valves shall conform with the latest revision of AWWA Standard for resilient-seated gate valves for water and sewage systems, AWWA C509. Valves shall be as manufactured by Mueller, M&H, Darling, Smith, Kennedy or approved equal.

3.3.2 BUTTERFLY VALVES

All butterfly valves shall be of the tight closing, rubber seat type with rubber seats which are recess mounted and securely fastened to the valve body. Valves shall be rated for 150 psi pressure and shall be satisfactory for applications involving valve operating after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full structural requirements of AWWA specifications C504. The manufacturer shall have manufactured tight-closing, rubber seated butterfly valves for a period of at least five years.

The valve bodies shall be constructed of cast iron (ASTM A126, Class B) and shall have integrally cast mechanical joint ends. Two trunnions for shaft bearings shall be integral with each body. Body thickness shall be strictly in accordance with AWWA C504.

All valve discs shall be constructed of cast iron Type-1!. All disc seating edges shall be smooth and polished. Valve shafts shall be constructed of 18-8 type 304 stainless steel and shall be one-piece unit extending full size thru the valve disc and valve bearings. Valve seats shall be of a natural rubber or a synthetic compound. Bonded-in seats must be simultaneously molded in, vulcanized and bonded to the body; and the seat bond must withstand 75 pounds pull under test procedure ASTM 0429-58, Method B.
Valves shall be fitted with sleeve type bearings. Bearings shall be corrosion resistant and self-lubricating. Bearings load shall not exceed 2500 psi.

Valve operators shall be of the traveling-nut type designed to withstand at least 300 foot-pounds of input torque at full open or closed portions without damage to the valve or operator. All operators shall be fully gasketed and grease-packed and designed to withstand submersion in water nut to the left (counterclockwise) and shall require a minimum of 32 turns to open from fully closed.

All surfaces of the valve shall be clean, dry and free from grease before painting. The valve interior surfaces, except seating surfaces, shall be evenly coated with black asphalt varnish in accordance with Federal Specifications TI-V-51 A and AWWA C504-58.

See Drawings WD-2 for typical setting for a buried butterfly valve.

Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C504-58., Section 13.

3.3.3 TAPPING SLEEVES AND VALVES

Tapping sleeves for connections to existing water lines shall be of the mechanical joint type suitable for working pressures of 150 psi and shall be Mueller No. H-615, American-Darling No. 1004, M & H No. 1174, or approved equal.

Tapping valves shall be of the mechanical joint type suitable for working pressures of 150 psi and shall be Mueller No. H-667, American Darling No. 565, M & H No. 751, or approved equal.

3.3.4 VALVE BOXES

Valve boxes shall be of 5 1/16 inch standard cast iron, two piece, screw type valve box with drop cover marked "WATER". Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them. Valve box bases shall not rest on the valves but shall be supported on crushed stone fill. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be at grade in any paving, walk or road surface, and two to three inches about ground in grass plots, fields, woods or other open terrain. Where valve box extensions are required, they shall be as supplied by valve box manufacturers. Extensions made up of pipe sections will not be accepted by the utility.

3.3.5 FIRE HYDRANTS

The CONTRACTOR shall furnish and install fire hydrants where shown on the plans. Hydrants shall conform in all respects to the requirements of AWWA C502-73. Hydrant barrel shall have safety breakage feature above the ground line. All hydrants shall have 6 inch mechanical joint shoe connection, two 2 1/2 inch discharge nozzles and one 4 Y inch pumper nozzle with caps fitted with cap chains. Connection threads and operating nuts shall conform to National Standard Specifications as adopted by National Board of Fire Underwriters.

Operating nut shall be 1 Y inches, and shall open left (counterclockwise). Main valve shall have 5 11. inch full opening and be of the compression type opening against water pressure so that the valve remains closed should the barrel be broken off.

Hydrants shall be fully bronze mounted. Main valve shall have a threaded bronze seat ring assembly of such design that it is easily removed by unscrewing from a threaded bronze drain ring. Bronze drain ring shall have multiple ports providing positive automatic drainage as the main valve is opened or closed.

Drainage waterways shall be completely bronze to prevent rust or corrosion.

Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stop shall be provided to limit stem travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir protected from weather and the waterway with O-ring seals.

Hydrants shall be designed from 150 psi working pressure and shop tested to 300 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drain shall function and there shall be no leakage into the bonnet.

Hydrants shall be set plumb with not less than three cubic feet of crushed stone and backed with at least one cubic foot of Class "C" concrete or equivalent.

Fire Hydrants shall be located not more than 100 feet from the edge of existing or proposed pavement and shall not be more than 20 feet from a street intersection unless otherwise specified by the UTILITY. Hydrants shall be installed with a vertical distance from the center of the pumper nozzle to the ground of 16 to 18 inches. All fire hydrants shall be provided with a shut-off valve in the hydrant lateral as shown in Drawing WD-3. Fire hydrants shall be offset from common property line three to five feet and not set on iron property pins.

Hydrants shall be Mueller Company Model A-423 American-Darling Model B-62-B, M & H Compression Type Traffic Model, or approved equal.

All new fire hydrants installed in accordance with these specifications shall be painted as follows:

Preparation – The fire hydrant surface shall be washed with No. 40 Metalprep. Let completely dry for one hour.
Priming – Apply one (1) coat of No. 296 Zinc Chromate Primer to fire hydrant surface. Care shall be taken to insure that the operating nut remains clean of primer. Allow to dry for a minimum of 24 hours.

Final Coat – Apply one (1) coat of No. 2474 Safety Yellow to fire hydrant surface, except for hydrant cover and pumper nozzle cap and hydrant cover shall receive one (1) coat, as specified by this Utility, of either:

- No. 2472, Safety Red Enamel
- No. 2473, Safety Orange Enamel
- No. 2474, Safety Yellow Enamel
- No. 2475, Safety Green Enamel

Care shall be taken to insure that the operating nut remains clean of paint.

All coatings and paints shall be as manufactured by Porter Paint Company, or approved equal.

Unless otherwise approved by this utility, no coating or paint shall be applied when the ambient temperature is below 50 degrees F. or the relative humidity is above 85 percent.

### 3.3.6 AIR RELEASE VALVES AND BOXES

Air release valves shall be the combined vacuum and air release type and shall be equipped with cast iron body and cover, stainless steel float, Buna-N seat and bronze linkage. Valve shall have one inch threaded inlet and be suitable for 150 psi water working pressure. Valve shall be APCO No. 200-A as manufactured by Valve and Primer Corp., Schaumburg, Illinois, or approved equal.

Air release valves shall be installed at the high point on the water main as shown on the Drawings and to the main by a corporation stop with inside 1.P.S. threaded outlet. The inlet pipe to the valve shall be ASTM 843 extra strong seamless red brass pipe with 1.P.S. male threaded ends.

The air release valve box shall be a 24 inch reinforced concrete pipe conforming to ASTM C76, Class II, Wall B, and shall be set on a No. 9 crushed stone or gravel base. The cover shall be cast iron, medium duty, perforated and of the size to fit the bell of the pipe.

### 3.3.7 BLOWOFFS

Blowoffs shall be installed at right angle to the water main at the locations shown on the Drawings or as directed by the UTILITY. The standpipe shall have a drainhole at its lowest point and the discharge end shall be equipped with an adapter to connect it to a BGFD standard 2" Y2" hose. Blowoffs shall be as shown on Standard Drawings No. WD-4.

### 3.3.8 FIRE PROTECTION LINES

Installation of water lines to be used for private fire protection systems (i.e., sprinkler systems) shall have an approved check valve installed at the property line.

### 3.4 TRENCH EXCAVATION

Unless specifically directed otherwise by the UTILITY, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches. Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.

Unless specifically authorized by the UTILITY, trenches shall in no case be excavated or permitted to become wider than two feet six inches plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than two feet six inches at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted granular fill up to the top of the pipe or providing pipe with additional crushing strength as determined by the UTILITY. This determination shall take into account the actual trench loads that may result and the strength of the pipe being used.

All excavated materials shall be placed a minimum of two feet back from the edge of the trench.

Where conditions exist that may be conducive to slides of cave ins, proper and adequate sheeting, shoring and bracing shall be installed (See Section 3.4.2) to provide safe working conditions and to prevent damage of work.

Trenches shall be kept free of water during the laying of pipe and until the pipeline has been backfilled.

Backfilling shall be as set out hereinafter.
3.4.1 OBSTRUCTIONS

In cases where stonew sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or molested unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.

The CONTRACTOR shall notify the utility companies 48 hours prior to excavation adjacent to their facilities.

3.4.2 SHORING, SHEETING AND BRACING

Where unstable material is encountered or where the depth of excavation in earth exceeds six feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing, and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow rights-of-way or other constructed areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the CONTRACTOR; however, the ENGINEER may require the submission of shoring plans (accompanied by the supporting computations) for review prior to the CONTRACTOR undertaking any portion of the work.

Foundations adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing, or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the CONTRACTOR shall be held strictly responsible for any damage to said foundation.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable whales and braces.

Care shall be taken to avoid excessive backfill loads on the completed pipelines, and the requirements that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameters of the pipe shall, as set out in Section 3.4 hereinbefore, be strictly observed.

All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as necessary.

3.4.3 BLASTING

All blasting operations shall be conducted in accordance with the municipal ordinances, State laws, and Section 9 of the manual of Accident Prevention in Construction published by the Associated General Contractors of America, Inc. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by him.

All shots shall be covered with heavy timber or steel blasting mats to prevent flying material. Unless otherwise specified or directed, delay caps shall be used to reduce earth vibrations and noise.

All blasting operations shall be covered by public liability insurance, or if said public liability insurance does not cover blasting, then the CONTRACTOR shall have separate public liability insurance to cover his blasting operations.

All blasting operations shall be supervised and perfomed by qualified personnel.

3.5 PIPELINE BEDDING

In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and insofar as possible where bell and spigot pipe are involved so that none of the load will be carried on the bells.

Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches above the bottom of the trench as excavated.

Supporting of pipe shall be as set out hereinafter, and in no case shall the supporting of pipe on blocks be permitted.

3.5.1 EARTH FOUNDATION

All water main pipe shall be supported on a bed of Size #9 crushed stone as defined by K.D.H.S. and as shown on Standard Drawing No. WD-5. Bedding material shall be free from rock and be acceptable to the UTILITY. In no case shall pipe be supported directly on rock.

3.5.2 ROCK FOUNDATION

If the trench bottom is in rock, the excavation shall be undercut to a minimum depth of six inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone (see Standard Drawing NO. WD-5).
3.5.3 SPECIAL BEDDING

In wet, yielding mucky locations, where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the UTILITY, yielding and mucky material in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Crushed stone or other such granular material, if necessary, as determined by the UTILITY to replace poor subgrade material, shall be classified as “Special Pipe Bedding”.

Granular material for “Special Pipe Bedding” shall be #9 crushed stone.

3.6 LAYING PIPE

All pipe shall be laid with ends abutting and true to line and grade as shown on the plans. Supporting of pipe shall be as specified under “Pipe Bedding” hereinbefore and in no case will the supporting of pipes on blocks be permitted.

Fittings for the water mains shall be provided and placed as and where directed by the UTILITY or shown on the plans. All open ends of pipes and of branches shall be sealed or plugged.

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Any piece of pipe or fitting which is known to be defective shall not be laid or placed in the lines. Any defective pipe or fitting discovered after the pipe is laid shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

Granular bedding material as specified hereinbefore, shall be used to correct irregularities in the earth trench subgrade.

The interior of the pipe, as the work progresses, shall be clean. When laying of nay pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth or other material.

No backfilling, (except for securing pipe in place) over pipe will be allowed until the ENGINEER, or his representative has made an inspection of the joints, alignment and grade in the section laid, but such inspection shall not relieve the CONTRACTOR of further liability in case of defective joints, misalignment caused by backfilling and other such deficiencies that are noted later.

3.7 JOINTING PIPE

The type of joints described hereinbefore in Section 3.2.1 and 3.2.2 shall be installed in accordance with the manufacturer’s recommendations.

3.8 BACKFILLING PIPELINE TRENCHES

All backfilling shall be accomplished in accordance with the details shown on Standard Drawings No. WD-5 and the requirements of this section. Any variances must be approved in writing by the UTILITY.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95 percent of standard (ASTM D969) Proctor density where mechanical tamping of backfill is required.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressure do not occur.

3.8.1 METHOD "A" BACKFILLING IN OPEN TERRAIN

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to the springline (centerline) of the pipe shall be backfilled with #9 crushed stone.

When installing ductile iron pipe, the portion of the trench from the springline of the pipe to a point six inches above the pipe shall be backfilled with #9 crushed stone.

The upper portion of the trench above the compacted portion shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the ENGINEER.

3.8.2 METHOD "B" BACKFILLING UNDER PAVED AREAS

Backfilling of pipeline trenches under sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:
The lower portion of the trench, from a point six inches below the bottom of the pavement or concrete sub-slab up to grade, shall be backfilled with a base course of dense graded aggregate, crushed stone, or fine gravel and sand suitable to the appropriate governing body having jurisdiction over the street or roadway. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

3.8.3 SETILEMENT OF TRENCHES

Wherever water lines are in, or cross, driveways and streets, the CONTRACTOR shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the OWNER-DEVELOPER.

3.9 CONCRETE CRADLE, ANCHORS OR ENCASEMENT

Concrete cradle, anchors or encasement of water mains and fittings shall be placed where shown on the plans. Concrete shall be 3000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints.

Water mains shall have concrete thrust or "kicker" blocks at all pipe intersections and changes of direction to resist forces acting on the pipeline, as shown on Standard Drawings No. WD-6 and WD-7.

Encasement of water mains under creeks and drainage waterways shall be constructed as shown on Standard Drawing WD-9.

In places where concrete will be poured at a mechanical joint fitting, polyethylene (plastic) sheet, a minimum of 3 mil, shall be wrapped around the fitting to prevent the concrete from coming in contact with the bolts and nuts.

3.10 HIGHWAY AND RAILROAD CROSSINGS

Steel encasement pipe for road and railroad crossings shall be bored and/or jacked in place to the elevations shown on the plans. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside. The encasement pipe shall be installed after the encasement pipe is in place.

Installation of the water pipe in the encasement pipe shall be as per manufacturer’s recommendations. After the water main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with brick or concrete block masonry in a manner acceptable to the UTILITY.

3.11 TESTING OF LINES

On all projects involving the installation of water pipeline, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results.

a. All water mains shall be give a hydrostatic test to 150 psi, which under leakage shall not exceed the limits established in Section 4 of AWWA Standard Specifications C600.

b. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.

c. Duration of test shall be not less than two hours.

d. Where leaks are evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or relaid.

e. All pipe, fittings and other materials found to be defective under test shall be removed and replaced.

f. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with.

g. The UTILITY shall furnish a recording gauge and clock used during leakage test and recording pressure charts during duration of test. Recording pressure charts remain the property of the UTILITY at conclusion of test.

h. All hydrants shall be open with caps tightened securely during hydrostatic test.

3.12 DISINFECTION OF WATER LINES

The new potable water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the UTILITY.

After testing, a solution of hypochlorite using HTH or equal shall be introduced into the section of the line being disinfected sufficient to insure a chlorine dosage of at least 50 ppm in the main. While the solution is being applied, the water should be allowed to escape at the ends of the line until tests indicate that a dosage of at least 50 ppm has been obtained throughout the
open and close all valves and cocks while chlorinated water shall be allowed to remain in the pipe for 24 hours, after which a residual of at least 25 ppm shall be obtained. The disinfection shall be repeated until 25 ppm is obtained, after which time the main shall be thoroughly flushed until the residual chlorine content is not greater than 1.0 ppm.

Following disinfection of the line, bacteriological samples shall be collected and analyzed in accordance with the requirements of Kentucky Department for Natural Resources and Environmental Protection. When the samples have been approved, the new line then may be given a hydrostatic test. The disinfection of water lines will proceed this hydrostatic testing and the two tests shall not be run concurrently.

3.13 CONNECTION TO EXISTING SYSTEM

Unless otherwise directed by the UTILITY, the CONTRACTOR shall connect the new water main to the existing water system. The CONTRACTOR must notify the UTILITY when the connection is to be made to that representatives of the utility may operate existing valves and witness the connection. A minimum notice of 24 hours must be given.

In case a wet tap must be made in connecting to the existing system, the tapping sleeve, valve and box and all other necessary material shall be provided by the CONTRACTOR. The actual work in tapping the line shall be performed by the UTILITY after receiving the tapping fee from the OWNER-DEVELOPER.

3.14 CUSTOMER SERVICE CONNECTIONS

Water service connections shall be made in accordance with the details shown on Standard Drawings No. WD-8. Locations and sizes of service connections shall be as directed by the UTILITY. The UTILITY shall install a tap on the new main, service piping from the water main to the customer's property line, and a curb stop and curb box at the property line, except for water line construction in new subdivisions. In new subdivisions, the CONTRACTOR shall install the tap, with the service piping and curb stop with box extended ten feet inside the property line. Long side services feeding apartment complexes with up to 4 units shall be (2) 1" copper lines. Long side services feeding apartment complexes with (5) or more units shall be 2" PVC.

3.14.1 PIPE AND FITTINGS

Water services piping shall meet the following requirements:

Copper service pipe shall be seamless copper water tube, ASTM B 88, Type K.

All fittings shall be compatible with the type of service piping used. All compression joints on plastic tubing or in which mechanical stresses are imposed on the tubing or pipe, such as from tightening a screw, shall have stainless steel insert stiffeners in the end of the tubing or pipe, sufficiently protecting the stressed area.

An individual service line shall be provided for each lot. In cases where a subdivision is presently or is planned to be zones for townhouses, service line shall be sufficient in quantity to service each unit individually.

3.14.2 COPRORATION STOPS

Corporation stops shall have AWWA C800-66 C.S. threaded inlet. Outlets shall be suitable for the type of service piping furnished and laid.

Corporation stops shall be Mueller H-15000, or approved equal.

3.14.3 CURB STOPS

A curb stop shall be installed on the end of every customer service pipe. The curb stop shall be installed at the customer's property line except for new construction (see 3.14 above) Curb stop end connections shall be suitable for the type of service piping installed. The curb stop shall be Mueller No. H-15175, or approved equal.

A curb box shall be a two inch iron pipe centered over the curb stop key and extended 24 inches above finished grade. Exposed pipe shall be painted fluorescent orange.

3.14.4 Tracer Wire

Insulated, 12 gauge, solid copper (Do not use braided wire) tracer wire will be laid with all metallic and no metallic water mains. When tracer wire is spliced, contractor will use 3M Direct Bury Splice Kits, 3M ID #80-6105-9435-2. Tracer wire shall be spliced at hydrant tee with on single wire running to hydrant and through cap chain attachment hole. At tie-ins, tracer wire will be brought up in valve box. Tracer wire is never to be tied off below grade. Tracer wire will not be run with copper service lines.
Cast iron Cover Marked "Water"  
(Clown No. F-2491 or Equal)  

Finished Asphalt or Concrete Grade

Finished Earth Grade

Precast Concrete Slab, 24" Min. Dia. x 4" Thick

Mechanical Joint Only

Paved Or Concrete Areas
Precast Concrete Slab, 24" Minimum Dia. x 4" Thick

Cast iron Cover Marked "Water" (Clow No. F-2491 or Equal)

Finished Earth Grade

Cast iron Value Box, install Plumb and Centered Over Valve Operating Nut. (Clow No. F-2454 or Equal)

Operating Nut

Totally Enclosed Gear Reducer

Class "B" Concrete Support Under Valve Operation

Note: Butterfly Valves to be used on Water Mains 10" or larger.
Need #12 Coated Copper Wire As Required. It Shall Be Extended And Attached To Safety Flange Bolt On Each Fire Hydrant.

Need #12 Solid, Coated Copper Wire As Required.

5 1/4" Fire Hydrant:
With 2 2 1/2" Hose Nozzles And One Pumper Nozzle

Place Conc. Kicker Behind Hydrant, Minimum of 8" Deep 15" High And Full Width Of Trench (Kick To Bear On Undisturbed Earth).


Min. of 3 Cu. Feet of Crushed Stone Fine Gravel, Or Sand Under Hydrant For Drainage.

Value Box
(Refer To Typical Gate Value Setting)

Tee or Tapping
= O Valve & Sleeve

Note: Never tie tracer wire off below grade, at end of line and tapping valves. Bring wire up in valve box.
Plan

Threaded To Accept 2" Hose Connection

2" Gate Valve

# 9 Crushed Stone Backfill

2" Galvanized Pipe

Section A - A

Cast Iron Valve Box and Cover. (Refer To Typical Gate Valve Setting Dwg. No. WD-1).
Typical Backfill & Bielding Methods

No. 9 Crushed Stone Backfill and Pipe Bedding to Springline of Pipe.

- Method "B" - (Paved Areas)

Note:
Cutting and Repairing Existing Pavement Concrete or Gravel Shall Be in Accordance With Owners Requirements.
1/4" x 3" Steel Strapped Drilled
To Accomodate Anchor Bolts.

Ductile Iron Bend

3/4" Dia. Stainless Steel, Threaded Anchor Bolts
With Stainless Steel Nuts.

Water Main

3/4" Dia. Tie Bar

Class "C" Concrete

Note:
Mechanical Joint Restraint Systems
"Mega Lug" 1100 Series or Approved Equal.

Vertical Bends

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<th>Vertical Bend &amp; Straight Pipe</th>
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Note:
Anchors To Be Full Width Of Trench.
Anchors Must Be Placed Against Undisturbed Earth.

No. 5 Reinforcement Bar

Water Main

Class "C" Concrete

Straight Pipe
Side of Trench

Class C Cone.

45 & 90° Bends

Side of Trench

Class C Cone.

Section A - A

Plates & Tees

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Concrete or Solid Cone. Block

Plugs

Concrete Thrust Blocks
Install At Property Line, Except For Construction in New Subdivisions, in Which Case it Shall Be 10 Feet Inside Property Line.

2" Iron Pipe Painted Fluorescent Orange

Finished Grade Earth Or Pavement

Refer To Dwg. No. WD-5 For Backfill.

Curb Stop

Corporation Stop

Copper Service Line

Bedding & Backfill To Be No. 9 Crushed Stone 6" Above & Below Service Line

1 Cu. Ft. Crushed Stone

24" Above Finished Grade

Finished Grade

Meter Installation By B.G.M.U.

To Be No. 9 Crushed Stone

6" Above & Below Service Line

Bedding & Backfill

..
Extended Encasement 2'-0" Beyond Water Line On Each Side.

Cap Shall Extend 1'-0"
Beyond Trench On Both Sides.

Water Level

6" Con. Cap

D. G. A.

2'-6" Min.

P.V.C. Water Main

Typical Creek Crossing For
P.V.C. Water Main

Concrete Encasement

Typical Creek Crossing For
D. Water Main

BGMU
Bowling Green Municipal Utilities

Water Line Encasement

WD-9
SECTION FOUR

SANITARY SEWERS

4.1 PURPOSE

The purpose of this section is to outline the requirements for proper design, construction, inspection, and final acceptance of manholes, sanitary sewer lines and house connections.

4.2 DESIGN REQUIREMENTS

A complete set of computations should be made available to the UTILITY in a tabular form, which indicates depth of flow and velocities at minimum, average, and maximum daily waste flows for the different sizes of sewers proposed.

4.1.1 DEPTH

In general, sewers shall be sufficiently deep so as to receive sewage by the sewers and to prevent freezing, but shall not be less than three feet deep.

4.1.2 SLOPE

All sewers shall be so designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second. The following are the minimum slopes which should be provided; however, slopes greater than these are desirable.

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<tr>
<th>Sewer Size</th>
<th>Minimum Slope in Feet Per 100 feet</th>
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<td>8 inch</td>
<td>0.40</td>
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<tr>
<td>10 inch</td>
<td>0.28</td>
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<td>12 inch</td>
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<td>30 inch</td>
<td>0.067</td>
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<td>36 inch</td>
<td>0.058</td>
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Sewers shall be laid with uniform slope between manholes. Sewers on the 20 percent slope or greater or when specified by the UTILITY, shall be anchored with concrete anchors spaced no further than 36 inches center to center.

4.1.3 SIZING

New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable. Generally, the main, truck and outfall sewers shall be designed to carry, when running full, not less than 250 gallons daily per capita contributions of sewage, exclusive of sewage or other waste flow from industrial plants.

4.2 PIPE MATERIAL

All pipe, joint and fittings for sanitary sewer shall be constructed of clay, polyvinyl chloride (P.V.C.), acrylonitrile-butadiene styrene (A.B.S.) or ductile iron pipe unless otherwise approved by the UTILITY.

4.2.1 POLYVINYL CHLORIDE PIPE AND FITTINGS (PVC)

P.V.C. pipe shall be extruded from Type I, Grade 1, polyvinyl chloride material designated as PVC 1120, meeting ASTM Specifications D 3034, Type PSM, and a standard dimension ratio of SDR 35.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color.

The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, burst pressures, flattening, extrusion quality, marking and all other requirements of the Commercial Standards CS 256-63 shall be conformed with in all respects.

Pipes shall be furnished in 10 foot lengths. The pipe shall have a bell on one end. Male ends of pipe must be beveled on the outside. Pipe shall have a ring painted around the male end or ends in such a manner as to allow field checking of setting depth of pipe in the socket. This requirement is made to assist construction superintendents and inspectors in visual inspection of pipe installation.

Pipe must be delivered to job site by means which will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and strung or stored as close the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for an extended period of time. If pipe is not to be installed shortly after delivery to the job site, it must be stored in shaded location and strung as needed.

4.2.2 DUCTILE IRON PIPE AND FITTINGS

Ductile cast iron pipe shall conform to ANSI A21.51 and AWWA C 151. All ductile cast iron pipe thickness shall be designed according to ANSI A21.50 and AWWA C150 requirements.

Ductile cast iron pipe and fittings shall receive the standard cement mortar lining with bituminous seal coast on the inside in accordance with ANSI A 21.4 requirements. Thickness of the lining shall be as set out in aforesaid specification. Pipe and fittings shall have standard coal tar or asphalt based bituminous outside coating a minimum of 1 mil think.

Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or word "DUCTILE". Shop inspection and testing shall be in accordance with the AWWA Specifications cited above and shall be certified by an independent laboratory.

Fittings for ductile cast iron pipe shall be mechanical joint class 250 gray iron conforming to ANSI A21.10 and AWWA C1 10 for short body cast iron fittings. Fittings shall be bituminous coated outside and shall receive the standard cement mortar lining with bituminous seal coat on the inside as specified hereinbefore.

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an 8 mil thick polyethylene encasement meeting the requirements of ANSI A21.5. Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation, and waste dumps. If such corrosive soils are expected, the design engineer shall be responsible for conducting resistivity tests on the soil.

4.2.3 STEEL ENCASEMENT PIPE

Encasement pipe shall be steel, plain end, uncoated, unwrapped, have welded joints and be in at least 18-foot lengths. The steel pipe shall have a yield point strength of 35,000 psi and conform to AWWA Specification C202. The wall thickness of the pipe shall be a minimum of 0.250 inches for highway crossings and 0.344 inches for railroad crossings.

The thickness and diameter of encasement pipe shall conform to requirements set forth by the Kentucky Department of Transportation, Bureau of Highways for highway crossings and American Railway Engineering Association for railroad crossings.

4.3 TRENCH EXCAVATION

Unless specifically directed otherwise by the UTILITY, not more than 500 feet of trench shall be opened ahead of the pipe laying work of any one crew, and not more than 500 feet of open ditch shall be left behind the pipe laying work of any one crew.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans, cut sheets or as specified by the UTILITY. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight inches. Where rock is encountered, it shall be removed to a minimum depth of four inches below the pipe bells.

Unless specifically authorized by the UTILITY, trenches shall in no case be excavated or permitted to become wider than 2 feet 6 inches plus the nominal diameter of the pipe at the level or below the top of the pipe. If the trench does become wider than 2 feet 6 inches at the level of or below the top of the pipe, special precautions may be necessary, such as providing compacted granular fill up to the top of the pipe or providing pipe with additional crushing strength of the pipe being used. The OWNER DEVELOPER shall bear the cost of such special precautions as necessary.

All excavated materials shall be placed a minimum of 2 feet from the edge of the trench.

Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed to provide safe working conditions and to prevent damage to work.

Trenches shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of water shall be at the OWNERS DEVELOPER’S expense. Backfilling shall be as set out hereinafter.

4.3.1 OBSTRUCTION

In cases where storm sewers, gas lines, water lines, telephone lines and other utilities, or other underground structures are encountered, they shall not be displayed or molested unless necessary, in which case they shall be replaced in as good condition as found as quickly as possible.

The CONTRACTOR shall notify the utility companies 48 hours prior to excavation adjacent to their facilities.

4.3.2 SHORING, SHEETING AND BRACING OF EXCAVATIONS

Where unstable material is encountered or where the depth of excavation in earth exceeds six feet, the sides of the trench or excavation shall be supported by substantial sheeting, bracing and shoring, or the sides sloped to the angle of repose. Sloping the sides of the ditch to the angle of repose will not be permitted in streets, roads, narrow right-of-way or other constricted
areas unless otherwise specified. The design and installation of all sheeting, sheet piling, bracing and shoring shall be based on computations of pressure exerted by the materials to be retained under construction conditions. Adequate and proper shoring of all excavations shall be the entire responsibility of the CONTRACTOR.

Foundations, adjacent to where the excavation is to be made below the depth of the existing foundation, shall be supported by shoring, bracing or underpinning as long as the excavation shall remain open, or thereafter if required to insure the stability of the structure supported by the foundation, and the CONTRACTOR shall be held strictly responsible for any damage to said foundations.

Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable whales and braces.

Care shall be taken to avoid excessive backfill loads on the completed pipelines and the requirements that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameter of the pipe shall, as set out in Section 4.3 hereinbefore, be strictly observed.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

4.3.3 BLASTING

Shall be conducted in accordance with the municipal ordinances, state laws, and Section 9 of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, Inc. All explosive shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, except with light charges of explosives. Any damage done by blasting is the responsibility of the CONTRACTOR and shall be promptly and satisfactorily repaired by him.

Blasting operations shall be covered by public liability insurance, or if said public liability insurance does not cover blasting, then the CONTRACTOR shall have separate public liability insurance to cover his blasting operations.

4.4 PIPE BEDDING

In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe and insofar as possible where bell and spigot pipe are involved so that none of the load will be carried on the bells.

Where undercutting and granular bedding are involved, the depth at the bottom of the bells of the pipe will be at least four inches above the bottom of the trench as excavated.

Supporting of pipe shall be as set out hereinafter, and in case shall the supporting of pipe on blocks be permitted. See Drawing SD-1 for typical bedding methods.

4.4.1 EARTH FOUNDATION

All sewer pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone.

4.4.2 ROCK FOUNDATION

If the trench bottom is in rock the excavation shall be undercut to a minimum depth of six inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone.

4.4.3 SPECIAL BEDDING

In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the UTILITY, yielding and mucky material in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe. Crushed stone or other such granular material, if necessary, as determined by the UTILITY to replace poor subgrade material, shall be classified as “Special Pipe Bedding”.

Granular material for “Special Pipe Bedding” shall be K.D.H.S. #78 stone.

4.5 LAYING PIPE

The laying of sewer pipe in finished trenches shall be commenced at the lowest point so that the spigot or tongue ends point in the direction of flow.

If the CONTRACTOR desires, he may use a laser beam instrument to set the grades on sewer lines in lieu of using a grade string and batter boards set from grade stakes. In using such an instrument, the CONTRACTOR shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be corrected by the CONTRACTOR.

All pipe lengths shall be laid with ends abutting and true to line and grade as given by the ENGINEER. They shall be fitted and matched so that when laid
they will form a sewer with a smooth and uniform invert. Supporting of pipe shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipe on blocks be permitted.

Branches, fittings and specials for sewer lines shall be provided and laid as and where directed by the UTILITY or shown on the plans.

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure its being clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the UTILITY. No piece of pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood plug fitted into the pipe bell, so as to exclude earth or other material and precautions taken to prevent flotation of pipe by runoff into trench.

4.5.1 JOINTING POLYVINYL CHLORIDE PIPE

All joints and connections shall be as established in Section 4.2.2 hereinbefore. Assembly of pipe and fitting JOmts shall be in accordance with manufacturer's recommendations.

4.5.2 JOINTING DUCTILE IRON PIPE

All joints and connections shall be established in Section 4.2.5 hereinbefore. Assembly of pipe and fitting JOmts shall be in accordance with manufacturer's recommendations.

4.6 BACKFILLING PIPELINE TRENCHES

All backfilling shall be accomplished in accordance with the details shown on Standard Drawing SD-1 and the requirements of this section. Any variances must be approved in writing by the UTILITY.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill of at least 95 percent of standard (ASTM D698) proctor density where mechanical tamping of backfill is required.

Before acceptance, the CONTRACTOR will be required to level off all trenches or to bring the trench up to the level of the surrounding terrain. The CONTRACTOR shall also remove from roadways, right-of-ways and/or private property all excess earth or other materials resulting from construction.

In the event that pavement is not placed immediately following trench backfilling in streets and highways, the CONTRACTOR shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

4.6.1 METHOD "A" BACKFILLING IN OPEN TERRAIN

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

In all cases the lower portion of the trench, from the pipe bedding to the springline (centerline) of the pipe shall be backfilled with #9 crushed stone.

When using ductile iron pipe, the portion of the trench from the springline of the pipe to a point six inches above the pipe shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. This material shall be placed in six inch layers and mechanically tamped.

When using PVC pipe, ABS pipe, clay pipe and cast iron pipe, the portion of the trench from the springline of the pipe to a point 12 inches above the pipe shall be backfilled with No. 9 crushed stone.

The upper portion of the trench above the crushed stone portion shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the UTILITY. The trench backfilled shall be headed over or leveled.

4.6.2 METHOD "B" BACKFILLING UNDER PAVED AREAS

Backfilling of pipeline trenches under sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to a point six inches below the bottom of the pavement or concrete sub-slab, shall be backfilled with crushed stone or fine gravel. The upper portion of the trench,
from a point six inches below the bottom of the pavement or concrete sub-slab up to grade, shall be backfilled with a base course of dense grade aggregate or crushed stone, fine gravel and said suitable to the governing body having jurisdiction over the street or roadway. At such time that pavement is accomplished, the excess base course shall be removed as required.

4.6.3 SETTLEMENT OF TRENCHES

Wherever sewer lines are in, or across, driveways and streets, the CONTRACTOR shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the CONTRACTOR. Repair of settlement damage shall meet the approval of the appropriate governing body.

4.7 MANHOLES AND CLEANOUTS

Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 400 feet. Manholes of the form and dimensions shown on the approved plans shall be built as directed. The manhole proper shall be constructed of precast concrete rings (see Standard Drawing No. Sd-2, 3 & 4) or of a monolithic construction (see Standard Drawing No. Sd-15). They shall be constructed on 3500 psi concrete foundations.

Cleanouts (or Lampholes) will only be allowed with the written approval of the Utility and only at the end of a line with a proposed extension. The cleanout shall be constructed of the same pipe material as the main (see Standard Drawing No. Sd-14).

4.7.1 STANDARD MANHOLES

The standard manholes shall be five feet or more in depth, measured from the base of the cover frame to the top of the concrete footing and shall be on cone-type construction as shown on Standard Drawing No. Sd-2.

4.7.2 SHALLOW MANHOLES

The shallow manholes shall be five feet or less in depth, measured from the base of the cover frame to the top of the concrete footing and shall be of flat top construction as shown on Standard Drawing Sd-3.

4.7.3 STANDARD DROP MANHOLES

A drop pipe shall be provided for a sewer entering a manhole at an elevation if 24 inches or more above the manhole invert and shall be built as a part of the standard manhole. The pipe shall be laid in the manhole as shown on the plans and encased with concrete. The pipe which is laid to the drop portion of the manhole shall be supported with 3500 psi concrete extending from the drop stack to the reinforced base of the manhole as shown on Standard Drawing Sd-4.

4.7.4 PRECASE CONCRETE RINGS

Precast concrete rings for manholes shall conform to ASTM C76, Class II, Wall B, with a minimum concrete strength of 4000 psi, except that rings for manholes for 12 feet deep shall be Class III. 0-ring gaskets shall be installed between connected ring sections.

4.7.5 MANHOLE INVERTS

Manhole inverted shall be formed from 3500 psi concrete. Inverts shall be formed by laying the pipe straight through the manhole, pouring the concrete invert, and then breaking out the top half of the pipe. Curved inverts shall form a smooth, even half-pipe section as shown in Standard Drawing Sd-5. The inverts shall be constructed when the manhole is being built using prefabricated forms.

The excavation shall be kept free of water while the manhole is being constructed and the manhole shall not be backfilled until inspected by the Utility.

4.7.6 MANHOLE STEPS

Manhole steps shall be made of steel reinforced polypropylene plastic as the PSI manhole step manufactured by M.A. Inc., Inc., Peachtree City, Georgia, or any steel reinforced plastic step which produces equal or better performance.

Manhole steps in monolithic manholes shall be placed prior to pouring concrete. The steps shall be inserted in spaces provided in the forms and securely fastened to prevent movement during concrete placement.

4.7.7 MANHOLE & CLEANOUT FRAMES AND COVERS

Manhole castings for manholes eight feet, or less, in depth shall consist of cast iron frames and 26 inch diameter covers, weighing not less than 400 pounds per frame and cover, dimensioned as shown on Standard Drawing Sd-9.

Manhole castings for manhole deeper than eight feet shall consist of cast iron frames and 28 inch diameter covers, weighing not less than 500 pounds per frame and cover, dimensioned as shown on Standard Drawing Sd-10.

Manhole covers must sit neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. They shall have sufficient corrugations to prevent a slipperiness. The lids shall have two pick holes about 1 inches wide and Yz
inch deep with 3/8 inch undercut all around. Lids on sanitary sewer manholes must not be perforated.

If manhole is located below flood level for 100-year rainfall, watertight manhole castings shall consist of cast iron frames with machined bearings surfaces, gasket seal and bolted lids. They shall be Neenah R-1916-F, Vulcan Foundry VM-50 Special, or approved equal, as in Drawing SD-11.

Cleanout casting shall be Neenah R-1973-A or approved equal.

4.7.8 MONOLITHIC MANHOLES

The vertical forms, wall spacers, steps and placing cone must be positioned and firmly clamped in place before any placement is made. The wall spacers shall be placed 90 degrees from each other. The concrete shall have a minimum concrete strength of 4000 psi, Class A, with a maximum slump of 2 inches. The first placement of approximately Yi yard of concrete deposited evenly around the walls and vibrated until there is a minimum slope of 60 degrees from the bottom of the forms to the bearing surface both inside and outside of the manhole. When this is complete and before additional concrete is placed, the concrete shall be deposited in evenly distributed layers of 18” with each layer to bond it to the preceding layer. The wall spacers shall be raised as the placements are made with area from which the spacer is withdrawn being carefully vibrated. Excessive vibration is to be avoided. The forms may be removed as soon as the concrete has sufficiently set, or approximately two hours. In forming manholes around PVC pipe, care should be taken to avoid deformation of the pipe from the loads imposed on it. Methods of precaution may involve allowing initial lifts to set before continuing or steel/iron encasement of the PVC pipe at the manhole. PVC pipe entering the manhole wall shall be fitted with a rubber connector to insure bonding of the concrete. Back filling shall be performed evenly and carefully around the manhole twenty-four (24) hours or more after the placement of concrete is completed.

4.8 TESTING OF LINES

The testing of gravity sewers shall be accomplished by the CONTRACTOR in accordance with the procedures listed hereinafter.

4.8.1 GRAVITY SANITARY SEWER LINES

On all projects involving installation of sanitary sewer lines, the finished work shall comply with the provisions listed below or similar requirements which will insure equal or better results.

a. After the collection and/or outfall lines have been brought to completion, and prior to the final inspection, the CONTRACTOR shall rod out the entire system, from manhole to manhole, appropriate tools for the removal from the lines of any and all dirt, debris and trash.

b. Prior to the final inspection, the ENGINEER shall inspect each individual line, from manhole to manhole, either by use of lights or other means at his disposal to determine whether the completed lines are true to line and grade as laid out or as shown on the plans.

c. The UTILITY may require that the CONTRACTOR pass through the system under its own momentum, a wooden ball of a diameter one inch less than the nominal diameter of the pipe, except that no ball larger than eight inches in diameter shall be used.

d. All lines or sections that are found to be laid improperly with respect to line or grade, that are found to contain broken or leaking sections of pipe, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced.

e. The CONTRACTOR shall lay sewer lines, including house connections, so that the ground water infiltrations shall not average more than 1500 gallons per 24 hours per mile of sewer without regard to the diameter of the sewer. Only the length of the main sewers shall be used in making the foregoing computation even though the house connections (from the main sewer to the property line) should be in place as included as part of the system when infiltration is measured. This requirement may be applied to a portion of the contract work, such as the sewers in a separate drainage

f. The UTILITY will also require all sanitary sewer to receive a low-pressure air test for leakage. The air test will be made after all house connections have been installed to property lines and backfilling has been completed and compacted.

The first series of air tests is to be made after 2,000 L.F. of sewer have been laid but before 4,000 L.F. are completed. The purpose of this first series of tests is to assure both the CONTRACTOR and the OWNER that the material and method of installation meet the intent of these specifications. The remainder of the tests are to be conducted after approximately each additional 10,000 L.F. have been laid.

All ties and end of sewer services shall be plugged with flexible joints plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.
Prior to testing, the pipe will be checked to see that it is clean. If not, it shall be cleaned by passing through the pipe a full gauge squeegee it shall be the CONTRACTOR's responsibility to have the pipe clean.

Immediately following this check or cleaning, the pipe installation shall be tested with low-pressure air. Air shall be slowly supplied to the plugged pipe installation until the internal air pressure reaches 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization.

The requirements of this specification shall be considered satisfaction provided that the time required for leaks, for the pressure to decrease from 3.5 to 3.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe is not less than that shown in the "Allowable Time Table" listed below, which is for 400 foot sections of pipe. For testing of shorter sections of pipe the utility shall determine duration of test.

### ALLOWABLE TIME TABLE

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<thead>
<tr>
<th>Pipe Size</th>
<th>Time (Min)</th>
<th>Time (Sec)</th>
<th>Pipe Size</th>
<th>Time (Min)</th>
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<td>30&quot;</td>
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g. In order to test for infiltration, the UTILITY may also require exfiltration tests on each section of pipe between manholes after it has been laid but prior to backfilling of joints. Exfiltration tests shall be conducted by plugging the lower end of the section of sewer to be tested and filling the sewer with water to a point approximately five feet above the invert at the lower end of at least one foot above the pipe joints and measuring the amount of leakage for a given interval of time. Exfiltration shall not exceed 10 percent times the infiltration limits set out hereinbefore. All observed leaks shall be corrected even though exfiltration is within the allowable limits. Exfiltration tests will normally be required for flat sections of sewer that are expected to be below the wet season ground water table.

h. To test for infiltration, the UTILITY may also require that the CONTRACTOR plug the open ends of all lines at the CONTRACTOR plug the open ends of all lines at the manhole so that measurements may be made at each section of the sewer line. This infiltration test will not be made until the sewer line is completed, and the CONTRACTOR will be required to correct all conditions that are conducive to excessive infiltration and may be required to relay such sections of the line that may not be corrected otherwise. All observed leaks shall be corrected even though infiltration is within allowable limits.

### 4.9 HOUSE CONNECTIONS

The UTILITY shall approve the location of the points on the collector sewers where tees and wyes are to be installed for house connections. The CONTRACTOR shall lay the house connection lines from this point to the property line, or easement line.

All house connections, unless otherwise specified or directed, shall be 6 inch PVC, or cast iron soil pipe as specified hereinbefore and as indicated on the Drawings. Trenching, pipe laying, joints and backfilling shall conform to the requirements set out herein. All open ends shall be sealed with standard plugs to the satisfaction of the UTILITY. To protect the sealed end from trenching equipment, a #4 bar shall be placed at end of lateral to help retain cap and protect pipe from trenching equipment. #4 bar shall be long enough to remain 4 feet above finish grade. It shall also be painted fluorescent orange.

A individual service line shall be provided for each lot. In cases where a subdivision is presently or is planned to be zoned for townhouses, service line shall be sufficient in quantity to service each unit individually.

For shallow sewers (10 feet or less in depth) in rock or earth trenches, the trees shall be encased entirely with crushed stone (Kentucky Highway Department Size No. 78) and fully compacted.

House connection pipe shall be the same as used in the collector lines and shall be placed between the tee branch to customer property line, except for sewer line construction in new subdivision in which case the house connection pipe shall be extended ten feet inside the property line. Tee branches will have a minimum of 10 LF between them. No more than one lateral will be laid in any one trench. No horizontal bends will be allowed. Only one vertical bend will be allowed on any one lateral unless dealing with deep (10+) sewer in rock excavation. The pipe shall be laid on a uniform grade from the tee branch to meet to probable building sewer grade at the street right-of-way so that no bends will be needed for the final connection.

For deep sewers (greater than 10 feet in depth) in rock, the tees shall be encased entirely with Class "B" concrete. House connections in this case shall be a combination of cast iron pipe, cast iron bends, and standard adapter and sewer pipe of same material used for collector lines, extended from the tee to the property line. The cast iron pipe shall be laid
vertically from the branch to a point to meet the probable building sewer grade. From this point the appropriate pipe (pipe same as used in collector lines) shall be laid on a uniform slope to match the probable grade of the building sewer.

Under normal conditions, where elevations are not critical, house connection pipe shall be laid on a slope of not less than one foot per 100 feet (approximately 1.8 inch per foot). Where elevations are critical, minimum grade may be 0.5 foot per 100 feet laid with batter boards and grade line string, same as specified for main sewers.

The tapping of house connections into manholes on the newly constructed sewers will not be permitted, except where approved by the UTILITY. Where it is necessary to do so, the invert of the house connections shall not be higher than a point three inches below the top of the bench. If necessary, a standard drop connection shall be provided for a house connection that is tapped into a manhole.

The installation of house connections shall follow immediately or be concurrent with the construction of the main sewer. This method of construction will permit more advantages handling of backfilling and will also avoid possible damage to the main sewer by subsequent exposure for connection of the service lines.

4.10 CONNECTIONS TO EXISTING LINES

The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sewers to an existing collector line. A representative of the UTILITY must be present while the connection is being made. The UTILITY should be present at least a 24 hour advance notice before the connection is made. All taps shall be made by BGMU.

Connections to existing line shall be with a manhole. Service tees will not be permitted.

4.11 CONNECTIONS TO EXISTING MANHOLES

The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sanitary sewer or force main to an existing manhole. A representative must be present while the connection is being made. The UTILITY should be given at least a 24 hour advance notice before the connection is made.

No fittings will be allowed in the manholes. Drop manhole connections shall be constructed outside of the manhole (see Standard Drawing No. SD-4).

4.12 CONCRETE, CRADLE, ANCHORS OR ENCASMENT

Concrete cradle, anchors or encasement of sewer lines and/or fittings shall be placed where shown on the plans. Concrete shall be Class "B" and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe of injure the joints.

4.13 LOCATING NEAR WATER MAINS

4.13.1 HORIZONTAL SEPERATION

Whenever possible sewers and sewer manholes should be laid at least 10 feet horizontally from any existing or proposed water main. Should local conditions prevent a lateral separating of 10 feet, a sewer may be laid closer than ten feet to the water main provided that:

a. The bottom (invert) of the water main shall be at least 24 inches above the top (crown) of the sewer. Where this vertical separation cannot be obtained, the sewer shall be constructed of approved water pipe, pressure tested, in place, without leakage prior to backfilling.

4.13.2 VERTICAL SEPERATION

Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 24 inches below the bottom of the water main. When the elevation of the sewer cannot be buried to meet the above requirements, the water main shall be relocated to provide this separation or the sewer line shall be reconstructed with slip-on or mechanical-joint cast iron pipe, approved pressure pipe or prestressed concrete cylinder pipe for a distance of ten feet on each side of the water line and should be pressure tested, in place, without leakage prior to backfilling. One full length of water main should be centered over the sewer so that both joints will be as far from the sewer as possible.

4.14 HIGHWAY AND RAILROAD CROSSINGS

Steel encasement pipe for road and railroad crossings shall be bored and/or jacked in place to the elevations shown on the plans. All joints between lengths shall be on the plans. All joints between lengths shall be solidly welded with a smooth, non-obstructing joint inside. The encasement pipe shall be installed without bends. The sewer line pipe shall be installed after the encasement pipe is in place.

Installation of the sewer line in the encasement pipe shall be as per manufacturer's recommendations. After the sewer main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with brick or concrete block masonry in a manner acceptable to the UTILITY.
SECTION FIVE

SEWAGE FORCE MAIN

5.1 PURPOSE

The purpose of this section is to give specifications for the primary materials utilized in the construction of sanitary sewer force mains.

5.2 DESIGN REQUIREMENTS

Sanitary sewer force mains shall be designed so that the minimum velocity of 2.0 fps is developed when the sewage pumps are operating at the design TDH. Minimum depth of 30 inches cover must be provided. Insulated, 12 gauge, solid copper tracer wire shall be laid with all metallic and no metallic pipe.

5.3 PIPE MATERIALS

5.2.1 DUCTILE IRON PIPE, FITTINGS AND JOINTS- SEE SECTION 3.2.1.

5.2.2 POLYVY NYL CHLORIDE PRESSURE PIPE, FITTINGS AND JOINTS- SEE SECTION 3.2.2.

5.2.3 STEEL ENCASEMENT- SEE SECTION 3.2.3

5.3 TESTING OF SEWAGE FORCE MAINS

On all projects involving the installation of sewage force mains, the finished work shall comply with the provisions listed below, or similar requirements which will insure equal or better results:

Leakage in pipelines, when tested under pressure of 50# in excess of normal operating pressure, shall not exceed 5 psi differential during the duration of the test.

Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.

Pipelines shall be tested before backfilling at joints except where otherwise required by necessity, local ordinance, or public convenience.

Duration of test shall be not less than two hours.

Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or re-laid, and leakage minimized, regardless of total leakage as shown by test.

All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the CONTRACTOR's expense.

Lines which fail to meet tests shall be repaired and retested as necessary until the requirements until the requirements are complied with.

The UTILITY shall furnish a recording gauge and clock used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall remain the property of the UTILITY at conclusion of test.

5.4 CONNECTING FORCE MAIN TO MANHOLE

All sanitary sewer force mains must connect to manholes at the flow channel elevation. The ENGINEER shall show detail on his plans indicating the method of connecting force mains to manholes.

5.5 CONCRETE THRUST BLOCKS

Concrete thrust blocks shall be provided at all bends in the force main as shown on Standard Drawings SD-3.

5.6 COPPER WIRE

All polyvinyl chloride pressure pipe used for sewage force mains shall be laid with 12 gauge, coated, solid copper wire to aid in locating.
6" Minimum For Pipe Bedding
- Method "8"
(Paved Areas)

No. 12 Solid Coated Copper Wire.
Sanitary Sewer or FM

Rock Free Earth Backfill
No Mechanical Tamping Required.

No. 9 Crushed Stone Backfill
and Pipe Bedding to Springline of Pipe.

Asphalt Base Material
3" Thick in Trench
Flush with Existing Pavement

Existing Pavement

Crushed Stone or Fine Gravel
Backfill and Pipe Bedding.

Note:
Cutting and Repairing Existing
Pavement Concrete or Gravel
Shall Be n Accordance With
Owners Requirements.
NOTE: M.H. To Be Set On Foundation Of 6" Bed Of No. 9 Crushed Stone. Foundation To Be Set On Undisturbed Material Compacted To Action To Be In 6" Lifts From Undisturbed Soil.

Plastic Coated MH Steps (No. 3 Deformed Steel Rod Mfg. M.A. Ind., Inc.)

Rubber Water Stops —.... To Be Used With P.V.C. Or A B.S. Pipe

Cone. Cradle To Extend To Limits Of Excavation

Reinf. With No. 4 Bors At a" O.C. Both Ways

SECTION C-C

Set Frame Costing In Full Portland Cement Mortar Bed

SECTION 0-0

Cone. Cradle On 6 Inch Bed Of No. 9 Crushed Stone

BGMU
Bowling Green Municipal Utilities

Typical Standard Manhole

SD-2
10" Min. or One Size Larger Than Anticipated Sewer, Sleeve With Plug For Future Sewer 12" Max.

PLAN

SECTION A-A

Reinf. With No. 4 Bors At a" O.C. Both Ways.
Refer To Dwg. No. SD-1 For Back fill.

Grade

Min. Slope 1/6" Per Ft.

Wye...
Branch

No. 9 Crushed Stone Backfill & Pipe Bedding

Support Pipe As Shown In Dwg. No. SD-1 In a Straight Line Horizontally & Vertically.

Provide No. 4 Bar, Painted Fluorescent Orange, To Protect End Of Pipe From Trenching Equipment And To Retain Plug.

Tight Plug At End Of House (Provide Easily Removable Water Connection.)

No. 9 Crushed Stone Backfill & Pipe Bedding

Refer To Dwg. SD-1 For Backfill

SECTION A-A
Type "9" Lid Design
Depressed Pockets

Open Pickhole

NEENAH FOUNDRY COMPANY
R - 1642     FRAME S "8" LIO

BGMU
Bowling Green Municipal Utilities

Standard Circular Manhole Frame And Cover
SD-9
Bottom Of Slob May Be Either Round Or Square

Joint At End Of Concrete Cradle

Concrete Cradle

SECTION A - A

Manhole Frame 8 Cover
(Refer To Standard Circular Manhole Frame 8i Cover)

Set Frame Costing In Full Portland Cement Mortar Bed

** Plastic Coated MH Steps
(No. 3 Deformed Steel Rod Mfg. M.A. Ind. Inc.)

* Top Slab Forming Sholl Be Optional

Concrete Cradle On 6 Inch Bed Of No. 9 Crushed Stone

Reinforce With No. 4 Bars. At 8 O.C. Both Ways.

SECTION B - B

BGMU
Bowling Green Municipal Utilities

Typical Shallow Manhole

SD-3
Manhole Frame & Cover
(Refer To Standard Circular Manhole Frame & Cover)

Grade

Plastic Coated M.H. Steps
(No. 3 Deformed Steel Rod Mfg. M.A. Ind. Inc.)

0-Ring Gasket

Precast Cone Rings

Cloy Or C.I. Pipe. (Other Material Requires Individual
Written Approval By aG.M.U.)

Provide A Minimum Fall Of O.I. From Drop Inlet
To Main Channel.

Reinf. With No. 4 Bars At 8" O.C. Both Ways

Precast Ring
Adjusting Collar
Limited To 3"
Including Mortar Joint.

Extend Encasement To Limits Of Manhole Excavation.

Concrete Encasement

SECTION A-A

SECTION B-B

BGMU
Bowling Green Municipal Utilities

Typical Drop Manhole

SD-4
... Refer To Dwg. No. SD-1

Property Line

6" 45° Bend

Min. Slope 1/8" Per Ft.

Provide No. 4 Bar, Painted
Fluorescent Orange, To Protect
End Of Pipe From Trenching
Equipment And To Retain Plug.

Support Pipe On No. 9 Crushed Stone

Alignment Straight Between Bends

No. 9 Crushed Stone

Bockfill & Pipe Bedding

Concrete

NOTES:

I. This Distance Shall Be 10 Feet
For Construction In New Subdivisions.

Refer To Dwg. No. SD-1

For Backfill

No. 9 Crushed Stone

Backfill & Pipe Bedding

SECTION A-A
"X" Heavy Soil Pipe Bend
(B Min. Length)
6" C.I. Pipe

Min. Slope 1/8" Per Ft.

She’ll Be Backfilled With No.9 Crushed Stone
To a Width Of 1' S Each Side Of Wye

Extra Heavy Soil Pipe Riser

Encase Fitting In Class "C" Concrete

NOTES:
I. This Distance Shall Be 10 Feet For
   Construction in New Subdivisions

Encase Fitting In Class "C" Concrete

Fine Gravel, Sand Or Crushed Stone (KY Hwy. Dept. No. 9)
When Ventilated Covers Are Ordered Core 12-1"
Dia Holes

Pick Holes 1-1/2"

Shaded Portion-High
Plain Portion-Low

Cover to Read (SANITARY SEWER)

HALF PLAN
TOP OF COVER

HALF PLAN
UN DERSI O E OF COVER

28-3/4"

3-1/8"

7-5/8"

4"

7-5/8"

SECTION AA

JOHN BOUCHARD
No. 1230
BOWLING GREEN STANDARD

PLAN OF FRAME

1-1/4" x 11-5/16" Fillet on Frame

3/4" x 12" Anchor Bolts

BGMU
Bowling Green Municipal Utilities

Standard Circular Manhole Frame And Cover

SD-10
2 - NF-22642
Concealed Pickholes

Bolt Pod

4 - 1" P Cored
Anchor Bolt Holes
<4> 90° On 33 3/4" G.

112" Neoprene Cord
Gasket 40 Durometer

4 - 12: 13x134" Hex. Head Stainless Steel Rec'd Capscrews

NEENAH FOUNDRY COMPANY
R-1916F FRAMES AND LID

BGMU
Bowling Green Municipal Utilities

Standard Watertight Manhole Frame And Cover

SD-11
Extend Encasement 2'-0" Beyond Water

Line On Each Side

TYPICAL CREEK CROSSING FOR
SANITARY SEWER LINE
45° a 90° BENDS

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SECTION SIX

SEWAGE PUMP STATIONS

6.1 PURPOSE

The purpose of this section is to outline specifications for a sewage pumping station that is to become a part of the BGMU’s sewerage System.

6.2 DESIGN REQUIREMENTS

Design calculations for sewage pump stations shall include the pump capacity at the design TOH, static head between the pump discharge and the force main discharge, capacity of the wet well, frequency and duration of operation.

6.3 SCOPE

THE work to be performed under this section of this specifications consists of the furnishing of all labor, materials, equipment and services necessary for furnishing and installing factory built, underground submersible sewage pumping stations complete and in proper operating condition. The location, size, and details of the stations shall be as shown on the plans. The work for the station shall include excavation, placing the concrete base slab, construction of th pump and valve pits, including hatches and covers, connecting the influent sewers to the station, all interior piping, connection of the force main to the station and all other necessary piping, valves and fittings required.

Other work to be performed under this section includes backfilling, grading, electrical work as shown on the drawings or specified in this section and acceptance tests.

6.4 GENERAL

The underground submersible sewage pumping station shall be furnished with all necessary equipment installed in a precast concrete manhole as shown on the drawings and in accordance with Drawings SD-14. The principal items of equipment in the station shall include two-vertical, motor-driven non-clog submersible sewage pumps, necessary gate and check valves, required piping, central control panel with circuit breakers, motor starters, access hatch, and automatic pumping level controllers, vent piping, slide rails, and other required appurtenances and wiring.

6.5 PUMP AND VALVE PITS

The pump and valve pits shall be constructed of prefabricated reinforced concrete pipe conforming to the requirements of AASHO M-207. The concrete slab cover for the pump pit shall be adequately reinforced to support a live load of 100 pounds per square foot.

6.6 PUMPS

THE pumps shall be capable of handling unscreened sewage at a pumping rate adequate for the total dynamic head and flow rate required for proper operation of the system in which it exists. The design shall be such that the pump unit will be automatically and firmly connected to the discharge piping when lowered into place on its mating discharge connection, permanently installed in the wet well. The pump shall be easily removable for inspections or service, requiring no bolts, nuts or other fastenings to be disconnected. For this purpose, there shall be no need for personnel to enter the wet well. Each shall be fitted with a chain of adequate length and strength to permit raising and lowering the pump for inspection and removal. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 165 feet.

All major parts, such as the stator casing, oil casing, sliding bracket, volute and impeller shall be of gray iron. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed bolts and nuts shall be of stainless steel.

6.7 PUMP MOTORS

All pump motors above 5 horsepower shall be vertical, submersible, and rated for continuous duty on 230 volts, 3-phase, 4-wire electric be designed for single phase service. Before locating the site of the pump station, the ENGINEER shall determine the availability of power service by coordinating his efforts with the Electric Division of BGMU.

Pump motors shall be housed in an air-filled, water right casing and shall have Class "F" insulated winding which shall be moisture resistant. The motor shall be Nema Design B rated 155 degree C maximum. Pump motors shall have cooling characteristics suitable to permit continuous operation in a totally nonsubmerged condition.

Motors shall be supplied with heat sensing units attached to motor winding. The heat sensing units shall trip the starter if motor overheats.

The cable entry water seal design shall be such that precludes specific torque requirements to insure a watertight and submersible seal. Epoxies, silicones or other secondary sealing systems shall be used. The cable entry junction box and motor shall be separated by a stator lead sealing gland or terminal board which shall isolate the motor interior from foreign materials getting access through the pump top.
The pump motor cable installed which shall be suitable for submersible pump applications and this shall be indicated by a Code or legend permanently embossed on the cable. Cable sizing shall conform the NEC specifications for pump motors shall be of adequate size to allow motor voltage conversion without replacing the cable.

6.7 LEVEL CONTROLS

Liquid level controls shall include mercury switch level sensor s in corrosion and shock resistant plastic casing with flexible cord and weight. The level control system shall include support brackets for suspending a minimum of four sensors at proper levels in the wet well, and NEMA 4 water tight junction box as shown on the plans: one for pump turn-on; one for pump turn-off; one for both pumps ON and one for alarm. Controls for automatically alternating the pumps shall also be installed.

6.8 MOTOR CONTROLS

Motor controls shall consist of a duplex control panel in a NEMA 4 waterproof enclosure, and shall have a dead front with separate removable inside panel to protect electrical equipment. Panel will contain circuit breakers, magnetic starter and Hand-off-auto switch for each motor. Duplex panels will include an automatic electric alternator. Motor control mounting frames shall be constructed of 2"x 2" x 1/4" angle iron. Nema enclosure and mounting frame shall be primed with one coat of #296 Zinc Chromate Primer and one final coat of #4133 Garvin Green.

A high water alarm flashing light shall be supplied in separate NEMA 4 enclosure and mounted at the control box. All motor controls shall include all equipment required by the manufacturer and the UTILITY to insure proper operation of the pumping station.

6.9 ELECTRICAL WIRING

The pumping stations shall be completely wired at the factory, in accordance with the National Electric Code and shall be color coded. The pump cables shall be one continuous cable, without splices or junction boxes of any type, from the pump to the control panel. All wiring outside the control cabinet shall be in rigid conduit or "Sealite". All necessary equipment shall be permanently wired with suitable connecting means and overload protection. Cord, plug and receptacle type connections will not be acceptable.

6.10 OUTSIDE ELECTRICAL SERVICE

Connection of electrical service to the pumping station shall be as indicated on the drawings and further specified herein.

a. The service pole shall be fully treated, southern yellow pine roofed 15 degrees one way and gained before treatment.

b. The weatherproof switch and meter socket shall be fastened to rustproof channels that are banded to the poles with rustproof bands.

c. The service entrance fitting at the pole shall be cast aluminum with stainless steel screws.

d. Conduit and conduit fittings shall be heavy, threaded, galvanized steel. Fittings shall have neoprene gaskets for covers. Conduit shall be fastened to the service pole with two-hole heavy galvanized straps with rustproof la screws minimum spacing on 5 foot centers.

e. Control wire extensions shall be made as detailed on the drawings. Components shall be NEMA 4.

f. Insulating bushings of the heavy fiber reinforced type shall be employed on all conduit terminations.

g. All screws and fasteners are to be rustproof, double hot dipped galvanized, Mone! metal or stainless steel.

h. Fuses shall be Bussman "Low-Peak", or approved equal.

i. All the electrical work shall be inspected and approved by an electrical inspector. Two copies of the certificates of approval by the Electrical Inspector shall be mailed to the Utility and a label of acceptance must be glued inside the door of the disconnect before final acceptance.

j. Hour meters shall be installed for each pump in the control panel.

k. An electrical outlet with 110V service shall be installed in the control panel where possible. Where not possible, a waterproof outlet shall be installed on the control panels support legs.

l. A surge/lighting arrester shall be installed to protect the pump station and shall be located as close as possible to the control panel. The installations shall be in accordance with Article 280 Surge Arresters, of the current National Electrical Code.

6.11 SEWAGE PIPE, FITTINGS AND VALVES
All inside piping shall be Class 52 Ductile Iron pipe, flanged ANSI Class 125 inside and terminating in mechanical joints bells outside. Outside piping shall conform to the requirements set out hereinbefore.

Gate valves shall be solid wedge, bronze fitted. Check valves shall be weight loaded, external lever type, bronze fitted. Gate valves shall be provided on the discharge lines and a check valve on the discharged line between pump and gets valve as shown on the plans.

A pressure gauge shall be installed downstream of the check valve. Coupling adapters shall be Type 912 cast iron as manufactured by Smith-Blair, or approved equal.

6.12 CONCRETE BASE, PUMP WELL AND VALVE PIT

Class "A" reinforced concrete shall be provided for the pumping station base slab as shown on the plans. The pump well shall be of precast reinforced concrete pipe of the dimensions as shown on the drawing, or approved equal. All applicable provisions of Section 7, shall govern the construction of the pump well and valve pit. Valve pit shall have a 3/4 inch hot dipped galvanized steel checkered plate covering.

6.13 FACTORY TESTING

The pump manufacturer shall perform inspection tests on each pump before shipment to insure proper operation of the pump and compliance to the customer's purchase order.

6.14 ACCEPTANCE TEST

After installation, the pumping station shall be given a running test of all equipment. During the test, all piping and seals shall be checked to insure no leaks occur at all and controls shall be carefully checked and balanced for proper operation.

The Contractor shall furnish all necessary tools, materials, equipment and supervision of the tests, however, the OWNER-DEVELOPER will furnish the electrical energy.

Any defects in the equipment or failure to meet the guaranteed requirements of those specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the UTILITY as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

6.15 TOOLS, SPARE PARTS AND MANUALS

One complete set of tools required for routine maintenance, together with any special tools required for such purpose, shall be furnished. Tools shall be supplied in a substantial steel tool box.

A complete replacement pump shaft seal assembly, complete with installation instructions and spare volute gasket shall be furnished.

A complete operating and maintenance manual, in duplicate shall be furnished. A one-year's supply of lubricants shall be supplied.

6.16 MANUFACTURER

The pumps shall be as manufactured by Flygt, Came Deming, or approved equal.

6.17 SITE DEVELOPMENT

6.17.1 STRIPPING AND TOPSOILING

Before excavation and grading is commenced for pumping station, the topsoil and sod shall be removed from the areas affected and stockpiled. When final grading is accomplished, the topsoil shall be spread evenly over the excavated areas. Rough grading shall have been carried approximately six inches below finished grade and brought back up to grade with topsoil as set out herein.

6.17.2 SITE GRADING AND FILLS AROUND STRUCTURES

All materials used for backfill around pumping stations shall be of a quality acceptable to the UTILITY and shall be free from large or frozen lumps, wood and other extraneous material. All spaces excavated and not occupied by footings, foundations, walls or other permanent work shall be re-filled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement. In making the fills with terraces around the structures, the fill shall be placed in layers not exceeding 12 inches in depth and shall be kept smooth with an approved type roller and/or compacted to the satisfaction of the UTILITY. When, in the opinion of the ENGINEER, it is not practical to roll sections of the fill immediately adjacent to buildings or structures, then such sections shall be thoroughly compacted by means of mechanical tamping, hand tamping or puddling as may be required by the ENGINEER. All fills shall be placed so as to load structures symmetrically.

The grading shall be brought to the levels shown on the plans or to do the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches in diameter. Rock and/or shale excavation which has been removed may be placed in the fills,
but it shall not be closer than 12 inches from finished grade.

Where required, an access drive shall be constructed to the pump station. This shall consist of crushed stone material and be constructed to the city of Bowling Green Department of Public Works specifications for D.G.A. base.

6.17.3 EXCAVATION

Excavation shall be accomplished in such places as indicated on the drawings to the lines, grades and elevations shown, or as directed. The excavation shall be maintained in such a manner so as to be well drained at all times. Temporary drains, or drainage ditches, shall be installed at the CONTRACTOR’S expense to intercept or divert surface water. The CONTRACTOR’s expense to intercept or divert surface water. The CONTRACTOR shall, at his own expense, provide adequate facilities for promptly and continuously removing water from the excavation. Should unstable material be encountered, or if the depth of excavation exceeds six feet, the sides of the excavation shall be supported by sheeting, bracing and shoring, or the sides sloped to the angle of repose.

6.17.4 LANDSCAPING

All disturbed areas around the pump stations shall be graded, fertilized and seeded as required in Section 8 and/or as directed by the UTILITY.

6.17.5 CLEAN UP

The Contractor shall remove all objectionable matter resulting from his operations.
Notes:

2. Junction Box for Control, Mount on.
3. To top and side of top shell.
5. Pour Concrete Pavement Dimensions Shown.
6. Power and Control Conducts from Junction Box to Control Panel to be located Outside Vault Well. Junction Box on Slab PC/Paint/Under to Vault Well. Win.
7. Liquid Level Sensor: Multi-Trade Lo... Sensor shall be Rated for Operation of MDR (L...), or Directed by Pump Control System.

Bottom - 1.3. Earth Ground from the Control...
SECTION SEVEN

CONCRETE

7.1 PURPOSE

The purpose of this section is to give specifications for concrete utilized in the construction of water mains sanitary sewers and sewage pump stations and other related items in the construction of public facilities.

7.2 CEMENT CONCRETE

Cement concrete shall consist of a mixture of Portland Cement, fine aggregate, coarse aggregate, with or without air entrainment as required, combined in the proportions and mixed to the consistency specified; and shall be deposited in such forms and to such dimensions as indicated on the plans or as specified by the ENGINEER.

7.1.1 GENERAL

All cement concrete shall be in accordance with the Kentucky Department of Highways Specifications for the various classes and type as specified therein. Unless otherwise directed by the UTILITY, the classes or types of concrete to be used in various types of construction shall be as set forth below.

a. Class "A" - 3500 psi 28 day strength as per K.D.H.S. Section 601- for all curb and gutter, sidewalks, paved ditches, retaining walls, drainage structures, pipe headwalls, sewage lift stations base slab and other miscellaneous structures.

b. Class "B" - 2500 psi 28 day strength as per K.D.H.S. Section 601- except use cement factor of 1.25 for encasement or cradle of sanitary sewer pipe structures.

c. 3500 psi 28 day strength as per K.D.H.S. Section 501- for all concrete street pavement.

7.1.2 CEMENT

Cement, unless otherwise specified, shall conform to ASTM C 150 for Type I, Portland Cement with a 3 to 6 percent air by volume added to the mix or ASTM C 175 for Type IA, Air Entraining Portland Cement.

7.1.3 FINE AGGREGATE- SEE SECTION 7.2.1

7.1.4 COARSE AGGREGATE- SEE SECTION 7.2.2

7.1.5 WATER

Water shall be kept free from injurious amounts of oil, acid alkali, organic matter or other such deleterious substances. A rule of thumb to follow is that when the water is fit to drink, it is suitable for concrete.

7.1.6 ADMIXTURES

Admixtures for adding air to concrete made with Type I Portland Cement, must meet the requirements of ASTM C 226.

7.1.7 CONSISTENCE OF CONCRETE

The consistence of the concrete shall be such as to produce a mixture which will be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement, but without permitting the materials to segregate or excess water to collect on the surface. When the specified slump is three inches or less, the tolerance shall be plus or minus 1/2 inch. When the specified slump is greater than three inches, the tolerance shall be plus or minus one inch.

7.1.8 TRANSPORTING AND/OR CONVEYING

Concrete shall be conveyed from the mixer to the place of final deposit immediately after mixing by methods which will prevent the separation or loss of material.

Equipment for chuting, pumping and pneumatically conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at the delivery and without aggregation of the material.

Non-agitating type trucks shall not be used to haul ready mixed concrete under any circumstances. With respect to the trucks used to deliver ready mixed concrete, the number of revolutions of the drum at agitation speed and other such details shall conform to ASTM C 94. In all such cases, however, the concrete shall be delivered to the job site and discharged within 1 1/2 hours or before the drum has been revolved 300 times, whichever comes first, after the mixing water has been added to the other ingredients. In how weather or under other conditions contributing to quick stiffening of the concrete, a time less than 1 1/2 hours may be specified by the UTILITY.

7.1.9 PLACING CONCRETE

Concrete shall be delivered to its position of placement, within the required time for delivery after mixing and within the required time interval between delivery of batches, as specified hereinafter or by the UTILITY for the method of mixing and handling employed.

Water shall be removed from all foundation excavation or formwork before the concrete is deposited. The method and manner of placing shall be
such as to avoid the possibility of segregation or separation of aggregates or the displacement of the reinforcement. Placing of the concrete shall be such as to entirely fill the form, but not to bulge or distort the form on their alignment. Special care shall be taken to fill each part of the forms by depositing concrete as near to its final position as possible, to work the coarser aggregate back from the face and to force the concrete under and around the reinforcing bars without displacing them.

The concrete shall not be allowed to drop freely more than three of four feet. In thin sections, drop chutes or rubber, canvas or metal shall be used. Drop chutes shall be provided in several lengths or shall be in sections which can be hooked together so that the length can be adjusted as concreting progresses.

When vibrating is required, it shall be done by methods approved by the UTILITY and with equipment approved by the UTILITY.

7.1.10 CURING

All concrete shall be cured for a period of not less than 7 days after pouring. The method used to provide curing shall be approved by the UTILITY. Membrane curing, plastic sheet curing, and wetted burlap curing will be considered satisfactory.

If at any time during the seven day curing period, the air temperature is 40 degrees F. or less, concrete shall be the UTILITY to aid curing and to prevent freezing. Protective covering which will protect the surface of freshly placed concrete from rain shall be readily available at the site of the work. Concrete damaged as a result of failure on the part of the CONTRACTOR to adequately protect the concrete from rain or freezing shall be removed and replaced at the expense of the CONTRACTOR as directed by the UTILITY.

7.2 AGGREGATE FOR PORTLAND CEMENT CONCRETE

7.2.1 FINE AGGREGATE

Fine aggregate shall consist of natural sand having a clean uncoated grains, free from injurious amounts of clay, flaky material, lignite, organic material and other such foreign substances and shall meet the requirements of ASTM C33.

Fine aggregate shall meet the graduation requirements as set out in Exhibit 7.2.t.

7.2.2 COARSE AGGREGATE

Coarse aggregate shall be crushed stone, gravel or slag having clean, hard uncoated particles. Crushed stone is preferred for coarse aggregate; gravel or slag shall not be used unless written approval is obtained from the UTILITY. It shall be free from injurious amounts of soft, friable, thin, elongated or laminated pieces, shall meet the requirements of ASTM C33 and the gradation requirements as listed in Exhibit 7.2.t.
SECTION EIGHT

SEEDING AND SODDING

8.1 PURPOSE

The purpose of this section is to outline the requirements for proper seeding, sodding and landscaping in areas of construction.

8.2 SEEDING, SODDING AND LANDSCAPING

Shall be accomplished as described hereinafter. Unless otherwise specified by the UTILITY, all graded areas shall be left smooth and thickly sown with a mixture of grasses at a rate of not less than 87 pounds per acre. Unless otherwise specified, the mixture shall consist of 60 percent Kentucky Fescue #31, 30 percent Creeping Red Fescue, and 10 percent White Clover. When the final grading has been completed, the entire area to be seeded shall be fertilized with number 12-12-12 fertilizer at a rate of 1000 pounds per acre. Agriculture limestone shall be added at a rate of 4.4 tons per acre or as specified by the ENGINEER. After the fertilizer and agricultural limestone has been distributed, the CONTRACTOR shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be broadcast either by hand or by approved sowing equipment at the rate specified. After the seed has been distributed, the CONTRACTOR shall then lightly cover the seed by use of a drag or other approved device. All seed shall be certified. The seeded area shall then be covered with straw to a depth of approximately 1.2 inches. Any necessary reseeding or repairing to final acceptance. If the construction work is brought to completion when, in the opinion of the ENGINEER, the season is not favorable for the seeding of the grounds, then the CONTRACTOR shall delay this item of the work until the proper season for such seeding as directed by the ENGINEER.

Sodding will not be required unless specifically set forth by the Utility. When sodding is required, it shall be at least 60 percent good quality Kentucky Bluegrass, strongly rooted, and free of pernicious weeds and shall be so laid that no voids occur between strips. Weed roots shall be removed as the sod is laid, and the finished surface shall be true to grade, even and equally firm at all points. Well screened topsoil shall be lightly sprinkled over the sodded areas and shall be raked to insure sealing the sod joints. The sodded areas shall be thoroughly watered.