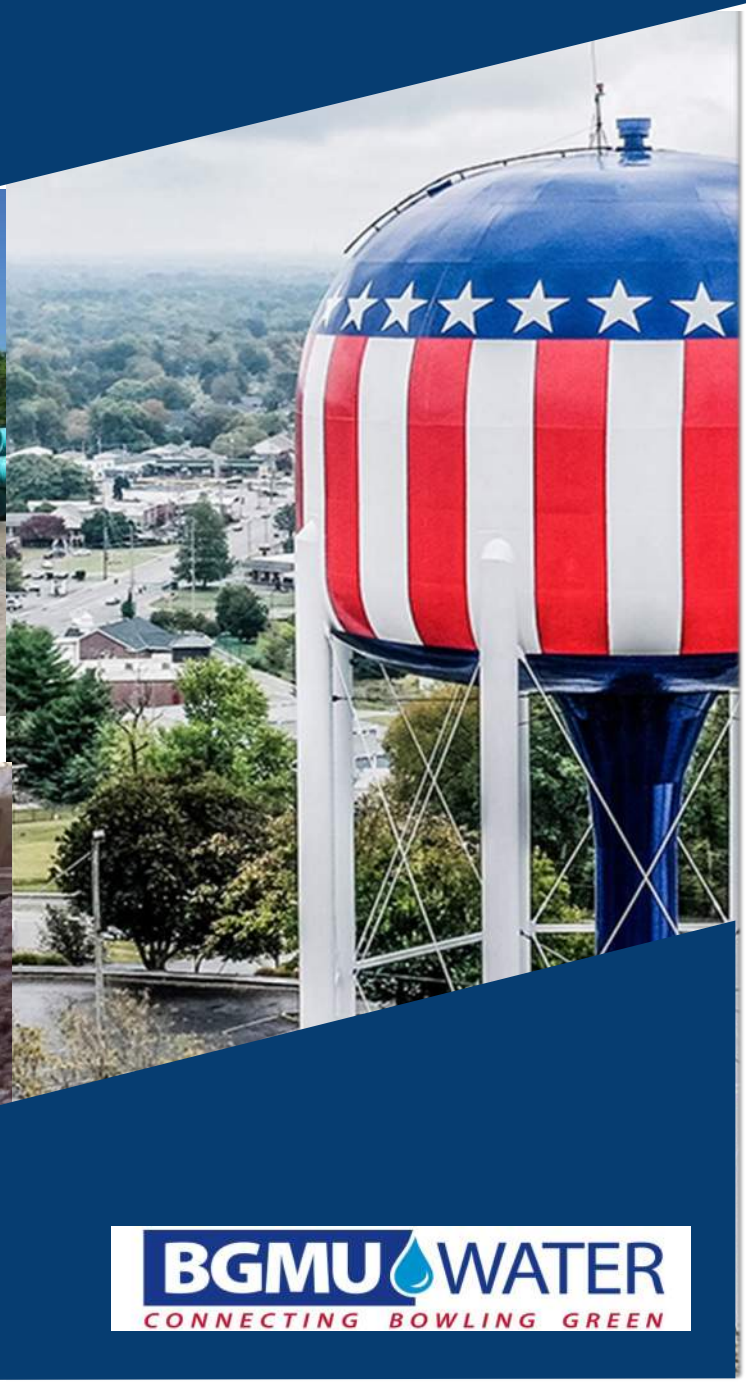
Minimum Design and Construction Specification Manual

January, 2025



BGMU WATER
CONNECTING BOWLING GREEN

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SECTION 1 – INTRODUCTION

PURPOSE

The purpose of this manual is to provide information and guidance to land developers, design engineers, and contactors in the construction of water and sanitary sewer facilities that are to become part of be connected to the Bowling Green Municipal Utilities (BGMU) Water Distribution System and/or Sanitary Sewer Collection System. These regulations and procedures are to be followed by any person or corporation in the development of a residential subdivision, commercial subdivision, industrial subdivision, 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 ensure the protection of health and welfare of the general public and assure that products and methods used for construction prolong the lifespan of new assets.

AUTHORITY

The Bowling Green Municipal Utilities Board was established by City Ordinance No. 76-8 merging the Electric Plant 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.

REFERENCES

References that are used in this manual are from the American Water Works Association (AWWA), National Precast Association (NPCA), Ten States Standards, Kentucky Division of Water (KDOW), and American Society of Testing Materials (ASTM).

Standard Drawings showing details of certain improvements, which may be issued by the Engineer, shall be complimentary to and a part of this manual.

GENERAL REQUIREMENTS

In order to ensure 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 BGMU 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:

1.1 Prepare detailed construction drawings.
1.2 The UTILITY shall perform construction inspection of the proposed utilities. The UTILITY shall certify to the ENGINEER that the utilities were installed per specifications.

1.3 The UTILITY will locate all utilities during construction utilizing GPS, these GPS points will then be given to the engineer for the 'As-Built' Drawings.
1.4 Provide a complete set of 'As-Built' drawings to the UTILITY in PDF format.
1.5 AutoCAD or Shapefile Drawings files of the new Water and Sanitary Sewer Lines based upon KY Single Zone Coordinate system with NAVD 83 datum.

UTILITY'S AUTHORITY

The UTILITY, or its designated representative, shall decide questions which may arise as to the quality and acceptability of materials furnished and work performed. The UTILITY 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 or Federal law or regulation, then the more stringent requirement will become the minimum specification.

OBLIGATION OF CONTRACTOR

The CONTRACTOR shall perform and complete the work to the satisfaction of the UTILITY 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, flagman, 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.

COOPERATION

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

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.

FINAL INSPECTION

In addition to normal inspection which will 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 sewer 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.

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.

PERMITS, EASEMENT, AND RIGHTS-OF-WAY

Unless otherwise required by the agencies involved, the OWNER-DEVELOPER 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.

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- Drawings 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 as per the UTILITY’s inspector.

CONTRACTOR- The person, form, 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 or 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.

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 Sanitary Sewer Division.

SECTION 2 – PROCEDURES

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 utilities or utility services that are to be connected to or become a part of the UTILITY system.

APPLICATION PHASE

The first step in the procedure is for the OWNER-DEVELOPER to file an application to the Water and Sanitary 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 BGM U 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 11 W' x 17" H sheet or via digitally via PDF with a sufficient scale to provide detail to show the location of the proposed development. A portion of an existing city map may be adequate for this, 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 up 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 fire protection) and whether the existing sewer system

has capacity to receive the flow 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 not 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.

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 ensure 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 data attached to the plans:

a. 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.

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

c. Design calculations of sewage lift stations and force mains shall show pump capacity at design Total Dynamic Head, head loss through 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 and profile sheets, 24" x 36'', to a scale of 1" = 50' (horizontal) and 1" = 5' (vertical) and shall contain the following minimum information. (Scale can be larger for smaller projects but should maintain the 10x vertical exaggeration)

Title Sheet

a. Name and Address of Engineering Firm
b. Name of Design Engineer
c. Name and Address of OWNER-DEVELOPER

d. Name of Development
e. Vicinity Map

Plan Sheet

a. Topography and layout of development (streets, curb and gutter, sidewalks, drainage headwalls, storm drains, lot lines and utility easements).
b. Pipe Material and Pressure Rating
c. Pipe Size
d. Location and Type of Valves
e. Location and Size of Fire Hydrants
f. Location and Size of Blow Offs
g. Location, size, and material of service tubing, curb stop and box
h. Profile of Water Line and other proposed underground utilities that cross the Water Line.
i. Existing Facilities i.e. hydrants, valves, line sizes, storm drains, and sewer lines.
j. The statement "All construction shall meet or exceed BGMU minimum specifications."

Plans prepared by the ENGINEER for the construction of Sewer Lines shall be drawn on plan and profile sheets, 24" x 36", to a scale of 1" = 50' (horizontal) and 1" = 5' (vertical) and shall contain the following minimum information. (Scale can be larger for smaller projects but should maintain the 10x vertical exaggeration)

Title Sheet

a. Name and Address of Engineering Firm
b. Name of Design Engineer
c. Name and Address of OWNER-DEVELOPER
d. Name of Development
e. Vicinity Map

Plan Sheet

a. Topography and layout of development (streets, curb and gutter, sidewalks, drainage headwalls, storm drains, lot lines and utility easements).
b. Pipe Material
c. Pipe Size
d. Location by station number and type of manhole
e. Length of sewer line and grade between manholes
f. Invert of sewer at each manhole for both inlet and outlet and the fall within the manhole.
g. Location, size, and material of house connections.
h. Profile of sewer line and other proposed underground facilities.
i. Existing facilities, i.e. manholes, line sizes, storm drains, and water lines.
j. The statement "All construction shall meet or exceed BGMU minimum specifications."

Plans prepared by the ENGINEER for the construction of Sewer Pump Stations shall be drawn on sheets, 24" x 36", to a scale of 1" – 5' or larger and shall contain the following minimum information.

Title Sheet

a. Name and Address of Engineering Firm
b. Name of Design Engineer
c. Name and Address of OWNER-DEVELOPER
d. Name of Development
e. Vicinity Map

Plan Sheet

a. Name of Pump Manufacturer
b. Number of Pumps
c. Pump discharge at design Total Dynamic Head
d. Dimensions, elevations, and capacity of wet well
e. Location of pump controls and other site items.
f. Piping and valve arrangement inside station.
g. The statement "All construction shall meet or exceed BGMU minimum specifications."

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 a 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 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.

REVIEW PHASE

After the completed plans have been reviewed by the OWNER-DEVELOPER with the ENGINEER, and approved by the ENGINEER, 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 the 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.

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.

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 the Notice 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 incurred in the field between the water and sewer facilities and the drainage work.

The UTILITY shall provide a full-time resident inspector paid for by the OWNER-DEVELOPER to ensure that all construction is accomplished in accordance with the approved plans and the standard specifications contained herein. The UITLITY'S resident inspector shall be on the job several hours per day, GPS locate fittings, services, and other points when the CONTRACTOR is working on the construction of water and/or sewer facilities. UTILITY's inspector fee shall be estimated at the beginning of the project and the OWNER-DEVELOPER shall the be reimbursed for hours that were over-estimated or billed for hours that were under-estimated.

In addition to the inspection, it is requested that the CONTRACTOR or the UTILITY'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. Any Representative 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 CONTRACTOR and UTILITY.

CERTIFICATES 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 UTILITY shall certify in writing to the ENGINEER 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 delivered as per the must accompany the ENGINEER's certification.

If 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.

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.

REFUND AGREEMENT

lf 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.

SUMMARY OF OWNER/DEVELOPER MILESTONES

The following list of milestones was developed as a quick summary to the processes in this document. Please note that these are in order of how they should be performed.

1. Application to connect to existing facilities
2. KRS 96.539 Response
3. Project Design submitted to Utility for review (2 Sets)
4. Project Design returned to Engineer for Corrections (if required)
5. Project Design returned to Utility corrected (3 sets)
6. Project Design approved by Utility for Construction
7. Kentucky Department of Natural Resources notified by Utility of approval for Construction
8. Kentucky Department of Natural Resources approval for construction received.
9. Shop Drawings reviewed and approved
10. Pre-construction Conference
11. Notice to Proceed from Utility to Developer
12. Construction Initiated
13. Changes in Construction approved in writing
14. Construction Completed
15. Water Distribution System Disinfection
    a. Disinfection records complete
    b. Bacteriological test results received
16. Utilities Pressure Tested
    a. Water Distribution
    b. Gravity Sanitary Sewer Collection
    c. Pressurized Sanitary Sewer Collection
17. Sanitary Sewer Inspection
    a. Gravity Sewer lines cleaned and free from debris
    b. Gravity Sewer Lines and Services Inspected utilizing CCTV.
18. As-Builts
    a. Engineer to submit As-builts utilizing the Utility's GPS coordinates from onsite inspection
    b. PDF submitted to the Utility.
19. Final Inspection, Tracer Wire Inspection, and punch list items corrected.
20. Required Easements Recorded or Plat with Easements Recorded
21. Certification Letter to Kentucky Department of Natural Resources stating that utilities were put in per plan and specifications
22. Letter of Acceptance and Bond from Owner.

SECTION 3 – WATER MAINS

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.

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. Analysis should include four scenarios:

1. Average Demand - This scenario shall demonstrate that the proposed water main does not exceed 150 PSI at every node. Flows can be estimated using known data or from the IAPMO Water Demand Calculator.
2. Peak Demand - Peak demand shall be evaluated using a diurnal curve provided by BGMU or appropriate peaking factor. This scenario shall demonstrate that the proposed water main maintains 30 PSI at every node.
3. Flushing Scenario - The hydraulic analysis shall demonstrate that the proposed water main can be flushed at a minimum of 2.5 feet per second while keeping system pressure above 20 PSI within the pressure zone of the project.
4. Ultimate Capacity - Show a continued increase in demand on the system until 20 PSI is achieved at a junction node. The ultimate capacity flow of the system shall be adequately larger than the flows from Scenario 3.

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:

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

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

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

4. 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.

SIZE OF SERVICE PIPE

All service piping shall be one inch (1") 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.

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.

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.

SEPARATION OF WATER LINES AND SANITARY SEWER LINES

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.

PIPE MATERIAL

All water mains shall be constructed of Ductile Iron (DIP), unless otherwise approved by the UTILITY, except 10 inches and larger shall be ductile iron.

1.1 DUCTILE IRON PIPE (DIP), FITTINGS, AND JOINTS

Ductile iron pipe shall conform to the latest AWWA specifications C151 (ANSI A21-51) with standard thickness as designated to AWWA C150. Class 350 or greater is required on all lines 12" and below. Larger lines will have the pressure class written on the Engineering Plans.

The interior of the pipe shall be cement-mortar lined with an asphaltic seal coat in accordance with AWWA C104 (ANSI A21.4). The exterior of all pipe, unless otherwise specified, shall receive either a asphaltic 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. Any DIP laid in these areas shall be

wrapped in a polyethylene encasement wrap.

Fittings shall be Mechanical Joint Class 250 conforming to AWWA Specifications. Fittings shall be asphalt-coated outside and shall receive the standard cement lining with an asphaltic 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 C111 (ANSI A2l.ll). 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. DIP shall utilize a restraining gasket that has wedges built into the gasket to grip the pipe as it is seated. These gaskets shall utilize a different color than standard gaskets so pipe crews and inspectors can easily see the difference.

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. All fittings shall utilize a restrained Mechanical Joint, any type of restraining joint can be used on DIP.

Joints for ductile iron fittings shall be mechanical joint type only. All valves for buried service on the water mains shall be of the mechanical joint type. All bolts on fittings shall be sprayed with rubberized spray-on undercoating to minimize corrosion on the bolts. Approved undercoating manufacturers are 3M 0883 or approved equal.

Fire Hydrant Assemblies shall utilize an anchor (swivel) tees and anchor (swivel) couplings to restrain the gate valve to the main line tee, and then the hydrant to the valve.. This is the only exception to MJ type fittings.

Mechanical joint plain and bell ends of fittings shall conform to the dimensions set forth in AWWA Cl 11- 72 (ANSI A21. l 1).

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

1.2 POLYVINYL CHLORIDE PIPE (PVC), FITTINGS, AND JOINTS

Only allowed when the availability of Ductile Iron Pipe is in question.

PVC water pipe shall conform, as a minimum, to ANSI/AWWA C900, and shall be pressure Class 305 psi or DR14 (minimum) when installing pipes smaller than 12”.

Fittings shall be ductile iron Mechanical Joint Class 250 conforming to AWWA specifications C110 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. All fittings shall utilize restrained MJ joint packs, when using plastic pipe, the UTILITY requires the use of locking ring style (Grip Ring) of restrained joints. We will only allow variances from this if the pipe is too large for this style.

Joints shall be of the push-on type conforming to ASTM D3139 and F4777 requirements for elastomeric gasket joints. All jointing material and lubricants shall be non-toxic. Joints shall have no more than 3 degrees of deflection at the joint. Joints should also utilize a joint stop at each slip joint connection. (Rubber or Ductile joints stops are allowable)

1.3 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 A 139 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. (WD-5)

WATER LINE APPURTENANCES

1.4 GATE VALVES

All gate valves shall be of iron-body resilient-seated gate valves with non-rising 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-3. 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 to meet this 3' standard. Gate valves set with valve boxes shall be provided with a two-inch (2") 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 operated. Any valves installed outside of road or concrete should include a tapered precast concrete ring, installed 30 days after water line installation.

All valves shall conform to the latest revision of the 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. (WD-3)

1.5 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 fully 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 or ductile 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. Valve shall be certified to comply with the low lead requirements of the Safe Drinking Water Act, ANSI/NSF372.

All valve discs shall be constructed of cast or ductile iron Type. All disc seating edges shall be smooth and polished. Valve shafts shall be constructed of stainless steel and shall be one-piece unit extending full size thru the valve disc and valve bearings. Valve seats shall be EPDM or another 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. Bearing 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 vale 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 coated with fusion bonded epoxy in accordance with AWWA C550.

See Drawings WD-3 for typical setting for a buried butterfly valve.

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

1.6 TAPPING SLEEVE AND VALVES

Tapping sleeves for connections to existing water lines shall be stainless steel and utilize a full circumferential seal. Suitable for working pressures of 200 psi or greater.

Tapping valves shall be of the mechanical joint type suitable for working pressures of 200 psi and shall be Mueller No. H-304, Romac Industries SST III, JCM 432, or approved equal.

1.7 VALVE BOXES

Valve boxes shall be of 5-1/4” inch standard cast or ductile iron, two-piece, screw type valve box with drop cover marked "WATER". Valve boxes shall be accurately centered and installed plumb over valve operating nut, then backfilled while 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. Any valves installed outside of road or concrete should include a tapered precast concrete ring, installed 30 days after water line installation.

1.8 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 1/2” 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 2” inches, and shall open left (counterclockwise). Main valve shall have 5-1/4” full opening and be of the compression type opening against water pressure so that the valve remains closed should the barrel be broken off.

Hydrant 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 0-ring seals.

Hydrants shall be designed from 250 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 50 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 18 to 24 inches. All fire hydrants shall be provided with a shut-off valve in the hydrant lateral as shown in Drawing WD-4. Fire hydrants shall be offset from common property line three to five feet and not set on iron property pins.

Hydrant should have the capability of integral installation of acoustic and pressure monitoring hardware for a dry-barrel hydrant. This should be done inside the current Hydrant Body, without addition of other devices outside the hydrant.

Hydrants shall be Mueller Company Model A-423, or approved equal.

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

1. Interior and Exterior above and below ground shall be coated with high performance 2-part epoxy. Exterior above ground line—one coat of UV resistant high gloss 2-part polyurethane enamel in Safety Yellow (SW4084).

2. Bonnet and nozzle caps should then be scuffed and painted using a similar UV resistant high gloss 2-part polyurethane enamel in the correct color for the hydrant flow.

GPM Range	Paint Color	Color Code
0-500	Red	SW4081*
500-999	Orange	SW4083*
1000-1499	Green	SW4085*
1500+	Blue	SW4086*

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

All coatings and paints shall be as manufactured by Sherwin-Williams, or approved equal.

Unless otherwise approved by this utility, no coating or paint shall be applied when the ambient temperature is below 35 degrees F. or the relative humidity is above 85 percent.

Once coated a 2" wide band of 3M white reflective tape, or approved equal, should be placed below the bonnet of the hydrant. This should meet the specifications of 3M diamond grade rated for 7 years of use. Surface should be clean and dry before adhering tape to the hydrant.

1.9 AIR RELEASE VALVES

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 I.P.S. threaded outlet. The inlet pipe to the valve shall be ASTM 843 extra strong seamless red brass pipe with I.P.S. male threaded ends.

The air release valve box shall be a 24-inch corrugated plastic pipe 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 correct size to fit the over the pipe.

1.10 BLOWOFFS

End of line blowoffs shall no longer be installed and a standard fire hydrant as specified previously shall be installed in place of blowoffs.

1.11 FIRE LINE ASSEMBLIES (FLA)

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 and meet the current BGMU policies for FLAs.

TRENCH EXCAVATION

Unless specifically directed otherwise by the UTILITY, no 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 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 consider 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 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.

1.12 OBSTRUCTIONS

In cases where storm 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.

1.13 SHORING, SHEETING, AND BRACING

Where unstable material is encountered or where the depth of excavation in earth exceeds sex 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 ensure 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.

1.14 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 blasting operations.

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

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.

1.15 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-1. Bedding material shall be free from rock and be acceptable to the UTILITY. In no case shall pipe be supported directly on rock.

1.16 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-1).

1.17 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.

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 plastic pipe 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 UTILITY, 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.

BACKFILLING PIPELINE TRENCHES

All backfilling shall be accomplished in accordance with the details shown on Standard Drawings No. WD-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 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.

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. (WD-1)

1.18 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 spring line (centerline) of the pipe shall be backfilled with #9 crushed stone.

When installing ductile iron pipe, the portion of the trench from the spring line of the pipe to 1’ from the surface shall be backfilled with material free of rocks 4” or larger.

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.

1.19 METHOD “B” BACKFILLING UNDER PAVED AREAS

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

Any backfill of utilities within in a Public Right-of-Way shall be governed by the Public Works entity

that has control of that public roadway. Please see their latest details for proper backfill.

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.

1.20 SETTLEMENT OF TRENCHES

Wherever water lines are in, or cross, driveways and streets, the CONTRACTOR shall compact these areas with a hydraulic compactor to minimize any settlement. 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.

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-2.

Encasement of water mains under creeks and drainage waterways shall be constructed as shown on Standard Drawing WD-5.

In places where concrete will be poured at a mechanical joint fitting, polyethylene (plastic) sheet, a minimum of 5 mil, shall be wrapped around the fitting to prevent the concrete from coming in contact with the bolts and nuts.

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.

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 given a hydrostatic test to the lowest pressure rating of the pipe in the water system, 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. UTILITY reserves the right to increase this test period to 6 hours if during the first pressure test the integrity of the line is brought into question, or inspection of the line yielded items not approved by the UTILITY.

d. Where leaks are evident on the surface where joints are covered, the joints shall have its bolts retightened or pipe re-laid.

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 used during leakage test to log pressures throughout the duration of test. Pressure data remains the property of the UTILITY at conclusion of test.

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

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.

During construction the CONTRACTOR shall periodically add Calcium Hypochlorite Powder so that when the system is filled it insures a chlorine dosage of at least 50 ppm in the main. The water should be allowed to escape at the ends of the line until testing indicates that a dosage of 50 ppm has been obtained throughout the pipe being tested.

Close all valves, fire hydrants, and cocks while chlorinated water shall be allowed to remain in the pipe for no less than 24 hours, after which a residual chlorine of at least 25 ppm shall be obtained. The disinfection shall be repeated until 25 ppm is obtained. The After which time the main shall be thoroughly flushed until the residual chlorine content is not greater than 1.0 ppm or current system chlorine levels.

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

CONNECTION TO EXISTING WATER DISTRIBUTION 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 so 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.

CUSTOMER SERVICE CONNECTIONS

Water service connections shall be made in accordance with the details shown on Standard Drawings No. WD-4. 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 and in the center of the lot (to avoid driveway conflicts). Long side services feeding apartment complexes with up to 4 units shall be (2) 1" service lines. Long side services feeding apartment complexes with (5) or more units shall be 2" PVC Sch 40 (no male adapters to be used).

1.21 PIPE AND FITTINGS

Water services piping shall meet the following requirements:

Crosslinked polyethylene pipe (PEXa) shall be seamless, produced in accordance with AWWA C904.

PEXa water service pipe shall be required to demonstrate ability to satisfy the performance requirements of section F.7 of PPI TR-3 for PE materials in order to apply a 0.63 design factor resulting in a 200 psi pressure rating at 73.4 degrees F (23C)

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.

1.22 CORPORATION 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. Any approved equals must have the same thread patterns as the companies set forth below.

Corporation stops shall be:
1" Service Ford Ball-type Corporation Stop
2" Service Mueller Ball-type Corporation Stop

1.23 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. Any approved equals must have the same thread patterns as the companies set forth below.

Curb stops shall be:

1" Service Ford ball type Curb Stop
2" Service Mueller ball type Corporation Stop

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.

Tracer Wire

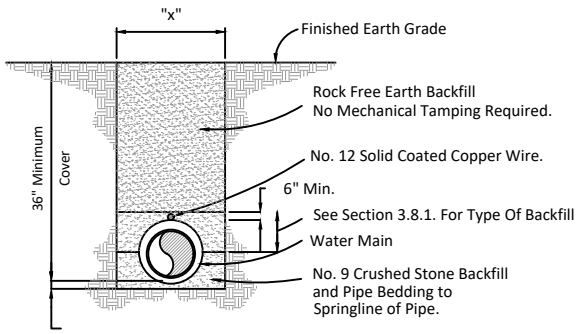
Insulated, 12-gauge Copper Clad Steel Conductor with a minimum break load of 450 lbs. and specifically designed for tracer wire. (Do not use braided wire) The wire shall be taped to the North or east side of the pipe below the spring line of the pipe. Tracer wire will be laid with all metallic and non-metallic water mains.

Whenever possible the tracer wire should be run seamlessly from fire hydrant to fire hydrant. Each fire hydrant or dead end shall be grounded utilizing a drive-in magnesium grounding rod (must be driven into undisturbed earth) and connected to a Cobra Access Point 3-Terminal (manufactured by Copperhead Industries) or approved equal that is attached to the hydrant. The Ground should attach to one side of the Access point and then then the Tracer Wire attach to the other side. Dead end sections of pipe shall be grounded and utilize a BoaBox (manufactured by Copperhead industries) or approved equal with a marker post next to it for locating purposes. Wires shall be terminated to the lid of the BoaBox.

If the wire must be spliced, contractor will use Copperhead Snakebite Locking Connectors (LSC1230C) or approved equals. All products must be designed for use in underground tracer wire installation. All connectors must use dielectric silicone to seal out moisture and corrosion. They should also be installed in a manner to prevent any uninsulated wire exposure to the soil.

Contractor will install mainline to service connector at every branch, twisting and turning the wire around fittings to follow a branch is prohibited. In addition, the end of every branch tracer wire shall be laid next to the Curb Stop. (UD-1)

Standard Water Main Details



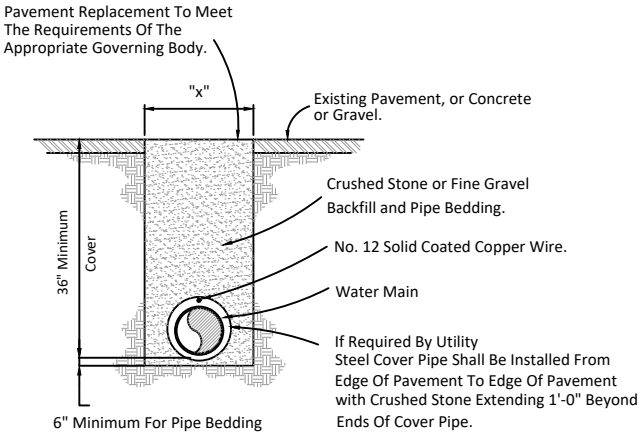
6" Minimum For Pipe Bedding

- Method "A" -
(Open Areas)

TRENCH WIDTH	
PIPE SIZE	"X"
4" Thru 12"	30"
14" Thru 18"	36"
20" Thru 24"	42"
26" Thru 36"	54"

Note:

Cutting and Repairing Existing Pavement Concrete or Gravel Shall Be in Accordance With Owners Requirements.



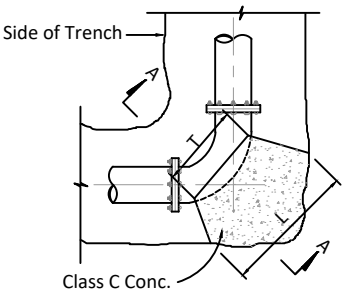
- Method "B" -
(Paved Areas)

Typical Backfill & Bedding Methods

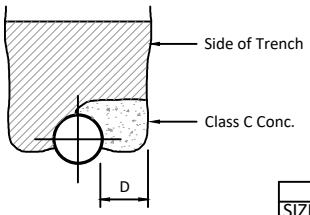
Bowling Green Municipal Utilities
P.O. Box 10300
Bowling Green, KY 42102
PH. 270-782-1200

WD-1

Standard Water Main Details

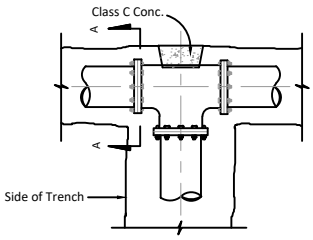


45 & 90 Bends

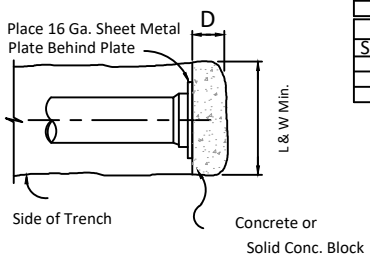


Section A - A

Plugs & Tees							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L&W	14"	16"	18"	20"	22"	24"	24"
(45) Eighth Bends							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L	12"	14"	16"	18"	20"	22"	24"
T	10"	12"	14"	16"	16"	18"	18"
(90) Quarter Bends							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	8"	10"	12"	12"
L	15"	18"	21"	24"	27"	30"	34"
T	10"	12"	14"	16"	18"	20"	22"



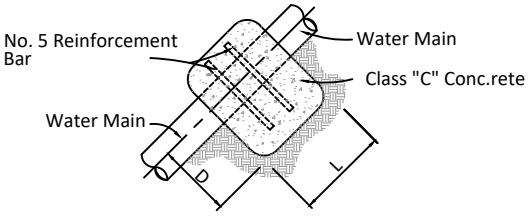
TEES



Plugs

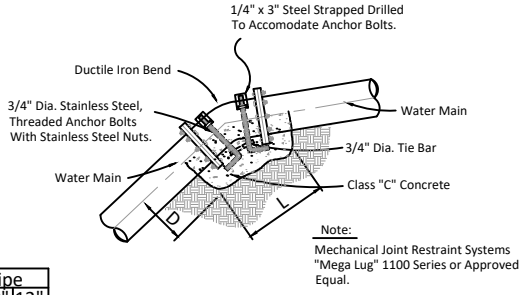
Concrete Thrust Blocks

Note:
Anchors To Be Full Width Of Trench.
Anchors Must Be Placed Against Undisturbed Earth.



Straignt Pipe

Vertical Bend & Straight Pipe							
SIZE	2"	3"	4"	6"	8"	10"	12"
D	10"	12"	12"	15"	15"	18"	18"
L	12"	18"	18"	24"	24"	30"	30"



Vertical Bends

Typical Concrete Anchor Blocks

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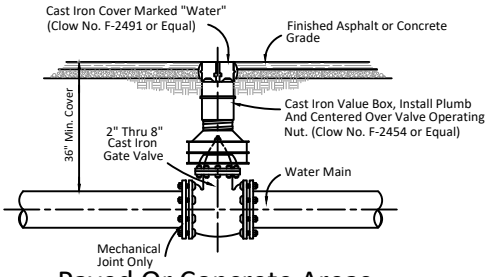
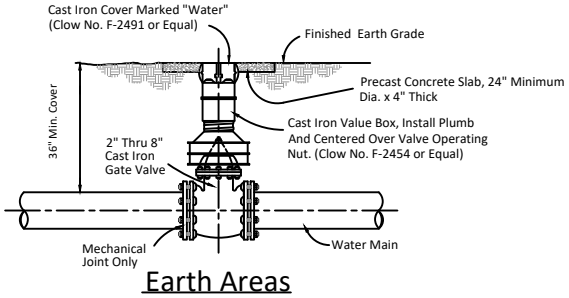
WD-2

Standard Water Main Details

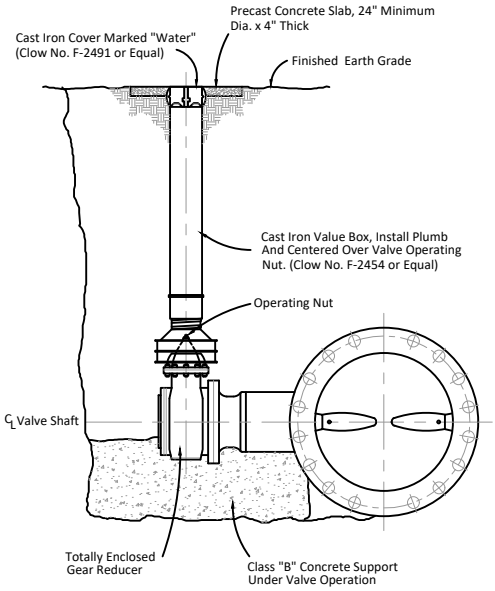


Paved Or Concrete Areas



Earth Areas

Typical Gate Valve Setting



Note: Butterfly Valves to be used on Water Mains 10" or larger.

Typical Setting For
Buried Butterfly Value

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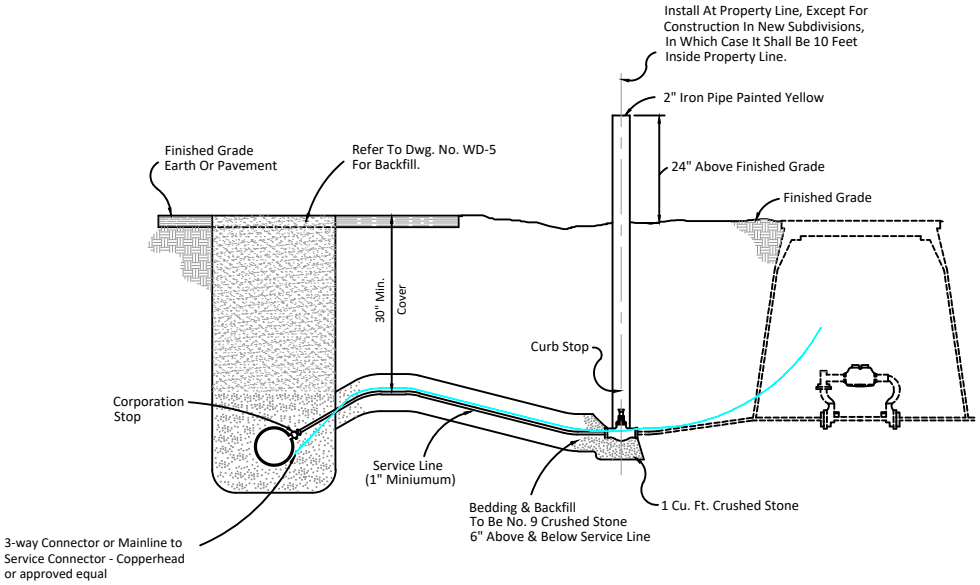
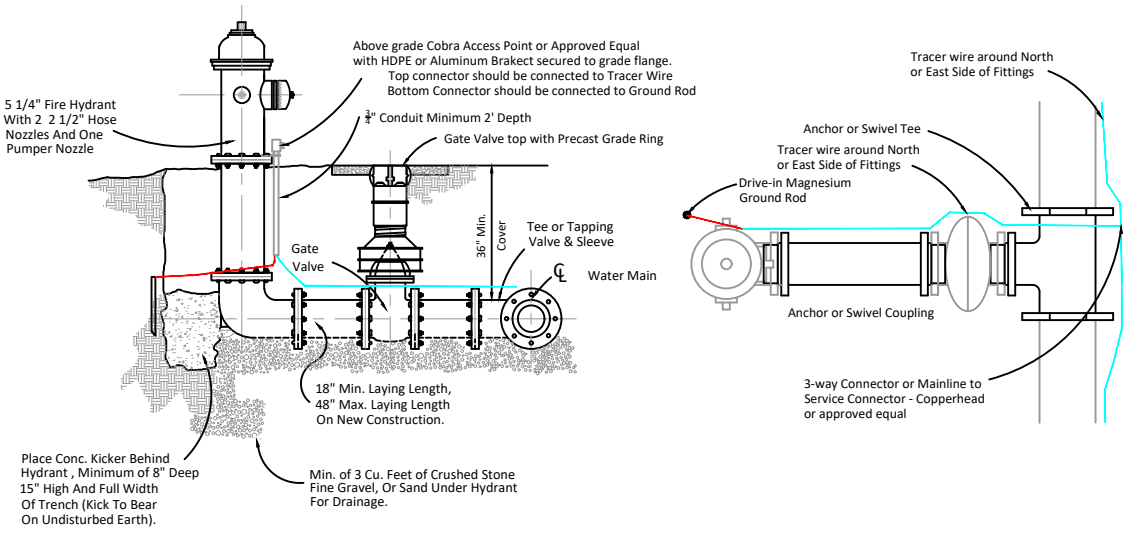
WD-3

Standard Water Main Details



Typical 5/8" & 1" Service Connection



Typical Fire Hydrant Setting

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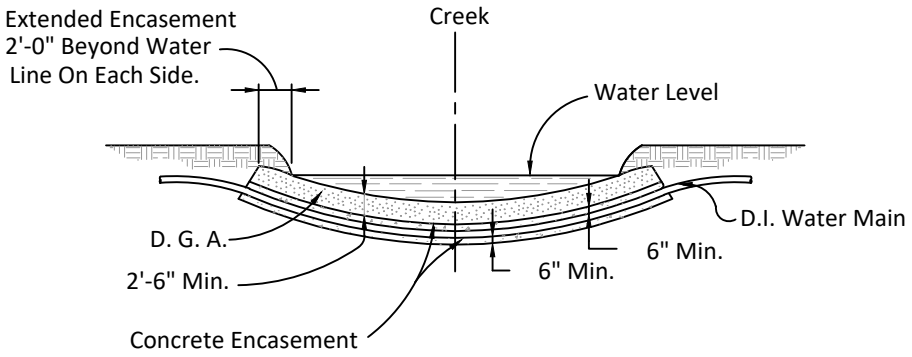
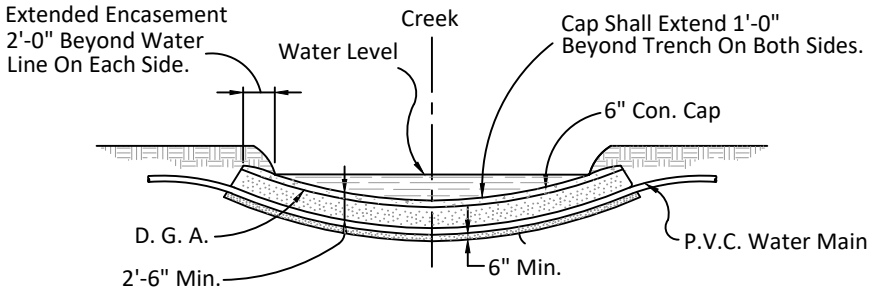
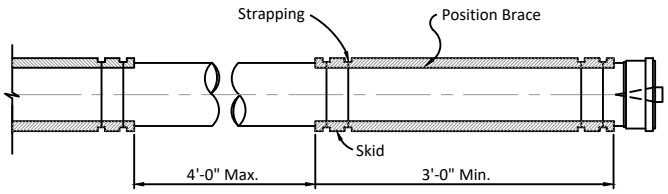
WD-4

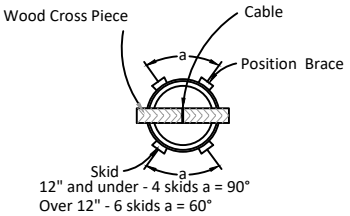


Typical Creek Crossing For D.I. Water Main



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





Casing Skids For Water Or Sewer Line Installation In Casing Pipe

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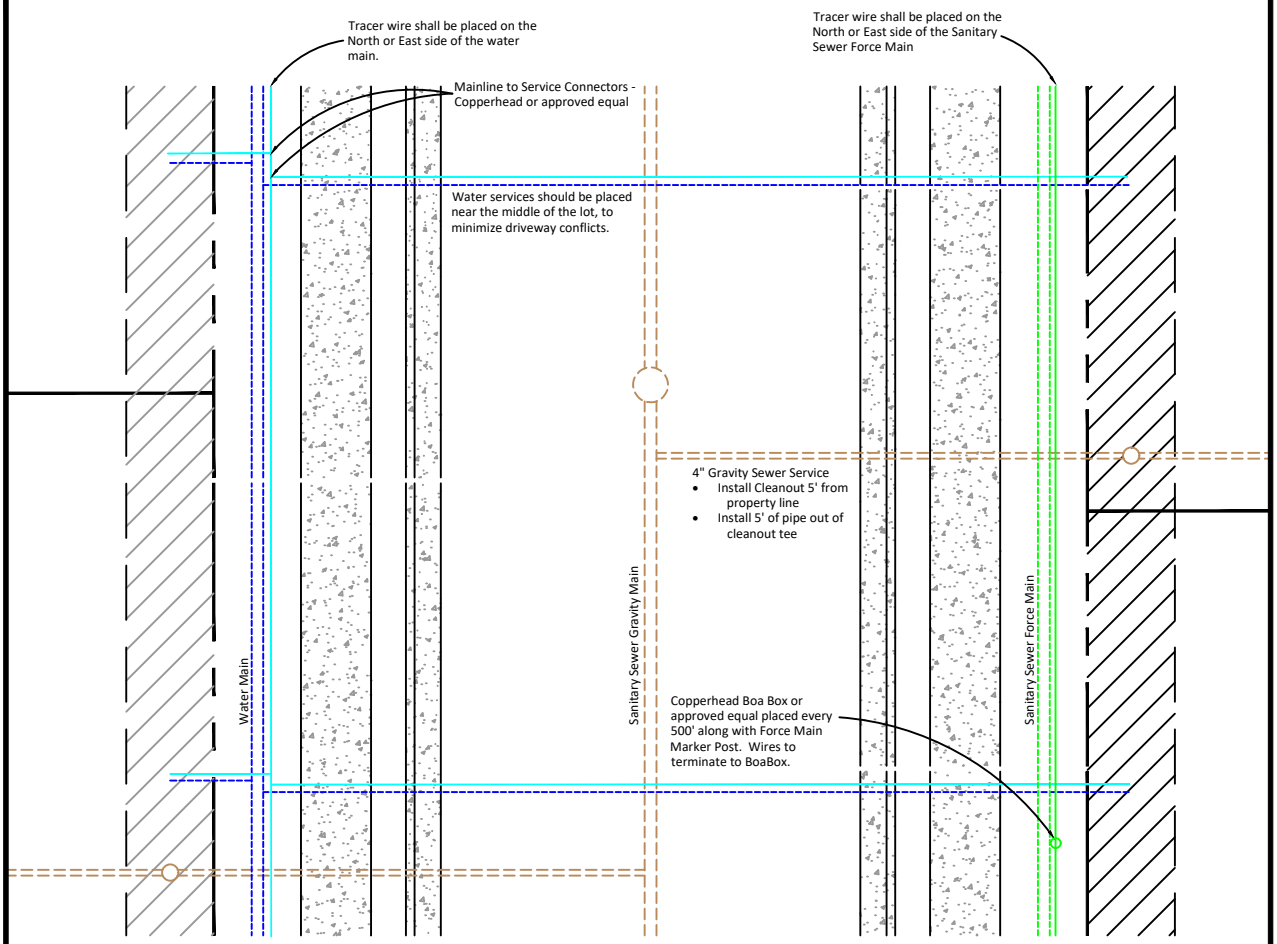
WD-5

Standard Utility Detail



WATER AND SANITARY SEWER TYPICAL STREET LAYOUT

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UD-1

SECTION 4 – SANITARY SEWERS

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.

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.

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.

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.

Sanitary Sewers larger equal to or larger than 48" inches should be designed and constructed to give mean velocities, when flowing full, of not less than 3 feet per second, based on Manning's Formula using an "n" value of 0.013.

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.

Sanitary Sewer Pipe Diameter	Minimum Slope in Feet per 100 Feet
8"	0.400
10"	0.280
12"	0.220
15"	0.150
18"	0.120
21"	0.100
24"	0.080
30"	0.058
36"	0.046
42"	0.037

1.3 SIZING

New sewer systems shall be designed based on an average daily per capita flow of sewage of not less than 70 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, trunk 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. The table below shows development types and corresponding design flows.

Residential			Population/Unit	Average Gal/Unit/Day
Single Family Dwelling			3	210
Two Family Dwelling			6	420
Multi-family Dwellings				
	1-Bedroom		2	140
	2-Bedroom		3	210
	3-Bedroom		4	280
Mobile Homes			3	210
Commercial/Industrial		**Unit**	**Population/Unit**	**Average Gal/Unit/Day**
Motel Rooms		Students	1	70
Schools		Persons	0.15	10.5
Nursing Homes		Bed	1	70
Offices		Employee	0.15	10.5
Laundromats		Washer	4	280
Other Commercial		Acres	20	1400
Industrial		Acres	10	700
In all cases with commercial or industrial developments, actual numbers from plumber or designer should be used when available. With any allowance for future expansion.				

PIPE MATERIAL

All pipe, joint and fittings for sanitary sewer shall polyvinyl chloride (P.V.C.), iron pipe unless otherwise approved by the UTILITY.

1.4 POLYVINYL CHLORIDE PIPE AND FITTINGS

PVC pipe shall be extruded from Type I, Grade 1, and polyvinyl chloride material designated as PVC 1120, meeting ASTM Specifications D 3034, Type PSM, and a standard dimension ratio of SDR 35 at depths no greater than 12 feet. Pipes over installed deeper than 12' shall have a standard dimension ration of SDR 26.

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 in all respects.

Pipes shall be furnished in 14-foot lengths. The pipe shall have a bell on one end. Male ends of

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

Pipe must be delivered to the job site by means which will adequately support it and not subject it to undue stresses. In particular, the pipe shall be supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and stung or stored as close to the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for longer than one (1) year. If pipe is to be stored longer, then it should be moved to a shaded area or covered with a tarp.

1.5 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.

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

1.6 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.

1.7 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 slopped 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 ensure 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.

1.8 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.

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.

1.9 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.

1.10 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.

1.11 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.

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 UTI LITY. 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.

1.12 JOINTING POLYVINYL CHLORIDE (PVC) PIPE

All joints and connections shall be as established in Section 4 part 3.1 hereinbefore. Assembly of pipe and fitting Joints shall be in accordance with manufacturer's recommendations.

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 toe 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.

1.13 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 spring line (centerline) of the pipe shall be backfilled with #9 crushed stone.

The portion of the trench from the spring line 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 8” and larger 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.

1.14 METHOD “B” BACKFILLING UNDER PAVED AREAS

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

Any backfill of utilities within a Public Right-of-Way shall be governed by the Public Works entity that has control of that public roadway. Please see their latest details for proper backfill.

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.

1.15 SETTLEMENT OF TRENCHES

Wherever sanitary sewer lines are installed or locations where they may cross driveways, sidewalks or streets, the CONTRACTOR shall compact these areas with a hydraulic compactor to minimize any settlement. 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.

MANHOLES

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 sections and manufactured to National Precast Association (NPCA) standards. (Standard Drawing No. SD-4, 5 & 6)

1.16 STANDARD MANHOLES

The standard manholes shall be precast structures five feet or more in depth and 4’ in diameter, measured from the base of the cover frame to the top of the concrete floor. As the size of the sanitary sewer line increases the diameter of the manhole will need to increase to allow for a smooth sweep in the invert. The precast should be connect with a tongue and groove joint, and shall have a layer of butyl mastic between each concrete surface. Standard Drawing No. SD-2.

1.17 SHALLOW MANHOLES

The shallow manholes shall be precast structures five feet or less in depth and 4’ in diameter, measured from the base of the cover frame to the top of the concrete invert and shall be of flat top construction. As the size of the sanitary sewer line increases the diameter of the manhole will need to increase to allow for a smooth sweep in the invert. The precast should be connect with a tongue and groove joint, and shall have a layer of butyl mastic between each concrete surface. Standard Drawing No. SD-5.

1.18 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.

1.19 PRECAST CONCRETE RINGS

Precast concrete rings for manholes shall conform to ASTM C76, Class II, Wall B, with a minimum concrete strength of 4,000 psi, with tongue and groove joints for each section. Butyl Mastic shall then be placed between each concrete surface. Once manholes exceed 12' in depth a layer of Butyl tape should be applied to the deeper joints to minimize possible infiltration.

In the case that concrete rings are being used for adjustment. The CONTRACTOR may utilize a Cretex Pro-Ring, expanded polypropylene ring system or approved equal. These should be installed per manufacturer's recommendation, utilizing recommended adhesives.

1.20 MANHOLE INVERTS

Manhole inverts shall be formed in a monolithic base from 3500 psi concrete. Curved inverts shall form a smooth, even half-pipe section as shown in Standard Drawing SD-4 . 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.

1.21 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.

1.22 MANHOLE AND COVERS

Manhole castings for manholes depth shall consist of cast iron frames and 26 inch diameter covers. J.R. Hoe MC-375 BGMU Round Manhole Frame and Cover or approved equal. These covers should only be used on BGMU owned manholes. Use on private sewer is prohibited.

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. Frame shall be anchored to the precast manhole with ½" wedge anchors.

If manhole is located below flood level for 100-year rainfall, watertight manhole castings shall consist of ductile iron frames with machined bearings surfaces, gasket seal and bolted lids. They shall be Pamtight Manhole Covers 32" clear opening or approved equal, as in Drawing SD-6

TESTING OF SANITARY SEWER ASSETS

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

1.23 GRAVITY 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. 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.

   a. 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.

b. 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.

c. 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.

d. 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.

Allowable Time Table		
	Time	
Pipe Size	Mins	Sec
8"	3	57
10"	4	43
12"	5	40
15"	7	5
18"	8	30
21"	9	50
24"	11	20
30"	14	10

e. The requirements of this specification shall be considered satisfied provided that the time required, in seconds, 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.

b. Prior to the final inspection, the CONTRACTOR or CONTRACTOR'S Representative shall video inspect each main line segment and service installed as part of the WORK.
   a. The video footage should be accomplished with a camera capable of 720(h) or greater resolution and include an inclinometer to verify the slope of the new line.
   b. All inspections should utilize the PACP standard coding system for the inspection.
   c. Video footage, reports, and database shall be given to the UTILITY once the segments have been accepted.
   d. Any defects or flaws found during the inspection shall be corrected by the contractor, and the lines then inspected again to show that they have been repaired.
   e. BGMU currently utilizes POSM software for its own in-house inspections and has established interconnections between that software and others. Other interconnections can be made, but should be discussed with BGMU before proceeding with the work.
   f. If any pipe looks to be egg-shaped or deformed, the owner reserves the right to have the contractor pull an appropriately sized mandrel through the line, or the CONTRACTOR can provide laser profiling data to show the pipe is not deformed.

c. 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. Contractor shall utilize StrongBack Fernco's or MaxAdaptor Couplings for the repair.

d. 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 area or prone to flooding.

e. 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.

1.24 MANHOLES

a. All manholes shall be required to meet the requirements of the vacuum test as per the current ASTM C 1244 "Standard Test Method for Concrete Sewer Manholes by the negative Air Pressure (Vacuum) Test" prior to acceptance. This method is laid out in this section but the ASTM method shall overrule if updated since this manual's last revision.

   a. Vacuum Testing

      i. The CONTRACTOR shall plug all incoming and outgoing pipes and brace the plugs appropriately.

      ii. A vacuum plate should then be placed on the top of the casting and a vacuum should be pulled to 10 inches of Hg. The UTILITY's Representative will then measure the time it takes for the gauge to fall to 9 inches of Hg. The table below shows the value this time must exceed.

	Diameter		
Depth	4'	5'	6'
(Feet)	(Time in Seconds)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

Adjustment of Vacuum Pressure for Ground Water											
Hydrostatic Head (ft)	12	13	14	15	16	17	18	19	20	21	22+
Vacuum Pressure (in Hg)	10	9	8	7	6	5	4	3	2	1	**
** No test should be performed with greater than 22' of Hydrostatic Head											

iii. If ground water was present during excavation the Vacuum Pressure should be adjusted accordingly to minimize the chance of failure of the structure. (NPCA Guidance)

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 4-inch PVC SDR 35 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. Each service shall be extended 10’ into the property and shall include a cleanout at the end of the service. Cleanout should utilize a two-tee and shall have a cleanout casting USF 6993 SIP Industries. Stub out at least 4’ of pipe from the back side of the cleanout for when plumber ties on.

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.

An 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 all sewers in rock or earth trenches, the tees 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 and shall be no more than 45 degrees from horizontal. No more than one lateral will be laid in any one trench. No horizontal bends will be allowed.

For deep sewers (greater than 10 feet in depth) in rock, the 45 degree bend at or near the branch tee shall have a concrete thrust block poured under it to relieve stress from the mainline pipe and carry the weight of the service.

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.

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.

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 given at least a 24-hour advance notice before the connection is made. All manhole cores shall be made by BGMU.

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

CONNECTIONS TO EXISTING MANHOLES

The CONTRACTOR shall provide all labor and material required in connecting the newly constructed sanitary sewer or force main to be an existing manhole. A representative must be present while the connection is being made. The UTILITY should be given a minimum of 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).

CONCRETE, CRADLE, ANCHORS OR ENCASEMENT

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.

LOCATING NEAR WATER LINES

1.25 HORIZONTAL SEPARATION

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.

1.26 VERTICAL SEPARATION

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 pre-stressed 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.

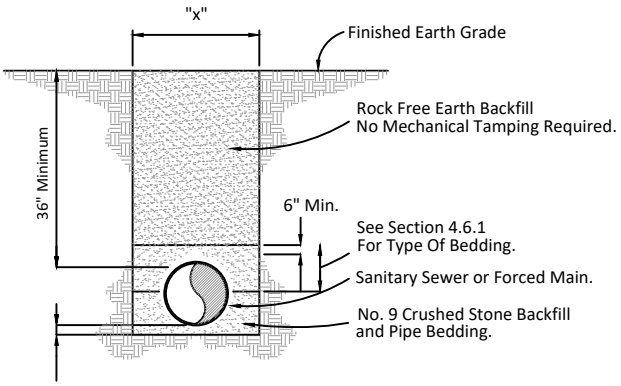
HIGHWAY AND RAILROAD CROSSINGS

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.

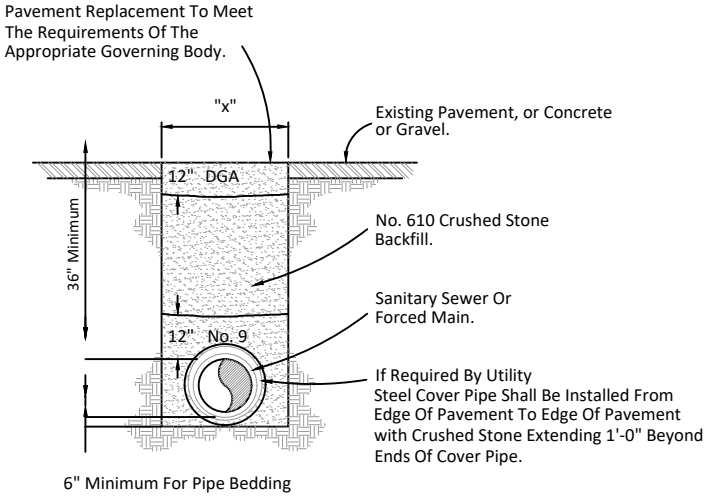
Installation of the sewer line in the encasement pipe shall be as per manufacturer's recommendations. After the sewer main has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with brick or concrete block masonry in a manner acceptable to the UTILITY.

Standard Sanitary Sewer Details

Trench Width	
Pipe Size	"X"
4" Thru 12"	30"
14" Thru 18"	36"
20" Thru 24"	42"
26" Thru 36"	54"



- Method "A" -
(Open Areas)



Note:

Cutting and Repairing Existing Pavement Concrete or Gravel Shall Be in Accordance With Owners Requirements.

- Method "B" -
(Paved Areas)

Typical Backfill & Bedding Methods

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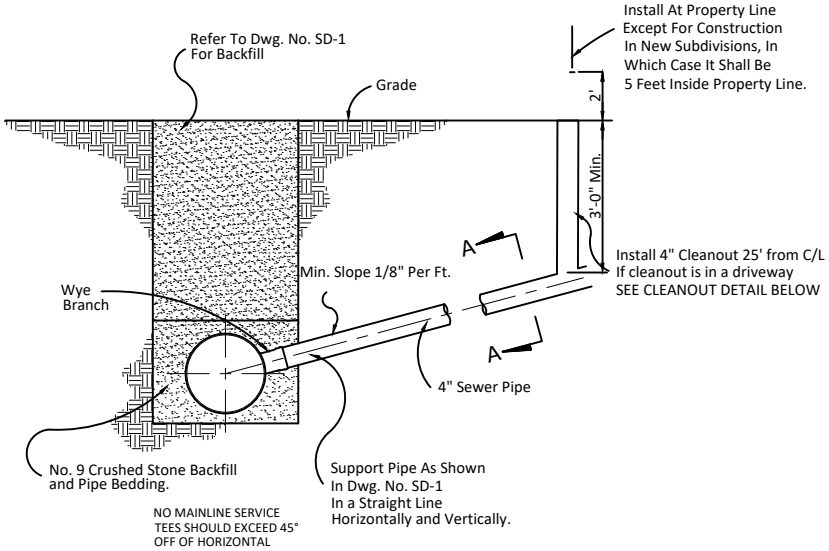
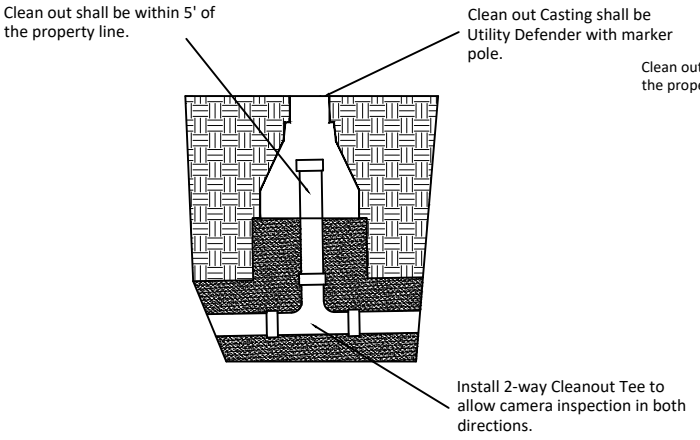
SD-1

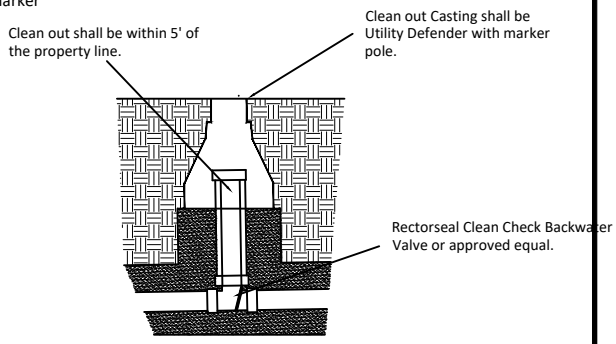
Standard Sanitary Sewer Details



House Connection For Shallow Sewer In Earth Or Rock



CLEAN OUT DETAIL



CLEAN OUT DETAIL
WHEN HOUSE IS BELOW
MANHOLE GRADE OR
BASEMENT GRAVITY

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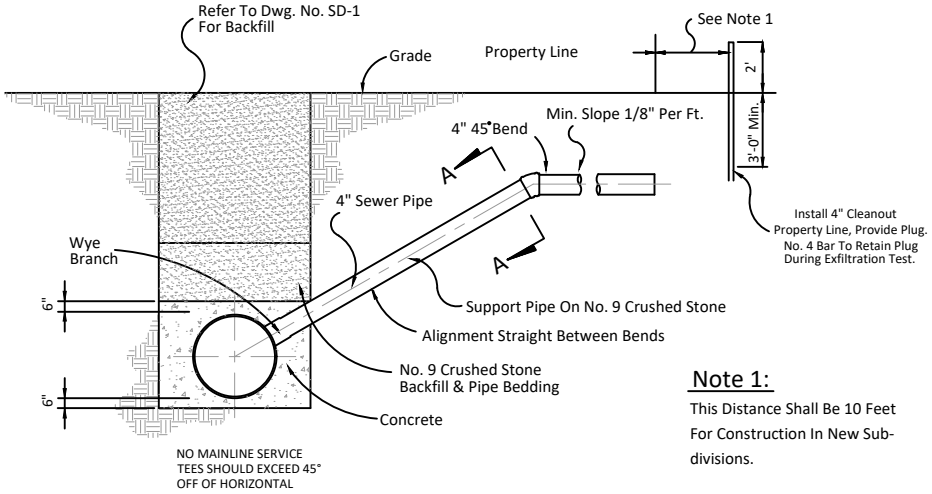
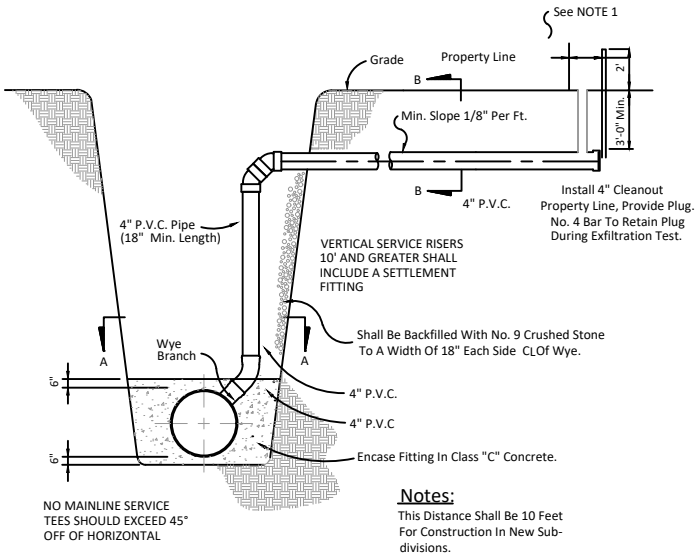
SD-2

Standard Sanitary Sewer Details

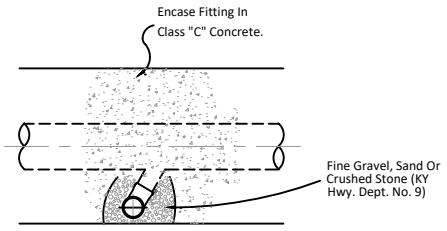


Note 1:
This Distance Shall Be 10 Feet For Construction In New Sub-divisions.

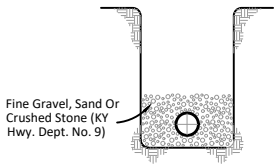
House Connection For Deep Sewer In Earth



Notes:
This Distance Shall Be 10 Feet For Construction In New Sub-divisions.



Section A - A



SECTION B - B

House Connection For Deep Sewer In Rock Excavation

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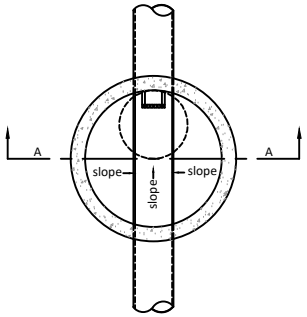
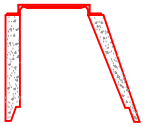
SD-3

Standard Sanitary Sewer Details

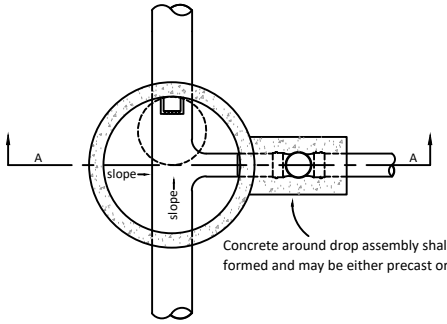


Section B-B

Note: Eccentric barrel sections shall be installed in all instances unless otherwise specified by BGMU

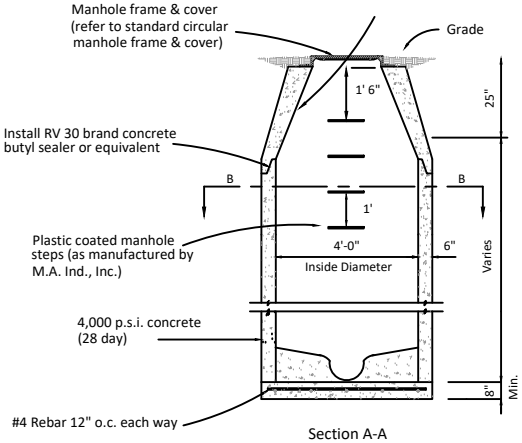


The view A-A of each manhole is downstream and therefore does not illustrate the eccentricity of the top barrel.



Concrete around drop assembly shall be formed and may be either precast or poured-in-place

Section B-B



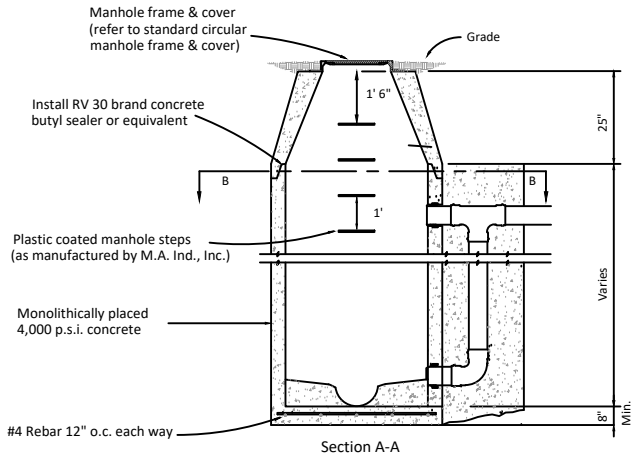
Section A-A

Typical Standard Manhole
(precast)

Set frame casting in full Portland Cement Mortar bed

Note: Manhole to be set on foundation of undisturbed soil or fill material compacted to 90% standard proctor, compaction to be in 6" lifts from undisturbed soil.

10" minimum if manhole is 8' - 12'



Section A-A

Typical Drop Manhole
(precast)

Typical Standard Manholes
(precast)

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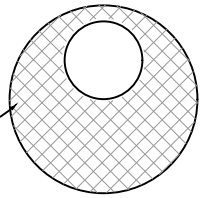
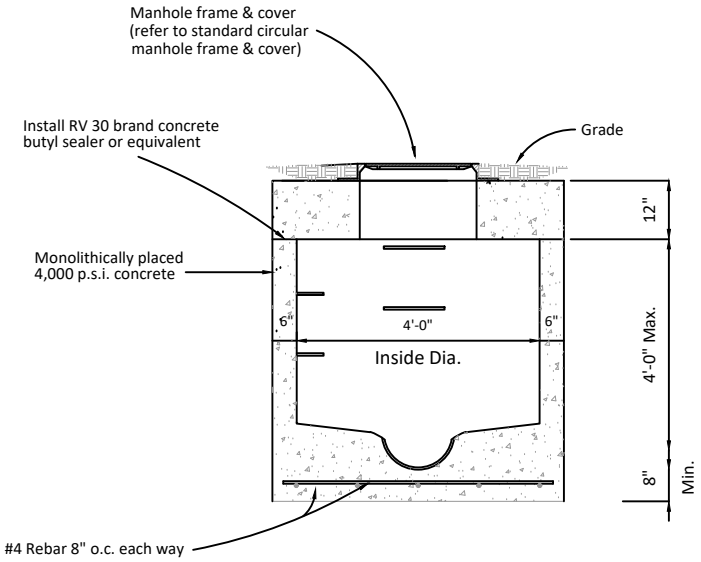
SD-4

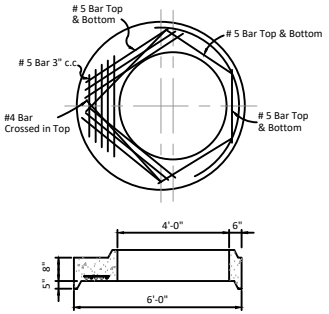
Standard Sanitary Sewer Details



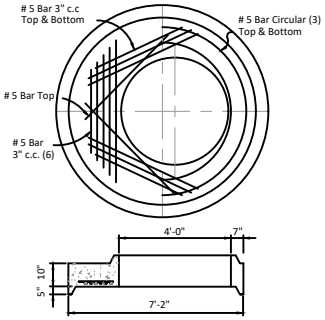
Top Of Slab Reinforcement Plan



Typical Shallow Manhole
(precast)

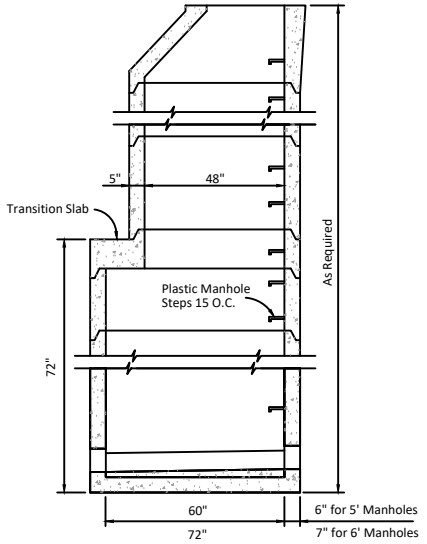


5'-0" To 4'-0" Transition Slab



6'-0" To 4'-0" Transition Slab

Note:
Concrete 4500 PSI @ 28 Days
Reinforced to ASTM C-478
Transition Slab Reinforcement.



5' Dia. To 4' Dia. M.H.
6' Dia. To 4' Dia. M.H.

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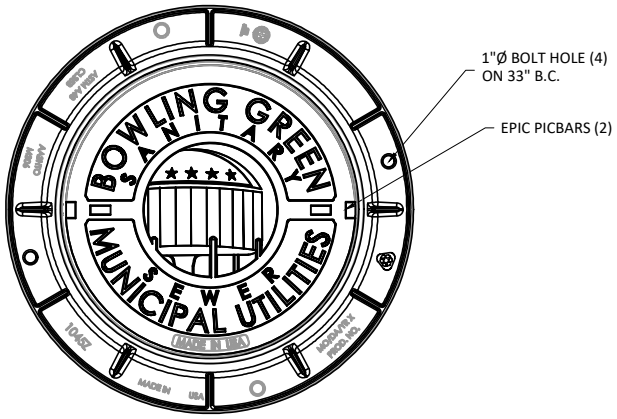
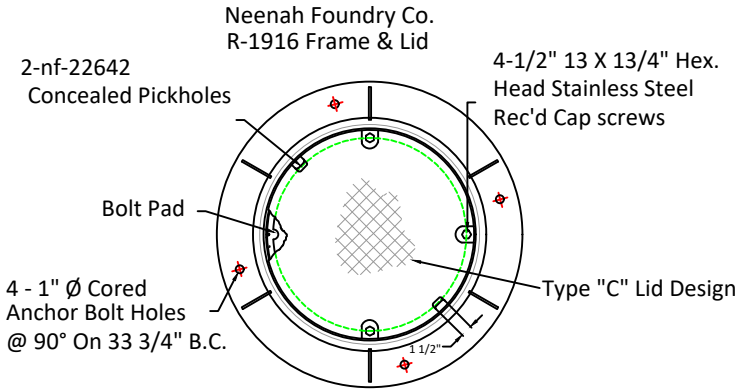
SD-5

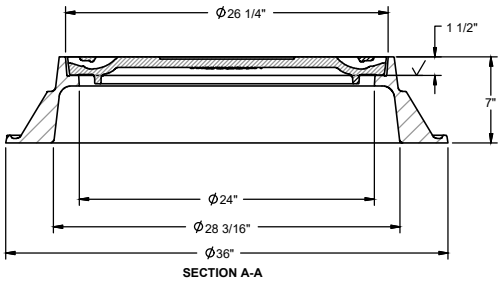
Standard Sanitary Sewer Details

J.R. HOE CASTINGS
MC-375 BGMU CASTING

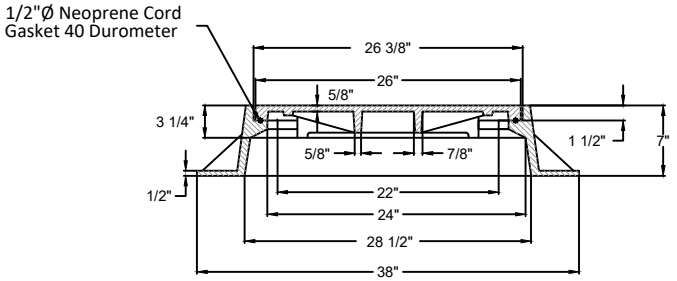


Neenah Foundry Co.
R-1916 Frame & Lid





Standard Circular Manhole Frame And Cover



Standard Watertight Manhole Frame And Cover

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SD-6

SECTION 5 – SANITARY SEWER FORCE MAIN

PURPOSE

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

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 non-metallic pipe.

PIPE MATERIALS

PVC Force main pipe shall conform, as a minimum, to AWWA C900 Specification, and shall be pressure Class 235. The pipe furnished under ASTM D1784 shall have a standard dimension ratio of no less than DR 18, and shall be rated to a working pressure of at least 185 psi at 73.4 ° F.

Fittings shall be ductile 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 Protecto 401 inside all fittings.

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

PVC in casings pipes shall be outfitted with a Resistive Insertion Grip (The Rig, Utility Solutions Inc.) or approved equal. The is a small ring that will resist the pipe from being over-inserted into the bell while loading the Casing.

STEEL ENCASEMENT

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 A 139 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.

SANITARY SEWER FORCE MAIN APPURTENANCES

1.1 AIR RELEASE VALVES

Air release valves should be at the top of any intermediate high points on the force main route. Valves shall be constructed and designed to limit the effects of corrosion, and should be made for easy maintenance. Air Release Valves shall be ARI D-025 or approved equal.

Air Release valves should be installed in an appropriately sized precast structure to enable maintenance and repair of the valves. Valve and riser piping shall be 304 stainless steel.

1.2 ODOR CONTROL CANISTERS

Odor Control Canisters should be installed on any Air Release Valves that are near residential or high traffic areas. To minimize spare parts BGMU has standardized on ANUE Geomembrane Odor Control Canisters or approved equal.

TESTING OF SANITARY SEWER FORCE MAINS

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

a. All mains shall undergo a hydrostatic test to maximum pressure rating of pipe, 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 bolts retightened or re-laid.

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 an electronic pressure recorder used during leakage test for recording pressure charts during the duration of test. Recording pressure charts remain the property of the UTILITY at conclusion of test.

CONNECTING FORCE MAIN TO EXISTING 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. Once a new force main has been tied into an existing manhole the CONTRACTOR will be responsible for applying a 3-layer Polyurea coating such as SpectraShield or Obic to minimize future corrosion damage. This should include the termination manhole and two manholes downstream of the force main.

CONCRETE THRUST BLOCKS

Concrete thrust blocks shall be provided at all bends in the force main as shown on Standard Drawings SD-8.

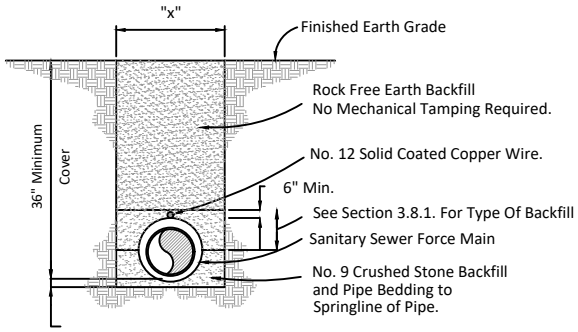
TRACER WIRE

Insulated, 12-gauge Copper Clad Steel Conductor with a minimum break load of 450 lbs. and specifically designed for tracer wire. (Do not use braided wire) The wire shall be taped to the North or east side of the pipe near the 10 o'clock position. Tracer wire will be laid with all metallic and non-metallic water mains.

Whenever possible the tracer wire should be run seamlessly from access point to access point. Each access point shall be grounded utilizing a drive-in magnesium grounding rod (must be driven into undisturbed earth) and connected to a BoaBox (manufactured by Copperhead Industries) or approved equal. The Ground should attach to one side of the Access point and then then the Tracer Wire attach to the other side. Dead end sections of pipe shall be grounded and utilize a BoaBox (manufactured by Copperhead industries) with a marker post next to it for locating purposes. Wires shall be terminated to the lid of the BoaBox.

If the wire must be spliced, contractor will use Copperhead Snakebite Locking Connectors (LSC1230C) or approved equals. All products must be designed for use in underground tracer wire installation. All connectors must use dielectric silicone to seal out moisture and corrosion. They should also be installed in a manner to prevent any uninsulated wire exposure to the soil.

Standard Sanitary Sewer Details

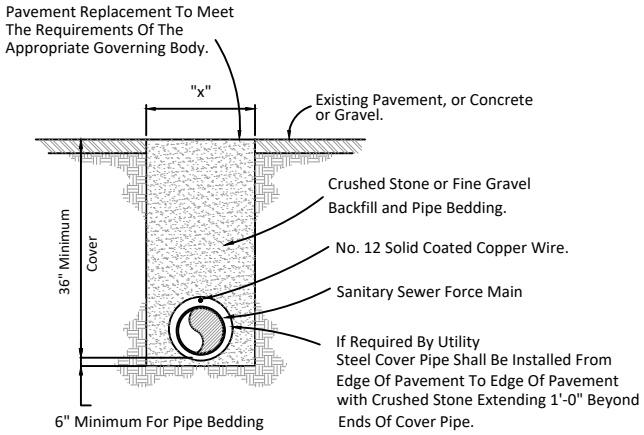


- Method "A" -
(Open Areas)

TRENCH WIDTH	
PIPE SIZE	"X"
4" Thru 12"	30"
14" Thru 18"	36"
20" Thru 24"	42"
26" Thru 36"	54"

Note:

Cutting and Repairing Existing Pavement Concrete or Gravel Shall Be in Accordance With Owners Requirements.



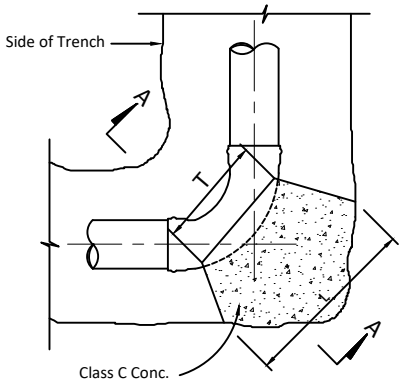
- Method "B" -
(Paved Areas)

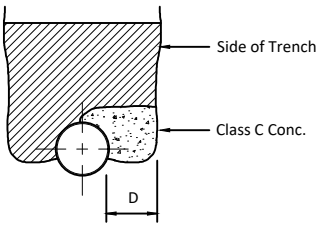
Typical Backfill & Bedding Methods

Bowling Green Municipal Utilities
P.O. Box 10300
Bowling Green, KY 42102
PH. 270-782-1200

SD-7

Standard Sanitary Sewer Details



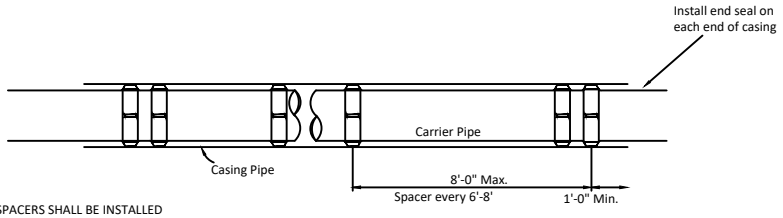


Section A - A

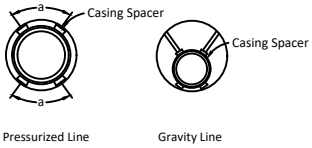
Plugs & Tees							
Size	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L & W	14"	16"	18"	20"	22"	24"	24"
(45°) Eighth Bends							
Size	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	6"	6"	6"	6"
L	12"	14"	16"	18"	20"	22"	24"
T	10"	12"	14"	16"	16"	18"	18"
(90°) Quarter Bends							
Size	2"	3"	4"	6"	8"	10"	12"
D	6"	6"	6"	8"	10"	12"	12"
L	15"	18"	21"	24"	27"	30"	34"
T	10"	12"	14"	16"	18"	20"	22"

45° & 90° Bends

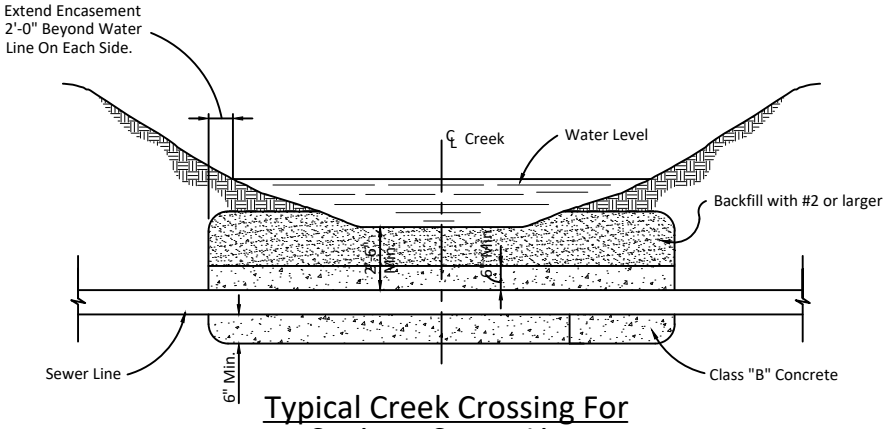
Force Main Thrust Blocks



NOTE
1 - CASING SPACERS SHALL BE INSTALLED A MAXIMUM OF 1' ON EITHER SIDE OF A PIPE JOINT.



Casing For Water Or Sewer Line Installation In Casing Pipe



Typical Creek Crossing For Sanitary Sewer Line

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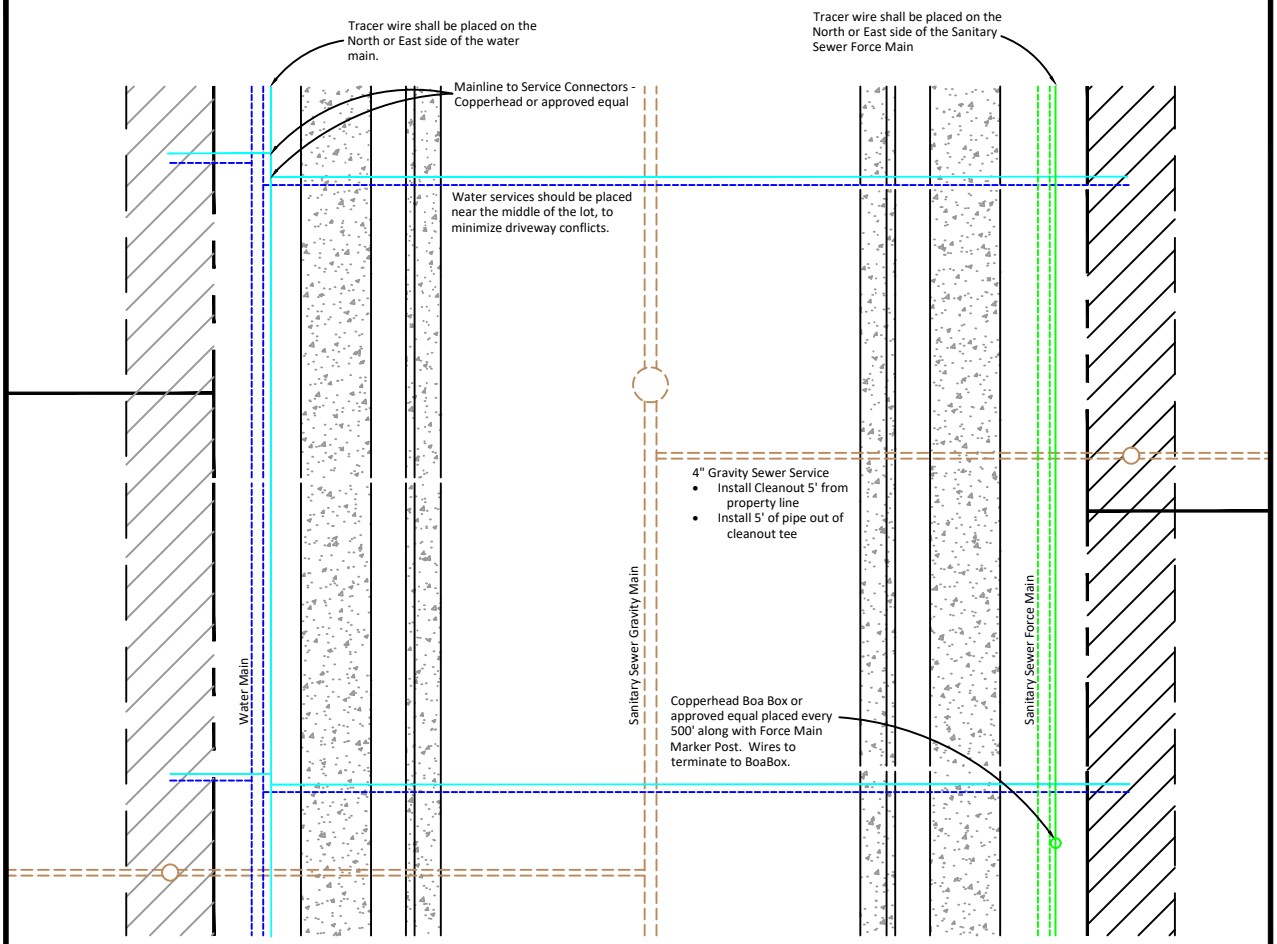
P.O. Box 10300
Bowling Green, KY 42102
PH. 270-782-1200

SD-8

Standard Utility Detail



WATER AND SANITARY SEWER TYPICAL STREET LAYOUT

BGMU Water - Wastewater Engineering

Bowling Green Municipal Utilities
P.O. Box 10300
Bowling Green, KY 42102
PH. 270-782-1200

UD-1

SECTION 6 – LOW PRESSURE SEWER SYSTEM

PURPOSE

As the county continues to grow, areas that were previously passed up for development due to lack of sewer availability, terrain, and rocky ground are slowly being looked at for development. In order to adapt to these difficult building conditions BGMU will allow Engineer's to propose Low-Pressure Sewer Systems (LPSS). These systems are not meant to be used in all developments and will require permission to install. Please note that the development should primarily contain single family homes. The ENGINEER shall present a recommendation, noting sound engineering principles, on why the new site should be allowed to install a LPSS. The UTILITY will review this recommendation and respond to allow or disallow. If the request is disallowed, reasons why the UTILITY will not allow, shall be provided.

DESIGN REQUIREMENTS

The UTILITY will be establishing a maintenance program for these LPSS and in for order for enrollment into this maintenance programs all LPSS shall utilize E-One Extreme Progressive Cavity Grinder Pump Stations. Standardizing on one company will allow the UTILITY to maintain parts and pumps to better serve these new facilities.

ENGINEER shall present a Design Report with their assumptions on population served, per capita flows, percentage of units contributing flow at instant in time, design flows, corresponding velocities, minimum and maximum elevations, etc. Calculations shall be prepared using Environment One's (E-One's) LPS Design Assistant, latest version.

Please pay special attention to the following items when reviewing your Design Report:

1. Plans shall clearly depict the different zones used in E-One's Software.
2. Verify that line sizes on report match those on the plans.
3. Main shall be sized to be the largest diameter that allows a velocity greater than 2 ft/s and a pump TDH less than 180 feet at both initial and final phase of development
4. Submit all LPS Design Assistant worksheets with review package.
5. Identify future phases of development and verify that initial design is adequate to serve future growth.

Design basis for wastewater flows shall be based on past meter readings from like developments, E-One's LPS Design Software, Kentucky Division of Water Standards, or Ten States Standards.

LPSS MAIN LINE

The material and installation standards for the LPSS main lines and Air Release Valves shall be the same as those laid out in the force main section in the previous section of this document. The LPSS shall be a minimum of 2" in diameter. Care should be taken during installation to lay the pipe at a consistent grade to minimize the need for Air Release Valves. System should be designed with flush stations and end of line flush stations per E-One's recommendations. (LP-1)

SERVICE LINES AND CLEANOUTS

Gravity Service from house to E-One Pump station shall be <12' or include a cleanout to remove possible blockages.

LPSS FORCE MAIN LATERAL (DEVELOPER RESPONSIBILITY)

Saddle on existing LPSS Main line, corporation stop, then install 1-1/4" HDPE SDR 11 to a maximum of 5' past the property line. At the end of the lateral line install an E-One clean out and curb stop with a 4" pipe above the cleanout and curb stop to allow for inspection. 4" pipe should be stubbed up into a Copperhead BoaBox or approved equal.

E-ONE PUMP STATION INSTALLER

Shall run 1-1/4" HDPE SDR 11 from the station to the curb stop and check valve combination. If the service line runs under any private hard surfaces (i.e, sidewalk, driveway, etc.) installer should install a SCH 80 Casing pipe a minimum of 12" past each side of the hard surface.

TRACER WIRE

Tracer Wire shall be installed on all the lines listed above. LPSS mainline shall have the same requirements for tracer wire as a sanitary sewer force main. Mainline to Service line connectors shall be used to branch off for service laterals and DEVELOPER/CONTRACTOR shall run tracer wire to the BoaBox at the FM lateral. E-One Pump installer shall then run Tracer Wire from station to the BoaBox at the curb stop check valve combination.

CONNECTION TO EXISTING SEWER

All connections of the manifolded LPS System to an existing Gravity Sewer System shall be made at a manhole. CONTRACTOR should install an internal drop as shown in E-One's Standard specifications. An isolation valve shall be installed within 10' of the manhole connection. In addition, all manholes termination manholes shall be coated using Spectrashield or OBIC coating to minimize corrosion, along with the next two manholes downstream.

If the tie-in is near other residences, the ENGINEER shall recommend odor control options for this termination. If a Carbon Scrubber is deemed to be the most economical, the vessel must be sized for a minimum of one year media life.

LINE VALVE PLACEMENT AND SPACING

Valves shall be full port plug valves or approved equal. Valves shall be no more than 1,000 ft apart and placed on the branch of any Tee.

Valves should include valve boxes for access to the 2" operating nut and shall say sewer. Valve Box should be installed approximately 2" above curb height and include a tapered precast concrete ring.

LPSS PUMP STATION CONTROL PANEL

All E-One pump stations shall utilize the E-One Sentry Protect Plus Panel and it should be attached to the side of the house within site of the pump station. Panel should be installed new lower than 36" and no higher than 60". All wiring shall meet or exceed E-One's recommendations along with all local or state codes. No holes shall be drilled into the back, sides, or top of the box. All penetrations should be made on the bottom of the panel to minimize potential water intrusion.

TESTING LPSS MAIN AND LATERALS

Testing shall conform to the testing laid out in the previous force main section.

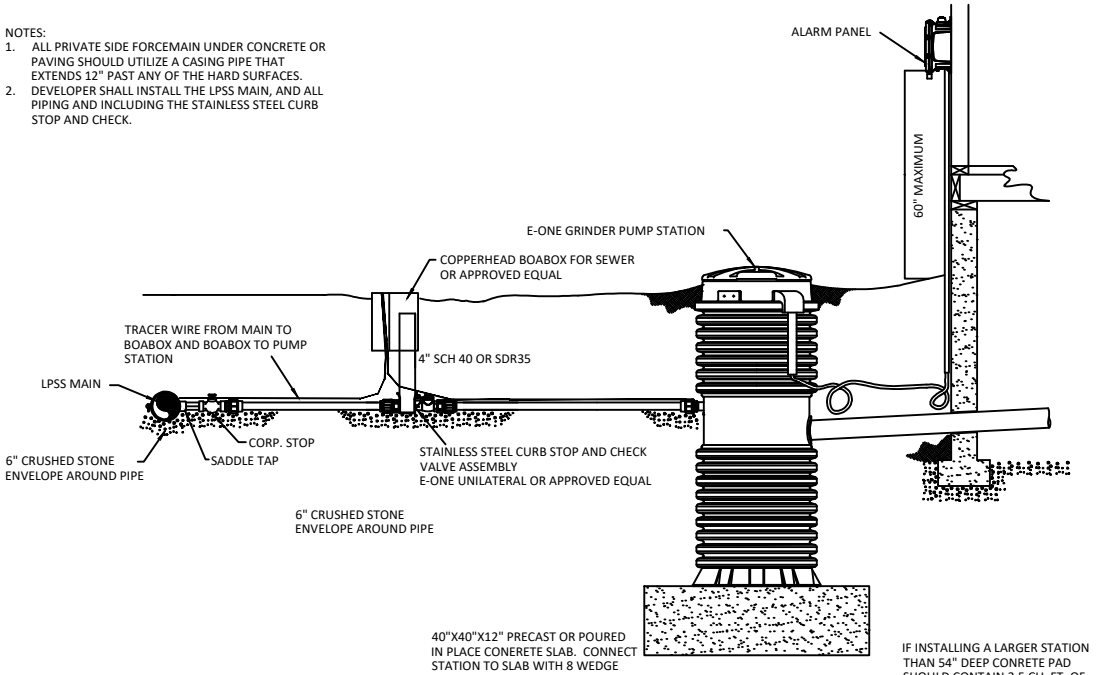
MAINTENANCE AGREEMENT

All facilities served by the LPS shall agree to BGMU's maintenance and service agreement before being placed into service.

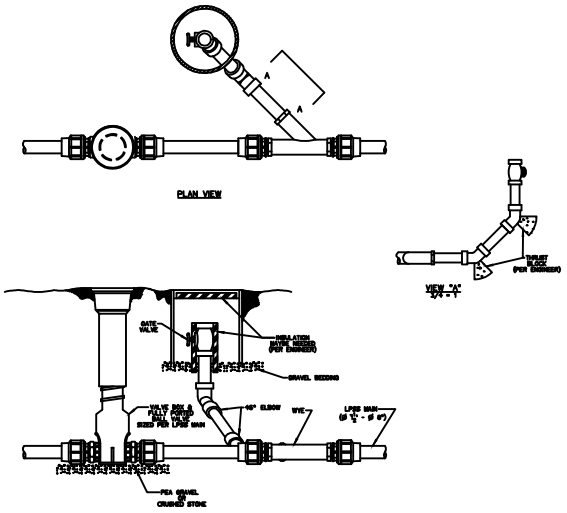
All new homes will be automatically enrolled into BGMU's maintenance and service agreement to ensure that the system continues be maintain to optimize life of the equipment. Customers can opt out of the maintenance program, after signing a waiver for the maintenance agreement.

Low Pressure Sewer System Details

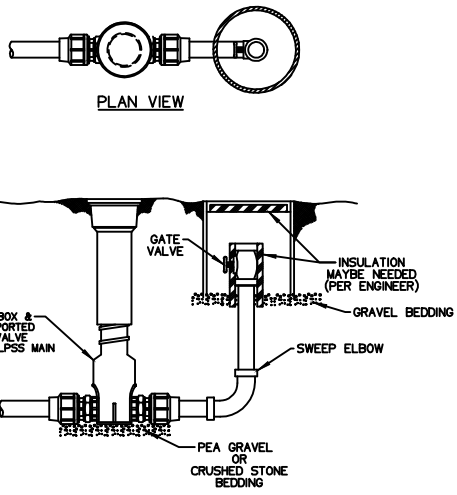
NOTES:
1. ALL PRIVATE SIDE FORCEMAIN UNDER CONCRETE OR PAVING SHOULD UTILIZE A CASING PIPE THAT EXTENDS 12" PAST ANY OF THE HARD SURFACES.
2. DEVELOPER SHALL INSTALL THE LPSS MAIN, AND ALL PIPING AND INCLUDING THE STAINLESS STEEL CURB STOP AND CHECK.



TYPICAL GRINDER PUMP INSTALLATION



TYPICAL FLUSHING STATION



TYPICAL END-OF-LINE FLUSHING STATION

Bowling Green Municipal Utilities
P.O. Box 10300
Bowling Green, KY 42102
PH. 270-782-1200

LP-1

SECTION 7 – SANITARY SEWER PUMP STATION

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.

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.

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 the 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, and electrical work as shown on the drawings or specified in this section and acceptance tests.

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 SPS-1. 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.

PRECAST WET WELL AND VALVE VAULT

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.

PUMPS

These pump specifications apply to a general pump station typically sited in a subdivision with single family residential housing. If installing a pump station for commercial, industrial, or multi-family residential housing the utility may need to change the specification to account for the increased trash and different makeup of the proposed wastewater.

1.1 PUMP CONSTRUCTION

All major castings shall be of ASTM A-48, Class 40B gray, cast iron with smooth surfaces devoid of porosity, irregularities, or other defects. All exposed fasteners shall be of AISI 304 stainless steel. All exterior surfaces not constructed of stainless steel shall be protected by a factory-applied, two-part, 95% or greater solids epoxy paint (Chesterton, Belzona, or equal).

Sealing design between castings shall incorporate Nitrile (Buna-N) O-rings in controlled compression in two planes of the sealing interface. The interfaces shall be machined, metal-to-metal contacts and shall not require a specific torque on the securing fasteners to ensure sealing. Rectangular cross sectioned gaskets which require specific torque limits to achieve compression are susceptible to uneven compression and may be compressed beyond the point of permanent deformation; therefore, they shall not be acceptable.

1.2 COOLING SYSTEM

Each unit shall be provided with an integral motor cooling system. A stainless-steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers, or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

You may also meet this specification by using a motor that is rated to use in a dry pit submersible pump or a premium efficiency motor that is design to run cooler. It is BGMU's belief that a cooler running motor will provide for longer life.

1.3 CABLE ENTRY SEAL

The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief

function. The assembly shall provide ease of changing the cable when necessary, using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

1.4 MOTOR

The motor shall be an air-filled, submersible, squirrel cage, induction-type motor of the NEMA type B design. The motor shall be housed in a watertight enclosure capable of continuous operation at a submergence of 65 feet, and made of ASTM A-48, Class 40B Cast Iron. Fitting the stator into the enclosure with the use of bolts, pins, or other fastening devices which would require penetration of the housing shall not be acceptable. The stator windings shall be insulated with moisture-resistant Class-H insulation. In each phase winding, there shall be embedded a bi-metallic temperature sensor, wired in series and interlocked with the motor overload protection in the control panel. Any of these thermal switches shall cut out electric power if the temperature in its winding exceeds 140°C (284°F), and shall automatically reset when the winding temperature returns to normal conditions. The motor shall be non-overloading through the selected performance curve and shall perform in accordance with NEMA MG1, Part 30. The motor shall be rated for continuous operation in environments up to 104°F or intermittently up to 140°F, and shall be capable of sustaining 15 starts per hour. Motors shall be available to meet NEMA MG1, Part 31 and shall be VFD-rated

The motor service factor (combined effect of voltage, frequency, and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/- 10%. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

1.5 BEARINGS

The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two-row angular contact ball bearing to handle radial loads. The lower bearing shall be a two-row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 100,000 hours at any usable portion of the pump curve.

1.6 MECHANICAL SEALS

Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide or silicon-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant tungsten-carbide or silicon-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50% capacity.

1.7 PUMP SHAFT

The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel – ASTM A479 S43100-T. Shaft sleeves will not be acceptable.

1.8 IMPELLER

The impeller shall be of Cast Iron or Hard-Iron TM (ASTM A-532 (Alloy III A) 45% chrome cast iron) as specified by the station design, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The impeller

shall be hardened to Rc 60 throughout, and shall be capable of handling solids, fibrous materials, heavy sludge, and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

Alternatively, impeller shall be cast as one piece and shall be ASTM A48 Class 40B Cast Iron and treated to meet or exceed the physical characteristics of the impellers above. Impellers shall be statically and dynamically balanced, to assure that vibration amplitudes, measured at the level of the upper bearing while operating in a vertical position, and remain within the limits specified by the Hydraulic Institute Standards. Impeller shall be single vane, two-vane, or multi-vane.

1.9 VOLUTE

The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B-40B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover insert ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of Hard-Iron™ (ASTM A-532 (Alloy III A) 45% chrome cast iron) and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

Alternately, stationary Wear Ring, made of a material to meet or exceed the physical characteristics above, shall maintain close tolerances between the rotating impeller and the stationary Volute.

1.10 PROTECTION

1.10.A THERMAL PROTECTION

Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm.

1.10.B LEAKAGE PROTECTION

A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

Alternately, a conductive seal probe shall be mounted into the mechanical seal chamber and when interlocked with control panel, probe shall indicate the presence of contaminants within the mechanical seal chamber.

The thermal switches and float switch/probe shall be connected to a Mini CAS or other thermal/leakage relay control and status monitoring unit. The Mini CAS or other thermal/leakage relay unit shall be designed to be mounted in the pump control panel.

1.11 WARRANTY

Each pump must have a 100% full 5 year non-prorated warranty from the factory. Proration of any kind will not be acceptable.

CONTROL PANEL

To ensure interoperability and aid in the stocking of maintenance parts BGMU has standardized control panels. See Drawing SPS-X for the complete wiring diagram and bill of materials. Some parts can be provided with “or equal parts”. However, we will accept no substitutions on PLC, HMI, or VFDs.

OUTSIDE ELECTRICAL SERVICE

Electrical Service to the pump station shall abide by all current national and state codes. The service will include a meter base and main disconnect, mounted to a stand that is behind the control panel. See Standard SPS Drawing SPS-1

PUMP STATION PIPE, FITTINGS, AND VAULTS

All internal piping in the wet well shall be Class 52 Ductile Iron pipe, flanged ANSI Class 125. Pipe shall be coated to include an internal and external coating to prevent corrosion. Internal coating should be Protecto 401 or approved equal and the external should Fusion Bonded Epoxy or approved equal. Piping in the valve vault shall also be flanged Class 52 Ductile Iron pipe with the interior Protecto 401 lining or equal. All flange accessory packs should utilize stainless steel hardware.

Valve vault shall include flanged AVK check valves or approved equal, and Pratt plug valves or approved equal for isolation valves. CONTRACTOR may utilize flange coupling adapters (Sigma or approved equal on each entry and exit pipe to allow for space to remove valves later. Coupling adapters shall be, Sigma flange Adapter or equal, ductile iron as manufactured by Sigma, or approved equal. Coupling adapters should utilize a restrained Mechanical Joint Pack, Sigma One-Lok or approved equal.

All flange accessory packs should utilize stainless steel hardware.

A pressure gauge shall be installed downstream of the check valve. Gauge and small diameter piping for gauge shall be 304 Stainless Steel.

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.

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 ensure 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.

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.

STRIPPING AND TOP SOIL

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.

1.12 SITE GRADING AND FILL 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 UTLITY. 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.

1.13 EXCAVATION

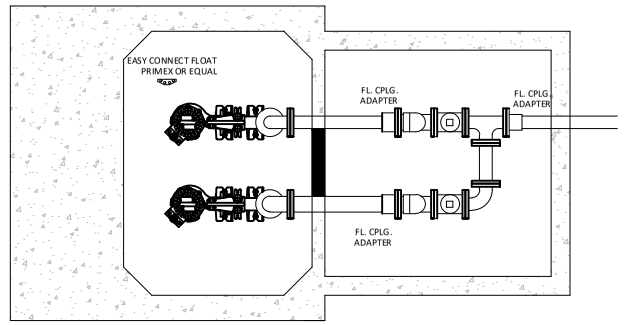
Excavation shall be accomplished in such places as indicated on the drawings to the lines, grades and elevations shown, or as directed. The excavation shall be maintained in such a manner so as to be well drained at all times. Temporary drains, or drainage ditches, shall be installed at the CONTRACTOR'S expense to intercept or divert surface water. The CONTRACOR'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.

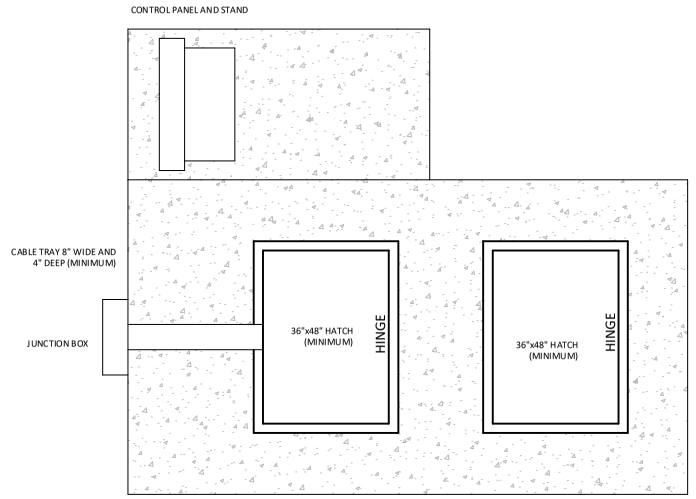
1.14 LANDSCAPING

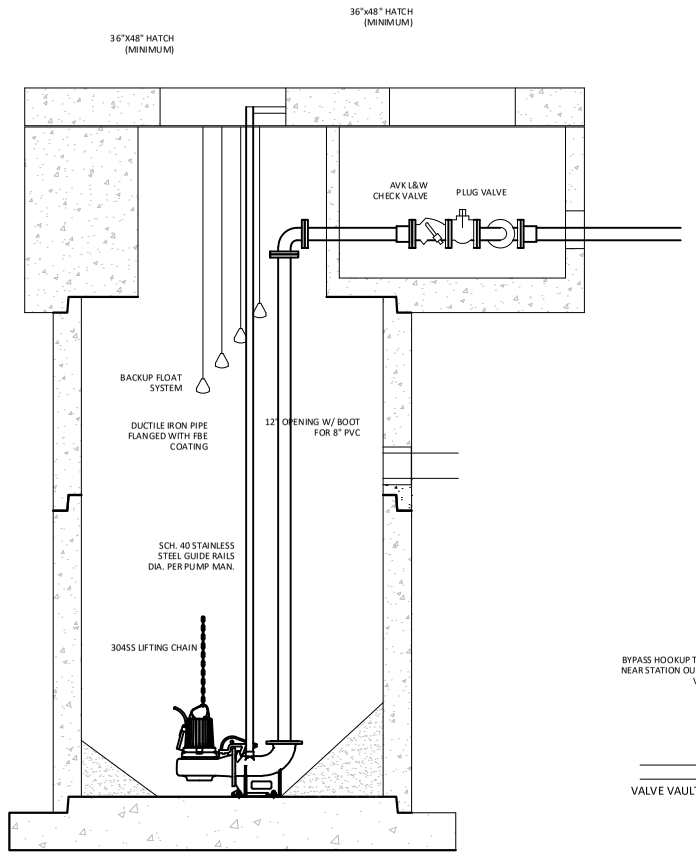
All disturbed areas around the pump stations shall be graded, fertilized, and seeded as required in Section 8 and/or as directed by the UTILITY.

1.15 CLEAN UP

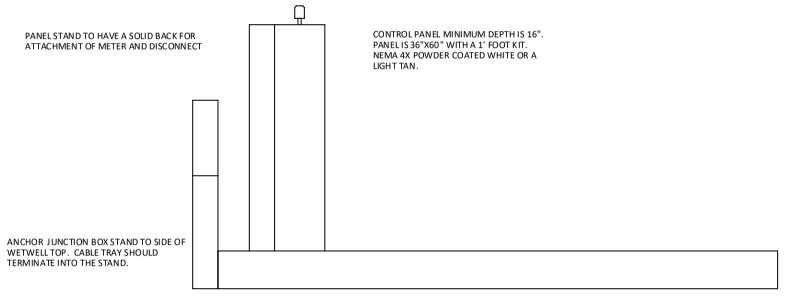
The Contractor shall remove all objectionable matter resulting from his operations.

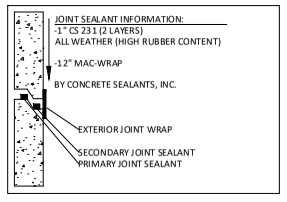




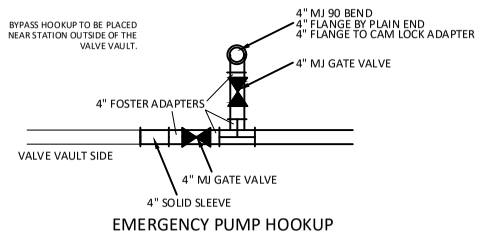


SECTION VIEW

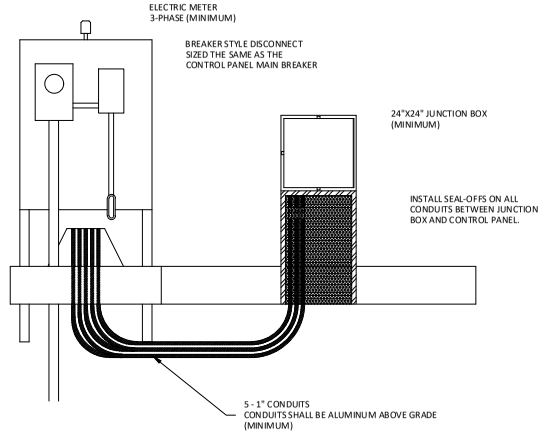




JOINT DETAIL



EMERGENCY PUMP HOOKUP



NOTES:

1 - ALL ITEMS INSIDE THE WET WELL SHALL BE ALUMINUM, 304 STAINLESS STEEL, OR DUCTILE IRON WITH AN APPROVED COATING.

2 - GUIDE RAILS, CHAINS AND BRACKETS SHALL BE STAINLESS STEEL.

3 - STILL WELL SHALL BE 4" PVC PIPE.

4 - CONTRACTOR SHALL INSTALL SEAL OFFS ON ALL CONDUITS BETWEEN THE CONTROL PANEL AND JUNCTION BOX.

5 - CONTRACTOR SHALL VERIFY ALL DIMENSION BEFORE ORDERING MATERIALS. DIMENSIONS ARE SHOWN FOR INFORMATIONAL PURPOSES ONLY.

6 - ALL WIRES IN WETWELL SHALL BE SUPPORTED BY STAINLESS STEEL KELLUM GRIPS TO KEEP WIRES ORGANIZED AND OUT OF THE WAY.

7 - SEE SPECIFICATIONS FOR OWNER PROVIDED MATERIALS, ANY ITEMS NOT LISTED IN THESE DOCUMENTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

8 - CONCRETE SHOWN ON THE PLANS SHALL BE STAMPED CONCRETE (STANDARD GREY CONCRETE WITH CHARCOAL RELEASE). ALL CONCRETE SHALL BE SEALED WITH A CLEAR WETLOOK SEALER WITH >35% SOLIDS. BGMU DOES OWN STAMPS FOR THIS WORK IF THE CONTRACTOR WOULD LIKE TO UTILIZE THEM.

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WWW. BGMU.COM

STANADARD PUMP STATION DRAWING
BOWLING GREEN ~ WARREN COUNTY, KY

DRAWN BY: SMN
CHECKED BY: SMN

PROJECT NUMBER:
DATE OF DRAWING: 1/18/2022
SCALE: N/A

REVISIONS
DESCRIPTION

SPS-1

SHEET 1 OF 1

DUPLEX CONTROL PANEL - BILL OF MATERIALS

CONTROL PANEL					
Item No.	Qty	Manufacturer	Part #	Description	Device
1	6	Allen Bradley	1492-EAHJ35	END ANCHOR HEAVY DUTY	TB1, TB2, TB3
2	3	Allen Bradley	1492-EAJ35	END ANCHOR	TB1,TB2,TB3,TB4
3	1	Allen Bradley	1492-EBJ16	Feed Thru Terminal Block End Barrier	TB1
4	3	Allen Bradley	1492-EBJ3	Feed Thru Terminal Block End Barrier	TB1, TB2, TB3, TB4
5	1	Allen Bradley	1492-J35	FEED THRU TERMINAL BLOCK 600V 115A	TB1
6	51	Allen Bradley	1492-J4	FEED THRU TERMINAL BLOCK 600V 35A	TB1, TB2, TB3, TB4
7	1	Allen Bradley	1492-REC15	DIN RAIL MOUNT DUPLEX GFCI RECEPTACLE	RECPT126
8	1	Allen Bradley	1492-SP1B010	1 POLE SUPPLEMENTARY PROTECTOR 1A	CB347
9	10	Allen Bradley	1492-SP1B050	1 POLE SUPPLEMENTARY PROTECTOR 5A	ENCLOSURE
10	1	SOLA HD	HZ4X-1000	1000 VA TRANSFORMER 240/120 N4X ENCLOSED	XF137
11	1	Allen Bradley	1763-L16DWD	MICROLOGIX 1100, 12/24V DC POWER, (10) 12/24V DC DIGITAL INPUTS, (2) 10V ANALOG INPUTS, (6) RELAY OUTPUTS	PLC502
12	1	Allen Bradley	1766-L32BXBA	MICROLOGIX 1400, 12 DIGITAL FAST 24V DC INPUTS, 8 DIGITAL 24V DC INPUTS, 6 RELAY OUTPUTS, 3 FAST 24V DC OUTPUTS, 3 NORMAL 24V DC OUTPUTS, 4 ANALOG (12 BIT) INPUTS, 2 ANALOG (12 BITS) OUTPUTS, 24V DC POWER	PLC402
13	1	Weintek	MT8100IE	10" WIDE SCREEN HMI, 1 ETHERNET, 2 SERIAL, 2 USB 24V DC INCLUDE DEVELOPMENT SOFTWARE	OIT319
14	1	Allen Bradley	4983-DD24	4983 SURGE AND FILTER PROTECTION, DIN RAIL MOUNT, DATALINE UL 497B, 24V, NONE, NO POLE CONFIGURATION	SP347
15	2	Allen Bradley	800H-JR2H	3 POSITION SELECTOR SWITCH MAINTAINED	SS208, SS233
16	1	Allen Bradley	855BS-N35SL4	ROUND 90MM BEACON, 1/2" CONDUIT MOUNT, STANDARD, 24/48V DC AC/DC FULL VOLTAGE, LED SINGLE COLOR SELECTABLE STEADY/FLASH, RED N4X	LT435
17	1	APPLETON	ADR1044-RS	100 AMP RECEPTACLE FLANGE MOUNT 4W, 4P	PJ101
18	1	ATC	RB-08	RELAY SOCKET FOR PHASE MONITOR	PM119
19	1	ATC	SUA-230-ALAU	PHASE MONITOR RELAY 190-270V ADJUSTABLE	PM119
20	1	HOFFMAN	A603618SSFSN4-MOD	STAINLESS STEEL FREE STANDING SINGLE DOOR ENCLOSURE 60"X36"X18" POWDER COATED TAN	ENCLOSURE
21	1	HOFFMAN	A60P36F1	ENCLOSURE SUBPANEL 48"X32"	ENCLOSURE
22	1	HOFFMAN	A72SP36F4	SWING OUT PANEL 30.88"X30.81"	ENCLOSURE
23	1	HOFFMAN	A-HC110E	CORROSION INHIBITOR	ENCLOSURE
24	1	HOFFMAN	DAH601	SEMICONDUCTOR CONTROL PANEL HEATER 60W	HTR130
25	2	ICC	FR-A7N-ETH	ETHERNET/IP ADAPTOR FOR MITSUBISHI DRIVES	VFD107, VFD111
26	2	MITSUBISHI	FR-F820-00340-3-N6	10 HP 240V VARIABLE FREQUENCY DRIVE W/ COVER FOR ETHERNET CARD	VFD107, VFD111
27	1	ILSCO	D676-8	GROUND BAR	
28	2	XYLEM FLYGT	40-50 10 98	MINI CAS II PUMP MONITOR RELAY 120VAC OR OTHER PUMP COMPANY PROTECTION RELAY	PMR217, PMR242
29	6	LEVITON	62460-10E	CAT 6 PATCH CORD, 10 FOOT LENGTH BLACK COLOR	CBL320, CBL340, CBL341, CBL341A, CBL342, CBL343
30	1	N-TRON	108TX	UNMANAGED ETHERNET SWITCH WITH 8 COPPER WIRE PORT	DN339
31	1	ORION	OD1232-SPOT / DIN	DIN RAIL MOUNT COOLING FAN 120V AC	FAN128
32	1	PHOENIX	2856812.0000	120V AC PLUG AND HEADER SURGE SUPPRESSOR	SU139
33	1	PHOENIX	2859521.0000	3 PHASE SURGE SUPPRESSOR W/ SEPARATE N AND PE	SU104
34	1	SOLA HD	SDN 2.5-30/40 RED	REDUNDANT POWER SUPPLY MODULE	PW334
35	2	SOLA HD	SDN 5-24-100P	24VDC 5A POWER SUPPLY	PW326, PW330
36	1	SOLA HD	SDU850	850VA UNINTERRUPTIBLE POWER SUPPLY DIN RAIL MOUNT	UPS315
37	4	SQUARE D	8501 RXM 3AB2F7	PLUG IN RELAY 3PDT 120 VAC COIL W/ PILOT LIGHT	CR143, CR144, CR145,CR146
38	4	SQUARE D	8501 RXZ E2S111M	PLUG IN RELAY SOCKET	CR143, CR144, CR145,CR146
39	2	SQUARE D	HDL36100	3 POLE MOLDED CASE CIRCUIT BREAKER	CB107, CB111
40	2	SQUARE D	QDL32200	3 POLE MOLDED CASE CIRCUIT BREAKER	CB102, CB102A
41	1	HOFFMAN	ATEMNC	NC THERMOSTAT	TAS130
42	1	SQUARE D	QOU210	10 AMP DOUBLE POLE DIN RAIL MOUNT CIRCUIT BREAKER	CB135
43	2	SQUARE D	QUO115	15 AMP CIRCUIT BREAKER, 1 POLE	CB126, CB138
44	1	SQUARE D	S29354	CIRCUIT BREAKER INTERLOCK KIT	CB102, CB102A
45	1	GE	10113.0000	DIRECT WIRE FLUORESCENT LIGHT	LT131
46	1	SAGINAW	SCE-FK1224-SS	STAINLESS STEEL FLOOR STAND KIT 12" HIGH 24" WIDE	ENCLOSURE
47	2	GOULD	67003.0000	3 POLE DISTRIBUTION BLOCK	DB1, DB2
48	1	GOULD	67571.0000	SINGLE DISTRIBUTION BLOCK	NEUTRAL BLOCK
	1	PHOENIX	2963860.0000	SINGLE RECEPTACLE	RECPT129
49	1	MOXA	ONCELL G3150-HSPA-T	MOXA CELL PHONE MODEM G3150	
JUNCTION BOX					
55	1	HOFFMAN	A24H2408SSLP	NEMA 4X WALL MOUNT ENCLOSURE 24"X24"X8"	JUNCTION BOX ENCLOSURE
56	1	HOFFMAN	A24P24	ENCLOSURE SUBPANEL	JUNCTION BOX ENCLOSURE
57	2	ALLEN-BRADLEY	1492-EAJ35	END ANCHOR	TB1,TB2,TB3
58	3	ALLEN-BRADLEY	1492-EBJ3	FEED THRU TERMINAL BLOCK END BARRIER	TB1,TB2,TB3
59	10	ALLEN-BRADLEY	1492-J4	FEED THRU TERMINAL BLOCK 600V 35A	TB2, TB3
60	2	FERRAZ-SHAWMUT	63106	POWER DISTRIBUTION BLOCKS	TB1
61	1	PRIMEX	1055247, 1053955	KWIKSWITCH FLOAT SYSTEM (4 - 25' FLOATS AND 1 SPARE)	
62	1	MJK	209935.0000	EXPERT 2100 HYDROSTATIC SUBMERSIBLE PRESSURE TRANSDUCER (0-30FT)	

1. ITEM #27 IS TO BE PROVIDED BY PUMP MANUFACTURE AND INSTALLED BY ADGO IN CONTROL PANEL
2. ITEMS 55-62 ARE PUMP REMOTE JUNCTION BOX
3. ITEMS 61 & 62 ARE SHIPPED LOOSE AND FIELD INSTALLED

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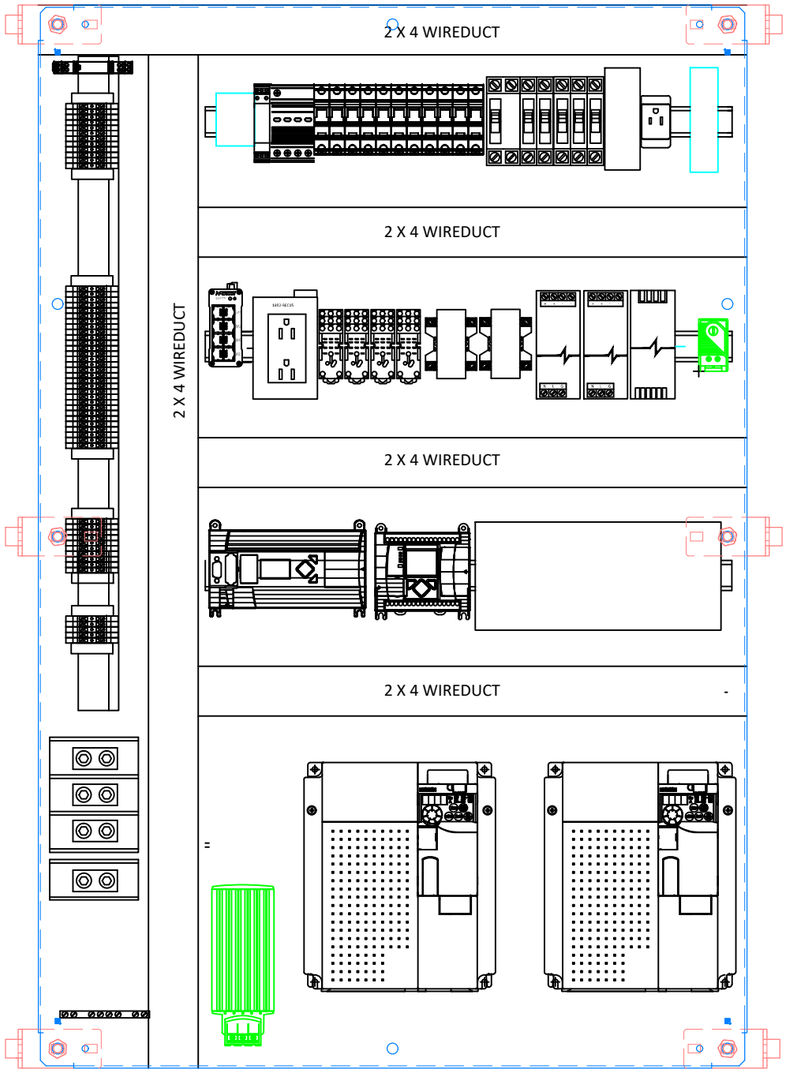
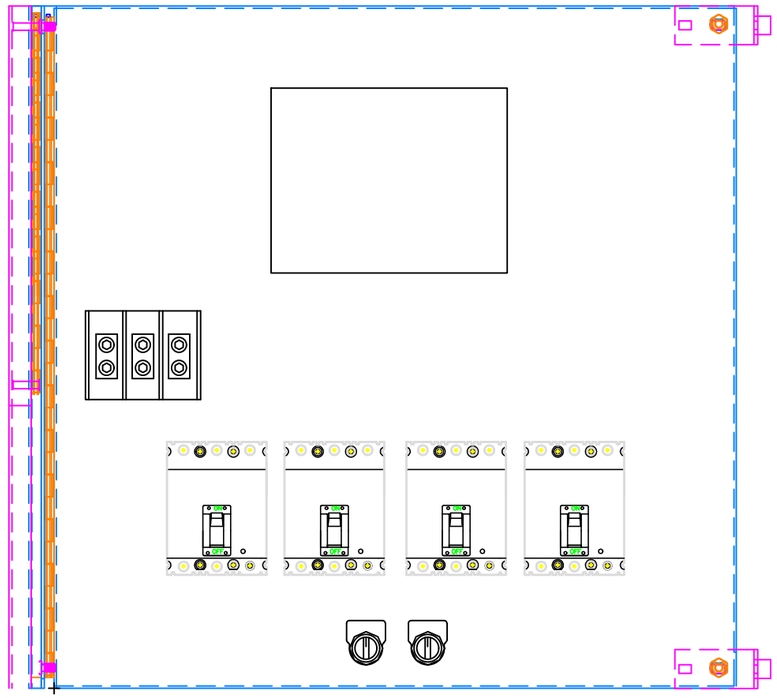
DUPLEX CONTROL PANEL - PANEL LAYOUT





1) REFER TO 5381-02 FOR BILL OF MATERIAL.

2) ENGRAVE NAMEPLATES

3) EXACT PLACEMENT TO BE DETERMINED DURING LAYOUT FOR BREAKERS CB102 AND CB102A.

NAMEPLATE SCHEDULE

A PUMP 1
HAND OFF REMOTE

B PUMP 2
HAND OFF REMOTE

ENCLOSURE TYPE RATING
NEMA 4X

SHORT CIRCUIT CURRENT
10000 A RMS
SYMMETRICAL @ 120V

UL TORQUE SPECS:

TB1, TB2, TB3
ALLEN BRADLEY
1492–J4 9.0 LB–IN
1492–JG4 9.0 LB–IN
SURGE SURPRESSION
PHOENIX
2839282 7.08 LB–IN
2856113 7.08 LB–IN

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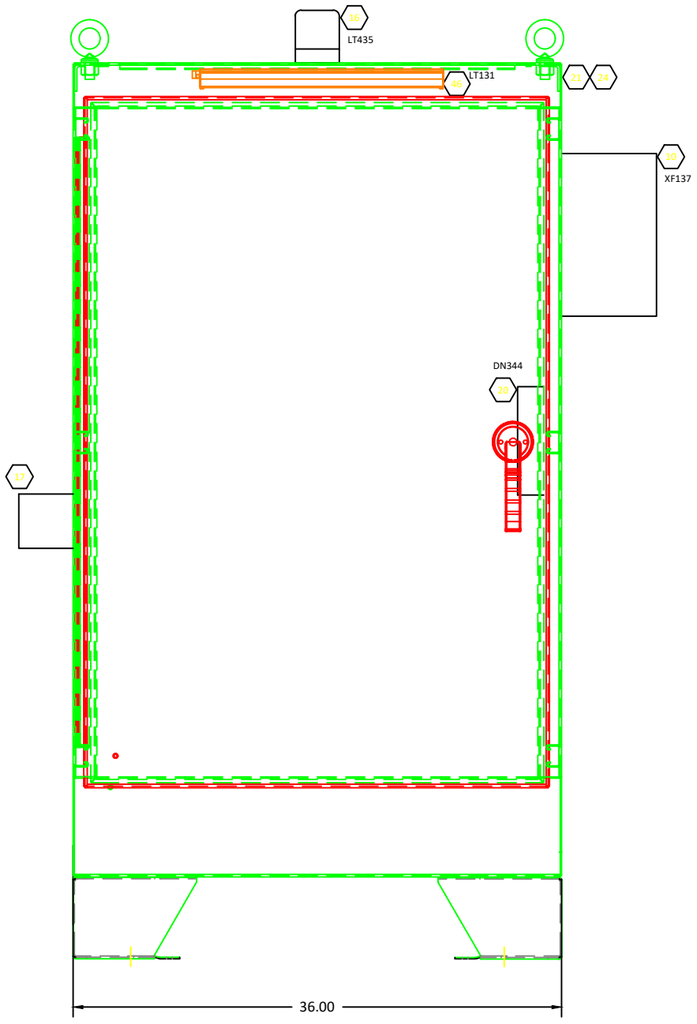
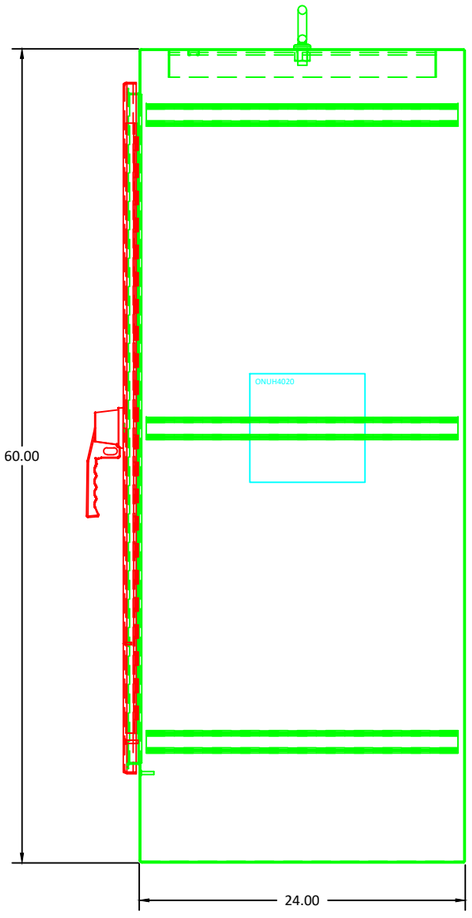
DUPLEX CONTROL PANEL - CONTROL PANEL PLAN





1. REFER TO 5381-02 FOR BILL OF MATERIAL.
2. ENGRAVE NAMEPLATES.
3. ITEM #20 FIBER OPTIC MEDIA CONVERTER TO BE LOCATED ON RIGHT INSIDE OF ENCLOSURE MOUNTED ON UNISTRUT

ENCLOSURE TYPE RATING
NEMA 4X

SHORT CIRCUIT CURRENT
10000 A RMS
SYMMETRICAL @ 120V

UL TORQUE SPECS:

TB1, TB2, TB3
ALLEN BRADLEY
1492-J4 9.0 LB-IN
1492-JG4 9.0 LB-IN
SURGE SURPRESSION
PHOENIX
2839282 7.08 LB-IN
2856113 7.08 LB-IN

PANEL TO BEAR
UL508A LABEL

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Duplex Control Panel - Table of Contents

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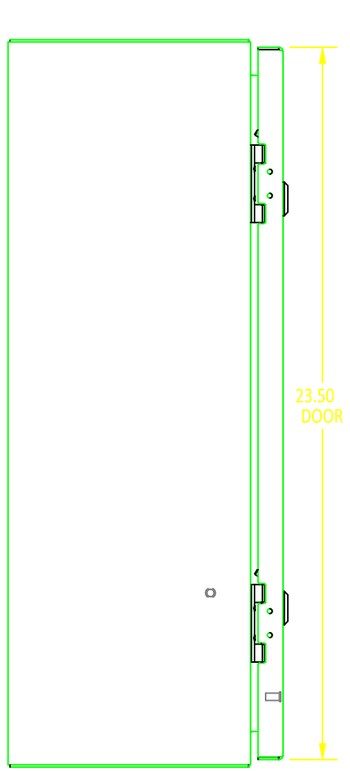
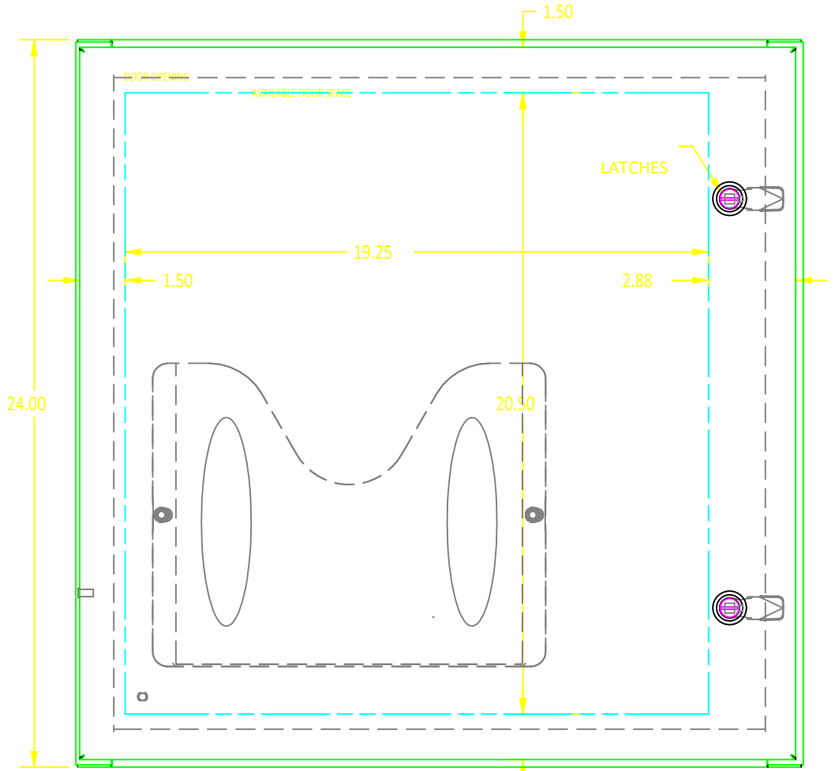
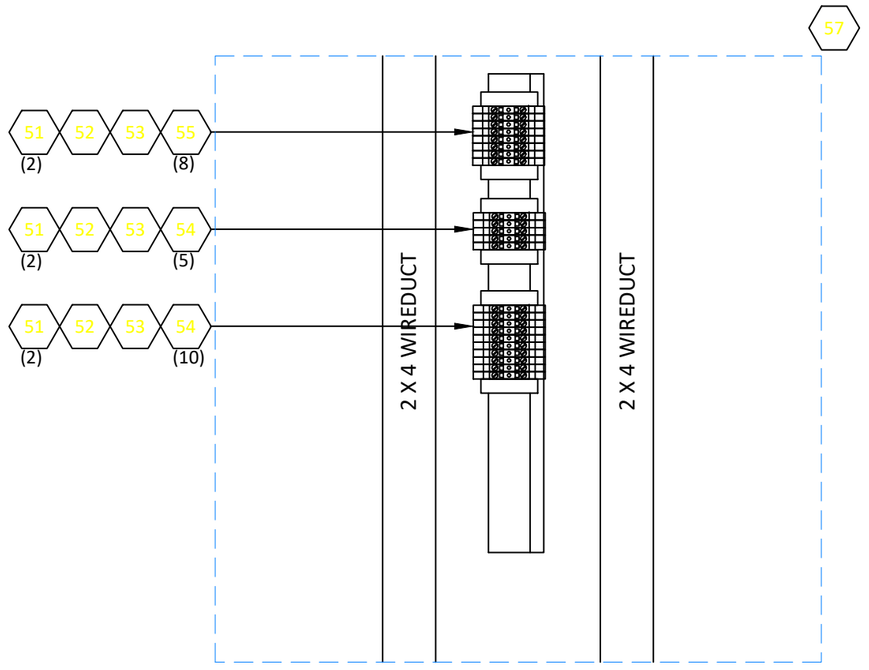
DUPLEX CONTROL PANEL - JUNCTION BOX PLAN



LEFT SIDE VIEW



FRONT VIEW



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DUPLEX CONTROL PANEL - TERMINAL BLOCK SCHEDULE

PUMP PANEL TB SCHEDULE

TB1		TB2		TB3	
TERMINAL #	WIRE #	TERMINAL #	WIRE #	TERMINAL #	WIRE #
1	N	1	4101	1	2212
2	1431	2	4111	2	2211
3	1441	3	4191	3	2471
4	1451	4	4201	4	2481
5	1461	5	4211	5	--
6	1402	6	4221	6	--
7	--	7	4231	7	--
8	--	8	4281	8	--
9	--	9	4291	9	--
10	--	10	4301	10	--
11	--	11	4361		
12	--	12	4371		
		13	4381		
		14	4391		
		15	4401		
		16	5161		
		17	5171		
		18	5181		
		19	5351		
		20	5361		
		21	5371		
		22	5381		
		23	--		
		24	--		
		25	--		
		26	--		
		27	--		
		28	--		
		29	--		
		30	--		

TB4	
TERMINAL #	WIRE #
1	3351
2	3351
3	3351
4	3351
5	3351

JUNCTION BOX TB SCHEDULE

TB1		TB2		TB3	
TERMINAL #	WIRE #	TERMINAL #	WIRE #	TERMINAL #	WIRE #
1	1072	1	1431	1	2212
2	1082	2	1441	2	2211
3	1092	3	1451	3	2471
4	GND	4	1461	4	2481
5	1112	5	1402	5	--
6	1122			6	--
7	1132			7	--
8	GND			8	--
				9	3472
				10	3472

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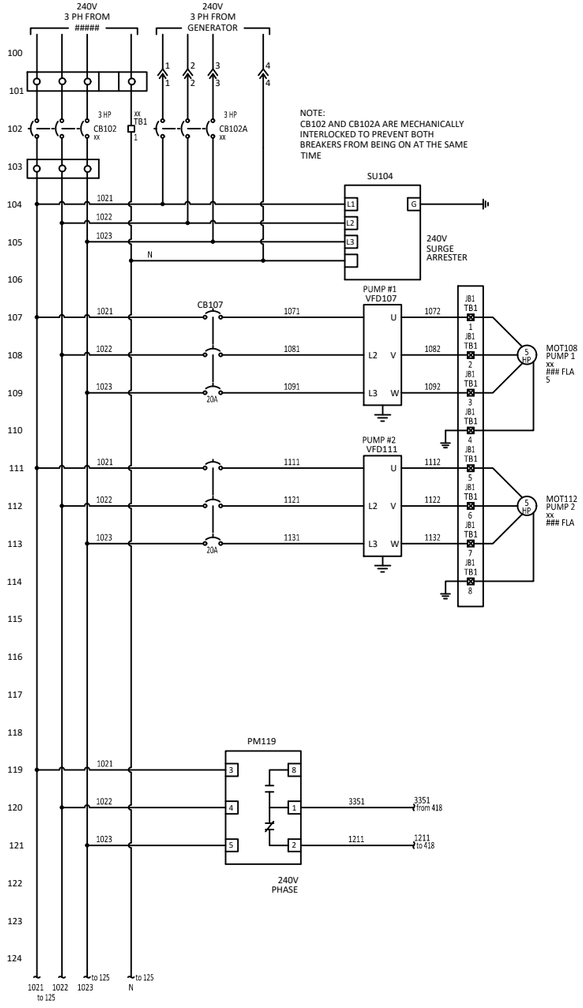
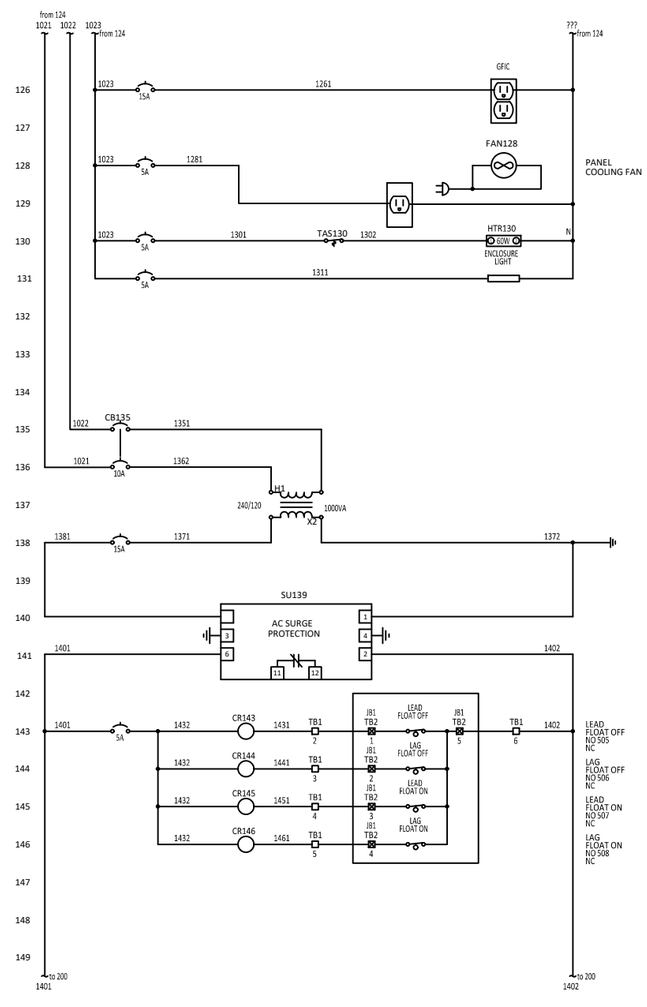
DUPLEX CONTROL PANEL - WIRING DIAGRAM 1





1) TERMINAL BLOCK DESIGNATION

TB# TERMINAL BLOCK NUMBER
□
TERMINAL NUMBER
IF INCLUDES LETTER INDICATES MULTI LEVEL BLOCK
A - LOWER LEVEL
B - MIDDLE LEVEL
C - UPPER LEVEL

□ TERMINAL
■ GROUNDING TERMINAL
⊠ FIELD TERMINAL

VINYL WRAP TYPE

3) UNLESS NOTED ON THE SCHEMATICS USE THE FOLLOWING TYPE THHN FOR WIRING:

AC POWER	RED #14
NEUTRAL	WHITE #14
AC CONTROL	RED #14
DC	**BLUE #14**
GROUND	GREEN #14
REMOTE POWER	YELLOW
ANALOG	BELDEN #8719

4) WIRING DESIGNATIONS

——— PANEL WIRING
——— FIELD WIRING

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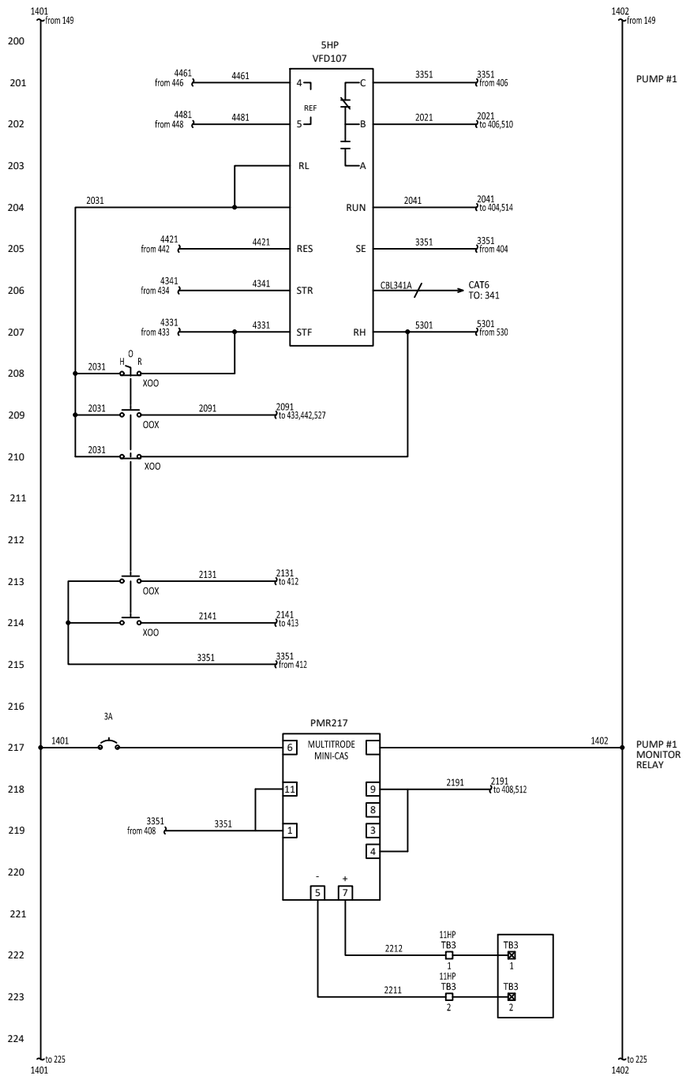
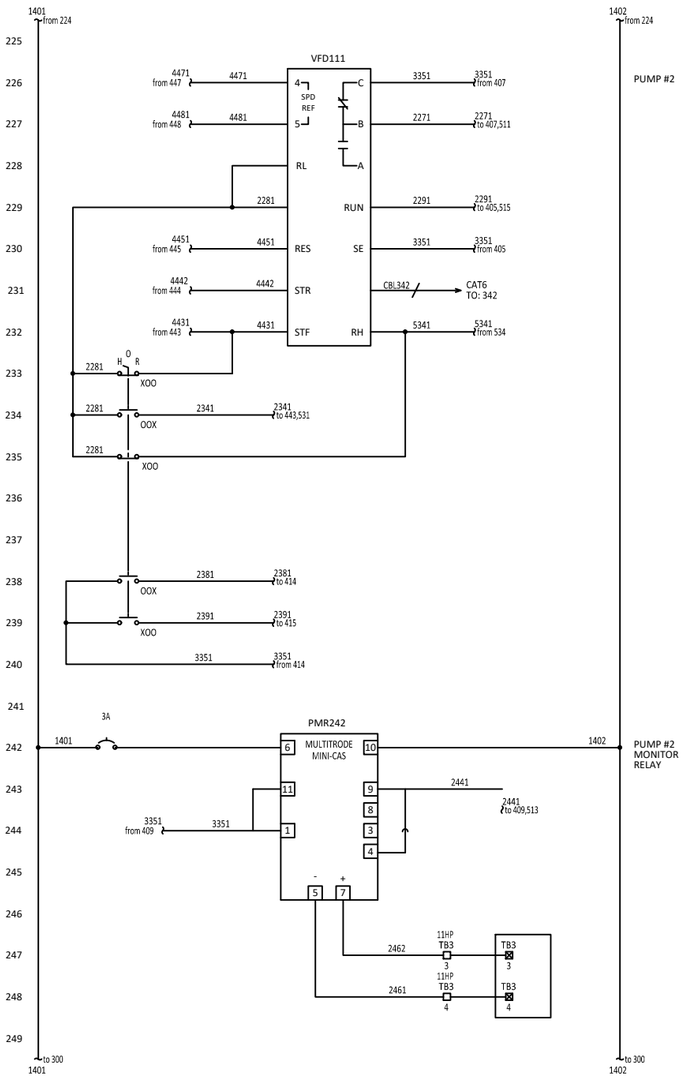
DUPLEX CONTROL PANEL - WIRING DIAGRAM 2





1) TERMINAL BLOCK DESIGNATION

TB# TERMINAL BLOCK NUMBER

TERMINAL NUMBER
IF INCLUDES LETTER INDICATES
MULTI LEVEL BLOCK
A - LOWER LEVEL
B - MIDDLE LEVEL
C - UPPER LEVEL

□ TERMINAL
■ GROUNDING TERMINAL
⊠ FIELD TERMINAL

2) ALL WIRE TAGS TO BE VINYL WRAP TYPE

3) UNLESS NOTED ON THE SCHEMATICS USE THE FOLLOWING TYPE THHN FOR WIRING:

AC POWER	RED #14
NEUTRAL	WHITE #14
AC CONTROL	RED #14
DC	**BLUE #14**
GROUND	GREEN #14
REMOTE POWER	YELLOW
ANALOG	BELDEN #8719

4) WIRING DESIGNATIONS

——— PANEL WIRING
——— FIELD WIRING

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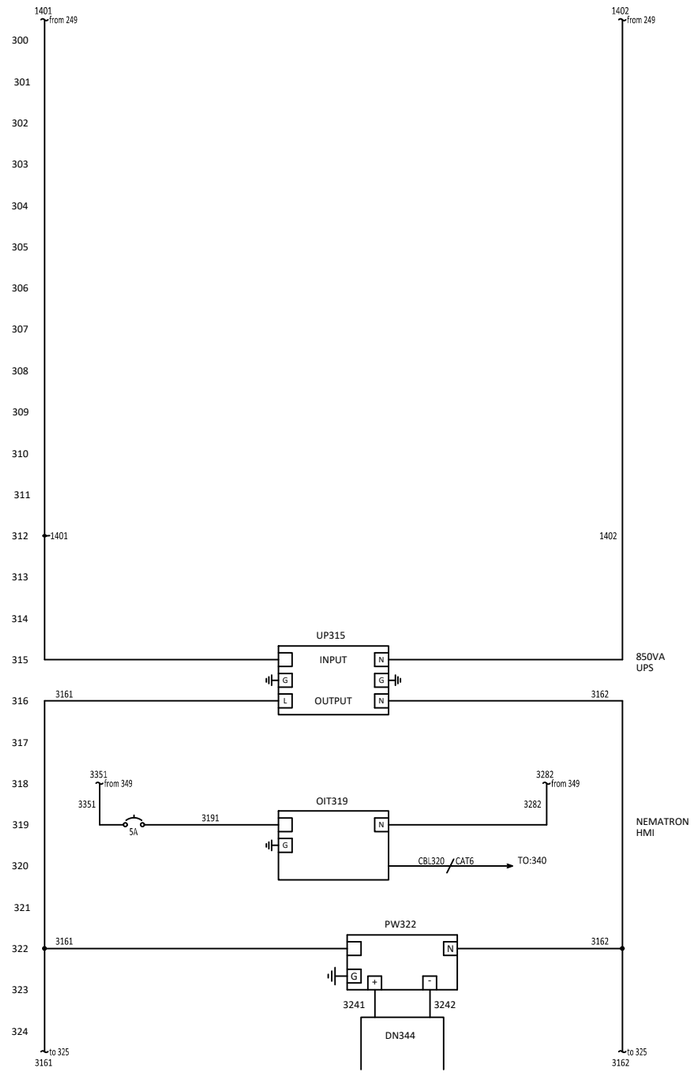
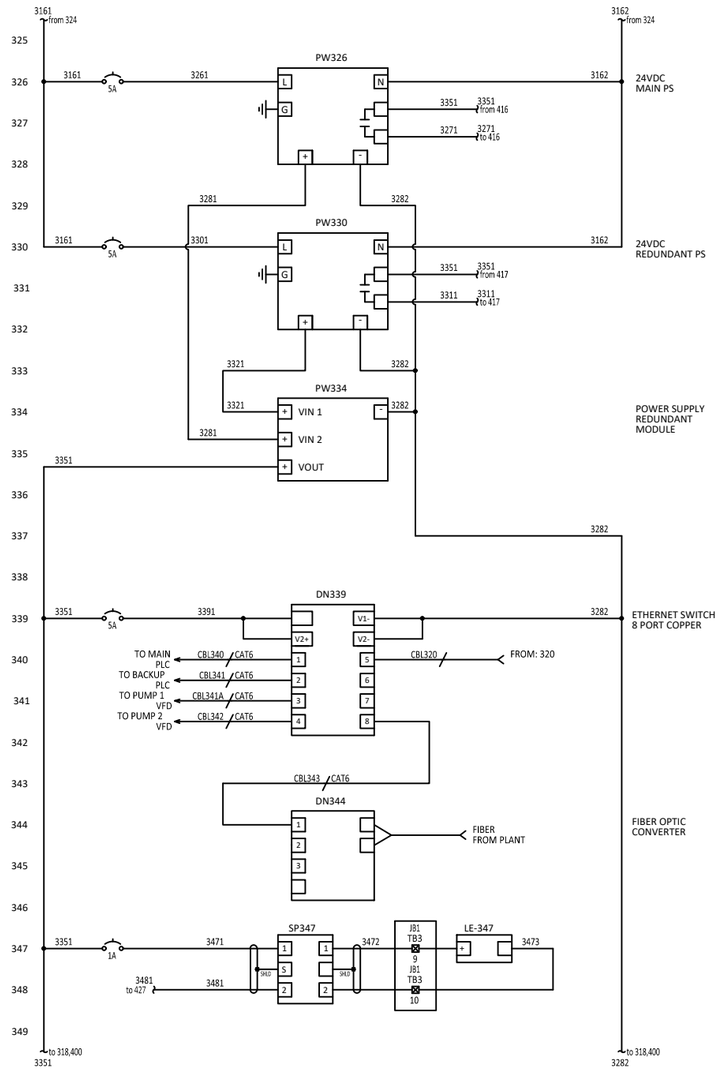
DUPLEX CONTROL PANEL - WIRING DIAGRAM 3





1) TERMINAL BLOCK DESIGNATION

TB# TERMINAL BLOCK NUMBER
□
TERMINAL NUMBER
IF INCLUDES LETTER INDICATES
MULTI LEVEL BLOCK
A - LOWER LEVEL
B - MIDDLE LEVEL
C - UPPER LEVEL

□ TERMINAL
■ GROUNDING TERMINAL
⊠ FIELD TERMINAL

2) ALL WIRE TAGS TO BE
VINYL WRAP TYPE

3) UNLESS NOTED ON THE
SCHEMATICS USE THE
FOLLOWING TYPE THHN FOR WIRING:

AC POWER	RED #14
NEUTRAL	WHITE #14
AC CONTROL	RED #14
DC	**BLUE #14**
GROUND	GREEN #14
REMOTE POWER	YELLOW
ANALOG	BELDEN #8719

4) WIRING DESIGNATIONS

——— PANEL WIRING
——— FIELD WIRING

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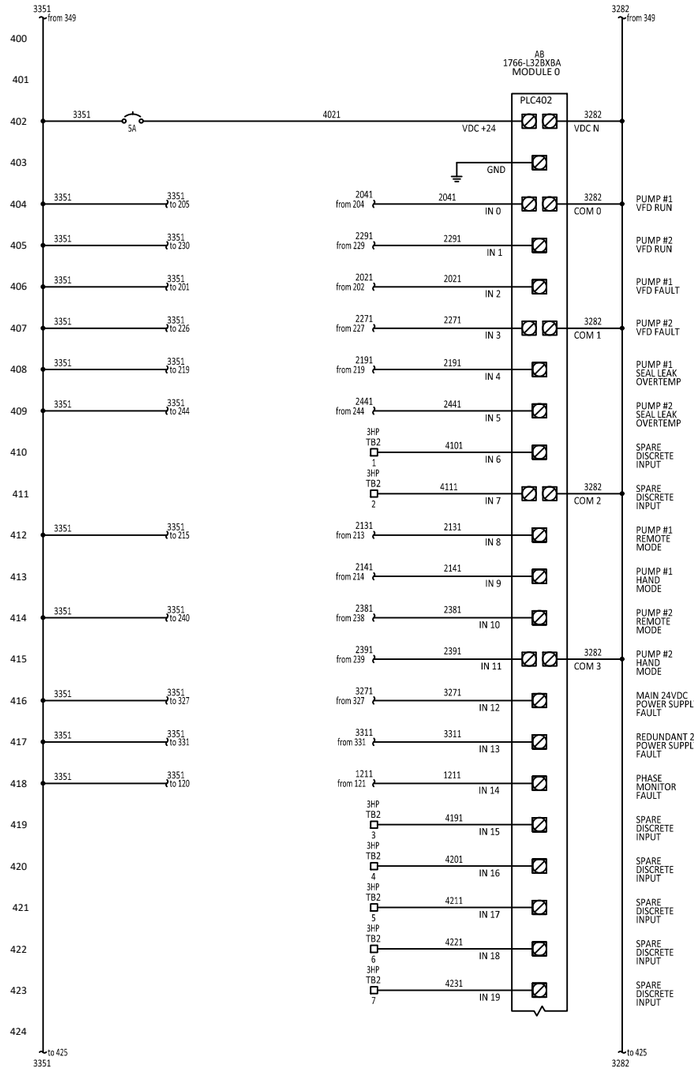
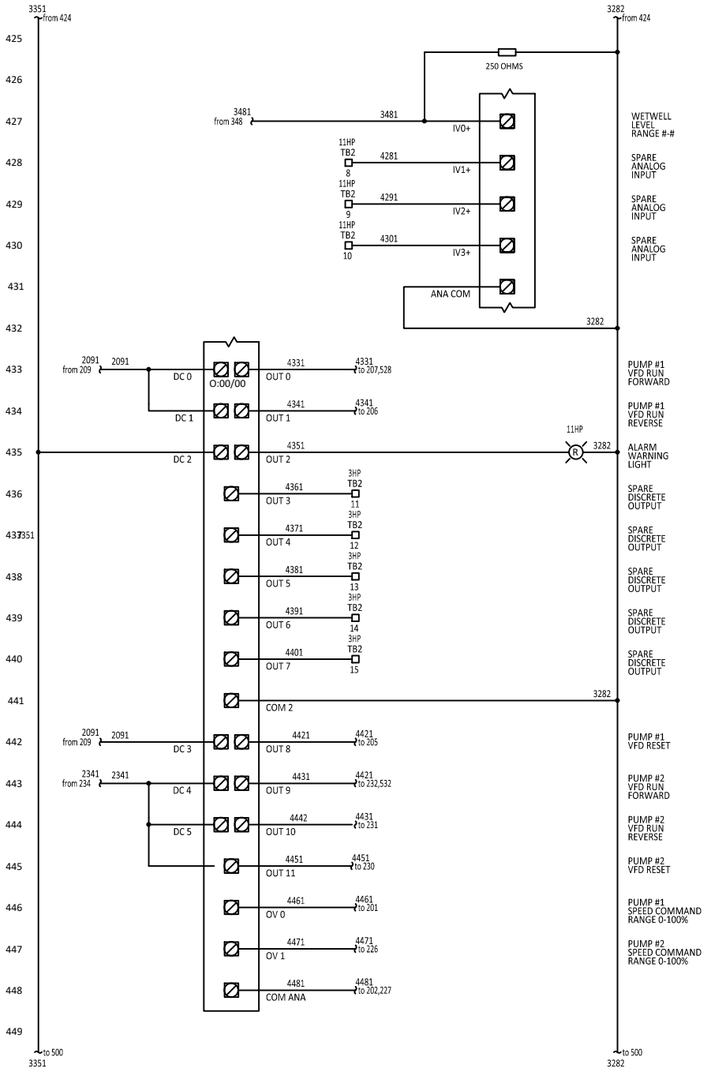
DUPLEX CONTROL PANEL - WIRING DIAGRAM 4





1) TERMINAL BLOCK DESIGNATION
   TB# TERMINAL BLOCK NUMBER
   □ ## TERMINAL NUMBER
   IF INCLUDES LETTER INDICATES MULTI LEVEL BLOCK
   A - LOWER LEVEL
   B - MIDDLE LEVEL
   C - UPPER LEVEL

   □ TERMINAL
   ■ GROUNDING TERMINAL
   ⊠ FIELD TERMINAL

2) ALL WIRE TAGS TO BE VINYL WRAP TYPE

3) UNLESS NOTED ON THE SCHEMATICS USE THE FOLLOWING TYPE THHN FOR WIRING:

AC POWER	RED #14
NEUTRAL	WHITE #14
AC CONTROL	RED #14
DC	**BLUE #14**
GROUND	GREEN #14
REMOTE POWER	YELLOW
ANALOG	BELDEN #8719

4) WIRING DESIGNATIONS

——— PANEL WIRING
——— FIELD WIRING

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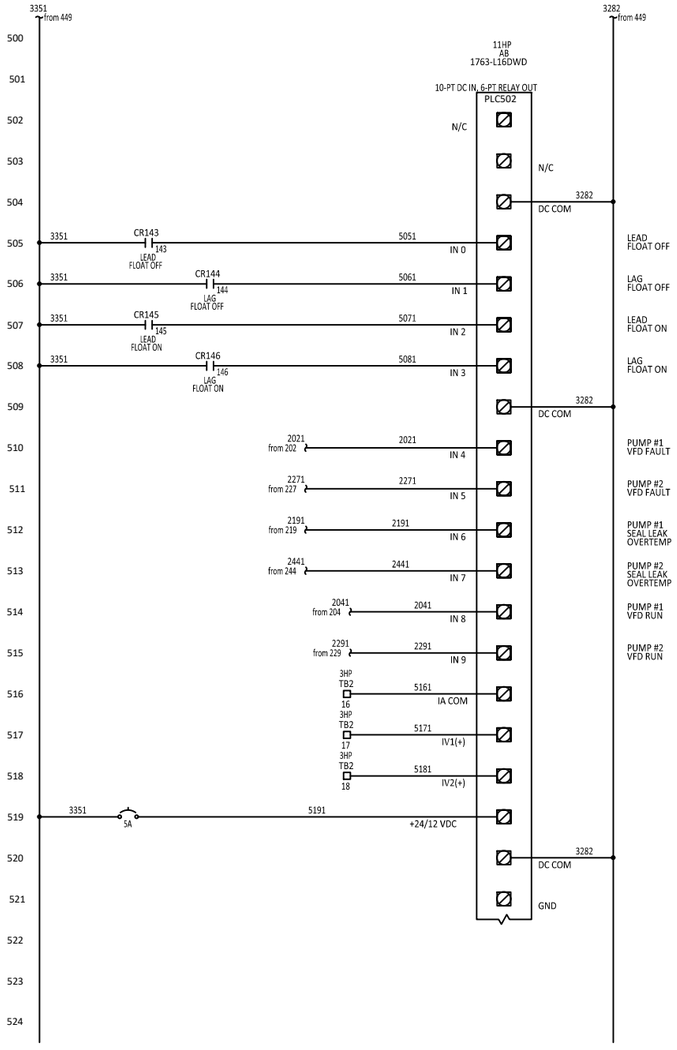
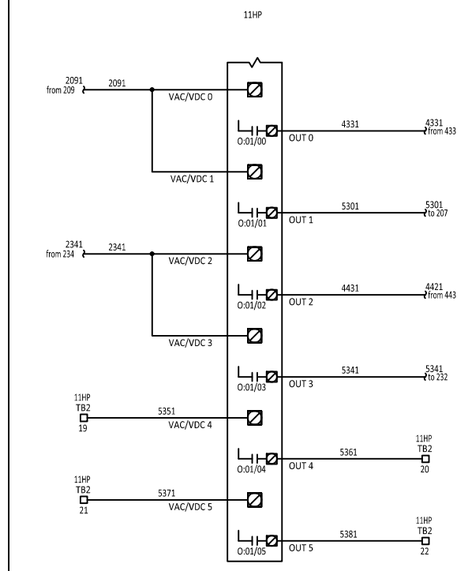
DUPLEX CONTROL PANEL - WIRING DIAGRAM 5





PUMP #1 RUN FORWARD

PUMP #1 RUN HIGH SPEED

PUMP #2 RUN FORWARD

PUMP #2 RUN HIGH SPEED

SPARE RELAY OUTPUT

SPARE RELAY OUTPUT

1) TERMINAL BLOCK DESIGNATION

TB# TERMINAL BLOCK NUMBER

TERMINAL NUMBER
IF INCLUDES LETTER INDICATES MULTI LEVEL BLOCK
A - LOWER LEVEL
B - MIDDLE LEVEL
C - UPPER LEVEL

□ TERMINAL
■ GROUNDING TERMINAL
⊠ FIELD TERMINAL

2) ALL WIRE TAGS TO BE VINYL WRAP TYPE

3) UNLESS NOTED ON THE SCHEMATICS USE THE FOLLOWING TYPE THHN FOR WIRING:

AC POWER	RED #14
NEUTRAL	WHITE #14
AC CONTROL	RED #14
DC	**BLUE #14**
GROUND	GREEN #14
REMOTE POWER	YELLOW
ANALOG	BELDEN #8719

4) WIRING DESIGNATIONS

——— PANEL WIRING
——— FIELD WIRING

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SECTION 8 – CONCRETE

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.

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.

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.

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 C175 for Type IA, Air Entraining Portland Cement.

ADMIXTURES

Admixtures for adding air to concrete made with Type I Portland Cement, must meet the requirements of ASTM C226.

CONSISTENCY OF CONCRETE

The consistency 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 'h inch. When the specified slump is greater than three inches, the tolerance shall be plus or minus one inch.

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 C94. In all such cases, however, the concrete shall be delivered to the job site and discharged within 1 hour 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 I 'h hours may be specified by the UTILITY.

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 hereinbefore 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.

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.

SECTION 9 – SEEDING AND SODDING

PURPOSE

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

SEEDING

Shall be accomplished as described hereinafter. Unless otherwise specified by the UTILITY, all graded areas shall be left smooth a thickly sown with a mixture of grasses at a rate of not less than 4 pounds per 1,000 Sq.Ft.

Unless otherwise specified, the mixture shall consist of:

- 50 percent Tall Lawn Fescue
- 40 percent Creeping Red Fescue
- 10 percent Annual Rye

When the final grading has been completed, the entire area to be seeded shall be fertilized with number 10-10-10 fertilizer at a rate of 15 pounds per 1,000 Sq. Ft. and potentially 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. All seed shall be certified. The seeded area shall then be covered with straw at a rate of 2 bales per 1,000 Sq. Ft. Any necessary reseeding or repairing to final acceptance will be made to provide an approximated 80% germination.

SODDING

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 or Fescue, 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 and fertilized as per the rate listed in the seeding section of this document.

LANDSCAPING

Any landscaping that the CONTRACTOR or OWNER may want around BGMU Utilities must be presented in a plan to BGMU for approval. The UTILITY must maintain safe work areas and enable valves and hydrants to be found in emergency cases.