STANDARD PROCEDURES

FOR

SANITARY SEWER DESIGN and CONSTRUCTION

PADUCAH McCRACKEN
JSA
JOINT SEWER AGENCY

Paducah-McCracken County Joint Sewer Agency

621 Northview Street
Paducah, Kentucky 42001

Revision History

This page documents the revisions made over time to these **Standard Procedures**. The most recent iteration should be listed in the first row, with consecutive versions following.

Revision No.	Date of Revision	Page(s)/Section(s) Revised	Revision Explanation
1.0	04/25/2025	All	Complete revision to new format

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SECTION 00010 - INTRODUCTION

PURPOSE

The purpose of this document is to provide information and guidance to land developers, design engineers, and contractors in the design and construction of sanitary sewer facilities that are to become part of the sanitary sewer system that is owned and operated by the Paducah-McCracken County Joint Sewer Agency (AGENCY).

AUTHORITY

The Paducah-McCracken County Joint Sewer Agency (JSA) was established in 1998 in accordance with KRS 76.231 to own, manage, control, and operate regional comprehensive wastewater facilities within McCracken County, Kentucky. The jurisdiction of the JSA includes all of McCracken County, including the City of Paducah.

GENERAL REQUIREMENTS

In order to ensure that the design and construction of sanitary sewer facilities meet generally accepted sanitary engineering design criteria and generally recognized construction methods for such facilities, the OWNER and/or DEVELOPER of lands in which sanitary sewer lines are to be constructed and become part of the JSA System must employ a Professional ENGINEER currently licensed to perform work in the Commonwealth of Kentucky in accordance with KRS 322.040.

At a minimum, the OWNER/DEVELOPER shall employ the ENGINEER to:

- Perform a preliminary study of all sanitary sewer improvements necessary to serve the project
- Prepare detailed construction drawings
- Prepare and submit all permits necessary to do the work
- Perform inspection as needed during the construction phase
- Coordinate with the OWNER/DEVELOPER and/or CONTRACTOR to resolve construction-related issues as may arise
- Prepare and submit all Project Closeout documentation to the AGENCY upon completion of the project

OBLIGATION OF CONTRACTOR

The CONTRACTOR shall perform and complete the work to the satisfaction of the AGENCY and in accordance with these specifications. The CONTRACTOR shall conduct his work 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.

DEFECTIVE MATERIALS AND WORKMANSHIP

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

FINAL INSPECTION

In addition to normal inspection that occurs during construction and development improvements, a Final Inspection will be made by a representative of the AGENCY. Final Inspection will be made prior to acceptance and final approval of any improvement(s), and only after all improvements are complete. As part of the Final Inspection, the AGENCY shall be given a completed set of "As-Built" plans. All sanitary sewer manholes and access openings shall be opened and all facilities shall be cleaned of all dirt, mud, and other foreign matter. The OWNER/DEVELOPER and/or ENGINEER 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, aboveground, and underground utilities, both public and private. Where existing utilities or appurtenance structures are encountered, they shall not be displaced or disturbed unless necessary and in such case shall be replaced in as good or better condition than found, as quickly as possible, and in accordance with the individual utility owner's requirements. 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 and/or CONTRACTOR 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 local ordinances, laws, and/or codes which may apply to same.

DEFINITIONS

AGENCY – Paducah McCracken County Joint Sewer Agency (JSA)

APPROVED – Material, equipment, workmanship, process or method that has been accepted by the Paducah McCracken County Joint Sewer AGENCY as suitable for the proposed use.

AS-BUILT – A certification by the ENGINEER whose stamp appears on the plans that the measurements, depths, materials, and facilities that are shown on the plans are true and correct and are constructed in accordance with the Standard Specifications of the Paducah McCracken County Joint Sewer AGENCY.

CONTRACTOR – The person, firm or corporation with whom the OWNER/DEVELOPER has executed an agreement to perform the SANITARY SEWER construction for the project.

ENGINEER – A licensed Professional ENGINEER, registered in the Commonwealth of Kentucky as set out in KRS Chapter 322, who is responsible for project oversight.

OWNER / DEVELOPER – An individual, group or individuals, partnership, firm, association or corporation that is constructing, or having constructed, sewer facilities that are to become a part of, or be connected to the Paducah McCracken County Joint Sewer AGENCY's system. The term "OWNER" and/or "DEVELOPER" includes sub-dividers and builders.

RESIDENT INSPECTOR – A representative of the AGENCY (or ENGINEER) who is required to be on the job site during any construction of facilities that are to become part of the Paducah McCracken County Joint Sewer AGENCY's system to ensure that the facilities are being constructed in accordance with the Technical Specifications of the Paducah McCracken Joint Sewer AGENCY.

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.

END OF SECTION

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SECTION 00020 – PROCEDURES

PURPOSE

The purpose of this section is to establish a working relationship between the OWNER/DEVELOPER, ENGINEER, CONTRACTOR, and AGENCY by describing the step-by-step procedure to be followed by each party in initiating and completing the construction of any sanitary sewer improvements that are to be connected to or become part of the sanitary sewer system that is owned and operated by the Paducah-McCracken County Joint Sewer Agency (AGENCY).

PLANNING

Prior to any detailed survey and/or design taking place, the DEVELOPER and/or ENGINEER should provide planning-level information that conveys the overall scope of the project. This should include site location, proposed use(s), proximity to existing sanitary sewer mains, roads, etc., in order to educate the AGENCY on what the proposed development will entail. The AGENCY will utilize this preliminary data to evaluate the impact the proposed development will have on the existing sanitary sewer system. The AGENCY will then determine whether the existing sanitary sewer system has adequate capacity to convey and treat the projected wastewater flow.

A planning-level map showing the AGENCY's existing service area can be viewed online by accessing the Map~GIS portal at: https://mapgis-map-gis.hub.arcgis.com/.

PRELIMINARY DESIGN

Once the AGENCY agrees to the intent of the project, the ENGINEER can then utilize the information gathered during the planning process to prepare Preliminary Design drawings showing the proposed sanitary sewer improvements. At approximately a 60% level of completion, the ENGINEER should submit the Preliminary Design drawing(s) to the AGENCY for review and comment. This submittal can be made via email (in .pdf format) or hard-copy paper.

FINAL DESIGN

The ENGINEER shall incorporate the AGENCY's comments from the preliminary design review into the Final Design drawings. The minimum information to be included in the Final Design documents is summarized in the following section of this document. All plans submitted for Final Design review shall be stamped and signed by the ENGINEER.

PLAN REQUIREMENTS

- **General**

  Plans submitted to the AGENCY shall include all information necessary for a full review. One (1) set of project plans and accompanying documents shall be submitted to:

  Paducah-McCracken Joint Sewer Agency
  621 Northview Street
  Paducah, KY 42001

  Plans shall be prepared by a Professional ENGINEER currently licensed to perform work in the Commonwealth of Kentucky in accordance with KRS 322.040

- **Basis of Design**

  All sanitary sewer improvements shall be designed in general accordance with 401 KAR 5:005, with the current edition of the "Recommended Standards for Wastewater Facilities" (commonly referred to as Ten States' Standards), and with the AGENCY's Standard Specifications. Standard engineering practices shall be utilized when evaluating and designing all sanitary sewer improvements. Any deviation from the above-referenced design criteria shall be subject to approval by the AGENCY.

- **Coordinate System and Datum**

  Horizontal control shall be referenced to the Kentucky State Plane Coordinate System, South Zone (1602), NAD 83 in US survey feet, or latest revision. Reference the project vertical control to USGS Datum (NAVD88). The horizontal and vertical control should be clearly noted on the project plans. If a project involving the AGENCY is part of a larger project (e.g. utility relocation for KYTC), the drawings may utilize the coordinate system and datum of the larger project.

- **Easements**

  All sanitary sewer improvements to be owned and maintained by the AGENCY shall be located within a dedicated easement, unless otherwise approved by the AGENCY. All existing easements shall be shown on the project plans and should indicate easement dimensions and recording information (e.g. deed book, page number), if known. New sanitary sewer easements shall be prepared on a legal document similar to the AGENCY's standard easement form and shall be submitted to the AGENCY for review prior to execution and/or recording. All new sanitary sewer easements shall be notarized.

  Sanitary sewer easements shall be centered on the sewer main whenever possible. The minimum easement width for sanitary sewer construction is 15 ft. For sanitary sewers installed at a depth greater than 15 ft., the minimum easement width shall be 20 ft. Easements required for pump stations shall be coordinated with the AGENCY.

  The ENGINEER (and/or OWNER/DEVELOPER) shall be responsible for contacting the affected property owner and obtaining the necessary signatures as required by the easement document. Should modifications, restrictions or special conditions (e.g. easement width, special restoration, construction restrictions, etc.) be requested/required by the affected property owner, the

ENGINEER (and/or OWNER/DEVELOPER) shall obtain approval from the AGENCY prior to accepting the requested change(s).

It is the sole responsibility of the OWNER/DEVELOPER to provide compensation, goods or services to a property owner as may be required in order to obtain an easement. All such obligations shall remain solely between the OWNER/DEVELOPER and property owner. The AGENCY will not provide compensation to a third party as part of easement acquisition/negotiation initiated by the OWNER/DEVELOPER.

Once all easements have been obtained, the ENGINEER shall submit the original, fully-executed documents to the AGENY for final review. The AGENCY will then deliver to the AGENCY's counsel for review and recording at the McCracken County Clerk's Office. The cost for recording will be borne by the AGENCY.

Construction shall not be initiated until all necessary easements have been obtained unless authorized by the AGENCY.

- **Project Summary**

Plans for new sanitary sewer improvements shall be accompanied with a summary of the proposed project. This summary shall include a brief description of the project and work to be performed, the proposed number of new sewer connections (if any), and the anticipated flow resulting from the proposed improvements. For projects involving the construction of a pumping station, the project summary shall include all calculations used to determine the size of pumps, structures, force mains, etc.

- **Pumping Stations**

The use of a pumping station shall be considered only when the area cannot be served by gravity sewers, including reasonable extensions to existing or proposed gravity sewer lines. The use of multiple small pumping stations on a lower pressure system would be considered on a case by case basis. Upon determining that a pumping station is necessary to serve the development, the OWNER/DEVELOPER and/or ENGINEER shall notify the AGENCY and arrange a meeting to discuss the project. All pumping stations shall be designed in accordance with AGENCY's standards.

- **Highway Encroachment Permits**

An encroachment permit is required for any project that will encroach on public right-of-way. It is the responsibility of the OWNER/DEVELOPER and/or ENGINEER to coordinate with the respective agency having jurisdiction and ensure that all permits and sureties are obtained prior to initiation of construction.

For projects that impact **City of Paducah** right-of-way, contact the City of Paducah Engineering Dept. at (270) 444-8511.

For projects that impact **McCracken County** right-of-way, contact the McCracken County Road Dept. at (270) 442-9163.

For projects that impact **Kentucky Transportation Cabinet (KYTC)** right-of-way, prepare and submit an "Application for Encroachment Permit" (Form TC 99-1A) to the KYTC District 1 Permit Section, (270) 898-2431, for review and approval.

- **Construction Plans**

  Plans prepared by the ENGINEER shall contain the following minimum information:

  - **Title Sheet**
    - Name of Project or Development
    - Location Map
    - Name and Address of Owner/Developer
    - Name and Address of Design Engineer
    - PE Stamp of Design Engineer
  - **Plan and Profile Sheets**
    - Surface features, including (but not limited to): existing and proposed contours, topography and elevations of streets, streams, and water surfaces, floodplain information (if applicable), property boundary information, existing and proposed easements, existing and proposed utilities, and finished floor elevations of structures within the development.
    - Sewer Manholes - stationing, type of manhole, rim and invert elevations
    - Gravity Sewer Mains – pipe size and material, slope of pipe between manholes, deflection angle at manholes
    - Sewer Force Mains – pipe size and material, location and type of all horizontal/vertical fittings, location of any air release valves
    - Sewer Pump Stations – site layout showing location of all structures, entrances, fencing, and lighting; dimensions and elevations of all structures; piping and valve arrangement; pump information including manufacturer/model, number of pumps, and pump discharge at design total dynamic head (TDH); location of pump controls; name of power provider with available phase/voltage, location of available power service indicating whether service is underground or aboveground, and location of proposed transformer
  - **Detail Sheets**
    - All applicable construction details needed for the project, in accordance with the AGENCY's Standard Details, including (but not limited to) details for trench sections, manholes, service connections, utility crossings, creek crossings, erosion and sediment controls, encased bores, and thrust blocking.

REVIEW AND APPROVAL

- **Local (JSA) Review**

  The ENGINEER shall submit the Final Design package to the AGENCY for the purpose of obtaining Final Approval. A complete submittal package consists of the following items:

  - Stamped Drawings (2 sets, paper)
  - Project Specifications (1 set, paper)
  - Project Summary
  - Location Map
  - Pump Station Calculations (if applicable)
  - Easement Documents (if required)
  - Highway Encroachment Permits (if required)

  The AGENCY will review the submittal for conformance with all applicable standards and will issue a letter and one copy of drawings indicating Approval and/or any noted deficiencies or comments. This information will be returned directly to the ENGINEER. A copy of the AGENCY letter will be sent to the OWNER/DEVELOPER, when possible. **Please note that it is the responsibility of the ENGINEER to communicate with the OWNER/DEVELOPER.**

  The ENGINEER should allow a 30-day period for review time; however, the AGENCY will conduct it's review as expeditiously as possible.

- **State (DOW) Review**

  Once AGENCY Approval is granted, it is the responsibility of the ENGINEER to make a submittal to the Kentucky Division of Water (DOW) in order to obtain a Permit for Sewer Line Construction. For information regarding the submittal requirements, the ENGINEER should contact the Water Infrastructure Branch at (502) 564-3410, http://water.ky.gov. No construction shall take place prior to receiving DOW Approval.

CONSTRUCTION DRAWINGS

The ENGINEER shall incorporate any comments and/or revisions resulting from the review process into a set of Construction Drawings that will be used by the CONTRACTOR for the project. It shall be the responsibility of the ENGINEER to ensure that the CONTRACTOR has the correct set of documents throughout construction. A copy of the Construction Drawings shall be submitted to the AGENCY prior to scheduling a pre-construction conference.

AGREEMENT

Once a Sewer Line Construction Permit is issued, the AGENCY will prepare an Agreement and Waiver document and forward to the ENGINEER for execution by the OWNER/DEVELOPER. The purpose of this Agreement and Waiver is to establish the mutually agreeable terms under which the project will be constructed and the subsequent transfer of ownership from the OWNER/DEVELOPER to the AGENCY. An original, fully-executed copy of the Agreement must be submitted to the AGENCY prior to any construction taking place

PRE-CONSTRUCTION CONFERENCE

Once the AGENCY has received all required documents, the ENGINEER and/or CONTRACTOR can schedule an on-site Pre-Construction Conference to discuss the project. This Pre-Construction Conference is required prior to initiating construction.

CONSTRUCTION PHASE

The OWNER/DEVELOPER shall be responsible to the AGENCY for the proper construction of the sanitary sewer improvements. It is the AGENCY's expectation that the ENGINEER will have a representative on site periodically to monitor construction as it progresses. The ENGINEER shall be notified immediately of any conflicts incurred in the field between the sanitary sewer facilities and other site features (e.g. utilities, buildings, roadways, ditches, etc.). It is the responsibility of the ENGINEER to notify the AGENCY of any such conflicts that could significantly alter the proposed sewer alignment, depth, or proximity to other surface features.

The AGENCY's Field Inspector will be on site periodically to monitor the progress of construction activities and will work with the CONTRACTOR and/or ENGINEER to resolve minor construction-related issues as may arise.

TESTING

Once construction is complete, the CONTRACTOR will be responsible for all testing of the sanitary sewer improvements in accordance with the AGENCY's Technical Specifications. The CONTRACTOR shall notify the AGENCY a minimum of 24-hours in advance of any testing taking place. The ENGINEER shall have a representative on-site to witness and document all testing. Upon completion, the ENGINNER shall submit all test results to the AGENCY.

FINAL INSPECTION

Upon completion of the project, the AGENCY's Field Inspector will conduct a walking site inspection with the CONTRACTOR. This inspection will identify items that are either outstanding or otherwise require additional work in order for the AGENCY to consider the project to be complete. The resulting "Punch List" will be provided to the CONTRACTOR, ENGINEER and OWNER/DEVELOPER in letter form by the AGENCY.

It is the responsibility of the OWNER/DEVELOPER to ensure that the CONTRACTOR performs any outstanding work in a timely manner.

RECORD DRAWNGS

It is the responsibility of the CONTRACTOR to maintain an accurate set of Record Drawings ("As-Builts") as construction of the project progresses. This set of Record Drawings shall be kept on the job site at all times. These Record Drawings shall accurately depict the location of the new sanitary sewer improvements and shall indicate any deviations made from the Construction Drawings.

The ENGINEER shall submit one (1) full-size paper copy and one (1) electronic copy (in PDF format) of the Record Drawings to the AGENCY upon completion of the project. These drawings shall be stamped by the ENGINEER and clearly labeled "Record Drawings" with corresponding date of submittal.

ENGINEER'S CERTIFICATION

Upon completion of construction and all required submittals, the ENGINEER shall certify, in letter form, that the facilities have been constructed and tested in accordance with the approved plans and specifications. This letter of certification shall be addressed and submitted to the Kentucky DOW Water Infrastructure Branch. A copy of the certification shall be submitted to the AGENCY.

CERTIFICATE OF COMPLETION

Upon completion of the project, the AGENCY will prepare a Certificate of Completion for execution by the OWNER/DEVELOPER. The purpose of this Certificate of Completion is to verify that all payment(s) have been made for all labor, services, materials, supplies, equipment, etc. that were necessary to complete the sanitary sewer improvements.

WARRANTY

A one (1) year Warranty period for the sanitary sewer improvements will initiate upon completion and submittal of **all of the above listed documents**. The AGENCY will issue a letter to the OWNER/DEVELOPER establishing the Warranty period.

During this Warranty period, the OWNER/DEVELOPER is responsible for any and all defects and any work required to remedy said defects. The AGENCY reserves the right to extend the Warranty period if, in the opinion of the AGENCY, there may be inherent defects with the installed sanitary sewer improvements or other problems that may negatively affect their performance.

Once the Warranty period is complete and there are no outstanding obligations of the OWNER/DEVELOPER, the AGENCY will accept the sanitary sewer improvements into the AGENCY's system and assume responsibility of future maintenance and operation of said improvements, subject to the terms of the Agreement and Waiver.

END OF SECTION

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APPENDIX A

TECHNICAL SPECIFICATIONS

FOR

SANITARY SEWER

Paducah-McCracken County Joint Sewer Agency

621 Northview Street
Paducah, Kentucky 42001

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SECTION 01000 – GENERAL REQUIREMENTS

1.01 DEFINITIONS

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AS-BUILT – A certification by the ENGINEER whose stamp appears on the plans that the measurements, depths, materials, and facilities that are shown on the plans are true and correct and are constructed in accordance with the Standard Specifications of the Paducah McCracken County Joint Sewer AGENCY.

CONTRACTOR – The person, firm or corporation with whom the OWNER/DEVELOPER has executed an agreement to perform the SANITARY SEWER construction for the project.

ENGINEER – A licensed Professional ENGINEER, registered in the Commonwealth of Kentucky as set out in KRS Chapter 322, who is responsible for project oversight.

OWNER / DEVELOPER – An individual, group or individuals, partnership, firm, association or corporation that is constructing, or having constructed, sewer facilities that are to become a part of, or be connected to the Paducah McCracken County Joint Sewer AGENCY's system. The term "OWNER" and/or "DEVELOPER" includes sub-dividers and builders.

RESIDENT INSPECTOR – A representative of the AGENCY (or ENGINEER) who is required to be on the job site during any construction of facilities that are to become part of the Paducah McCracken County Joint Sewer AGENCY's system to ensure that the facilities are being constructed in accordance with the Technical Specifications of the Paducah McCracken Joint Sewer AGENCY.

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.

1.02 REFERENCED STANDARDS

Referenced standards and specifications contained in the Technical Specifications are as follows:

- ACI – American Concrete Institute
- AISC – American Institute of Steel Construction, Inc.
- ANSI – American National Standards Institute
- ASA – American Standards Association (also designed by USASI)
- ASTM – American Society of Testing Materials, Inc.
- AWS – American Welding Society
- AWWA – American Water Works Association
- PCA – Portland Cement Association

- UL – Underwriter's Laboratories, Inc.
- USASI – United States of American Standards Institute (also designated as ASA)
- Kentucky Department of Highways, Standard Specifications for Road and Bridge Construction, 2000 Edition.
- ASME – American Society of Mechanical ENGINEERs
- ASI – American Steel Institute
- NBFU – National Board Fire Underwriters

1.03 SCOPE

The CONTRACTOR shall provide and pay for all materials, labor, equipment, tools, heat, transportation, superintendents, temporary facilities, construction of every nature, taxes legally collectable because of the work, permits, and all other services necessary to complete the work under the contract and deliver the work complete within the specified time frame.

1.04 PERMITS, CERTIFICATES, LAWS, ORDINANCES, AND CODES

The CONTRACTOR shall, at his own expense, procure all permits, certificates and licenses required of him by law for the execution of his work. He shall comply with all federal, state and local laws, ordinances or rules and regulations relating to the performance of the work.

1.05 PROJECT

The project is located in Paducah, McCracken County, Kentucky and consists of the construction of SANITARY SEWER facilities and related appurtenances, including, but not limited to, construction staking, temporary facilities, construction of every nature, traffic control, temporary erosion control, permanent seeding and protection, right-of-way monumentation, and other related appurtenances.

1.06 CLEANING UP

The CONTRACTOR shall, at all times, keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish and, prior to completion of the work, remove any rubbish from and about the premises, and remove all tools, equipment, and materials. Upon completion, and prior to final payment, the CONTRACTOR shall leave the premises in a neat, clean, and workmanlike condition satisfactory to the OWNER and AGENCY. All property, both public and private, which has been damaged during the execution of the work, shall be restored in an acceptable manner prior to final payment to the CONTRACTOR at no additional cost to the AGENCY.

1.07 DEFECTIVE MATERIAL AND WORKMANSHIP

Materials not in accordance with the specifications and/or defective work may be rejected by the AGENCY and/or the ENGINEER (or a representative thereof) at any time before final approval and acceptance. Failure by the AGENCY to reject defective work shall not be construed as an acceptance of same.

1.08 AGENCY'S DECISIONS

All claims of the CONTRACTOR shall be presented in writing to the AGENCY for decision. All decisions of the AGENCY shall be final except in cases where time and/or financial considerations are involved, which will be subject to arbitration.

1.09 PRIVATE PROPERTY

The CONTRACTOR shall not enter upon private property for any purpose without obtaining permission, and he shall be responsible for the preservation of all public property, trees, monuments, etc., along and adjacent to the street, right-of-way, easement and/or site, and shall use every precaution necessary to prevent damage or injury thereto. He shall use suitable precautions to prevent damage to pipes, conduits, and other underground structures, and shall protect carefully from disturbance or damage all monuments and property markers until an authorized agent has witnessed or otherwise referenced their location and shall not remove them until directed.

1.10 TRAFFIC CONTROL

The CONTRACTOR shall comply with the Commonwealth of Kentucky's Department of Transportation Manual on Uniform Traffic Control Devices for Highway Construction and Maintenance (MUTCD), current edition, at all times. No work will be allowed on public right-of-way(s) until the proper warning and construction signs have been erected in accordance with the Manual on Uniform Traffic Control Devices. All required permits shall be obtained prior to commencing construction activities.

1.11 PUBLIC SAFETY AND CONVENIENCE

The CONTRACTOR shall at all times conduct his work as to ensure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to ensure the protection of persons and property in a manner satisfactory to the AGENCY.

1.12 ACCIDENT PREVENTION

The CONTRACTOR shall exercise proper precaution at all times for the protection of persons and property. The safety provisions of applicable law, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General CONTRACTORs of America, Inc. as well as all OSHA requirements shall be observed, and the CONTRACTOR shall take or cause to be taken such additional safety and health measures as the AGENCY may determine to be reasonably necessary. Machinery, equipment and all hazards shall be guarded in accordance with the safety provisions of the "Manual of Accident Prevention in Construction", to the extent that such provisions are not in contravention of applicable law. CONTRACTOR to furnish all safety materials needed. CONTRACTOR must furnish their Safety Policy for job site to the AGENCY prior to beginning construction. The policy should address, but not limited to, confined space entry, trenching and shoring, and any other applicable safety precautions.

1.13 DAMAGE TO EXISTING FACILITIES, PROPERTY, ETC.

The CONTRACTOR shall avoid damage as a result of his operations to existing sidewalks, street, pavement, utilities, adjoining property, the work of other CONTRACTORs and the property of the OWNER and others, and shall, at his own expense, completely repair any damage thereto caused by operations.

Location of Utilities

It shall be the CONTRACTOR's responsibility to familiarize himself with the location of all utilities or other obstructions with the specified limits of his construction, and to accurately determine the location of such utilities or obstruction, in order that he may prevent all damage thereto. The AGENCY makes no expressed or implied guarantee for the accuracy of the information shown.

Claims for Extra Cost

Omission of the specific location of utilities or obstructions on the drawings provided will not constitute basis of claims for extra cost for damage to said utilities, or to any other property or equipment, nor shall this relieve the CONTRACTOR of his responsibility to repair all such damage at his own expense.

1.14 LOCATION AND PROTECTION OF UTILITIES

Prior to initiation of excavation, the CONTRACTOR shall locate all utilities in the work area in accordance with applicable governmental rules, laws and regulations. The CONTRACTOR shall comply with the requirements of the Underground Facility Damage Prevention Act of 1994 (a.k.a. Kentucky 811) in accordance with KRS 367.49. **Please note that the Paducah-McCracken County JSA (a.k.a. AGENCY) is not a member of Kentucky 811. Locate requests related to SANITARY SEWER within the JSA service area can be submitted via email to jsabud@jointsewer.com.**

Take appropriate measures to verify the locations of and protect utilities. Expose utilities located within the required limits of work utilizing hand tools. Provide proper support as required to prevent damage during construction. Immediately notify utility OWNER any time damage occurs to a utility installation. Repair damaged utilities in accordance with utility company procedures at no extra cost to the OWNER/DEVELOPER, the affected utility OWNER, or the AGENCY. Take such measures as necessary to minimize any disruption of utility service.

1.15 FINAL INSPECTION

In addition to normal inspection, which may be conducted during construction of development improvements, a representative of the AGENCY's ENGINEERing Department will make a Final Inspection. Final Inspection will be made following completion of all required testing and prior to acceptance of any unit for maintenance by the AGENCY and only after all improvements are completed. All sanitary manholes or access openings shall be opened and all facilities shall be cleaned of all dirt, mud and other foreign matter. The CONTRACTOR shall provide personnel as required to aid in the Final Inspection.

1.16 RECORD DRAWINGS

At the completion of the Contract Time, the CONTRACTOR shall deliver to the AGENCY, thru the ENGINEER, the complete intact copy of Record (AS-BUILT) Drawings. Note that it shall be the responsibility of the CONTRACTOR to keep an accurate set of AS-BUILT Drawings on the job site at all times. The AS-BUILT Drawings shall include (at a minimum) all items outlined in Section 3.17 and Section 4.16 of these Technical Specifications. Submission of suitable AS-BUILT Drawings will be required prior to issuance of final payment. In addition, verification by the ENGINEER that record drawings are periodically maintained will be required prior to each partial payment by the AGENCY. All AS-BUILT drawings shall be printed (to scale) on 24" x 36" plan sheets. Digital files of the AS-BUILT drawings shall also be submitted to the AGENCY in .pdf format.

1.17 TESTING

The CONTRACTOR shall perform all required testing of installed piping, equipment, etc. as required by these Technical Specifications.

1.18 LAYOUT OF WORK

The CONTRACTOR shall immediately upon entering the Project Site for the purpose of beginning the work, locate all general reference points and take such action as necessary to prevent their destruction; layout his own work and be responsible for, all lines, elevations, and measurements of all work to be executed under the Contract.

1.19 WORK HOURS

Work hours for this project shall be limited to between 7:00 a.m. and 4:00 p.m. Monday through Friday, unless otherwise approved by the AGENCY. No work on weekends or holidays will be permitted, unless otherwise approved by the AGENCY.

1.20 TEMPORARY FACILITIES

The CONTRACTOR is responsible for all temporary facilities used to store materials and equipment. The CONTRACTOR shall provide, install and maintain adequate temporary sanitation facilities at the site. These temporary facilities shall be approved by the ENGINEER and the AGENCY. Upon completion of the work, all temporary equipment and structures shall be removed from the site. At no time shall the site distance from the stop bar at any intersection be inhibited by the CONTRACTOR's equipment or materials.

1.21 PRODUCT HANDLING

Materials delivered to and stored on the site must be handled in a careful manner as to prevent any damage to the materials. All materials and equipment damaged during manufacture, shipment, delivery, storage, or construction shall be replaced with material or equipment of exactly the same kind by the CONTRACTOR at no additional cost to the AGENCY.

1.22 CONSTRUCTION SCHEDULE

To ensure adequate planning and execution of the work so that the work is completed within the number of days allowed in the contract, the CONTRACTOR shall submit a Schedule of Construction Activities shown as milestones and Schedule of Values to assist the ENGINEER in appraising the reasonableness of the proposed schedule and in evaluating progress of work.

1.23 SHOP DRAWINGS

The CONTRACTOR shall provide three (3) sets of shop drawings for the work as required by these Technical Specifications.

END OF SECTION

SECTION 02000 - EARTHWORK

2.01 SCOPE

The CONTRACTOR shall furnish all labor, materials, equipment, tools, transportation, services and all other incidental items necessary to perform the work, all in accordance with the drawings and various sections of these specifications.

2.02 CLEARING AND GRUBBING

The CONTRACTOR is responsible for obtaining the permission of the private property owner prior to entering areas outside of easements and right of ways. Remove small trees, weeds, grass, logs, stumps and other obstructions along the proposed alignment and within the designated easement or right of way of the proposed installation as directed by the AGENCY and as necessary for the proper performance of the required construction work. Removal of trees with a trunk diameter of six (6) inches or greater, shrubbery, fences, poles, surface structures, livestock or ornamental fence lines and other personal property improvements will require the approval of the AGENCY prior to removal. Materials removed during clearing and grubbing operations shall be disposed of in a manner satisfactory to the AGENCY and/or OWNER/DEVELOPER.

2.03 PROTECTION OF PROPERTY AND SURFACE STRUCTURES

Protect trees, shrubbery, fences, poles, surface structures, livestock or ornamental fence lines and personal property improvements from damage unless their removal is shown on the Drawings or as authorized by the AGENCY. Restore to original condition and/or replace in-kind damaged structures and other personal property improvements following the completion of work at no extra cost to the AGENCY. Existing property monumentation disturbed during construction shall be replaced by a licensed professional land surveyor at no additional cost to the AGENCY.

2.04 EXCAVATION - GENERAL

Excavate to the depth and width required for the proper execution of the work involved as depicted on the project drawings and as dictated by all applicable local, state, and federal standards. Excavation will be open cut unless otherwise indicated. Short sections may be drilled or tunneled if, in the opinion of the AGENCY, the pipe can be safely and properly installed and backfilled. Store topsoil removed from the excavation limits in a manner approved by the AGENCY for use in restoration of the work area.

2.05 EXCAVATION - CLASSIFICATION

All excavation shall be unclassified. Excavation shall proceed through all material of any nature encountered regardless of the type, character or composition thereof to the required depth. Any reference to rock, earth, or any other material on the plans whether in number, words, letters or lines is for information only and is not to be taken as an indication of classified excavation or the quantity of either rock, earth or any other material involved. Excavation may be performed by any recognized method of safe practice to complete the job in the most expeditious manner, however, the CONTRACTOR shall satisfy himself as to the type of soil to be encountered. Unauthorized excavation shall be backfilled at the CONTRACTOR'S expense with compacted

earth, gravel, or other material as approved and directed by the AGENCY. Any unsuitable material encountered shall be disposed of in a manner approved by the ENGINEER and/or AGENCY.

2.06 TRENCH EXCAVATION

GENERAL - Excavate trenches to sufficient depth and width at the indicated grade to meet the requirements of the approved plans. All work shall be in accordance with all applicable local, state, and federal standards.

MAINTENANCE OF SYSTEMS - Conduct trenching operations in a manner which will not interfere with the proper operation of roadways, sewers, drainage, utilities, etc. Avoid damaging roadways, sewers, drainage structures, utilities and other infrastructure facilities. Roadways, sewers, drainage structures, utilities and other infrastructure facilities damaged as a result of construction shall be restored as soon as possible to a condition equal to or better than the original condition at no added expense to the AGENCY and/or OWNER/DEVELOPER. Provide suitable bridges and flagmen where required to maintain traffic over open trenches.

OBSTRUCTIONS - Where obstructions not shown on the plans are encountered during the progress of the work, and interferes to such an extent that an alteration in the plans is required, the AGENCY shall have the authority to change the plans and order deviations from the line and grade, or to arrange with the individual owners of the structures for the removal, relocation or reconstruction of the obstructions.

LENGTH - Do not extend trench excavation more than one-hundred (100) feet ahead of the pipe installation work, except in those areas which require a trench to drain saturated soils.

EXCAVATED MATERIAL - Excavated materials to be used as backfill shall be stored and retained in a neat pile at least 2 feet or more from the edge of the trench excavation. Remove surplus material or material deemed unacceptable for backfill from the area within 24 hours of excavation. Remove surplus excavated material not required for backfill operations from paved roads and streets immediately following placement of backfill. Store excavated topsoil separately for use in restoration of disturbed areas following completion of construction.

MAXIMUM LENGTH OF OPEN TRENCH: The maximum length of open trenches allowed including sections partially backfilled is 200 feet.

PROTECTION - Comply with OSHA Construction Standards Subpart P Sections 1926.650-1926.653 when performing trench excavation. Slope, shore, sheet or otherwise support trench walls to prevent caving and to protect existing roadways, utilities, and/or structures.

DEWATERING - Keep trenches and other excavations dewatered throughout the progression of construction. Discharge from dewatering equipment should be directed into adjacent ditches, storm drains, or other natural drainage ways. Dewatering shall be the responsibility of the CONTRACTOR and shall be considered incidental to the work being performed.

PIPE BEARING SURFACE - Excavate trench of sufficient width conforming to typical details included in the approved plans to the required depth regardless of the material encountered. For gravity sewers, excavate trench a minimum of 5 inches below grade. Undercut and provide a minimum 6-inch compacted earth cushion to support sewer force mains when rock is encountered at the required trench grade. Undercut unstable trench areas incapable of

providing a sufficient foundation for the pipe as approved and/or directed by the AGENCY. Backfill unstable undercut areas to subgrade with standard bedding material or other APPROVED select fill. Granular bedding material shall be size 9m crushed limestone in accordance with the Kentucky Department of Highways "Standard Specifications for Road and Bridge Construction, Section 612, or APPROVED equal.

2.07 STRUCTURAL EXCAVATION

GENERAL - Excavate to elevations and dimensions indicated on approved plans as necessary to provide space for construction operation and inspection. Fill unauthorized excess cuts at no extra cost to the AGENCY and/or OWNER with an APPROVED material as directed by the AGENCY.

PROTECTION - Comply with OSHA Construction Standards Subpart P Sections 1926.650-1926.653 for shoring and sloping walls of excavations. The design of shoring systems shall be provided by the CONTRACTOR at no extra expense to the AGENCY and/or OWNER.

SUBGRADE - Delay excavation of the final 6 inches of soil above the required subgrade elevation until just prior to the placement of the base material. Upon removal of soil to subgrade elevation, utilize hand tools to trim the excavation to final grade leaving a solid base to receive base material. Compact and consolidate any loose soil remaining at the bottom of the excavation. The bottom of the excavation shall be free of mud and muck and shall be stable enough to remain firm and intact under the feet of workmen before deposition of the base material. If suitable bearing is not encountered at the depth indicated on the Drawings, the CONTRACTOR should immediately notify the AGENCY and secure written instructions prior to proceeding.

DEWATERING - Keep excavations free from water. Discharge accumulated water into ditches, storm drains or other natural drainage ways. Dewatering shall be the responsibility of the CONTRACTOR and shall be considered incidental to the work being performed.

WASTE - Dispose excess or unsuitable material at an AGENCY APPROVED off-site location.

2.08 BLASTING

In general, blasting will not be allowed on any project within the AGENCY'S service area.

2.09 BACKFILL

INITIAL BACKFILL - Required for backfilling pipe trenches within unimproved surfaces. Place initial backfill in two layers to a point at least 12 inches above the top of embedded pipe utilizing hand methods or approved mechanical methods. Initial backfill material shall contain sufficient fine materials and shall be free of organic matter, refuse, ashes, cinders, frozen material, rock, large stones, boulders, and other unsuitable substances. Initial backfill shall be placed in a manner which will not disturb the embedded pipe.

FINAL BACKFILL - Place final backfill following the placement of initial backfill. Final backfill material shall contain sufficient fines necessary to provide a dense mass, free of voids and capable of the specified compaction. Stones larger than 6 inches in any dimension shall not be placed within 3 feet of the top of the pipe. Large stones may be placed in the remainder of the backfill if approved by the AGENCY and if well separated and so arranged that no backfill

settlement will result. Masses of stiff clay or other consolidated material greater than one cubic foot in volume shall not be allowed to fall more than 5 feet into the trench unless the pipe is cushioned by a minimum 3 feet of cover. Other special backfill requirements are as follows:

GRASS AREA - Provide excess backfill to compensate for anticipated settlement. Place backfill in a neat rounded manner covering the limits of the trench.

RIGHT-OF-WAY - Compact backfill in maximum 6-inch layers within right-of-way and at other locations indicated on the drawings to at least 85% maximum dry density.

IMPROVED SURFACES - Place select backfill conforming to the material requirements included in Section 2.10 of these specifications. Compact select backfill in maximum 6-inch lifts to a minimum density of 95 % standard proctor density at ± 2% of optimum moisture content as determined by ASTM D698. Obtain the services of a qualified soil-testing laboratory to provide the necessary lab and field testing to prove compliance with the requirements specified herein. Provide one standard proctor moisture-density curve complying with ASTM D 698 for each class of select fill material. Perform field density tests utilizing a nuclear density meter or other authorized equipment/procedure as directed by the AGENCY. A minimum of one test at a location determined by the AGENCY will be required for each improved surface crossing. Additional field density tests shall be performed as directed by the AGENCY.

EXTRA OR EXCESS BACKFILL MATERIAL - Maintain trench and excavated areas which have settled or have been excessively backfilled throughout construction for a period of one year following the substantial completion date at no additional cost to the AGENCY and/or OWNER. Provide additional suitable material as required to fill up depressions caused by settlement. Refill trenches as often as necessary to bring them back to original grade. Maintain roadway and driveway trenches in a manner that is acceptable for the proper maintenance of traffic. Remove from the construction site any excess material remaining following backfilling operations due to the installation of the pipe and bedding or the use of select or other backfill materials.

2.10 STRUCTURAL FILL

SOIL - Provide inorganic soils free from wood, garbage, cinders and other miscellaneous debris from an AGENCY approved source for use where shown on the drawings and/or as required by the AGENCY. Place in even horizontal layers not exceeding eight inches (8") in depth at ± 2% of optimum moisture content as determined by ASTM D698. Compact each lift to a density of at least 95% of the maximum dry density as determined by ASTM D698.

D.G.A. - Provide crushed limestone meeting the gradation requirements corresponding to DGA as specified in Section 805 of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction for use where shown on the drawings and/or as required by the AGENCY. Place DGA in horizontal layers not exceeding six inches (6") in depth and compacted with a vibratory roller or other approved compaction equipment to a density equivalent to 84% solid volume. The solid volume density shall be determined by the materials bulk specific gravity weight (ASTM C127).

FLOWABLE FILL - Place flowable fill concrete at locations specified on the Drawings. The design compressive strength shall be 80 psi at 28 days. The design mix shall consist of an AGENCY approved proportion of Type 1 Portland Cement (ASTM C-150), Fly Ash (ASTM C-618-85), Sand (ASTM C-33), Air Entrainment Admixture (ASTM C-260) and water.

TESTING - Obtain the services of a qualified soil-testing laboratory to provide the necessary lab and field testing to prove compliance with the requirements specified herein. Provide one standard proctor moisture-density curve complying with ASTM D698 for each class of select fill material. Provide the bulk specific gravity of DGA material utilizing test method ASTM C127. Perform field density tests utilizing a nuclear density meter or other authorized procedure as directed by the AGENCY. Provide a minimum of two (2) tests for each alternating lift of fill material at representative locations chosen by the AGENCY.

2.11 FINAL GRADING

Grade areas disturbed by construction to the elevations shown on the drawings or as necessary to match the grade of the adjacent area and to maintain drainage without any ridges or depressions. Remove all wood, clods, rocks and other debris that would interfere with surface restoration activities.

2.12 CLEANING UP

Remove surplus pipeline material, equipment, tools, forms, temporary structures from staging and work areas. Remove excess earth, stones, rubble, etc. from the work area and dispose in a manner complying with pertinent governmental laws and regulations. Dispose of rubbish, lumber, trash, etc. in an approved landfill facility.

2.13 MAINTENANCE OF SURFACES

Maintain the surfaces of unpaved trenches, roadways, drainage channels/pipes/structures, adjacent curb and gutters, sidewalks, shrubbery, fences and other disturbed surfaces and structures for a period of one (1) year following the certification of project completion by the ENGINEER. Perform maintenance work at intervals required by the ENGINEER to maintain compliance with the requirements set forth herein and pertinent governmental rules and regulations.

END OF SECTION

SECTION 03000 - GRAVITY SANITARY SEWER

3.01 SCOPE

This specification applies to all labor, materials, equipment, and services necessary for the construction of gravity sewers, and appurtenances as shown on the drawings in compliance with the requirements more fully described hereinafter.

3.02 SUBMITTALS

Submit **three (3)** copies of shop drawings, specifications, lists of material, material data sheets or other documentation as necessary to illustrate compliance with the requirements specified herein.

3.03 HANDLING AND STORAGE

Store and handle materials in accordance with APPROVED manufacturer standards. Prevent dirt, mud and other foreign material from coming into contact with materials during handling and storage.

3.04 GRAVITY SEWER SYSTEM MATERIALS

STANDARD SDR RATED PVC SEWER PIPE

A. General: Provide plastic gravity sewer pipe and fittings (type PSM) complying with the requirements of ASTM D3034. The standard dimension ratio (SDR) of all pipe and fittings shall not exceed 35 unless otherwise specified. The minimum pipe stiffness at 5% deflection shall be 46 psi for all sizes when tested in accordance with ASTM D2412. All PVC gravity sewer pipe shall be green in color.

B. Joints: Provide bell and spigot type joints conforming to ASTM D3212. Gaskets shall conform to the requirements of ASTM F477. All bells shall be formed integrally with the pipe and shall contain a factory installed elastomeric gasket that is positively retained. No solvent cement joints will be permitted in field construction except as specifically authorized by the AGENCY.

C. Fittings: Provide push-on joint fittings compatible with the supplied pipe and conforming to ASTM D3034.

DUCTILE IRON PIPE

A. Materials: Provide ductile iron pipe conforming to the standards set forth in ANSI A21.51 (AWWA C151-76 for grade 60-42-10 ductile iron pipe). Pipe shall have manufacturer's outside coating and a standard cement lining conforming to ANSI A21.4 (AWWA C104).

B. Joints: Provide mechanical joint pipes (AWWA C111-ANSI A21.11). Use of other joint types is subject to the approval of the ENGINEER and/or AGENCY.

C. Minimum Thickness: Minimum pipe thickness less cement lining for mechanical joint ductile iron pipes are as follows:

Size (in.)	Class	Wall Thickness (inches)
4	51	.26
6	51	.28
8	51	.30
10	51	.32
12	51	.34
14	51	.36
16	51	.37
18	51	.38
20	51	.39
24	51	.41

D. Fittings: Provide ductile iron mechanical joint fittings conforming to ANSI 21.10. Fittings shall have cement lining and inside and outside seal coating conforming to ANSI 21.4 (AWWA C104). Payment for fittings shall be incidental to the unit price of the bid item.

PRECAST CONCRETE MANHOLES

A. General: Provide precast bituminous coated concrete manholes and associated materials of the size indicated on the APPROVED drawings and meeting the following requirements:

B. Manholes: Provide pre-cast, bituminous-coated reinforced concrete manholes and related appurtenances conforming to ASTM C478 and ASTM D4479. Manhole joints and the joint between the casting and manhole shall be sealed with "E-Z Stik" butyl joint sealant or AGENCY APPROVED equal. Each joint shall provide a watertight seal.

C. Inverts: Manhole inverts shall be paved as shown on the Drawings with portland cement concrete. Provisions shall be made to provide a 0.10' (one-tenth of a foot) drop in elevation from inlet to outlet.

D. Pipe Connections: All holes for pipe connections in manholes shall have a factory-installed flexible rubber pipe connector system to prevent infiltration. The pipe connector shall conform to the latest revision of ASTM C923. For manholes of 12 feet or less in depth, without the presence of ground water, the pipe connector system shall be PSX as manufactured by Press-Seal Gasket Corporation, or an AGENCY APPROVED equivalent. For manholes of 12 feet or greater in depth, or when ground water is present, the pipe connector system shall be A-Lok Manhole Pipe Seal as manufactured by A-Lok Corporation, Trenton, NJ, or an AGENCY APPROVED equivalent.

E. Frames and Covers: Manhole frames and covers shall be Neenah R-1642 as manufactured by Neenah Foundry Company, or an AGENCY APPROVED equivalent. For applications requiring watertight and/or bolt-down lids, provide Neenah R-1916-F series as manufactured by Neenah Foundry Company, or an AGENCY APPROVED equivalent. All manhole castings shall be made in the USA.

F. Steps: MA Industries model PSI-PF manhole steps, or AGENCY APPROVED equal.

GROUT

Provide non-shrink, non-metallic grout complying with the requirements of Section 601.06 of the Ky. Dept. of Highways Standard Specifications for Road and Bridge Construction.

CONCRETE

Concrete mixtures shall comply with the requirements of Section 601 of the Ky. Dept. of Highways Standard Specifications for Road and Bridge Construction. Provide Class AA Concrete for all applications requiring metal reinforcement. Class AA concrete shall conform to the following:

Slump: 3" / ±1"
Air: 5% / ±1%
Temp.: 45^{O} / 90^{O} F

Class B concrete shall be used for all non-reinforced concrete applications as well as fill for cavities or voids and mass footings. Slump, air and temperature requirements at time of placement are equivalent to those for Class AA concrete above.

METAL REINFORCEMENT

Provide metal reinforcement complying with the requirements of the latest revision of ASTM Specification A615, grade 60. Reinforcement steel shall be free from paint, oil, grease, loose scale, dirt or other substances that would prevent bond between steel and concrete.

PIPE BEDDING

Provide crushed limestone aggregate conforming to the gradation requirements for designation 9M in accordance with the gradation requirements of the Ky. Dept. of Highways Standard Specifications for Road and Bridge Construction, or AGENCY APPROVED equal.

SELECT FILL

A. Limestone DGA: Provide limestone DGA complying with the gradation requirements of Section 805 of the Ky. Dept. of Highways Standard Specifications for Road and Bridge Construction.

B. Flowable Fill: Place flowable fill concrete at locations specified on the Drawings. The design compressive strength shall be 80 psi at 28 days. The design mix shall consist of an

ENGINEER APPROVED proportion of Type 1 Portland Cement (ASTM C-150), Fly Ash (ASTM C-618-85), Sand (ASTM C-33), Air Entrainment Admixture (ASTM C-260) and water.

STEEL CASING PIPE

Provide steel encasement pipe complying with the requirements of ASTM A139 at the locations specified on the drawings. All encasement pipes shall have minimum yield strength of 35,000 psi and a minimum thickness of 0.25 inches. Encasement pipe shall be thoroughly coated with asphalt bitumen on exterior surfaces. See Sub-Section 3.13 – "Installing Pipe Through Casings", for installation of carrier pipe through casing pipe.

3.05 MATERIAL HANDLING

Inspect all materials upon delivery. Return and replace defective materials. Unload, move, store and otherwise handle material in a safe and workmanlike manner in strict accordance with material manufacturer's recommendations. All materials damaged prior to installation shall be replaced with materials complying with the requirements of pertinent specifications prior to installation at no extra cost to the AGENCY and/or OWNER/DEVELOPER.

3.06 OBSTRUCTIONS

Where obstructions (other than utilities) not shown on the plans are encountered during the progression of the work and interfere to such an extent than an alteration in the plans is required, the AGENCY shall have the authority to change the plans and order deviations from the line and grade or to arrange with the individual owners of the structures for removal, relocation, or reconstruction of the obstruction. If the plan revisions result in a change in the amount of work by the CONTRACTOR, such altered work shall be done on the basis of payment to the CONTRACTOR for extra work, or credit to the AGENCY and/or OWNER for less work. All costs associated with relocation of any utility obstruction are the responsibility of the CONTRACTOR.

3.07 GRADE AND ALIGNMENT

Construct gravity sewers to the lines and grades depicted on the Drawings. Utilize a laser device designed to be suitable for use in the installation of sewers to maintain the proper line and grade. Verify the grade and alignment of the sewer utilizing conventional surveying equipment (transit and/or level) at 100-ft. intervals as requested by the ENGINEER.

Batter boards may be utilized as guides for alignment and grade of the SANITARY SEWER if they are provided at the following intervals:

Percent Grade of Sewer	Interval
0% to 0.4%	20 feet
0.4% to 5%	25 feet
>5%	50 feet

3.08 TRENCH EXCAVATION

Excavate trenches to the required width, alignment and grade as depicted on the Drawings. Comply with the specified requirements set forth in *Section 02000 Earthwork* and all applicable governmental regulations and laws.

3.09 BEDDING

Upon excavation of the trench to the required subgrade elevation, place and compact bedding (per Section 3.04) to the required grade. Provide 5" (min.) of bedding throughout the length of the pipe installation. Bedding material shall be placed in a manner that will provide adequate support under the pipe in a longitudinal direction. Blocking shall not be used as a means of holding grade during the placement of bedding. Excavate bell holes in the bedding at each joint to accommodate the assembly of each joint of pipe while maintaining uniform pipe support.

3.10 LAYING AND JOINING PIPE AND FITTINGS

GENERAL PROCEDURE

A. Prior to installation, each component of piping shall be cleaned and inspected for damage. Damaged components shall be rejected and replaced.

B. Following excavation of trench to specified subgrade elevation, place bedding material to grade to provide a firm and satisfactory bed.

C. Initiate pipe-laying operations at the lowest elevation and terminate only at manholes, service branches or cleanouts. Pipe bells shall be laid on the upstream end of each joint of pipe.

D. Plug the end of the pipe to prevent the entrance of water, mud or any other foreign matter whenever pipe laying operations are interrupted. Secure the pipe as necessary to prevent dislodgment.

E. Upon completion of each joint, place and consolidate bedding material under the pipe haunch and up to the spring line to provide adequate pipe support to the pipe while avoiding both vertical and lateral displacement of the pipe from the proper alignment. Backfill trench as specified herein.

LOCATION AND ALIGNMENT

A. Embed pipe and fittings in the trench with the invert conforming to the required elevations, slopes and alignment, and with the pipe bottom uniformly and continuously supported by a firm bedding and foundation.

JOINING PIPE AND FITTINGS

A. Field cut pipe with either hand or mechanical saws or plastic pipe cutters as needed. Pipe ends shall be cut square and perpendicular to the pipe axis. Spigots shall have burrs removed and ends smoothly beveled by mechanical means or by hand with a rasp or file. Place stop marks on field cut spigots with a felt tip marker or wax crayon to

ensure proper insertion length during assembly. The angle and depth of field bevels and lengths to stop-marks shall be comparable to factory pipe spigots. For pipes with external profile, follow the manufacturer's recommendations for cutting and beveling pipe in the field.

B. The area left in the bedding for the bell shall be no larger than necessary to accomplish proper joint assembly. When the joint has been made, fill remaining void underneath the bell and spigot area with bedding material to provide adequate support to the pipe throughout its entire length.

C. Assemble joints in accordance with the recommendations of the manufacturer. If lubricant is required to facilitate assembly, it shall have no detrimental effect on the gasket or on the pipe when subjected to prolonged exposure. If requested by the AGENCY, verify the proper assembly of the joints by rotation of the spigot by hand or with a strap wrench. If unusual joining resistance is encountered or if the insertion mark does not reach the flush position, disassemble the joint, inspect for damage, reclean the joint components and repeat the assembly steps. Unless otherwise APPROVED by the AGENCY, each joint shall be made utilizing non-mechanical means such as the bar and block method.

3.11 SERVICE LINES, CONNECTIONS AND INCIDENTAL STRUCTURES

BRANCH FITTINGS

A. Fittings for service connections, drop manholes, stacked laterals, siamese laterals, cleanouts, etc. shall be molded or fabricated with all gasket connections.

B. Service line taps into existing lines shall be made utilizing a gasket fitting in conjunction with a repair sleeve coupling or, where APPROVED by the AGENCY, utilizing a gasket saddle wye with all stainless-steel clamps. Holes for saddle connections shall be made with hole saws or by use of keyhole or saber saw. Holes for wye saddle connections shall be laid out with a template, de-burred and carefully beveled to provide a smooth hole to conform with the dimensions of the fitting.

SERVICE LINES - Unless otherwise shown on the Drawings, service lines shall be extended from the main to the property line at a minimum depth of 8', uniform alignment and a minimum grade of 1/8" per foot and maximum grade of 1/4" per foot. Where the depth of the service lateral would exceed 10' at the property line following the grade constraints outlined above, a vertical stack shall be constructed in accordance with the typical details on the Drawings at the connection of the service line at the main.

PIPE CAPS AND PLUGS - All caps and plugs should be braced, staked, anchored, wired or otherwise secured to the pipe to prevent leakage under the maximum anticipated thrust from internal abnormal pressures associated with testing.

CLEANOUTS – Six-Inch (6”) cleanouts shall be installed at the property line or back of easement whichever is nearest the proposed or existing structure. Cleanouts shall extend a minimum of 24” out of the ground. Cleanout construction shall be in accordance with the APPROVED plans. The CONTRACTOR and/or OWNER/DEVELOPER shall be responsible for any damage to new (or existing) cleanouts for the duration of the project. Individual protective cleanout boxes may be required at the AGENCY’S request.

3.12 MANHOLES

EXCAVATION AND BASE PREPARATION - Excavation for manholes shall be in accordance with the requirements for structural excavations as outlined in *Section 02000 Earthwork* of these specifications. Pre-cast concrete manhole bases shall be placed on a compacted rock base consisting of 6" of dense graded aggregate (DGA) limestone material. The base material shall be compacted to a minimum density of 95% of the maximum dry density of the material as determined by ASTM D698.

JOINT SEALING - Joints between the manhole barrel sections, upper barrel section and casting and the manhole barrel and invert shall be sealed with manhole joint sealant as specified in Section 03000 of these specifications. Joint sealant shall be placed in accordance with manufacturer's recommendations as necessary to ensure that all joints are sealed sufficiently to prevent the inflow of storm water or infiltration of ground water.

CASTING - Unless otherwise noted on the drawings, watertight bolt down lids shall be utilized at all locations where manholes are located within ditch lines, drainage channels, floodplains or other locations which may be periodically submerged. Standard castings shall be utilized at all other locations.

FINAL GRADE - Approximate casting elevations are shown on the Drawings. The final casting elevation shall be adjusted in the field as conditions warrant. Adjust manholes as necessary to ensure that the top of casting is flush with the surrounding surfaces, unless otherwise instructed by the AGENCY. All manhole rim adjustments required due to final site grading shall be the responsibility of the CONTRACTOR and/or OWNER/DEVELOPER.

PIPE CONNECTIONS - Pipe connections at manholes with pre-cast invert sections shall be made utilizing the gaskets specified in *Section 03000 Gravity Sanitary Sewer* of the specifications. Pipe connections into existing manholes, where core drilling in the manhole barrel is required, shall be made utilizing a watertight manhole boot as APPROVED by the AGENCY.

CAST IN PLACE INVERTS - For inverts cast in place, the pipe may first be laid through and beyond the manhole location followed by overbuilding the manhole, grouting the bench and cutting out the top of the pipe in the manhole.

GROUT - Fill all handling holes and minor imperfections with non-shrink, non-metallic portland cement grout and finish grouted areas to match the immediate surrounding area of the structure.

3.13 INSTALLING PIPE THROUGH CASINGS

Install encasement meeting the requirements specified in *Section 03000 Gravity Sanitary Sewer* of these specifications at the location indicated on the Drawings. Encasement shall be installed using either the open cut method (utilized where surfaces are unimproved) or the bore and jack method (utilized where surfaces are improved or for railroad crossings) as specified on the drawings. Polyethylene pipeline spacers shall be strapped around the pipe as depicted on the Drawings to support the pipe within the casing. Spacers shall be as manufactured by Pipeline Seal and Insulator, Inc. (PSI), or AGENCY APPROVED equivalent. Casing End Seals shall be installed to casing and carrier pipe with use of stainless-steel bands. End Seals shall be as manufactured by Advance Products & Systems, Inc., or AGENCY APPROVED equivalent. A minimum of two (2) supports shall be used per joint of pipe providing a maximum span of 6 1/4 feet for PVC pipe lengths of 12.5 feet. The maximum span between supports for pipe lengths of 20 feet shall not exceed that shown in the table below:

Nominal Pipe Size Inches	Unsupported Span Feet
4	6.0
6	7.8
8	9.5
10	11.0
12	12.4
15	14.2
18	16.2
21	18.1
24	19.6
27	20.0*
30	20.0*
36	20.0*

Note: Each joint must be supported. Therefore, the maximum unsupported span will always be limited by pipe length.

3.14 BACKFILL

Following the placement of bedding material, backfill shall be placed in accordance with the provisions outlined in *Section 02000 Earthwork*. Provide a minimum of 30 inches cover over the top of the pipe before the trench is compacted with a wheel loader. Provide at least 48 inches of cover before using mobile trench compactors of the hydro-hammer or impact type.

3.15 RESTORATION OF SURFACES AND/OR STRUCTURES

The CONTRACTOR shall restore and/or replace paving, curbing, sidewalks, gutters, shrubbery, fences, sod or other disturbed surfaces or structures to a condition equal to that which existed before the work began to the satisfaction of the AGENCY. All surfaces shall be maintained in accordance with provisions outlined in *Section 02000 Earthwork* of these technical specifications.

3.16 PERFORMANCE AND ACCEPTANCE TESTS

All projects shall be tested upon completion of the installation. All testing shall be in accordance with *Section 05000 Sanitary Sewer Testing*. The CONTRACTOR shall supply all testing equipment. Sections of sewer which fail to pass the tests shall have defects located and repaired or replaced, and shall be retested until within the specified allowance. Certification of substantial completion will not be issued until such time all of the SANITARY SEWER installation has been tested and found to be satisfactory and all surface/structure restoration and clean up has been completed.

3.17 AS-BUILTS

At the completion of the Work, the CONTRACTOR shall deliver to the AGENCY, a complete intact copy of Record Drawings ("AS-BUILTS"). It shall be the responsibility of the CONTRACTOR to maintain an accurate set of AS-BUILT Drawings as work progresses. This set of AS-BUILT Drawings shall be kept on the job site at all times. The AS-BUILT plans shall accurately depict the location of the new facilities installed and any deviations made from the Drawings.

Submission of the AS-BUILT Drawings will be required prior to issuance of final payment. In addition, verification by the AGENCY that AS-BUILT drawings are periodically maintained will be required prior to each partial payment by the AGENCY and/or OWNER/DEVELOPER.

The AS-BUILT Drawings for SANITARY SEWER construction shall accurately depict (at a minimum) the following information:

A. The location of SANITARY SEWER mains and force mains shall be indicated, including the angle of the main constructed at each manhole.
B. Manhole lid elevations and manhole inverts.
C. Sewer laterals shall be referenced to the nearest downstream manhole, measured along the centerline of the sewer main.
D. The length of the lateral shall be measured at right angles from the centerline of the wye to the end of the lateral.
E. The depth of the lateral at the main shall be measured from the top of ground to the top of the wye on the main.
F. The location of the lateral at the property line shall be measured from the nearest property corner.
G. The depth of the lateral at the property line shall be measured from the top of ground to the top of the lateral.

3.18 PAYMENT

Payment for Gravity SANITARY SEWER shall include all equipment, labor, material, excavation, dewatering, bedding, backfill, surface restoration, and testing as outlined in these specifications and as required by the AGENCY to provide a complete and functional system.

END OF SECTION

SECTION 04000 – SANITARY SEWER FORCE MAIN

4.01 SCOPE

This specification applies to all labor, materials, equipment, and services necessary for the construction of sewer force mains, and appurtenances as shown on the drawings in compliance with the requirements more fully described hereinafter.

4.02 SUBMITTALS

Submit three (3) copies of product data sheets on material to be used.

PRODUCT DATA

A. Materials list of items proposed to be provided under this Section.
B. Manufacturer's specifications and other data needed to prove compliance with the specified requirement.
C. Names and addresses of the nearest service and maintenance organization that readily stocks repair parts.
D. Manufacturer's recommended installation procedures which, when APPROVED by the AGENCY, will become the basis for accepting or rejecting actual installation procedures used on the Work.

4.03 MATERIALS

A. Defective Materials: The CONTRACTOR shall be responsible for all material furnished by him, and shall replace at his own expense all such material found defective in the manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of material found defective prior to final acceptance of the work of prior to expiration of warranties.

B. Storage of Materials: The CONTRACTOR shall be responsible for the safe storage of materials furnished by or to him and accepted by him and intended for the work until it has been incorporated in the completed project. Material, all pipes, fittings, and other accessories shall be kept free from dirt and foreign matter at all times.

C. Pipe Materials: Provide pipe and associated materials of the size indicated on the Drawings and meeting the following requirements:

1. Ductile Iron Pipe and Fittings:

a. General: Ductile Iron Pipe (Class 51) shall be designed in accordance with ANSIA 21.50 (AWWA C150) and shall conform to the standards set forth in ANSI 21.51 (AWWA C151 for grade 60-42-10 ductile iron pipe).

b. Coating and Lining: Pipe shall have manufacturer's outside coating and a standard cement lining conforming to ANSI 21.4 (AWWA C104).

c. Joints: Interior pipe joints may be either 125-pound flanged joint ANSI A21.15 (AWWA C115) or 125-pound cast iron “Uni-Flange” adapter (ANSI B16.1 - ANSI B16.5) as manufactured by Uni-Flange Corporation at Northboro, Massachusetts. Pipe joints that are located outside, either exposed or backfilled, shall be mechanical joint ANSI A21.11 (AWWA C111).

d. Minimum Thickness: Minimum pipe thickness for push-on joint ductile iron pipe is shown is Table 1 as follows:

TABLE 1. MINIMUM DUCTILE IRON PIPE THICKNESS

Size	Class	Pipe Metal Thickness (Inches)
$2^1/_2$	51	0.25
4”	51	0.26
6”	51	0.28
8”	51	0.30
10”	51	0.32
12”	51	0.34
14”	51	0.36
16”	51	0.37
18”	51	0.38

e. Fittings: Fittings installed below grade shall be mechanical joint, ductile iron conforming to AWWA C153. Fittings shall have cement lining and inside and outside seal coating conforming to ANSI 21.4 (AWWA C104). Fittings installed above grade shall be flanged end, ductile iron conforming to ANSI 21.10 (AWWA C110).

2. Plastic Pipe and Fittings (Open Cut): Plastic pipe for open cut applications shall be rigid unplasticized polyvinyl chloride (PVC) conforming to the requirements of ASTM D 1784 and ASTM D 2241. Pipe shall have a minimum standard dimension ratio (SDR) of 21 and a pressure rating of 200 psi complying with ASTM D2241. The PVC compound used in the manufacture of this pipe shall meet or exceed the requirements for class 12454-A or 12454-B as defined by ASTM D1784. Plastic pipe joint shall be of the push-on type with a continuous elastomeric ring gasket compressed into the annular space between bell and spigot end of pipe complying with ASTM D 3139 for SANITARY SEWER flow. Plastic pipe is to be green in color.

3. Plastic Pipe and Fittings (Directional Drill): Plastic pipe for directional drilling applications shall be Certa-Lok™ Yelomine™ thrust-restrained PVC with Iron Pipe Size (I.P.S.) outside diameters designed for permanent use, as manufactured by CertainTeed Corporation, or AGENCY APPROVED equal.

4. Joints: Fittings installed below grade shall be mechanical joint, ductile iron conforming to AWWA C153. Fittings shall have cement lining and inside and

outside seal coating conforming to ANSI 21.4 (AWWA C104). Fittings installed above grade shall be flanged end, ductile iron conforming to ANSI 21.10 (AWWA C110).

D. Mechanical Joint Thrust Restraint: Mechanical joint restraint shall be incorporated in the design of the follower gland for fittings where noted on the Drawings. The restraint mechanism shall consist of a plurality of individually activated gripping surfaces to maximize restraint capability. Glands shall be manufactured of ductile iron conforming to ASTM A536-80. The gland shall be such that it can replace the standardized mechanical joint gland and can be used with the standardized mechanical joint bell conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153 of latest revision. Twist-off nuts, sized same as tee-head bolts, shall be used to ensure proper actuating of restraining devices. The restraining glands shall have a pressure rating equal to that of the PVC pipe on which it is used and shall be EBAA Iron, Inc. Megalug, or APPROVED equal.

E. Valves and Fittings: All valves and fittings for buried service on the ductile iron or PVC force mains shall be cast iron or ductile iron with mechanical joint type pipe connections.

F. Locator Wire and Tape: Tracer wire and locator tape shall be furnished and installed with all force mains. The tracer wire shall be taped or suitably held over the top center of the pipe and shall be #12 copper wire with THW insulation or APPROVED equal. All splices shall be soldered or mechanically bound (compression fittings) and shall be wrapped with a waterproof wrapping to ensure continuity and insulation of the copper wire from the soil and securely connected at flange bolts to all valves and fittings to provide a suitable electrical connection. The electrical continuity of tracer wire between valves shall be verified and defects found shall be corrected prior to acceptance by the AGENCY. A metallic locator tape shall be buried in the trench a minimum of 12” over the top of the pipe and a minimum of 12” below the finished grade. The words “Caution Sewer Force Main Below” shall be repetitively printed along the length of the tape.

4.04 INSTALLATION

A. Obstructions: Where obstructions (other than utilities) now shown on the plans are encountered during the progress of the work and interfere to such an extent that an alteration in the plans is required, the ENGINEER shall have the authority to change the Plans and order deviations from the line and grade or to arrange with the individual owners of the structures for removal, relocation, of reconstruction of the obstruction. If the change in Plans results in a change in the amount of work by the CONTRACTOR, such altered work shall be done on the basis of payment to the CONTRACTOR for extra work, or credit to the AGENCY and/or OWNER for less work. All costs associated with relocation of any utility obstruction are the responsibility of the CONTRACTOR.

B. Handling: Pipe shall be handled without dropping or bumping in a manner to ensure installation in a sound, undamaged condition. Pipe shall be lifted with slings or as recommended by the manufacturer. Hooks in contact with joint surfaces shall not be used. Equipment used for handling shall be capable of the required work with an adequate safety factor against overturning or overloading.

4.05 PIPE LAYING

A. General: Proper implements, tools and facilities shall be provided and used by the CONTRACTOR for the safe and convenient prosecution of the work. All pipe fittings and valves shall be carefully lowered into the trench piece by piece by means of a derrick, ropes of other suitable tools or equipment, in such a manner as to prevent damage to force main materials.

B. Alignment and Grade: All pipes shall be laid and maintained to the required lines and grades shown on the drawings, and as required to prevent undue deflections and breakages after flow has been placed in the lines to the operating pressures. Fittings and valves shall be set at the required locations, spigots centered in valves and all valves stems set plumb.

C. Depth of Pipe: All pipes shall be laid to a minimum depth of cover over the top of the pipe of three feet (3 ft.) in all areas.

D. Factory Representative: No pipe shall be laid, until factory representative of the company supplying the pipe visits the site and instructs the CONTRACTOR in the manner, ways and procedures of installing the pipe for this particular project. The length of the initial visit shall be of sufficient time to thoroughly acquaint the CONTRACTOR with acceptable methods of laying, blocking and backfilling in and around the pipe. All pipe laying shall be in strict accordance with the manufacture's recommendations and installation manual unless otherwise specified herein.

E. Trench Water: No pipe shall be laid in water, or when the trench conditions of the weather are unsuitable for the work to be done. When pipe laying is not in progress, the open ends of the pipe shall be closed to exclude trench water, dirt, and small animals from the pipe. Whenever trench water is excluded from the interior of the pipe, adequate backfill shall be deposited upon the pipe to prevent floating. Any pipe which has floated shall be removed from the trench and relayed as directed.

F. Placing: After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with APPROVED backfill material tamped under it except at the joints. Pipe and fittings which do not allow a sufficient and uniform space for fittings of proper dimensions to ensure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.

G. Protection: At times pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug. Joints of pipe in the trench which cannot be completed shall be caulked with packing to make watertight as possible.

H. Unsuitable Laying Conditions: No pipe shall be laid on frozen ground, in water, or when trench conditions are unsuitable.

I. Anchorage of Bends, Tees and Plugs: At all tees, plugs, caps and bends $11^{1}/_{4}$ degrees and over, movement shall be prevented by using appropriately sized thrust blocking. Thrust

blocks and supports shall be as shown in the typical details, with sufficient volume of concrete being provided, but care being taken to allow for future tightening of all nearby joints.

J. Grades: The grade of the force main shall be gradually changed to lower the line where necessary to get under existing utilities.

K. Permissible Deflection at Joints: Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstruction or plumb stems, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory making of the joint and push-on joint ductile iron pipe shall not exceed those tabulated in Table I and Table II AWWA specification C600. Where pipe is laid in long radius curves, the CONTRACTOR is to ensure that the pipe be positioned firmly against the outside of the trench to prevent shifting under pressure.

L. Cutting Pipe: The cutting of pipe for inserting valves, fittings, of closure pieces shall be done in a neat and workmanlike manner without damage to the pipe so as to leave a smooth end at right angles to the axis of the pipe. If the cut end of the pipe is to be inserted into the bell end with gasket, the outside edge of the filed cut plain end pipe shall be conditioned for use by filing of grinding a small taper at an angle of about thirty degrees.

4.06 VALVES

A. Location: Valves shall be located as shown on the Plans and APPROVED by the ENGINEER.

B. Valve Boxes and Valves Pits: A valve box shall be provided for every valve. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box culvert flush with the surface of the finished pavement or such other level as may be directed.

C. Combination Air Release Valve: The air release valves shall be constructed complete, including the manhole where called for on the Plans and/or as directed by the AGENCY. The complete installation shall include concrete valve vault and cast-iron top. Combination air release valves shall be A.R.I. Model D-025 as manufactured by A.R.I. USA, Inc.

4.07 ROAD AND DRIVE CROSSINGS

Crossings at existing paved roadways and drives shall be installed by directional drilling methods, unless otherwise directed by the AGENCY. Crossings at gravel roadways and drives shall be installed by open cut, unless otherwise directed by the AGENCY. Gravel roadways and drives shall be restored with full-depth compacted rock backfill per the plans. The final rock surface shall match the material and color of the existing surface.

4.08 HIGHWAY CROSSINGS

The method of making the highway crossing shall be in accordance with the requirements of the Kentucky Department of Highways in every respect, and under no circumstance shall work

begin on highway crossings until the CONTRACTOR has secured and paid for all permits and posted all bonds requires by the said Department of Highways.

4.09 UTILITY CROSSINGS

Generally, the sewer force main shall cross below all other utilities excluding water, so that a clear distance between the sewer main and the other utilities is at least **eighteen (18)** inches. There shall be a clear distance of **twenty-four (24)** inches between gas or petroleum transmission lines and the force main. Individual utility owners shall be contacted prior to the construction of any crossing.

4.10 CREEK CROSSINGS

PVC pipe used at creek crossings shall be encased in 3,000 psi concrete filled to sufficient depth to prevent floating of the empty pipe. The concrete may be poured into an unformed ditch around the pipe. The concrete encasement shall cover the length of the pipe at the normal pool stage of the creek. The CONTRACTOR shall take necessary steps to prevent floating of pipe during the pouring and curing time of the concrete.

4.11 STEEL CASING PIPE

Provide steel encasement pipe complying with the requirements of ASTM A139 at the locations specified on the drawings. All encasement pipes shall have minimum yield strength of 35,000 psi and a minimum thickness of 0.25 inches. Encasement pipe shall be thoroughly coated with asphalt bitumen on exterior surfaces. Install encasement meeting the requirements at the location indicated on the Drawings. Encasement shall be installed using either the open cut method or the bore and jack method as specified on the drawings. Polyethylene pipeline spacers shall be strapped around the pipe as depicted on the Drawings to support the pipe within the casing. Spacers shall be as manufactured by Pipeline Seal and Insulator, Inc. PSI), or APPROVED equivalent. Casing End Seals shall be installed to casing and carrier pipe with use of stainless-steel bands. End Seals shall be as manufactured by Advance Products & Systems, Inc., or APPROVED equivalent. A minimum of two supports shall be used per joint of pipe providing a maximum span of 6 1/4 feet for PVC pipe lengths of 12.5 feet. The maximum span between supports for pipe lengths of 20 feet shall not exceed that shown in Table 2 below:

TABLE 2. MAXIMUM SPAN BETWEEN SUPPORTS

Nominal Pipe Size Inches	Unsupported Span Feet
4	6.0
6	7.8
8	9.5
10	11.0
12	12.4
15	14.2
18	16.2
21	18.1

24	19.6
27	20.0*
30	20.0*
36	20.0*

*Note: Each joint must be supported. Therefore, the maximum unsupported span will always be limited by pipe length.

4.12 FIELD INSPECTION

All pipe and accessories shall be laid, jointed and tested under pressure for defects and leakage. All materials found during the progress of the work, having cracks, flaws of other defects will be rejected. The CONTRACTOR shall promptly remove all defective materials from the site.

4.13 REPAIRING LEAKS

After flow has been placed in the lines and any breaks, pipe rupture, or leaks occur, the CONTRACTOR shall repair same with new joints of pipe at no cost to the AGENCY and/or OWNER/DEVELOPER. The CONTRACTOR shall not be allowed to use repair clamps.

4.14 CLEAN UP

The CONTRACTOR shall be responsible for all cleanup work incidental to the installation of all pipe, fittings and valves and shall be responsible for the backfill throughout the course of the work and until the disturbed ground reaches its original condition.

4.15 PERFORMANCE AND ACCEPTANCE TESTS

All projects shall be tested upon completion of the installation. All testing shall be in accordance with *Section 05000 Sanitary Sewer Testing*. The CONTRACTOR shall supply all testing equipment. Sections of sewer which fail to pass the tests shall have defects located and repaired or replaced, and shall be retested until within the specified allowance. Certification of substantial completion will not be issued until such time all of the sewer installation has been tested and found to be satisfactory and all surface/structure restoration and clean-up has been completed.

4.16 AS-BUILTS

At the completion of the Work, the CONTRACTOR shall deliver to the AGENCY, a complete intact copy of Record Drawings (AS-BUILTS). It shall be the responsibility of the CONTRACTOR to maintain an accurate set of AS-BUILT Drawings as work progresses. This set of AS-BUILT Drawings shall be kept on the job site at all times. The AS-BUILT plans shall accurately depict the location of the new facilities installed and any deviations made from the Drawings.

Submission of the AS-BUILT Drawings will be required prior to issuance of final payment. In addition, verification by the AGENCY that record drawings are periodically maintained will be required prior to each partial payment by the AGENCY and/or OWNER/DEVELOPER.

The AS-BUILT Drawings for SANITARY SEWER construction shall accurately depict the following information:

A. The location of SANITARY SEWER force mains, bends, air valves, and structures shall be indicated.

B. Elevations shall be provided at a minimum of 100-foot intervals and at all bends, high points, low points, air valves, and at locations where elevations are called out on the plans.

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4.17 PAYMENT

Payment shall be per linear foot of sewer force main installed. Payment shall include pipe, fittings, bedding, surface restoration, driveway pipe replacement and appurtenances. Payment includes compensation for all tools, labor and equipment necessary. Air Release Valve Payment per each shall include air release valve, valve vault, piping, fittings, bedding and appurtenances. Payment includes compensation for all tools, labor and equipment necessary.

END OF SECTION

SECTION 05000 – SANITARY SEWER TESTING

5.01 SCOPE

Provide all material, equipment, tools and labor necessary to perform the tests specified herein.

5.02 SUBMITTALS

Submit **one (1)** copy of each required test data form to the AGENCY within 7 days of the completion of each test.

5.03 GRAVITY SEWER LAMP TEST

Perform the lamp test, as directed by the AGENCY, to verify the accuracy of alignment of the installed sewer and that the sewer is free of debris and obstructions. The lamp test shall be performed following the placement of at least one (1) foot of backfill over the section of sewer to be tested. The segment of sewer shall be visually lamped with lights or mirrors. The line shall be visually inspected at the manhole opposite of the manhole in which being illuminated. The full diameter of the pipe in respect to the vertical axis should be visible and a minimum 7/8 of the diameter of the pipe in respect to the horizontal axis should be visible when viewed. Segments of sewer not meeting the requirements above shall be removed and re-laid as necessary to meet the requirements.

5.04 GRAVITY SEWER DEFLECTION TEST

Perform a deflection test a minimum of thirty (30) days after the trench section has been backfilled, or as specified by the AGENCY. The maximum allowable deflection shall be limited to five (5) percent of the base inside diameter of the sewer. The test shall be performed by pulling an AGENCY APPROVED mandrel through the segment of sewer being tested. Segments that have deflected more than the allowed five (5) percent shall be removed and re-laid in accordance with the installation specifications. Following reconstruction, the segment shall be retested for deflection. The size of the mandrel shall be verified by the ENGINEER prior to beginning the test.

5.05 GRAVITY SEWER LOW PRESSURE AIR TEST

GENERAL - Perform a low-pressure air test on each segment of sewer between manholes following the backfilling of the sewer trench to the specified final grade. Tests shall be conducted in the presence of the ENGINEER. Unless otherwise specified, procedures and equipment for the low-pressure air test shall comply with the requirements specified in the "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe" UNI-B-6-90 published by Uni-Bell PVC Pipe Association.

PROCEDURE - Plug all pipe openings with pipe plugs after the test section has been cleaned and wetted. The air temperature in the test section should be between 45 degrees and 95 degrees Fahrenheit. The interior of the pipe should be wet immediately prior to the installation of the plugs. Pressurize the pipe section to a pressure between 3.5 psig and 4.0 psig and allow time for the pressure to stabilize. When the pressure has stabilized and is at least 3.5 psig, record the time required for the pressure to drop 0.5 psi. The test pressure shall be adjusted

for segments of sewer below the water table. The pressure shall be increased by dividing the vertical distance (ft.) of the phreatic surface over the sewer invert by 2.31. The minimum allowable times for the 0.5-psig pressure drop for plastic pipe is attached as Table 1. Test identification information and data shall be recorded on the AGENCY's Air Test Data Sheet. If the pressure drop exceeds 0.5 psig in the specified time period, the CONTRACTOR shall at his own expense; repair the defective joints or sections until the pressure drop is within the specified allowance.

TABLE 1. MINIMUM SPECIFIED TIME REQUIRED FOR SIZE AND LENGTH OF PIPE (FOR A 0.5 PSIG PRESSURE DROP)

Pipe Dia. (in.)	Min. Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	1:53	597	.190 L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	.427 L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	26:04	43:16	50:30	57:42	46:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

5.06 FORCE MAIN PRESSURE TEST

A. General: After the trench has been backfilled as specified, all piping with the exception of any valved section shall be subjected to a pressure test under the supervision of the ENGINEER and the AGENCY. **The amount of pressure applied to the new system will be determined by the AGENCY and/or ENGINEER based on anticipated pumping conditions.** In no scenario shall the test pressure exceed 150 psi.

B. Length of Test: The duration of each pressure test shall be at least three (3) hours, after reaching the required test pressure.

C. Procedure: Each valve section of the pipe shall be slowly filled with water and the specified test pressure applied by means of a pump connected to the pipe in a manner satisfactory to the AGENCY. The pump, pipe, connections, gauges and all necessary apparatus shall be furnished by the CONTRACTOR. The test connection shall be made at the highest point in the test section or provisions made for pressure differentials due to elevations. The test

pressure may not vary + or -5 psi for the duration of the test.

D. Expelling Air: Before applying the test pressure, all air shall be expelled from the pipe. If hydrants of blow-off valves are not available at high places, the CONTRACTOR shall make the necessary taps (requires service clamp and corporation stop) at points of highest elevation before the test is made with the approval of the AGENCY. These taps shall be left in place and location marked.

E. Defects: Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of this pressure test shall be removed and replaced by the CONTRACTOR with new material in the manner specified and the test shall be repeated until satisfactory to the AGENCY.

5.07 FORCE MAIN LEAKAGE TEST

A. General: A leakage test shall be conducted concurrently with the pressure test. The duration of each leakage test shall be three hours and during the test, the main shall be subject to the required test pressure.

B. Permissible Leakage: Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No pipe installation will be accepted until the leakage is less than the number of gallons per hour as determined by Table 2 as follows:

TABLE 2. ALLOWABLE LEAKAGE PER 1,000 FEET OF PIPELINE

Pipe Size (in.)	Maximum Loss (Gal./Hr.)	Test Pressure (PSI)	Test Period (Hours)
10	0.92	150	3
8	0.74	150	3
6	0.55	150	3
4	0.37	150	3
3	0.28	150	3
$2^1/_2$	0.23	150	3
2	0.18	150	3

C. Procedure: Each end of the main shall be capped. The main shall then be filled slowly with water by means of a pump connected to the low end of the main. The pump shall be connected to the main in a manner satisfactory to the AGENCY. Provisions shall be made at the high end of the main to expel all air from the line. After all air has been expelled from the main, the water pressure in the main shall then be increased gradually to the required test pressure. After the pressure has stabilized to the required test pressure, the test shall begin. Water required to maintain the test pressure shall be withdrawn from a calibrated container. The outlet ends of any pressure regulating device shall discharge into the calibrated container in order to accurately determine the actual amount of water required to maintain the required water pressure within the test section. The duration of the test shall be three hours. Should any test of the pipe disclose leakage greater than that specified, the CONTRACTOR shall, at his own expense, repair the defective joints or sections until the

leakage is within the specified allowance.

D. Final Acceptance: No pipe installation will be accepted until the leakage is less than the number of gallons per hour as specified in above table for the size pipe being tested.

5.08 MANHOLE VACUUM TEST

A vacuum test shall be performed on all concrete manholes. The test shall conform to the preparation and procedure as outlined in the most recent edition of the ASTM designation C 1244 (Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test) and more generally described as follows:

1. All lift holes and pipes leading into and out of the manhole shall be properly braced and plugged.
2. A vacuum of 10 in. of Mercury shall be drawn on the manhole.
3. The valve on the vacuum line of the test head shall be closed and the vacuum pump shall be shut off.
4. The time shall be measured for the vacuum pressure to drop to 9 in. of Mercury.
5. The manhole vacuum test shall be considered passed if the time required for the pressure to drop from 10 in. of Mercury to 9 in. Mercury exceeds the time specified in Table 1 of ASTM C 1244 and Table 3 as shown below.
6. If the manhole fails the initial test, necessary repairs shall be made by a method APPROVED by the ENGINEER. The manhole shall then be retested until a satisfactory test is obtained.

TABLE 3. MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS

	Diameter (in.)								
	30	**33**	**36**	**42**	**48**	**54**	**60**	**66**	**72**
Depth (ft)	**Time (seconds)**								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	39	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

5.09 PAYMENT

No separate payment will be made for performing any testing as described in this section.

END OF SECTION

SECTION 06000 – SANITARY SEWER LIFT STATION

6.01 SCOPE

This section of the Specifications shall outline the general construction of small, duplex SANITARY SEWER lift stations installed within the JSA's system.

6.02 SUBMITTALS

A. General: Submit **three (3)** copies each of the manufacturer's data sheets and operation and maintenance information as described herein to the AGENCY.

B. Manufacturer's Data Sheets: Submit manufacturer's data sheets for each of the products specified herein to the AGENCY for approval. Highlight or otherwise distinguish that data that applies specifically to the products subject to approval. Provide certification on each submittal stating that the product information has been reviewed and that the product that will be used in the Work will comply with the requirements of the specifications. Provide and date and signature with each certification statement.

C. Manufacturer's Operation and Maintenance Manual: Upon completion of the project, supply manufacturer's operation and maintenance manuals for the pump station, controls, telemetry (if specified) and related accessories to the AGENCY for future reference. As a minimum, the manufacturer's operation and maintenance manual should include the following information:

1. Data sheets for the pumps, pump mounting hardware, pump discharge piping, valves, pump controls, telemetry equipment (if specified) and entry hatch to the pump wet well. Material data sheets should include manufacturer's name and address, equipment model no., serial no., date manufactured, date installed, name and address of equipment installer, equipment operation specifications (H.P., RPM, Voltage, Phase, Amps, Temp. ranges, etc.), materials of construction and other information important for the proper identification of the equipment and related components.

2. Pump operating curves with the specified operating point clearly labeled as well as information concerning the impeller size, operating speed, voltage, phase, horsepower and theoretical efficiency.

3. Installation drawings illustrating the AS-BUILT elevations of the bottom of the wet well, elevations of incoming pipes, elevation of force mains leaving the wet well, elevations of the float controls. The installation drawings shall include an itemized breakdown identifying each of the components that make up the system. Include descriptive information for each of the components including size, type of material, etc.

4. Electrical diagrams and specifications for the pumps, pump controls, and telemetry system (if specified). Identify each electrical component and its pertinent specifications. Include specifications and dimensional information for the enclosures

to be included as part of the installation.

5. Operating procedures for the pumps, controls and telemetry system (if specified).

6. Preventative and routine maintenance procedures and related recommended maintenance task frequencies for mechanical and electrical equipment.

7. Warranty for covered equipment.

8. Names and addresses for repair centers and part suppliers.

6.03 PRODUCT HANDLING

A. Delivery and Storage: Materials shall be handled in a manner complying with the recommendations of the manufacturer. Materials shall be stored in an organized manner at a location that will not interfere with the work. Mechanical and electrical equipment shall be stored in an area protected from the elements in order to exclude moisture.

B. Protection: Take appropriate measures to protect stored materials from the potential of damage from ongoing activities adjacent to the storage area.

C. Replacement: Replace materials damaged during shipment, handling, or storage prior to installation. Such replacements shall be made at no additional cost to the OWNER.

6.04 WARRANTY

A. General: All Work associated with this section shall be covered by the standard one-year contract warranty in accordance with requirements of General Conditions.

B. Equipment and Structures: All mechanical and electrical equipment, as well as structures installed as part of the Work, shall be covered by a full manufacturer's warranty for a minimum period of one (1) year after the acceptance of the installation by the AGENCY.

6.05 PRODUCTS

A. STRUCTURES

1. Wet Well - Provide appropriately sized diameter pre-cast concrete manhole sections complying with ASTM C478 as APPROVED by the OWNER. The minimum diameter for all wet wells shall be 6-feet, unless authorized by the AGENCY. Manhole sections shall be Bituminous Coated. Construct top and bottom slabs to the dimensions shown on the Drawings. Use reinforcement for slabs as specified on drawings. Reinforcement for wall sections shall be in accordance with the provisions outlined in ASTM C478. Comply with minimum section thickness requirements of ASTM C478 for walls and slabs unless dimensioned otherwise on the Drawings.

2. Wet Well Hatch- Provide duplex aluminum hatch and frames as shown on the plans. The exterior surface of the hatches shall be raised tread plate to provide a skid resistant surface. Hinges and hardware shall be 300 series stainless steel. The hatch will be designed for a 300 psf live and dead load. Each hatch shall be provided with a safety

latch to hold the door in an open position. Each hatch door shall be provided with a locking hasp. A fall protection system shall also be provided. The access hatch fall protection system shall be as manufactured by Halliday Products, Inc., Orlando. Fl, or APPROVED equal. Hatch size and placement in the top slab shall be in accordance with the pump supplier's recommendation.

3. Valve Vault - Provide appropriately sized diameter pre-cast concrete manhole section complying with ASTM C478 as APPROVED by the OWNER. Construct wall sections, top slabs and bottom slabs to meet the requirements outlined above for the precast wet well. Valve vault hatch shall meet the dimensions as shown on the plans. The minimum diameter for all valve vaults shall be 6-feet, unless authorized by the AGENCY. All valve vaults shall be Bituminous Coated.

B. PUMPS AND RAIL ASSEMBLY

1. Pumps

   a. Operating Conditions - Each pump shall be rated as shown on the plans. The pump shall be non-overloading throughout the entire range of operation without employing service factor. The pump shall reserve a minimum service factor of 1.20. The performance curve submitted for approval shall state in addition to head and capacity performance, the pump efficiency, solid handling capacity and reflect motor service factor.

   b. Construction - The pump shall be a centrifugal, non-clog, solids handling, submersible type designed for use with wastewater. The pump shall be able to pass a 3-inch (3") solid. The pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. All external mating parts shall be machined and Buna N Rubber O-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

2. Electrical Power Cord - The power cord shall be in compliance with prevailing electric codes for the design load and service conditions. The cord entry into the motor connection area shall be protected with a redundant system to exclude the entrance of moisture into the area. The power cable entry into the cord cap assembly shall be made with initially with a rubber bushing compression coupling. Additionally, the cavity of the motor connection area shall be filled with an epoxy compound potting. Connection of the power cable to the motor leads shall be made utilizing heavy-duty connectors with brass inserts. Power cords shall be min. 30-ft in total length, unless otherwise required due to site conditions.

3. Motor - The stator, rotor and bearings shall be mounted in a sealed submersible cast iron housing. The stator windings shall have Class F insulation rated for a minimum 155ºC. The winding housing shall be filled with clean high dielectric oil. Air filled motors will not be acceptable. The pump and motor assembly shall be designed so that they may be operated partially or completely submerged in the liquid being pumped. Dependence on the use of water jackets shall not be acceptable. The stator shall be held securely in place to the motor housing either by heat shrinking or through the use of mechanical fasteners. The pump shall be equipped with heat sensors. The heat

sensor shall be mounted directly on the stator windings and sized to open at 120ºC and automatically reset at 30-35ºC differential. The sensor shall be connected in series with the motor starter coil.

4. Bearings and Shaft - The pump shaft shall be supported by an upper radial bearing and a lower thrust bearing. The upper radial bearing shall have a minimum B-10 life at the specified condition of 50,000 hours and the lower thrust bearing shall have a minimum B-10 life at the specified condition of 50,000 hours. Bearings shall be of a standard type, which would typically be available locally. The shaft shall be machined from a solid 303 stainless steel forging and be a design which is of large diameter with minimum overhang to reduce shaft deflection and prolong bearing life.

5. Seals – A tandem mechanical shaft seal system running in an oil bath shall be provided. Pumps larger than 3 horsepower shall be provided with:

    a. Upper seal shall be of carbon/tungsten carbide and lower seal shall be tungsten carbide/tungsten carbide or,
    b. Upper stationary seal shall be made of carbon and the rotating seal face shall be made of tool steel. Lower stationary seal face and rotating seal face shall be made of silicone carbide.

    Pumps of 3 horsepower and smaller may have seals which shall contain one stationary tungsten carbide ring and one positively driven rotating carbon ring and function as an independent secondary barrier between the pumped liquid and the stator housing. Each interface shall be held in contact by its own spring system.

    Conventional mechanical seals that require a constant pressure differential to affect sealing will not be allowed.

    Seals shall be industry standard and universally available.

    Each pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency. An electric probe or seal failure sensor shall be installed in the seal chamber between the two tandem mechanical seals to sense the entrance of moisture or contaminants. Upon failure of the lower seal, a signal will be sent to the specified alarm mechanism at the control panel. Opposed mechanical seals shall not be acceptable.

6. Impeller – Impeller shall be of the two-vane, non-coated, enclosed non-clogging design and have pump-out vanes on the front and backside of the impeller to prevent grit and other materials from collecting in the seal area. Impellers shall be statically, dynamically, and hydraulically balanced in accordance with standard industry procedures. Impellers shall be securely keyed to the shaft with a locking arrangement whereby the impeller cannot be loosened by torque from either forward or reverse direction. A stainless-steel washer and bolt shall be utilized for attachment of the impeller to the shaft.

7. Casing – Pump casing shall be constructed of ASTM A-48, Class 30 cast iron. The casing shall be of the end suction and centerline discharge type equipped with an

automatic pipe coupling arrangement for ease of installation and piping alignment. The design shall be such that the pumps will be automatically connected to the discharge piping when lowered into position with the guide rails. The casing shall be accurately machined and bored for register fits with the suction and casing covers. A volute case wearing ring shall be provided to minimize impeller wear. The wear ring shall be brass and held by stainless steel fasteners. The wear ring shall be easily replaceable in the field. Wear rings of other materials shall not be acceptable.

Mating surfaces where watertight seals are required shall be machined and fitted with nitrile rubber O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between mating surfaces, resulting in proper compression of the O-rings without the requirement of specific torque limits.

8. Paint - The pump shall be painted after assembly but before testing, with zinc chromate base enamel. The paint shall be applied to a minimum dry mil thickness of 6 mils. The paint shall be air dried prior to testing.

9. Testing - Commercial testing shall be required and performed by the manufacturer. All testing shall be performed at no extra cost to the OWNER. The tests required shall include the following:

    a. Visual test to verify specified HP, voltage, phase and hertz.

    b. Motor and seal housing shall be meggerred for infinity to test for moisture content or insulation defects.

    c. The stator windings shall be checked for imbalance during operation. Check amperage readings at each leg. If a significant difference is noted among the readings, check stator windings with a bridge to determine if unbalanced resistance exists. If unbalanced resistance exists, replace stator.

    d. Following submerged operation, megger motor and seal housing to verify that no moisture has entered.

    A report summarizing the test results shall be prepared and submitted with the manufacturers operation and maintenance manual.

C. RAIL SYSTEM AND RELATED ACCESSORIES

1. General - Provide 300 series stainless steel dual pipe rail system, discharge elbow with guide arms, hydraulic sealing flange assembly with sealing diaphragm, guide rail connector, lifting chain, access frame and hatch (per Part A above), float mounting bracket, control equipment and discharge piping. All hardware inside the wet well shall be 300 series stainless steel.

2. Discharge Elbow with Guide Arms - Provide cast or ductile iron discharge elbows designed to mount directly on sump floor. Elbows shall have a 125-lb. flange faced and drilled on the outlet side, with a machined mating inlet connection. The design of the elbow will be such as the discharge connection is made without the need for any nuts, bolts or gaskets. The base elbow shall also anchor and align the pump rail or rails.

Accessory bolts, washers, nuts, anchors etc. shall be 300 series stainless steel.

3. Hydraulic Sealing Flange – Provide cast iron hydraulic sealing flanges, complete with Buna N rubber diaphragm type gaskets for each pump discharge. The rubber diaphragm shall be held in place with a clamp ring with stainless steel fasteners. CONTRACTOR to provide two (2) spare pairs of sealing flanges per pump.

4. Lifting Chain - Each pumping unit shall be provided with a stainless-steel lifting chain and be of sufficient length to extend from the pump to the top of the wet - well plus five additional feet. The access frame shall provide a hook to attach the chain when not in use. The lifting chain shall be sized according to the pump weight.

5. Float Mounting Bracket - A float-mounting bracket shall be provided with 300 series stainless strain reliefs that support and hold the level control cords. Continuous cords are to run from pumps and level controls to a junction box as shown on plans. No splices shall be made in the wiring. The bracket shall be fabricated from stainless steel and attached to the access frame with 300 series stainless steel fasteners. A dielectric spacer should be installed when bolting to the aluminum access frame.

6. Guide Rail-(Dual Rail Guide) - Provide dual rail system comprised of 2" stainless steel pipe. Bolt directly to base elbow and an upper guide rail bracket, which is bolted directly to access frame hatch.

7. Piping - Pipe and Fittings for lift station shall be flanged 250-pressure class ductile iron in accordance with the provisions of *Section 04000 Sewer Force Main* of these specifications. Accessory bolts, washers, nuts, anchors, etc. shall be 300 series stainless steel.

8. Check Valves - Provide Mueller, or APPROVED equal, swing check valves with outside lever and spring.

9. Plug Valves - Provide Dezurik cam operated plug valves with hand wheel, or AGENCY APPROVED equal.

D. CONTROL PANEL

1. General - Control panel shall be assembled and tested by a shop meeting U.L. Standard 508 for industrial controls. The motor control panel shall be assembled and tested by the same manufacturer supplying the pump to ensure suitability and assurance of experience in matching controls to motors and to ensure single source responsibility for the equipment. All enclosures provided for all control panels shall be stainless steel and meet requirements of NEMA 4X.

2. Construction

    a. The control panel shall be constructed in accordance with the JSA's standard lift station control panel design. Any proposed deviations from the drawings shall be submitted and APPROVED by the AGENCY prior to panel construction.

    b. Wiring shall be neatly arranged and fixed in the cabinet with ties. Wires shall be

color-coded and numbered. Where colors are repeated, numbers shall be affixed. A schematic shall be attached inside the door. All incoming conduit shall be sealed to prevent moisture and gases from entering the control panel. All ground connections shall be made in accordance with NEC standards.

3. Controls:
    i. The pumps shall be controlled by the liquid level in the wet well and the operation of the pumps shall be (1) start the lead pump at the lowest “pump on” level; (2) immediately start the lag pump in case of lead pump failure; (3) start the lag pump at the highest “pump on” level; (4) stop the pumps at the “pump off” level; (5) alternate the lead pump for each pumping cycle; and (6) activate the alarm at the high water level. A “low water” level may be incorporated at the AGENCY’s request.

    ii. Liquid level mercury float switches shall be used to control the pump operation. The float switches shall be adjusted by the CONTRACTOR for operation of the pumps as shown on the Plans.

E. FIELD TESTING

The manufacturer's representative shall be responsible for performing start-up testing following at the project site following completion of the installation and prior to final acceptance of the lift station. AGENCY personnel shall be notified a minimum of 48 hours before performing start-up testing. Start-up testing shall include as a minimum:

1. Pump drawdown test to determine output of each pump running individually and together.

2. Amperage readings with pump operating individually and together.

3. Proper operation of all control systems.

The results of the field tests must be submitted to the AGENCY prior to final acceptance of installation and final payment to the CONTRACTOR.

6.06 EXECUTION

Installation of the lift station shall be in strict accordance with the lift station manufacturer's installation instructions and the JSA’s standards of lift station design. Excavation for structures shall be in accordance with the *Section 2000 Earthwork*, of these technical specifications.

6.07 PAYMENT

Payment for the SANITARY SEWER lift station shall be lump sum and shall include all equipment, labor, material, excavation, dewatering, bedding, backfill, surface restoration, and testing as outlined in these specifications and as required by the AGENCY to provide a complete and functional system.

END OF SECTION

SECTION 08000 - LANDSCAPING AND SEEDING

8.01 SCOPE

This section of the specifications consists of furnishing all labor, materials and equipment necessary to complete the landscaping and seeding other miscellaneous work not otherwise covered. Application of materials should comply with Kentucky Department of Highway's Standard Specifications for Road and Bridge Construction.

8.02 FINAL DRESSING

After other outside work is finished and all backfilling and embankments complete and settled, all areas of the site should be graded to the specified elevation and slopes. All swales shall be trimmed and dressed by hand, other surfaces shall be so graded that effective drainage shall be secured and in accordance with the plans. All grading work and surfacing shall be completed to the satisfaction of the AGENCY and/or OWNER/DEVELOPER.

8.03 MATERIALS

A. Lime
Four (4) tons of agricultural limestone per acre shall be uniformly applied immediately prior to the seedbed preparation.

B. Fertilizer
Premium fertilizer having an analysis of 10-10-10 shall be applied at the rate of 2,000 pounds per acre.

C. Seed
Kentucky 31 Fescue shall be seeded at the rate of two hundred seventy-five (275) pounds per acre with a drill or broadcast uniformly over the freshly prepared seedbed and firmed into the soil with a cultipacker. Kentucky 31 Fescue seed certified by the Kentucky seed Improvements Association shall be used. No seed shall be planted having a test date of more than 120 days prior to the date of seeding.

D. Mulch
Mulch shall consist of wheat and rye straw applied at the rate of two (2) tons per acre.

8.04 METHODS

A. Preparation of Seedbed
Where the area to be seeded is not sufficiently pulverized to provide good seedbed, the seedbed shall be prepared by pulverizing the soil to a minimum depth of two inches (2") with a disk harrow, drag harrow, spike tooth or similar tool, immediately prior to seeding. All clods, rocks and undesirable material that would interfere with seeding operations shall be removed.

B. Sowing of Seed
The seeding operation shall be performed immediately after the seedbed has been prepared and the lime and/or fertilizer has been applied and mixed with the surface soil, or

at a later time if directed by the AGENCY. The seed shall be drilled or broadcast with regular APPROVED type of equipment and methods acceptable to the AGENCY. Do not sow any seed until the AGENCY verifies compliance with specified requirements. The seed shall be applied in such manner so as to ensure uniform distribution over the area to be seeded. All rocks, clods, and debris over 2" in diameter shall be removed. Mulch shall then be applied.

8.05 MAINTENANCE

Any damage occurring to this phase of the work until final acceptance shall be repaired and/or replaced by the CONTRACTOR at no expense to the AGENCY and/or OWNER/DEVELOPER.

8.06 CLEANING UP

The entire area shall be cleaned of all surplus dirt, material, straw, etc., and left in a neat and pleasing appearance.

8.07 BASIS OF PAYMENT

Payment unit will be lump sum for work performed under this section of the specifications. Measurement will be plan quantity. Payment shall be considered total compensation for all work described.

END OF SECTION