TECHNICAL SPECIFICATIONS

Belfry – Pond Creek Wastewater Collection System and WWTP Water Supply

May, 2018

Prepared for:

Mountain Water District
Pike County, Kentucky

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SECTION ELEVEN

TECHNICAL SPECIFICATIONS

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SECTION I

TECHNICAL SPECIFICATIONS

SPECIAL PROVISIONS

1.1 SCOPE

This specification sets forth OWNER'S special project requirements which are UNIQUE to this project. All requirements of this section shall be considered as integral parts of the successful completion of the Project. All items discussed herein are considered incidental to the overall accomplishment of the Project and no separate payment shall be made for these items.

1.2 CONFLICTING ELEMENTS

In the event of a conflict between the elements of the Contract Documents, the MORE STRINGENT REQUIREMENT ON THE CONTRACTOR SHALL GOVERN.

1.3 EXISTING OPERATIONS / SEQUENCE OF WORK

1.3.1 The CONTRACTOR shall coordinate all work through the ENGINEER. The CONTRACTOR shall notify OWNER and ENGINEER at least fourteen calendar days in advance of any shutdown of any wastewater process necessary to perform the work required by the Contract. In no event, shall the CONTRACTOR cause a discharge of raw wastewater into the waters of the Commonwealth.

1.3.2 The CONTRACTOR shall notify the OWNER and ENGINEER at least 10 calendar days prior to any construction activity at the site.

1.3.3 **No sanitary sewer waste will be permitted into this system (Contract II) until the Wastewater Treatment Plant (WWTP), as outlined in Contract I of this project, has been completed, startup performed and the WWTP is ready to receive active flow.**

1.4 WORKING HOURS

Paragraph 6.3 of the General Conditions is supplemented as follows:

1.4.1 Regular working hours are defined as up to 8 hours per day, Monday through Friday, beginning no earlier than

7:00 a.m. and ending no later than 7:00 p.m., excluding holidays. Whenever the CONTRACTOR is performing any part of the work, with the exception of equipment maintenance and clean-up, OWNER'S representation and/or inspection will be required.

1.4.2 Requests to work other than regular working hours must be submitted to the OWNER'S designated representative, at least 48 hours prior to any proposed weekend work or scheduled extended work weeks, to give the OWNER ample time to arrange for representation and/or inspection during those periods. Periodic unscheduled overtime on weekdays will be permitted provided that two hours notice is provided to OWNER'S designated representative. Maintenance and clean-up may be performed during hours other than regular working hours.

1.4.3 The OWNER incurs additional expense when the CONTRACTOR exceeds regular working hours. Consequently, CONTRACTOR shall reimburse the OWNER for additional engineering and/or inspection costs incurred as a result of overtime work and in excess of the regular working hours stipulated herein. These costs shall be a line item deduction from the CONTRACTOR'S monthly payment request. Overtime costs for OWNER'S personnel shall be based on the individual's current overtime wage rate. Overtime costs for personnel employed by the ENGINEER shall be calculated in accordance with the terms of the ENGINEER'S contract with the OWNER.

-- THE END --

SECTION II

TECHNICAL SPECIFICATIONS

GENERAL PROVISIONS

2.1 SCOPE

This section of the technical specifications is prepared to establish general requirements applicable to the entire Project. All items discussed herein are considered incidental to the overall accomplishment of the Project and no separate payment shall be made for these items.

2.2 IDENTIFICATION OF PARTIES

OWNER - The Mountain Water District.
The OWNER owns and is responsible for the completed wastewater facilities.

ENGINEER - Registered professional engineer designated by OWNER to provide design, construction inspection, and certification services.

CONTRACTOR- The entity(s) responsible under contract to OWNER to furnish labor, equipment, etc. to complete the work specified herein.

2.3 RECORD DRAWINGS

The CONTRACTOR shall furnish record drawings in accordance with the requirements of the 'Submittals' section of these specifications.

2.4 EXISTING UTILITIES AND UNDERGROUND FACILITIES

Attention is called to the presence of existing utilities and underground facilities. The CONTRACTOR is solely responsible to accurately locate, and avoid damage to, all existing utilities and underground facilities. See “Existing Utilities” herein.

2.5 SCHEDULES

2.5.1 Progress and Payment Schedules. Within 10 calendar days of Notice of Award, prepare and submit to the ENGINEER a proposed construction progress schedule. The schedule shall be in the form of a bar chart addressing the major project activities. The bar chart shall provide for a comparison of the proposed schedule to actual completion.

2.5.2 Submittal Schedules. Within 10 calendar days of Notice of Award, prepare and submit to the ENGINEER a proposed submittal schedule (See paragraph 26 of General Conditions).

2.5.3 Schedule Updates. All project schedules shall be updated for each CONTRACTOR pay request.

2.5.4 WARNING: NO CONTRACTOR PAYMENTS SHALL BE APPROVED BY THE ENGINEER UNTIL ACCEPTABLE PROJECT SCHEDULES HAVE BEEN PROVIDED BY THE CONTRACTOR. CONTRACTOR PAY REQUEST APPLICATIONS WILL BE IMMEDIATELY RETURNED IF THEY ARE NOT ACCOMPANIED BY THE REQUIRED SCHEDULE UPDATES.

2.6 STAKING AND MARKING

The ENGINEER will be responsible for providing the survey reference monuments and benchmarks. Construction stakeout and "as built" surveys shall be the responsibility of the CONTRACTOR.

2.7 CONSTRUCTION PHOTOGRAPHS

2.7.1 The term "photograph" as used herein refers to a photographic view, including similar exposures taken to assure the usefulness of the photographic record. All photographs shall be taken in color, not black and white.

2.7.2 The CONTRACTOR shall photograph the project limits prior to construction. The same views shall be re-photographed upon completion of all construction activities. In lieu of photography, CONTRACTOR may opt to video the project limits. The CONTRACTOR shall furnish the ENGINEER two copies of this video cassette for a completeness review. NO WORK CAN BE PERFORMED UNTIL THE ENGINEER HAS REVIEWED, AND ACCEPTED, THE PRE-CONSTRUCTION PHOTOGRAPHS AND/OR VIDEOS.

2.7.3 The CONTRACTOR shall have an average of ten (10) photographs per month made of the work during its progress and twenty (20) photographs of the completed facilities, in addition to those required above in paragraph 2.7.2.

2.7.4 All photographic work shall be done by a qualified, established photographer acceptable to the ENGINEER. Two prints of each photograph shall be provided.

2.7.5 The film negatives shall be retained in the files of the photographer until the completion of the project and shall then be turned over to the ENGINEER. The photographer shall release all copyrights, or other restrictions, on the use of the photographic prints and film negatives.

2.7.6 Each photograph shall have an identification label which provides:

1. Contractor's name
2. Short Description of View
3. Photo No. and Date Taken
4. Photographer's Firm Name

2.8 TESTING

The cost of all testing shall be borne by the CONTRACTOR unless directed otherwise.

2.9 INSTALLATION REQUIREMENTS

Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as suggested by the respective manufacturers, unless otherwise specified herein.

2.10 PROOF OF COMPLIANCE

See Quality Control - Section IV

2.11 MAINTAINING DRAINAGE

At no time shall the flow of any existing streams or gullies be blocked. Ditches or culverts which become inoperable during the work effort shall be promptly cleaned out.

2.12 DUST AND LITTER CONTROL

All access roads, excavations, embankments, waste areas, etc. within the project boundaries shall be maintained free of dust and litter which could cause a nuisance to others. Dust control shall be performed as the work proceeds and whenever a dust nuisance occurs. From time to time, as the need arises, the construction area shall be policed to collect all scattered litter and debris.

2.13 CLEAN UP

After all construction work is complete, and prior to final inspection, all disturbed areas shall be cleaned and left in a sightly condition. All unused material shall be removed and disposed of properly.

2.14 REPAIR OF DAMAGE

Any damage done to structures, fills, roadways, or other areas shall be repaired at the CONTRACTOR'S expense before final payment is made.

2.15 PROJECT LIMITS

The CONTRACTOR shall be responsible for satisfying himself as to the construction limits for the project. The CONTRACTOR shall not establish work, storage, or staging areas outside the project limits, unless otherwise directed or approved by the ENGINEER.

2.16 BURNING

There shall be no burning on this Project.

2.17 MATERIALS SUITABLY STORED

Request for payment for stored materials MUST be prepared in compliance with Paragraph 14.02 of the General Conditions.

2.18 EXPLANATION OF MEASUREMENT AND PAYMENT TERMINOLOGY

The various items of work will be measured and paid for as "Lump Sum," "Each," or by "Unit Prices" as established in these specifications. These methods of payment are defined as follows:

a) Lump Sum: When this term is used as an item of payment, it shall be inferred that the complete structure, structural unit or element of work is specified as the unit measurement. As such, it will be construed to include all necessary materials and accessories required for installation. No final measurements will be made.

b) Each: The definition for Lump Sum applies to the term "each" except more than one may be included in the Project and the actual number installed will be the final measurement.

c) Unit Price Quantities: When unit price quantities for a specific portion of the project are designated in the Contract Documents as the pay quantity, actual quantities for such specified portion serve as the basis for payment. Actual quantities shall be determined by the differences in measurements taken before and after construction.

d) Plan Quantities: When the specifications indicate that 'Plan Quantities' are the basis of payment, the design quantities enumerated on the bid schedule shall be the final pay quantity unless the related dimensions in the Drawings are revised by the Engineer.

-- THE END --

SECTION III

TECHNICAL SPECIFICATIONS

SUBMITTALS

3.1 SCOPE

This specification sets forth the procedure to be employed in submitting and processing all CONTRACTOR submittals.

3.2 SHOP DRAWINGS

3.2.1 The CONTRACTOR shall submit for the review of the ENGINEER Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Conditions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the CONTRACTOR for checking and processing by the ENGINEER.

3.2.2 ENGINEER's review of the CONTRACTOR's drawings shall be considered as a gratuitous service, given as assistance to the CONTRACTOR in interpreting the requirements of the Contract, and in no way shall it relieve the CONTRACTOR of any of his responsibilities under the Contract. Any fabrication, erection, setting or other Work done in advance of the receipt of Shop Drawings returned by the ENGINEER and noted as "Approved" or "Approved as Noted" shall be entirely at the CONTRACTOR's risk. The ENGINEER's review will be confined to general arrangement and compliance with the design concept and Specifications only, and will not be for the purpose of checking dimensions, weights, clearances, fitting, tolerances, interferences, coordination of trades, etc.

3.2.3 If Shop Drawings are returned for correction, they shall be immediately corrected and resubmitted for review as described above, and such procedures will not be considered as grounds for delay in completing the Work.

3.2.4 Shop Drawings submitted by subcontractors shall be sent directly to the CONTRACTOR for preliminary checking. The CONTRACTOR shall be responsible for their submission to the ENGINEER at the proper time so as to prevent delays in delivery of materials.

3.2.5 The CONTRACTOR shall thoroughly check all subcontractors Shop Drawings as regards to measurements,

sizes of members, materials and details to satisfy himself that they conform to the intent of the Specifications. Drawings found to be inaccurate or otherwise in error shall be returned to the subcontractors by the CONTRACTOR for correction before submitting them to the ENGINEER. Before submission, the CONTRACTOR shall mark (stamp) the drawings as being checked and approved by him, dated and signed. The CONTRACTOR's approval (stamp) shall constitute a representation that all quantities, dimensions, field construction criteria, materials, catalog numbers, performance criteria and similar data have been verified and that, in his opinion, the submittal fully meets the requirements of the Contract Documents and the scope of work involved.

3.2.6 All details on Shop Drawings submitted for review shall clearly show the relation of the various parts and where the Work depends upon field measurements, such measurements shall be obtained by the CONTRACTOR and noted on the Shop Drawings before being submitted to the ENGINEER for review.

3.2.7 All submissions shall be properly referenced to indicate clearly the specification section, location, service and function of each particular item. All submissions for one item or group of related items shall be complete. The ENGINEER reserves the right to reject manufacturer's publications in the form of catalogues, pamphlets, or other data sheets when they are submitted in lieu of prepared Shop Drawings. Such submissions shall specifically indicate the item for which approval is requested. Identification of items shall be made in ink, and submissions showing only general information are not acceptable.

3.2.8 If the Shop Drawings contain any departures from the Contract requirements, specific mention thereof shall be made in the CONTRACTOR's letter of transmittal. Where such departures require revisions to layouts or structural changes to the Work, the CONTRACTOR shall, at his own expense, prepare and submit for approval revised layout and structural drawings. Such drawings shall be of the size approved by the ENGINEER.

3.2.9 All shop drawings shall be in English.

3.2.10 The ENGINEER will review the first and second shop drawing submittals at no cost to the CONTRACTOR. Review of the third submittal and any subsequent submittal will be at the CONTRACTOR's expense. Payment will be deducted from the Contract amount at a rate of 3 times direct labor cost plus expense.

3.3 ELECTRONIC PROJECT DOCUMENTATION AND COMMUNICATION (PROJECT WEBSITE):

3.3.1 All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet-based submittal service (Project Website) that receives, logs and stores documents, and notifies addressees via email.

1. Beyond submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, and any other document any participant wishes to make part of the project record. The intent shall be that construction phase documentation be paperless to the greatest extent possible.
2. The Contractor and the Engineer are required to use this service.
3. The Engineer shall serve as the 'Administrator' for the service until Final Completion.
4. It is Contractor's responsibility to submit documents in PDF format.
5. Provide up to (20) Twenty 'Project Website' user licenses for the use of the Owner, Owner's Commissioning Authority, Special Inspections, Engineer and Engineers Consultants at no extra charge.
6. Users of the service need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such Software capability is provided by the service provider.
7. Contractor, Subcontractors and other parties granted access by Contractor to the 'Project Website'shall execute a data licensing agreement in the form of and Agreement acceptable to the Owner and Engineer.
8. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
9. All other specified submittal and document transmission procedures apply, except that electronic document requirements to not apply to actual physical samples or color selection charts. Transmittals for these items must still be posted to the service so that team members may take action on them, however, and to act as a record of the submittal made, selections determined and action taken.

3.3.2 Cost: The cost of the service is included as an

Allowance. (See Bid Schedule.)

3.3.3 Submittal Service:

1. eCommunication by Lynn Imaging, (502) 499-8400, www.lynnimaging.com

3.3.4 Training: One, one-hour, web-based training session will be arranged for all participants, with representatives of Engineer and Contractor participating; further training is the responsibility of the user of the service.

3.3.5 Project Closeout: Engineer will determine when to terminate the service for the project. Contractor shall provide (4) four complete archive copies of the 'Project Website' files to the Owner and to the Engineer in a digital Storage Format acceptable to the Engineer.

3.3.6 Project Website

1. The Internet-Based Submittal Service, established for the purposes of hosting and managing project communication and documentation shall include the following functions:
   a. Project Directory
   b. Project Correspondence
   c. Meeting Minutes
   d. Contract Modification forms and logs
   e. RFI forms and logs.
   f. Task and Issue Management
   g. Photo Documentation
   h. Schedule and Calendar Management
   i. Submittal forms and logs
   j. Payment Application forms
   k. Drawings and Specification document hosting, viewing and updating
   l. Online Document Collaboration
   m. Reminder and Tracking functions
   n. Archiving Functions
   o. Digital Date file transfer and storage for submittals, coordination and other digital files.

3.4 RECORD DRAWINGS

3.4.1 The Record Drawings shall consist of the Contract Drawings (PDF, updated to 'As Built' conditions) and the approved Shop Drawings in reproducible form (PDF) and shall be submitted to the ENGINEER at any time upon request during construction, but no later than the Final Inspection.

3.4.2 Contract Drawings shall be legibly marked to record

actual construction including:

A) All deviations in location or elevation of any underground installation from that shown on the Contract Drawings.

B) Any significant changes in above ground installation from approved Shop Drawings or Contract Drawings.

C) No such deviations from the Contract Drawings or approved Shop Drawings shall be made without approval by the ENGINEER.

3.4.3 Specifications and addenda shall be legibly marked up to record:

A) Manufacturer, trade name, catalog number, and Supplier of each product and item of equipment actually installed.

B) Changes made by Change Order or Field Order.

C) Other matters not originally specified.

3.4.4 Shop Drawings shall be legibly annotated to record changes made after review.

3.4.5 Reproducible Record Drawings shall be submitted in accordance with the General Conditions, Supplementary Conditions, and General Requirements.

3.5 MEASUREMENT AND PAYMENT

Submittals shall be considered a part of CONTRACTOR'S Lump Sum Bid for "Mobilization/DeMobilization" and shall not be measured for separate payment.

-- THE END --

SECTION IV

TECHNICAL SPECIFICATIONS

QUALITY CONTROL

4.1 CODES, STANDARDS AND INDUSTRY SPECIFICATIONS

A) Material or operations specified by reference to published specifications of a manufacturer, testing agency, society, association or other published standards shall comply with requirements in latest revisions thereof and amendments or supplements thereto in effect on date of Advertisement for Bidders.

B) Discrepancies between referenced codes, standards, specifications and Contract Documents shall be governed by the latter unless written interpretation is obtained from ENGINEER.

C) Material or work specified by reference to conform to a standard, code, law, or regulation shall be governed by Contract Document when they exceed requirements of such references; referenced standards shall govern when they exceed Contract Documents.

D) Proof of Compliance:

Whenever Contract Documents require that a product be in accordance with Federal Specification, ASTM designation, ANSI specification, or other association standard, at ENGINEER'S request, CONTRACTOR shall present an affidavit from manufacturer certifying that product complies therewith. Where requested or specified, submit supporting test data to substantiate.

4.2 MANUFACTURER'S DIRECTIONS

Utilize manufactured articles, materials and equipment as directed by manufacturers unless herein specified to contrary. Discrepancy between an installation required by Contract Documents and manufacturer's instructions and recommendations shall be resolved by ENGINEER before work may proceed. In all cases, the more stringent requirements shall govern.

4.3 TESTING

A) All testing (when required) will be in accordance with the pertinent codes and regulations and with selected standards of the American Society for Testing and Materials.

B) The OWNER will select the testing laboratories.

C) The CONTRACTOR will bear the cost of all testing unless directed otherwise.

-- **THE END** --

SECTION V

TECHNICAL SPECIFICATIONS

TEMPORARY FACILITIES

5.1 SUBMITTALS

Submit six copies of the following:

A) A 'temporary facilities plan' illustrating the location of the field office, sanitary facilities, layoff areas, and project signs. Plan to include a floor plan for ENGINEER'S field office and furnishings.

B) The proposed layout/color scheme for the Project Sign.

5.2 FIELD OFFICE

5.2.1. The CONTRACTOR shall furnish and maintain a field office on site. The office shall be established at a location approved by the ENGINEER. **AN AUTHORIZED REPRESENTATIVE OF THE CONTRACTOR SHALL BE IN THE FIELD OFFICE AT ALL TIMES WHILE WORK IS IN PROGRESS.**

5.2.2. The CONTRACTOR shall provide a field office for the duration of the Project. It shall be weathertight, have a tight floor, and suitable ventilation. The office shall have at least three screened windows capable of being opened, a screen door and a solid door provided with cylinder lock and three keys. The office shall be provided with heating equipment, electrical wiring, outlets and fixtures suitable to lighten the tables and desk adequately as directed. The CONTRACTOR shall furnish and equip the field office complete within five (5) days of Notice to Proceed.

5.2.3. The field office provided shall be furnished by the CONTRACTOR as follows:

1. One plan table, 3 ft. x 5 ft. and one stool
2. Three additional chairs
3. Four-drawer, filing cabinet with lock
4. Waste paper basket
5. Air Conditioner (12,000 BTU)

5.2.4. The CONTRACTOR shall supply all fuel for heating and pay all electrical bills. A watt-hour meter shall be installed for determination of electric consumption and appropriate charges for that consumption.

5.2.5. The CONTRACTOR shall furnish the field office with a private telephone for the ENGINEER's exclusive use. With the exception of charges for long distance and toll calls, the CONTRACTOR shall pay all bills charged against the ENGINEER's telephone, including installation charge and all monthly charges throughout the construction period.

5.3 MATERIAL STORAGE

The CONTRACTOR must make arrangements for his staging areas and areas of material storage.

5.4 SANITARY FACILITIES

The CONTRACTOR shall provide and maintain all necessary sanitary facilities at the site, in accordance with all applicable regulations, and shall properly remove same at completion of the project.

5.5 UTILITIES

The obtaining of all utilities which may be required for the construction shall be the responsibility of the CONTRACTOR.

5.6 PROJECT SIGN

The CONTRACTOR shall furnish and install a project sign. The sign shall reasonably conform to the size and dimensions shown in Section 4 of Funding Agency Forms.

5.6 SAFETY

CONTRACTOR shall comply with all pertinent provisions of Kentucky Safety Standards of Division of Occupational Safety, Department of Labor, and Federal Occupational Safety and Health Construction Standards, that are in effect at time this Contract is entered into and during period in which Contract is to be performed.

5.7 MEASUREMENT AND PAYMENT

Provision of temporary facilities shall be considered a part of CONTRACTOR'S Lump Sum Bid for "Mobilization/DeMobilization" and shall not be measured for separate payment.

-- THE END --

SECTION VI

TECHNICAL SPECIFICATIONS

MOBILIZATION/DEMOBILIZATION

6.1 SCOPE

This element of work shall consist of the mobilization of the CONTRACTOR'S forces and equipment necessary for performing the work required under the Contract.

It shall include the purchase of contract bonds (including KTC encroachment permit bond); transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other temporary facilities at the site; development of submittals and record drawings in accordance with Section III of these specifications; and other preparatory and incidental work.

This specification covers mobilization for work required by the Contract at the time of award. If additional mobilization costs are incurred during performance of the Contract as a result of changes or added items of adjustment in contract price, compensation for such costs will be included in the price adjustment for the items of work changed or added.

6.2 PAYMENT

THE CONTRACTOR'S LUMP SUM BID FOR MOBILIZATION/DEMOBILIZATION MAY NOT EXCEED THREE PERCENT (3%) OF THE TOTAL BASE BID FOR THIS CONTRACT. Payment of the total lump sum price for "Mobilization/ DeMobilization" will constitute full compensation for all labor, materials, equipment, and all other items necessary for and incidental to completion of the work. If the CONTRACTOR elects to demobilize and remobilize before completion of the work, no additional payment will be made.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Fifty percent (50%) of the "Mobilization/Demobilization" price may be invoiced when the following conditions have been met:

1) the field office and sanitary facilities are in-place;

2) the CONTRACTOR has furnished the bond for the Kentucky Department of Highways Encroachment Permit in the name of the OWNER; (Contract 1 _____,);

3) the CONTRACTOR's project schedules (construction, payment, and submittals) have been approved by the ENGINEER;

4) the CONTRACTOR has furnished a plan for disposal of waste materials;

5) the Project Sign has been erected; and

6) all project silt controls have been installed.

The remaining fifty percent of "Mobilization/DeMobilization may **not** be invoiced until the CONTRACTOR has submitted acceptable 'Record Drawings' (As-Built Plans and Shop Drawings) in accordance with the requirements of Section III of these specifications.

-- **THE END** --

SECTION VII

TECHNICAL SPECIFICATIONS

MAINTAIN & CONTROL TRAFFIC

7.1 SCOPE

The purpose of this section is to outline the requirements for maintenance and control of traffic during construction.

7.2 QUALITY CONTROL

The Contractor's traffic control activities shall conform to the AASHTO Manual of Uniform Traffic Control Devices, the Kentucky Department of Highways publication "Standard Drawings", and to the requirements of Section 107 of the current edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction."

7.3 CLOSING OF STREETS

It is understood that the construction activities may require the closure of certain streets within the Project Limits. The Contractor shall erect Detour signs when an alternate route is available at the intersections to inform motorists of the closures. If no alternate is available then the CONTRACTOR shall abide by KYDOH standards in stoppage of traffic. Appropriate barricades shall be erected to prevent traffic from entering the Project Limits when necessary.

In the event that the Owner does not secure right of access to the entire Project Area, access shall be maintained at all times for residents and emergency vehicles.

7.4 MEASUREMENT AND PAYMENT

“Maintain & Control Traffic” shall be considered a necessary and integral part of the Work and shall not be measured for separate payment. “Maintain & Control Traffic” shall be incidental to “Mobilization/Demobilizaton”.

--- THE END ---

SECTION VIII

TECHNICAL SPECIFICATIONS

CONSTRUCTION STAKING

8.1 SCOPE

The CONTRACTOR shall furnish all necessary personnel and equipment to provide all customary construction surveys including, but not limited to, the following:

a) Establish right-of-way and construction easement limits.

b) Establish the project construction centerlines

c) Provide adequate reference points to permit prompt re-establishment of the construction centerline throughout the construction.

d) Grade staking

e) Structure staking

f) Establish final “as-built” plan and profile location of all completed facilities and depict same on record drawings.

The CONTRACTOR's staking (survey) party shall be under the general supervision of an ENGINEER registered in the State of Kentucky. IT SHALL BE UNDERSTOOD THAT SUPERVISION OF THE CONSTRUCTION STAKING PARTY IS SOLELY THE RESPONSIBILITY OF THE CONTRACTOR AND ANY ERRORS AND INACCURACIES RESULTING FROM THE OPERATIONS OF THE CONSTRUCTION STAKING PARTY SHALL BE CORRECTED AT **NO** COST TO THE OWNER, OR SUMMIT ENGINEERING, INC., IF SUMMIT ENGINEERING, INC. IS NOT THE ONE DOING THE SUPERVISING.

8.2 SUBMITTALS

Upon completion of the project, the CONTRACTOR shall submit the following to the ENGINEER:

a) the field notes,

b) 'as built' plans on Mylar media, of no less scale than the design drawings depicting the “as built” plan and profile location of all constructed facilities.

8.3 MEASUREMENT AND PAYMENT

"Construction Staking" shall be considered a necessary and integral part of the Work and shall not be measured for separate payment. “Construction Staking” shall be incidental to “Mobilization /DeMobilization.”

-- THE END --

SECTION IX

TECHNICAL SPECIFICATIONS

SILT CONTROL STRUCTURES

9.1 SCOPE

This work shall consist of furnishing all materials, equipment, labor, and incidentals necessary for the installation, maintenance, and removal of silt control facilities as directed by the ENGINEER.

9.2 GENERAL

The exact locations, configuration, and dimensions of the various types of silt control shall be directed by the ENGINEER at the time of construction. These structures shall be installed prior to any surface disturbance on the area for which they are necessary to control silt.

The CONTRACTOR shall schedule construction activities so that the amount of exposed soil is minimized. This is to be accomplished by disturbing only those areas which are to be worked immediately and by revegetating each area as soon as practical.

9.3 MATERIALS

9.3.1 Silt Control Hay Bales: Silt Control Bales shall consist of either straw or hay bales. All bales are to be firmly bound by twine, and are to be installed using wooden stakes or steel bars.

9.3.2 Silt Fence: Silt Fence filter fabric shall be specifically designed for this purpose by the manufacturer and shall meet or exceed the following specifications:

Bursting Strength	(ASTM D751)	150 psi
Grab Strength	(ASTM D1682)	100 psi
Permeability		0.02 to 0.03 cm/sec

Silt fence posts shall be either timber stakes (2" x 2" min) or pressed steel stakes set plumb and to sufficient depth to provide a sound anchor for the supporting wire fence and/or filter fabric.

9.3.3 Gabion Wire: The wire incorporated in the lid and body of gabion units shall be constructed of galvanized steel. The mesh shall be constructed by double twisting the adjoining wire, i.e., both wires must be twisted in an interlocking, nonraveling fashion. All wire for corners, edges, selvedges, and binding in both types of units shall be heavily galvanized with a minimum zinc coating of 0.80 ounces per square foot of uncoated wire

surface, as determined by tests conducted in accordance with ASTM A90. The tensile strength of the wire shall be at least 60,000 pounds per square inch, and the mesh must have sufficient elasticity to permit 10 percent elongation diameter of the individual wires. The following minimum wire diameters are required for non-PVC coated units only.

Type /Use of Wire	--Minimum Diameters-- Gabion
Mesh wire	0.118
Selvedge/corner wire	0.150
Lacing/connecting wire	0.0866

9.3.4 Gabion Rock Fill: The baskets shall be filled with clean, hard, durable limestone from a source approved by the ENGINEER. The stone shall be well-graded, with sizes ranging from a minimum of 5 inches to a maximum of 8 inches for gabion baskets, as measured in the greatest dimension; and shall otherwise comply with the requirements of these Technical Specifications.

9.3.5 Gabion Anchors: Steel anchors shall be standard deformed type bars conforming to ASTM A-615. The bars shall be manufactured from new billet steel of American manufacture, and shall have a minimum yield strength of 60,000 psi (Grade 60).

9.4 FABRICATION OF GABIONS

9.4.1 General: The gabion units shall be fabricated in such a manner that the base, sides, ends, and lids can be assembled at the construction site into a rectangular unit of the specified sizes. The body of the units shall be of single unit construction, the base, ends, sides, and lids formed of a single woven mesh unit.

All perimeter edges of the mesh forming the unit shall be securely selvedged so that the joints formed by tying the selvedges have at least the same strength as the body of the mesh.

Lacing wire shall be supplied in sufficient quantity to permit all sides, ends, and diaphragms of the body to be securely fastened, as well as to fasten the top to all sides, ends, and diaphragms of the body.

Dimensions for height, length, and width are subject to a tolerance limit of +3% of the manufacturer's stated sizes.

9.4.2 Gabions: The gabions shall be constructed with a hexagonal weave having an opening of approximately 3 1/4 inches by 4 1/2 inches. When the gabion length exceeds its width, it shall be supplied with diaphragms to form individual cells of equal length and width. The gabion unit shall be furnished with the necessary diaphragms secured in proper position on the base in such a manner that no additional tying at this juncture will be necessary. The diaphragms shall be of the same material composition as the gabion.

9.4.3 Certification: Each shipment of gabions to a job site shall be accompanied by a certification from the manufacturer, which states that the material conforms to the requirements of this Specification. The certification shall be on the manufacturer's letterhead and shall be signed by an officer of that company.

9.5 INSTALLATION

9.5.1 Silt Control Bales: The general locations and typical configurations of the type of silt control is subject to adjustments based on individual site conditions. Installation is labor intensive in order to assure stable and durable usage; additional hand labor may be required to provide adequate footing for the bales.

9.5.2 Silt Fences: Silt fences shall be supported with vertical wood posts which are protected by means of a metal cap or other device to prevent damage when hammers are used to drive the posts into the ground.

9.5.3 Gabions: The foundation shall be accurately prepared to accept the gabions. The foundation shall be inspected and approved by the ENGINEER prior to placement of the units.

Empty units shall be assembled individually on a hard, flat surface -- generally at the installation site. Care must be exercised to assure that each basket is stretched or manipulated as necessary to achieve the proper rectangular shape. Sides, ends, and diaphragms must be erected (and laced) to ensure the correct orientation of all seams and creases. Once assembled, empty units shall be set to the lines and grades directed by the ENGINEER.

All units shall be connected to the adjoining units, while empty, by lacing wire along the perimeters of their contact surfaces. Securing diaphragms, ends and sides, closure of units, and connecting adjoining units shall be accomplished by continuous stitching with alternating single and double loops at 4-inch intervals. All ends of lacing wire are to be securely fastened and not protruding.

Empty units are to be stretched, after being properly laced and connected to the adjoining unit(s), to obtain uniform alignment and to remove kinks. A standard fence stretcher, "come-along" or other means of tensioning the unit may be used. Adjacent rows of gabion units are to be placed such that the seams are offset.

The units shall be carefully filled with stone by hand and/or machine to maintain alignment; to avoid bulges, damage to coating, and/or separation of units; and to minimize voids. The maximum height from which stone may be dropped into gabion units shall not exceed 36 inches. In gabions over 2-foot high, the stone is to be placed in 12-inch lifts; adjusted by hand, if necessary, to form a reasonable smooth surface, and cross-ties (or bracing wires) installed. Cross-ties are to be looped through the mesh on opposing sides of the basket, and the wire tightened by twisting.

The ENGINEER may require the CONTRACTOR to use hand labor to selectively place the layers of stone along exposed surfaces (i.e., top, front, and ends) to provide a uniform surface and an overall appearance suitable to the site-specific situation at each installation. After each unit has been filled, the lid shall be leveled as necessary and secured to the sides, ends, and diaphragms using the previously described lacing (or stitching) technique.

9.6 MAINTENANCE

During the course of the project, silt control structures shall be maintained in sound condition and accumulations of silt which may threaten their effectiveness shall be removed. Silt removed from silt control structures shall be spread in the general vicinity of the individual structures, except when such practices may be a detriment to the environment and/or the project.

Upon completion of the project, the ENGINEER may direct the CONTRACTOR to remove, clean, or replace silt control structures and revegetate such disturbances in accordance with the seeding section of these Technical Specifications.

9.7 MEASUREMENT AND PAYMENT

Provision of all silt control structures shall be a part of CONTRACTOR'S Lump Sum bid for "Mobilization/DeMobilization" and shall not be measured for separate payment.

-- THE END --

SECTION X

TECHNICAL SPECIFICATIONS

EXISTING UTILITIES

10.1 SCOPE

It shall be the CONTRACTOR's sole responsibility to locate existing utilities, make appropriate arrangements regarding relocation of existing utilities, either temporary or permanent, maintain the utility service throughout the construction period, and have final relocations performed at the end of the construction period. The CONTRACTOR shall notify affected utility owners, record locations of utilities on record drawings, hire specialty contractors, etc. as necessary.

All utility relocation work shall be conducted with the full knowledge and written consent of the ENGINEER and the utility owners involved. The CONTRACTOR shall comply with all applicable Federal, State and Local utility ordinances.

The CONTRACTOR shall bear sole, and full, responsibility for loss of project time arising from poor relocation coordination and from claims of damage relating to disruption of utility service. **The OWNER will not extend the Contract time for delays resulting from utility relocations.**

The utility owners affected by this project are as follows:

Gas	Columbia Gas of Kentucky P.O. Box 14241 Lexington, KY 40512-4241 Phone: 1-800-432-9345
Water	Mountain Water District P.O. Box 3157 Pikeville, KY 41502 Contact: Moss Kessee (606) 631-9167
Phone	AT&T 29 Wills Branch Prestonsburg, KY 41653 Contact: Jack Salyer (606) 433-7791

Power	American Electric Power 4249 North Mayo Trail Pikeville, KY 41501 Contact: Jerry Smith (606) 437-3764
Television	Inter-mountain Cable 20 Laynesville Road Harold, KY 41635 Phone: (606) 478-9406

10.2 AGREEMENTS

In general, when relocation of a utility is required, the relocation must be performed by the Utility Company or licensed agent of the utility company. Contractor shall secure written relocation agreements with each utility documenting the scope of the relocation activities and the responsibilities of the Utility Company and the Contractor with respect to the work and payment therefore.

10.3 SPECIAL REQUIREMENTS

The relocation agreements are subject to special requirements. These include:

-- NONE --

10.4 MEASUREMENT AND PAYMENT

CONTRACTOR’S protection and relocation of existing utilities as described in this section shall be considered a part of CONTRACTOR’s Lump Sum bid for “Mobilization/DeMobilization” and shall not be measured for separate payment.

CONTRACTOR’s reconnection of Potable Water Customers will be

-- THE END --

SECTION XI

TECHNICAL SPECIFICATIONS

REMOVAL AND DISPOSAL OF EXISTING ON-SITE TREATMENT FACILITIES

11.1 SCOPE

A. Remove and dispose of existing on-site treatment facilities, piping, and appurtenances unavoidably encountered in the process of construction.

B. Fill voids created as a result of removals of existing underground treatment facilities.

11.2 REGULATORY REQUIREMENTS

A. Conform to applicable local code for removal of structures, safety of adjacent structures, dust control, and runoff control.

B. Obtain required permits and licenses from appropriate authorities. Pay associated fees including disposal charges.

11.3 PREPARATION

A. Provide, erect, and maintain erosion control devices, temporary barriers and security devices.

B. Protect existing landscaping materials, appurtenances, and structures which are not to be removed or demolished. Repair damages caused by removal operations at no cost to Owner.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as needed.

D. Mark location of utilities. Protect and maintain in safe and operable condition, utilities that are to remain. Prevent interruption of existing utility service to occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities as acceptable to governing authorities and Owner.

11.4 REMOVAL

A. Prior to removal of treatment facility, all waste shall be removed by pumping and transported to the nearest wastewater treatment plant.

B. After removal of all waste, the treatment facility shall be removed from the ground and disposed of in accordance with all local, state and federal regulations.

C. Following removal of the treatment facility, the pit shall be backfilled in accordance with the technical specifications.

D. A licensed plumber shall then connect the house lateral to the sanitary sewer in accordance with the technical specifications.

11.5 MEASUREMENT AND PAYMENT

A. Measurement and Payment: Removal of treatment facilities encountered in the process of construction shall be paid as “Each” as mentioned in the Bid Schedule.

-- THE END --

SECTION XII

TECHNICAL SPECIFICATIONS

SANITARY SEWER FORCE MAINS

12.1 PURPOSE

The purpose of this section is to outline the requirements for the proper construction of sanitary sewer force mains and siphons.

12.2 GENERAL REQUIREMENTS

The sanitary sewer force mains and siphons shall be laid in reasonable conformance to the lines and grades shown on the Design Drawings. In no event shall any section of force main be constructed at an elevation higher than that specified for the air release valve. No reach of force main shall be laid on a 0% slope. A #10 copper trace wire shall be laid with all non-metallic force mains and siphons.

12.3 QUALITY CONTROL

Submit five copies of the following:

A) Documentation to substantiate pipe material's compliance with these specifications.

B) Documentation to substantiate that pipe bedding materials will conform to requirements of these specifications.

C) Documentation of pressure and leak testing.

12.4 PIPE MATERIALS

PIPE:

12.4.1 HIGH DENSITY POLYETHYLENE PIPE: The pipe shall be Green Stripe Pipe. The Pipe shall be equal to Chevron Phillips Performance Pipe 4200 Series and shall be supplied in the following classes:

Nominal Size
1 ¼" DR 11
2" DR 11
3" DR 11
4" DR 11
5" DR 11
6" DR 11
8" DR 11

Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350-99 with a minimum cell classification of PE345464C. Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

12.4.2 ASTM 2241 POLYVINYL CHLORIDE PRESSURE PIPE, FITTINGS AND JOINTS – ASTM 2241 PVC shall not be used on this project.

FITTINGS:

12.4.3 BUTT FUSION FITTINGS: Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy Datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

12.4.4 ELECTROFUSION FITTINGS: Electrofusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and be the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.

12.4.5 FLANGED AND MECHANICAL JOINT ADAPTERS: Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

12.4.6 MECHANICAL RESTRAINT: Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.

Serrated restrainer shall be ductile iron ASTM A536-80 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.

The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used or 150 PSI which ever is lesser. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

Nominal Size	Restraint Width	Serrations per inch
4″, 6″	1-1/2″	8
8″ 10 & 12″	1-3/4″	8

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

12.5 INSTALLATION

GENERAL:

12.5.1 PIPE & FITTINGS: Size as indicated on the plans. Install as shown in accordance with manufacturer's recommendations.

JOINING:

12.5.2 BUTT FUSION: Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the

pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself.

12.5.3 SIDEWALL FUSION: Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

12.5.4 MECHANICAL: Bolted joining may be used where the butt fusion method cannot be used. Flange joining will be accomplished by using a HDPE flange adapter with a ductile iron back-up ring. Mechanical joint joining will be accomplished using either a molded mechanical joint adapter or the combination of a Sur-Grip Restrainer and Pipe Stiffener as manufactured by JCM Industries, Inc. Either mechanical joint joining method will have a ductile iron mechanical joint gland.

12.5.5 OTHER: Socket fusion, hot gas fusion, threading, solvents, and epoxies may not be used to join HDPE pipe.

12.5.5.1 The CONTRACTOR shall furnish a fusing apparatus and generator to the Owner once construction is complete. The fusing apparatus shall be Central Plastic 2A Electric Heater and Bag with Dyes for 2″, 1 ½″, and 1 ¼″ HDPE pipe. The generator shall be a North Star portable generator 15,000 surge watts, 13,500 running watts having two 120 volt 20 amp duplex outlets, one 120/240 volt 60 amp outlet, one 120 volt 30 amp locking plug outlet, one 120/240 30 amp locking plug outlet, and a 20 hp electric start Kohler engine.

12.5.6 QUALITY AND WORKMANSHIP: The pipe and/or fitting manufacturer's production facility shall be open for inspection by the owner or his designated agents with a reasonable advance notice. During inspection, the manufacturer shall demonstrate that it has facilities capable of manufacturing and testing the pipe and/or fittings to the standards required by this specification.

12.5.7 PACKAGING, HANDLING & STORAGE: The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project neatly, intact and without physical damage. The transportation carriers shall use appropriate methods and intermittent checks to insure the pipe is properly supported, stacked and restrained during transportation such that the pipe is not nicked, gouged, or physically damaged.

Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The pipe shall be handled in such a manner that it is not pulled over sharp objects or cut by chokers or lifting equipment.
Sections of pipe having been discovered with cuts or gouges in excess of 10% of the pipe wall thickness shall be cut out and removed. The undamaged portions of the pipe shall be rejoined using the heat fusion joining method.

Fused segments of the pipe shall be handled so as to avoid damage to the pipe. Chains or cable type chokers must be avoided when lifting fused sections of pipe. Nylon slings are preferred. Spreader bars are recommended when lifting long fused sections.

12.6 CONSTRUCTION PRACTICE

12.6.1 TRENCH CONSTRUCTION: Trenching shall be done in accordance with ASTM D 2321, Section 6 and/or ASTM D2774.

12.6.2 EMBEDMENT MATERIAL: Embedment materials shall be Class I, Class II, or Class III materials as defined by ASTM D 2321, Section 5. The use of Class IV and Class V materials for embedment is not recommended and should be done only with the approval of the engineer. Class I crushed stone and Class II well-graded gravels are preferred. The embedment material shall have an installed density of at least 85% Standard Proctor Density through compaction or consolidation.

12.6.3 BEDDING: The pipe bedding shall be constructed in accordance with ASTM D2321, Section 5, Table 2.

12.6.4 HAUNCHING AND INITIAL BACKFILL: Haunching and initial backfill shall be as specified in ASTM D2774 and/or ASTM D2321, Section 5, Table 2 using Class I, Class II or Class III materials. Materials and compaction shall be specified by the engineer.

12.7 TESTING

The completed force main and siphon shall be subjected to a combined pressure and leakage test as described in Section 4 of AWWA C600. The testing shall be subject to the following:

A) All tests shall be conducted in the presence of the ENGINEER.

B) The CONTRACTOR shall furnish a recording pressure device to be used for the pressure and leak test. The device shall be a Dickson PR300 Pressure Logger with all appropriate cables and software. The Device and software shall become the property of the OWNER at conclusion of test. The pressure charts from the test shall be retained by the OWNER as evidence of the testing.

C) All test waters shall be potable water from the OWNER's water distribution system. When connecting to the existing Mountain Water District Potable Water System the CONTRACTOR shall utilize a Reduced Pressure Zone Backflow Prevention device. The device shall be a Zurn / Wilkins RPZ Backflow Preventer Model Number 975XL. The Pressure Zone Backflow Prevention device shall become property of the OWNER at the conclusion of the project. Withdrawals of water from the OWNER’s system **must be both authorized and metered.** The OWNER will bill the contractor for all waters used in accordance with its current rate schedule.

D) The test pressure shall be 100 psi or the maximum operating pressure of the lift station, whichever is greater.

E) Duration of test shall be no less than two hours.

F) Where leaks are evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or relaid, and leakage minimized regardless of total leakage as shown by test.

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

H) Lines which fail to meet test requirements shall be repaired and retested as necessary until test requirements are complied with at no additional cost to OWNER.

12.8 CONNECTING FORCE MAIN TO MANHOLE

All sanitary sewer force mains to be connected to manholes must connect at the elevation indicated on the design drawings.

12.9 CONCRETE THRUST BLOCKS

Concrete thrust blocks shall be provided at all bends in the force main as shown on the Detail Sheets of the Design Drawings.

12.10 MEASUREMENT AND PAYMENT

12.10.1 Measurement: Pipe for force mains and siphons in place, complete, successfully pressure tested shall be measured in linear feet along the pipe centerline. Pipe bends will not be measured for separate payment. Bends shall be measured in linear feet. No allowance shall be made for laps or drops at connections.

12.10.2 Payment: Payment for force mains and siphons will be made at the contract unit price for the applicable diameter as set forth in the Bid Schedule. Such payment shall constitute full compensation for all materials, labor, equipment, and incidentals necessary for the completion of the work.

-- THE END --

SECTION XIII

TECHNICAL SPECIFICATIONS

PRESSURE SEWER LATERALS
&
BUILDING SEWER

13.1 SCOPE

Furnish all labor, material, equipment and incidentals required to install, complete and ready for operation, all sanitary sewer service laterals as shown on the Drawings and as specified herein.

13.2 SPECIAL REQUIREMENTS

The CONTRACTOR will encounter a variety of house connection situations. These include:

a. Existing Service Replacement Lateral. Sewers for most of this project will be constructed in existing residential neighborhoods. Since the existing homes already have sanitary disposal systems (straight pipes, septic tanks, combined sewers, etc.), there is a danger that the landowners will not connect to the new sewer system and defeat the water quality improvement objectives of this project. Consequently, where possible, the CONTRACTOR will be required to follow the procedure outlined in **13**.4 herein to completely connect existing residents to the new sewers.

Any connection of a lateral within the limits of the project easements is covered by the DOW construction permit. Any connection of a lateral beyond the limits of the easements is **NOT** covered by the DOW construction permit and, therefore, requires a plumbing permit, a plumbing inspection, and actual connection by a licensed plumber. It is a project requirement that the CONTRACTOR obtain all necessary permits, schedule the required inspections, pay all fees, and have a licensed plumber as a member of his construction field personnel. The provision of these services shall be considered incidental to the unit price bid for 4 inch gravity sewer pipe.

13.3 GENERAL

13.3.1 Building Sewer:
NONE

13.3.2 Pressurized Sewer Line:
All polyethylene pipe and tubing furnished under these specifications shall conform to all applicable requirements of the latest revision of the following standards, unless otherwise specified herein;

- AWWA C-901: Specification for Polyethylene Pressure Pipe, Tubing, and Fittings, ½" through 3" for Water.
- ASTM D2239: Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) (Iron Pipe Size, Inside Diameter)
- ASTM D2737: Specification for Polyethylene (PE) Plastic Tubing (Copper Tube Size, Outside Diameter)
- ASTM D3350: Specification for Polyethylene Plastics Pipe and Fittings Materials.

NSF #13 and #61

13.4 MATERIALS

13.4.1 Building Sewer: PVC pipe and fittings shall be used for all gravity sanitary sewer laterals. The pipe shall be extruded from Type I, Grade 1, polyvinyl chloride material, designated as PVC 1120, meeting ASTM specifications D3034, Type PSM, with a standard dimension ratio of SDR 35.

13.4.2 Pressure Sewer Laterals: The pipe shall be Chevron Phillips Performance Pipe Series 5100 or approved equal. The laterals shall be of Iron Pipe Size (IPS) ID ASTM D2239.

Nominal Size	Outside Dimension	Approximate ID
1.25"	1.774	1.380

The pipe and fitting material shall have a classification number of 355434C in accordance with ASTM D3350. The pipe shall also have a pressure rating of 160 PSI. In addition, the material must exceed 1000 hours when tested in accordance with the Ring Environmental Stress Crack Resistance Test (Radar Ring Test) with fewer than 20% failures. Also, the extruded pipe shall have impact strengths greater than 15 ft#/in. at 32° Fahrenheit when tested in accordance with the (ASTM D256 Sharpie Impact Test). The material shall be of virgin quality. The pipe supplier shall provide a representative to instruct the CONTRACTOR's crew on Butt Fusion and installation and witness the first twenty joints.

The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions or other injurious defects. It shall be uniform in color, opacity, density and other physical properties.

Butt fusion of the pipe fittings shall be performed in accordance with the pipe manufacturer's recommendations as to equipment and technique. The fusion operation shall be performed by an individual who has demonstrated the ability to fuse polyethylene pipe in the manner recommended by the pipe supplier.

13.5 INSTALLATION

13.5.1 Building Sewer Lateral: **Couplings or sleeves for connecting pipes of different sizes or materials shall be made of ductile iron such as those manufactured by Muller Co., Dresser or Clow. Rubber couplings, such as those made by Fernco, will not be allowed. The OWNER and CONTRACTOR shall meet with the landowner to determine a mutually agreeable location for each lateral prior installation.** The CONTRACTOR shall lay a four-inch building connection line from the existing building sewer to the new grinder unit, IF, and only IF, the landowner signs up for sewer service and pays the Water District's tap fee. This four inch sewer is referred to herein as the 'building sewer'.

If the CONTRACTOR completes a 'building sewer' connection, he shall smoke test the landowner's system to verify that roof leaders or other storm drainage sources have not been connected to the new sewer. The abandoned, or disconnected, service connection shall be suitably plugged or reconnected to a storm drainage system as applicable.

All house laterals, unless otherwise specified or directed, shall be standard PVC pipe as specified hereinbefore and as indicated on the Drawings. Trenching, pipe laying, joints and backfilling shall conform to the requirements set forth herein for pipe laying.

The pipe shall be laid on a uniform grade from the grinder pump to the existing sewer.

The installation of house connections shall not occur until the pressure sewer is ready for service.

13.5.2 Pressure Sewer Lateral: Refer to the Sanitary Sewer Force Main Specification for Installation of Pressurized Sewer Pipe.

13.6 MEASUREMENT AND PAYMENT

13.6.2 House Sewer Laterals: House Sewer Laterals shall be measured as four inch lateral lines (house connection to Grinder Basin) in place, complete, successfully pressure tested, shall be measured in linear feet along the pipe centerline. Pipe fittings in the collector sewer (wyes, tees) will be measured "each." The length of fittings measured for payment will be deducted from the lineal feet of pipe laid to avoid double payment. Pipe bends will not be measured for separate payment. Pipe bends shall be included in the linear feet of pipe. No allowance shall be made for laps or drops at connections.

There shall be no separate measurement or special payment for disconnecting / reconnecting existing building sewers, for smoke testing existing building sewer systems, for four inch to six inch PVC adaptors, or for other work associated with installing building sewer systems as same shall be considered incidental to cost for four inch gravity sewer. CONTRACTOR should prepare his unit price bid accordingly.

CONTRACTOR SHOULD NOTE THAT HOUSE LATERAL FOOTAGE IS AN ESTIMATE AND COULD VARY SIGNIFICANTLY. ESTIMATE WAS ASSUMED TO BE 20 FEET PER HOME.

13.6.3 Pressure Sewer Laterals: Pressure Sewer Lateral shall be measured as 1.25” lateral lines (Grinder Basin to Collector Force Main) in place, complete, successfully pressure tested, shall be measured in linear feet along the pipe centerline.

13.6.4 Payment: Payment for pipe will be made at the contract unit price per linear foot for each pipe diameter as set forth in the Bid Schedule. Payment for fittings shall be made at the contract price "each" as set forth in the Bid Schedule. Such payment shall constitute full compensation for all materials, labor, equipment, and incidentals necessary for the completion of the work. Plug and rebar for marking the ends of laterals shall be considered incidental to the linear foot price of pipe.

-- THE END --

SECTION XIV

TECHNICAL SPECIFICATIONS

PRESSURE SEWER LATERAL ASSEMBLY

14.1 SCOPE

Furnish all labor, material, equipment and incidentals required to install, complete and ready for operation, a connection of a 1.25" force main from a residential grinder station to a force main or gravity sewer main as shown on the Drawings and as specified herein.

14.2 QUALITY ASSURANCE/SUBMITTALS

14.2.1 Submit five copies of itemized summary of source of manufacture of each item in pressure connection. Provide manufacturer's certification of compliance with specification for each item.

14.3 MATERIALS

14.3.1 Pressure Pipe: The HDPE 1.25" force main is covered under the force main section of these specifications.

14.3.2 Pressure Sewer Lateral Assembly: The pressure sewer lateral assembly shall be made of brass. The assembly shall include:

1) a brass male 1.25" x PVC pack joint coupling as manufactured by Ford Meter Box Company, Inc., or equal;
2) two brass male 1.5" x CTS pack joint couplings as manufactured by Ford Meter Box Company, Inc., or equal;
3) a female 1.5" brass swing check valve, Legend Valve model T-451, or equal;
4) a 1.5" heavy duty forged brass full port ball valve, Legend Valve model T- 1001, or equal;
5) a 1.5" brass threaded close nipple as manufactured by BMI Canada, or equal.

All valves shall be rated for 200 psi service. Valves shall have the appropriate compression end fittings for the specified service tubing. The brass swing check valve shall

be rated for 125 psi service. Check valves shall have the appropriate compression end fittings for the specified service tubing. Entire assembly shall be suitable for housing in a 17″x30″x18″ meter box.

14.3.3 Meter Box and Lid: The pressure sewer lateral assembly shall be housed in a 17″x30″x18″ rectangular structural foam material meter box as manufactured by Pentek, or equal. The meter box shall be equipped with a green T-Cover equal to Carson Industries, LLC model 1419-4.

14.3.4 HDPE Tapping Saddle Assembly: If the 1.25″ HDPE force main is to be connected to another HDPE force main, the CONTRACTOR shall attach to the main a double strap iron service saddle with a 1.5″ branch equal to model F202 as manufactured by Ford Meter Box Company. The branch length shall be suitable for connection to the corporation stop of the pressure sewer lateral assembly. The ballcorp corporation stop shall be 1.5″ x CTS brass with a fluorocarbon-coated brass ball valve as manufactured by Ford Meter Box Company, or equal.

14.3.5 Gravity Main Tapping Saddle: If the 1.25″ HDPE force main is to be connected to a PVC gravity main, a tapping saddle will be required. Tapping saddles shall be Smith Blair 313-872-10 suitable for connection to PVC pipe with OD between 7.69 and 8.72 inches. Each saddle shall be furnished with a C8655 “compression couple by male” fitting to allow an 1.25″ compression connection to the 1.25″ HDPE force main.

14.4 INSTALLATION

14.4.1 Taps: Taps (where required) shall be made in accordance with the manufacturer’s directions. The tap shall be protected by 6″ of fine sand or gravel as indicated in the detail drawings.

14.4.2 Meter Box Setting: The meter boxes shall be set in a neat and workmanlike manner. The lid of the meter box shall be set:

1) Away from paved surfaces.
2) 0.5″ above grade in improved lawns, and
3) 2″ above grade in unimproved areas.

14.5 MEASUREMENT AND PAYMENT

14.5.1 Measurement: “Pressure Sewer Lateral Assembly” shall be measured ‘Each.’ For purposes of measurement and payment, no distinction shall be made between connections to HDPE force mains or connections to gravity sewer mains. The “Pressure Sewer Lateral Assembly” is defined to include the pressure sewer lateral assembly, meter box and lid, and HDPE tapping saddle assembly (or brass tapping saddle, as applicable).

14.5.2. Payment: Payment for "Pressure Sewer Lateral Assembly” will be made at the Contract Unit Price ‘each’ as set forth in the Bid Schedule for the actual quantity measured. Payment ‘each’ shall be considered full compensation for all materials, labor, equipment and incidentals necessary for the completion of the work.

-- THE END --

SECTION XV

TECHNICAL SPECIFICATIONS

FORCE MAIN VALVES

15.1 SCOPE

This work shall consist of furnishing and installing Valves on 10″, 8″, 6″, 4″, 3″, 2″ and 1.25″ High Density Polyethylene pipe.

15.1.1 QUALITY ASSURANCE/SUBMITTALS

15.1.1.1 Submit five copies of manufacturer's certification of compliance with applicable AWWA specifications. The Certificate is to be signed by corporate officer having authority to legally bind the company.

15.2 MATERIALS

15.2.1 General: Valves 3″ and larger shall be gate valves. Valves less than 3″ shall be thermoplastic ball valves (Nordstrom or equal).

15.2.2 Gate Valves: All gate valves shall be iron body, nonrising stem, fully bronze mounted (Mueller or approved equal). VALVES SHALL BE RATED FOR WORKING WATER PRESSURES OF 150 PSI. Valves shall be of standard manufacture and of the highest quality both as to materials and workmanship.

All gate valves for "below ground" service shall be furnished with mechanical joint end connections. Gate valves for "above ground" (or pit) installations shall be furnished with flanged end connections.

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

Each gate valve for "below ground" service shall be installed in a vertical position with a valve box, as shown in the Design Drawings. Gate valves set with boxes shall be provided with a two inch square operating nut and shall be opened by turning to the left (counterclockwise). Each gate valve for "above ground" (or pit) installations shall be furnished with a hand wheel operator.

15.2.3 Ball Valves: Two inch valves shall be thermoplastic ball valves manufactured from glass reinforced nylon materials (Nordstrom or equal).

15.2.4 Valve Box and Cover: The valve box and cover shall be of cast iron construction (Clow F-2450, or equal) and shall be engraved with the word “water”.

15.2.5 Valve Marker: Each valve assembly shall be delineated by a valve marker as detailed in the Drawings. The marker shall consist of a 3” yellow PE pipe embedded vertically adjacent to the valve. The marker shall include a weatherproof label identifying the valve owner and provide an emergency phone number for the owner.

15.2.6 Plug: If the gate valve is to be installed at the end of a line the CONTRACTOR shall provide one full joint of ductile iron pipe with cap beyond the valve.

15.3 INSTALLATION

Trenching, bedding, and backfilling requirements for gate valves shall conform to the installation requirements for water lines and fittings. The base of the valve shall be anchored in concrete as shown in the Design Drawings. The valve box shall be installed vertically, centered over the stem of the operating nut. The valve box base shall be placed at least two inches above the flanged joint of the valve cover. The top of the operating nut should be no higher than the hub or upper part of the valve box base where it connects to the center section.

15.4 MEASUREMENT AND PAYMENT

15.4.1 Measurement: Valves for buried service in-place, tested, and accepted shall be measured each. Valves installed in vaults, pits, and pumping stations shall be considered incidental to the complete price for the vault, pit or pumping station and shall not be measured for separate payment.

15.4.2 Payment: Valves measured for payment shall be paid for at the contract price "each" as set forth in the Bid Schedule. Payment as specified shall be considered as full compensation for all labor, materials, equipment, and incidentals necessary to perform the work as required. The valve box and cover shall be considered incidental to the installation and shall not be measured for separate payment.

-- THE END --

SECTION XVI

TECHNICAL SPECIFICATIONS

AIR RELEASE VALVE AND PIT

16.1 SCOPE

The CONTRACTOR shall provide all labor, tools, materials and equipment to furnish and install air and vacuum release valves and pits as shown on the Design Drawings and as directed.

16.2 QUALITY ASSURANCE/SUBMITTALS

Submit five copies of the following:

1. Documentation to substantiate compliance with materials section of this specification.

16.3 MATERIALS

A. Tapping Saddle: Tapping saddles shall be of double band type construction.

B. Pipe: All pipe shall be 2″ HDPE DR-11 and maintain a working pressure of 160 psi.

C. Combination Air Valve:

- All air release valves shall be combination air/vacuum release valves designed for raw sewage and effluent. The valve shall be a model D-0252T as manufactured by A.R.I or approved equal.
- Each valve is to have: 2″ N.P.T. intake; corrosion resistant conical body of reinforced nylon; corrosion resistant non-metallic operating mechanism; stainless steel spring loaded float to allow for system vibrations and turbulence; & working pressures of 3-240 PSI.

D. A 2″ brass isolation valve shall be furnished for installation between the discharge pipe and air valve.

E. Valves with steel or cast iron bodies or internal parts that are corrosive are not acceptable.

F. Valve Pit: Valve pit shall be a manhole Type “B” in accordance with Section XIV of these specifications.

16.4 INSTALLATION

Installation shall include the complete assembly with pit and top, shut-off valves, blow-offs, air valves, isolation valve, piping, fittings, and union, all complete and ready for operation in general conformance with the Drawings. Work in and around the pit will be done in a workmanlike manner leaving the top of the box one inch above the original ground surface.

16.5 MEASUREMENT AND PAYMENT

A. Measurement: Air and Vacuum Release Valve and Pit assemblies shall be measured each.

B. Payment: Air and Vacuum Release Valve and Pit assemblies, in-place and accepted, shall be paid for at the contract unit price each as established in the Bid Schedule. Payment as specified shall be considered full compensation for all labor, materials, equipment, and incidentals necessary to perform the work as required.

-- THE END --

SECTION XVII

TECHNICAL SPECIFICATIONS

PAVEMENT REPLACEMENT

17.1 PURPOSE

The purpose of this section is to outline requirements for the proper replacement of roadway and parking lot surfaces damaged through installation of utilities and the construction of new surfaces to serve the completed facilities.

17.2 QUALITY ASSURANCE/SUBMITTALS

A) All standards, material, methods of installation, equipment and construction shall be in accordance with the current edition of the Kentucky Department of Highways (KYDOH) publication "Standard Specifications for Road and Bridge Construction," except as modified herein.

B) Submit five copies of the following:

1) Documentation to substantiate compliance with the materials section of this specification.

17.2 GENERAL

Existing paving in roadways, entrances, parking lots, etc. shall be restored to a condition equal to that which existed before the work began and to the satisfaction of the OWNER. In restoring improved surfaces new pavement is required. No permanent surface shall be placed within thirty (30) days after backfilling shall have been completed, except by order of the ENGINEER!

It is a project requirement that the CONTRACTOR furnish a temporary pavement equal in character to the existing pavement damaged by the construction within thirty (30) days of the completion of the trench backfilling. The CONTRACTOR shall maintain this temporary pavement until such time as the CONTRACTOR effects the permanent pavement replacement as set forth herein. CONTRACTOR'S INSTALLATION AND MAINTENANCE OF TEMPORARY PAVEMENT REPLACEMENT SHALL BE AT CONTRACTOR'S SOLE EXPENSE. This project requirement is established to encourage CONTRACTOR to complete permanent pavement replacements at the earliest possible date following backfilling.

17.3 PAVEMENT REPLACEMENT CLASSES

Pavement replacement includes the following types or classes:

1) Bituminous Pavement Replacement without Concrete Sub-Slab.

2) Concrete Pavement Replacement.

3) Gravel Surface Replacement.

17.4 MATERIALS

17.4.1 Bituminous Concrete Surface: Bituminous concrete conforming to Sections 401 and 402 of the current edition of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction shall be used for replacement of all existing bituminous surfaces. All bituminous material aggregates, mineral fillers, tack and seal coats shall meet the appropriate materials specifications of the aforementioned Department of Highways publication. Before placing any bituminous surface, the CONTRACTOR shall submit the design plant mix for the ENGINEER'S approval. This submittal shall address both the last date the mix was approved by the Department of Highways and the location where the mix was most recently used.

17.4.2 Concrete Surface: Concrete for pavement replacement shall be a mixture of Portland Cement, fine aggregate, coarse aggregate, with or without air entrainment, as required, combined in the proportions, mixed, and placed as specified for Class "A" concrete in Sections 501 and 601 of the publication Standard Specifications for Road and Bridge Construction, (1983 Edition, Kentucky Transportation Cabinet, Department of Highways).

17.4.3 Dense Graded Aggregate: Dense graded aggregate used for a base shall be a durable, crushed limestone meeting the requirements of Section 805 of the publication Standard Specifications for Road and Bridge Construction, (1983 Edition, Kentucky Transportation Cabinet, Department of Highways).

17.5 INSTALLATION OF BITUMINOUS SURFACES

17.5.1 General: The class of bituminous surface that will be used is Bituminous Pavement Replacement for Pavements without Concrete Sub-Slab. The definition of this class is as follows:

a) "Bituminous Pavement Replacement without Concrete Sub-Slab" does not require a concrete sub-slab. The pavement thickness shall be no less than the existing pavement thickness. The pavement width shall not exceed the maximum widths as specified in the Detail Drawings.

17.5.2 Base Preparation: The pipe trench shall be backfilled as indicated on the Detail Drawings. This backfill shall be cut back, shaped, graded, and compacted. A base course of 6" of dense graded aggregate shall then be placed and compacted.

For Full Width Pavement Replacement/Construction the base course shall be prepared as follows:

a. Compact 6" of DGA in pipe trench per the Detail Drawings.

b. Clean the existing pavement of construction debris (mud, gravel, etc.) This requires brooming!

c. Potholes, ruts, and other severely deteriorated portions of existing pavement shall be patched with bituminous base.

d. The cleaned and patched surface shall be jointly inspected by the CONTRACTOR and the ENGINEER. The surface must be accepted in writing by the ENGINEER before tacking operations begin.

e. The cleaned and patched surface shall be shot with 0.4 lb/sy of RS-2 tack.

17.5.3 Surface Course: The prepared pipe trench shall be paved with bituminous concrete Class I per the Detail Drawings. For full width construction, the full surface width shall receive a 2" base course and 1" surface course of bituminous concrete Class I per the Detail Drawings.

17.6 INSTALLATION OF CONCRETE SURFACES

17.6.1 Base Course: The pipe trench shall be backfilled as indicated on the Design Drawings. This backfill shall be cut-back, shaped, graded and compacted. A base course of 6" of dense graded aggregate shall then be placed and compacted.

17.6.2 Surface Course: The existing concrete pavement shall be cut-back with a concrete saw the distance as specified on the Design Drawings so that the final surface can be placed in a strip of uniform width. The subgrade shall be shaped, graded and compacted as directed by the ENGINEER. Class "A" concrete as described herein shall be placed to the greater of the existing pavement thickness or 6". The concrete slab shall be reinforced with 6" x 6" No. 4 wire mesh.

17.7 INSTALLATION OF GRAVEL SURFACES

17.7.1 Gravel Pavement Replacement: The pipe trench shall be backfilled as indicated on the Design Drawings. The trench backfill shall be cut-back, shaped, graded and compacted. A 6" course of dense graded aggregate shall then be placed and compacted.

17.8 MEASUREMENT AND PAYMENT

17.8.1 Measurement: There shall be no measurement for payment as the work shall be Lump Sum.

17.8.2 Payment: Payment shall be made at the Lump Sum contract Price as set forth in the Bid Schedule for the applicable contract. Payment as specified shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work.

-- THE END --

SECTION XVIII

TECHNICAL SPECIFICATIONS

BORE AND/OR ENCASE

18.1 SCOPE

This work shall consist of furnishing and installing steel encasement pipes for sanitary sewer lines and force mains by boring, jacking, or open cut methods.

18.1.1 Quality Assurance/Submittals

18.1.1.1 Submit five copies of certified mill test report on steel encasement pipe.

18.2 GENERAL

The CONTRACTOR shall comply with the previously obtained permits and approvals for completion of this work. Copies of the permits and/or approvals are reproduced in the Permits section of this document.

18.3 MATERIALS

18.3.1 Encasement Pipe: Encasement pipe shall be steel, plain end, uncoated, unwrapped, have continuously welded joints and have a yield point strength of 35,000 psi and conform to AWWA Specifications C200. The minimum wall thickness of the pipe shall be as indicated in the Detail Drawings.

In general, the inside diameter of the encasement pipe shall be 4 inches greater than the largest outside diameter of the carrier pipe. The Detail Drawings provide a table from which required encasement pipe diameters may be derived.

Field welding of encasement pipe shall be performed by a certified welder in accordance with the requirements of AWWA Specification C206-82.

18.3.2 Seals: A removable watertight rubber seal shall be used to seal the annulus between the excavation and the encasement pipe.

18.4 INSTALLATION - BORE AND JACK

No distinction shall be made between boring through earth or boring through rock. The CONTRACTOR shall conduct his own investigation of subsurface conditions and shall base his bid on his own findings.

The jacking will be allowed in one direction only. The installation procedure must provide for the placement of the encasement pipe concurrently with the removal of the soil.

Grouting between the excavation and the encasement pipe will be required if ordered by the ENGINEER or if, for any reason, the excavation exceeds one (1) inch larger than the outside diameter of the liner. Grout holes shall be provided in the tunnel lining with a spacing not to exceed four and one-half (4.5) feet measured longitudinally. The location of the holes shall be varied around the periphery of the encasement pipe to suit field conditions which will permit the proper grouting sequence to insure complete filling of void spaces outside the encasement pipe. The CONTRACTOR shall fill all the void space outside the encasement pipe with Portland Cement grout. The machine used for grouting shall permit the application of a pressure up to seventy-five (75) pounds per square inch in excess of any external water pressure. A gage shall be provided which will accurately indicate working pressure and this gage shall be carefully watched during grouting operations. The pressure shall at no time be allowed to exceed that considered safe or which would distort the encasement pipe. Grout pipes shall be one and one-half (1½) inches inside diameter.

The carrier pipe shall be installed after the encasement pipe is in place. The installation of the carrier pipe shall be in accordance with the manufacturer's specifications using casing skids as shown in the Detail Sheets of the Design Drawings. After the carrier pipe has been installed, inspected, and tested as specified, both ends of the encasement pipe shall be closed with a removable, water-tight "boot" in a manner acceptable to the OWNER.

18.5 INSTALLATION - OPEN CUT

Where the encasement pipe is placed in open cut, the encasement pipe trenching, bedding, laying, and backfilling shall conform to the requirements of the applicable sections of these Specifications. The carrier pipe shall be installed after the encasement pipe is in place. The installation of the carrier pipe shall be in accordance with the manufacturer's specification using casing skids as shown in the Detail Sheets of the Design Drawings. After the carrier pipe has been installed, inspected, and tested as specified, both ends of the cover pipe shall be closed with a removable, watertight "boot" in a manner acceptable to the OWNER.

18.6 MEASUREMENT AND PAYMENT

18.6.1 Measurement: "Bore and Encase for 'X' inch Pipe" of the applicable diameter will be measured by the linear foot of steel encasement pipe furnished, installed, inspected and accepted. "Open Cut Encase for ‘X’ inch Pipe" of the applicable diameter will be measured by the linear foot of steel encasement pipe furnished, installed, inspected and accepted.

18.6.2 Payment: Payment for "Bore and Encase for 'X' inch Pipe" of the applicable diameter will be made at the contract unit price per linear foot as set forth in the Bid Schedule for the number of feet of encasement pipe measured. Payment for "Open Cut Encase for ‘X’ inch Pipe" of the applicable diameter will be made at the contract unit price per linear foot as set forth in the Bid Schedule for the number of feet of encasement pipe measured. Such payment shall constitute full compensation for all materials, labor, equipment and incidentals necessary for the completion of the work. Carrier pipe installed in the encasement pipe will be measured and paid for as indicated in the applicable sections of these Specifications.

-- THE END --

SECTION XIX

TECHNICAL SPECIFICATIONS

RESIDENTIAL WASTEWATER PUMPING STATIONS

19.1 SCOPE

Provide all labor, materials, and equipment necessary for furnishing and installing underground residential submersible sewage pumping station(s) complete and in proper operating condition. The work includes all work shown or implied on the Drawings. The work includes (but is not limited to):

1. Coordination of final station location and controls location with resident and OWNER.

2. Furnishing, installation and start-up of factory built simplex submersible grinder pump station complete with enclosure, plumbing and controls.

3. All related electrical work required to place the pumping unit in service including connection of the station's power supply to the property owner supplied junction box.

4. **Connection of the resident's sewer lateral to the completed pump station.**

5. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, etc.

Installation of the Pumping Station force main is covered under a separate section of these specifications and is not a part of this specification.

19.2 QUALITY CONTROL

19.2.1 Base Bidding: These specifications and the Drawings are based on provision of an Environmental One submersible pumping unit. To simplify repairs and inventory of spare parts, the OWNER has mandated that The SUCCESSFUL BIDDER (CONTRACTOR) may not submit an equal submittal.

19.2.2 Guarantee: The manufacturer of the submersible pumping station shall guarantee all equipment supplied against defects in workmanship and material for a period of sixty (60) months after notice of OWNER's acceptance, but no

greater than sixty-five (65) months after receipt of shipment. The OWNER will report any defects found during the warranty period to the MANUFACTURER.

In the event a component fails to perform as specified or is proven defective in service during the warrents period, the Manufacturer shall repair or replace such defective part without cost to the OWNER. He shall further provide, without cost, such labor as may be required to replace, repair, or modify major equipment components.

19.2.3 Start-Up: The manufacturer shall provide the services of a factory-trained representative to perform initial start-up of the pumping units and to instruct the OWNER's operating personnel in the operation and maintenance of the equipment.

19.3 SUBMITTALS

19.3.1 Submit five (5) bound copies of the following:

1. Manufacturer's warranty/guarantee.

2. Pump station Shop Drawings complete with station drawing, electrical schematics, and accessory components.

3. Pump station O & M Manuals. Manuals are to provide basic instructions for preventative and cyclic maintenance, sources of spare parts, etc.

19.4 MATERIALS - WET WELL

19.4.1 TANK: Fiberglass Construction. The tank shall consist of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.

The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending

beyond the tank walls to support concrete anchoring, as required, to prevent flotation. The tank shall include a solid fiberglass cover, secured with threaded stainless steel fasteners, providing low profile mounting.

The pump discharge piping components shall be 1-1/4″ IPS and consist of PVC pipe fittings, a PVC ball valve, rated at 200 psi WOG, with integral union to facilitate piping disconnect. Installation of the pump discharge piping shall require field assembly by the installing party. The tank shall have a discharge bulkhead, which terminates outside the tank wall with a 1-1/4″ female pipe thread. The discharge bulkhead shall be factory installed and warranted by the manufacturer to be watertight. The tank shall be furnished with an EPDM grommet to accept a 4.50″ OD (4″ DWV or SCHD 40) inlet pipe. The power and control cable shall connect to the pump by means of the provided NEMA 6P electrical quick disconnect (EQD) and shall enter the tank through a watertight strain relief connector supplied by the manufacturer. Installation of the inlet grommet and cable strain relief shall require field penetration of the tank wall by the installing party. Provision shall be made for tank venting in the 4″ inlet line in accordance with national and local plumbing code requirements.

19.5 MATERIALS – PUMPS

19.5.1 PUMP: The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the progressing cavity type with mechanical seal. The rotor shall be constructed of stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. Buna-N is not acceptable as a stator material. The material shall be suited for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

The pump(s) shall be capable of delivering 15 GPM against a total dynamic head of 0 feet (0 PSIG) and 9 GPM against a total dynamic head of 138 feet (60 PSIG) at a maximum of 8.0 amps. The pump(s) must also be capable of operating at negative total dynamic head without overloading the motor(s). Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

19.5.2 MECHANICAL SEAL: The pump shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and

carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

19.5.3 GRINDER: The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stamped, stainless steel shredder ring assembly spaced in accurate, close annular alignment with the driven impeller assembly, which shall carry two hardened, 400 series stainless steel cutter bars.

This assembly shall be dynamically balanced and operate without vibration over the entire range of specified operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including pump starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks, which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2. The grinder inlet shroud shall have a diameter no less than 5 inches.

3. At maximum flow, the average inlet velocity must not exceed 0.2 feet per second.

4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, to finely divided particles that will pass freely through the passages of the pump and the 1-1/4" diameter discharge piping.

19.6 MATERIALS - PUMP MOTORS

The motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the

use of an automatic-reset, integral thermal overload protector incorporated into the motor.

19.7 MATERIALS – CHECK VALVE

The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve secured to the stainless steel pump discharge elbow. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low backpressure. The valve body shall be injection-molded parts made of glass filled thermoplastic.

Provision by the installing party shall be made for the supply and installation of a separate check valve in the 1 1/4" service lateral between the grinder pump station and the sewer main, preferably next to the curb stop.

19.8 MATERIALS - CONTROLS

CONTROLS: All necessary controls shall be located in the control cover of the core unit. The control cover will be attached with stainless steel fasteners. The grinder pump will be furnished with a length of 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements. Non-fouling waste water level detection for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a second, independent, air-bell sensor and pressure switch of the same type.

To assure reliable operation of the pressure sensitive switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent entry of water into the motor compartment.

ALARM/DISCONNECT PANEL: Each Grinder Pump Station shall include a NEMA 3R, Alarm/Disconnect Panel suitable for wall or pole mounting. The NEMA 3R enclosure shall be manufactured of corrosion resistant thermoplastic and be furnished with a hinged cover and pad lock.

For each core, the panel shall contain one (1) - 15 amp, double pole circuit breaker for the power circuit and one (1) 15 amp single pole circuit breaker for the alarm circuit. The Alarm/Disconnect Panel shall include a visual high-level alarm indicator. The visual alarm lamp shall be inside a red fluted lens mounted to the top of the enclosure in such a manner as to maintain NEMA 3R rating. The alarm sequence is to be as follows:

1. When liquid level in the tank rises above the alarm level, the contacts on the alarm pressure switch will close and the visual alarm will illuminate on the control panel.

2. The visual alarm will remain illuminated until the sewage level in the tank drops below the "off" setting of the alarm pressure switch.

19.9 MATERIALS – CORE UNIT

Pump units with slide away couplings shall be provided. The slide away coupling shall allow the pump to be installed or removed without requiring personnel to enter the wet well. The Grinder Pump Station shall have an easily removable core assembly consisting of the pump, motor, grinder, all motor controls, check valve, anti-siphon valve, EQD and wiring. The grinder pump core unit shall be furnished with polypropylene lifting harness connected to the pump body to facilitate easy removal when necessary. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation.

19.10 MATERIALS - ACCESSORIES

A. All materials exposed to wastewater shall have inherent corrosion protection. Acceptable corrosion protection includes epoxy powder-coated cast iron, fiberglass, stainless steel, polyethylene, nylon, and PVC.

B. **Spare core assemblies shall be included with the total order for the residential grinder pump package as indicated on the bid schedule.**

C. Electrical Systems & Components - All electrical systems and components shall be in full accordance with the current edition of the National Electrical Code. All power supply lines and control lines to the pump station shall be fully encased in rigid conduit meeting

NEC requirements. All electrical systems and components in wet wells and enclosed spaces shall comply with National Electrical Code requirements for Class I, Group D, Division 1 locations and shall be suitable for use in corrosive environments. All conduits extending from the wet well to the control panel shall be sealed at the entrance to the control panel to prevent the intrusion of corrosive gases! The control circuitry shall be provided with "Ground Fault" interruption protection, which will de-energize the circuit in the event of any failure in the electrical integrity of the pump power cable.

19.11 INSTALLATION

19.11.1 Maintenance of Service: Wastewater service shall be maintained throughout the construction activity. No discharge to surface waters shall be allowed.

19.11.2 Installation shall be in accordance with the Manufacturer's requirements and the referenced codes and specifications.

19.11.3 Excavation: CONTRACTOR shall select means, methods, sequences and techniques of construction to both protect adjacent properties and to provide a stable, safe working environment. Decision as to whether to use sheet piles with wales and struts, manhole trench box, piles and lagging, or other methods of excavation support shall be the CONTRACTOR'S.

19.11.4 Backfilling: Before backfilling is started, the excavated pit shall be cleared of all rubbish and debris and shall be de-watered. The backfill material shall be free of frozen lumps, vegetation and debris. Backfill material shall be placed in uniform horizontal layers not exceeding 6 inches in thickness (loose measure). As a precaution against the development of unbalanced stresses, the backfill shall be placed and compacted symmetrically about the excavation to 95% of Standard Proctor Density.

The grading shall be brought to the level of the existing topography or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches in diameter.

19.11.5 Electrical: The electrical connection of the residential grinder pump station shall be in accordance to all state and federal electrical codes and shall be connected

separately from all other electrical devices (i.e. no piggy-backing).

19.12 TESTING

19.12.1 Electrical: All electrical work shall be inspected and approved by an electrical inspector. Two copies of the Certificate of Approval shall be provided to the ENGINEER before final acceptance.

19.12.2 Pump Test: The completed installation shall be given a running test of all equipment. While the pump(s) is/are running, all piping and seals shall be checked to insure that no leaks occur. All controls and warning indicators shall be checked for proper operation.

19.12.3 Smoke Test: The CONTRACTOR shall smoke test the resident's incoming sewer system (in the presence of the ENGINEER) to verify that roof leaders are not connected to the grinder system. A written report of all smoke testing, with emphasis on non-complying homeowners, shall be furnished to the ENGINEER at the completion of the project.

19.12.4 Repair: Any defects or failure to meet the requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the OWNER as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

19.13 MEASUREMENT AND PAYMENT

19.13.1 Measurement: The payment categories for Residential Grinder Stations are as follows:

Item 5a - Install Residential Grinder Pump Station, Complete, In-Place
Item 5b - Complete Residential Grinder Pump Package - Materials
Item 5c - Pressure Sewer Lateral Assembly
Item 5d - Grinder Pump Floodplain Installation
Item 5e - Extra Vertical Height Residential Grinder Enclosure
Item 5f – Extra Vertical Height Residential Grinder Enclosure – Materials

The OWNER has already bid items 5b and 5f. The OWNER will purchase these items from an authorized representative of E-One. Once the Owner has delivered these Items to the CONTRACTOR, The CONTRACTOR is responsible FOR ALL MATERIALS AND PROPER STORAGE. **Item 5b is to include spare core assemblies to be suitably stored by the CONTRACTOR at the**

OWNER'S designated maintenance facility. The CONTRACTOR shall place the balance of his costs to complete the work under this specification XIX in Items 5a and 5c.

Please Note: The work of Items 5a, 5c, 5d, and 5e shall include (but not be limited to):

1. Coordination of final station location and controls location with resident and OWNER.

2. Furnishing, installation and start-up of factory built simplex submersible grinder pump station complete with enclosure, plumbing and controls.

3. All related electrical work required to place the pumping unit in service including connection of the station's power supply to the resident's power center (light panel). At a minimum this work will include coordination with the resident, a small light panel (where fuse boxes are present); a 30 amp circuit breaker; a NEMA 3R/4 (breaker type) disconnect of the appropriate amperage, wiring, conduit, and related electrical accessories.

4. Connection of the resident's sewer lateral to the completed pump station.

5. Acceptance testing of the completed grinder pump station installation including electrical inspection of wiring and smoke test of resident's plumbing.

6. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, etc.

19.13.2 Payment: Payment shall be made at the unit price ('each', 'VF' or 'LF' as applicable) for the actual number of units furnished / installed (as applicable) as set forth in the Contract. Payment as specified for Items '5a' through '5f' shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work specified herein and no other separate payment shall be made. It is noted that the force main from the grinder station is a separate pay item and is not included as a part of this section.

-- THE END --

SECTION XX

TECHNICAL SPECIFICATIONS

GRAVITY SANITARY SEWER LINES

20.1 SCOPE

The purpose of this section is to outline the requirements for the proper construction of gravity sanitary sewer lines and facilities appurtenant thereto.

20.1.1 Construction Tolerances: Contractor shall provide necessary leveling equipment to check the elevation of the flow line of the pipe as follows:

GRADE	FLOW LINE ELEVATION CHECK	ALLOWABLE ERROR
.004 - .008	Every 100 feet	± .03
.008 - .012	Every 150 feet	± .05
Above .012	Every 190 feet	± .07

20.1.2 Quality Assurance/Submittals

Submit five copies of the following:

A) Documentation to substantiate pipe material's compliance with these specifications.

B) Submit five copies of CONTRACTOR'S Bedding and Backfilling Plan. At a minimum the plan shall:

1. Identify/acknowledge the segments of pipe line to be backfilled using "open", "gravel", and "paved" criteria,

2. Include a Proctor Curve for the backfill material for every 1900 LF of pipe trench (curve to be prepared and sealed by a geotechnical engineer licensed in the State of Kentucky),

3. Include quarry's material certification for all aggregates utilized for bedding, haunching, and initial protective backfill, and

4. Include name and qualifications of CONTRACTOR'S nuclear density technician (technician must be a full time employee of CONTRACTOR, spot checks by a sub-contracting testing firm are not acceptable).

C) Documentation of low pressure air testing, mandrel testing, and infiltration checks.

20.2 MATERIALS

All pipe, joint, and fittings for the sanitary sewer shall be constructed of the materials as indicated on the Design Drawings.

11.2.1 Polyvinyl Chloride Pipe and Fittings (PVC) - PVC pipe and fittings shall be extruded from Type I, Grade 1, polyvinyl chloride material designated as PVC 1119, meeting ASTM Specifications D 3034, Type PSM, and a standard dimension ratio of SDR 35.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color. The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, marking and all other requirements of the Commercial Standards CS 256-63 shall be conformed within all respects.

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

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

20.2.2 Ductile Iron Pipe, Fittings and Joints: Ductile iron pipe shall conform to the latest AWWA Specifications C151 (ANSI A21-51) with standard thickness as designated in AWWA C150. Thickness class shall be as follows:

DIAMETER	**PRESSURE CLASS**
8" - 12"	350
14" - 30"	250

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

Where ductile iron pipe is to be installed in corrosive soil conditions, the pipe shall be protected by an eight mil thick polyethylene encasement meeting the requirements of ANSI A21.14. Such corrosive soils include but are not limited to salt marshes, saturated alkaline soils, cinder fills, areas of decaying vegetation, and waste dumps.

Bends and fittings shall be Mechanical Joint Compact Ductile Iron fittings, conforming to AWWA Specifications C153 for short body iron fittings. Fittings shall be tar-coated outside and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on (AWWA C111), mechanical joint (AWWA C111), flanged (AWWA C115) or ball and socket type as called for in the Plans. Bells for push-on type joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket is locked in place against displacement as the joint is assembled.

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

Joints for all bends and fittings for buried service shall be mechanical joint type only (AWWA C111). Flanged joint pipe shall be used in vaults, pits and above ground service installation. Flanged joint pipe may not be used for buried service.

20.2.3 Geotextile Type III - Geotextiles shall be woven or non-woven geotextile fabrics meeting the material and strength requirements for Type III fabrics as set forth in Section 215 of the Kentucky Department of Highways publication “Standard Specifications for Road and Bridge Construction.”

20.2.4 Bedding Stone - Bedding stone shall be durable crushed limestone meeting the requirements of Section 805 of the Current Edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction."

20.3 INSTALLATION

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

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

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

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

All excavated materials shall be placed a minimum of two feet back from the edge of the trench. Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed (as described hereafter) to provide safe working conditions and to prevent damage of work.

20.3.1.1 Trench Rock: "Sanitary sewer trench rock" is defined as any material which cannot be excavated from the pipe trench with an excavator (Caterpillar 320) having a break out force rated at not less than 35,750 lbs. and occupying an original volume of at least one (1.0) cubic yard.

"Sanitary sewer trench rock" will **NOT** be measured on this project for separate payment. **All excavation shall be unclassified.** THE CONTRACTOR IS EXPECTED TO EMPLOY A ROCK TRENCHER OR HOE RAM AS NECESSARY AND PREPARE HIS BID ACCORDINGLY.

20.3.1.2 Trench Drainage: The CONTRACTOR shall maintain all excavations free of water. He shall provide all dams, flumes, channels, sumps, or other works necessary to keep the excavation entirely clear of water and shall provide and operate pumps or other suitable equipment of adequate capacity for dewatering the excavation. He shall avoid producing mud in the trench or channel bottoms by his operations. If necessary, or so directed by the ENGINEER, the CONTRACTOR shall place crushed stone at his own expense to maintain a firm, dry excavation bottom and base. Pipe bedding, laying, jointing, and the placing of concrete shall be done in a water-free trench or excavation. The water shall be disposed of at the CONTRACTOR's expense. Waters removed from excavations shall not be disposed of in the sanitary sewer system.

Where the excavation extends below the water table, and lowering of the water table is necessary to prevent excessive inflows and maintain stability within the excavation, dewatering shall be performed. The CONTRACTOR shall use well points, sump pumps, or any other method of dewatering as required to lower the water table below the bottom of the excavations in a manner that will prevent the loss of fine soil particles. He shall obtain the ENGINEER's approval prior to the use of special dewatering equipment other than well points or sump pumps. Dewatering operations are considered incidental to the work and no additional compensations shall be made to the CONTRACTOR. Prior to beginning the work, the CONTRACTOR shall obtain, at his

expense, the necessary dewatering permits from the Commonwealth of Kentucky, Department of Natural Resources and Environmental Protection Cabinet (KNREPC).

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

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

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

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

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

braces.

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

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

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

20.3.1.5 Blasting: Blasting is not permitted on this project. In the event a situation arises where blasting cannot be avoided, the following shall apply. All blasting operations shall be conducted in accordance with the municipal ordinances, State laws, and Section 9 of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, Inc. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. Any damage done by blasting is the responsibility of the Contractor and shall be promptly and satisfactorily repaired by him.

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

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

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

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

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

Supporting of pipe shall be as set out hereinbefore, and in no case shall the supporting of pipe on blocks be permitted. The Design Drawings present typical approved bedding methods.

20.3.2.1 Earth Foundation: All pipe shall be laid on a six inch bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone. Granular bedding shall be mechanically compacted prior to pipe placement.

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

20.3.2.3 Special Bedding: In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the ENGINEER may order “Special Pipe Bedding.” When the ENGINEER orders “Special Pipe Bedding” (in writing), the CONTRACTOR shall:

a. overexcavate the mucky subgrade to the depth directed,

b. install a Type III geotextile as illustrated in the detail drawings,

c. backfill the geotextile with bedding stone, and

d. overlap the geotextile envelope in accordance with the detail drawings.

It is to be expressly understood that “Special Pipe Bedding” may only be employed upon written order of the ENGINEER.

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

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

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

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

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

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

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

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

20.3.4 Concrete Cradle, Anchors or Encasement: Concrete cradle or encasement of sewer lines and/or fittings shall be placed where shown on the plans. Sewers on 19 percent slopes or greater shall be anchored securely with concrete anchors, spaced as follows:

A) Not over 36 feet center to center on grades 19 percent and up to 35 percent.

B) Not over 24 feet center to center on grades 35 percent and up to 50 percent

C) Not over 16 feet center to center on grades 50 percent and over

Concrete shall be KYDOH Class "B" and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of pipe or injure the joints.

For this contract, concrete for pipe encasement and anchors is considered an incidental item included in the linear foot price of pipe.

20.3.5 Jointing Pipe: The pipe joints described shall be installed in accordance with the manufacturer's recommen-dations.

20.3.6 Backfilling Pipeline Trenches: All backfilling shall be accomplished in accordance with the bedding and backfilling detail provided in the Design Drawings. Any variances must be approved in writing by the ENGINEER.

When directed by the ENGINEER, the CONTRACTOR shall add water to the backfill material or dry out the material when needed to attain a condition near optimum moisture content for a maximum density of the material when it is tamped. The CONTRACTOR shall obtain a compaction of the backfill as indicated in the detail drawings at a moisture content within two percent of optimum.

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

When the pipe trench crosses a street or roadway, the CONTRACTOR shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

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

In all cases the pipe bedding, haunching and trench backfilling shall be done strictly according to the details in the plan set.

20.4 TESTING OF GRAVITY SEWER LINES

The testing of gravity sewers shall be accomplished by the CONTRACTOR as described herein. All gravity sewer lines shall be subjected to the following tests:

a. Visual Inspection/Test.

b. Leakage (Infiltration/Exfiltration).

c. Low pressure Air Test.

d. Deflection Test.

20.4.1 Test Methodologies

a. **Preparation.** Upon completion of backfilling and grading for the pipe reach to be tested, and immediately prior to testing activities, the CONTRACTOR shall clean the sewer of all debris and trash by rodding with appropriate tools. All proposed sewer laterals for the pipe reach to be tested must be in-place, temporarily plugged, and backfilled in the reach to be tested. THE CONTRACTOR SHALL PROVIDE BY-PASS PUMPING OF INTERRUPTED SEWER SERVICES AT NO ADDITIONAL COST TO THE OWNER FOR THE DURATION OF THE TESTING ACTIVITY

b. **Visual Inspection/Test.** The ENGINEER shall visually inspect the pipe reach to be tested, in the presence of the CONTRACTOR, after CONTRACTOR completes the preparatory cleaning activities. If the ENGINEER's visual inspection reveals obvious defects such as obstructions or leakage, or if the inspection reveals that the CONTRACTOR has not maintained the pipe on a 'gun barrel straight' line and grade from manhole to manhole, the ENGINEER shall notify the CONTRACTOR and OWNER in writing of the pipe sections failing the visual inspection. The CONTRACTOR shall subsequently repair or replace all defective materials and/or workmanship, necessary to meet the visual test requirements, at no additional cost to the OWNER.

c. **Leakage.** The CONTRACTOR shall conduct a leakage test in the presence of the ENGINEER. If the groundwater table is more than two feet above the invert of the pipe, an infiltration test shall be conducted. If the groundwater table is less than two feet above the invert of the pipe, the CONTRACTOR shall conduct an exfiltration test. To test for leakage, the pipe reach shall be isolated with removable plugs. For an

infiltration test, the volume of water which enters the sewer in a 24 hour period is to be determined. For an exfiltration test the sewer is to be filled with water to a point two feet above the upstream invert, and the volume of water lost over a 24 hour period is to be determined. Leakage shall not exceed 190 gallons per mile of pipe per inch of pipe diameter. All leaks detected by this testing procedure shall be repaired even though leakage is within limits. If leakage is not within limits, the CONTRACTOR shall repair or replace all defective materials and/or workmanship, and retest, as necessary to demonstrate that the repaired section meets the leakage requirements, at no additional cost to the OWNER.

d. **Low Pressure Air Test.** The CONTRACTOR shall conduct low pressure air testing in the presence of the ENGINEER. The air tests shall be conducted in accordance with the latest edition of the UNI-BELL Plastic Pipe Association Standard UNI-B-6-82 "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe."

All ties and ends of sewer services shall be plugged with flexible joints, plugs or caps securely fastened to withstand the internal test pressures. Such plugs or caps shall be readily removable, and their removal shall provide a socket suitable for making a flexible jointed lateral connection or extension.

The pipe must be clean prior to testing (See **Preparation**).

Air shall be slowly supplied to the plugged pipe installation until the internal air pressure is 4.0 pounds per square inch greater than the average back pressure of any ground water that may submerge the pipe. At least two minutes shall be allowed for temperature stabilization.

The air test requirements shall be satisfied if the time required (in seconds) for the pressure to decrease from 3.5 to 3.0 pounds per square inch (greater than groundwater backpressure) is not less than that shown in the "Specification Time Table" (Table A). The ENGINEER

shall determine the test time for pipe test lengths not provided in Table A. If the time for the indicated 0.5 psi pressure loss is less than the stated limits, the CONTRACTOR shall repair or replace all defective materials and/or workmanship, and retest, as necessary to demonstrate that the repaired section meets the air test requirements, at no additional cost to the OWNER.

e. **Deflection Test (PVC and HDPE Pipe).** No less than 30 days after the completion of backfilling, the CONTRACTOR shall pass a calibrated mandrel, or other approved device, through the sewer pipe to demonstrate that no pipe deflection greater than 5 percent of the inside diameter of the pipe has occurred. The CONTRACTOR shall repair or replace all pipes exhibiting greater than 5 percent deflection, and retest, as necessary to demonstrate compliance with deflection criteria, at no additional cost to the OWNER.

TABLE "A"

SPECIFICATION TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

1 PIPE DIAMETER (in.)	2 MINIMUM TIME (min: sec)	3 LENGTH for MINIMUM TIME (ft)	4 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	36:04	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	53:42	64:38	75:24	86:10	96:57
36	17:00	66	16.384 L	25:39	38:28	51:17	64:06	76:55	102:34	89:44	115:23

SOURCE: UNI-B-6-82

20.5 MEASUREMENT AND PAYMENT

20.5.1 Measurement: Gravity Sanitary Sewer Pipe in place, complete, successfully pressure tested shall be measured in linear feet along the pipe centerline. Pipe fittings (wyes, tees) will be measured "each." The length of fittings measured for payment will be deducted from the lineal feet of pipe laid to avoid "double" payment. Pipe bends will not be measured for separate payment. Bends shall be measured in linear feet. No allowance shall be made for laps or drops at connections.

“Special Pipe Bedding” - ordered in writing by the ENGINEER - in place and accepted shall be measured by the ton of bedding stone actually placed (to the top of the geotextile envelope). There will be no separate measurement of Geotextile Type III or other incidentals.

20.5.2 Payment: Payment for pipe will be made at the contract unit price per linear foot for each pipe diameter as set forth in the Bid Schedule for the actual quantities measured. Payment for fittings shall be made at the contract price "each" as set forth in the Bid Schedule. Such payment shall constitute full compensation for all materials, labor, equipment, and incidentals necessary for the completion of the work.

Payment for “Special Pipe Bedding” - ordered in writing by the ENGINEER - shall be made at the contract unit price per ton for the actual quantity measured. There shall be no separate payment for Geotextile Type III or other incidentals.

-- **THE END** --

SECTION XXI

TECHNICAL SPECIFICATIONS

FLOWABLE FILL CONCRETE ENCASEMENT FOR SANITARY SEWERS IN CLOSE PROXIMITY TO POTABLE WATER LINES

21.1 SCOPE

This work shall consist of furnishing and placing flowable fill as an alternate to compacted soil as approved by the ENGINEER as described in Division 600 and Division 800 of the current edition "***Transportation Cabinet Standards Specifications for Road and Bridges Construction***" for the state of Kentucky herein known as "Standard Specifications". Flowable fill may only be used when ordered in writing by the Engineer. Applications for this material include encasement for new sanitary sewer force main that is in close proximity to potable water lines. Flowable fill will "NOT" be used for thrust blocks, vertical anchors, kickers, or any other application that does not directly relate to encasement of pipe as called out within the Plan Set.

21.2 QUALITY ASSURANCE/SUBMITTALS

Submit six (6) copies of the following:

a. Source of concrete and mix design,
b. Concrete tickets (on delivery),
c. Concrete field test results (on delivery-per KYDOH),
d. Concrete strength testing (testing in accordance with "Standard Specifications")

21.3 MATERIALS

All materials shall meet the requirements of Section 800 of the "*Standard Specifications*".

21.4 MIX DESIGN

Use the flowable fill mixture design as described in the "*Standard Specifications*".

If the CONTRACTOR chooses to deviate from the specified proportions and materials then he/she shall make and test a batch of at least 4 cubic yards to ensure that the mix will have flow and density

characteristics suited for the intended use. The CONTRACTOR shall submit mix designs for flowable fill to the ENGINEER for approval.

21.5 CONSTRUCTION:

When used as backfill for pipe, where flotation or misalignment may occur, correct alignment shall be ensured by means of straps, soil anchors, or other approved means of restraint.

Flowable fill shall be protected from freezing for a period of 36 hours.

21.6 JOBSITE ACCEPTANCE:

Acceptance of Flowable fill will be based on documentation as outlined in the "*Standards Specifications*".

Contractor shall demonstrate that all mixtures shall be firm within 3 hours and shall also apply to the following guidelines:

1) When performing the open-ended cylinder modified flow test the flow shall be 8 inches.
2) The mixture shall bleed freely within 10 minutes.
3) The mixture shall support a 150-pound person within 3 hours.

21.7 MEASUREMENT AND PAYMENT

A. Measurement: "Flowable Fill", when ordered in writing by the Engineer, shall be measured by cubic yard.

B. Payment: "Flowable Fill", in-place and accepted, shall be paid for at the contract unit price per cubic yard as established in the Bid Schedule. Payment as specified shall be considered full compensation for all labor, materials, equipment, and incidentals necessary to perform the work as required.

-- THE END --

SECTION XXII

TECHNICAL SPECIFICATIONS

SEEDING, CLEAN-UP & LANDSCAPING

22.1 SCOPE

The purpose of this section is to outline the requirements for proper seeding, clean-up, and landscaping of all areas disturbed by construction.

22.2 SUBMITTALS

Submit six copies of documentation demonstrating compliance with the materials requirements of this specification.

22.3 SEEDING AND CLEAN-UP

22.3.1 General: All areas disturbed by construction which are not specifically designated for future construction 'by others' shall be seeded in accordance with this specification.

22.3.2 Requirements: Seeding shall be accomplished as described hereinafter. Unless otherwise specified by the OWNER, all areas to be seeded shall be left smooth and thickly sown with a mixture of grasses at a rate of not less than 87 pounds per acre. Unless otherwise specified, the mixture shall consist of 60 percent Kentucky Fescue #31, 30 percent Creeping Red Fescue, and 10 percent White Clover. After completion of rough grading in seeding areas, the CONTRACTOR shall apply agricultural limestone at a rate of 4 tons/ac and then re-distribute previously stockpiled site topsoils to a loose depth of 6 inches. The topsoil shall then be fertilized with number 12-12-12 fertilizer at a rate of 1000 pounds per acre. After fertilizer has been distributed, the CONTRACTOR shall disc or harrow the ground to thoroughly work the fertilizer into the soil. The seed shall then be broadcast either by hand or by approved sowing equipment at the rate specified. The CONTRACTOR shall protect the seeded area with straw mulch or hay mulch at a rate of two tons per acre. Plastic netting shall be used to anchor the mulch on all slopes steeper than 3:1. **All seed shall be certified**. Any necessary reseeding or repairing shall be accomplished by the CONTRACTOR prior to final acceptance. Cleanup, grading, seeding, and planting or restoration of all areas shall begin immediately. Exposed areas shall not remain unprotected for more than seven days.

22.3.3 Success and Maintenance: All areas seeded shall have a ninety (90) percent vegetative cover of lawn grasses, free of noxious weeds, at the end of the first growing season. Additionally, no individual area of bare ground, where seeding has been unsuccessful, shall exceed one square yard in surface area. CONTRACTOR shall be responsible for full expense of corrective seeding necessary to meet this performance criterion. OWNER shall incur no expense for

remedial seeding.

22.3.4 Equivalency: These seeding specifications are intended to establish an attractive cover of lawn grasses. The CONTRACTOR may submit an alternate plan for establishment of vegetative cover. However, no alternative revegetation methodology shall be employed without the express written approval of the ENGINEER. If the CONTRACTOR employs an alternative revegetation methodology, he is still bound by the Success and Maintenance requirements of this specification.

22.4 LANDSCAPING

Reasonable care shall be taken during construction to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees that receive damage to branches shall be trimmed of those branches to improve the appearance of the tree. Tree trunks damaged by construction shall be treated with a tree dressing.

During the course of construction, some existing vegetation may be damaged to an extent that the ENGINEER believes it will not survive. The ENGINEER may then direct the CONTRACTOR to replace said vegetation upon completion of the construction. THE ENGINEER MUST APPROVE (IN WRITING) ALL LANDSCAPING ACTIVITIES (and the cost of same) PRIOR TO THEIR PERFORMANCE. PAYMENT WILL NOT BE MADE FOR ANY LANDSCAPING ACTIVITIES PERFORMED WITHOUT PRIOR WRITTEN APPROVAL OF THE ENGINEER.

22.5 MEASUREMENT AND PAYMENT

22.5.1 Measurement: There shall be no measurement for “Seeding and Cleanup” as the work shall be Lump Sum. Landscaping shall be performed on a direct cost basis as described in payment. The bid schedule will provide for a predetermined “Landscape Allowance” budget.

22.5.2 Payment: Payment for “Seeding and Cleanup” shall be made at the Lump Sum contract price as set forth on the Bid Schedule. Payment as specified shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the “Seeding and Cleanup” work specified herein.

The fixed amount shown on the Bid Schedule for “Landscape Allowance” represents the ENGINEER’S best estimate of the cost of repairing existing landscape features. The method of payment shall be reimbursement of the actual, documented costs of replacement plus five (5) percent. The ENGINEER must pre-approve the type, location, and cost of all landscape plantings as set forth above. Payment as specified shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the “Landscaping” work specified herein.

-- **THE END** --

SECTION XXIII

TECHNICAL SPECIFICATIONS

FLUSHING CONNECTIONS

23.1 GENERAL

23.1.1 DESCRIPTION: The work of this Section includes furnishing and installation of a force main flushing connections pipe, fittings, valves, valve boxes, valve marker, complete, as indicated in the Contract Documents, including labor, tools, materials and equipment.

23.1.2 CONTRACTOR SUBMITTALS: Submit six copies of the following: Documentation to substantiate compliance with materials section of this specification.

23.2 PRODUCTS

23.2.1 BASIC MATERIALS

A. High Density Polyethylene Pipe (HDPE)

1. The pipe shall be Green Stripe Pipe. The Pipe shall be equal to Chevron Phillips Performance Pipe 4200 Series and shall be supplied in the following classes:

Nominal Size	Outside Dimension (In)	Approximate ID (In)
1.25″ DR 11	1.660	1.358
2″ DR 11	2.358	1.926
3″ DR 11	3.475	2.839
4″ DR 11	4.467	3.649
6″ DR 11	6.577	5.373

2. Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350-99 with a minimum cell classification of PE345464C. Pipe shall have a manufacturing standard of ASTM D3035 and be manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

3. Butt Fusion Fittings

Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy Datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

4. Electrofusion Fittings

Electrofusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and be the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.

5. Flanged and Mechanical Joint Adapters

Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

B. HDPE Ball Valves

1. Ball valves shall be NSF Approved, bubble-tight shutoff, fused body shell, smooth full bore with multiple elastomeric stem seals, butt fused and SDR 11.

2. Provide Nordstrom Poly-Water Valve or approved equal.

C. PVC Pipe and Fittings

1. PVC pipe and fittings shall be extruded from Type I, Grade 1, polyvinyl chloride material designated as PVC 1119, meeting ASTM Specifications D 3034, Type PSM, and a standard dimension ratio of SDR 35.

2. The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions or other defects. The pipe shall be as uniform as commercially practical in color. The workmanship, pipe dimensions and tolerances, outside diameters, wall thickness, eccentricity, sustained pressures, marking and all other requirements of the Commercial Standards CS 256-63 shall be conformed within all respects.

3. Pipe must be delivered to job site by means which will adequately support it and not subject it to undue stress. In particular, the load shall be so supported that the bottom rows of pipe are not damaged by crushing. Pipe shall be unloaded carefully and

strung or stored as close to the final point of placement as is practical. Pipe must not be exposed to the direct rays of the sun for an extended period of time as per manufacturer recommendations. If pipe is not to be installed shortly after delivery to the job site, it must be stored in a shaded location and strung as needed.

D. Plug Valves

1. Plug valves shall be non-lubricated, eccentric type with neoprene resilient faced plugs and flanged or mechanical joint ends as shown on the PLANS. Port areas of the valve shall be at least 80 percent of full pipe area. Valves shall be semi-steel or cast iron body and plug, raised eccentric seat, with a welded in overlay of not less than 90 percent pure nickel on all surfaces contacting the plug face. The valves shall have cylindrical seating surfaces that are eccentrically off-set. Valves shall have permanently lubricated, stainless steel bearings in the upper and lower plug stem journals and shall be of the bolted bonnet design.

2. The valve shall be capable of being repacked without removing the bonnet and the packing shall be adjustable without requiring disassembly of the valve. Valve seats shall comply with AWWA Standard C-507, Section 8, Paragraph 7.2 and with AWWA Standard C-504, Section 9, Paragraph 9.4. Bearings shall comply with AWWA Standard C-507, Section 3, Paragraphs 8, 8.1, 8.3, and 8.4 and with AWWA Standard C-504, Section 10. Valve shaft seals shall be Buna and shall comply with AWWA Standard C-507, Section 10, and with AWWA C-504, Section 11. All valve seats shall be installed opposite to the normal direction of the flow. They shall be DeZurik Eccentric Plug Valves or equal.

E. Valve Marker

Each flushing connection assembly shall be delineated by a valve marker as detailed in the Drawings. The marker shall consist of a 3″ yellow PE pipe embedded vertically adjacent to the valve. The marker shall include a weatherproof label identifying the valve owner and provide an emergency phone number for the owner.

F. Valve Box

Valve pit shall be a polyethylene meter box 36″ in diameter by 36″ deep with extension ring for the cover. The cover shall be cast iron.

23.3 EXECUTION

23.3.1 INSTALLATION; CONSTRUCTION; ERECTION; APPLICATION:

Installation shall include the complete assembly with pit and top, shut-off valves, blow-offs, air valves, isolation valve, piping, fittings, and union, all complete and ready for operation in general conformance with the Drawings. Work in and around the pit will be done in a workmanlike manner leaving the top of the box one inch above the original ground surface.

23.4 MEASUREMENT AND PAYMENT

23.4.1 Measurement: Flushing Connections for buried service in-place, tested, and accepted shall be measured each.

23.4.2 Payment: Flushing Connections measured for payment shall be paid for at the contract price "each" as set forth in the Bid Schedule. Payment as specified shall be considered as full compensation for all labor, materials, equipment, and incidentals necessary to perform the work as required.

-- THE END --

SECTION XXIV

TECHNICAL SPECIFICATIONS

DUPLEX GRINDER PUMP STATIONS

24.1 SCOPE

Provide all labor, materials, and equipment necessary for furnishing and installing underground duplex submersible sewage pumping station(s) complete and in proper operating condition. The work includes all work shown or implied on the Drawings. The work includes (but is not limited to):

1. Coordination of final station location and controls location with resident and OWNER.

2. Furnishing, installation and start-up testing of factory built duplex submersible grinder pump station complete with enclosure, plumbing and controls.

3. All related electrical work required to place the pumping unit in service including connection of the station's power supply to the property owner supplied junction box.

4. **Connection of the resident's sewer lateral to the completed pump station.**

5. Furnishing and installation of the 2" service main isolation valve and check valve in a standard meter vault at the point of connection of the service main with the interceptor force main.

6. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, etc.

PLEASE NOTE - Installation of the Pumping Station 2" service main between the pump station and the main force main is covered under a separate section of these specifications and is not a part of this specification.

24.2 QUALITY CONTROL

24.2.1 Base Bidding: These specifications and the Drawings are based on the provision of a E-One submersible pumping unit. To simplify repairs and inventory of spare parts, the OWNER has mandated that the SUCCESSFUL BIDDER (CONTRACTOR) provide a single pump unit for use throughout the system.

24.2.2 Guarantee: The manufacturer of the submersible pumping station shall guarantee all equipment supplied against defects in workmanship and material for a period of sixty (60) months after notice of OWNER’s acceptance, but no greater than sixty-five (65) months after receipt of shipment. The OWNER will report any defects found during the warranty period to the MANUFACTURER.

In the event a component fails to perform as specified or is proven defective in service during the warranty period, the Manufacturer shall repair or replace, at his discretion, such defective part without cost to the OWNER. He shall further provide, without cost, such labor as may be required to replace, repair, or modify major equipment components.

24.2.3 Start-Up: The manufacturer shall provide the services of a factory-trained representative to perform initial start-up of the pumping units and to instruct the OWNER's operating personnel in the operation and maintenance of the equipment.

24.3 SUBMITTALS

24.3.1 Submit five (5) bound copies of the following:

1. Manufacturer's warranty/guarantee.

2. Pump station Shop Drawings complete with station drawing, electrical schematics, and accessory components.

3. Pump station O & M Manuals. Manuals are to provide basic instructions for preventative and cyclic maintenance, sources of spare parts, etc.

24.4 MATERIALS - WET WELL

Fiberglass Construction. The tank shall consist of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of

cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.

The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation. The tank shall include a solid fiberglass cover, secured with threaded stainless steel fasteners, providing low profile mounting.

The pump discharge piping components shall be 2″ IPS and consist of PVC pipe fittings, a PVC ball valve, rated at 200 psi WOG, with integral union to facilitate piping disconnect. A 2″ anti-siphon valve shall be integral to the piping inside the basin. Installation of the pump discharge piping shall require field assembly by the installing party. The tank shall have a discharge bulkhead, which terminates outside the tank wall with a 2″ female pipe thread. The discharge bulkhead shall be factory installed and warranted by the manufacturer to be watertight. The tank shall be furnished with an EPDM grommet to accept a 4.50″ OD (4″ DWV or SCHD 40) inlet pipe.

The power and control cable shall be 32′ in length standard and shall connect to the pump by means of the provided NEMA 6P electrical quick disconnect (EQD) and shall enter the tank through a watertight strain relief connector supplied by the manufacturer. Junction boxes will not be acceptable. Installation of the inlet grommet and cable strain relief shall require field penetration of the tank wall by the installing party. Provision shall be made for tank venting in the 4″ inlet line in accordance with national and local plumbing code requirements.

See design drawings for tank sizes and details.

24.5 MATERIALS – PUMPS

Pumps shall be of the progressive cavity or centrifugal design. The pumps must be capable of operating at negative total dynamic head without overloading the motor. Under no conditions shall in-line piping or valving be allowed to create a false apparent head.

The pump(s) operations curve shall be as follows:

Ops Point 1	8 GPM	@ 176 Ft
Ops Point 2	10 GPM	@ 120 Ft
Ops Point 3	12 GPM	@ 70 Ft
Ops Point 4	14 GPM	@ 15 Ft

The pump(s) must be capable of delivering cleansing velocities as dictated by Division of Water of 2 feet/second against a continuous total dynamic head of up to 185 feet.

24.5.1 PROGRESSIVE CAVITY PUMPS: The pumps shall be a custom designed, integral, vertical rotor, motor driven, solids handling pumps of the progressing cavity type with mechanical seal. The rotors shall be constructed of stainless steel. The stators shall be of a specifically compounded ethylene propylene synthetic elastomer. Buna-N is not acceptable as a stator material. The material shall be suited for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, good aging properties, and outstanding wear resistance.

24.5.2 MECHANICAL SEAL: The pumps shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

24.5.3 GRINDER: The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece stainless steel motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft. The grinder will be of the rotating type with a stamped, stainless steel shredder ring assembly spaced in accurate, close annular alignment with the driven impeller assembly, which shall carry hardened, stainless steel cutter bars.

This assembly shall be dynamically balanced and operate without vibration over the entire range of specified operating pressures. The grinder shall be constructed so as to eliminate clogging and jamming under all normal operating conditions including pump starting. Sufficient vortex action shall be created by the grinder pump, to scour the tank free of deposits or sludge banks, which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. *The grinder shall be positioned in such a way that solids are fed in an upward flow direction.*

2. The grinder inlet shroud shall have a diameter no less than 5 inches.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of "foreign objects," such as paper, wood, plastic, glass, rubber and the like, to finely divided particles that will pass freely through the passages of the pump and the 2" diameter discharge piping.

24.6 MATERIALS - PUMP MOTORS

The motors shall be a 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, squirrel cage induction type with a low starting current. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor.

24.7 MATERIALS – CHECK & ISOLATION VALVES

A check valve and isolation valve shall be provided within the fiberglass wet well as depicted in the design drawings. The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve secured to the stainless steel pump discharge elbow. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Working parts will be made of a 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A non-metallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low backpressure. The valve body shall be injection-molded parts made of glass filled thermoplastic.

A pump isolation valve and check valve shall also be provided in a standard meter box enclosure at the point of connection of the service main to the main pressure sewer header.

Provision of all isolation valves and check valves shall be considered an integral part of the unit price EACH for duplex pump stations and shall not be considered for separate payment.

24.8 MATERIALS - CONTROLS

CONTROLS: All necessary controls shall be located in the control cover of the core unit. The control cover will be

attached with stainless steel fasteners. The grinder pumps will be furnished with a length of 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements. Non-fouling waste water level detection for controlling the operation of the pumps shall be accomplished by monitoring the pressure changes in an integral air-bell level sensor connected to a pressure switch. The level detection device shall have no moving parts in direct contact with the wastewater. High-level sensing will be accomplished in the manner detailed above by a second, independent, air-bell sensor and pressure switch of the same type. Float switches will not be acceptable

To assure reliable operation of the pressure sensitive switches, each core shall be equipped with a breather assembly, complete with a suitable means to prevent entry of water into the motor compartment.

ALARM/DISCONNECT PANEL - MOD T260 Duplex Alternating Panel: The grinder pump station shall include a NEMA 4X, UL listed control and alarm panel(s) suitable for wall or pole mounting by the CONTRACTOR. The NEMA enclosure shall be manufactured of fiberglass to assure corrosion resistance. The enclosure shall include a hinged pad lockable cover.

The panel shall contain one (2) 15-amp single pole circuit breaker for the alarm circuit, and shall contain one (2) 15-amp double pole circuit breaker per core for the power circuit. The panel shall contain terminal blocks, integral power bus, push to run feature and a complete alarm circuit.

The control/alarm panel(s) shall include the following features:

1. Corrosion-proof fiberglass enclosure
2. NEMA 4X rated enclosure
3. Lockable latch with padlock
4. Circuit breakers
5. Terminal blocks & ground lugs
6. Dry Contacts
7. Lead/Lag indicator lights
8. Alarm indicator lights
9. Run indicator lights
10. Manual Push-to-Run

The Alarm/Disconnect Panel shall include a visual high-level alarm indicator. The visual alarm lamp shall be inside a red fluted lens mounted to the top of the enclosure in such a manner as to maintain NEMA 4 rating. The alarm sequence is to be as follows:

1. When liquid level in the tank rises above the alarm level, the contacts on the alarm pressure switch will close and the visual alarm will illuminate on the control panel.

2. The visual alarm will remain illuminated until the sewage level in the tank drops below the "off" setting of the alarm pressure switch.

24.9 MATERIALS – CORE UNIT

Pump units with slide away couplings shall be provided. The slide away coupling shall allow the pumps to be installed or removed without requiring personnel to enter the wet well. The Grinder Pump Station shall have easily removable core assemblies consisting of the pump, motor, grinder, all motor controls, check valve, anti-siphon valve, EQD and wiring. The grinder pump core units shall be furnished with polypropylene lifting harnesses or stainless steel chains. In the event that guide rails are used to facilitate easy removal, guide rail material must be stainless steel. All mechanical and electrical connections must provide easy disconnect accessibility for core unit removal and installation.

24.10 MATERIALS - ACCESSORIES

A. All materials exposed to wastewater shall have inherent corrosion protection. Acceptable corrosion protection includes epoxy powder-coated cast iron, fiberglass, stainless steel, polyethylene, nylon, and PVC.

B. Spare core assemblies shall be included as set forth in the bid schedule.

C. Electrical Systems & Components - All electrical systems and components shall be in full accordance with the current edition of the National Electrical Code. All power supply lines and control lines to the pump station shall be fully encased in rigid conduit meeting NEC requirements. All electrical systems and components in wet wells and enclosed spaces shall comply with National Electrical Code requirements. All conduits extending from the wet well to the control panel shall be sealed at the entrance to the control panel to prevent the intrusion of corrosive gases! The control circuitry shall be provided with “Ground Fault” interruption protection, which will de-energize the circuit in the event of any failure in the electrical integrity of the pump power cable.

24.11 INSTALLATION

24.11.1 Maintenance of Service: Wastewater service shall be maintained throughout the construction activity. No discharge to surface waters shall be allowed.

24.11.2 Installation shall be in accordance with the Manufacturer's requirements and the referenced codes and specifications.

24.11.3 Excavation: CONTRACTOR shall select means, methods, sequences and techniques of construction to both protect adjacent properties and to provide a stable, safe working environment. Decision as to whether to use sheet piles with wales and struts, manhole trench box, piles and lagging, or other methods of excavation support shall be the CONTRACTOR'S.

24.11.4 Backfilling: Before backfilling is started, the excavated pit shall be cleared of all rubbish and debris and shall be de-watered. The backfill material shall be free of frozen lumps, vegetation and debris. Backfill material shall be placed in uniform horizontal layers not exceeding 6 inches in thickness (loose measure). As a precaution against the development of unbalanced stresses, the backfill shall be placed and compacted symmetrically about the excavation to 95% of Standard Proctor Density.

The grading shall be brought to the level of the existing topography or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches in diameter.

24.12 TESTING

24.12.1 Electrical: All electrical work shall be inspected and approved by an electrical inspector. Two copies of the Certificate of Approval shall be provided to the ENGINEER before final acceptance.

24.12.2 Pump Test: The completed installation shall be given a running test of all equipment. While the pump(s) is/are running, all piping and seals shall be checked to insure that no leaks occur. All controls and warning indicators shall be checked for proper operation.

24.12.3 Smoke Test: The CONTRACTOR shall smoke test the resident's incoming sewer system (in the presence of the

ENGINEER) to verify that roof leaders are not connected to the grinder system. A written report of all smoke testing, with emphasis on non-complying homeowners, shall be furnished to the ENGINEER at the completion of the project.

24.12.4 Repair: Any defects or failure to meet the requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the OWNER as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

24.13 MEASUREMENT AND PAYMENT

24.13.1 Measurement: The payment categories for Duplex Grinder Stations are as follows:

Item 5f - Install Duplex Grinder Pump Station, Complete, In-Place
Item 5b – Pressure Sewer Lateral Assembly
Item 5g – Complete Duplex Grinder Pump Station - Materials

The OWNER has already bid item 5g. The OWNER will purchase these items from an authorized representative of E-One. Once the Owner has delivered these Items to the CONTRACTOR, The CONTRACTOR is responsible FOR ALL MATERIALS AND PROPER STORAGE. **Item 5g is to include spare core assemblies to be suitably stored by the CONTRACTOR at the OWNER'S designated maintenance facility.** The CONTRACTOR shall place the balance of his costs to complete the work under this specification in Items 5f and 5b.

Please Note: The work of Items 5f and 5b shall include (but not be limited to):

1. Coordination of final station location and controls location with resident and OWNER.

2. Furnishing, installation and start-up of factory built simplex submersible grinder pump station complete with enclosure, plumbing and controls.

3. All related electrical work required to place the pumping unit in service including connection of the station's power supply to the resident's power center (light panel). At a minimum this work will include coordination with the resident, a small light panel (where fuse boxes are present); a 30 amp circuit breaker; a NEMA 3R/4 (breaker type) disconnect of the appropriate amperage, wiring, conduit, and related electrical accessories.

4. Connection of the resident's sewer lateral to the completed pump station.

5. Acceptance testing of the completed grinder pump station installation including electrical inspection of wiring and smoke test of resident's plumbing.

6. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, etc.

24.13.2 Payment: Payment shall be made at the unit price ('each', 'VF' or 'LF' as applicable) for the actual number of units furnished / installed (as applicable) as set forth in the Contract. Payment as specified for Items '5f', '5b', and '5g' shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work specified herein and no other separate payment shall be made. It is noted that the force main from the grinder station is a separate pay item and is not included as a part of this section.

-- **THE END** --

SECTION XXV

TECHNICAL SPECIFICATIONS

QUADPLEX GRINDER PUMP STATIONS

25.1 SCOPE

Provide all labor, materials, and equipment necessary for furnishing and installing underground quadplex submersible sewage pumping station(s) complete and in proper operating condition. The work includes all work shown or implied on the Drawings. The work includes (but is not limited to):

1. Coordination of final station location and controls location with resident and OWNER.

2. Furnishing, installation and start-up of factory built simplex submersible grinder pump station complete with enclosure, plumbing and controls.

3. All related electrical work required to place the pumping unit in service including connection of the station's power supply to the property owner supplied junction box.

4. **Connection of the resident's sewer lateral to the completed pump station.**

5. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, etc.

Installation of the Pumping Station force main is covered under a separate section of these specifications and is not a part of this specification.

25.2 QUALITY CONTROL

25.2.1 Base Bidding: These specifications and the Drawings are based on provision of an Environmental One submersible pumping unit. To simplify repairs and inventory of spare parts, the OWNER has mandated that The SUCCESSFUL BIDDER (CONTRACTOR) may not submit an equal submittal.

25.2.2 Guarantee: The manufacturer of the submersible pumping station shall guarantee all equipment supplied against defects in workmanship and material for a period of sixty (60) months after notice of OWNER’s acceptance, but no greater than sixty-five (65) months after receipt of shipment. The OWNER will report any defects found during the warranty period to the MANUFACTURER.

In the event a component fails to perform as specified or is proven defective in service during the warrents period, the Manufacturer shall repair or replace such defective part without cost to the OWNER. He shall further provide, without cost, such labor as may be required to replace, repair, or modify major equipment components.

25.2.3 Start-Up: The manufacturer shall provide the services of a factory-trained representative to perform initial start-up of the pumping units and to instruct the OWNER's operating personnel in the operation and maintenance of the equipment.

25.3 SUBMITTALS

25.3.1 Submit five (5) bound copies of the following:

1. Manufacturer's warranty/guarantee.

2. Pump station Shop Drawings complete with station drawing, electrical schematics, and accessory components.

3. Pump station O & M Manuals. Manuals are to provide basic instructions for preventative and cyclic maintenance, sources of spare parts, etc.

25.4 MATERIALS

25.4.1 PUMP: The pump shall be a custom designed, integral, vertical rotor, motor driven, solids handling pump of the **progressing cavity type** with a single mechanical seal. Double radial O-ring seals are required at all casting joints to minimize corrosion and create a protective barrier. All pump castings shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. The rotor shall be through-hardened, highly polished, precipitation hardened stainless steel. The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service.

Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material because it does not exhibit the properties as outlined above and required for wastewater service.

25.4.2 GRINDER: The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The grinder impeller assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. Attachment by means of pins or keys will not be acceptable. The grinder will be a one-piece, forged 4140 cutter wheel of the rotating type with inductively hardened cutter teeth (Rockwell 55-58c) for abrasion resistance. A stationary quench hardened and ground shredding ring shall be provided. The shredding ring will have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque.

This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. The grinder shall be constructed so as to minimize clogging and jamming under all normal operating conditions including starting. Sufficient vortex action shall be created to scour the tank free of deposits or sludge banks which would impair the operation of the pump. These requirements shall be accomplished by the following, in conjunction with the pump:

1. The grinder shall be positioned in such a way that solids are fed in an upward flow direction.

2. The maximum flow rate through the cutting mechanism must not exceed 4 feet per second. This is a critical design element to minimize jamming and as such must be adhered to.

3. The inlet shroud shall have a diameter of no less than 5 inches. Inlet shrouds that are less than 5 inches in diameter will not be accepted due to their inability to maintain the specified 4 feet per second maximum inlet velocity which by design prevents unnecessary jamming of the cutter mechanism and minimizes blinding of the pump by large objects that block the inlet shroud.

4. The impeller mechanism must rotate at a nominal speed of no greater than 1800 rpm.

The grinder shall be capable of reducing all components in normal domestic sewage, including a reasonable amount of “foreign objects,” such as paper, wood, plastic, glass, wipes, rubber and the like, to finely-divided particles which will pass freely through the passages of the pump and the 1-1/4" diameter stainless steel discharge piping.

25.4.3 ELECTRIC MOTOR: As a maximum, the motor shall be a 1 HP, 1725 RPM, 240 Volt 60 Hertz, 1 Phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current not to exceed 30 amperes and high starting torque of 8.4 foot pounds. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application. Non-capacitor start motors or permanent split capacitor motors will not be accepted because of their reduced starting torque and consequent diminished grinding capability. The wet portion of the motor armature must be 300 Series stainless. To reduce the potential of environmental concerns, the expense of handling and disposing of oil, and the associated maintenance costs, oil-filled motors will not be accepted.

25.4.4 MECHANICAL SEAL: The pump/core shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

25.4.5 TANK: Fiberglass Construction. The tank shall be a wetwell design consisting of a single wall, laminated fiberglass construction. The resin used shall be of a commercial grade suitable for the environment. The reinforcing material shall be a commercial grade of glass fiber capable of bonding with the selected resin. The inner surface shall have a smooth finish and be free of cracks and crazing. The exterior tank surface shall be relatively smooth with no exposed fiber or sharp projections present.

The tank wall and bottom shall be of sufficient thickness and construction to withstand the imposed loading due to saturated soil at the specified burial depth for each available tank height. All station components must function normally when exposed to the external soil and hydrostatic pressures developed at the specified burial depth. The tank bottom shall be reinforced with a fiberglass plate extending beyond the tank walls to support concrete anchoring, as required, to prevent flotation.

The tank shall have two (2) stainless steel duplex why discharge manifolds which terminates outside the tank wall with a 1-1/4" female pipe thread 180 degrees from each other. The discharges bulkheads (manifolds) shall be factory installed and warranted by the manufacturer to be watertight. The tank shall be furnished with a factory drilled but field installed EPDM grommet to accept a 6.625" OD (6" DWV or SCH 40) inlet pipe. A flow dividing partition shall be positioned directly below the inlet. The power and control cable shall connect to the pump by means of the provided NEMA 6P electrical quick disconnect (EQD) and shall enter the tank through a field installed watertight strain relief connector supplied by the manufacturer. An electrical junction box shall not be permitted in the tank. Installation of the inlet grommet and cable strain relief shall require field penetration of the tank wall by the installing party.

Tanks shall include an aluminum checker plate cover, secured with threaded stainless steel fasteners, providing low profile mounting. This cover shall be a 1/3 – 2/3 split hinged cover for ease of access and pump removal. The tank shall also be vented to prevent sewage gases from accumulating inside the tank by means of a factory-provided, field-installed mushroom vent. The station cover shall be factory drilled to accept the mushroom vent.

The tank and stainless steel discharge bulkheads shall be factory-tested to be watertight.

Consult the contract drawings for station tank sizes (diameter and height).

25.4.6 DISCHARGE HOSE AND DISCONNECT/VALVE: All discharge fittings and piping shall be constructed of polypropylene, EPDM or PVC. The discharge hose assembly shall include a shut-off valve rated for 200 psi WOG and a quick disconnect feature to simplify installation and pump removal. The

bulkhead penetration shall be factory installed and warranted by the manufacturer to be watertight.

25.4.7 ELECTRICAL QUICK DISCONNECT: The grinder pump core shall include a factory-installed NEMA 6P electrical quick disconnect (EQD) for all power and control functions. The EQD will be supplied with 32', 25' of useable, electrical supply cable (ESC) to connect to the alarm panel. The EQD shall require no tools for assembly, seal against water before the electrical connection is made, and include radial seals to assure a watertight seal regardless of tightening torque. Plug-type connections of the power cable onto the pump housing will not be acceptable due to the potential for leaks and electrical shorts. Junction boxes are not acceptable due to the large number of potential leak points. The EQD shall be so designed to be conducive to field wiring as required.

25.4.8 CHECK VALVE: The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the discharge piping. The check valve will provide a full-ported passageway when open, and shall introduce a friction loss of less than 6 inches of water at maximum rated flow. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure. The valve body shall be an injection molded part made of an engineered thermoplastic resin. The working pressure of the valve shall be at least 235 psi. Ball-type check valves are unacceptable due to their limited sealing capacity in slurry applications.

25.4.9 ANTI-SIPHON VALVE: The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure. The valve body shall be injection-molded from an engineered thermoplastic resin. Holes or ports in the discharge piping are not acceptable anti-siphon devices due to their tendency to clog from the solids in the slurry being pumped. The anti-

siphon port diameter shall be no less than 60% of the inside diameter of the pump discharge piping.

25.4.10 CORE UNIT: The grinder pump station shall have an easily removable core assembly containing pump, motor, grinder, all motor controls, check valve, anti-siphon valve, electrical quick disconnect and wiring. The watertight integrity of the core unit shall be established by a 100% factory test at a minimum of 5 PSIG.

25.4.11 CONTROLS: All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating motor starting controls in a plastic enclosure is not acceptable. Wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. Level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. Level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. Level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.

Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from the pump.

All fasteners throughout the assembly shall be 300 Series stainless steel. High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled

by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes. Tube or piping runs outside of the station tank or into tank-mounted junction boxes providing pressure switch equalization will not be permitted due to their susceptibility to condensation, kinking, pinching, and insect infestation. The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a **FACTORY INSTALLED** NEMA 6P EQD half attached to it.

25.4.12 ALARM PANEL: Each pair of grinder pumps shall include a NEMA 4X, UL-listed duplex alarm panel suitable for wall or pole mounting (2 duplex panels shall be provided per Quadplex station). The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel. The enclosure shall not exceed 12.5" W x 16" H x 7.5" D.

Each alarm panel shall contain two (2) 15-amp, double-pole circuit breakers for the pump core’s power circuit and two (2) 15-amp single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

1. When liquid level in the sewage wet-well rises above the alarm level, audible and visual alarms are activated, the contacts on the alarm pressure switch activate, and the redundant pump starting system is energized.

2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.

3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the “off” setting of the alarm pressure switch.

The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain the NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

In addition to the above, two high level indicator lights shall be mounted within the enclosure on the duplex panel’s alarm circuit board. During high level alarm indication on duplex stations, the appropriate indicator light will illuminate to indicate which core requires service.

The entire alarm panel, as manufactured and including any of the following options, shall be listed by Underwriters Laboratories, Inc.

(OPTIONAL) Alarm Contacts Package – Note: The Alarm Contacts Package is included with optional Protection, PreSTAT and Extreme Package as outlined below

- **Alarm Activated Dry Contacts –** Normally open relay contact closes upon alarm activation.
- **Alarm Activated Contacts for Remote Indoor Alarm Module –** Will work with or without power to the alarm panel and is designed to work with E/One’s Remote Sentry.
- **Alarm Activated Remote Powered Terminal –** Normally open relay contact closes upon alarm activation supplying an output voltage which will be equal to the alarm circuit input supply voltage.

(OPTIONAL) Generator Receptacle and Auto Transfer – The alarm panel shall include a 20 amp, 250 VAC generator receptacle with a spring-loaded, gasketed, cover suitably mounted to provide access for connection of an external generator while maintaining the NEMA 4X rating. An automatic transfer switch shall be provided, which automatically switches from AC power to generator power during a power outage. The alarm board

power shall be provided through the generator receptacle during a power outage, allowing the audible and visual alarms to function normally in generator mode. When AC power is restored, the panel is automatically switched back to the AC power mode.

(OPTIONAL) Remote Sentry Indoor Alarm Module – A separate, remote indoor alarm module shall be provided to indicate a high level alarm with or without AC power to the grinder pump station. The Remote Sentry indoor alarm module shall have an internal power source enabling its continued operation without AC power. The Remote Sentry shall have an audible alarm and a visual alarm, both of which shall automatically reset if the high level alarm condition is eliminated. The Remote Sentry indoor alarm module shall include a Silence button for the audible alarm and a Test button.

(OPTIONAL) Run-time/Hour Meter – A run-time or hour meter to display the total run-time or operation time for the pump core shall be provided.

(OPTIONAL) Event/Cycle Counter – An event or cycle counter to display the number of operations of the pump core(s) shall be provided.

OPTIONAL) Auto Dialer – Automatic Voice/Pager Dialer with 2 voice message alarm zones, calls up to 4 telephones, pagers, or cell phones, automatic redials busy or unanswered calls, built in line seizure (releases line if user picks-up their phone), and remote turn off feature to terminate active alarm channel

25.4.13 SERVICEABILITY: The grinder pump core, including level sensor assembly, shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation. Each EQD half must include a water-tight cover to protect the internal electrical pins while the EQD is unplugged. A pump push-to-run feature will be provided for field trouble shooting. The push-to-run feature must operate the pump even if the level sensor assembly has been removed from the pump assembly. All motor control components shall be mounted on a readily replaceable bracket for ease of field service.

25.4.14 OSHA CONFINED SPACE: All maintenance tasks for the grinder pump station must be possible without entry into the grinder pump station (as per OSHA 1910.146 Permit-required confined spaces). *"Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space."*

25.4.15 SAFETY: The grinder pump shall be free from electrical and fire hazards as required in a residential environment. As evidence of compliance with this requirement, the completely assembled and wired grinder pump station shall be listed by Underwriters Laboratories, Inc., to be safe and appropriate for the intended use. UL listing of components of the station, or third-party testing to UL standard are not acceptable.

The grinder pump shall meet accepted standards for plumbing equipment for use in or near residences, shall be free from noise, odor, or health hazards, and shall have been tested by an independent laboratory to certify its capability to perform as specified in either individual or low pressure sewer system applications. As evidence of compliance with this requirement, the grinder pump shall bear the seal of NSF International. Third-party testing to NSF standard is not acceptable.

25.5 INSTALLATION

25.5.1 Maintenance of Service: Wastewater service shall be maintained throughout the construction activity. No discharge to surface waters shall be allowed.

25.5.2 Installation shall be in accordance with the Manufacturer's requirements and the referenced codes and specifications.

25.5.3 Excavation: CONTRACTOR shall select means, methods, sequences and techniques of construction to both protect adjacent properties and to provide a stable, safe working environment. Decision as to whether to use sheet piles with wales and struts, manhole trench box, piles and lagging, or other methods of excavation support shall be the CONTRACTOR'S.

25.5.4 Backfilling: Before backfilling is started, the excavated pit shall be cleared of all rubbish and debris and shall be de-watered. The backfill material shall be free of frozen lumps, vegetation and debris. Backfill material shall be placed in uniform horizontal layers not exceeding 6 inches in thickness (loose measure). As a precaution against the development of unbalanced stresses, the backfill shall be placed and compacted symmetrically about the excavation to 95% of Standard Proctor Density.

The grading shall be brought to the level of the existing topography or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches in diameter.

25.5.5 Electrical: The electrical connection of the quadplex grinder pump station shall be in accordance to all state and federal electrical codes and shall be connected separately from all other electrical devices (i.e. no piggy-backing).

25.6 TESTING

25.6.1 Electrical: All electrical work shall be inspected and approved by an electrical inspector. Two copies of the Certificate of Approval shall be provided to the ENGINEER before final acceptance.

25.6.2 Pump Test: The completed installation shall be given a running test of all equipment. While the pump(s) is/are running, all piping and seals shall be checked to insure that no leaks occur. All controls and warning indicators shall be checked for proper operation.

25.6.3 Smoke Test: The CONTRACTOR shall smoke test the resident’s incoming sewer system (in the presence of the ENGINEER) to verify that roof leaders are not connected to the grinder system. A written report of all smoke testing, with emphasis on non-complying homeowners, shall be furnished to the ENGINEER at the completion of the project.

25.6.4 Repair: Any defects or failure to meet the requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the OWNER as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

25.7 MEASUREMENT AND PAYMENT

25.7.1 Measurement: The payment categories for Quadplex Grinder Stations are as follows:

Item 5j - Install Quadplex Grinder Pump Station, Complete, In-Place
Item 5b – Pressure Sewer Lateral Assembly
Item 5k – Complete Quadplex Grinder Pump Station - Materials

The OWNER has already bid item 5k. The OWNER will purchase these items from an authorized representative of E-One. Once the Owner has delivered these Items to the CONTRACTOR, The CONTRACTOR is responsible FOR ALL MATERIALS AND PROPER STORAGE. **Item 5k is to include spare core assemblies to be suitably stored by the CONTRACTOR at the OWNER'S designated maintenance facility.** The CONTRACTOR shall place the balance of his costs to complete the work under this specification in Items 5j and 5b.

Please Note: The work of Items 5j and 5b shall include (but not be limited to):

1. Coordination of final station location and controls location with resident and OWNER.

2. Furnishing, installation and start-up of factory built simplex submersible grinder pump station complete with enclosure, plumbing and controls.

3. All related electrical work required to place the pumping unit in service including connection of the station's power supply to the resident's power center (light panel). At a minimum this work will include coordination with the resident, a small light panel (where fuse boxes are present); a 30 amp circuit breaker; a NEMA 3R/4 (breaker type) disconnect of the appropriate amperage, wiring, conduit, and related electrical accessories.

4. Connection of the resident's sewer lateral to the completed pump station.

5. Acceptance testing of the completed grinder pump station installation including electrical inspection of wiring and smoke test of resident's plumbing.

6. All related site work including clearing, grading,

trenching, backfilling, surface restoration, clean-up, etc.

25.7.2 Payment: Payment shall be made at the unit price ('each', 'VF' or 'LF' as applicable) for the actual number of units furnished / installed (as applicable) as set forth in the Contract. Payment as specified for Items '5j', '5b', and '5k' shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work specified herein and no other separate payment shall be made. It is noted that the force main from the grinder station is a separate pay item and is not included as a part of this section.

-- THE END --

SECTION XXVI

TECHNICAL SPECIFICATIONS

SUBMERSIBLE WASTEWATER PUMPING/LIFT STATIONS

26.1 SCOPE

Provide all labor, materials, and equipment necessary for furnishing and installing underground centrifugal submersible sewage pumping station(s) complete and in proper operating condition. The work includes all work shown or implied on the Drawings. The work includes (but is not limited to):

1. Provision of a motor control center complete with control panel, service entrance, disconnects as required by Electric Company, and meter base;

2. Installation of a precast concrete wet well and valve pit complete with aluminum access hatches;

3. Installation of new submersible pumping units complete with guide rails;

4. Installation of miscellaneous pipe, valving, etc.;

5. Associated electrical work, including security lights;

6. All related site work including clearing, grading, trenching, backfilling, surface restoration, clean-up, installation of chain link fencing etc.

Installation of the Pumping Station force main (from the discharge side of the meter box) is covered under a separate section of these specifications and is not a part of the Lump Sum price for Submersible Pumping Stations.

26.2 QUALITY CONTROL

26.2.1 Base Bidding: These specifications and the Drawings are based on provision of the Myers submersible pumping unit from the existing Virgie Lift Station. The SUCCESSFUL BIDDER (CONTRACTOR) may submit an 'or equal' submittal for consideration in accordance with Section 6.7.1 of the General Conditions (unless his bid write-in precludes same).

26.2.2 Guarantee: The manufacturer of the submersible pumping station shall guarantee all equipment supplied against defects in workmanship and material for a period of five (5) years or 10,000 hours.

In the event a component fails to perform as specified or is proven defective in service during the guaranteed period, the Manufacturer shall repair or replace, at his discretion, such defective part. He shall further provide, without cost, such labor as may be required to replace, repair, or modify major equipment components.

26.2.3 Start-Up: The manufacturer shall provide services of a factory-trained representative for a maximum period of one day on-site to perform initial start-up of the pumping units and to instruct the OWNER's operating personnel in the operation and maintenance of the equipment.

26.3 SUBMITTALS

26.3.1 Submit five (5) bound copies of the following:

1. Manufacturer's warranty/guarantee.

2. Pump station Shop Drawings complete with station drawing, electrical schematics, and accessory components.

3. Pump station O & M Manuals. Manuals are to provide basic instructions for preventative and cyclic maintenance, sources of spare parts, etc.

26.4 MATERIALS - WET WELL & VALVE PIT

26.4.1 Pit: The wet well and valve pit shall be constructed of pre-cast concrete manhole rings (of the diameters indicated on the Drawings) meeting the requirements of the manhole specifications provided herein.

26.4.2 Access Hatch: Aluminum access hatches with clear openings of the size required for access to and removal of the pumps as recommended by the Manufacturer shall be cast integral with the flat slab top for the wet well. The valve pit shall have a 36” square clear opening access hatch cast integral with the flat slab top for the wet well. All access hatches shall be rated for a live load of 150 psf.

26.5 MATERIALS - PUMPS

26.5.1 Quality Control & Performance: See Table XXVI-A.

26.5.2 Construction:

1. Type - Submersible

2. Volute/Shell - High strength cast iron, Class 30. All exposed nuts and bolts shall be type 304 stainless steel or brass construction. All surfaces, coming into contact with sewage, other than stainless steel or brass, shall be protected by an approved sewage resistant coating.

3. Impeller - Gray cast iron, Class 30. Grinders shall have a stationary cutter of hardened stainless steel.

4. Seals - Tandem mechanical shaft seal system. Upper seal-tungsten carbide ring against carbon ring. Lower seal - two tungsten carbide rings.

5. Shaft - AISI type 420 stainless steel.

6. Junction Chamber - Electric cable shall enter motor through watertight elastomer grommets. Water sealing to be functionally separated from strain relief.

26.6 MATERIALS - SUBMERSIBLE PUMP MOTORS

1. Class - Submersible

2. Construction - Squirrel cage, induction, shell type design, housed in an air-filled water tight chamber.

3. Power Service - See Table XXVI-A

4. Speed - See Table XXVI-A

5. Insulation - Class 'F' Suitable to 155 Deg. C

26.7 MATERIALS - CONTROLS

A. General: The motor control centers shall be completely self contained. Each center shall provide:

1. Combination circuit breaker/overload unit providing overload protection, short circuit protection, reset and disconnect for all phases.

2. Across the NEMA rated line magnetic contactor with integrated thermal overload protection and field replaceable contacts / coil.

3. Hand/Off automatic pump operations selector switch.

4. 120 volt power for receptacle with ground fault interruption protection and control panel pilot circuitry. All 120 volt circuits, including control circuit, shall have disconnect breakers (no fuses)

5. Automatic alternator.

6. The pumps shall be controlled by mercury float displacement switches. Four floats shall be provided, each with an appropriate length of cord for control of the pump station as shown on the PLANS.

B. Construction: Panel to be NEMA 4

C. Accessories: The panel shall include the following accessories:

1) Alarms

a) Pilot Lights. All alarm conditions shall trigger a front of control panel pilot light indicating the nature of the failure. In the absence of an alarm condition the pilot light shall glow half bright to indicate bulb integrity. In an alarm condition the pilot light shall glow full strength and flash.

b) Common Annunciation. All alarm conditions shall trigger an external 60W light and audible horn to alert the operator of an alarm condition.

c) Alarms. The following alarms shall be provided:

..Power Failure (provide auto restart)

..Pump Failure

..Use of Lag Pump

..Unauthorized Entry

..High wet well level.

2) Condensation Heater

3) Elapsed Time Meters

4) Pump Run Lights

5) Lightning Arrestor

6) Three-phase power monitor (phase loss, low voltage, phase reversal). Any of these conditions shall trigger external alarm light and alarm horn.

7) Pole Mounting Bracket

8) 2 - 110 Volt Convenience Outlets

9) Control Panels (Outside control panels shall be stainless steel for corrosion resistance).

26.8 MATERIALS – LEVEL SENSOR

Furnish and install level sensor equal to Multitrode Liquid Level Sensor Model 3.0/10-10.

26.9 MATERIALS - SLIDE AWAY COUPLING SYSTEM

Pump units with slide away couplings shall be provided. The slide away coupling shall allow the pump to be installed or removed without requiring personnel to enter the wet well.

A stainless steel lifting chain of the appropriate weight and length shall be provided for each pump supplied.

Stainless steel guide rails of the appropriate size and length shall be provided for each pump supplied.

26.10 MATERIALS - VALVE PIT

26.10.1 All pipe, fittings, and joints in the valve pit shall be ductile iron flanged pipe of the size indicated in the Drawings.

26.10.2. Ductile-iron pipe shall meet the following requirements:

1. Flanged ductile-iron pipe shall conform to current ANSI Specification A2l.51 with factory applied screwed long hub flanges except as otherwise specified hereinafter. Flanges shall be faced and drilled after being screwed on the pipe, with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe.

2. Mechanical-joint ductile-iron pipe shall be as specified for the flanged pipe except the joints shall conform to ANSI Specification A21.1l as applicable. Mechanical-joint pipe shall be furnished with sufficient quantities of accessories as required for each joint.

3. Fittings shall be ductile iron as specified above. Except as specified below, flanges and flanged fittings shall conform to ANSI A2l.10 for 150 psi pressure rating.

4. Pipe thickness classes shall be Class 51 for all sizes of pipe.

5. Pipe and fittings shall be cement mortar lined and bituminous seal coated on the inside in accordance with ANSI Specification A2l.4 except that the cement lining thickness shall be not less than 1/8-in for 3-12 inch pipe, 3/16-in for 14-24 inch pipe and 1/4-in for pipe 30-in and larger. A plus tolerance of 1/8-in will be permitted. Ring gaskets shall be of approved composition suitable for the required service.

6. Pipe and fittings exposed to view in the finished work shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of rust inhibitive primer as specified in Section 09901. All other pipe and fittings shall be shop coated

on the outside with coal tar enamel in accordance with the above referenced ANSI Specifications and will not require any other coating. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping the surfaces shall be sealed with a non-bleeding sealer coat such as Inertial Tar Stop, or Mobil Anti-Bleeding Aluminum Sealer or equal. Sealing shall be a part of the work of this Section.

26.10.3. Sleeve Type Couplings

1. Sleeve-type couplings shall be as made by Dresser Mfg. Div., Bradford, Pa., Smith-Blair, Inc., San Francisco, California, R.H. Baker & Co., Inc., Huntington Park, California, or equal.

2. Couplings for buried pipe shall be of cast iron and shall be Dresser Style 53, Smith-Blair Style 431, Baker Allcast, or equal. The couplings shall be provided with stainless steel bolts and nuts unless indicated otherwise.

3. Couplings for exposed pipe shall be of steel and shall be Dresser Style 38 or 138, Smith-Blair Style 413, Baker Allsteel, or equal. When installed in force mains, harness couplings or joint harnesses shall be provided. The couplings shall be provided with black steel bolts and nuts unless indicated otherwise.

4. All couplings shall be furnished with the pipe stop removed.

5. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

26.10.4. Wall Castings

1. Wall castings shall be of the sizes and types as shown on the Drawings. Flanges and mechanical joint bells shall be drilled and tapped for studs where flush with the wall.

26.10.5. Filler flanges and beveled filler flanges shall be furnished and installed as required. Filler flanges and beveled filler flanges shall be furnished faced and drilled

complete with extra length bolts. Filler flanges shall be Clow Fig. F-l984 or equal and beveled filler flanges shall be Clow Fig. F-l986 or equal.

26.10.6. Blind flanges shall be furnished and installed as required. Blind flanges shall be furnished faced and drilled to ANSI Bl6.1 125 lb Standard.

26.10.7 Check Valve: Check valves shall be horizontal swing checks with outside spring and lever -- flanged joint. The valve body shall be cast iron and the trim shall be bronze. Clow F 5381 or equal.

26.10.8 Plug Valve: Plug valves shall be full flow, flanged joint, eccentric plug valves equal to Clow F 5412. Valve body shall be cast iron. Seat rings shall be 304 stainless steel. The valve shall be lever actuated.

26.10.9 Pressure Gage: A pressure gage shall be installed on the discharge header. The pressure gage shall have a minimum face diameter of 4.5 inches, read 0 to 200 FEET HEAD, and be accurate to 1/2 percent of scale. The pressure gage shall be equipped with an isolation valve, snubber and protective diaphragm suitable for use with wastewater.

19.10.10 Ball Valve: Ball valves shall be bronze valves equal to a Grainger 4A800.

26.10.11 Clamp-on Ultrasonic Flow Meters:

A. The flowmeter shall utilize ultrasonic, Dual Frequency Doppler (DFD) technology, which will transmit a minimum of two independent frequencies through the flow steam, to provide indication, totalization, data logging and signal transmission of liquid flow rate in full pipes.

B. The flowmeter will measure flow rates of solids-bearing and/or aerated fluids over a velocity span of 0.2 and 32 ft/s. Two Dual Frequency transducers will be supplied with the instrument and shall be suitable for pipe sizes from 0.5 to 200 inches.

C. The instrument will provide a +1% total error band under reference conditions.

D. Configuration will be via a front panel, 19-key,

flat membrane keypad with tactile feedback. Input parameters will be password protected. The nonvolatile memory shall retain totalizer and user parameters for up to five years. Flowmeter diagnostics shall be accessible via the keypad.

E. A 90,000 point data logger, programmable in 30 second, 1, 5, 15, 30 and 60 minute intervals, will be included as standard in the flowmeter. HydraLink data retrieval software (Windows 95/98 version), will be supplied with the instrument.

F. The analog output shall be opto-isolated, 12 bit, 4-20 mA DC signal proportional to flow. Output current limiting circuitry will be incorporated in the flowmeter electronics. A RS232 serial interface will also be provided.

G. The flow meter shall be suitable for 90-132 VAC, 190-250 VAC, 50/60 Hz, switch selectable.

H. The transducers shall be encased in stainless steel shrouds and shall be suitable for submersion and operation from -40°F to +250°F (-40°C to +122°C).

I. The transducers will attach to the outside of the pipe by means of stainless steel straps. The standard transducer cable length will be 20 feet (6m). Optional cable lengths, in 10 ft. (3m) increments, shall be available up to 500 feet (152m).

J. The flowmeters electronics shall be designed to operate at temperatures between --5°F to +140°F (-20°C to +60°C). All electronic circuits are to be interchangeable with other flow meters having the same model number. All circuit boards will be conformally coated with an anti-fungus compound.

K. The display shall be a backlit, 240 x 60 dot, high resolution graphics display.

L. The electronics enclosure shall be environmentally protected to NEMA 4X (IP65).

M. For additional security, the enclosure will provide a facility for the attachment of a padlock to prevent unauthorized access to the display and front panel.

N. The manufacturer shall provide a full NIST traceable flow calibration certificate.

O. The instrument shall be manufactured in the USA at an ISO 99001 certified facility.

P. The Dual Frequency Doppler flowmeters shall be the Polysonics Hydra SX40 model manufactured by Polysonics, Inc., 10335 Landsbury, Suite 300, Houston Texas, a Controlotron, a Compu-Flow or approved equal.

26.10.12 Air Release Valve:

A. All air release valve shall be combination air/vacuum release valves designed for raw sewage and effluent. The valve shall be a model D-025 as manufactured by A.R.I. or approved equal.

B. Each valve is to have: 2″ N.P.T. intake; corrosion resistant conical body of reinforced nylon; corrosion resistant non-metallic operating mechanism/ stainless steel spring loaded float to allow for system vibrations and turbulence; and working pressures of 3-240 PSI.

26.11 MATERIALS - ACCESSORIES

A. Wet Well Piping - All interior wet well piping 3″ in diameter and larger shall be HDPE SDR 11. All interior wet well piping less than 3″ in diameter shall be HDPE SDR 11 pipe of the size indicated in the drawings.

B. Spare Parts - A complete replacement pump shaft seal assembly shall be provided for each pump station. The replacement seal assembly shall be packed in a suitable container along with complete installation instructions. A spare impeller shall also be provided for each pump station.

C. Electrical Systems & Components - All electrical systems and components shall be in full accordance with the current edition of the National Electrical Code. All electrical systems and components in wet wells and enclosed spaces shall comply with National Electrical Code requirements for Class I, Group D, Division 1 locations and shall be suitable for use in corrosive environments. All conduits extending from the wet

well to the control panel shall be sealed at the wet well exit and at the entrance to the control panel to prevent the intrusion of corrosive gases! The control circuitry shall be provided with "Ground Fault" interruption protection that will de-energize the circuit in the event of any failure in the electrical integrity of the pump power cable. Further, all convenience outlets shall be ground fault protected.

D. Trash Pump – Upon completion of construction, Contractor shall provide owner with an 8 HP, 3" NorthStar Trash Pump capable of 21,000 GPH with suction hose, strainer, and discharge, or equal.

26.12 INSTALLATION

26.12.1 Maintenance of Service: Wastewater service shall be maintained throughout the construction activity. No discharge to surface waters shall be allowed.

26.12.2 Installation shall be in accordance with the Manufacturer's requirements and the referenced codes and specifications.

26.12.3 Excavation: CONTRACTOR shall select means, methods, sequences and techniques of construction to both protect adjacent properties and provide a stable, safe working environment. Decision as to whether to use sheet piles with wales and struts, manhole trench box, piles and lagging, or other methods of excavation support shall be the CONTRACTOR'S.

26.12.4 Backfilling: Before backfilling is started, the excavated pit shall be cleared of all rubbish and debris and shall be de-watered. The backfill material shall be free of frozen lumps, vegetation and debris. Backfill material shall be placed in uniform horizontal layers not exceeding 6 inches in thickness (loose measure). As a precaution against the development of unbalanced stresses, the backfill shall be placed and compacted symmetrically about the excavation to 95% of Standard Proctor Density.

The grading shall be brought to the level of the existing topography or to the elevations established by the ENGINEER. Final dressing shall be accomplished by such methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than two inches in diameter.

26.12.5 Paving: Provide bituminous, or gravel, paving as indicated by the Drawings. Restore all damaged curbs.

26.12.6 Fence: The chain link fence enclosure shall be erected in accordance with Kentucky Department of Highways Standard Drawings RFC-002-01 and RFG-005-02 and Section 720 of Standard Specifications for Road and Bridge Construction.

26.13 TESTING

26.13.1 Electrical: All electrical work shall be inspected and approved by an electrical inspector. Two copies of the Certificate of Approval shall be provided to the ENGINEER before final acceptance.

26.13.2 Pump Test: The completed installation shall be given a running test of all equipment. While the pump(s) is/are running, all piping and seals shall be checked to insure that no leaks occur. The pressure gages installed in the valve pit shall be used to monitor static, operating, and shut off head conditions for each pumping unit. All controls and warning indicators shall be checked for proper operation.

26.13.3 Repair: Any defects or failure to meet the requirements of these specifications shall be promptly corrected by the CONTRACTOR by replacement. The decision of the OWNER as to whether or not the CONTRACTOR has fulfilled his obligation shall be final and binding on all parties.

26.14 MEASUREMENT AND PAYMENT

26.14.1 Measurement: There shall be no measurement for payment as the work shall be lump sum.

26.14.2 Payment: Payment shall be made at the Lump Sum Contract Price for each submersible pumping station as shown on the PLANS.

Payment as specified shall constitute full compensation for all labor, materials, equipment and incidentals necessary to complete the work specified herein.

TABLE XXVI-A
TECHNICAL SPECIFICATIONS SECTION XXVI
MATERIALS - SUBMERSIBLE PUMPS

	Toler Lift Station
QUALITY CONTROL	
Make & Model	FLYGT NP3171 SH3 SmartRun 474
Impeller Size	213 mm (8 3/8")
PERFORMANCE DATA	
Quantity of Pumps	2
Operating Point	
GPM Flow @	300
FT Head at On	100
Speed	2930
Power Service	400 V/3 PH
Horsepower	29.5

--THE END--

SECTION XXVII

TECHNICAL SPECIFICATIONS

CONNECTIONS TO EXISTING WATER LINES

27.1 SCOPE

This work shall consist of furnishing and installing all necessary materials to connect new water mains to existing water lines.

27.2 SUBMITTALS

27.2.1 Submit five copies of documentation substantiating manufacturer's compliance with these specifications.

27.3 MATERIALS

27.3.1 Tapping Sleeves: The tapping sleeve shall be of full circle clamp type construction of the appropriate diameter and approved by the manufacturer for use with the existing pipe encountered. The tapping branch of the sleeve shall be mechanical joint. The CONTRACTOR shall verify that the rated pressure class of the tapping sleeve exceeds the working pressure of the water line. Valves used in tapping operations shall be as specified in the valve section of these specifications except that the seat rings shall be of large diameter to permit entry of the tapping machine cutters.

27.3.2 Bends and Fittings: Bends and fittings shall be ductile iron, mechanical joint conforming to the requirements of Section IX of these specifications.

27.4 INSTALLATION

Installation shall be made as directed in the Design Drawings or as indicated in the manufacturer's literature. The CONTRACTOR shall make every possible effort to minimize any interruption in water service for existing customers. The CONTRACTOR must satisfy the following conditions prior to proceeding with the connection:

a. The ENGINEER shall have accepted the new pipe line as in-place, suitably pressure tested, suitably disinfected, and ready for service.

b. All water outages must be approved by the OWNER. The CONTRACTOR shall have provided both the OWNER and the ENGINEER at least 72 hours advance written notice of the scheduled date for the water outage and connection. This notice should advise the OWNER to schedule personnel to terminate service in the affected pipe reach and to notify customers of the pending outage.

c. The CONTRACTOR shall have all necessary bends, fittings, glands, adapters, etc. on-site on the date notice of the impending connections is forwarded to the ENGINEER.

d. Connections to existing water lines may only be made on Monday, Tuesday, and Wednesday. No connections to existing water lines may be made on Thursday, Friday, Saturday, or Sunday.

All pipe bendings and fittings shall be restrained using a steel tiebolt joint restraint system (Star SuperStar system, or equal). The number of restraints employed per mechanical joint shall be based on the manufacturer’s load tables for the ambient system pressure. Installation shall be made as directed in the Design Drawings or as indicated in manufacturer's literature.

27.5 MEASUREMENT AND PAYMENT

27.5.1 Measurement: Connections to existing water lines shall be measured each.

27.5.2 Payment: "Connect to Existing Water Line" shall be paid for at the contract price "each" as set forth in the Bid Schedule. This payment shall constitute full compensation for all materials, labor, equipment and incidentals necessary for the completion of the work. Payment for the tapping valve will be made under the valve section of these specifications. There will be no separate payment for "hunt and search excavation", for restraint system, public notices, bends, fittings or other incidentals.

- THE END -

SECTION XXVIII

TECHNICAL SPECIFICATIONS

WATER LINES AND FITTINGS

28.1 SCOPE

This work shall consist of furnishing, installing, testing, and disinfecting potable water line pipes of various diameters.

28.1.1. Quality Assurance/Submittals

28.1.1.1 Submit five copies of documentation to substantiate pipe material's compliance with these specifications.

28.1.1.2 Submit five copies of CONTRACTOR'S Bedding and Backfilling Plan. At a minimum the plan shall:

a. Identify/acknowledge the segments of pipe line to be backfilled using "open", "gravel", and "paved" criteria,

b. Include a representative Proctor Curve for the backfill material for all significant sections of pipe line to be backfilled using "paved" criteria (curve to be prepared and sealed by a geotechnical engineer registered in the State of Kentucky - curve not required if CONTRACTOR backfills entire trench with fine crushed stone),

c. Include quarry's material certification for all aggregates utilized for bedding, haunching, and initial protective backfill, and

d. Include name and qualifications of CONTRACTOR'S nuclear density technician (technician must be a full time employee of CONTRACTOR, spot checks by a sub-contracting testing firm are not acceptable).

28.1.1.3 Submit five copies of each pressure test performed within 48 hours of test completion. Documentation to include quantity of water used and pressure charts from recording pressure gage.

28.1.1.4 Submit five copies of documentation for each disinfection of each pipe reach within 7 days of collection of samples. Documentation to include form of chlorine applied, method of application, quantity of make-up water used, quantity of residual chlorine concentration one hour after dosing, residual chlorine concentration 24 hours after dosing, point of disposal of waters of chlorination, method of de-chlorination, quantity of flushing water supplied, and results of bacteriological examination of water samples.

28.2 MATERIALS

28.2.1 General: All pipe used for potable water service shall be as indicated in the plans.

28.2.2 Ductile Iron Pipe, Fittings, and Joints: Ductile iron pipe shall conform to the latest AWWA Specifications C151 (ANSI A21-51) with standard thickness as designated in AWWA C150. Thickness class shall be 350 unless noted otherwise on the plans by the ENGINEER.

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

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

Bends and fittings shall be Mechanical Joint Compact Ductile Iron fittings, conforming to AWWA Specifications C153 for short body iron fittings. Fittings shall be tar-coated outside and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on (AWWA C111), mechanical joint (AWWA C111), restrained mechanical joint, or ball and socket type as called for in the Plans. Bells for push-on type

joints shall have an annular recess in the pipe socket to accommodate a single rubber gasket. Plain ends shall be suitably beveled to permit easy entry into the bell. The gasket is locked in place against displacement as the joint is assembled.

Mechanical joints shall be bolted and of the stuffing box type and shall consist of a bell with exterior flange and interior recess for the sealing gasket, a pipe or fitting plain end, a sealing gasket, a follower gland, tee-head bolts and hexagon nuts. A restrained mechanical joint is a mechanical joint with a ductile iron retainer gland equal to a Clow F-1058 retainer gland or the Megalug Series 1100 joint restraint.

Joints for all bends and fittings for buried service shall be restrained mechanical joint type only (AWWA C111). Flanged joint pipe shall be used in vaults, pits and above ground service installation. Flanged joint pipe may not be used for buried service.

28.2.3 Polyvinyl Chloride Pipe, Fittings and, Joints: PVC water pipe shall conform, at a minimum, to ASTM Specifications D-2241, and shall be pressure class 250. The pipe furnished under ASTM A-2241 shall have a standard dimension ratio not to exceed SDR 17, and shall be rated to a working pressure of at least 250 psi at 73.4^{o}F.

Fittings shall be cast iron Mechanical Joint Class 250 conforming to AWWA Specifications C110 for short body cast iron fittings. Fittings shall be tar-coated outside, and shall receive the standard cement lining with bituminous seal coal on the inside as specified for the ductile iron pipe.

Joints shall be of the push-on type conforming to ASTM D3139 and F477 requirements for elastometric-gasket joints. All jointing material and lubricants shall be non-toxic.

28.2.4 High Density Polyethylene Pipe and Fittings: HDPE shall be Blue Stripe Pipe. The Pipe shall be equal to Chevron Phillips Performance Pipe 4000 Series.

Pipe shall be manufactured from a PE 3408 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350-99 with a minimum cell classification of PE345464C. Pipe shall have a manufacturing standard of ASTM D3035 and be

manufactured by an ISO 9001 certified manufacturer. The pipe shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects. ASTM 2241 PVC shall not be used on this project.

Butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification. All fittings shall be pressure rated to provide a working pressure rating no less than that of the pipe. Fabricated fittings shall be manufactured using a McElroy Datalogger to record fusion pressure and temperature. A graphic representation of the temperature and pressure data for all fusion joints made producing fittings shall be maintained as part of the quality control. The fitting shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.

Electrofusion Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and be the same base resin as the pipe. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055.

Flanged and Mechanical Joint Adapters shall be PE 3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350-99 and be the same base resin as the pipe. Flanged and mechanical joint adapters shall have a manufacturing standard of ASTM D3216. All adapters shall be pressure rated to provide a working pressure rating no less than that of the pipe.

Mechanical restraint for HDPE may be provided by mechanical means separate from the mechanical joint gasket sealing gland. The restrainer shall provide wide, supportive contact around the full circumference of the pipe and be equal to the listed widths. Means of restraint shall be machined serrations on the inside surface of the restrainer equal to or greater than the listed serrations per inch and width. Loading of the restrainer shall be by a ductile iron follower that provides even circumferential loading over the entire restrainer. Design shall be such that restraint shall be increased with increases in line pressure.

Serrated restrainer shall be ductile iron ASTM A536-80 with a ductile iron follower; bolts and nuts shall be corrosive resistant, high strength alloy steel.

The restrainer shall have a pressure rating of, or equal to that of the pipe on which it is used. Restrainers shall be JCM Industries, Sur-Grip or pre-approved equal.

Nominal Size	Restraint Width	Serrations per inch
4″, 6″	1-1/2″	8
8″ 10 & 12″	1-3/4″	8

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

28.2.5 Pipe Bedding: Pipe bedding stone shall be durable crushed limestone meeting the requirements of Section 805 of the Current Edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction."

28.2.6 Geotextile Type III: Geotextiles shall be woven or non-woven geotextile fabrics meeting the material and strength requirements for Type III fabrics as set forth in Section 215 of the Current Edition of the Kentucky Department of Highways publication "Standard Specifications for Road and Bridge Construction."

28.3 INSTALLATION

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

All backfilled ditches shall be maintained in such a manner that they will offer no hazard to the passage of traffic.

The convenience of the traveling public and property owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged. Excavated materials shall be disposed of so as to cause the least interference.

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

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

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

Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed (See Section 28.3.1.2) to provide safe working conditions and to prevent damage of work.

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

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

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

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

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

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

Care shall be taken to avoid excessive backfill loads on the completed pipelines, and the requirements that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameters of the pipe shall, as set out in Section 28.3 hereinbefore, be strictly observed.

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

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

28.3.1.3 Blasting: Blasting operations on this project are prohibited.

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

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

Supporting of pipe shall be as set out hereinbefore, and in no case shall the supporting of pipe on blocks be permitted. The Design Drawings present typical approved bedding methods.

28.3.2.1 Earth Foundation: All pipe shall be laid on a six inch bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #9 crushed stone. Granular bedding shall be mechanically compacted prior to pipe placement.

28.3.2.2 Rock Foundation: If the trench bottom is in rock the excavation shall be undercut to a minimum depth of six inches below the bottom of the pipe. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe.

Granular bedding shall be #9 crushed stone. Granular bedding shall be mechanically compacted prior to pipe placement.

28.3.2.3 Special Bedding: In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the ENGINEER may order “Special Pipe Bedding.” When the ENGINEER orders “Special Pipe Bedding” (in writing), the CONTRACTOR shall:

a. overexcavate the mucky subgrade to the depth directed,

b. install a Type III geotextile as illustrated in the detail drawings,

c. backfill the geotextile with bedding stone, and

d. overlap the geotextile envelope in accordance with the detail drawings.

It is to be expressly understood that “Special Pipe Bedding” may only be employed upon written order of the ENGINEER.

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

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

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

to leave a smooth end at right angles to the longitudinal axis of the pipe.

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

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

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

28.3.4 Jointing Pipe: The pipe joints described shall be installed in accordance with the manufacturer's recommendations.

28.3.5 Backfilling Pipeline Trenches: All backfilling shall be accomplished in accordance with the details of this section and the project plans. Any variances must be approved in writing by the ENGINEER.

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

When the pipe trench crosses a street or roadway, the CONTRACTOR shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

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

In all cases the pipe bedding and haunching shall be #9 crushed stone. The pipe bedding shall be mechanically tamped prior to placement of the pipe. The pipe bedding shall be thoroughly compacted taking care not to damage the pipe.

28.3.5.1 Method "A" Backfilling in Open Terrain: Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

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

The portion of the trench from the springline of the pipe to a point 6 inches above the pipe shall be backfilled in six inch lifts with #9 crushed stone. Each lift shall be hand tamped taking care not to damage the pipe.

The portion of the trench from a point 6 inches above the top of the pipe to the ground surface shall be backfilled in six (6) inch lifts with material which is free from ¾" or larger rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. The backfill shall be mechanically tamped in six inch lifts to 95 percent of standard Proctor Density (ASTM D-698).

28.3.5.2 Method "B" Backfilling Under Graveled Areas: Backfilling of pipeline trenches under existing and proposed graveled parking lots, driveways, etc. shall be accomplished in the following manner:

The pipe bedding and haunching shall be placed and compacted as described in Paragraph 28.3.5.1. The lower portion of the trench from the pipe springline to a

point 6 inches above the pipe, shall be backfilled and lightly tamped with #9 crushed stone as described in Paragraph 28.3.5.1. The portion of the trench from a point 6 inches above the pipe to a point 6 inches below the ground surface shall then be backfilled with available material in six (6) inch lifts. Each lift shall be compacted to 100 percent of Standard Proctor Density (ASTM D-698) at a moisture content within two percent of optimum. The final 6 inches of the trench backfill shall be thoroughly compacted dense graded aggregate.

28.3.5.3 Method "C" Backfilling Under Paved Areas: Backfilling of pipeline trenches under existing and proposed sidewalks, streets, proposed streets, and driveways shall be accomplished in the following manner:

The pipe bedding and haunching shall be placed and compacted as described in Paragraph 28.3.5.1. The lower portion of the trench from the pipe springline to a point 6 inches above the pipe, shall be backfilled and lightly tamped with #9 crushed stone as described in Paragraph 28.3.5.1. The portion of the trench from a point 6 inches above the pipe to a point 6 inches below the ground surface shall then be backfilled with #9 crushed stone in six inch (6) lifts. Each lift shall be compacted to 100 percent of Standard Proctor Density (ASTM D-698) at a moisture content within two percent of optimum.

The upper portion of the trench from a point six inches below the bottom of the existing or proposed pavement or concrete sub-slab may be backfilled with a base course of dense graded aggregate which shall be maintained flush with the pavement surface for at least 30 days prior to placement of the final surface. The excess dense graded aggregate shall be removed concurrently with the placement of the final pavement surface.

28.3.5.4 Settlement of Trenches: Wherever pipe lines are in, or across, driveways and streets, the CONTRACTOR shall be responsible for any trench settlement which occurs within these rights-of-way within one year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement

within this time, it shall be replaced by the CONTRACTOR. Repair of settlement damage shall meet the approval of the appropriate governing body.

28.3.5.5 Pavement Replacement: Pavement replacement shall be performed in accordance with the applicable section of these Technical Specifications.

28.4 TESTING OF LINES

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

a) All water mains shall be given a hydrostatic test. Test pressure shall be a minimum of 150 psi, 50 psi above the standard operating pressure (to be supplied by the ENGINEER), or 67% of the pipe rating, whichever is greater. Test pressure shall not vary by more than ±10 psi for the duration of the test. Leakage shall not be greater than that determined by the following formula: 1 gallon per inch of pipe diameter per mile per 24 hours.

b) All test waters shall be potable water obtained from the Mountain Water District distribution system. Withdrawals of water from the District system must be both authorized and metered. The District will bill the CONTRACTOR for all waters used in accordance with its current leak adjustment rate.

c) Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more one mile. The OWNER may allow testing in longer sections on a case by case basis.

d) Duration of test shall be no less than twenty-four hours.

e) Where leaks are evident on the surface where joints are covered, the joints shall be recaulked, repoured, bolts retightened or relaid, and leakage minimized regardless of total leakage as shown by test.

f) All pipe fittings and other materials found to be defective under test shall be removed, repaired or replaced at the discretion of the OWNER.

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

h) The CONTRACTOR shall furnish a recording pressure gauge for the pressure and leakage test. The device shall be a Dickson PR300 Pressure Logger with all appropriate cables and software. The device and software shall become the property of the OWNER at conclusion of test.

28.5 DISINFECTION OF WATER LINES

The new potable water lines shall not be placed in service, either temporarily or permanently, until they have been thoroughly disinfected by the Continuous Feed Method as set forth in the latest edition of AWWA Specification C-651. Specification C-651 is reproduced in the Reference Section of this Contract Document in its entirety.

The following requirements apply to the disinfection activity:

a) All flushing and test waters shall be potable water obtained from the Mountain Water District system. Withdrawals of water from the District system must be both authorized and metered. Mountain Water District will bill the CONTRACTOR for all waters used in accordance with its current leak adjustment rate.

b) The Tablet and Slug Method of disinfection may not be used.

c) The water lines shall be flushed prior to disinfection. Flush waters may be discharged to the nearest storm drain or surface water way in a controlled manner which will not result in environmental damage.

d) The CONTRACTOR shall have a chlorine test kit in his possession for purposes of monitoring the disinfection dose.

e) The free chlorine residual immediately after chlorine dosing shall be 50 mg/l. The free chlorine residual 24 hours after chlorine dosing shall not be less than 25 mg/l.

f) The heavily chlorinated waters of disinfection shall be neutralized with an approved neutralizing agent prior to discharge.

g) After disinfection and flushing, and before the water main is placed in service, bacteriological samples shall be collected and analyzed in accordance with the requirements of the Kentucky Department for Natural Resources and Environmental Protection. The new line may not be connected to the system until the samples have been approved.

28.6 MEASUREMENT AND PAYMENT

28.6.1 Measurement: Water pipe in place, complete, successfully tested and disinfected shall be measured in linear feet along the pipe centerline. Pipe fittings (tees, reducers, etc.) will be measured "each". The length of fittings measured for payment shall be deducted from the lineal feet of pipe laid to avoid "double" payment. Pipe bends will not be measured for separate payment. Bends shall be measured in linear feet. No allowance shall be made for laps or drops at connections.

“Special Pipe Bedding” - ordered in writing by the ENGINEER - in place and accepted shall be measured by the ton of bedding stone actually placed (to the top of the geotextile envelope). There will be no separate measurement of Geotextile Type III or other incidentals.

28.6.2 Payment: Payment for pipe will be made at the contract unit price per linear foot for each pipe class as set forth in the Bid Schedule. Payment for fittings will be made at the contract price "each" as set forth in the Bid Schedule. Such payment for pipe and fittings shall constitute full compensation for all materials, labor, equipment, and incidentals necessary for the completion of the work. Retainer glands for restrained mechanical joint pipe shall be considered incidental to the unit price for mechanical joint pipe.

Payment for “Special Pipe Bedding” - ordered in writing by the ENGINEER - shall be made at the contract unit price per ton for the actual quantity measured. There shall be no separate payment for Geotextile Type III or other incidentals.

-- THE END --

SECTION XXIX

TECHNICAL SPECIFICATIONS

GATE VALVES

29.1 SCOPE

This work shall consist of furnishing and installing gate valves of various diameters for potable water lines.

29.1.A QUALITY ASSURANCE/SUBMITTALS

29.1.A.1 Submit five copies of manufacturer's certification of compliance with applicable AWWA specifications. Certificate to be signed by corporate officer having authority to legally bind the company.

29.2 MATERIALS

29.2.1 Gate Valves: All gate valves shall be iron body, nonrising stem, fully bronze mounted (Mueller or approved equal). VALVES INSTALLED IN PVC WATER LINES SHALL BE RATED FOR WORKING WATER PRESSURES OF 250 PSI. VALVES INSTALLED IN DUCTILE IRON WATER LINES SHALL BE RATED FOR WORKING WATER PRESSURES OF 250 PSI. Valves shall be of standard manufacture and of the highest quality both as to materials and workmanship.

Gate valves larger than 12" shall be of resilient, parallel seat construction conforming to AWWA C500-80. Gate valves 12" and smaller shall be of resilient seat construction conforming to AWWA C509-80.

All gate valves for "below ground" service shall be furnished with mechanical joint end connections. Gate valves for "above ground" (or pit) installations shall be furnished with flanged end connections.

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

Each gate valve for "below ground" service shall be installed in a vertical position with a valve box, as shown in the Design Drawings. Gate valves set with boxes shall be provided with a two inch square operating nut and shall be

opened by turning to the left (counterclockwise). Each gate valve for "above ground" (or pit) installations shall be furnished with a hand wheel operator.

29.2.2 Valve Box and Cover: The valve box and cover shall be of cast iron construction (Clow F-2450, or equal) and shall be engraved with the word “water”.

29.2.3 Valve Marker: Each valve assembly shall be delineated by a valve marker as detailed in the Drawings. The marker shall consist of a 3” yellow PE pipe embedded vertically adjacent to the valve. The marker shall include a weatherproof label identifying the valve owner and provide an emergency phone number for the owner.

29.2.4 Plug: If the gate valve is to be installed at the end of a line the CONTRACTOR shall provide one full joint of ductile iron pipe with cap beyond the valve.

29.3 INSTALLATION

Trenching, bedding, and backfilling requirements for gate valves shall conform to the installation requirements for water lines and fittings. The base of the valve shall be anchored in concrete as shown in the Design Drawings. The valve box shall be installed vertically, centered over the stem of the operating nut. The valve box base shall be placed at least two inches above the flanged joint of the valve cover. The top of the operating nut should be no higher than the hub or upper part of the valve box base where it connects to the center section.

29.4 MEASUREMENT AND PAYMENT

29.4.1 Measurement: Gate valves for buried service in-place, tested, and accepted shall be measured each. Valves installed in vaults, pits, and pumping stations shall be considered incidental to the complete price for the vault, pit or pumping station and shall not be measured for separate payment.

29.4.2 Payment: Gate valves measured for payment shall be paid for at the contract price "each" as set forth in the Bid Schedule. Payment as specified shall be considered as full compensation for all labor, materials, equipment, and incidentals necessary to perform the work as required. The valve box and cover shall be considered incidental to the installation and shall not be measured for separate payment.

-- THE END --

SECTION XXX

TECHNICAL SPECIFICATIONS

FIRE HYDRANTS AND BLOW-OFF VALVES

30.1 SCOPE

Provide all labor, tools, materials, and equipment to furnish and install the fire hydrants and blow-off valves as shown on the plans.

30.2 QUALITY ASSURANCE/SUBMITTALS

30.2.1 All hydrants shall be Mueller Company Model A-423. No other hydrant may be used without consent of the OWNER.

30.3 MATERIALS

30.3.1 Hydrant: Hydrants shall conform in all respects to the latest edition of AWWA C502. Hydrant barrel shall have a safety breakage feature above the ground line. All hydrants shall have 6 inch mechanical joint shoe connections, two 2-1/2 inch discharge nozzles and one 4-1/2 inch pumper nozzle with caps fitted with cap chains. Connection threads and operating nuts shall conform to National Standard specifications as adopted by National Board of Fire Underwriters.

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

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

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

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

Hydrants shall be designed for 250 psi working pressure and shop tested to 300 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drains shall function and there shall be no leakage into the bonnet.

30.3.2 Blow-off: The blow off hydrant shall be equal to an Mueller or Kennedy post hydrant. A 4″ resilient wedge gate valve conforming to the requirements of the valving section of these Specifications shall be installed upstream of each post hydrant as illustrated in the detail drawings.

30.4 INSTALLATION

30.4.1 Hydrants shall have the interior cleaned of all foreign matter prior to installation.

30.4.2 Hydrants shall be set plumb with not less than three cubic feet of crushed stone and backed with at least one cubic foot of Class "C" concrete or equivalent. Additionally, ¾″ diameter stainless bridle rod collars or megalug restrained joint gland shall be employed for restraint. The hydrant drain holes shall be thoroughly inspected prior to placement of the crushed stone.

30.4.3 A gate valve must be installed in the service lateral of all hydrants and blowoffs.

30.4.4 The hydrants shall be installed with the pumper nozzle facing the main route of access. The vertical distance from the pumper nozzle to the ground shall be 18 inches.

30.4.5 All hydrant parts shall be inspected in open and closed position to verify working conditions prior to backfilling.

30.4.6 Hydrants and blow-offs shall not be set in the flow line of a ditch or drainage way.

30.4.7 Blow-offs shall be installed in accordance with the details presented in the Design Drawings.

30.5 MEASUREMENT AND PAYMENT

30.5.1 Measurement: "Fire Hydrants" in-place, tested and accepted shall be measured "each". "Blow-Offs" in place, tested and accepted shall be measured "each".

30.5.2 Payment: Payment for "Fire Hydrants" and "Blow-Offs" shall be made at the contract unit price "each" as set forth in the Bid Schedule for the actual number of hydrants and blow-offs measured. **The valve provided with a "Fire Hydrant" shall be measured and paid for under the valving section of these specifications. The valve provided with a "Blow-Off" shall be measured and paid for under the valving section of these specifications.** Payment as specified shall be considered full compensation for all labor, materials, equipment, and incidentals necessary to perform the work as required. Crushed stone backfill and concrete thrust backing are considered incidental to the hydrant installation.

- THE END -

SECTION XXXI

TECHNICAL SPECIFICATIONS

WATER SERVICE CONNECTIONS

31.1 SCOPE

This specification governs the provision of water service connections.

31.2 GENERAL

The CONTRACTOR shall provide .75″ through 1″ water service connections in accordance with this specification. Water service connections for meters in excess of 1″ shall be provided by OWNER.

31.3 QUALITY ASSURANCE/SUBMITTALS

31.3.1 Submit five copies of itemized summary of source of manufacture of each item in water service connection. Provide manufacturer's certification of compliance with specification for each item.

31.4 MATERIALS

31.4.1 Service Pipe: Water service pipe shall be 0.75″ or 1″ seamless copper water tubing Type "K" complying with ASTM-B88 AWWA C800.

31.4.2 Tapping Saddle: Tapping saddles shall be brass band type saddles equal to Ford S70 series for PVC pipe and the Ford 202 series for ductile iron pipe. The saddles shall be threaded to receive the appropriate diameter AWWA corporation stop.

31.4.3 Corporation Stop: Corporation stops shall conform to AWWA C800-84. Corporation stops shall have AWWA CC tapered thread inlets and pack joint or compression outlets for use with copper service line. The stop connections shall be appropriate for the service pipe diameter employed.

31.4.4 Meter Setter: The meter coppersetter shall be equal to the Ford 70 series V172-7 with 7 inch rise. If a pressure reducing valve is specified, a tandem coppersetter equal to a Ford TV172-7 shall be employed.

31.4.5 Meter Box and Lid: The meter box for coppersetters shall be 18″ internal diameter High Density Polyethylene Pipe. The meter box and lid shall be equal to the Russco LC218 FB-18. The meter box for tandem coppersetters shall be 18″ internal diameter High Density Polyethylene Pipe. The meter box and lid shall be equal to the Russco LC218 FB-18.

31.4.6 Meter: The meters shall be Badger series Meters $^{5}/_{8}$″ x ¾″ or 1″ cold water type as indicated.

31.4.7. Pressure Regulating Valve: The pressure reducing valve shall be ¾″ or 1″ regulator equal to Mueller's H-9310 (No. 2).

31.4.8. Curb Stop: Curb stops shall be equal to a Mueller 110, compression coupling both ends. Curb stop shall be suitable for diameter of service pipe employed. Curb stop shall be furnished complete with curb box and cover.

31.4.9. Recordall Transmitter Register: Each meter shall be furnished with an ORION Integral or Remote for Recordall Transmitter Register as described in the

31.5 INSTALLATION

31.5.1. Taps: **AT THE REQUEST OF THE MOUNTAIN WATER DISTRICT, THERE SHALL BE NO DRY TAPS.** The taps shall be made in accordance with the manufacturer's directions. Service line shall be protected by 6″ of fine sand or gravel as indicated in the detail drawings.

31.5.2. Meter Setting: The meter settings shall be accomplished in a neat and workmanlike manner. The lid of the meter box shall be set:

1) flush with paved surfaces.
2) 0.5″ above grade in improved lawns, and
3) 2″ above grade in unimproved areas.

31.5.3. Meter Setting with Double Cut Regulation. Double

Cut Regulation Meter Sets shall be required on all services where line pressures exceed 220 psi. One pressure reducing valve shall be installed in a separate box (straight setter) in front of the box containing the meter. The meter and one regulator shall be installed in a second box (tandem setter) immediately beyond the first box. Boxes for the PRV's and the meter shall be constructed no further than three feet apart.

31.5.4 THE CONTRACTOR MAY NOT INSTALL THE METER! A dummy meter shall be used to verify that each setting is installed in the proper working manner. The CONTACTOR shall deliver the meters (suitably boxed) to the OWNER's public works director.

31.6 MEASUREMENT AND PAYMENT

31.6.1 Measurement: A water service shall be measured as three quantities. They are: (1) 'X' inch copper water service line, (2) 'X' inch meter set with/without PRV and (3)'X' inch meter set with double cut regulation. 'X' inch copper water service line in-place, tested and accepted shall be measured in linear feet along the pipe centerline. 'X' inch meter sets shall be measured each. A 'meter set' is defined to include the tapping saddle, corporation stop, meter box, coppersetter, meter, pressure reducing valve(s) (if applicable), meter box(s), lid and curb stop of the 'X' inch diameter.

31.6.2. Payment: Payment for "'X' inch Copper Water Service Line" will be made at the Contract Unit Price set forth in the Bid Schedule for the actual quantity measured. Payment for "'X' Inch Meter Sets", "'X' Inch Meter Set with PRV" or 'X' inch meter sets with double cut regulation will be made at the Contract Unit Price "Each" as set forth in the Bid Schedule. Payment for those items shall be considered full compensation for all materials, labor, equipment and incidentals necessary for the completion of the work.

- THE END -

American Water Works Association
ANSI/AWWA C600-93
(Revision of ANSI/AWWA C600-87)

AWWA STANDARD

FOR

INSTALLATION OF DUCTILE-IRON WATER MAINS AND THEIR APPURTENANCES

AMERICAN NATIONAL STANDARD

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AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

SECTION 4: HYDROSTATIC TESTING

WARNING: The testing methods described in this section are specific for water-pressure testing. These procedures should not be applied for air-pressure testing because of the serious safety hazards involved.

Sec. 4.1 Pressure and Leakage Test

4.1.1 *Test restrictions.*

Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section.

Test pressure shall not exceed pipe or thrust-restraint design pressures.

The hydrostatic test shall be of at least a 2-h duration.

Test pressure shall not vary by more than ±5 psi (34.5 kPa) for the duration of the test.

Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the

rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve. For tests at these pressures, the test setup should include a provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened enough to equalize the trapped pressure with the line pressure, or fully opened if desired.

The test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

4.1.2 *Pressurization.* After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing. Each valved section of pipe shall be slowly filled with water, and the specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

4.1.3 *Air removal.* Before applying the specified test pressure, air shall be expelled completely from the section of piping under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as required by the specifications.

4.1.4 *Examination.* All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until satisfactory results are obtained.

4.1.5 *Leakage defined.* Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi (34.5 kPa) of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

4.1.6 *Allowable leakage.* No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

In inch-pound units,

$$L = \frac{SD\sqrt{P}}{133{,}200} \qquad \text{(Eq 1)}$$

Where:

L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage test, in pounds per square inch (gauge)

In metric units,

$$L_m = \frac{SD\sqrt{P}}{715{,}317} \qquad \text{(Eq 2)}$$

Where:

L_m = allowable leakage, in litres per hour
S = length of pipe tested, in metres
D = nominal diameter of the pipe, in millimetres
P = average test pressure during the leakage test, in kPa

These formulas are based on an allowable leakage of 11.65 gpd/mi/in. (1.079 L/day/km/mm) of nominal diameter at a pressure of 150 psi (1034 kPa).

4.1.6.1 Allowable leakage at various pressures is shown in Tables 6A and 6B.

4.1.6.2 When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/h/in. (1.2 mL/h/mm) of nominal valve size shall be allowed.

4.1.6.3 When hydrants are in the test section, the test shall be made against the main valve in the hydrant.

4.1.7 *Acceptance of installation.* Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe discloses leakage greater than that specified in Sec. 4.1.6, repairs or replacements shall be accomplished in accordance with the specifications.

4.1.7.1 All visible leaks are to be repaired regardless of the amount of leakage.

Table 6A Allowable leakage per 1000 ft of pipeline* — *gph*†

Avg. Test Pressure *psi*	Nominal Pipe Diameter—*in.*																	
	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	64
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60	9.56	10.19
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11	9.01	9.61
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58	8.43	8.99
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02	7.80	8.32
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72	7.47	7.97
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41	7.12	7.60
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.08	6.76	7.21
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73	6.37	6.80
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36	5.96	6.36
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97	5.52	5.88
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53	5.04	5.37
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05	4.50	4.80

*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
†Calculated on the basis of Eq. 1.

Table 6B Allowable leakage per 300 m of pipeline* — *L/h*†

Avg. Test Pressure *KPa*	Nominal Pipe Diameter—*mm*																	
	76	102	152	203	254	305	356	406	457	508	610	762	914	1067	1219	1400	1500	1600
3000	1.84	2.30	3.45	4.59	5.74	6.89	8.04	9.19	10.34	11.49	13.78	17.23	20.67	22.97	27.57	32.16	34.46	36.75
2800	1.78	2.22	3.33	4.44	5.55	6.66	7.77	8.88	9.99	11.10	13.32	16.64	19.97	22.19	26.63	31.07	33.29	35.51
2600	1.71	2.14	3.21	4.28	5.35	6.42	7.48	8.55	9.62	10.69	12.83	16.04	19.25	21.39	25.66	29.94	32.08	34.22
2400	1.64	2.05	3.08	4.11	5.14	6.16	7.19	8.22	9.25	10.27	12.33	15.41	18.49	20.55	24.66	28.76	30.82	32.87
2200	1.57	1.97	2.95	3.93	4.92	5.90	6.88	7.87	8.85	9.84	11.80	14.75	17.70	19.67	23.61	27.54	29.51	31.47
2000	1.50	1.88	2.81	3.75	4.69	5.63	6.56	7.50	8.44	9.38	11.25	14.07	16.88	18.76	22.51	26.26	28.13	30.01
1800	1.42	1.78	2.67	3.56	4.45	5.34	6.23	7.12	8.01	8.90	10.68	13.35	16.01	17.79	21.35	24.91	26.69	28.47
1600	1.34	1.68	2.52	3.36	4.19	5.03	5.87	6.71	7.55	8.39	10.07	12.58	15.10	16.78	20.13	23.49	25.16	26.84
1400	1.26	1.57	2.35	3.14	3.92	4.71	5.49	6.28	7.06	7.85	9.42	11.77	14.12	15.69	18.83	21.97	23.54	25.11
1200	1.16	1.45	2.18	2.91	3.63	4.36	5.08	5.81	6.54	7.26	8.72	10.90	13.08	14.53	17.43	20.34	21.79	23.25
1000	1.06	1.33	1.99	2.65	3.32	3.98	4.64	5.30	5.97	6.63	7.96	9.95	11.94	13.26	15.91	18.57	19.89	21.22
800	0.95	1.19	1.78	2.37	2.97	3.56	4.15	4.74	5.34	5.93	7.12	8.90	10.68	11.86	14.23	16.61	17.79	18.98
600	0.82	1.03	1.54	2.05	2.57	3.08	3.60	4.11	4.62	5.14	6.16	7.70	9.25	10.27	12.33	14.38	15.41	16.44

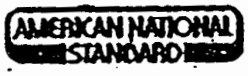
*If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.
†Calculated on the basis of Eq. 2.

American Water Works Association
ANSI/AWWA C651-92
(Revision of ANSI/AWWA C651-86)

AWWA STANDARD

FOR

DISINFECTING WATER MAINS



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AMERICAN WATER WORKS ASSOCIATION

6666 West Quincy Avenue, Denver, Colorado 80235

American Water Works Association

ANSI/AWWA C651-92
(Revision of ANSI/AWWA C651-86)

AWWA STANDARD FOR

DISINFECTING WATER MAINS

SECTION 1: GENERAL

Sec. 1.1 Scope

This standard presents essential procedures for disinfecting new and repaired water mains. All new water mains shall be disinfected before they are placed in service. All water mains taken out of service for inspection, repair, or other activities that might lead to contamination of water shall be disinfected before they are returned to service.

Sec. 1.2 References

This standard references the following documents. The latest current edition of each forms a part of this standard where and to the extent specified herein. In case of any conflict, the requirements of this standard shall prevail.

ANSI*/AWWA B300—Standard for Hypochlorites.

ANSI/AWWA B301—Standard for Liquid Chlorine.

Simplified Procedures for Water Examination. AWWA Manual M12. AWWA, Denver (1978).

Standard Methods for the Examination of Water and Wastewater. APHA,† AWWA, and WEF.‡ Washington, D.C. (18th ed., 1992).

Additional materials relating to activity under this standard include the following:

Chlorine Manual—Chlorine Institute Inc.§

Introduction to Water Treatment. WSO Series, Vol. 2. AWWA, Denver (1984).

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*American National Standards Institute Inc., 11 W. 42nd St., New York, NY 10036.

†American Public Health Association, 1015 15th St. N.W., Washington, DC 20005.

‡Water Environment Federation, 601 Wythe St., Alexandria, VA 22314.

§Chlorine Institute Inc., 2001 L St. N.W., Washington, DC 20036.

Material Safety Data Sheets for forms of chlorine used (provided by suppliers).

Safety Practice for Water Utilities. AWWA Manual M3. AWWA, Denver (1990).

Water Chlorination Principles and Practices. AWWA Manual M20. AWWA, Denver (1973).

Water Quality and Treatment. AWWA, Denver (4th ed., 1990).

Sec. 1.3 Record of Compliance

The record of compliance shall be the bacteriological test results certifying the water sampled from the new water main to be free of coliform bacteria contamination, and to be equal to or better than the bacteriologic water quality in the distribution system.

SECTION 2: FORMS OF CHLORINE FOR DISINFECTION

The forms of chlorine that may be used in the disinfection operations are liquid chlorine, sodium hypochlorite solution, and calcium hypochlorite granules or tablets.

Sec. 2.1 Liquid Chlorine

Liquid chlorine conforming to ANSI/AWWA B301 contains 100 percent available chlorine and is packaged in steel containers usually of 100-lb, 150-lb, or 1-ton (45.4-kg, 68.0-kg, or 907.2-kg) net chlorine weight. Liquid chlorine shall be used only (1) in combination with appropriate gas-flow chlorinators and ejectors to provide a controlled high-concentration solution feed to the water to be chlorinated; (2) under the direct supervision of a person who is familiar with the physiological, chemical, and physical properties of liquid chlorine, and who is trained and equipped to handle any emergency that may arise; and (3) when appropriate safety practices are observed to protect working personnel and the public.

Sec. 2.2 Sodium Hypochlorite

Sodium hypochlorite conforming to ANSI/AWWA B300 is available in liquid form in glass, rubber-lined, or plastic containers typically ranging in size from 1 qt (0.95 L) to 5 gal (18.92 L). Containers of 30 gal (113.6 L) or larger may be available in some areas. Sodium hypochlorite contains approximately 5 percent to 15 percent available chlorine, and care must be taken to control conditions and length of storage to minimize its deterioration. (Available chlorine is expressed as a percent of weight when the concentration is 5 percent or less, and usually as a percent of volume for higher concentrations. Percent × 10 = grams of available chlorine per litre of hypochlorite.)

Sec. 2.3 Calcium Hypochlorite

Calcium hypochlorite conforming to ANSI/AWWA B300 is available in granular form or in 5-g tablets, and contains approximately 65 percent available chlorine by weight. The material should be stored in a cool, dry, and dark environment to minimize its deterioration.

SECTION 3: BASIC DISINFECTION PROCEDURE

The basic disinfection procedure consists of

1. Preventing contaminating materials from entering the water main during storage, construction, or repair.
2. Removing, by flushing or other means, those materials that may have entered the water main.
3. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the main.
4. Protecting the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
5. Determining the bacteriological quality by laboratory test after disinfection.
6. Final connection of the approved new water main to the active distribution system.

SECTION 4: PREVENTIVE AND CORRECTIVE MEASURES DURING CONSTRUCTION

Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is, therefore, essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination. Also, any connection of new water main to the active distribution system prior to receipt of satisfactory bacteriological samples may constitute a cross-connection. Therefore, the new main must be isolated until bacteriological tests described in Sec. 7 of this standard are satisfactorily completed.

Sec. 4.1 Keeping Pipe Clean and Dry

Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. Rodent-proof plugs may be used when it is determined that watertight plugs are not practicable and when thorough cleaning will be performed by flushing or other means.

Delay in placement of delivered pipe invites contamination. The more closely the rate of delivery is correlated to the rate of pipe laying, the lower the risk of contamination.

Sec. 4.2 Joints

Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

Sec. 4.3 Packing Materials

Yarning or packing material shall consist of molded or tubular rubber rings, rope of treated paper, or other approved materials. Materials such as jute or hemp shall not be used. Packing material shall be handled in a manner that avoids contamination. If asbestos rope is used, it shall be handled in a manner that prevents asbestos from being introduced into the water-carrying portion of the pipe.

Sec. 4.4 Sealing Materials

No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Sealing material or gaskets shall be handled in a manner that avoids contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean.

Sec. 4.5 Cleaning and Swabbing

If dirt enters the pipe, it shall be removed and the interior pipe surface swabbed with a 1 percent hypochlorite disinfecting solution. If, in the opinion of the purchaser (or the purchaser's representative), the dirt remaining in the pipe will not be removed by the flushing operation, then the interior of the pipe shall be cleaned by mechanical means such as a hydraulically propelled foam pig (or other suitable device acceptable to the purchaser) in conjunction with the application of a 1 percent hypochlorite disinfecting solution to the interior pipe surface. The cleaning method used shall not force mud or debris into the interior pipe-joint spaces and shall be acceptable to the purchaser.

Sec. 4.6 Wet-Trench Construction

If it is not possible to keep the pipe and fittings dry during installation, every effort shall be made to ensure that any of the water that may enter the pipe-joint spaces contains an available-chlorine concentration of approximately 25 mg/L. This may be accomplished by adding calcium hypochlorite granules or tablets to each length of pipe before it is lowered into a wet trench, or by treating the trench water with hypochlorite tablets.

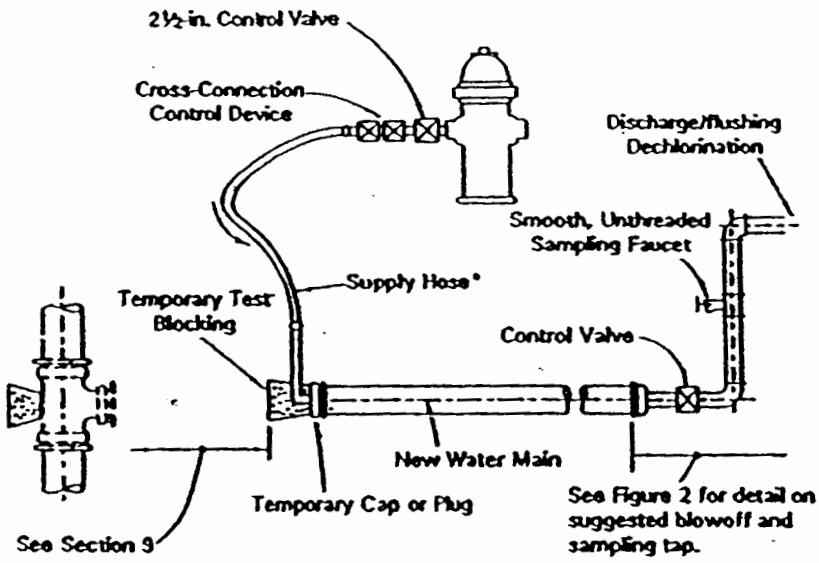
Sec. 4.7 Flooding by Storm or Accident During Construction

If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to the floodwater shall then be filled with a chlorinated potable water that, at the end of a 24-h holding period, will have a free chlorine residual of not less than 25 mg/L. The chlorinated water may then be drained or flushed from the main. After construction is completed, the main shall be disinfected using the continuous-feed or slug method.

Sec. 4.8 Backflow Protection (Optional)*

As an optional procedure (if specified by the purchaser), the new water main shall be kept isolated from the active distribution system by physical separation (see Figure 1) until satisfactory bacteriological testing has been completed and the

*Optional Sec. 4.8 is not included as part of the standard unless specifically identified in the purchaser's specifications.



*Clean potable-water hose only. Size and number of taps per Table 3 (page 8). This hose must be removed during the hydrostatic pressure test.

NOTE: Figure 1 applies to pipe with diameters 4 in. (100 mm) through 12 in. (300 mm). All larger sizes must be handled on a case-by-case basis.

Figure 1 Suggested temporary flushing/testing connection

disinfectant water flushed out. Water required to fill the new main for hydrostatic pressure testing, disinfection, and flushing shall be supplied through a temporary connection between the distribution system and the new main. The temporary connection shall include an appropriate cross-connection control device consistent with the degree of hazard, and shall be disconnected (physically separated) from the new main during the hydrostatic pressure test. It will be necessary to reestablish the temporary connection after completion of the hydrostatic pressure test to flush out the disinfectant water prior to final connection of the new main to the distribution system.

SECTION 5: METHODS OF CHLORINATION

Three methods of chlorination are explained in this section: tablet, continuous feed, and slug. Information in the foreword will be helpful in determining the method to be used. The tablet method gives an average chlorine dose of approximately 25 mg/L; the continuous-feed method gives a 24-h chlorine residual of not less than 10 mg/L; and the slug method gives a 3-h exposure of not less than 50 mg/L free chlorine.

Table 1 Ounces of calcium hypochlorite granules to be placed at beginning of main and at each 500-ft interval

Pipe Diameter		Calcium Hypochlorite Granules	
in.	*(mm)*	*oz*	*(g)*
4	(100)	0.5	(14)
6	(150)	1.0	(28)
8	(200)	2.0	(57)
12	(250)	4.0	(113)
16 and larger	(400 and larger)	8.0	(227)

Sec. 5.1 Tablet Method

The tablet method consists of placing calcium hypochlorite granules or tablets in the water main as it is being installed and then filling the main with potable water when installation is completed.

This method may be used only if the pipes and appurtenances are kept clean and dry during construction.

5.1.1 *Placing of calcium hypochlorite granules.* During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be as shown in Table 1.

WARNING: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

5.1.2 *Placing of calcium hypochlorite tablets.* During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe. Also, one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The number of 5-g tablets required for each pipe section shall be $0.0012\ d^2L$ rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by a food-grade adhesive.* There shall be no adhesive on the tablet except on the broadside attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.

5.1.3 *Filling and contact.* When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a

*Examples of food-grade adhesives are Permatex Form-A-Gasket No. 2 and Permatex Clear RTV Silicone Adhesive Sealant, which are manufactured by Loctite Corporation, Kansas City, KS 66115. These products have both been approved by the US Drug Administration (USDA) for uses that may involve contact with edible products. Neither product has been approved in accordance with NSF 61. Other company products, such as Permatex Form-A-Gasket No. 1, have not received FDA approval.

Table 2 Number of 5-g calcium hypochlorite tablets required for dose of 25 mg/L*

Pipe Diameter		Length of Pipe Section, ft (m)				
		13 (4.0) or less	18 (5.5)	20 (6.1)	30 (9.1)	40 (12.2)
in.	(mm)	Number of 5-g Calcium Hypochlorite Tablets				
4	(100)	1	1	1	1	1
6	(150)	1	1	1	2	2
8	(200)	1	2	2	3	4
10	(250)	2	3	3	4	5
12	(300)	3	4	4	6	7
16	(400)	4	6	7	10	13

*Based on 3.25-g available chlorine per tablet; any portion of tablet rounded to next higher integer.

velocity no greater than 1 ft/s (0.3 m/s). Precautions shall be taken to ensure that air pockets are eliminated. This water shall remain in the pipe for at least 24 h. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 h. As an optional procedure (if specified by the purchaser), water used to fill the new main shall be supplied through a temporary connection that shall include an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system (see Figure 1).

Sec. 5.2 Continuous-Feed Method

The continuous-feed method consists of placing calcium hypochlorite granules in the main during construction (optional), completely filling the main to remove all air pockets, flushing the completed main to remove particulates, and filling the main with potable water. The potable water shall be chlorinated so that after a 24-h holding period in the main there will be a free chlorine residual of not less than 10 mg/L.

5.2.1 *Placing of calcium hypochlorite granules.* At the option of the purchaser, calcium hypochlorite granules shall be placed in pipe sections as specified in Sec. 5.1.1. The purpose of this procedure is to provide a strong chlorine concentration in the first flow of flushing water that flows down the main. In particular, this procedure is recommended when the type of pipe is such that this first flow of water will flow into annular spaces at pipe joints.

5.2.2 *Preliminary flushing.* Before being chlorinated, the main shall be filled to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall not be less than 2.5 ft/s (0.76 m/s) unless the purchaser (or purchaser's representative) determines that conditions do not permit the required flow to be discharged to waste. Table 3 shows the rates of flow required to produce a velocity of 2.5 ft/s (0.76 m/s) in commonly used sizes of pipe. Note that flushing is no substitute for preventive measures during construction. Certain contaminants, such as caked deposits, resist flushing at any feasible velocity.

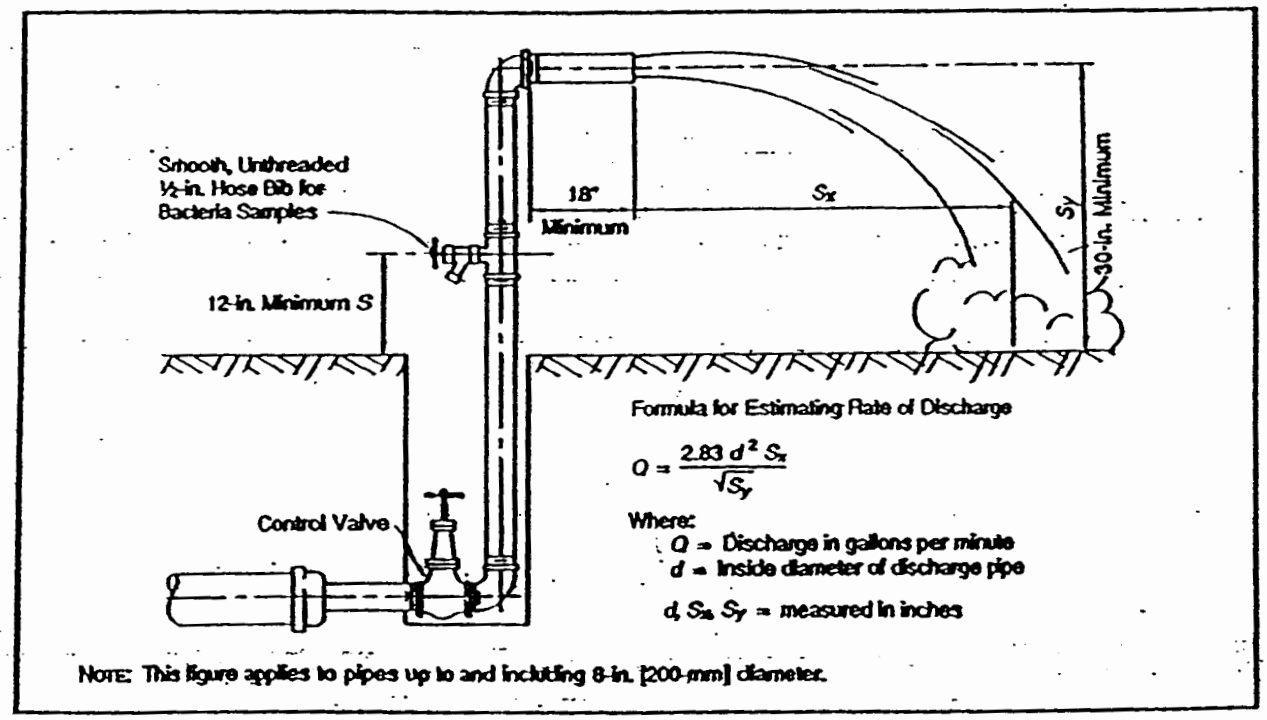
For 24-in. (600-mm) or larger diameter mains, an acceptable alternative to flushing is to broom-sweep the main, carefully removing all sweepings prior to chlorinating the main.

Table 3 Required flow and openings to flush pipelines (40 psi [276 kPa] residual pressure in water main)*

Pipe Diameter in.	(mm)	Flow Required to Produce 2.5 ft/s (approx.) Velocity in Main gpm	(L/s)	Size of Tap, in. (mm) 1 (25)	1½ (38)	2 (51 mm)	Number of 2½-in. (64-mm) Hydrant Outlets
				Number of Taps on Pipe†			
4	(100)	100	(6.3)	1	—	—	1
6	(150)	200	(12.6)	—	1	—	1
8	(200)	400	(25.2)	—	2	1	1
10	(250)	600	(37.9)	—	3	2	1
12	(300)	900	(56.8)	—	—	2	2
16	(400)	1600	(100.9)	—	—	4	2

*With a 40-psi (276-kPa) pressure in the main and the hydrant flowing to atmosphere, a 2½-in. (64-mm) hydrant outlet will discharge approximately 1000 gpm (63.1 L/s); and a 4½-in. (114-mm) hydrant outlet will discharge approximately 2500 gpm (160 L/s).

†Number of taps on pipe based on discharge through 5 ft (1.5 m) of galvanized iron (GI) pipe with one 90° elbow.



NOTE: This figure applies to pipes up to and including 8-in. [200-mm] diameter.

Figure 2 Suggested combination blowoff and sampling tap

5.2.3 *Procedure for chlorinating the main.*

1. Water supplied from a temporary, backflow-protected connection to the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly installed water main. In the absence of a meter, the rate may be approximated by methods such as placing a

pressures that may be created by the pumps. All connections shall be checked for tightness before the solution is applied to the main.

Sec. 5.3 Slug Method

The slug method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main to eliminate all air pockets, flushing the main to remove particulates, and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/L. The slow rate of flow ensures that all parts of the main and its appurtenances will be exposed to the highly chlorinated water for a period of not less than 3 h.

5.3.1 *Placing calcium hypochlorite granules.* Same as Sec. 5.2.1.

5.3.2 *Preliminary flushing.* Same as Sec. 5.2.2.

5.3.3 *Chlorinating the main.*

1. Same as Sec. 5.2.3(1).

2. At a point not more than 10 ft (3 m) downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 100 mg/L free chlorine. To ensure that this concentration is achieved, the chlorine concentration should be measured at regular intervals. The chlorine shall be applied continuously and for a sufficient period to develop a solid column, or "slug," of chlorinated water that will, as it moves through the main, expose all interior surfaces to a concentration of approximately 100 mg/L for at least 3 h.

3. The free chlorine residual shall be measured in the slug as it moves through the main. If at any time it drops below 50 mg/L, the flow shall be stopped, chlorination equipment shall be relocated at the head of the slug, and, as flow is resumed, chlorine shall be applied to restore the free chlorine in the slug to not less than 100 mg/L.

4. As the chlorinated water flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

SECTION 6: FINAL FLUSHING

Sec. 6.1 Clearing the Main of Heavily Chlorinated Water

After the applicable retention period, heavily chlorinated water should not remain in prolonged contact with pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use.

Sec. 6.2 Disposing of Heavily Chlorinated Water

The environment into which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment, then a neutralizing chemical shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water. (See appendix B for neutralizing chemicals.) Where necessary, federal, state, provincial, and local regulatory agencies should be contacted to determine special provisions for the disposal of heavily chlorinated water.

Table 4 Chlorine required to produce 25-mg/L concentration in 100 ft (30.5 m) of pipe—by diameter

Pipe Diameter		100 percent Chlorine		1 percent Chlorine Solution	
in.	*(mm)*	*lb*	*(g)*	*gal*	*(L)*
4	(100)	.013	(5.9)	.16	(0.6)
6	(150)	.030	(13.6)	.36	(1.4)
8	(200)	.054	(24.5)	.65	(2.5)
10	(250)	.085	(38.6)	1.02	(3.9)
12	(300)	.120	(54.4)	1.44	(5.4)
16	(400)	.217	(98.4)	2.60	(9.8)

Pitot gauge in the discharge, measuring the time to fill a container of known volume, or measuring the trajectory of the discharge and using the formula shown in Figure 2.

2. At a point not more than 10 ft (3 m) downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/L free chlorine. To ensure that this concentration is provided, measure the chlorine concentration at regular intervals in accordance with the procedures described in the current edition of *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12, or using appropriate chlorine test kits (see appendix A).

Table 4 gives the amount of chlorine required for each 100 ft (30.5 m) of pipe of various diameters. Solutions of 1 percent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires 1 lb (454 g) of calcium hypochlorite in 8 gal (30.3 L) of water.

3. As an optional procedure (if specified by the purchaser), water used to fill the new main during the application of chlorine shall be supplied through a temporary connection. This temporary connection shall be installed with an appropriate cross-connection control device, consistent with the degree of hazard, for backflow protection of the active distribution system (see Figure 1). Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 h, during which time all valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24-h period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L free chlorine.

4. Direct-feed chlorinators, which operate solely from gas pressure in the chlorine cylinder, shall not be used for the application of liquid chlorine. (The danger of using direct-feed chlorinators is that water pressure in the main can exceed gas pressure in the chlorine cylinder. This allows a backflow of water into the cylinder, resulting in severe cylinder corrosion and escape of chlorine gas.) The preferred equipment for applying liquid chlorine is a solution-feed, vacuum-operated chlorinator and a booster pump. The vacuum-operated chlorinator mixes the chlorine gas in solution water; the booster pump injects the chlorine-gas solution into the main to be disinfected. Hypochlorite solutions may be applied to the water main with a gasoline or electrically powered chemical-feed pump designed for feeding chlorine solutions. Feed lines shall be of such material and strength as to safely withstand the corrosion caused by the concentrated chlorine solutions and the maximum

SECTION 7: BACTERIOLOGICAL TESTS

Sec. 7.1 Standard Conditions

After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 h apart, shall be collected from the new main. At least one set of samples shall be collected from every 1200 ft (366 m) of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with *Standard Methods for the Examination of Water and Wastewater*, and shall show the absence of coliform organisms. A standard heterotrophic plate count may be required at the option of the purchaser (or purchaser's representative).

Sec. 7.2 Special Conditions

If trench water has entered the new main during construction or, if in the opinion of the purchaser (or purchaser's representative), excessive quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft (61 m) and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 h after final flushing has been completed.

Sec. 7.3 Sampling Procedure

Samples for bacteriological analysis shall be collected in sterile bottles treated with sodium thiosulfate as required by *Standard Methods for the Examination of Water and Wastewater*. No hose or fire hydrant shall be used in the collection of samples. A suggested combination blowoff and sampling tap useful for mains up to and including 8-in. (200-mm) diameter is shown in Figure 2. A corporation cock may be installed in the main with a copper-tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

SECTION 8: REDISINFECTION

If the initial disinfection fails to produce satisfactory bacteriological results, the new main may be reflushed and shall be resampled. If check samples also fail to produce acceptable results, the main shall be rechlorinated by the continuous-feed or slug method of chlorination until satisfactory results are obtained.

NOTE: High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to sample water entering the new main.

SECTION 9: FINAL CONNECTIONS TO EXISTING MAINS (OPTIONAL)*

As an optional procedure (if specified by the purchaser), water mains and appurtenances must be completely installed, flushed, disinfected, and satisfactory

*Optional Sec. 9 is not included as part of the standard unless specifically identified in the purchaser's specifications.

bacteriological sample results received prior to permanent connections being made to the active distribution system. Sanitary construction practices must be followed during installation of the final connection, so that there is no contamination of the new or existing water main with foreign material or groundwater.

Sec. 9.1 Connections Equal To or Less Than One Pipe Length (≤ 18 ft [5.5 m])

As an optional procedure (if specified by the purchaser), the new pipe, fittings, and valve(s) required for the connection may be spray-disinfected or swabbed with a minimum 1 percent solution of chlorine just prior to being installed, if the total length of connection from the end of a new main to the existing main is equal to or less than 18 ft (5.5 m).

Sec. 9.2 Connections Greater Than One Pipe Length (>18 ft [5.5 m])

As an optional procedure (if specified by the purchaser), the pipe required for the connection must be set up aboveground, disinfected, and bacteriological samples taken, as described in Sec. 5 through Sec. 8, if the total length of connection from the end of a new main to the existing main is greater than 18 ft (5.5 m). After satisfactory bacteriological sample results have been received for this "pre-disinfected" pipe, the pipe can be used in connecting the new main to the active distribution system. Between the time that satisfactory bacteriological sample results are received and the time that the connection piping is installed, the ends of this piping must be sealed with plastic wraps or watertight plugs or caps.

SECTION 10: DISINFECTION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING MAINS

The following procedures apply primarily when existing mains are wholly or partially dewatered. After the appropriate procedures have been completed, the existing main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water present little danger of contamination and require no disinfection.

Sec. 10.1 Trench Treatment

When an existing main is opened, either by accident or by design, the excavation will likely be wet and may be badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

Sec. 10.2 Swabbing With Hypochlorite Solution

The interior of all pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1 percent hypochlorite solution before they are installed.

Sec. 10.3 Flushing

Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward

the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

Sec. 10.4 Slug Chlorination

When practical, in addition to the procedures above, the section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated as described in Sec. 5.3, except that the dose may be increased to as much as 300 mg/L and the contact time reduced to as little as 15 min. After chlorination, flushing shall be resumed and continued until discolored water is eliminated, and the water is free of noticeable chlorine odor.

Sec. 10.5 Sampling

Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If positive bacteriological samples are recorded, then the situation shall be evaluated by the purchaser (or purchaser's representative) who can determine corrective action, and daily sampling shall be continued until two consecutive negative samples are recorded.

SECTION 11: SPECIAL PROCEDURE FOR CAULKED TAPPING SLEEVES

Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be lightly dusted with calcium hypochlorite powder.

Tapping sleeves are used to avoid shutting down the main to be tapped. After the tap is made, it is impossible to disinfect the annulus without shutting down the main and removing the sleeve. The space between the tapping sleeve and the tapped pipe is normally ½ in. (13 mm), more or less, so that as little as 100 mg/ft^2 of calcium hypochlorite powder will provide a chlorine concentration of over 50 mg/L.

APPENDIX A
Chlorine Residual Testing

This appendix is for information only and is not a part of AWWA C651.

SECTION A.1: DPD DROP DILUTION METHOD (FOR FIELD TEST)

The DPD drop dilution method of approximating total residual chlorine is suitable for concentrations above 10 mg/L, such as are applied in the disinfection of water mains or tanks.

Sec. A.1.1 Apparatus

1. A graduated cylinder for measuring distilled water.
2. An automatic or safety pipette.
3. Two dropping pipettes that deliver a 1-mL sample in 20 drops. One pipette is for dispensing the water sample, and the other is for dispensing the DPD and buffer solutions. The pipettes should not be interchanged.
4. A comparator kit containing a suitable range of standards.

Sec. A.1.2 Reagents

1. DPD indicator solution. Prepare as prescribed in *Standard Methods for the Examination of Water and Wastewater* (18th ed.), Section 4500-Cl G, p. 4-62.

Sec. A.1.3 Procedure

1. Add 10 drops of DPD solution and 10 drops of buffer solution (or 20 drops of combined DPD–buffer solution) to a comparator cell.
2. Fill the comparator cell to the 10-mL mark with distilled water.
3. With a dropping pipette, add the water sample one drop at a time, allowing mixing, until a red color is formed that matches one of the color standards.
4. Record the total number of drops used and the final chlorine reading obtained (that is, the chlorine reading of the matched standard).
5. Calculate the milligrams per litre of free residual chlorine as follows:

$$\text{mg/L chlorine} = \frac{\text{reading} \times 200}{\text{drops of sample}}$$

SECTION A.2: HIGH-RANGE CHLORINE TEST KITS

Several manufacturers produce high-range chlorine test kits that are inexpensive, easy to use, and satisfactory for the precision required.

APPENDIX B

Disposal of Heavily Chlorinated Water

This appendix is for information only and is not a part of AWWA C651.

1. Check with the local sewer department for conditions of disposal to sanitary sewer.

2. Chlorine residual of water being disposed will be neutralized by treating with one of the chemicals listed in Table B.1.

Table B.1 Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gal (378.5 m^3) of water

Residual Chlorine Concentration mg/L	Chemical Required: Sulfur Dioxide (SO_2) lb	(kg)	Sodium Bisulfite ($NaHSO_3$) lb	(kg)	Sodium Sulfite (Na_2SO_3) lb	(kg)	Sodium Thiosulfate ($Na_2S_2O_3 \cdot 5H_2O$) lb	(kg)
1	0.8	(.36)	1.2	(.54)	1.4	(.64)	1.2	(.54)
2	1.7	(.77)	2.5	(1.13)	2.9	(1.32)	2.4	(1.09)
10	8.3	(3.76)	12.5	(5.67)	14.6	(6.62)	12.0	(5.44)
50	41.7	(18.91)	62.6	(28.39)	73.0	(33.11)	60.0	(27.22)

MWD

Mountain Water District

WATER DISTRIBUTION LINES
TECHNICAL SPECIFICATIONS

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WATER DISTRIBUTION LINES

TECHNICAL SPECIFICATIONS

SECTION I

GENERAL REQUIREMENTS

1.1 Statement of Work

The requirements herein are intended to apply to those items of labor, tools, materials and equipment necessary for the construction of the water distribution lines and appurtenances as shown on the plans and described in the specifications. These requirements will apply to both new and replacement projects.

1.2 Preconstruction Conference

Prior to the start of any construction, the Contractor (and Developer if the project is in a subdivision and the work is being done for the DEVELOPER to be turned over to the District at completion of construction) shall attend a conference at the project site with the District Inspector and the Design Engineer. At this meeting, a general construction schedule will be developed so that the District inspection and testing services can be planned. The CONTRACTOR'S Job Foreman will be designated at this meeting, and communication at the job site between the District representative and the CONTRACTOR shall be through this individual.

1.3 Inspection

All construction work for the Utility or work done for or by a DEVELOPER that will connect to the District water system shall be subject to inspection and approval by the District Inspector. No water line shall be installed and covered without approval of the District Inspector. Sufficient notice (Preferably 3 District working days) shall be given prior to the requirement for inspection by the District Inspector. The District Inspector shall also make periodic inspections throughout the project.

1.4 Plans, Construction Staking and Cut-Sheets

The CONTRACTOR shall have on the job site at all times at least one individual who is competent to read and understand the plans.

1.5 Safety

The CONTRACTOR will provide adequate protection to safeguard and protect the public and workmen when working on public right-of-ways and property.

The CONTRACTOR shall be subject to inspection by the designated Safety Inspector, and will be required to abide by the Safety Inspector's recommendations and will be subject to work stoppage if compliance is not made.

1.6 Caution in Excavation

The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined. The location of existing underground structures should be determined by the CONTRACTOR enough in advance of the pipe-laying to provide for a change of design alignment by the Design Engineer, if required. Any loss or damage to the site or to the underground or surface utility within the site are due to construction activities shall be borne by the CONTRACTOR.

1.7 Approved Plans

No work shall commence on any water system until the CONTRACTOR has in this possession a complete set of approved plans prepared by a professional Engineer, registered in Kentucky, whose signed seal shall appear on each plan sheet. Each set of plans shall also be approved and signed by the Superintendent of the Mountain Water District. Any significant change from the original approved plans shall require an additional approval from the Superintendent. Verbal approval from the District Inspector shall decide whether a change is a minor change or a significant change.

1.8 Separation of Water Lines and Sanitary Sewers

1.8.1 General

The following factors shall be considered in providing adequate separation:

a. Materials and types of joints for water and sewer pipes,

b. Soil conditions,

c. Service branch connections into the water line and sewer lines,

d. Compensating variations in the horizontal and vertical separations.

e. Space for repairs and alterations of water and sewer pipe,

f. Offsetting of pipes around manholes.

1.8.2 Parallel Installation

a. Normal Conditions - Water lines shall be laid at least ten feet horizontally from a sewer or sewer manhole whenever possible, the distance shall be measured edge-to-edge.

b. Unusual Conditions - When local conditions prevent a horizontal separation of ten feet, the water line may be laid closer to a sewer or sewer manhole provided that:

1. The bottom of the water line is at least 18 inches above the top of the sewer.

2. Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved ductile iron water pipe, pressure-tested in place to 50 psi without leakage prior to backfilling.

3. The sewer manhole shall be of watertight construction tested in place.

1.8.3 Crossing

a. Normal Conditions - Water lines crossing sewers shall be laid to provide a separation of at least 18 inches between the bottom of water line and the top of the sewer whenever possible.

b. Unusual Conditions - When local conditions prevent a vertical separation described in 1.8.3a, the following construction shall be used:

1. Sewers passing over or under water lines shall be constructed of the materials described in 1.8.2.b2.

2. Water lines passing under sewers shall, in addition, be protected by providing:

a. A vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line.

b. Adequate structural support for the sewers to prevent excessive deflection of the joints and settling on and breaking water line.

c. That a joint of the water line be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

1.8.4 Sanitary Sewers or Sewer Manholes

No water pipes shall pass through or come in contact with any part of a sewer or sewer manhole.

1.8.5 Surface Water Crossing

Surface water crossings, both over and under water, shall be discussed with the Design Engineer before final plans are prepared.

1.8.5.1 Above Water Crossing

There shall be no above-water crossings allowed.

1.8.5.2 Under Water Crossing

a. The pipe shall be of a special construction, having flexible watertight joints.

b. Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair; the valves shall be easily accessible and not subject to flooding.

c. All water pipe and flexible watertight joints lying below the water table shall be concrete encased.

d. Permanent taps shall be made for testing and locating leaks. For stream crossings, a standard meter box, cover and copper setter shall be installed on the stream side nearest the source of supply.

1.9 Bored and Cased Crossings

When casing pipe is required for highways, railroad or other crossings, the project shall be completed in accordance with all applicable federal, state, and local regulations. In the case of railroad crossings, the project shall comply further with regulations established by the specific railroad company. In general, boring will be permitted for casing diameters through 36 inches with maximum length of about 175 feet, jacking for diameters 30 inches through 60 inches with lengths of about 200 feet; and tunneling for pipes 48 inches and larger for longer lengths. Spacers shall be used, as shown on drawing MW-11, and rubber boots to seal each end of casings.

1.10 Plans Required on the Job Site

The CONTRACTOR shall keep at the job site at all times two sets of approved plans and one set of project specifications shall be required.

1.11 Exceptions

Exceptions may be made to these specifications in cases where engineering data is presented to the District by a registered Engineer which show the suitability of some alternate method or material. Such a request for approval of an exception shall be made in writing, properly documented, to the District. The responsibility and authority for granting an exception to these specifications shall rest with the District.

1.12 Future Location of Water Mains

In order that PVC water mains may be located in the future and that all mains be protected from excavating equipment damaging the line, a metallic tape and locator wire shall be laid on top of the first lift being 12 inches over the crown of the pipe. The tape shall be continuous for the entire length of the pipe laid including all branches and junctions. This tape shall have a printed warning indicating the utility located beneath it. In addition to warning tape, there shall be installed a 14 gage locator wire continuous throughout the project. The wire shall be pulled in all valve boxes and hydrant areas.

1.13 Maintenance Period

After acceptance of the constructed water facilities and a complete set of as-built plans have been received by the District, the water facilities may be placed into service. The contractor shall be

responsible for the maintenance of the facilities for a period of not less than twelve (12) months. This period shall commence after formal acceptance of the water facilities by the District. The contractor shall repair any and all defects as determined by the District in the facilities that occur during the prescribed period prior to final acceptance of the new facilities into the District water system and maintenance responsibilities by the District. If such repairs are made the warranty shall extend to a period of one (1) year from the date of repair on said area.

The District may, at its option, make repairs during the warranty period of an emergency exists, i.e., loss of service to customers, or, if in the opinion of the Superintendent of Operations Manager, contractor could not begin repairs within 2 (two) hours. Contractor will reimburse the District for all costs associated with said repairs and overhead and administrative costs.

TECHNICAL SPECIFICATIONS

SECTION II

EXCAVATION, INSTALLATION AND BACKFILLING

2.1 Classification

Excavation shall be unclassified regardless of material encountered.

2.2 Clearing

Only that portion of the right-of-way easement actually needed for construction shall be cleared, unless directed otherwise by the INSPECTOR. In no case shall clearing of debris from clearing operations be taken past right-of-way easement lines into private property. Areas disturbed by construction operations shall be protected from erosion by suitable methods outlined by the Utility.

2.3 Excavation and Preparation of Trench

2.3.1 Cover

Pipe shall have a minimum cover of 36", unless otherwise shown on the plans and approved.

2.3.2 Bedding

Generally bedding will be Type 1 as depicted on Detail Sheet MW-5 for All Water Mains. Alternate types of bedding may be required due to special soil or load conditions and shall be specified by the Design Engineer or District.

2.3.3 Width

Width shall be sufficient to allow laying without walking or standing on the pipe and shall not be less than 6" on each side of the pipes largest diameter.

2.3.4 Bell Holes

Bell holes shall be excavated to accommodate each bell.

2.3.5 Rock Excavation

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 6" below and on each side of all pipe valves and fittings. Before the pipe is laid, the subgrade shall be made by backfilling with approved material and shall be tamped and graded as specified in Section 2.3. No blasting shall be permitted.

2.3.6 Excavation to Grade

The trench shall be excavated so as to provide a uniform and continuous bearing and support for the pipe on solid and undisturbed ground at every point between bell holes, except that it will be permissible to disturb and otherwise damage the finished surface over a maximum length of 18 inches near the middle of each length of pipe by the withdrawal of pipe slings or other lifting tackle. Any specified grade shall be corrected with approved material, thoroughly compacted as directed by the INSPECTOR. The finished subgrade shall be prepared accurately by means of hand tools.

The subgrade beneath the centerline of the pipe shall be finished to within 0.03 feet of a straight line between pipe joints or batter boards, and all tolerances shall be above the specified grade.

2.3.7 Unsuitable Material

Wet or otherwise unsuitable soil at the subgrade shall be removed and replaced with approved sound materials. Excess or unsuitable material shall be disposed of by the CONTRACTOR.

2.3.8 Topsoil Storage

Topsoil to be used in backfilling shall be stockpiles separately from other backfill materials.

2.3.9 Trench Protection

The CONTRACTOR shall furnish and erect such sheathing, bracing and shoring, and shall furnish necessary signs, barricades and temporary lighting as may be pertinent for the protection of his work, employees, the public, adjacent structures and to guard against contingencies which might give rise to delays in the work. Sheathing left in place shall be at the CONTRACTOR'S expense. Responsibility for preservation of trench banks and other excavated spaces and the prevention of injury to any persons or property shall rest entirely with the CONTRACTOR.

2.3.10 Pumping, Bailing & Drainage

The CONTRACTOR shall remove by pumping, bailing, or other appropriate means any damaging water which may accumulate or be found in the trenches or other excavations and shall form dams, flumes or effect other means to keep the excavations clear of water while work is in progress.

2.3.11 Blasting

No Blasting shall be permitted.

2.3.12 Excavation in Pavement

When pavement must be cut, the cut shall be made in a straight line, parallel to the pipe and 6 inches wider than the trench, on each side, so that an undisturbed shoulder will be provided under the new work. Sidewalks or curb and gutter disturbed by construction shall be removed and replaced at existing joints. Cutting shall be done neatly so that a uniform, straight joint will result to provide a bond with the original concrete or pavement.

Where trenches cross streets, not more than one-half of the street width shall be disturbed at one time, and the first trench opening shall be restored to satisfactory travelable condition before the second half is excavated. Placement of excavated material on existing pavement shall be avoided wherever possible, and when so placed, the pavement shall be satisfactorily cleaned by an approved method. No cleated equipment shall be used on pavements. Street drainage shall not be clogged and shoulders and ditches affected by trenching operations shall be maintained in satisfactory condition. Entrances shall not be blocked except for short periods, and ingress and egress to adjacent property shall be maintained at all times.

Traffic shall not be blocked or re-routed without permission from the Kentucky Department of Transportation, County, or other governing agencies.

Detail Sheet MW-10 exhibits acceptable method of pavement replacing methods.

2.4 Installation of Pipe, Fittings and Accessories

2.4.1 Placement

Pipe shall be placed in the trench in such a manner as to prevent damage to pipe end protective coatings and linings. Under no circumstances shall pipe be dropped or dumped into the trench.

2.4.2 Cleaning

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in line. Spigot and bell ends of pipe and gaskets shall be cleaned and lubricated according to the manufacturer's instructions. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug.

2.4.3 Direction of Laying

Pipe shall be laid with bell ends facing in the direction of laying, unless directed otherwise by the DESIGN ENGINEER. Where pipe is laid on grade of 10 percent or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe upgrade.

2.4.4 Deflection at Joints

Maximum deflection for mechanical joints and push-on joints shall be as follows:

	Mechanical Joint Allowable Deflection in Inches		Push-On Allowable Deflection in Inches	
Pipe Size	Lengths 18'	20'	Lengths 18'	20'
4"	31	35	19	21
6"	27	30	19	21
8"	20	22	19	21
10"	20	22	19	21
12"	20	22	19	21

2.4.5 Setting of Valves, Hydrants, and Fittings

A valve box and marker 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 cover flush with the surface of the finished pavement or such other level as may be directed. Hydrants shall be set so that the center of the outlet is 16 to 18 inches above finished grade when connected to the main and shall be tied to main or anchored to control thrust. Provide at least 3 C.F. of crushed stone or gravel under base to allow drainage from the hydrant drain valve. Fire hydrants shall not be set where seasonal groundwater table or surface flooding, as determined by the District, will prevent drainage from the hydrant barrel. Valve boxes and fire hydrants shall be installed in accordance with Standard Detail Sheets MW-1 and MW-3..

2.4.6 Anchorage

Pressure pipe lines shall be protected against joint pulling or thrust damage by suitable anchors, braces, or tie rods installed at direction changes effected by fittings and all other critical points(i.e., in-line valves, etc.). Thrust blocks shall be of the size indicated on the drawings and shall bear on solid undisturbed earth.

2.4.7 Testing

CONTRACTOR shall make all preparation, furnish all equipment, and shall supply the labor for all tests. Pressure and leakage tests shall be in accordance with AWWA C.600, Section 4.1 and 4.2. Test pressure shall be a minimum of 150 psi or 50 psi above the standard operating pressure or 67% of the pipe rating whichever is greater. In addition, the hydrostatic test boundaries shall be each valved section of the waterline and each valve shall be as a minimum subjected to test pressure on one side. Allowable leakage shall not be greater than that determined by the following formula:

1 gallon per inch of pipe diameter per mile per 24 hours

in which L is the allowable leakage, in gallons per hour; S is the length of pipe tested, in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure during the leakage test in pounds per square inch gauge.

The pressure test shall be performed first, and shall be for a period of at least 24 hours with pressure and metering charts provided to the District. The valved section of pipe under consideration shall be slowly filled with water and brought to the specified pressure by means of a pump. Before applying the specified test pressure, all air shall be expelled from the pipe.

The leakage test shall be conducted after the pressure test has been satisfactorily completed. The duration of each leakage test shall be twenty-four hours. The allowable leakage shall be as shown in the following table:

Allowable Leakage per 1000 ft. of Pipeline*—gph

Avg. Test Pressure	Nominal Pipe Diameter-In.													
psi	3	3	4	6	8	10	12	14	16	18	20	24	30	36
450	0.32	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73
400	0.30	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41
350	0.28	0.42	0.56	0.84	1.12	1.40	1.69	11.97	2.25	2.53	2.81	3.37	4.21	5.06
300	0.26	0.39	0.51	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68
275	0.25	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48
250	0.24	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27
225	0.23	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05
200	0.21	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82
175	0.20	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58
150	0.19	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31
125	0.17	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.55	1.68	2.01	2.52	3.02
100	0.15	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70

**For pipe with 18 ft. nominal lengths. To obtain the recommended allowable leakage for pipe with 20 ft. nominal lengths, multiply the leakage calculated from the table by 0.9. If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.*

The District's Inspector shall observe all tests. If the pipe fails to meet test requirements, all leaks shall be repaired and defective pipe repaired or replaced by the CONTRACTOR. The test shall be repeated until satisfactory results are obtained.

The CONTRACTOR shall meter all flushing water and report quantity to the

INSPECTOR.

2.4.8 Disinfecting Water Mains

Water mains and accessories shall be disinfected in accordance with AWWA C.651. The CONTRACTOR shall have on site a set of the most recent AWWA Standards. Care shall be taken to minimize entrance of foreign material into pipe, fittings and valves. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug. The main shall be flushed prior to disinfection with sufficient flow to produce a velocity of 2.4 fps. No site for flushing shall be chosen unless it has been determined that drainage is adequate at the site.

2.4.8.1 Methods of Chlorine Application

a. Continuous Feed Method - Potable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the pipe line at least 24 hours, after which, the chlorine concentration in the water shall be at least 25 mg/l. All valves and appurtenances shall be operated while the chlorinated water remains in the pipe line. Other methods must be approved by the District.

b. Slug Method if approved by the District - Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage which will result in a chlorine concentration of 100 mg/l in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/l chlorine solution for at least 3 hours. The chlorine residual shall be checked at regular intervals not to exceed 2000 feet to insure that adequate residual is maintained. As the chlorinated water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances.

c. Tablet Method if approved by the District - This method shall not be used if nonpotable water or foreign materials have entered the lines or if the water temperature is below 5°C (41°F).

The tablets shall be placed in each section and in all appurtenances. Enough tablets shall be used to insure that a chlorine concentration of 25 mg/l is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be Permatex No. 1 or an alternative approved by the District. The velocity of the potable water in the pipe line shall be less than 1 ft/sec. The water shall then remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the pipe

line. The CONTRACTOR may then proceed with adequate testing and flushing to make the line usable.

2.4.8.2 Final Flushing

Sites for flushing shall be chosen that are determined to have adequate drainage. In addition, special precautions shall be taken to prevent damage to aquatic life in receiving waters, from the heavily chlorinated waters. Flushing sites should be located as far from receiving waters as possible. Federal, state, and local regulations regarding toxic wastes must be followed. If necessary, dechlorination of the flushing water should be provided prior to discharge.

2.4.9 Bacteriological Testing

After final flushing and before the water main is placed in service, a minimum of two consecutive samples shall be collected at 24 hour intervals, for each section of pipe not exceeding 2000 feet throughout the length of pipe line. The samples shall be tested, by a laboratory chosen by the District, for bacteriologic quality and shall show the absence of coliform organisms.

2.5 – Backfilling

2.5.1 Material

All backfill material shall be free from mud, refuse, construction debris, organic material, boulders, rock over 4 inches, frozen or otherwise unsuitable material. From one foot above the top of the pipe to the original ground elevation, however, material containing stones up to 8 inches in their greatest dimension may be used, unless otherwise specified. The CONTRACTOR may backfill with the excavated material provided it meets the conditions as stated above.

2.5.2 Initial Backfill

All trenches shall be backfilled by hand with approved material in layers not exceeding 3 inches, from the bottom of the trench to the center line of the pipe. Material shall be deposited on both sides of the pipe simultaneously and compacted into place by tamping. From the center line of the pipe to a depth of 1 foot above the pipe the trench shall be backfilled by hand or by approved mechanical methods but in either case thoroughly tamped. In no case shall any particle size be larger than 3/4" in diameter in initial backfill.

2.5.3 Backfilling to Grade

The remainder of backfilling shall be carried up evenly on both sides of the trench in increments of twelve inches. Each layer of earth shall be compacted into place by tamping, before the next layer is applied. Damage to pipe lines or other structures resulting from compaction shall be corrected by the CONTRACTOR.

2.5.4 Finished Surfaces

Uniformly smooth grading of disturbed areas shall be required after backfill and compaction. Finished surfaces shall not be more than 0.10 feet above or below the original garde or cross section. Ditches and gutters shall be finished to drain readily. In grass or lawn areas, the last four inches of compacted fill will consist of topsoil or an approved soil which will support a turf growth after fertilizing and seeding. Settlement or other damage that occurs prior to acceptance of this work shall be repaired and grades satisfactorily re-established.

2.5.5 Seeding

All lawn and grass areas disturbed shall be fertilized with a 5-10-5 fertilizer at the rate of 35 pounds per 1000 square feet worked in by harrow or rake at least 48 hours prior to seeding. All seed shall comply with applicable State and Federal seed laws. The seed mixture shall be a combination of rapid germinating annual grasses and perennial grasses and shall be applied at the rate of 6 pounds per 1000 square feet. Adequate rolling shall follow to compact the seeded areas.

2.5.6 Backfill Under Pavement

Backfilling of trenches under existing or proposed pavement shall be in layers of not more than 12 inches in thickness, and each layer shall be compacted to a minimum of 95 percent density as compared to density of the same material when tested in accordance with AASHO Specification T-99. Compaction shall be by pneumatic tampers of other approved methods. Compaction by water will not be permitted under pavement. All material under the pavement shall consist of aggregate base material meeting the requirements of Kentucky Department of Highways, Standard Specifications for Road and Bridge Construction, latest edition. This material shall be thoroughly and uniformly tamped with pneumatic tampers or other approved methods. Moisture content shall be within 20 percent of optimum. All moisture-density tests required by Mountain Water District shall be performed by Laboratories approved by the District and the CONTRACTOR shall bear the costs of all testing. The CONTRACTOR will be responsible for and shall repair any settlement in the backfill or pavement for a period of one year after completion of the work.

2.5.7 Replacement of Pavement and Structures

The CONTRACTOR shall restore all pavement, sidewalks, curbing, gutters, shrubbery, fences, poles, or other property and surface removed or disturbed as a part of the work to a condition equal to or better than before the work began.

2.5.8 Clean Up

All surplus materials, tools, temporary structures, dirt, rubbish, rock and excess earth from the excavation shall be removed at the completion of construction and the site left in a clean condition.

2.5.9 Sediment Control

The CONTRACTOR will be responsible for control of siltation and erosion from the Project within the Project limits. Control shall include all necessary measures to minimize the deposition of materials in downstream areas.

TECHNICAL SPECIFICATIONS

SECTION III

MATERIAL

3.1 Pipe

Water mains and lateral pipe shall be one of the following materials, at the CONTRACTOR'S option, except where otherwise indicated. The CONTRACTOR shall indicate at the time of bidding the type of pipe to be installed.

3.1.1 Ductile Iron Pipe

Of Grade 60-42-10, centrifugally cast in accordance with ANSI/AWWA C151/A21.51-91 shall be used. Pipe class shall be as indicated on the drawings, and minimum wall thickness shall be according to ANSI/AWWA C150/A21.50-91. Pipe shall be in nominal 16', 18' or 20' lengths.

3.1.2 PVC Pipe

Polyvinyl Chloride Pipe, Fittings and Joints: PVC water pipe shall conform, at a minimum, to ASTM Specifications D-2241, and shall be pressure class 250. The pipe furnished under ASTM A-2441 shall have a standard dimension ratio of SDR 17 or lower, and shall be rated to a working pressure of at least 250 psi at 73.4°F. In no case shall PVC pipe be utilized in a situation that will subject the pipe to greater than 50% of the rated working pressure of the pipe. In such cases, ductile iron **shall** be utilized.

3.2 Joints and Joining

3.2.1 Ductile Iron Pipe

Joints shall be mechanical or slip-on as "Bell-Tite", "Tyton", "Grip-Tite", or approved equal, unless otherwise indicated. Joint assembly shall be installed according to the manufacturer's directions and shall comply with ANSI/AWWA C111/A21.11-90.

3.2.2 PVC Joints

Joints shall be of the push-on type conforming to ASTM D3139 and F477

requirements for elastometric-gasket joints. All jointing material and lubricants shall be non-toxic.

3.2.3 Restrained Joints

Provided that a schedule is submitted to the ENGINEER for approval, showing the location and length of pipe run where proposed for use, the CONTRACTOR shall have the option of using US Pipe "Field-Loc", Meglug 1400 or approved equal joint. Assembly, including allowed deflection, shall be strictly as recommended by the manufacturer. Concrete anchorage shown on the drawings will not be required where such joints are approved for use.

3.3 Fittings

3.3.1 Ductile Iron Fittings

Fittings of Grade 70-50-05 per ASTM A536, shall be of the same type and pressure class as the pipe, except that cast iron fittings of the same general pressure class may be used. Ductile-Iron fittings shall comply with ANSI/AWWA C110/A21.10-93.

3.3.2 PVC Fittings

Fittings shall be ductile iron Mechanical Joint Class 250 conforming to AWWA Specifications C110 for short body ductile iron fittings. Fittings shall be tar-coated outside, and shall receive the standard cement lining with bituminous seal coat on the inside as specified for the ductile iron pipe.

3.4 Protective Coating

Ductile iron pipe and fittings shall be cement lined in accordance with ANSI/AWWA C104/A21.4-90 except that the lining shall be half thickness, commonly referred to as "enameling", allowed by an interior coat of coal tar enamel. Underground pipe, fittings and accessories, and piping in casings shall have an exterior coat of coal tar enamel.

3.5 Service Connections

used. Only one service will be permitted per line.

3.5.2 Corporation Stop

Corporation stops shall be Ford F-1000-3 or approved equal with inlet threads conforming to AWWA C800-66 commonly known as the Mueller thread, and CTS-Pack joint fitting or connection.

3.5.3 Curb Stop

All services exceeding ¾" diameter or 50' in length and all stream crossings shall have curb stop. Curb stops shall have copper inlet and copper outlet, similar to the Ford model #B44-333, B44-444 or approved equal.

3.5.4 All service connections shall be "wet-tapped" with main line at normal operating pressures. No exceptions taken. Detail Sheet MW-8 depicts a Typical Service Connector.

3.6 Gate Valves

Gate valves shall be ductile cast iron, bronze mounted, resilient-seated, fusion bonded epoxy coating inside and out, with brass or bronze non-rizing stems complying with AWWA C509-87. Working pressure shall be at least equal to that of the pipe with which used. Valves shall open left or counter-clockwise. Valves shall be as manufactured by US Pipe model Metro seal 250, Mueller model A-2360 or approved equal.

3.7 Valve Boxes

Valve boxes shall be adjustable cast iron valve boxes of suitable diameter, length, and design shall be furnished and installed for all buried valves. Boxes shall be as the Buffalo Type No. H, 10380 by Mueller, F-2450 by Clow, E-3102 by M & H, or approved equal.

3.8 Hydrants

Fire hydrants shall be traffic type with safety flange protection conforming to AWWA C502-85 and shall have not less than 6 inch inside diameter barrel, 5 inch minimum hydrant valve and a capacity of not less than 1000 gpm with a loss of not more than 2.5 psi through the hydrant. Hydrants shall have a 6 inch mechanical joint connection to the water main; two 2.5 inch hose outlets; and one 4 inch pumper outlet, and be so designed that if broken off, the hydrant valve will remain closed. Direction of opening shall be left (counter-clockwise) and nozzle threadings shall be National Standard. Hydrants shall be a Mueller A24015 or an approved equal hydrant.

inch pumper outlet, and be so designed that if broken off, the hydrant valve will remain closed. Direction of opening shall be left (counter-clockwise) and nozzle threadings shall be National Standard. Hydrants shall be a Mueller A24015 or an approved equal hydrant.

3.9 Concrete

Concrete shall develop 2450 psi and 3500 psi compressive strength at 7 and 28 days, respectively, and be measured, mixed and placed according to the American Concrete Institute Standard Recommended Practice for these operations (ACI 614). Cement shall conform to ASTM C150 for Type I or III. Fine and coarse aggregates shall conform to ASTM C-33. Mixing water shall be clean and free from injurious quantities of oil, acid, alkali or other deleterious substances. Concrete shall be placed with the minimum suitable slope for the particular pour. An air entraining admixture, subject to the ENGINEER'S approval, shall be added to concrete at the mixer, unless air entraining cement is used or unless otherwise indicated in amount sufficient to entrain the percentages of air designated in the following table. Indicated air percentages shall be present at the time when concrete is placed in the forms.

Maximum Aggregate Size	Percent of Air
1-1/2", 2", or 2-1/2"	4% + or - 1%
3/4" or 1"	5% + or - 1%
3/8" or 1/2"	6% + or - 1%

Ready mixed concrete shall be mixed and delivered in compliance with ASTM C-94.

3.10 Casing Pipe

Casing pipe shall conform to the Materials Standards of ASTM Designation A-139 Grade B or approved equal. Only new prime pipe will be permitted. Casing pipe shall be 4" larger than the largest outside diameter of the carrier pipe.

When casing pipe is required for highways or railroad crossings, the project shall be completed in accordance with applicable federal, state, and local regulations. In the case of railroad crossings, the project should comply further with regulations established by the railroad company. In general, boring will be permitted for casing diameters through 36 in., with maximum length of about 175 ft.; jacking for diameters 30 in. through 60 in., with lengths of about 200 ft.; and tunneling for pipes 48 in. and larger for longer lengths.

3.11 Tapping Saddles

All connections to PVC pipe, including service connections, shall be made with approved Ford model S-70 tapping saddle or an approved equal for PVC or Ford model #F202 for ductile iron or approved equal.

3.12 Carrier Pipe

Carrier pipe shall be ductile iron pipe meeting the specifications as outlined in Section 2.3.1.1.

Carrier pipe may be pushed or pulled through the completed casing pipe. Casing spacers should be placed on the carrier pipe to ensure approximate centering within the casing pipe and to prevent damage during installation. Care must be exercised in order to avoid metal-to-metal contact. In order to avoid the transfer of earth and live loads to the carrier pipe, the space between the carrier and casing pipes should not be filled completely. Casing shall be sealed with a rubber boot type seal.