
SECTION 5
SPECIFICATIONS

SECTION 011100 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION OF THE PROJECT

- A. The project is located on US Route 20 from West Street to Bartlett Street and from Chestnut Street to Harbor Street in the City of Conneaut, Ashtabula County, Ohio.

1.2 PROJECT DESCRIPTION

- A. The project consists primarily of cured-in-place pipe (CIPP) lining of the 8" sanitary sewer mainline with alternates for additional ancillary work.
- B. The Base Bid consists pre-construction light cleaning and televising (bid item), heavy cleaning with complete root and debris removal of select portions of the pipe runs, 8" CIPP Lining, connection re-instatements, removal of protruding tap-in connections, and post television inspection (included in the unit prices of the work).
- C. Alternates 1A and 1B are for rehabilitation of the lateral to main connections and downstream ends of laterals for a select portion (~40%) of the laterals. The Owner will award one Alternate or the other or neither Alternate. Alternate 1A is for a main to lateral tophat style liner that extends into the lateral 5'. Alternate 1B is for a main to lateral liner that has a circumferential liner in the main a minimum of 18" (6" upstream and downstream of the lateral) and a 10' liner into the lateral.
- D. Alternate 2 is for rehabilitation of the manholes including cleaning of the manholes, inspection and patching of deteriorated areas or loose brick, replacement of deteriorated steps as directed, invert (bench) reconstruction as directed, and lining of the manhole walls up to the base of the frame/lid.

1.3 SPECIFICATIONS

- A. In general, these Specifications describe the work to be performed by the various trades, other than work specifically excluded. It shall be the responsibility of the Contractor and Subcontractors to perform all work incidental to their trade, whether or not specific mention is made of each item, unless such incidentals are included under another Item.
- B. It is advised that the Contractor and all Subcontractors familiarize themselves with the contents of the complete Specifications, particularly for the trades preceding, following, related or adjacent to their work.

1.4 DRAWING SCHEDULE

- A. The project manual contains a general location map.

END OF SECTION 011100

SECTION 011419 – USE OF SITE

PART 1 - GENERAL

1.1 GENERAL

- A. The Contractor will be allowed the use of as much of the site designated for the improvements as is necessary for his operation.

1.2 USE OF STREETS

- A. During the progress of the work, the Contractor shall make ample provisions for both vehicle and pedestrian traffic on any public street and shall indemnify and save harmless the Owner from any expense whatsoever due to his operations over said streets. The Contractor shall also provide free access to all the fire hydrants, water, and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked only one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public.
- B. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and may deduct the cost of such work from any monies due the Contractor under this Agreement, but the performance of such work by the Owner at its instance shall serve in no way to release the Contractor from his general or particular liability for the safety of the public or the work.
- C. The Contractor shall repair at no cost to the Owner, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Contractor shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or walks by his equipment or that of subcontractors or suppliers.

1.3 CLOSING STREETS TO TRAFFIC

The Contractor may with the approval of the Engineer, close streets, or parts of streets, to vehicular traffic. The streets are to remain closed as long as the construction work or the condition of the finished work requires or as determined by the Engineer. The Engineer shall be the judge of how many streets or parts of streets it is necessary for the Contractor to close at any time, and may refuse to permit the closing of additional streets to traffic until the majority of the work on the closed streets is completed and they are opened to traffic.

1.4 RIGHTS-OF-WAY

- A. Whenever it is required to perform work within the limits of public or private property or in rights-of-way, such work shall be done in conformity with all agreements between the Owner and the owners of such. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.
- B. The Contractor shall not (except after consent from the proper parties) enter or occupy with men, tools or equipment, any land outside the rights-of-way or property of the Owner.
- C. When the Contractor performs construction within 10 ft. of a right-of-way or easement line, he shall place tall stakes properly identified at points of change in width or direction of the right-of-way or easement line and at points along the line so that at least two stakes can be seen distinctly from any point on the line.

1.5 EASEMENTS

- A. Where the work is to be constructed upon easements, such easements will be secured by the Owner without cost to the Contractor. The Contractor shall not enter upon or occupy any private property outside of the limits of the easements furnished.
- B. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

1.6 PROTECTING EXISTING BUILDINGS, STRUCTURES AND ROADWAYS

- A. The Contractor shall, at his own expense, shore up and protect any buildings, roadways, utilities or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or material, but the cost of this work must be included in the price stipulated for the work to be done under this contract.

1.7 SITE FACILITIES

- A. The Contractor shall furnish and place sufficient quantities of portable toilet facilities at locations convenient for use by the Contractor's personnel, Subcontractors, the Engineer, and the Owner.

1.8 RESTORATION

- A. The contractor shall restore all areas per the plans and specifications and if not specified, at least to the condition existing prior to the start of work.

END OF SECTION 011419

SECTION 011423 - ADDITIONAL WORK, OVERTIME

PART 1 - GENERAL

1.1 NIGHT, SUNDAY AND HOLIDAY WORK

- A. No work will be permitted at night, Sunday or legal holidays except as noted on the plans or in the case of emergency and then only upon written authorization of the Engineer. Where no emergency exists, but the Contractor feels it advantageous to work at night, Sunday or legal holidays, the Contractor shall notify the Engineer at least two (2) days in advance, requesting written permission. Any work performed during the absence of the Engineer will be done at the Contractor's risk and responsibility and may be subject to rejection upon later inspection.

END OF SECTION 011423

SECTION 012513 – PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 MATERIALS AND EQUIPMENT

- A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified. Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.
- B. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 012513

SECTION 013119 - PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION MEETING

- A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.
- B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.
- C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.
- D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

1.2 PROGRESS MEETINGS

- A. If requested by the Owner, monthly progress meetings will be held at a location to be determined by the Owner on a regularly scheduled day mutually convenient to the Owner, Contractor, and Engineer.
- B. The Contractor shall provide an updated construction progress schedule and be prepared to comment in detail on all aspects of his work.

END OF SECTION 013119

SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 PROGRESS SCHEDULE

- A. Immediately after signing the Contract, the General Construction Contractor shall prepare a graphic progress schedule, indicating the work to be executed during each month and the rate of expected progress to secure completion on the agreed-upon completion date. The progress schedule shall be approved by the Engineer and Owner prior to starting work on the site. Copies of such graphic progress charts, upon which has been indicated the actual progress, shall be furnished to the Engineer with each requisition for payment.
- B. Should the rate of progress fall materially behind the scheduled rate of progress, and unless the delay is authorized by the Engineer, each offending Contractor shall furnish additional labor, work overtime, or take other necessary means required for completion of the work on the scheduled date. No additional compensation beyond the set Contract price shall be paid for action taken or overtime expense incurred in maintaining scheduled progress.

END OF SECTION 013216

SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.1 GENERAL

- A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.
- B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

- C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.
- D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.
- E. The Contractor shall submit Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions 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/Architect.
- F. It is the responsibility of each Prime Contractor to furnish to all other Prime Contractors and especially the General Construction Contractor reviewed Shop Drawings for guidance in interfacing the various trades; i.e., sleeves, inserts, anchor bolts, terminations, and space requirements.

- G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.
- H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.
- I. The Engineer/Architect will review the first and second Shop Drawing item 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 2.8 times direct labor cost plus expenses.

1.2 SUBMITTAL PROCEDURE

- A. All required submissions shall be made to the Engineer/Architect by the Prime Contractor(s) only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.
- B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.
- C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:
 - 1. Location
 - 2. Project Name
 - 3. Contract
 - 4. Name and Address of Engineer/Architect
 - 5. Name and Address of Contractor
 - 6. Name and Address of Subcontractor
 - 7. Name and Address of Supplier
 - 8. Name of Manufacturer
 - 9. Number and Title of appropriate Specification Section
 - 10. Drawing Number and Detail References, as appropriate.
 - 11. Submittal Sequence or Log Reference Number.
 - a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".
- D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

Signature

Date

Company

- E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.
- F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.
- G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.
- H. For product which require submittal of samples, furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

1.3 REVIEW PROCEDURE

- A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
- B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.
- C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.

- D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
 2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
 3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
 4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.
- E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.

APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Page	Paragraph	Description
A.		The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.
B.		Change in Contract Price (indicate + or -) \$ _____
C.		Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.
D.		Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

_____ CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature:

Firm:

Address:

Telephone:

Date:

Attachments:

For use by ENGINEER:

_____ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

_____ Accepted as evidenced by included CHANGE ORDER.

_____ Not accepted as submitted. See Remarks.

_____ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

_____ Not accepted. Do not resubmit.

By:

Date:

Remarks:

APPLICATION FOR USE OF "OR-EQUAL" ITEM

TO: _____

PROJECT: _____

SPECIFIED ITEM:

Page	Paragraph	Description
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A. The undersigned requests consideration of the following as an "or-equal" item in accordance with Article 6.05 of the General Conditions.

B. Change in Contract Price (indicate + or -) \$ _____

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.

D. Signature:

Firm:

Address:

Telephone: _____

Date: _____

Attachments: _____

For use by ENGINEER:

_____ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

_____ Accepted as evidenced by included CHANGE ORDER.

_____ Not accepted as submitted. See Remarks.

_____ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

_____ Not accepted. Do not resubmit.

By: _____ Date: _____

Remarks: _____

END OF SECTION 013323

SECTION 013326 – PRODUCT TESTING AND CERTIFYING

PART 1 - GENERAL

1.1 QUALITY OF MATERIALS

- A. Where the specifications call for mill or shop tests, the Contractor shall furnish duplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to contract requirements. Mill, shop or witness tests shall be subject to view by the Engineer's representative, but the Engineer's representation shall not relieve the Contractor from the necessity of furnishing certificates specified. The Engineer shall be notified by the Contractor in writing, sufficiently in advance of the time of making tests, so that proper arrangements may be made. Waiving of witness of tests by the Engineer may be in writing only by the Engineer. All costs for travel, lodging, food and transportation that are necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be included in the Contractor's bid for those item(s) specifically designated as being subject to witness testing.
- B. Unless otherwise specified, all materials, equipment and articles shall be erected, installed, applied, or connected, used, cleaned and conditioned in accordance with the printed instructions and directions of the manufacturer.
- C. The installation shall be so made that its several component parts will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.
- D. The work shall be executed in conformity with the best practice and so as to contribute to efficiency of operation, minimum maintenance, accessibility and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment and usage.
- E. Whenever in the contract documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment is to be regarded merely as a standard and such trade name shall be followed by "or equal".

1.2 QUALITY ASSURANCE

- A. The equipment and materials to be furnished under this Contract shall be the products of well established and reliable firms which have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment which have been in successful operation for at least five (5) years.

1.3 EXPERIENCE CLAUSE REQUIREMENT AND PERFORMANCE BONDS FOR MANUFACTURER

- A. For every piece of equipment furnished under this Contract, the manufacturer will be required to have a minimum of five (5) years of experience in providing this specific type of equipment. In lieu of this experience requirement, the manufacturer will be required to provide performance bond(s) for the faithful performance of the equipment and guarantee payment in a sum of not less than one hundred and fifty percent (150%) of the total equipment price for the completed work for that item. In the absence of verifiable experience, the manufacturer will be required to provide the performance bond(s) for the same number of years that the manufacturer was found lacking in experience from the specified five (5) year period. The performance bond(s) shall be from an approved surety company, to the satisfaction of the Owner's Law Director.
- B. Agents of bonding companies which write bonds for the performance and payment of the contract shall furnish power of attorney bearing the seal of the company, evidencing such agent's authority to execute the particular type of bond to be furnished, and evidencing also the right of the surety company to do business in the State of Ohio. Copy of this proof shall be attached to each copy of the contract.
- C. The bond shall be purchased through a surety company with a local agent upon whom service of process can be made.
- D. In event of failure of surety or co-surety, the manufacturer shall immediately furnish a new bond, as required herein. The manufacturer's bond will not be released until all provisions of the contract have been fulfilled.
- E. The surety used for the bid bond and performance bond shall be listed in the latest U.S. Treasury Circular 570 and the Penal Sums shall be within the maximum specified for such company in said Circular 570.

END OF SECTION 013326

SECTION 013543 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 UNNECESSARY NOISE, DUST AND ODORS

- A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

1.2 SEWAGE, SURFACE AND FLOOD FLOWS

- A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all sewage, surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

1.3 WORK IN FREEZING WEATHER

- A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

1.4 POLLUTION CONTROL

- A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- B. The Contractor shall perform work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems. This work shall conform to all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NDPEs Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work may consist of but not be limited to construction and continual maintenance of silt fence, bio bag filters, sedimentation traps, stilling basins, check dams, temporary seeding, temporary mulching, erosion mats and other means to clarify waters containing suspended materials from excavations, embankments, cleared and grubbed or stripped areas, stockpiles, well points, and disposal sites and shall be commensurate with the contractor's schedule, sequence of work, means and methods. If a SWPPP plan is not required for the project, the contractor shall at a minimum submit a plan of his proposed erosion control prevention methods for approval by the Owner and/or other regulatory authorities having jurisdiction prior to starting any construction activities which may cause erosion.

- C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.
- D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 013543

SECTION 014126 - GENERAL REGULATIONS AND PERMITS

PART 1 - GENERAL

1.1 PERMITS

The Contractor shall apply for and pay for all permits from the Owner and/or other authorities having jurisdiction.

1.2 ARCHAEOLOGICAL DISCOVERIES

Contractors and subcontractors are required under Ohio Revised Code (O.R.C.) Section 149.53, to notify Ohio's State Historic Preservation Office (SHPO), and to cooperate with that office in archaeological and historic surveys and mitigation efforts if such discoveries are uncovered within the project area.

Contact: Ohio's State Historic Preservation Office
Diana Welling, Resource Protection & Review Department Manager
Phone: 1-614-298-2000
Email: dwelling@ohiohistory.org

Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 014126

SECTION 014223 - INDUSTRY STANDARDS

PART 1 - GENERAL

1.1 ABBREVIATIONS

- A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

1.2 REFERENCE TO OTHER SPECIFICATIONS

- A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

1.3 CODES AND STANDARDS

- A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

SECTION 014323 – QUALIFICATIONS OF TRADESMEN

PART 1 - GENERAL

1.1 CHARACTER OF WORKMEN AND EQUIPMENT

- A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Engineer or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Engineer so orders, and shall not be re-employed unless express permission be given by the Engineer. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.

- B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 014323

SECTION 015526 - TEMPORARY TRAFFIC CONTROL DEVICES

PART 1 - GENERAL

1.1 BARRICADES, SIGNS AND LIGHTS

- A. The Contractor shall employ watchmen on the work when and as necessary. The Contractor shall erect and maintain such strong and suitable barriers and such lights as will effectively prevent the occurrence of any accident to health, limb or property. Lights shall be maintained between the hours of one-half (1/2) hour after sunset and one-half (1/2) hour before sunrise.
- B. No manhole, trench, excavation will be left open awaiting connection or removal at a later date by the Contractor's forces or others but shall be temporarily backfilled and resurfaced if applicable with a temporary pavement passable to traffic at no additional cost to the Owner.
- C. In addition to other safety requirements, a minimum of four (4) foot high fence will be incorporated around any shaft or manhole or other excavation left open at the end of a day's work.

1.2 MAINTENANCE OF TRAFFIC

- A. The Contractor is required to provide maintenance of traffic in conformance with the Ohio Manual of Uniform Traffic Control Devices and Item 614 of the current Construction and Material Specifications of the Ohio Department of Transportation.
- B. This work shall include providing suitable and satisfactorily trained and properly attired flagmen for use at any location where existing roadway is narrowed to a width of less than 2 full lanes (18 feet).
- C. The Contractor is also responsible for maintaining local access to all residences and businesses along the route of the construction and to provide whatever temporary materials are necessary to provide a safe, adequate drive surface.

END OF SECTION 015526

SECTION 016600 - PRODUCT HANDLING AND PROTECTION

PART 1 - GENERAL

1.1 DELIVERY AND STORAGE OF MATERIALS

- A. The Contractor shall be responsible for delivery and storage of all materials.
- B. The Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment. Deliveries of all construction materials and equipment should be made at suitable times.
- C. The Contractor shall store all materials required for the performance of this contract at sites designated by the Engineer or Owner.
- D. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.
- E. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.
- F. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.
- G. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

END OF SECTION 016600

SECTION 017800 - FINAL COMPLIANCE AND SUBMITTALS

PART 1 - GENERAL

- 1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.
- A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).
 - B. Contractor's Certification of Completion.
 - C. Contractor's Affidavit of Prevailing Wage.
 - D. Consent of Surety Company for Final Payment.
 - E. Affidavit of Final Acceptance Date and Correction Period.
 - F. Before the OWNER will approve and accept the work and release the retainer, the CONTRACTOR will furnish the OWNER a written report indicating the resolution of any and all property damage claims filed with the CONTRACTOR by any party during the construction period. The information to be supplied shall include, but not be limited to, name of claimant, date filed with CONTRACTOR, name of insurance company and/or adjuster handling claim, how claim was resolved and if claim was not resolved for the full amount, a statement indicating the reason for such action.
 - G. DBE Subcontractor Participation Forms SR-EPA.7-8 (Applicable for WPCLF & WSRLA funded projects only).

END OF SECTION 017800

SECTION 017821 - CLEANING AND PROTECTION

PART 1 - GENERAL

1.1 GENERAL

- A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.
- B. As circumstances require and when ordered by the Engineer, the Contractor shall clean the road, driveway, and/or sidewalk on which construction activity under this contract has resulted in dirt or any other foreign material being deposited with an automatic self-contained mechanical sweeper with integral water spray, vacuum and on-board or supplementary containment.
- C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.
- D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.
- E. The Contractor shall wash all windows and other glass surfaces, leaving all areas free from putty marks, paint, etc.
- F. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 017821

SECTION 017839 - PROJECT RECORDS, DRAWINGS

PART 1 - GENERAL

1.1 RECORD DRAWINGS

- A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.
- B. The Contractor shall furnish dimensioned drawings indicating locations of all underground mechanical and electrical facilities.

1.2 SERVICE CONNECTION RECORDS

- A. The Contractor shall record the location of all service and property connections, new or existing, made to utilities constructed under this contract. Such records shall be turned over to the Owner upon completion of the work. The cost of making such records shall be included in the various unit or lump sum prices stipulated for the various items of the work.
- B. The location of each sewer connection as measured along the sewer from the nearest downstream manhole and its description with respect to the sewer shall be recorded. The record shall include the depth of new stubs for future connections and the depth of existing connections as measured from the surface grade. Also, the use of any vertical riser pipe shall be noted.
- C. The location of each water connection as measured along the water line from the nearest fire hydrant.

END OF SECTION 017839

SECTION 330130 - MISCELLANEOUS TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 MAINTENANCE OF SANITARY FLOWS

- A. The Contractor for this contract shall be responsible for maintaining all sanitary flows through the existing sanitary sewerage systems. Provisions shall be made for temporary pumping and/or storage of sanitary flows during periods of sewer and manhole reconstruction, or when flows must be interrupted to make connections to the new facilities as directed by the Engineer.

END OF SECTION 330130

SECTION 330130.01- SEWER COLLECTION SYSTEM REHABILITATION DEFINITIONS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The work covered by this project shall include the furnishing of all labor, equipment, materials, and supervision; and performing all work necessary to investigate, rehabilitate, and/or replace the designated sewer lines, manholes, etc., all in accordance with the specifications. The work shall consist of, but not necessarily be limited to, performing the following work tasks where specified:

1. Sewer Line Cleaning
2. Sewer Flow Control
3. Television Inspection
4. Sewer Pipe Joint Testing
5. Sewer Pipe Joint Sealing
6. Sewer Manhole Rehabilitation
7. Sewer Manhole Replacement
8. Cured-in-Place Pipe Installation
9. Sewer Point Repairs

- B. The area of work and the type of repair/rehabilitation to be performed shall be at those locations shown on the tables or drawings in the Specific Project Requirements section of these specifications.

1.3 DEFINITIONS

- A. Wherever used in these specifications, the following words and terms shall have the meanings indicated:

1. AREAWAY: A paved surface, serving as an entry area to a basement or subsurface portion of a building, which is provided with some form of drainage device that may be connected to a sewer line.
2. AVAILABLE WATER: Water necessary for the performance of work, which may be taken only from fire hydrant(s) approved by the Owner, given conditions of traffic and terrain which are compatible with the use of the hydrant for performance of work.

3. **BUILDING SEWER:** The conduit which connects building wastewater sources to the public or street sewer (referred to also as "house sewer," "building connection," "lateral," or "service connection"), including lines serving homes, public buildings, commercial establishments, and industry structures. In this specification, the building sewer is referred to in two sections:
 - a. The section between the building and the property line, right-of-way line, or to a point specified and supervised by the Owner's designated representative.
 - b. The remaining section to the collector sewer, including the connection thereto.
4. **BYPASS:** An arrangement of pipes, conduits, gates, and valves whereby the flow may be passed around a hydraulic structure or appurtenance. Also, a temporary setup to route flow around a specified part of a sewer system.
5. **BYPASS PUMPING:** The transportation of sewage flows around a specific sewer pipe line section or sections via any conduit for the purpose of controlling sewage flows in the specified section or sections without flowing or spilling onto public or private property.
6. **CELLAR DRAIN:** A pipe or series of pipes which collect wastewater which leak, seep, or flow into subgrade parts of structures and discharge them into a building sewer, or by other means dispose of such wastewater into sanitary, combined or storm sewers.
 - a. Referred to also as a "basement drain."
7. **CHANGE ORDER:** A written order to the Contractor authorizing an addition, deletion, or revision in the work within the general scope of work of the agreement, or authorizing an adjustment in the agreement price or agreement time.
8. **COLLECTOR SEWER:** A sewer located in the public way which collects the wastewater discharged through building sewers and conducts such flows into larger interceptor sewers and pumping and treatment works.
 - a. Referred to also as "street sewer."
9. **COMBINED SEWER:** A sewer intended to serve as both a sanitary sewer and a storm sewer, or as both an industrial sewer and a storm sewer.
10. **COMPRESSION GASKET:** A device which can be made of several materials in a variety of cross sections and which serves to secure a tight seal between two pipe sections (e.g., "O"-rings).
11. **CORBEL OR CONE:** That portion of a manhole structure which slopes upward and inward from the barrel of the manhole to the manhole cover frame.
12. **CREW:** The number of persons required for the performance of work at a site as determined by the Contractor in response to task difficulty and safety considerations at the time or location of the work
13. **DEBRIS:** Soil, rocks, sand, grease, roots, etc., in a sewer line excluding items mechanically attached to the line such as protruding service connections, protruding pipe, joint materials, and the like.

14. EASEMENT: A liberty, privilege, or advantage without profit which the owner of one parcel of land may have in the land of another. In this agreement, all land, other than public streets, in which the Owner has sewer system lines or installations and right of access to such lines or installations.
15. EASEMENT ACCESS: Areas within an easement to which access is required for performance of work.
16. ENGINEER: The engineer (a person, joint venture, firm, or corporation) who works for or under a contract or subagreement with the Owner and is designated by the Owner as the Engineer of Record under the prime contract.
17. EXFILTRATION: The leakage or discharge of flows being carried by sewers out into the ground through leaks in pipes, joints, manholes, or other sewer system structures; the reverse of "infiltration".
18. EXISTING LINEAR FEET: The total length of existing sewer pipe in place within designated sewer systems as measured from center of manhole to center of manhole from maps or in the field.
19. FLOW CONTROL: A method whereby normal sewer flows or a portion of normal sewer flows are blocked, retarded, or diverted (bypassed) within certain areas of the sewer collection system.
20. FOUNDATION DRAIN: A pipe or series of pipes which collect groundwater from the foundation or footing of structures and discharge it into sanitary, storm, or combined sewers, or to other points of disposal for the purpose of draining unwanted waters away from such structures.
21. GROUTING: The joining together of loose particles of soil in such a manner that the soil so grouped becomes a solid mass which is impervious to water (see also SEWER PIPE JOINT SEALING).
22. HYDRAULIC CLEANING: Techniques and methods used to clean sewer lines with water, e.g.; water pumped in the form of a high-velocity spray and water flowing by gravity or head pressure. Devices include high-velocity jet cleaners, collapsible dams, etc.
23. INFILTRATION: The water entering a sewer system, including building sewers, from the ground, through such means as, but not limited to, defective pipes, pipe joints, connections, or manhole walls. Infiltration does not include, and is distinguished from, inflow.
24. INFILTRATION/INFLOW: A combination of infiltration and inflow wastewater volumes in sewer lines, with no way to distinguish either of the basic sources, and with the same effect of usurping the capacities of sewer systems and other sewer system facilities.
25. INFLOW: The water discharged into a sewer system, including service connections, from such sources as, but not limited to, roof leaders; cellar, yard, and area drains; foundation drains; cooling water discharges; drains from springs and swampy areas; manhole covers; cross connections from storm sewers, combined sewers, catch basins; storm waters; surface runoff; street washwater; or drainage. Inflow does not include, and is distinguished from, infiltration.

26. INSPECTOR: The Owner's on-site representative responsible for observation and recording of quantities of work performed as set forth in these specifications.
27. INTERCEPTOR SEWER: A sewer which receives the flow from collector sewers and conveys the wastewater to treatment facilities.
28. INTERNAL PIPE INSPECTION: The television inspection of a preselected sewer line section. A television camera is moved through the line at a slow, uniform rate and a continuous picture is transmitted to an aboveground monitor.
29. INVERT: The floor, bottom or lowest point of a conduit.
30. INVERT LEVEL (ELEVATION): The level (elevation) of the lowest portion of a liquid - carrying conduit, such as a sewer, which determines in part the hydraulic gradient available for moving the contained liquid
31. JOINTS: The means of connecting sectional lengths of sewer pipe into a continuous sewer line using various types of jointing materials. The number of joints depends on the lengths of the pipe sections used in the specific sewer construction work.
32. LINEAR FOOT: Being one foot as measured along the centerline of a sewer line.
33. LONG-TERM MODULUS OF ELASTICITY: The modulus of elasticity of the material after 50 years of service. This value may be extrapolated from a 10,000 hour test of the material.
34. MAJOR BLOCKAGE: A structural defect, collapse, or blockage which prohibits manhole-to-manhole cleaning with commercially available hydraulic or mechanical cleaning equipment.
35. MANHOLE SECTION: The length of sewer pipe connecting two manholes.
36. MECHANICAL CLEANING: Techniques and methods used to clean sewer lines of debris mechanically with devices such as power rodding machines, winch-pulled brushes, bucket machines, etc.
37. OVERFLOW:
 - a. The excess water that overflows the ordinary limits such as the stream banks, the spillway crest, or the ordinary level of a container.
 - b. To cover or inundate with water or other fluid.
38. PHYSICAL PIPE INSPECTION: The crawling or walking through manually accessible pipe lines. The logs for this inspection technique record the information of the kind detailed under Internal Pipe Inspection. This inspection technique is only undertaken when field conditions offer minimal hazard or jeopardy to personnel.
39. PIPE JOINT SEALING: A method of correcting leaking or defective pipe joints which permit infiltration of extraneous water into the sewers by means of applying chemical materials into and/or through the joint area from within the pipe.
40. REGULATOR: A device or apparatus for controlling the quantity of admixtures of sewage and storm water admitted from a combined sewer collector line into an interceptor sewer, or pumping or treatment facilities, thereby determining the amount and quality of the flows discharged through an overflow device to receiving waters or other points of disposal.
41. ROOF LEADER: A drain or pipe that conducts storm water from the roof of a structure downward and thence into a sewer for removal from the property, or onto the ground for runoff or seepage disposal.

42. SANITARY SEWER: A sewer intended to carry only sanitary or sanitary and industrial wastewater from residences, commercial buildings, industrial parks, and institutions.
43. SERVICE CONNECTION: see Building Sewer.
44. SEWER CLEANING: The utilization of hydraulic or mechanical techniques and/or devices to dislodge, transport, and remove debris from sewer lines.
45. SEWER PIPE: A length of conduit, manufactured from various materials and in various lengths, that when joined together can be used to transport wastewater from point of origin to a treatment works. Materials include, but are not limited to: Acrylonitrile-butadiene-styrene (ABS); Asbestos-Cement (AC); Brick Pipe (BP); Concrete Pipe (CP); Cast Iron Pipe (CIP); Ductile Iron Pipe (DIP); Polyethylene (PE); Polyvinylchloride (PVC); Reinforced Concrete Pipe (RCP); Reinforced Plastic Mortar (RPM); Steel Pipe (SP); Vitrified Clay Pipe (VCP).
46. SITE: Any location where work has been or will be done.
47. SITE ACCESS: An adequately clear area of a size sufficient to accommodate personnel and equipment required at the location where work is to be performed, including roadway or surface sufficiently unobstructed to permit conveyance of vehicles from the nearest paved roadway to the work location.
48. SPRING LINE: The horizontal midpoint of a sewer pipe.
49. STORM SEWER: A sewer intended to carry only storm waters, surface runoffs, street washwater, and drainage.
50. STREET ACCESS: Areas normally used for public vehicular traffic (including roads, streets, or areas within existing rights-of-way or easements) to which safe access is required for performance of work.
51. SUBCONTRACTOR: An individual, firm, or corporation having a direct contract with the Contractor for performance of part of the work.
52. SURCHARGE: When the sewer flow exceeds the hydraulic carrying capacity of the sewer line.
53. SURCHARGE CONDITION: When the sewer flow depth equals or exceeds the diameter of the discharging sewer line or lines.
54. SWALE (DIP, SAG): A significant deviation in pipe grade such as to cause entrapment of solids, semisolids, and liquids, thereby impeding the accuracy and/or effectiveness of flow measurements, cleaning, and internal inspection.

END OF SECTION 330130.01

SECTION 330130.02 - SEWER LINE CLEANING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The intent of sewer line cleaning is to remove foreign materials from the lines and restore the sewer to a minimum of 95% of the original carrying capacity or as required for proper lining of the pipe or seating of internal pipe joint sealing packers. Since the success of the other phases of work depends a great deal on the cleanliness of the lines, the importance of this phase of the operation is emphasized. It is recognized that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. If in the course of normal cleaning operations, damage does result from pre-existing and unforeseen conditions such as broken pipe, the Contractor will not be held responsible.
- B. The intent of chemical root treatment is to kill tree roots in sanitary/storm sewer lines and to inhibit root regrowth without damaging the trees, the environment, or the treatment plant.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Equipment Data: Submit a listing of equipment to be used on the project. Provide equipment operating instructions if requested by the Owner.
- B. Chemical Root Removal Data:
 - 1. Submit manufacturer's technical data and application instructions.
 - 2. Submit Material Safety Data Sheet(s) for the chemicals to be used in the root removal process.
 - 3. Submit a specimen product label of foaming material to be used in chemical root treatment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be of a type that has been in general use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.

2.2 CLEANING EQUIPMENT

- A. **Hydraulically Propelled Equipment:** The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment which cannot be collapsed is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.
- B. **High-Velocity Jet (Hydrocleaning) Equipment:** All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.
- C. **Mechanically Powered Equipment:** Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

2.3 CHEMICAL FOAM ROOT REMOVAL

- A. The chemical root treatment material shall be EPA registered and labeled for use in sewer lines and acceptable to the state agencies having jurisdiction over its use.
- B. The active ingredient for killing roots shall be a non-systemic herbicide which will kill roots at low concentrations but will not permanently affect parts of the plant distant from the treated roots. The active ingredient must be spontaneously detoxified by natural chemical/biochemical processes following its use. The active ingredient shall not adversely affect the performance of wastewater treatment plants.

- C. The active ingredient for inhibiting root regrowth in sanitary sewers shall inhibit root cell growth on contact but shall not be transported so as to damage other portions of the plant. The material shall form a persistent chemical barrier suppressing the growth of root tips. The material shall be sufficiently stable under conditions of use to provide protection for 12 months but shall be subject to decomposition in wastewater treatment plants without disturbing plant processes.
- D. The root treatment material shall contain emulsifiers to degrease root masses and remove fatty acids from root tissue and surfactants to convert an aqueous solution of the root treatment agent into a volatile foam.

PART 3 - EXECUTION

3.1 CLEANING PRECAUTIONS

- A. During sewer cleaning operations, satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to ensure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer.
- B. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily.
- C. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.
- D. No fire hydrant shall be accessed and/or operated without the prior approval from the official in the municipality governing the hydrants. And if approved by the municipality for use then the Contractor shall provide his own means for backflow prevention to the satisfaction of the Owner to prevent backflow from entering the connected hydrants.

3.2 SEWER CLEANING

- A. The designated sewer manhole sections shall be cleaned using hydraulically propelled, high-velocity jet, or mechanically powered equipment. Selection of the equipment used shall be based on the conditions of lines at the time the work commences. The equipment and methods selected shall be satisfactory to the Engineer. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes.
- B. If cleaning of an entire section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage may exist, the cleaning effort shall be suspended, and the Engineer shall be notified.

3.3 ROOT REMOVAL

- A. Roots shall be removed in the manhole sections where root intrusion occurs. Special attention should be used during the cleaning operation to assure complete removal of roots from the joints. Any roots which could prevent proper lining of the pipe, prevent the seating of a pipe joint packer, or prevent the proper application of chemical sealants shall be removed.
- B. Mechanical procedures may include the use of equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners.
- C. Chemical root treatment shall be used when directed by the Owner.
 - 1. The Contractor's attention is directed to the safety requirements and precautions associated with the use of the root treatment material. The Contractor shall use precautions for the protection of all persons, vegetation, animals and property. The Contractor is responsible for damage to private property and vegetation.
 - 2. The Contractor is required to be knowledgeable of and in compliance with federal and state requirements relative to the root treatment material and its use. Compliance with federal and state law shall supersede compliance with the provisions of this contract.
 - 3. All mixing/application procedures for chemical root treatment shall be consistent with the latest standards, requirements and recommendations of the manufacturer of the chemical root treatment material used. Mixing and application of the root treatment material shall be done under the supervision of a state-certified pesticide (herbicide) applicator as required by law.
 - 4. When the root tips are damaged or removed by sewer line cleaning, chemical treatment will be less effective. Consequently, no mechanical cleaning is recommended in lines prior to chemical root treatment unless extensive grease, root masses, or debris preclude proper application of the material.
 - 5. Sewer service shall generally not be interrupted during root treatment. In situations where it is necessary to shut down upstream pumping stations of block/bypass upstream flows, the Contractor shall coordinate his activities with the Engineer and Owner and do the work at night or during periods of low flow.
 - 6. All materials shall be delivered to the site in undamaged, unopened containers bearing the manufacturer's original label. Mixing of the root treatment material shall be done no more than 12 hours prior to use. The water used shall be clear and free of acid, alkali, oxidizing agents, oil, or other organic materials. Mixing water temperature shall be between 40°F and 80°F.
 - 7. Where conditions permit, the volume of foam shall be sufficient to completely fill the air space above the flow, manhole to manhole. In all cases, the volume of foam delivered to the sewer line shall be sufficient to attach to and permeate all root masses.
 - 8. The foam shall be applied at sufficient pressure to penetrate a minimum of 5 feet into service connections.
 - 9. Root Removal: The Contractor shall wait a minimum of 90 days from application of the foam to removal of roots unless otherwise directed by the Engineer.

- D. All roots must be removed prior to grouting or lining. If roots are detected during either of grouting or lining, the Contractor shall remove his equipment and reclean the line to ensure root removal. This work shall be performed at no additional cost to the Owner if the manhole section was previously cleaned as a pay item.

3.4 MATERIAL REMOVED

- A. All sludge, dirt, sand, rocks, grease, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned.
- B. Passing material from manhole section to manhole section, which could cause line stoppages, accumulations of sand in wet wells, or damage pumping equipment, shall not be permitted.
- C. When necessary or when directed by the Engineer, an approved dam or weir shall be constructed in the downstream manhole in such a manner that solids and debris will be trapped and retained. The cost of such a dam or weir shall be included in the cost of cleaning.

3.5 DISPOSAL of MATERIALS

- A. All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of at a location approved by the Owner.
- B. Trucks hauling solids or semisolids from the site shall be watertight so that no leakage or spillage will occur.
- C. All materials shall be removed from the site no less often than at the end of each workday.
- D. Under no circumstances will the Contractor be allowed to accumulate debris, etc., on the site of work beyond the stated time, except in totally enclosed containers and as approved by the Owner.

3.6 FINAL ACCEPTANCE

- A. Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of the Owner.
- B. If TV inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to reclean and reinspect the sewer line at no additional expense to the City.
- C. In areas where television inspection is not performed, the Engineer may require the Contractor to pull a double squeegee (with each squeegee the same diameter as the sewer) through each manhole section as evidence of adequate cleaning.

END OF SECTION 330130.02

SECTION 330130.03 - SEWER FLOW CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. The intent of this work is to control the flow in the sewer to enable the successful inspection, rehabilitation or replacement of the pipe.
- B. Depth of flow shall not exceed that shown below for the respective pipe sizes when performing television inspection, joint testing and/or sealing.

Pipe Diameter Maximum Depth of Flow

1.	6" - 10" Pipe	-	25% of pipe diameter
2.	12" - 24" Pipe	-	33% of pipe diameter
3.	27" & up Pipe	-	40% of pipe diameter

- C. Flow shall be controlled or bypassed from sewer sections being lined or replaced. The methods used shall be in accordance with the work being performed.

1.3 QUALITY ASSURANCE

- A. When flow in a sewer line is plugged, blocked, or bypassed; sufficient precautions must be taken to protect the sewer lines from damage that might result from sewer surcharging. Further, precautions must be taken to insure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

1.4 SUBMITTALS

- A. The Contractor shall submit a written request for Sewer Flow Control, specify the method and equipment to be used, and receive approval from the Owner prior to performing the work.
- B. For bypass pumping, submit shop drawings in accordance with the General Requirements showing pumps, piping layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly. Provide a wet weather operation plan which describes what procedures will be followed when flow exceeds pumping capacity. Provide a schedule for flow control operations (e.g. neatly printed bar graph) before commencing flow control work that the Owner's operations staff can plan around.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Sewer plugs shall be so designed that all or any portion of the sewage can be quickly released.
- B. Pumping and bypassing:
- C. Pumps bypass pipe, fittings, and joining methods shall be suitable and of a type normally used for raw sanitary sewage.
 - 1. The bypass system shall be of sufficient capacity to handle existing peak dry weather flow plus additional flow that may occur during a rainstorm unless otherwise provided for by an approved wet weather operation plan.
 - 2. If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum.
 - 3. Bypass piping to be furnished and installed shall include, but not limited to all pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joint restraints, joints and jointing materials, and pipe supports. Bypass piping shall be rated to twice the system operating pressure.
- D. Hydrocleaning equipment shall be equipped with high-velocity nozzles capable of pulling flow away from the pipe section being televised. The equipment shall carry its own water tank, auxiliary engines, pumps and hydraulically driven hose reel.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. The Contractor shall continuously supervise the level of water in the upstream and downstream sewers to ensure that harmful surcharging does not occur. The Contractor shall be responsible for any damage to the system and/or to public or private property resulting from improper execution of flow control measures.

3.2 PLUGGING OR BLOCKING

- A. A sewer line plug shall be inserted into the line upstream of the section being worked. During TV inspection, testing and sealing operations, flow shall be reduced to within the limits specified above. After the work has been completed, flow shall be restored to normal.

3.3 PUMPING AND BYPASSING

- A. When pumping and bypassing is required, the Contractor shall supply and install the pumps, conduits, and other equipment to divert the flow around the section in which work is to be performed. Under no circumstances will the discharge of raw sewage to other than sanitary sewers be allowed.
- B. The Contractor shall be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system.
- C. The proposed bypassing system shall be set up to allow traffic flow to local residents and businesses.
- D. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- E. Make connections to all existing force mains being bypassed.
- F. Install temporary bypass piping with restrained joints at horizontal and vertical changes in direction.
- G. Provide granular material for bedding and encasement of temporary piping when buried below pavement.
- H. Field test bypass piping and obtain approval from the Engineer prior to placing bypass system in service.
- I. Do not remove pumping and bypass system until it is no longer needed and can be replaced by authorized use of completed permanent facilities.

3.4 HYDRAULIC FLOW CONTROL

- A. This method shall be used for sewer televising only. The Contractor shall position the high-velocity nozzle no less than five (5) feet ahead of the television camera. Pressures shall be just sufficient to reduce the flow level in front of the camera to the specified depth. The jet nozzle shall be reeled in at the same rate as the forward movement of the television camera to maintain the separation distance.

END OF SECTION 330130.03

SECTION 330130.04 - SEWER POINT REPAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Other Sections Referenced:
 - 1. Section 330130.01 - Sewer Collection System Rehabilitation
 - 2. Section 330130.02 - Sewer Line Cleaning
 - 3. Section 330130.17 - Television Inspection
 - 4. Section 329219 - Seeding
- C. Other documents which shall be considered part of and included in these specifications
 - 1. ASTM A 48 - Specification for Gray Iron Castings.
 - 2. ASTM A 536 - Specification for Ductile Iron Castings.
 - 3. ASTM C 12 - Recommended Practice for Installing Vitrified Clay Pipe Lines.
 - 4. ASTM C 76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - 5. ASTM C 270 - Specification for Mortar for Unit Masonry.
 - 6. ASTM C 425 - Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
 - 7. ASTM C 443 - Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 8. ASTM C 478 - Specification for Precast Reinforced Concrete Manhole Sections.
 - 9. ASTM C 700 - Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
 - 10. ASTM C 923 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
 - 11. ASTM C 990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - 12. ASTM D3034 - Specification for Type PSM Poly(VinylChloride)(PVC) Sewer Pipe and Fittings.
 - 13. ASTM D3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 - 14. ODOT Construction and Material Specifications.

- a. Item 603 - Pipe Culverts, Sewers and Drains.
- b. Item 604 - Manholes, Catch Basins, Inlets, Inspection Wells, Junction Chambers or Monuments.
- c. Item 613 - Low Strength Mortar Backfill.
- d. Item 642 - Traffic Paint

15. Ohio Manual of Uniform Traffic Control Devices.

1.2 DESCRIPTION OF WORK

- A. Under this section, the Contractor shall replace existing sections of sewers and/or manholes necessary to restore the capacity, structural integrity and functional capabilities of the sewer system. Minimum sewer repairs are six (6) feet in length and may be longer depending on the conditions encountered. Manhole replacement will include sufficient lengths of sewer to reconnect the pipe to the manhole. Defects that could require point repairs include but are not necessarily limited to:
 - 1. Partial collapse where the pipe has broken and threatens to block the flow.
 - 2. Broken or protruding tap-in connections that cannot be repaired or cut from within the sewer pipe.
 - 3. Utility relocation where a utility line may have been constructed through the sewer pipe.
 - 4. Manhole replacement where the structural condition is too deteriorated for rehabilitation.
 - 5. Service connection pipe replacement.
- B. Point repairs are normally performed in established urban areas where the construction work is an inconvenience to the residents, business owners and traveling public. Therefore, the means and methods to be employed by the Contractor and the conduct of the Contractor's employees are important to the Owner. Any means, methods, or employee used in the execution of Point Repair work that is too disruptive to the public in the opinion of the Owner shall be modified by the Contractor to the satisfaction of the Owner at no additional cost to the Owner.
- C. Any point repair work performed by the Contractor shall be scheduled such that the excavation will be backfilled within two (2) days of the start of the work, unless additional time is granted by the specifications or granted in writing by the Engineer.
- D. Sewer Point Repairs will only be performed and paid for when the work is authorized in writing by the Engineer.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of sanitary and/or storm system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with sanitary and/or storm work similar to that required for project.
- C. Codes and Standards:
 - 1. Plumbing Code Compliance: Comply with applicable portions of National Standard Plumbing Code pertaining to selection and installation of sanitary and/or storm system's materials and products.
 - 2. Environmental Compliance: Comply with applicable portions of local Environmental Agency regulations pertaining to sanitary and/or storm systems.
 - 3. Utility Compliance: Comply with applicable portions of protection, installation and/or inspection requirements for each utility encountered during the construction of the point repair.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for sanitary and/or storm system materials and products.
- B. Record Drawings: At project closeout, submit record drawings of installed sanitary and/or storm sewage piping and products, in accordance with requirements of Division 1.
- C. Submit a description of the equipment proposed for the control of the sewer grade. When requested, include catalog data describing the function and the conditions of operation of the equipment. The Engineer shall have the right to disapprove the use of the proposed equipment if in his opinion such equipment will not provide a reliable control system.

1.5 SUBSURFACE CONDITIONS

- A. The Contractor shall make whatever test holes he deems necessary to determine the subsurface ground conditions, including the presence of water and rock. No extra compensation shall be allowed the Contractor as the result of subsurface conditions encountered within the project. All proposed test holes shall be approved by the Owner prior to digging.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pipe, fittings, and specials shall be of the size and material being replaced.
 - 1. Vitrified Clay Pipe shall conform to ASTM C 700, with ASTM C 425 joints.
 - 2. Reinforced Concrete Pipe shall conform to ASTM C 76, with ASTM C 443 joints for sanitary sewers or ASTM C 990 joints for storm sewers.
 - 3. PVC pipe and fittings shall conform to ASTM D 3034, with ASTM D 3212 joints.

- B. Manholes shall be precast concrete and shall conform to ASTM C 478.
1. Joints between sanitary manhole sections shall conform to ASTM C 443. Flexible connections for sanitary pipes shall conform to ASTM C 923, "A-Lok" Type as manufactured by A-Lok Products; or an approved equivalent.
 2. Joints between storm manhole sections shall conform to ASTM C 990. Cut-out openings for connecting pipes shall be made immediately after the pipe is removed from the casting form.
 3. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in cones or flat slab tops and holes formed or cored in the adjusting rings to match bolt size and spacing specified for the manhole casting.
- C. Precast concrete collars shall conform to ASTM C 478.
- D. Mortar shall conform to specifications for mortar for Unit Masonry, ASTM C 270 Type S, containing no masonry cement.
1. Mortar shall be composed of one (1) part Portland cement, Type II, to two (2) parts sand by volume.
- E. Materials for nonshrinking grout shall conform to CRD-C "Corps of Engineers Specifications for Non-Shrink Grout". Approved products are "Sauereisen F-100 Grout" by Sauereisen Cements Co.; "Five Star Grout" by U.S. Grout Corporation; "Masterflow 713" by Master Builders; "Euco N-S" by Euclid Chemical Company.
- F. Manhole frames and covers shall comply with the type specified on the manhole typical detail.
1. Ferrous castings shall be of uniform quality free from blowholes, shrinkage or other defects.
 2. Metal shall conform to ASTM A 48, Class 35 for gray iron or ASTM A 536, Grade 65-45-12 for ductile iron.
 3. Castings shall be smooth and well cleaned by shot blasting.
 4. Castings shall be manufactured true to pattern.
- G. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.
- H. Other utility conduits, thrust blocks, and other appurtenances shall be of the size and kind being replaced or as approved by the governing utility company and the Engineer.
- I. Low Strength Mortar Backfill shall conform to ODOT 613.03 Type 2.

PART 3 - EXECUTION

3.1 GENERAL

- A. **Public Notification:** The Contractor shall notify nearby residents and business owners forty-eight (48) hours in advance of beginning each point repair. The notification shall briefly describe the work to be performed, state the reason for the work, provide emergency phone numbers, and give a time estimate as to when the work will be completed. The language of the notification shall be approved by the Engineer.
- B. **Utility Notification:** Before any excavation work is started, the Contractor shall call the "Ohio Utilities Protection Service", at 1-800-362-2764, 48 hours in advance of the work. Non-member utilities must be contacted directly. The Contractor shall take all necessary precautions, at no additional expense to the Owner, to avoid damage to existing underground and overhead utility lines during the entire project. In the event of damage to existing public and/or private utilities, the agency concerned shall be notified immediately and all repair work shall be executed in accordance with the specifications of the respective agency at no additional expense to the Owner, including any inspection fees or maintenance crews.
- C. **Inspection Scheduling:** The Contractor shall notify the Engineer forty-eight (48) hours in advance of beginning work which requires compaction testing. Work will not begin until testing and/or inspection arrangements have been completed and approved by the Engineer.
- D. **Blasting will not be permitted.**
- E. **Unauthorized Excavations:** All excavations made outside of the lines, grades and replacement limits established by the Engineer, including the excavation, handling, rehandling, backfilling and disposal of such material shall be performed at the Contractor's own expense. This shall include that work caused by cave-ins, slides, swellings or upheavals. All spaces beneath foundations of structures, utilities, pipes or other existing facilities shall be filled with concrete or other acceptable material.
- F. **Noise, Dust and Odor Control:** The Contractor's performance of this Contract shall be conducted so as to eliminate all unnecessary noise, dust and odors. Dust control shall be performed at the Contractor's own expense whenever directed by the Engineer.
- G. **The word "rock"** wherever used as the name of an excavated material, shall mean boulders and solid masonry larger than one-half cubic yard in volume, of solid ledge rock and masonry which, in the opinion of the Engineer, required for its removal drilling and blasting, wedging, sledging or barring, or breaking up with a power-operated hand tool. No soft or disintegrated rock which can be removed with a hand pick or power-operated excavator or shovel; no loose, shaken or previously blasted rock or broken stone in rock fillings or elsewhere; and no rock exterior to the minimum limits of measurement, which may fall into the excavation, will be measured or allowed when extra payment for rock excavation is set forth.

3.2 PREPARATORY WORK OUTSIDE PAVED AREAS

- A. The Contractor shall clear the work areas of all trees less than six (6) inch caliper, shrubs, hedges, plants and flowers as directed by the Engineer.
- B. Shrubs and hedge plants shall be set aside, appropriately stored, and replanted after backfilling the excavation. Any shrub or hedge plant that dies prior to expiration of the warranty period shall be replaced with new nursery stock.
- C. All refuse and rubbish shall be cleared from the work area and all tree stumps shall be grubbed out. All cleared material and stumps shall be removed from the work area and disposed of in a manner approved by the Engineer.
- D. After clearing, but prior to starting main excavations, the Contractor shall remove from the work area all loam, topsoil and sand found suitable for future top dressing or use.
- E. Such material shall be removed in such a manner that it is clearly separated from the underlying material and shall be stored in such a manner and location as directed by the Engineer.
- F. No extra compensation will be allowed the Contractor for Clearing and Grubbing.

3.3 PREPARATORY WORK WITHIN PAVEMENT AREAS

- A. The Contractor shall set up traffic control in accordance with Ohio Manual of Uniform Traffic Control Devices to the satisfaction of the Owner.
- B. The existing pavement shall be neatly saw cut, excavated and disposed of at a location approved by the Owner.

3.4 PROTECTION OF EXISTING UTILITIES

- A. Where existing utilities are indicated as being in the line of the point repair section, the Contractor shall carefully expose them so as to cause no damage to them or interruption of their intended use. Existing pipes or conduits crossing the sewer trench, or otherwise exposed shall be adequately braced and supported to prevent any disruption to the line or grade of the utility.
- B. The Contractor shall keep fire hydrants accessible at all times.
- C. Utility services broken or damaged shall be repaired at once to avoid inconvenience to customers. Storm sewers shall not be interrupted overnight. Temporary arrangements, as approved by the Engineer, may be used until any damaged items can be permanently repaired. All items damaged or destroyed by Point Repair construction must be subsequently repaired to the satisfaction of the governing utility company.

3.5 INSTALLATION

- A. Where the sewer is located adjacent to, or within any pavement area, the Contractor shall be required to maintain vertical sides on all trenches using full sheeting and bracing if necessary. Maximum top width of trench permitted under such conditions shall be four (4) feet, plus the inside diameter of the pipe unless otherwise specified on the plans or prior approval has been received from the Engineer. In no case will the Contractor be permitted to excavate pipe trenches with sides sloping to the bottom.
- B. All material excavated in trenching and all materials used in construction of the work shall be deposited so as not to endanger the work or create unnecessary annoyance to the public. During the progress of the work, all material piles shall be kept trimmed up and maintained in a neat workmanlike manner. Excavated material in excess of that needed for backfilling shall be disposed of in areas approved by the Owner.
- C. Construction shall be in accordance with ODOT Item 611 Pipe Culverts, Sewers and Drains, Manholes, Catch Basins, Inlets, Inspection Wells, Junction Chambers or Monuments with the following exceptions:
 - 1. Excavated soil suitable for reuse shall be stockpiled on plywood sheets or other suitable means which will prevent spillage of undesirable subgrade material onto the surrounding lawn area.
 - 2. Bedding material shall be crushed limestone only.
 - 3. Pipe lengths shall not be deflected at the joint to any greater degree than recommended by the manufacturer of the particular joint being used. All pipe deflections shall be performed only with the Engineer's approval.
 - 4. Under pavement areas, Low Strength Mortar Backfill Material shall be placed from the top of the bedding up to the bottom of the pavement. The excavation shall then be plated and reopened to traffic until the low strength mortar obtains sufficient strength to support vehicle loads. In no event shall traffic be permitted on Low Strength Mortar Backfill for less than forty-eight (48) hours after the trench has been backfilled.
 - 5. Near pavement areas, Low Strength Mortar Backfill Material shall be placed from the top of the bedding up to a depth equal to the distance from the edge of the pavement.
 - 6. Outside pavement influence areas, minimum compaction requirements shall be 100% of the maximum dry density of the backfill material.
- D. The replacement pipe shall be laid at a uniform grade between the two points of connection with the existing pipe using the equipment and methodology approved for the control of the sewer grade.

3.6 SERVICE CONNECTIONS

- A. In general, where service connections are in the point repair limits or as ordered, provision shall be made in the sewers for service connections by inserting a tilted-up "T" Branch for each service connection with a branch size equivalent to the existing connection where necessary, the Contractor shall construct a riser in such manner, that the top of the riser

shall meet and properly receive the existing service connection. Risers are to be encased in Low Strength Mortar Backfill Material.

- B. The Contractor shall connect the new tee or wye branch to the existing service lateral so as to provide a leak free serviceable connection to the building owner.

3.7 CLEANING SITE AND RESTORING DAMAGED SURFACES

- A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish to the satisfaction of the Engineer.
- B. Unless otherwise called for on the plans, the Contractor shall replace in-kind all damaged or disturbed pavement and sidewalks to a condition equal to or better than that existing before the work was started as a part of performing the Point Repair work. Concrete sidewalks and pavement shall be replaced in whole blocks.
- C. All restoration of lawns, planting beds, and shrubbery shall be performed in accordance with Sodding, Seeding and Mulching as a part of performing the Point Repair work. The Contractor shall maintain the lawn and correct any settlement that occurs during the one-year maintenance period.
- D. Upon completion of the foregoing work, all tools and other property belonging to the Contractor shall be removed, and the site shall be left in good condition.

3.8 TRAFFIC PAINT

- A. The Contractor shall replace all existing pavement markings in the style and at the locations that existed prior to this work. The Contractor shall make records of these markings as they exist and shall supply these records to the Engineer prior to the start of any work. In the absence of such documentation, the Owner's discretion shall prevail.

3.9 INSPECTION BEFORE ACCEPTANCE

- A. In addition to work being observed by the Engineer during construction, each section of sewer on which a point repair is made shall be inspected in accordance with Television Inspection before final acceptance by the Owner. The point repair shall be true to both line and grade, free from cracks, broken bells, and protruding joint materials and shall show no leaks. The hydraulics of the sewer shall be in no ways be impaired. There shall be no projections of connecting pipe into the sewer. Any deposits of sand, dirt, mortar, or other materials shall be removed from the pipe in accordance with Sewer Line Cleaning at no additional cost to the Owner.

- B. If, as the result of any inspection, before final acceptance of the work, it is found that any section of any sewer has unduly settled, that joints have opened up or when the jointing material has come loose and projects into the sewer, or if pipes or bells are found cracked, broken or misshaped beyond accepted standards, or if any other defects are found in the sewers or in any of their appurtenances which might impair the satisfactory performance of the sewer or which show non-conformance with the drawings or Specifications, the Contractor shall cause such effective or inferior work to be promptly removed and replaced or satisfactorily repaired by proper material and workmanship without extra compensation for the labor, equipment and materials required.

- C. Should the Engineer require that any work be uncovered because of suspected failure or non-conformance or for inspection or other cause, and if such work is subsequently found satisfactory, the cost involved for such work will be paid for at the unit price bid for the respective items of work involved.

END OF SECTION 330130.04

SECTION 330130.11 - SEWER TELEVISION INSPECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and Technical Specification sections apply to work of this section.

1.2 SUMMARY

- A. The Contractor shall clean the sewer and trap all debris downstream for removal off-site. The Contractor may not flush the debris downstream in the sewer system.
- B. After cleaning, the manhole sections and individual lateral service lines shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section and/or one lateral line at a time. Final acceptance of the sewer will be given only after the DVD(s) are reviewed and approved by the Engineer.

1.3 QUALITY ASSURANCE

- A. The television inspection shall be done by a responsible commercial firm known to be skilled and regularly engaged in the business of sewer color DVD documentation. The firm shall furnish such information as the Owner deems necessary to determine the ability of that firm to perform the work in accordance with these specifications.

1.4 SUBMITTALS

- A. Submit a sample DVD of a television inspection similar to this project to verify picture and audio quality. When approved, this DVD will be the standard on which quality will be based and judged.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EQUIPMENT

- A. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative.

- B. The DVD with audio shall provide the highest quality picture and sound that is capable of being played back on conventional equipment **without special software**.

3.2 PROCEDURE

- A. Prior to televising, the sewer shall be charged with water until it begins to discharge at the downstream end so any depressions and low points that may be in the sewer will be filled.
- B. The camera will be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. The Contractor's CCTV equipment shall be utilized to remotely to televise the inside of the existing sanitary sewer laterals via access at each lateral's wye fitting to the main.
- C. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two (2) manholes of the section being inspected to insure good communications between members of the crew.
- D. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Engineer.
- E. The following information shall be provided on the DVD:
 - 1. The beginning of each DVD shall contain: project name, contract number, Contractor's name, firm doing filming, date of televising, manhole numbers or sections televised, direction of flow, location, distance between manholes, and distance to wyes, laterals televised with street number, and total tape counter number for the end of the DVD. The DVD counter shall be set at zero at the beginning of the DVD.
 - 2. The beginning of each section of pipe shall have a narrative describing; street locations, the manhole numbers and stationing at the beginning and end of this section, which direction the camera is traveling, the condition of the beginning manhole, size and material of pipe, and plan length of this section of pipe. Manhole numbers (from-to) shall be continuously displayed along with footage.
 - 3. During televising of each pipe section, there shall be a brief report as to findings, such as service connections, defects in pipe, water infiltration, dips in the line, debris, mud, etc. The footage of the finding from the beginning manhole shall also be called out.

4. The end of each section of pipe shall have a narrative describing; the as-built length of this pipe section center-to-center of manholes, the length of the pipe between joints, the overall condition of the pipe, the manhole number and stationing at the end of the section, and the condition of this manhole.
- F. The DVD shall be accompanied by a video log report. The format of the report shall be approved by the Engineer. The report shall contain a table of contents and a separate report page for each section of pipe between manholes or structures, or between a manhole and the end of a run of pipe.
- G. While the Engineer may have a representative on-site during televising, a separate review of the DVD(s) will be performed within ten (10) working days of receipt of the DVD(s). DVD recording playback shall be at the same speed as it was recorded. Slow motion and stop motion playback features shall be supplied.

END OF SECTION 330130.11

SECTION 330130.17 - TELEVISION INSPECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications, apply to work of this section.
- B. Other Sections Referenced:
 - 1. Section 330130.01 - Sewer Collection System Rehabilitation
 - 2. Section 330130.02 - Sewer Line Cleaning
 - 3. Section 330130.03 - Sewer Flow Control

1.2 DESCRIPTION OF WORK

- A. After cleaning or when otherwise specified, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time and the flow in the section being inspected will be suitably controlled.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Equipment Data: Submit equipment manufacturer's technical data and operation instructions for the televising and recording equipment to be used.
- B. Product Data: Submit brand name and specifications of video tape to be used for the recording of the televising data.
- C. Report: Submit sample televising log report for review and approval of content and format.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative, and if unsatisfactory, equipment shall be removed and no payment will be made for an unsatisfactory inspection.

2.2 MATERIAL

- A. CD-Rs (Read only) 650MB or DVD-Rs (Read Only) 4.7GB meeting the requirements of the ISO 9660 standard. CDs may be used to submit digital photos and inspection reports in JPEG format, while DVDs may be used to submit video recordings in MPEG format, and digital photos and inspection reports in JPEG format. Digital video and pictures may also be submitted on a flash drive.
- B. Copies of proprietary software (Read only) that may be necessary to view video and inspection reports concurrently shall be provided to the Engineer at no additional cost.

2.3 EQUIPMENT

- A. The television camera used for the inspection shall be one specifically designed and constructed for such closed-circuit sewer pipe inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera shall televise and transmit the image in color and shall have pan and tilt capabilities.
- B. The propulsion system for large diameter pipes shall be either a transporter, skid and winch arrangement, or with special approval from the Owner, a floatation device as recommended by the equipment manufacturer.
- C. The recording system shall be Digital utilizing high end industrial grade computer system with a shuttle cartridge, both with the capability for annotating and narrating the video image, and for producing digital photographs (JPEG format) or MPEG snippets of the video image.

PART 3 - EXECUTION

3.1 PROCEDURE

- A. Normally, the camera will be set up in the upstream manhole. Where the setup causes the camera lens to be positioned a distance upstream or downstream of the manhole wall, the operator shall make a visual observation of that portion of the sewer pipe not captured on the video tape and record the observations by voice over on the video tape.
- B. The height of the camera shall be adjusted so that the lens is at the center of the pipe.
- C. The camera will be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

- D. The camera will be moved to the far manhole and the recording shall show the condition of the manhole trough. The operator shall make a visual observation of the far manhole. Connecting pipes and manhole defects not captured on the video shall be recorded by voice over on the video tape and written in the television inspection log.
- E. Connections to the sewer shall be televised using the pan and tilt capabilities of the camera. The pan and tilt motion shall be a smooth transition from the mainline pipe to the connection with the camera remaining in an upright (12:00) position. Once the camera is viewing in the direction of the connection, the camera head may be rotated to enhance the view. Spiral rotation of the camera head as it approaches a connection is prohibited. The operator should also avoid 360 degree rotations when returning the camera to its "home: position. The camera shall be positioned in the sewer at a location which maximizes the sight distance up the connecting pipe. The acceptable length of televising shall be a distance of 6 feet, or to the end of the pipe (if capped), or to the first bend (if a wye).
- F. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall perform a reverse setup (set up his equipment so that the inspection can be performed from the opposite manhole). If, again, the camera fails to pass through the entire manhole section, the manhole section will be referred to the Engineer for evaluation.
- G. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two manholes of the section being inspected to insure good communications between members of the crew.
- H. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be by means of a footage counter with the value displayed on the video tape. The footage counter shall be set such that zero is the center of the beginning manhole. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the footage counter shall be checked above ground by use of a walking meter, roll-a-tape, or other suitable device. The footage counter shall be calibrated to an accuracy of +/- ½ foot or that which is satisfactory to the Engineer.
- I. Documentation of the television results shall be as follows:
 - 1. Television Inspection Logs: Electronically produced location records may be integrated with the video file or may be a stand-alone JPEG file. Electronic copies shall be kept by the Contractor and will clearly state a description of the location in relation to an adjacent manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, sewer connections, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to the Owner. Each feature called out on the inspection log shall be identified as to its location on the video by means of a footage counter. The television inspection log shall be named (if not integrated with the video) to reflect the corresponding manhole section.

2. Digital Video Recordings: The purpose of the digital recording shall be to supply a permanent audio/visual documentation of the sewer system and its structural condition that may be replayed at a later date. Digital video recording playback shall be at the same speed that it was recorded. All the standard motion playback features (such as those available in a Windows operating system and in accordance with ISO 9660) shall be incorporated.

END OF SECTION 330130.17

SECTION 330130.18 - SEWER LINE TELEVISION AND LATERAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 SUMMARY

- A. The Contractor shall perform sufficient tests to determine which house lateral to connect to the new sanitary sewer. For the purpose of this specification, all existing laterals which will be cut by the mainline sewer trench will be called "intercepted laterals". All laterals not cut by the mainline sewer trench will be called "far-side laterals".

1.3 JOB CONDITIONS

- A. In the course of excavation, the Contractor will intercept storm and sanitary laterals.
- B. The Contractor shall determine which laterals are storm and which are sanitary.
- C. The Contractor shall televise the sewers to determine which laterals are storm and which are sanitary.
 - 1. The video cassette tape shall be narrated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The recorded media shall be DVD.
- B. The following dye may be used:
 - 1. Fluorescent yellow/green

PART 3 - EXECUTION

3.1 INTERCEPTED LATERALS

- A. During the excavation of the mainline sewer trench, all intercepted storm and sanitary laterals shall be exposed in the mainline sewer trench.

- B. The Contractor shall perform a downspout test at each house, running water in each downspout for a sufficient amount of time to produce a stream of water at one or more of the exposed laterals in the trench.
- C. If the homeowner is on the premises, she or he shall be instructed not to use any water during the testing procedure and the Contractor shall perform a toilet flush test using dyed water to help determine which exposed lateral in the mainline trench is the sanitary lateral.
- D. Based on downspout and toilet flush testing results, a sanitary lateral shall be chosen to the satisfaction of the Engineer and connected to the new sanitary sewer.
- E. Storm laterals shall be reconnected across the mainline sewer trench.

3.2 FAR-SIDE LATERALS

- A. Prior to construction, the Contractor shall simultaneously televise and narrate on VHS video cassette tapes both the storm and sanitary sewers, stopping the camera at every far-side lateral connection. With the camera properly positioned at each lateral connection, a downspout test shall be performed on the house tributary to that lateral connection. The Contractor shall run water in each downspout for a sufficient amount of time to either produce a stream of water flowing from the connection or no water whatsoever.
- B. If the homeowner is on the premises, she or he shall be instructed not to use any water during the testing procedure. Without moving the camera from the lateral connection where the downspout test was just performed, the Contractor shall perform a toilet flush test, using enough water to prove beyond reasonable doubt that the lateral being tested is or is not the sanitary lateral.
- C. Video cassettes shall be examined by the Contractor. The Contractor shall determine which laterals are the sanitary laterals.
- D. During construction, the Contractor shall excavate the far-side treelawn at the location of the sanitary lateral as determined by him from the televising and testing results.
- E. The Contractor shall verify that the excavated lateral is the sanitary lateral by performing a dyed-water toilet flush test if the homeowner is on the premises. If the homeowner is not on the premises, the Contractor shall perform a downspout test while checking the excavated lateral to be assured that no downspout test water is present.
 - 1. If the excavated lateral passes the downspout/toilet flush tests to the satisfaction of the Engineer, the Contractor shall connect the excavated lateral to the new sewer.
- F. If the excavated lateral does not pass the downspout/toilet flush test to the satisfaction of the Engineer, this excavating and testing procedure shall be continued by the Contractor until an excavated lateral passes the downspout/flush tests to the satisfaction of the Engineer. Only at this time can the connection to the new sewer be performed.

G. The Contractor shall reconnect all storm lateral connections across the excavation.

END OF SECTION 330130.18

SECTION 330130.61 - SEWER PIPE JOINT SEALING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. Other Sections Referenced:
 - 1. Section 330130.01 - Sewer Collection System Rehabilitation
 - 2. Section 330130.02 - Sewer Line Cleaning
 - 3. Section 330130.03 - Sewer Flow Control
 - 4. Section 330130.17 - Television Inspection
 - 5. Section 330130.13 - Sewer Pipe Joint Testing
 - 6. Section 330130.63 - Chemical Sealing Materials

1.2 DESCRIPTION OF WORK

- A. A two-part chemical sealing material will be injected into the pipe joint. The chemicals will react to form a gelatinous material within and on the outside of the pipe. This gel will act as a flexible gasket to seal the joint and prevent groundwater from entering the pipe. An additive will be added to inhibit root growth through the gel material.
- B. It is the intent of the sewer pipe joint sealing work to seal all sewer pipe joints utilizing an internal joint sealing method. It is realized that this method may only be used on sewer pipe sections in sound physical condition. Longitudinally cracked or broken pipe will not be sealed. When bell cracks or chips are evident from pipe section offset, sealing may be undertaken where the offset is small enough to allow proper seating of the sealing packer on both sides of the joint to be sealed.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.
- B. Submit Material Safety Data Sheets for the chemicals used in the grout and root inhibitor.
- C. Equipment Data: Submit equipment manufacturer's technical data and operating instructions for the joint packing equipment to be used.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be of a type that has been in general use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.

2.2 MATERIAL

- A. Grout: The sealing material shall be formed from a two-part chemical grout that is mixed within the void area formed by the grouting packer. (See Chemical Sealing Materials).
- B. Root Inhibitor: A root inhibitor, such as dichlobenil or approved equal, shall be incorporated into every batch of grout.

2.3 EQUIPMENT

- A. The basic equipment shall consist of a television inspection system, necessary chemical sealant containers, pumps, regulators, valves, hoses, etc., and joint sealing packers for the various sizes of sewer pipes.
 - 1. The equipment shall be constructed in such a way as to provide means for introducing the sealing materials, under pressure, into the void area created by the expanded ends of the joint-testing device and means for continuously measuring the actual static pressure of the materials at and within the void area only.
 - 2. Void pressure data shall be transmitted to the televising recording equipment via an electrical pressure transducer located at the void.
 - 3. The recording equipment shall be capable of recording on the video tape the manhole section being tested, the footage from the beginning manhole, and a real-time image of the void pressure.
- B. Sealing equipment shall be housed in a suitable vehicle and arranged to allow for continuous observation of the television monitor and sealing equipment by the Engineer and three (3) other representatives of the Owner.

- C. The packer shall be cylindrical and have a diameter less than the pipe size and have cables attached at each end to pull it through the line. The packer device shall be constructed in a manner to allow a restricted amount of sewage to flow. Generally, the equipment shall be capable of performing the specified operations in lines where flows do not exceed the maximum line flows for joint testing/sealing (see Sewer Flow Control).
- D. The pumping unit, metering equipment, and the packer device shall be designed so that the proportions and quantities of materials can be regulated in accordance with the type and size of the leak being sealed.
- E. The equipment shall be manufactured of materials suitable for the addition of the root inhibitor.

PART 3 - EXECUTION

3.1 PREPARATORY WORK

- A. Prior to sealing a section of sewer, the pipe shall be cleaned and the flow controlled to enable a suitable depth for the sealing equipment (see Sewer Line Cleaning and Sewer Flow Control). The cost of this work shall be considered incidental to Sewer Pipe Joint Sealing and included in the price bid thereof.
- B. Root inhibitor shall be stored on the vehicle in unit doses (one dose per each batch of sealing material). Prior to starting the project, root inhibitor shall be transferred from bulk containers to individual containers. Bulk containers shall not be stored on the vehicle. Each dose shall be contained in a sealed container which shall not be opened until just prior to its inclusion in the batch.

3.2 JOINT SEALING PROCEDURE

- A. All joints, leaks or breaks shall be sealed. Sealing shall be accomplished by forcing the chemical sealing materials into or through joints, leaks or breaks by a system of pumps, hoses, and sealing packers.
- B. Jetting or driving pipes from the surface that could damage or cause undermining of the pipe lines shall not be allowed. Uncovering the pipe by excavation of pavement and soil (which would disrupt traffic, undermine adjacent utilities and structures, and cause further damage to the pipe lines being repaired) shall not be allowed.
- C. The packer shall be positioned over each joint, leak or break by means of a closed-circuit television camera in the line. It is important that the procedure used by the Contractor for positioning the packer be accurate to avoid over pulling the packer and thus not effectively sealing (grouting) the intended defect.
- D. The packer ends (end elements, sleeves) shall be expanded using controlled pressure. The expanded ends shall seal against the inside periphery of the pipe to form a void area at the joint, now completely isolated from the remainder of the pipe line.

- E. Into this isolated area, sealant materials shall be pumped through the hose system at controlled pressures which are in excess of groundwater pressures.

3.3 SEAL VERIFICATION

- A. Upon completion of the sealing of each individual joint, leak or break, the packer shall be deflated until the void pressure meter reads zero pressure, then reinflated and the joint retested as specified (see Sewer Pipe Joint Testing). The cost of this testing shall be included in the cost of Sewer Pipe Joint Sealing.
- B. Should the void pressure meter not read zero, the Contractor shall clean his equipment of residual grout material or make the necessary equipment repairs/adjustments to produce accurate void pressure readings.
- C. Joints that fail to meet the specified test criteria shall be resealed and retested until the test criteria can be met in order to receive payment.

3.4 RESIDUAL SEALING MATERIAL

- A. Residual sealing materials that extend into the pipe, reduce the pipe diameter, or restrict the flow shall be removed from the joint. The sealed joints shall be left reasonably "flush" with the existing pipe surface.
- B. If excessive residual sealing materials accumulate in the line and/or if directed by the Engineer the manhole section shall be cleaned to remove the residual materials. In no case shall excess grout material be flushed down the sewer.

3.5 RECORDS

- A. Videotape records shall be kept of the joint sealing performed in each manhole section. The following information shall be recorded on the videotape:
 - 1. Identification of the manhole section sealed.
 - 2. The footage location of each joint sealed, measured from the upstream manhole.
 - 3. Void pressure continuously recorded throughout the joint sealing procedure.
 - 4. Number of gallons of sealant used.
 - 5. A verbal statement indicating the sealing results (passed or failed) for each joint sealed.
 - 6. If a joint is not grouted, a verbal statement indicating the reasons for not sealing the joint.
- B. Written records also shall be kept of joint sealing performed in each manhole section. Written records shall include:
 - 1. Identification of the manhole section sealed.
 - 2. The footage location of each joint sealed, measured from the upstream manhole.
 - 3. Sealing pressure at refusal.
 - 4. Number of gallons of sealant used.

5. A statement indicating the sealing results (passed or failed) for each joint sealed.
- C. The complete sealing of each joint, leak or break shall be recorded on the video tape from the beginning of the pressure buildup in the void, through the pressure holding period, to the time of pressure release.
- D. A copy of the written records and title to the videotape records shall be given to the Owner prior to payment for Sewer Pipe Joint sealing.

3.6 GUARANTY

- A. All sewer pipe joint sealing work performed shall be guaranteed against faulty workmanship and/or materials for a period of one year after the completion of the work.
 1. Prior to the expiration of the guaranty period, an initial retest area consisting of specific manhole sections shall be selected by the Engineer/Owner. Manhole sections to be retested shall be randomly selected throughout the project area and shall be representative of the majority of the sealing work originally performed. The initial test area shall consist of at least 5%, but not exceed 10%, of the linear feet contained in the original project.
 2. Within the initial retest area, the Contractor shall retest all previously sealed joints as specified (see Sewer Pipe Joint Testing). Any joints failing the retest shall be resealed. If the failure rate of the retested joints is less than 1% of the joints retested, the work shall be considered satisfactory and no further retesting will be required. Payment for retesting the initial area shall be at the unit price bid for each item of work required (e.g.: cleaning, TV inspection, testing, etc.). No compensation shall be provided for resealing (grouting) joints that fail.
 3. If, in the initial retest area, the failure rate of the retested joints exceeds 1% of the joints retested, an additional retest area of equivalent size shall be selected and all previously sealed joints shall be retested. This additional testing and sealing, if necessary, will continue until a failure rate of less than 1% is met. Any additional testing/sealing required beyond the initial retest area shall be accomplished at no cost to the Owner.
 4. Should as much as 25% of the original project be retested and fail to meet the 1% requirement, the Contractor will be required to provide the same number of crews as utilized in the original project so that the retesting will proceed at a more rapid rate.

END OF SECTION 330130.61

SECTION 330130.63 - CHEMICAL SEALING MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. Other Sections Referenced:
 - 1. Section 330130.61 - Sewer Pipe Joint Sealing

1.2 DESCRIPTION OF WORK

- A. The intent of this section is to define the properties that a sealing material must have to perform effectively in the intended application and under expected field conditions.
- B. Generic chemical sealing materials currently in use are listed with the basic properties, performance standards, and mix ratios which are known to give acceptable performance.
- C. It is recognized that new and improved chemical sealing materials will become available from time to time. Sources, manufacturers, and product names of chemical sealing materials will thus change from time to time and therefore specific sources, manufacturers, and product names are not referred to in this specification.
- D. It should be understood that all of the generically classified chemical sealing materials can achieve desired long-lasting results when used in the proper application and properly applied. The knowledge and skill of the applicator has a greater effect on achieving the desired results than the specific sealing material applied.
- E. In every case, mixing and handling of chemical sealing materials shall be in strict accordance with the manufacturer's recommendations.

1.3 QUALITY ASSURANCE

- A. All chemical sealing materials used in the performance of the work specified must have the following properties and characteristics:
 - 1. While being injected, the chemical sealant must be able to react/perform in the presence of water.
 - 2. The cured material must be capable of withstanding submergence in water without degradation.
 - 3. The resultant sealant formation must prevent the passage of water.
 - 4. The sealant material, after curing, must be flexible as opposed to brittle or rigid.
 - 5. In place, the resultant sealant formation should be able to withstand freeze/thaw and wet/dry cycles without adversely affecting the seal.

6. The sealant formation must not be biodegradable. Additives may be used to meet this requirement.
7. The cured sealant should be chemically stable and resistant to concentrations of acids, alkalis, and organics found in normal sewage.
8. Packaging of component materials must be compatible with field storage and handling requirements. Packaging must provide for worker safety and minimize spillage during handling.
9. Mixing of component materials must be compatible with field operations and not require precise measurements.
10. Clean-up must be done without inordinate use of flammable or hazardous chemicals.
11. Residual sealing materials must be removable from the sewer after injection to insure no flow reduction, restriction, or blockage of normal sewage flows.

PART 2 - PRODUCTS

2.1 CHEMICAL SEALING MATERIALS

- A. The following is a generic listing of chemical sealing materials currently in use and the basic requirements, properties and characteristics of each:
 1. Acrylamide base gel chemical sealing material requirements, properties and characteristics:
 - a. A minimum of ten percent (10%) acrylamide base material by weight in the total sealant mix. A higher concentration of acrylamide base material may be used, when desirable, to increase strength or offset dilution during the induction period.
 - b. The ability of tolerate some dilution and react in moving water during the induction period.
 - c. A viscosity of approximately two (2) centipoise which can be increased with additives.
 - d. A constant viscosity during the induction period.
 - e. A controllable reaction time (induction period) from ten (10) seconds to one (1) hour.
 - f. A reaction (curing) which produces a homogeneous, chemically stable, nonbiodegradable, firm, flexible gel.
 - g. The ability to increase mix viscosity, density and gel strength by the use of additives, e.g.: diatomaceous earth.
 2. Urethane base foam chemical sealing material requirements, properties and characteristics:
 - a. Approximately one (1) part of urethane prepolymer thoroughly mixed with one (1) part of water by weight (50% prepolymer).
 - b. A liquid prepolymer having a solids content of eighty-two percent (82%) to eighty-eight (88%), specific gravity of 1.1 (9.15 pounds per gallon), and flash point of 20°F.

- c. A liquid prepolymer having a viscosity of 300 to 500 centipoise at 72°F that can be pumped through 500 feet of one-half (1/2) inch hose with a 500 psi head at a one (1) ounce/second flow rate.
 - d. A cure time of 15.0 minutes at 40°F, 8.2 minutes at 70°F, and 4.6 minutes at 100°F when the prepolymer is reacted with water only.
 - e. A cure time of 5.5 minutes at 40°F, 3.5 minutes at 70°F, and 2.6 minutes at 100°F when the prepolymer is reacted with water containing 0.4% accelerator.
 - f. During injection; foaming, expansion, and viscosity increase take place.
 - g. Physical properties of the cured foam of approximately; fourteen (14) pounds per cubic foot density, 80 to 90 psi tensile strength, and 700% to 800% elongation when a mixture of fifty percent (50%) prepolymer and fifty percent (50%) water undergoes a confined expansion to five times its initial liquid volume.
3. Urethane base gel chemical sealing material requirements, properties and characteristics:
- a. One (1) part prepolymer thoroughly mixed with between five (5) and ten (10) parts of water by weight. The recommended mix ratio is one (1) part urethane prepolymer to eight (8) parts of water (11% prepolymer).
 - b. A liquid prepolymer having a solids content of seventy-seven percent (77%) to eighty-three percent (83%), specific gravity of 1.04 (8.65 pounds per gallon), and flash point of 20°F.
 - c. A liquid prepolymer having a viscosity of 600 to 1200 centipoise at 70°F that can be pumped through 500 feet of one-half (1/2) inch hose with a 1000 psi head at a one (1) ounce/second flow rate.
 - d. The water used to react the prepolymer should be in the pH range of five (5) to nine (9).
 - e. A cure time of eighty (80) seconds at 40°F, fifty-five (55) seconds at 60°F, and thirty (30) seconds at 80°F when one (1) part prepolymer is reacted with eight (8) parts of water only. Higher water ratios give longer cure times.
 - f. A cure time that can be reduced five (5) to ten (10) seconds for water temperatures of 40°F to 80°F when one (1) part prepolymer is reacted with eight (8) parts of water containing gel control agent.
 - g. A relatively rapid viscosity increase of the prepolymer/water mix. Viscosity increases from about ten (10) to sixty (60) centipoise in the first minute for one (1) to eight (8) prepolymer to water ratio at 50°F.
 - h. A reaction (curing) which produces a chemically stable, nonbiodegradable, tough, flexible gel.
 - i. The ability to increase mix viscosity, density, gel strength and resistance to shrinkage by the use of additives to the water.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 330130.63

SECTION 330130.64 - SEWER MANHOLE REHABILITATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Other documents which shall be considered part of and included in these specifications
 - 1. ASTM A 48 - Specification for Gray Iron Castings.
 - 2. ASTM A 240 - Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
 - 3. ASTM A 536 - Specification for Ductile Iron Castings.
 - 4. ASTM A 615 - Steel Reinforcing Bar.
 - 5. ASTM C 32 - Specification for Sewer and Manhole Brick (Made from Clay or Shale).
 - 6. ASTM C 78 - Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
 - 7. ASTM C 109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).
 - 8. ASTM C 270 - Specification for Mortar for Unit Masonry.
 - 9. ASTM C 321 - Test Method for Bond Strength of Chemical-Resistant Mortars.
 - 10. ASTM C 478 - Specification for Precast Reinforced Concrete Manhole Sections.
 - 11. ASTM C 496 - Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
 - 12. ASTM C 579 - Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacing.
 - 13. ASTM C 596 - Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
 - 14. ASTM C 923 - Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
 - 15. ASTM D 638 - Test Method for Tensile Properties of Plastics.
 - 16. ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics.
 - 17. ASTM D 790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 18. ASTM D-4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Material
 - 19. ASTM D2566 - Test Method for Linear Shrinkage of Cured Thermosetting Casting Resins During Cure.

1.2 DESCRIPTION OF WORK

- A. Sewer manhole rehabilitation will repair deteriorated manholes and remove infiltration leaking into the sewer system. These manholes are of the brick or concrete block type. The work includes one or more of the following items.
 - 1. Structural rehabilitation of manhole bases and walls.
 - 2. Sealing of manhole walls, bases, and pipe connections.
 - 3. Removal and replacement of select steps found to be missing or loose.
- B. The manholes in this contract requiring rehabilitation work are illustrated on the map enclosed at the end of the Project Manual.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application and installation instructions for each proposed product.
- B. Measurements: Submit a sufficiently detailed list of measurements necessary for each rehabilitation product being used on the project.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be of a type that has been generally been in use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.

2.2 MANHOLE WALL STRUCTURAL REHABILITATION AND SEALING

- A. Severe active leaks shall be stopped with a cementitious grout or Strong-Seal Grout 250, Strong-Seal Grout 1000, 3M Scotch-Seal Chemical Grout 5600 or an approved equivalent. The type of grout to be used shall be compatible with the manhole rehabilitation system and approved by the Engineer. Cementitious grout shall meet the following requirements:
 - 1. Compressive Strength (ASTM C-579B): 1 day, 50 psi; 28 day, 250 psi.
- B. Minor leaks shall be stopped with ThoRoc Plug, IPA Ipanex-R, Strong-Seal Strong Plug, Vandex Plug, or an approved equivalent, which shall meet the following requirements:

1. Compressive Strength (ASTM C-579B): 1 hr., 600 psi; 24 hr., 1,000 psi.
 2. Bond (ASTM C-321): 1 hr., 30 psi; 24 hr., 80 psi.
- C. Patching mix shall be ThoRoc Patch, IPA Octocrete, Strong-Seal QSR, Vandex Uni Mortar 1Z, or an approved equivalent, which shall meet the following requirements:
1. Compressive Strength (ASTM C-579B): 15 min., 200 psi; 6 hr., 1,400 psi.
 2. Shrinkage (ASTM C-596): 0.1% @ 90% Relative Humidity.
 3. Bond (ASTM C-321): 28 day, 150 psi.
 4. Cement: Sulfate resistant.
 5. Applied Density: 98 to 110 pcf.
- D. Structural lining shall be either a cementitious-based product, a urethane resin based material, a cast-in-place seamless plastic lined wall, or an approved equivalent, which shall meet the following requirements:
1. Strong-Seal type MS-2A, Quadex QM-1s, for no or very mild sulfide conditions pH>3.0:
 - a. Compressive Strength (ASTM C109): 28 day, 6,000 psi
 - b. Tensile Strength (ASTM C496): 90 day, 600 psi
 - c. Flexural Strength (ASTM C78): 90 day, 700 psi
 - d. Shrinkage (ASTM C-596): 28 day, 0% @ 90% Relative Humidity.
 - e. Bond (ASTM C-321): 28 day, 130 psi.
 - f. Applied Density: 115 to 140 pcf.
 - g. Cement: Type I or Type III Portland Cement.
 2. AP/M Permaform Permacast CR-5000, Quadex Aluminaliner, Strong-Seal type MS-2C, or an approved equivalent for mild sulfide conditions pH>2.0:
 - a. Compressive Strength (ASTM C109): 28 day, 5,000 psi
 - b. Tensile Strength (ASTM C496): 90 day, 580 psi
 - c. Flexural Strength (ASTM C78): 90 day, 700 psi
 - d. Shrinkage (ASTM C-596): 28 day, 0% @ 90% Relative Humidity.
 - e. Bond (ASTM C-321): 28 day, 130 psi.
 - f. Applied Density: 115 to 125 pcf.
 - g. Cement: Calcium Aluminate Cement.
 3. Lafarge SewperCoat 2000 HS for harsh sulfide conditions in sanitary sewers:
 - a. Compressive Strength (ASTM C109): 28 day, 9,000 psi
 - b. Tensile Strength (ASTM C496): 90 day, 800 psi
 - c. Flexural Strength (ASTM C78): 90 day, 1,200 psi
 - d. Shrinkage (ASTM C-596): 28 day, 0% @ 90% Relative Humidity.
 - e. Bond (ASTM C-321): 28 day, 130 psi.
 - f. Applied Density: 145 to 155 pcf.
 - g. Content: Calcium Aluminate Cement and fused calcium aluminate aggregate.

4. Sprayroq SprayWall Urethane Resin Material:
 - a. Compressive Strength (ASTM D695): 10,500 psi
 - b. Tensile Strength (ASTM D638): 5,000 psi
 - c. Flexural Strength (ASTM D790): 10,000 psi
 - d. Shrinkage (ASTM D2566): 0.5%
 - e. Bond: > tensile strength of substrate
 - f. Flexural Modulus (ASTM D790): 550,000 psi.
 - g. Applied Density: 81 pcf
 - h. Chemical resistance to:

Hydrogen Sulfide	20%
Sulfuric Acid	17%
Nitric Acid	5%

5. AP/M Permaform cast-in-place manhole systems with Amer-Plate 95Y T-Lock white, high-polymer, vinyl chloride sheeting erected and installed per the manufacturers instructions.
 - a. Concrete Compressive Strength: 4,000 psi
 - b. Sheeting thickness: 0.065 inch

- E. Wall coatings shall be as specified in the Schedule of Work and/or Detailed Drawings, and shall be either a cementitious-based product, epoxy, fiberglass, polyurea, urethane resin based material, or an approved equivalent:
 1. Cementitious coatings shall be IPA Drycon, or Xypex Chemical Corp. Xypex Concrete Waterproofing by Crystallization, Vandex Super, or an approved equivalent.
 2. Epoxy coatings shall be Fosroc Epoxy Liner HBS100, or an approved equivalent and have chemical resistance to 10% Sulfuric Acid.
 3. Fiberglass linings shall be FiberLine System, or an approved equivalent.
 4. Polyurea coatings shall be Caraylon Spray-Seal or an approved equivalent.
 5. Urethane coatings shall be Sprayroq Spray-Wall or an approved equivalent.

2.3 MANHOLE CHANNEL AND SHELF

- A. Concrete for channel and shelf construction shall be 2,500 PSI and made with limestone aggregate and Portland cement, Type II.

2.4 MANHOLE STEPS

- A. Utilize new steps by MA Industries Model No. PS2-BG, or approved substitute designed for brick or block manhole structures.

PART 3 - EXECUTION

3.1 MEASUREMENTS

- A. The Contractor shall make all field measurements necessary to supply and install properly sized products.
- B. Prior to construction, the Engineer shall meet with the Contractor at each existing manhole site to prepare a final list of rehabilitation item quantities and measurements.

3.2 MANHOLE WALL STRUCTURAL REHABILITATION AND/OR SEALING

- A. Prior to any other work inside a manhole, all interior wall and invert surfaces shall be cleaned and prepared.
 - 1. Place covers over all pipe openings to prevent extraneous material from entering the sewer system.
 - 2. Cleaning shall be accomplished by water blasting using a minimum 1,500 psi water pressure. Existing incompatible or poorly bonded coatings, curing compounds, toppings, waxes, oils and greases shall be removed in a manner compatible with the rehabilitation system to be used.
 - 3. When appropriate for the rehabilitation system, a ten percent (10%) muriatic acid solution may be applied by spraying from above the manhole.
 - a. After the acid solution is used, the surface shall be thoroughly washed and allowed to dry.
 - b. Mixing, application, removal, and safety precautions shall be done in strict accordance with the manufacturer's specifications and recommendations.
 - 4. All material resulting from the cleaning and preparation operation shall be removed from the manhole being cleaned and disposed of by the Contractor in a manner approved by the Engineer.
- B. Visible leaks shall be sealed with the approved rapid setting product.
 - 1. The surfaces shall be prepared in accordance with the manufacturer's instructions prior to application of the sealing material.
 - 2. The sealing material shall be mixed and applied in strict accordance with the manufacturer's instructions.
 - 3. When necessary, 5/8-inch diameter temporary weep holes may be drilled in the wall to divert water from the flowing leak until it is sealed. After the leak has been sealed, the temporary weep holes shall be sealed in the same manner as flowing leaks.
- C. Patching, filling of voids, and smoothing out of the interior walls shall be performed with the approved products.

1. All cracked, loose, or disintegrating material shall be removed from the source to expose a sound substrate.
2. The material shall be mixed and applied in strict accordance with the manufacturer's instructions.

D. Manhole wall rehabilitation shall be applied with the approved products.

1. Contractor shall prepare the surfaces as necessary to assure the specified bonding strength.
2. Product shall be applied when ambient temperatures are within the manufacturer's specified range.
3. Rehabilitation material shall be mixed and applied in strict accordance with the manufacturer's instructions.
4. Product shall be applied uniformly to the walls and manhole shelf to form a monolithic liner.
 - a. Work shall be performed by a manufacturer's licensed installer or under the direct supervision of an experienced manufacturer's representative approved by the Engineer.
 - b. Product shall be sprayed under sufficient pressure to achieve the specified density.
 - c. The thickness of the liner shall be measured in a manner acceptable to the Engineer.
 - d. Thickness of any layer shall not exceed the manufacturer's recommendations.
5. Product shall be applied to the thickness specified in the Contract documents.

E. Surface sealing shall be performed with the approved products.

1. The manhole surfaces shall be prepared in accordance with the manufacturer's directions.
2. Surface sealing material shall be applied in strict accordance with the material manufacturer's recommendations. Epoxy coatings shall be applied in a minimum of two layers with the second coat being applied after the first coat has dried.
3. The thickness of the applied material shall be in accordance with the Contract documents.

3.3 MANHOLE CHANNEL AND SHELF

- A. Provide and install a temporary flume to control the flow during the channel and shelf construction.
- B. Remove all loose material and clean the bottom of the manhole in accordance with Manhole Wall Structural Rehabilitation and/or Sealing, Paragraph A.
- C. The bottom of the manhole shall be channeled to conduct flow from all inlet pipes to the outlet pipe.

1. Channels shall be the true shape of the lower half of the sewer pipe and shall have vertical sides from the spring line upward.
 2. Extend the channel from wall to wall of the manhole providing a long radius smooth curve where the flow changes direction.
 3. Match inverts of the connecting pipes at the manhole wall.
 4. The height of the shelf shall be the top of the outlet pipe or four (4) inches above any existing bottom masonry, whichever is higher.
- D. Slope the shelf from the top of the channel to the manhole wall at a 12:1 pitch.

3.4 MANHOLE STEPS

- A. Inspect and prepare the manhole wall where the new step will be installed to insure the wall is sound in order to provide the capacity that the steps are rated to receive. Any defects in the existing manhole wall preventing the wall from being sound shall be repaired by the contractor before proceeding onward.
- B. All new steps shall be positioned in line with existing steps and/or the manhole opening above and be equally spaced vertically with other steps in the manhole and be level. Sloped or mis-aligned steps are not acceptable and shall be re-done by the contractor.
- C. Contractor shall neatly core-drill existing manhole wall for the step's embedment and then fasten step to wall as per manufacturer recommendations.

3.5 MANHOLE REHABILITATION ACCEPTANCE

- A. After the manhole rehabilitation work has been completed, the manhole shall be visually inspected by the Contractor in the presence of the Engineer and the work shall be found satisfactory to the Engineer. In addition, at the Owner's request, the Contractor may be required within the maintenance period of the contract to visually re-inspect the manholes that were rehabilitated with the Owner. Any work that has become defective shall be redone by the Contractor at no additional expense to the Owner.

END OF SECTION 330130.64

SECTION 330130.72 - CURED-IN-PLACE PIPE LINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Other Sections Referenced:

1. Section 330130.01 - Sewer Collection System Rehabilitation
2. Section 330130.02 - Sewer Line Cleaning
3. Section 330130.03 - Sewer Flow Control
4. Section 330130.17 - Television Inspection
5. Section 330130.04 - Sewer Point Repairs

C. Other documents which shall be considered part of and included in these specifications

1. ASTM D 543 - Test Method of Resistance of Plastics to Chemical Reagents
2. ASTM D 638 - Test Method for Tensile Properties of Plastics
3. ASTM D 790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
4. ASTM E 132 - Test Method for Poisson's Ratio at Room Temperature
5. ASTM F1216 - Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
6. ASTM F1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

1.2 DESCRIPTION OF WORK

A. The intent of cured-in-place pipe (CIPP) is to rehabilitate sewer lines by installing a flexible polyester felt tube saturated with a thermosetting resin into the existing pipe. When cured and complete, the installed pipe should extend the full length of the pipe section being rehabilitated and shall provide a structurally sound, continuous, tight-fitting, watertight pipe within a pipe. Deficiencies which will be corrected by the finished product include:

1. Cracked and broken pipe caused by poor construction, unstable soil, earth movement, infiltration, roots, destructive loadings, cleaning tool damage, etc.
2. Corrosion of pipe caused by acid attack above the flow line.
3. Erosion of pipe caused by abrasion below the flow level.
4. Degradation of brick pipe caused by loss of masonry.
5. Infiltration of groundwater and soil through leaking pipe joints and structural defects.
6. Exfiltration of transported fluid through leaking pipe joints and structural defects.
7. Inflow of surface water and infiltration of groundwater through unused or illegal connections.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- B. Installer's Qualifications: Firms with at least 5 successfully completed projects having installed an aggregate total of 10,000 linear feet of the submitted manufacturer's cured-in-place liner.

1.4 SUBMITTALS

- A. Submit the latest edition and any revisions thereto of the manufacturer's technical data and installation instructions.
- B. Submit Material Safety Data Sheet(s) for the resins, any other chemical additives, and any other chemicals used in the CIPP system.
- C. Submit certified copies of all test reports on the properties of the proposed resin materials prior to their use. Tests shall be performed by an approved independent testing laboratory or other approved source.
- D. Submit design calculations for the CIPP material thickness for each section of the pipe to be rehabilitated. Calculations shall assume the existing pipe is in fully deteriorated condition; groundwater is at a depth of 2' below ground surface and existing pipe is deflected up to 10%.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be of a type that has been generally been in use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.
- B. Products acceptable for cured-in-place pipe.
 - 1. Eco-Liner Epoxy/Felt
 - 2. Inliner
 - 3. Insituform
 - 4. Masterliner
 - 5. National Liner
 - 6. Spinello Liner

2.2 MATERIALS

- A. All materials used in the installation of CIPP shall be equal to or exceed the manufacturer's standards.

1. Resin: The thermosetting resin shall be specifically blended for use with the CIPP process.
2. Tubing: The felt tubing shall be fabricated from material and suitable mechanical strengtheners as recommended by the manufacturer for each specific installation. The tubing shall be properly sized to the actual diameter of the sewer pipe and to the length of the sewer section to be rehabilitated. The Contractor shall be responsible for sizing the liner through field verification of the actual pipe diameter and length. The uncured tubing shall be designed to withstand the insertion stresses, and to be able to negotiate pipe joint offsets, gaps, and angular changes up to and including forty-five degrees (45°).
3. The nominal specified thickness for each pipe section shall be designated in the Proposal section or Specific Project Requirements section of the specifications or as shown on the plans. The cured material thickness tolerance shall be plus or minus twenty-five percent ($\pm 25\%$) of the specified thickness. The thickness of any inner and/or outer membrane shall not be included.
4. Where specific thicknesses are not provided the following values shall be used to calculate a minimum value.
 - a. All pipe shall be considered fully deteriorated.
 - b. All pipe shall be subjected to soil loads of 120 pounds per cubic foot.
 - c. All pipe shall be subject to AASHTO HS-20 highway loading.
 - d. The water table shall be assumed to be five (5) feet below the ground surface.
 - e. All pipe shall be assumed to have five percent (5%) ovality.
5. The cured pipe material shall conform to the minimum structural standards as listed below. Evidence shall be presented to demonstrate that the long-term modulus of elasticity of the cured product is no less than fifty percent (50%) of the herein specified Modulus of Elasticity (Short-term).

<u>Cured Pipe Material Test</u>	<u>Test Method</u>	<u>Minimum Value</u>
a. Chemical Resistance	ASTM D 543	< allowed loss
b. Tensile Strength	ASTM D 638	3,000 psi
c. Flexural Strength	ASTM D 790	4,500 psi
d. Flexural Modulus of Elasticity	ASTM D 790	250,000 psi
e. Poisson's Ratio	ASTM E 132	0.3

6. Any material failing to meet any of the structural standards of this specification may be rejected or may be cause for changing the material thickness if approved by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATORY PROCEDURES

- A. The Contractor shall notify all homeowners on the manhole section to be lined forty-eight (48) hours in advance of the work to be done. The Contractor shall inform the homeowner of

precautions necessary to prevent backup of sewage into the house. Notification shall include language that the work may extend beyond normal permitted working hours, if necessary to reinstate service laterals.

B. The following preparatory procedures shall be adhered to unless otherwise approved by the Engineer:

1. **Cleaning of Sewer Line:** Prior to any pipe installation in a designated section of sewer, the Contractor shall clean the sewer line as specified under Sewer Line Cleaning.
2. **Inspection of Sewer Line:** In accordance with the Television Inspection requirements, the Contractor shall televise the pipe with experienced personnel specially trained in locating breaks, obstacles, and service connections. The interior of the sewer line shall be carefully inspected to determine the location and extent of any structural failures. The location of any conditions which may prevent proper installation of the CIPP shall be noted so that such conditions can be corrected.
3. **Connections:** While televising the mainline sewer, the Contractor shall accurately measure and record the locations and positions of service connections using a fiberglass or other tape approved by the Engineer. Additionally, the Contractor shall utilize the pan and tilt capabilities of the televising equipment to determine which connections are live (active) and which are not in use.
4. **Bypassing Sewage:** The Contractor shall bypass the sewage around the section or sections of sewer line that are to be rehabilitated. The bypass shall be made by plugging an existing upstream manhole and pumping the sewage into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. All bypassing of flow shall be performed as specified under Sewer Flow Control.
5. **Line Obstructions:** It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, dropped joints, protruding service connections, or collapsed pipe that will prevent installation. If the obstruction(s) could have been removed by bucket machines or by using conventional cleaning methods, no compensation will be granted.
 - a. Internal repairs are protruding service connections, dropped portions of pipe which can be removed or pushed back in place, and other obstructions which can not be cleared using conventional cleaning methods, but which can be cleared from within the pipe. Such internal repairs shall be approved in writing by the Engineer prior to the commencement of the work and shall be considered as a pay item.
 - b. Point repairs are obstructions that cannot be removed by either conventional sewer cleaning equipment or by internal equipment. The Contractor shall make an excavation to expose and remove or repair the obstruction. Such excavation shall be approved in writing by the Engineer prior to the commencement of the work, shall be performed as specified under Point Repairs, and shall be considered as a pay item.

6. Pre-Insertion Television Inspection: The Contractor shall televise and record the sewer pipe immediately before installing CIPP. This televising is to assure that the pipe is clean and existing pipe conditions are acceptable for lining. Should additional cleaning be required, it shall be provided at no additional cost to the Owner. The cost of this televising shall be included in the cost of CIPP.

3.2 INSTALLATION PROCEDURES

- A. General: The Contractor shall designate a location where the uncured resin in original containers and the fiber felt tube will be impregnated prior to installation. The Contractor shall provide for the Owner's inspection of the materials and impregnation procedure. A resin/catalyst system compatible with the requirements of this method shall be used. The quantities of the liquid thermosetting material shall be sufficient to provide the thickness specified herein. When a proprietary lining technique is used and the licensor's procedures for proper installation differ from these specifications, the licensor's procedures shall govern.
- B. Handling: The Contractor shall exercise care during transportation, storage and handling of the liner system to ensure that it will not be torn, cut, or otherwise damaged. The tube shall be impregnated with resin not more than twenty-four (24) hours before the proposed time of installation. Prior to insertion, the tube shall be stored and transported to the site in a refrigerated truck. The insertion shall take place no later than thirty (30) minutes after the catalyst is placed into the resin mix.
- C. Insertion: The impregnated fiber felt tube shall be inserted through an existing manhole, through the pipe to be rehabilitated, to the designated rehabilitation location. The tube shall be inserted in accordance with the manufacturer's instructions.
- D. Inflation: The inflation/expansion pressure shall be sufficient to hold it tight to the pipe wall, to produce dimples at side connections and flared ends at manhole walls. Care shall be taken not to over stress the felt tube at the elevated curing temperatures, which may cause damage or failure prior to cure.
- E. Curing: After insertion and inflation/expansion is completed, the Contractor shall supply a suitable heat source. The equipment shall be capable of delivering heat throughout the section to raise the curing medium temperature above the recommended minimum value. This minimum temperature shall be determined by the resin/catalyst system employed. The temperature shall be maintained within the manufacturer's recommended limits for the duration of the cure period. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the installation process.
- F. Cool down: The Contractor shall cool the hardened pipe to a temperature below 100°F before relieving the pressure in the liner. Care shall be taken in the release of the pressure so that a vacuum will not be developed that could damage the newly installed pipe.

- G. **Sealing Pipe Ends:** The Contractor shall seal both ends of the CIPP in accordance with the manufacturer's recommendations for the field conditions. If, due to broken or misaligned sewer pipe at manhole walls, the installed pipe fails to make a tight seal, the Contractor shall apply a sealant at that point. The sealant shall be of a resin mixture compatible with that used in the CIPP process. The end shall be sealed for a distance of at least (1) pipe diameter inside the host pipe.
- H. **Testing:** After the installation procedures have been performed and curing is complete, but before any service connections are reinstated, the Contractor shall conduct a leakage test on the sewer line to determine if it is watertight.
1. For water cured liners, the test shall be conducted by using the existing hydrostatic head provided by the standpipe. The test time shall be fifteen (15) minutes, during which time no makeup water shall be added to the standpipe. If at the end of the test period, no significant water loss is observed in the standpipe, the watertightness of the cured-in-place pipe will be considered satisfactory.
 2. For air or steam cured liners, the test shall be conducted by removing the bladder and plugging both ends of the cured pipe. The pipe shall then be pressurized with air to a test pressure of one-half (1/2) psi per vertical foot of pipe depth (not exceeding a test pressure of ten (10) psi). The air flow shall be stopped. If the required pressure can be developed and if the pressure decays by less than one (1) psi within four (4) minutes, the watertightness of the liner pipe will be considered satisfactory.
- I. **Service Connection Reinstatement:** After testing, the Contractor shall reinstate the existing live service connections. This shall generally be done without excavation, from the interior of the pipe by means of a television camera and a remotely controlled cutting device. The work shall be performed by experienced operators so that no blind holes are made in the CIPP. The openings of the existing live service connections shall be cut to not less than ninety percent (90%) of their original size. All cuts shall be brushed free of burrs, frayed edges, or any restriction preventing free flow of the sewage. Excessive cuts, wrong holes, or trial cuts shall not be made and must be repaired at no cost to the Owner to the full satisfaction of the Engineer.

3.3 FINAL ACCEPTANCE

- A. **Finish:** The finished pipe shall be continuous over the entire length of sewer run between two manholes and be free from significant defects.
1. Any defects which will affect, the intended use, integrity or strength of the pipe shall be repaired, at the Contractor's expense, in a manner mutually agreed by the Owner and the Contractor.
- B. **Inspection:** After the work is completed, the Contractor shall provide the Owner with a videotape showing both the before and after conditions, including the reinstated service connections.

- C. Testing: Sufficient portions of the trimmings of each end of a CIPP section shall be marked as to location and given to the Engineer for measurements of thickness and testing of structural properties.
- D. Cleanup: After the installation work has been completed and all testing acceptable, the Contractor shall clean up the entire project area. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.
- E. Warranty: During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor.

END OF SECTION 330130.73

SECTION 330130.73 - CURED-IN-PLACE PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Other documents which shall be considered part of and included in these specifications
 - 1. ASTM D 543 - Test Method of Resistance of Plastics to Chemical Reagents
 - 2. ASTM D 638 - Test Method for Tensile Properties of Plastics
 - 3. ASTM D 790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - 4. ASTM E 132 - Test Method for Poisson's Ratio at Room Temperature
 - 5. ASTM F1216 - Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
 - 6. ASTM F1743 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

1.2 DESCRIPTION OF WORK

- A. The intent of cured-in-place pipe (CIPP) is to rehabilitate sewer lines by installing a flexible polyester felt tube saturated with a thermosetting resin into the existing pipe. When cured and complete, the installed pipe should extend the full length of the pipe section being rehabilitated and shall provide a structurally sound, continuous, tight-fitting, watertight pipe within a pipe. Deficiencies which will be corrected by the finished product include:
 - 1. Cracked and broken pipe caused by poor construction, unstable soil, earth movement, infiltration, roots, destructive loadings, cleaning tool damage, etc.
 - 2. Corrosion of pipe caused by acid attack above the flow line.
 - 3. Erosion of pipe caused by abrasion below the flow level.
 - 4. Degradation of brick pipe caused by loss of masonry.
 - 5. Infiltration of groundwater and soil through leaking pipe joints and structural defects.
 - 6. Exfiltration of transported fluid through leaking pipe joints and structural defects.
 - 7. Inflow of surface water and infiltration of groundwater through unused or illegal connections.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

- B. Installer's Qualifications: Firms with at least 5 successfully completed projects having installed an aggregate total of 10,000 linear feet of the submitted manufacturer's cured-in-place liner.

1.4 SUBMITTALS

- A. Submit the latest edition and any revisions thereto of the manufacturer's technical data and installation instructions.
- B. Submit Material Safety Data Sheet(s) for the resins, any other chemical additives, and any other chemicals used in the CIPP system.
- C. Submit certified copies of all test reports on the properties of the proposed resin materials prior to their use. Tests shall be performed by an approved independent testing laboratory or other approved source.
- D. Submit design calculations for the CIPP material thickness for each section of the pipe to be rehabilitated.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be of a type that has been generally been in use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.
- B. Products acceptable for cured-in-place pipe.
 - 1. LMK Technologies
 - 2. Eco-Liner Epoxy/Felt
 - 3. Inliner
 - 4. Insituform
 - 5. Masterliner
 - 6. National Liner
 - 7. Spinello Liner

2.2 MATERIALS

- A. All materials used in the installation of CIPP shall be equal to or exceed the manufacturer's standards.
 - 1. Resin: The thermosetting resin shall be specifically blended for use with the CIPP process.

2. Tubing: The felt tubing shall be fabricated from material and suitable mechanical strengtheners as recommended by the manufacturer for each specific installation. The tubing shall be properly sized to the actual diameter of the sewer pipe and to the length of the sewer section to be rehabilitated. The Contractor shall be responsible for sizing the liner through field verification of the actual pipe diameter and length. The uncured tubing shall be designed to withstand the insertion stresses, and to be able to negotiate pipe joint offsets, gaps, and angular changes up to and including forty-five degrees (45°).
3. The nominal specified thickness for each pipe section shall be designated in the Proposal section or Specific Project Requirements section of the specifications or as shown on the plans. The cured material thickness tolerance shall be plus or minus twenty-five percent ($\pm 25\%$) of the specified thickness. The thickness of any inner and/or outer membrane shall not be included.
4. Where specific thicknesses are not provided the following values shall be used to calculate a minimum value.
 - a. All pipe shall be considered fully deteriorated.
 - b. All pipe shall be subjected to soil loads of 120 pounds per cubic foot.
 - c. All pipe shall be subject to AASHTO HS-20 highway loading.
 - d. The water table shall be assumed to be five (5) feet below the ground surface.
 - e. All pipe shall be assumed to have five percent (5%) ovality.
5. The cured pipe material shall conform to the minimum structural standards as listed below. Evidence shall be presented to demonstrate that the long-term modulus of elasticity of the cured product is no less than fifty percent (50%) of the herein specified Modulus of Elasticity (Short-term).

<u>Cured Pipe Material Test</u>	<u>Test Method</u>	<u>Minimum Value</u>
a. Chemical Resistance	ASTM D 543	< allowed loss
b. Tensile Strength	ASTM D 638	3,000 psi
c. Flexural Strength	ASTM D 790	4,500 psi
d. Flexural Modulus of Elasticity	ASTM D 790	250,000 psi
e. Poisson's Ratio	ASTM E 132	0.3

6. Any material failing to meet any of the structural standards of this specification may be rejected or may be cause for changing the material thickness if approved by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATORY PROCEDURES

- A. The Contractor shall notify all homeowners on the manhole section to be lined forty-eight (48) hours in advance of the work to be done. The Contractor shall inform the homeowner of precautions necessary to prevent backup of sewage into the house. Notification shall include language that the work may extend beyond normal permitted working hours, if necessary to reinstate service laterals.
- B. The following preparatory procedures shall be adhered to unless otherwise approved by the Engineer:
 - 1. **Cleaning of Sewer Line:** Prior to any pipe installation in a designated section of sewer, the Contractor shall clean the sewer line as specified under Sewer Line Cleaning.
 - 2. **Inspection of Sewer Line:** In accordance with the Television Inspection requirements, the Contractor shall televise the pipe with experienced personnel specially trained in locating breaks, obstacles, and service connections. The interior of the sewer line shall be carefully inspected to determine the location and extent of any structural failures. The location of any conditions which may prevent proper installation of the CIPP shall be noted so that such conditions can be corrected.
 - 3. **Connections:** While televising the mainline sewer, the Contractor shall accurately measure and record the locations and positions of service connections using a fiberglass or other tape approved by the Engineer. Additionally, the Contractor shall utilize the pan and tilt capabilities of the televising equipment to determine which connections are live (active) and which are not in use.
 - 4. **Bypassing Sewage:** The Contractor shall bypass the sewage around the section or sections of sewer line that are to be rehabilitated. The bypass shall be made by plugging an existing upstream manhole and pumping the sewage into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow. All bypassing of flow shall be performed as specified under Sewer Flow Control.
 - 5. **Line Obstructions:** It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, dropped joints, protruding service connections, or collapsed pipe that will prevent installation. If the obstruction(s) could have been removed by bucket machines or by using conventional cleaning methods, no compensation will be granted.
 - a. Internal repairs are protruding service connections, dropped portions of pipe which can be removed or pushed back in place, and other obstructions which cannot be cleared using conventional cleaning methods, but which can be cleared from within the pipe. Such internal repairs shall be approved in writing by the Engineer prior to the commencement of the work and shall be considered as a pay item.

- b. Point repairs are obstructions that cannot be removed by either conventional sewer cleaning equipment or by internal equipment. The Contractor shall make an excavation to expose and remove or repair the obstruction. Such excavation shall be approved in writing by the Engineer prior to the commencement of the work, shall be performed as specified under Point Repairs, and shall be considered as a pay item.
6. Pre-Insertion Television Inspection: The Contractor shall televise and record the sewer pipe immediately before installing CIPP. This televising is to assure that the pipe is clean and existing pipe conditions are acceptable for lining. Should additional cleaning be required, it shall be provided at no additional cost to the Owner. The cost of this televising shall be included in the cost of CIPP.

3.2 INSTALLATION PROCEDURES

- A. General: The Contractor shall designate a location where the uncured resin in original containers and the fiber felt tube will be impregnated prior to installation. The Contractor shall provide for the Owner's inspection of the materials and impregnation procedure. A resin/catalyst system compatible with the requirements of this method shall be used. The quantities of the liquid thermosetting material shall be sufficient to provide the thickness specified herein. When a proprietary lining technique is used and the licensor's procedures for proper installation differ from these specifications, the licensor's procedures shall govern.
- B. Handling: The Contractor shall exercise care during transportation, storage and handling of the liner system to ensure that it will not be torn, cut, or otherwise damaged. The tube shall be impregnated with resin not more than twenty-four (24) hours before the proposed time of installation. Prior to insertion, the tube shall be stored and transported to the site in a refrigerated truck. The insertion shall take place no later than thirty (30) minutes after the catalyst is placed into the resin mix.
- C. Insertion: The impregnated fiber felt tube shall be inserted through an existing manhole, through the pipe to be rehabilitated, to the designated rehabilitation location. The tube shall be inserted in accordance with the manufacturer's instructions.
- D. Inflation: The inflation/expansion pressure shall be sufficient to hold it tight to the pipe wall, to produce dimples at side connections and flared ends at manhole walls. Care shall be taken not to over stress the felt tube at the elevated curing temperatures, which may cause damage or failure prior to cure.
- E. Curing: After insertion and inflation/expansion is completed, the Contractor shall supply a suitable heat source. The equipment shall be capable of delivering heat throughout the section to raise the curing medium temperature above the recommended minimum value. This minimum temperature shall be determined by the resin/catalyst system employed. The temperature shall be maintained within the manufacturer's recommended limits for the duration of the cure period. The cure period shall be of a duration recommended by the resin manufacturer, as modified for the installation process.

- F. Cool down: The Contractor shall cool the hardened pipe to a temperature below 100°F before relieving the pressure in the liner. Care shall be taken in the release of the pressure so that a vacuum will not be developed that could damage the newly installed pipe.
- G. Sealing Pipe Ends: The Contractor shall seal both ends of the CIPP in accordance with the manufacturer's recommendations for the field conditions. If, due to broken or misaligned sewer pipe at manhole walls, the installed pipe fails to make a tight seal, the Contractor shall apply a sealant at that point. The sealant shall be of a resin mixture compatible with that used in the CIPP process. The end shall be sealed for a distance of at least (1) pipe diameter inside the host pipe.
- H. Testing: After the installation procedures have been performed and curing is complete, but before any service connections are reinstated, the Contractor shall conduct a leakage test on the sewer line to determine if it is watertight.
 - 1. For water cured liners, the test shall be conducted by using the existing hydrostatic head provided by the standpipe. The test time shall be fifteen (15) minutes, during which time no makeup water shall be added to the standpipe. If at the end of the test period, no significant water loss is observed in the standpipe, the watertightness of the cured-in-place pipe will be considered satisfactory.
 - 2. For air or steam cured liners, the test shall be conducted by removing the bladder and plugging both ends of the cured pipe. The pipe shall then be pressurized with air to a test pressure of one-half (1/2) psi per vertical foot of pipe depth (not exceeding a test pressure of ten (10) psi). The air flow shall be stopped. If the required pressure can be developed and if the pressure decays by less than one (1) psi within four (4) minutes, the watertightness of the liner pipe will be considered satisfactory.
- I. Service Connection Reinstatement: After testing, the Contractor shall reinstate the existing live service connections. This shall generally be done without excavation, from the interior of the pipe by means of a television camera and a remotely controlled cutting device. The work shall be performed by experienced operators so that no blind holes are made in the CIPP. The openings of the existing live service connections shall be cut to not less than ninety percent (90%) of their original size. All cuts shall be free of burrs, frayed edges, or any restriction preventing free flow of the sewage. Excessive cuts, wrong holes, or trial cuts shall not be made and must be repaired at no cost to the Owner to the full satisfaction of the Engineer.

3.3 FINAL ACCEPTANCE

- A. Finish: The finished pipe shall be continuous over the entire length of sewer run between two manholes and be free from significant defects.
 - 1. Any defects which will affect, the intended use, integrity or strength of the pipe shall be repaired, at the Contractor's expense, in a manner mutually agreed by the Owner and the Contractor.

- B. Inspection: After the work is completed, the Contractor shall provide the Owner with a videotape showing both the before and after conditions, including the reinstated service connections.
- C. Testing: Sufficient portions of the trimmings of each end of a CIPP section shall be marked as to location and given to the Engineer for measurements of thickness and testing of structural properties.
- D. Cleanup: After the installation work has been completed and all testing acceptable, the Contractor shall clean up the entire project area. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.
- E. Warranty: During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor.

END OF SECTION 330130.73

SECTION 330130.74 – CIPP CONNECTION WITH LATERAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 Specifications, apply to work of this section.
- B. Other Sections Referenced:
 - 1. Section 330130.01 – Sewer Collection System Rehabilitation Definitions
 - 2. Section 330130.02 – Sewer Line Cleaning
 - 3. Section 330130.03 – Sewer Flow Control
 - 4. Section 330130.16 – Television Inspection
- C. Other documents which should be considered part of and include in these specifications
 - 1. ASTM F-2561 Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One-Piece Main and Lateral Cured-In-Place Liner.
 - 2. ASTM D-790 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - 3. ASTM D-792 Standard Test Methods for Density and Specific Gravity of Plastics by Displacement.
 - 4. ASTM D-2990 Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.
 - 5. MD5813 Standard Specification for Cured-in Place Thermosetting Resin Sewer Pipe.

1.2 DESCRIPTION OF WORK

- A. This specification covers material requirements, installation practices, and test methods for the reconstruction of a sewer service lateral pipe and the main connection without excavation. The lateral pipe is renovated remotely from the main pipe to a sewer cleanout located within the public right of way or without an existing sewer cleanout. The pipe renovation shall be accomplished by the inversion and inflation of a resin impregnated, single-piece lateral and main connection liner assembly. The liner assembly is pressed against the lined main pipe by inflation of a bladder and held under pressure until the thermo-set resin has cured. When cured, the liner shall extend over a predetermined length of the service lateral and the full circumference of the main pipe connection forming a continuous, single-piece, tight fitting, corrosion resistant and verifiable non-leaking cured in-place pipe (CIPP) inclusive with gasket seals. The Materials and Installation practices shall adhere to the minimum requirements of ASTM F2561-11 “Standard Practice for Rehabilitation of a Sewer Service Lateral and its Connection to the Main Using a One-Piece Main and Lateral Cured-in Place Liner.”

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.4 SUBMITTALS

- A. Submit the latest edition and any revisions thereto of the manufacturer's technical data and installation instructions.
- B. Submit Material Safety Data Sheet(s) for the resins, any other chemical additives, and any other chemicals used in the CIPP system.
- C. Submit certified copies of all test reports on the properties of the proposed resin materials prior to their use. Tests shall be performed by an approved independent testing laboratory or other approved source.
- D. Submit design calculations for the CIPP material thickness for each section of the pipe to be rehabilitated.

1.5 QUALIFIED BIDDER

- A. A qualified bidder for installing a mainline/lateral connection and lateral repair system shall use a Manufactured System that has a minimum of a five-year history of satisfactory performance and the Manufactured System shall have performed a minimum of 10,000 successful installations during this time period in the U.S., including 300,000 feet of lateral lining. Bidders shall be prepared to submit a list of installation projects, numbers of connections sealed and lateral footage lined providing contact names, addresses, and telephone numbers for reference.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and material shall be of a type that has been generally been in use for a period of five (5) years. Work performed with experimental equipment or material will not be permitted without prior written consent of the Owner.
- B. The reconstruction shall be accomplished using a non-woven textile tube of particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The lateral tube located within a translucent inversion bladder is vacuum impregnated with the synthetic resin and is then placed inside of a protective carrying device. The mainline portion of the liner is physically attached to the lateral portion and is

affixed around a rigid “T” launching device. The protective “T” launching device is winched into the existing sewer. When the “T” launching device is properly positioned at the lateral connection, the mainline bladder is inflated by pressurized air that presses the main liner against the host pipe. The lateral portion is then inverted up through the lateral service line by the action of the inversion bladder. Once the resin-saturated liner is cured, the inversion bladder and launching/carrying devices are removed.

2.2 MATERIAL

- A. All Main line to Lateral Connectors shall be manufactured by LMK Technologies or approved substitute.
- B. Liner Assembly - The liner assembly shall be continuous in length and consist of one or more layers of absorbent textile material i.e. needle punched felt, circular knit or circular braided tubes that meet the requirements of ASTM F1216 and ASTM D5813 Sections 6 and 8. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause de-lamination in the cured in-place pipe. The textile tube and sheet shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections. The wet-out textile tube and sheet shall meet ASTM F 1216, 7.2 as applicable, and shall have a uniform thickness and 5% to 10% excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.
- B. Mainline Liner Tube - The main sheet will be flat with one end overlapping the second end and sized accordingly to create a circular lining equal to the inner diameter of the main pipe. The interior of the textile sheet shall be laminated with an impermeable, translucent flexible membrane. The textile sheet before insertion shall be permanently marked on the membrane as a “Lateral Identification” correlating to the address of the building the lateral pipe provides service.
- C. Lateral Liner Tube - The exterior of the lateral liner tube shall be laminated with an impermeable, translucent flexible membrane. Longitudinal seams in the tube shall be stitched and thermally sealed. The lateral tube will be continuous in length and the wall thickness shall be uniform. The lateral tube will be capable of conforming to offset joints, bells, disfigured pipe sections and pipe diameter transitions up to 20% of the connection diameter.
- D. Mainline Connection - The main tube and lateral tube shall be formed as a one-piece assembly by stitching the lateral tube to the main sheet aperture. The connecting end of the lateral tube shall be shaped to match the aperture and curvature of the main tube. The lateral tube and main tube are connected by stitching and sealing the stitching using a flexible UV cured adhesive/sealant. The main and lateral tubes are assembled in the shape of a “T” or WYE with corresponding dimensions. Submittals for the liner assembly must include the manufacturers test protocol and tests data that certifies the connection between the liner tubes is leak-free, when subjected to a controlled vacuum leak test.

- E. Gasket Seals - The mainline connection shall include a seamless molded flange shaped end seal gasket attached to the main liner tube by use of stainless steel snaps. The lateral tube shall include an O-ring gasket attached six-inches from the upstream terminating end of the lateral tube.
- F. End Seal Test Data - The hydrophilic gaskets must include test data that reports substantial water-tightness at the terminating ends of a CIPP when subjected to hydrostatic loading that simulates subterranean conditions. Gasket seal submittals must include tests data simulating hydration/ dehydration conditions for a period of 10,000-hours and the test results must successfully demonstrate and document long-term performance without deterioration, loss of material, flexibility, and expansion of the gasket during repeated cycles of hydration and dehydration.
- G. Bladder Assembly - The liner assembly shall be surrounded by a second impermeable, inflatable, flexible translucent membrane (translucent bladder) that will contain the resin and facilitate vacuum impregnation while monitoring of the resin saturation during the resin impregnation (wet-out) procedure.

2.3 RESIN SYSTEM

- A. The resin/liner system shall conform to ASTM D5813 Section 8.2.2 10,000 hour test.
- B. The resin shall be a corrosion resistant polyester, vinyl ester, epoxy or silicate resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project.
- C. The resin shall produce CIPP, which will comply with the structural and chemical resistance requirements of ASTM F1216.

Table 1 - CIPP Initial Structural Properties

Property	ASTM Test	Minimum Value	
		psi	(MPa)
Flexural Strength	D 790	4,500	(31)
Flexural Modulus	D 790	250,000	(1,724)

2.4 DESIGN CONSIDERATIONS

- A. The CIPP shall be designed per ASTM F1216, Appendix X1.
- B. The CIPP design for the lateral tube shall assume no bonding to the original pipe.
- C. Roughness Coefficient the liner must be smooth and have an average “n” factor of 0.013 or lower.

PART 3 - EXECUTION

3.1 INSTALLATION RECOMMENDATIONS

- A. Access Safety – Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations.
- B. Cleaning and Inspection – As per 330130.02 and 330130.16.
- C. Accessing the Lateral – The lateral pipe shall be remotely accessed from the main pipe for purposes of cleaning, pre-inspection, liner insertion and post inspection.
- D. Plugging – The upstream side of the cleanout shall be plugged during insertion and curing of the liner assembly ensuring no flows enter the pipe and no air, steam or odors will enter the building. When required, the main pipe flows will be by-passed. The pumping system shall be sized for normal to peak flow conditions. The upstream manhole shall be monitored at all times and an emergency deflating system will be incorporated so that the plugs may be removed at any time without requiring confined space entry.
- E. Inspection of Pipelines – The interior of the pipeline shall be carefully inspected to determine the location of any condition that shall prevent proper installation, such as roots, and collapsed or crushed pipe sections. These conditions shall be noted. Experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television shall perform inspection of pipelines.
- F. Line Obstructions – The existing service lateral shall be clear of obstructions that prevent the proper insertion and expansion of the lining system. Changes in pipe size shall be accommodated, if the lateral tube is sized according to the pipe diameter and condition.

Obstructions may include dropped or offset joints of no more than 20% of inside pipe diameter. Where a partial obstruction is caused by the lateral pipe being cocked at the wye connection and protruding into the wye, the protruding portion of the lateral pipe shall be trimmed to provide a clear passage of at least 80% of the inside pipe diameter.

- G. Resin Impregnation – The liner assembly is encapsulated within the translucent bladder (liner/bladder assembly) shall be saturated with the resin system (wet-out) under controlled vacuum conditions. The volume of resin used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. No dry or unsaturated area in the mainline sheet or lateral tube shall be acceptable upon visual inspection.

- H. Liner Insertion – The lateral tube and inversion bladder will be inserted into the carrying device. The mainline liner and bladder shall be wrapped around a “T” launching device, and held firmly by pacing four (4) hydrophilic O-rings around the main liner. An adhesive sealant 300ml in volume is applied to the main/lateral interface and shall be applied as a two inch (2”) wide band on the main liner. Both the launching and carrying device are pulled into the pipe using a cable winch. The pull is complete when the open port of the “T” launching device is remotely positioned by use of sewer cameras to be aligned with the interface of the service connection and mainline pipe. The lateral tube is completely protected during the pull. The mainline liner is supported on a rigid “T” launcher that is elevated above the pipe invert through the use of a rotating skid system. The liner assembly shall not be contaminated or diluted by exposure to dirt, debris, or water during the pull.
- I. Bladder – The main bladder shall be inflated causing the main sheet to unwrap and expand, embedding the hydrophilic O-rings between the main liner and the main pipe as the main liner is pressed tight against the main pipe. The lateral tube is inverted by the action of the lateral bladder through the center of the main liner as it extends up into the lateral pipe to a distance of three (3) feet. The main/lateral bladder assembly shall extend past all ends of the liner, as no cutting and trimming shall be required.

3.2 CIPP PROCESSING

- A. Curing – After the liner has been fully deployed into the lateral pipe, pressure is maintained pressing the liner firmly against the inner pipe wall until the liner is cured at ambient temperatures or by a suitable heat source. The heating equipment shall be capable of delivering a mixture of steam and air throughout the liner bladder assembly to a uniform raise the temperature above the temperature required to cure the resin. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles. The manufacturer’s recommended cure schedule shall be submitted.
- B. CIPP Processing – Curing shall be done without pressure interruption with air or a mixture of air and steam for the proper duration of time per the resin manufacturer’s recommendations. The curing process is complete when the temperature of the CIPP reaches 100 degrees Fahrenheit or less, the processing shall be finished.

3.3 FINISH

- A. The finished CIPP – CIPP Shall be a homogenous liner assembly located within a lateral service pipe for a specific length, and extending into the main pipe to renew 16-inches of the main pipe (5” on either side of a 6” lateral or 6” on either side of a 4” connection). The CIPP shall smooth with minimal wrinkling and increase flow rate. The CIPP shall be free of dry spots, lifts, and delaminated portions. The CIPP shall include an engineered taper at

each end providing a smooth transition to the host pipe for accommodating video equipment and maintaining proper flow in the mainline. After the work is completed, the installer will provide Owner with video footage documenting the repair and the visual markings identifying the sewer lateral address as completed work. The finished product must provide an airtight/ watertight verifiable non-leaking connection between the main sewer and sewer service lateral.

3.4 INSPECTION AND TESTING PRACTICES

- A. Sampling – It is required by the Owner, that Contractor shall prepare a CIPP sample. The sample shall be prepared by securing a flat plate mold using the textile tube material and resin system as used for the rehabilitated pipe.
- B. Pressure – The pressure applied on the plate sample will be equal to the highest pressure exerted on the lateral tube during the inversion process.
- C. Length – The minimum length of the sample must be able to produce at least five specimens for testing in accordance with ASTM D-790-03.
- D. Conditioning – Condition the test specimens at $73.4 \pm 3.6^\circ$ F ($23 \pm 2^\circ$ C) and $50 \pm 5\%$ relative humidity for not less than 40 hour prior to test in accordance with Practice ASTM D 618, for those tests where conditioning is required.
- E. Short-Term Flexural (Bending) Properties – The initial tangent flexural modulus of elasticity and flexural stress shall be measured for gravity and pressure pipe applications in accordance with Test Method D 790 and shall meet the minimum requirements of Table 1.
- F. CIPP Wall Thickness – The minimum wall thickness at any point shall not be less than 87.5% of the specified design thickness as agreed upon between Owner and Contractor.
- G. Gravity Pipe Leakage Testing – It is required by the Owner that Contractor shall test five percent (5%) of the sealed connections. Contractor shall use an air test method where a test plug is placed adjacent to the upstream and downstream ends of the main sheet CIPP and at the upper most end of the lateral tube. This test should take place after the CIPP has cooled down to ambient temperature. The test pressure shall be 4 PSI for a three-minute) minute test time and during this time the pressure shall not drop below 3.5 PSI.

3.5 WARRANTY

- A. All CIPP liners shall be certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for ten (10) years from the date of acceptance. The Contractor guarantees the work to be free from defects caused by faulty workmanship and/or materials for a period of ten (10) Years. During the warranty period, any defects which affect the integrity, strength or water tightness of the pipe shall be repaired at the Contractor's expense.

- B. The Contractor shall carry Professional Liability Coverage and provide proof of insurance during the term of the contract.

END OF SECTION 330130.74

SECTION 333100 - SANITARY SEWER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnishing all labor, materials, tools, equipment, and services for all sanitary sewers as shown on the Drawings.
- B. Although such is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a functional and complete installation.

1.2 RELATED DOCUMENTS AND SECTIONS

- A. Section 015713 - Temporary Erosion Control

1.3 SUBMITTALS

- A. Product Data
 - 1. PVC pipe, each type specified
 - 2. Reinforced concrete pipe
 - 3. Vitrified clay pipe
 - 4. Ductile iron pipe
 - 5. Manhole castings
 - 6. Precast concrete manholes
 - 7. Manhole steps
- B. Shop Drawings
 - 1. Precast concrete manholes showing:
 - a. Orientation plan for each manhole or inlet indicating where all pipes connect.
 - b. The size and elevation of connecting pipes.
 - c. Details of drop connections.
 - d. Invert concrete channeling details.
 - e. Pipe to manhole connection details.
 - f. Casting and step orientation.
- C. Samples
- D. Quality Control Submittals
 - 1. Design Data
 - 2. Test Reports
 - 3. Certificates
 - a. Evidence of current membership in specified manufacturer's associations.

- b. Evidence of ODOT precertification for the manufacturing RCP pipe.
 - c. Evidence of National Precast Concrete Association (NPCA) certification for the manufacture of precast concrete manholes.
- 4. Manufacturers Instructions

- E. Contract Closeout Submittals
 - 1. Project Record Documents
 - 2. Operation and Maintenance

1.4 REFERENCES

- A. ASTM A-48 Standard Specification for Gray Iron Castings
- B. ASTM C-12 Standard Practice for Installing Vitrified Clay Pipe Lines
- C. ASTM C-76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- D. ASTM C-150 Standard Specification for Portland Cement
- E. ASTM C-270 Standard Specification for Mortar for Unit Masonry
- F. ASTM C-425 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
- G. ASTM C-443 Standard Specifications for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- H. ASTM C-478 Standard Specifications for Precast Reinforced Concrete Manhole Sections
- I. ASTM C-700 Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
- J. ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- K. ASTM C-1173 Standard Specification for Flexible Transition Couplings for Underground Piping Systems
- L. ASTM D-2321 Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- M. ASTM D-3034 Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- N. ASTM D-3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

- O. ASTM F-477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- P. ASTM F-679 Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
- Q. ANSI/AWWA C111/A21.11 American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
- R. ANSI/AWWA C151/A21.51 American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids
- S. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution

1.5 QUALITY ASSURANCE

- A. Qualifications
- B. Regulatory Requirements
- C. Certifications
- D. Field Samples
- E. Pre-Installation Conference

1.6 PROJECT CONDITIONS

- A. Environmental Requirements
- B. Existing Conditions
 - 1. Verify locations of underground utilities.
 - 2. Protect existing structures and utilities from damage. Repair if damaged by this work.
 - 3. Do not change pipe sizes without securing written approval of Engineer.
- C. Field Measurements
 - 1. If it becomes necessary to change location of sanitary sewer lines due to underground utility interference, secure approval of Engineer.
 - 2. If Contractor initiated, make changes approved by the Engineer without added cost to Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping
- B. Acceptance at Site
 - 1. All material and all equipment shall be subject to visual inspection and acceptance or rejection after delivery to the site of the work. All rejected material shall immediately be removed from the site.
- C. Storage and Protection

PART 2 - PRODUCTS

2.1 PIPE

- A. Polyvinyl Chloride Pipe (PVC): 4" - 15" Diameter
 - 1. All polyvinyl chloride pipe in this size range shall conform to ASTM D-3034 SDR 26, shall be integral bell and spigot type, with joints conforming to ASTM D-3212 and elastomeric seals conforming to ASTM F-477.
 - 2. All pipe and fittings shall be marked or stenciled in conformance with ASTM D-3034. All gaskets shall be marked or stenciled with the ASTM specification designation, name or trademark of the manufacturer, and pipe size.
 - 3. Acceptable manufacturers shall be current members of the Uni-Bell Plastic Pipe Association.

2.2 PRECAST CONCRETE MANHOLES

- A. All precast manhole units shall be manufactured in accordance with the provisions of ASTM C-478.
- B. Joints between manhole units shall be gasketed and shall comply with the requirements of ASTM C-443. All gaskets shall be marked or stenciled with the ASTM specification designation, name or trademark of the manufacturer, and pipe size.
- C. The standard length of riser units shall be 48 inches. Lengths of 32 inches or 16 inches shall be used to meet required dimensions.
- D. Openings for connecting pipes in riser units, bottom riser units, integral base units, and for access in flat slabs shall be preformed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form.

- E. Connectors between new precast concrete manholes and pipes shall be made by casting the connector integrally with the manhole wall. The connectors shall be composed of EPDM with stainless steel take down bands for compressing the connector against the outside diameter of the pipe. The connectors shall comply with the requirements of ASTM C-923, and shall be "Z-Lok" Type as manufactured by A-Lok Products; or an approved equivalent.
- F. All openings in existing manholes shall be field cored and shall have mechanical connectors complying with the requirements of ASTM C-923 and shall be equal to Kor-N-Seal as manufactured by NPC, Inc., Milford, NH.
- G. Annular spaces at pipe entrances shall be field sealed with a one component, hydraulic cement based, fast setting repair mortar equal to Thoro Products Waterplug as manufactured by ChemRex Inc., Shakopee, MN.
- H. The top four (4) inches to twelve (12) inches of the manhole shall provide for adjustment of casting to grade. Adjustment shall be through the use of a maximum of two (2) precast concrete adjusting collars.
- I. Where pressure tight manhole frames and covers are specified, threaded inserts shall be cast in eccentric cones or flat slab tops, and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

2.3 MANHOLE STEPS

- A. All steps shall be minimum of twelve (12) inches in width with safety side lugs to prevent slipping and shall conform to the latest OSHA requirements. Manhole steps shall be of polypropylene plastic reinforced with a 3/8", No. 60 grade epoxy coated reinforcing rod.
- B. Manhole steps shall conform to the requirements of ASTM C-478.
- C. Acceptable manufacturers are:
 - 1. American Step Company, Inc.
 - 2. Lane International, Inc.
 - 3. M. A. Industries, Inc.

2.4 CASTINGS

- A. All castings shall be true to pattern and free from cracks, gas holes, flaws and excessive shrinkage. Surfaces shall be free from burnt-on sand and shall be reasonably smooth. Runners, fins, risers and other cast-on pieces shall be removed. Castings for manhole frames and covers and for any other purpose under these specifications shall conform to all the requirements for Class No. 35B for Gray Iron Castings of the ASTM A-48. All castings shall be commercially machineable and, in the case of manholes, the frame and cover shall be so machined that it will be

impossible to rock the cover after it has been seated in the proper position in the frame.

1. Manhole frames and covers shall be as detailed on the Drawings.

2.5 MASONRY MORTAR

- A. Mortar shall conform to ASTM C-270, Type M, but shall not contain masonry cement.
- B. Mortar shall be UltraMortar Type M as manufactured by UltraKote Products, Inc. or Lafarge Mortar Cement, Type M as manufactured by Lafarge Corporation, or approved equal.
- C. Only sufficient mortar shall be prepared for immediate use, and any mortar that has set shall not be retempered or used in the work.
- D. Setting accelerators or anti-freeze compounds shall not be used.

2.6 MANHOLE ENCAPSULATION MATERIALS

- A. Manhole encapsulation material shall be irradiated and cross-linked polyethylene impermeable backing, coated with protective heat-activated adhesive. Material width shall be sufficient to extend 4-inches below the cone unit-grade ring joint and 4-inches above the grade ring-frame joint.
- B. The manhole encapsulation material shall be as manufactured by Canusa, Division of Shaw Resources Inc., The Woodlands, TX or equal.
- C. Primer shall be as recommended by the manufacturer.

2.7 PREFORMED BUTYL MASTIC SEALANT

- A. Preformed butyl mastic sealant material shall be furnished in 1-inch wide strips conforming to the requirement of ASTM C-990.
- B. The butyl mastic sealant shall be Bidco C-56 as manufactured by Bidco Sealants, Inc., Park Hills, MO or equal.

2.8 COUPLINGS

- A. Couplings for connecting dissimilar pipe materials or pipe sizes shall be a rubber type coupling with a sealing "O" ring under each of two sealing clamp bands and a Type 316 stainless steel shear ring. Coupling shall be manufactured with natural and synthetic rubbers conforming to ASTM C 425 and ASTM C 1173.
- B. Coupling shall be Flex-Seal Adjustable Repair Coupling as manufactured by the Mission Rubber Company, Corona, CA, or approved equal.

PART 3 - INSTALLATION

3.1 ALIGNMENT AND GRADE

- A. Horizontal and Vertical Control
 - 1. All horizontal and vertical control required for the complete layout and performance of the Work under this contract shall be done by a registered surveyor at the Contractor's expense, and any observations by the Engineer of the Contractor's methods will not relieve the Contractor of his responsibility.
 - 2. The Contractor shall be solely responsible for the accuracy of all horizontal and vertical control.
- B. Alignment and grade shall be established by means of a laser beam.
- C. The Contractor shall furnish all material and labor to establish line and grade of the generated laser beam from the benchmarks and control points indicated on the Drawings. The laser shall be securely anchored and checked periodically by the Contractor. The laser calibration shall be demonstrated when requested by the Engineer. Strict adherence to the manufacturer's operation procedure shall be observed. Only qualified and trained employees may be assigned to install, adjust, or operate laser equipment, and proof of qualifications of the equipment operator must be available at all times. Areas in which lasers are used must be posted with standard laser warning placards, and the laser beam shall be turned off when not needed. During rain, snow, dust, excessive heat, or fog the operation of laser systems shall be prohibited where practicable because of beam scatter.

3.2 PIPE INSTALLATION

- A. All pipe installation shall conform to the trench and bedding details shown on the Drawings.
- B. PVC pipe shall be installed in full compliance with ASTM D-2321. Clay pipe shall be installed in full compliance with ASTM C-12. All concrete pipe shall be installed in conformity with recommended practices published by the American Concrete Pipe Association in the "Concrete Pipe Installation Manual".
- C. Only one type and strength of pipe shall be used between any two consecutive manholes, unless otherwise shown on the Drawings.
- D. After the trench has been excavated and the pipe bedded, the pipe shall be laid to the line and grade as shown on the Drawings. All joints shall be made as hereinafter specified. In no case shall any material except bedding material be placed under the bell of the pipe to secure proper grade.

- E. Prior to being lowered into the trench, each pipe shall be carefully inspected and those which are damaged or not meeting the specified requirements shall be rejected and clearly marked as rejected and removed from the Work. Satisfactory means shall be used to hold the pipe in line until embedment of pipe is complete. Precautions shall be taken to insure that the spigot end of the pipe being laid is pushed the proper depth into the bell of the preceding pipe.
- F. All conduit shall be laid starting at the outlet end and laid with the bell end upstream.
- G. In no case shall more than thirty (30) feet of trench be opened in advance of the pipe laying operations.
- H. Conduit shall not be laid in water, mud, or any otherwise unsuitable trench. No drainage shall run through the newly laid pipe. All sewers shall be temporarily capped with a watertight seal at the open ends at the completion of each day's work and no drainage water shall be permitted to flow through the sewer.
- I. All trenches and excavations shall be backfilled as specified as soon as possible after the pipe is laid and jointed. Where concrete encasement or cradle is used, pipe shall not be backfilled for at least twenty-four (24) hours after placing concrete except that pipe may be covered to a depth of not to exceed sixteen (16) inches over the top of the pipe.

3.3 JOINTING

- A. Polyvinyl Chloride (PVC) Pipe
 1. Dust, dirt and foreign matter shall be removed from joint surfaces. When jointing pipe using the required compression type joint, a lubricant recommended by the gasket manufacturer shall be used. The gasket shall be lubricated by drawing it through lubricant held in the hand of the worker, thus coating the entire surface of the gasket.
 2. When laying the pipe in concrete bedding, care shall be exercised to prevent the joint materials from coming in contact with the fresh concrete until after the joint has been completed.

3.4 PERMISSIBLE DEFLECTION AT JOINTS

- A. No pipe deflections or springing of joints, to effect a change in direction will be allowed, except by permission or direction of the Engineer, or as shown on the Drawings. Any permitted or directed deflection shall be a maximum of 80 percent of the allowable deflection value established by the pipe manufacturer.

3.5 MANHOLES

- A. Build each manhole to dimensions shown on Drawings and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.

- B. Set frames for manholes, within areas to be paved, to final grade. In asphalt pavement, surround frames set to grade with a ring of compacted asphalt concrete base material immediately after backfilling operations are complete. Place asphalt concrete mixture up to one (1) inch below top of frame, slope to grade, and compact with hand tamp.
- C. Precast bases shall be placed on a bed of crushed gravel or crushed limestone, meeting AASHTO M 43 gradation, having a minimum thickness of three (3) inches. The bedding shall be compacted and provide uniform support for the entire area of the base.
- D. Provision shall be made for a minimum of four (4) inches and a maximum of twelve (12) inches of precast concrete grade rings between the uppermost precast section and the bottom of the cast iron manhole frame in order to set manhole cover to grade.
- E. No more than two lifting holes or other lifting devices shall be utilized for handling the precast sections. All lifting holes shall be acceptably sealed with a hydraulic cement based, fast setting repair mortar, meeting the requirements of Article 2.2 of this Section, prior to backfilling around the manhole.
- F. Inverts shall be formed to the equivalent of half-pipes in concrete and as follows:
 - 1. Carry concrete out to the manhole wall with a slope of ½ in./ft. from the top of the half-pipe.
 - 2. The bottoms of all manholes shall be channeled to conduct flow in the planned direction. Channels shall be the true shape of the lower half of the sewer pipe and shall match inverts of connecting pipe at the manhole wall.

3.6 BRANCH CONNECTIONS

- A. In general, provision shall be made in the sewers for service connections by inserting a wye branch in the sewer at the location shown on the Drawings, where required or ordered, for each service connection with a branch size called for by the Drawings but never less than six (6) inch, for sewers ten (10) feet or less in depth. Where indicated on the plans, the Contractor shall construct a riser, as per detail, in such manner, that the top of the riser shall be not less than seven (7) feet below grade or at such elevation as to properly receive the required service connection, with full regard to elevation of service sewer and slope from building or structure to the sewer which shall not be less than one percent (1%).
- B. The approximate location of service connections are shown on the Drawings based upon available information. The Owner may increase the number of connections or delete some connections as the sewer is being built.
- C. Openings at the outer ends of the connections shall be closed and sealed with approved stoppers when connection is not immediately placed into service.

3.7 MAINTAINING SEWAGE FLOW

- A. The Contractor shall be required to maintain the flow in all existing live sewers during construction and the method employed shall be approved by the Engineer.

3.8 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

- A. The Contractor shall replace, move, support, or repair and maintain all pipes for water, steam, air or gas, and all wire conduit(s), and all other structures encountered in the work and repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of the Contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the full satisfaction of the Owner.

3.9 CONNECTION TO EXISTING SEWER SYSTEM

- A. The Contractor shall make connections to the existing sewer system as shown on the Drawings. The connections shall be made by the Contractor at such hours that will cause the least disturbance to the flow in the existing sewer system. The Contractor, however, shall notify the Engineer at least five working days in advance of the time he desires to make the connections and no such connections shall be made until the permission of the Engineer is obtained.

3.10 CLEAN-UP

- A. Before final acceptance for the Work, the Contractor shall clear the sewers of any mortar, dirt or other refuse that may have been left or accumulated in the sewers. All manholes and other structures shall be cleared of all forms, scaffolding, bulkheads, centering, surplus mortar, rubbish or dirt and left in a clean and proper condition.

3.11 DEFECTS TO BE MADE GOOD

- A. If, at any time before the completion of the contract, any broken pipes, or any defects, are found in the sanitary sewers or in any of their appurtenances, the Contractor shall cause the same to be removed and replaced by proper material and workmanship, without extra compensation for the labor and material required. All materials shall be carefully examined by the Contractor for defects before placing and any found defective shall not be placed in the line.

END OF SECTION 333100

SECTION 333100.17 - SERVICE LATERALS, TEES OR RISERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. The contractor shall furnish and install all service laterals, tees and risers at the locations shown on the Drawings or as directed by the Engineer.
- B. Material to be furnished and installed, but not limited to:
 - 1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, yard drains, clean outs, stoppers, plugs, joint restraints, joints and jointing materials, and pipe supports.
 - 2. Granular material for bedding and encasement of pipelines.
 - 3. Class B concrete for blocking and encasement of pipelines.
 - 4. Make connections to all existing and/or new facilities and provide temporary services.
 - 5. Install temporary plugs and/or stoppers and harnessing.
 - 6. Test and clean pipelines.

1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.
- B. Field inspection
 - 1. All pipe sections, specials and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective.

Any defective piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Engineer at the Contractor's expense.
 - 2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.
- C. Field testing
 - 1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.

2. The Engineer may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece of pipe core and any additional samples required.

1.4 SUBMITTALS

- A. Submit shop drawings in accordance with the General Requirements showing layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly.
- B. A pipe manufacturer's certificate stating that the materials have been sampled and tested in accordance with the appropriate provisions and meet the requirements of the designated specification and shall be signed by an authorized agent of the manufacturer.
- C. If directed by the Engineer, each certificate shall be accompanied by a report showing test results compared to specification requirements. Test specimens shall be selected in conformance with the designated specification, except that not less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

PART 2 - PRODUCTS

2.1 SEWER PIPE AND JOINT MATERIALS

- A. All sewer pipe and joint materials for service laterals and risers shall be of the type specified in the specifications herein, or as shown on the Contract Drawings.

PART 3 - EXECUTION

3.1 PREPARATION OF TRENCH

- A. Preparation of trenches shall be done as specified in the specifications herein, or as shown on the Contract Drawings.

3.2 PIPE INSTALLATION

- A. Installation shall be done as specified in the specifications herein, or as shown on the Contract Drawings.

3.3 TESTING

- A. Testing shall be done as specified in the specifications herein, or as shown on the Contract Drawings.

3.4 SERVICE LATERALS, TEES OR RISERS

- A. The following are included for payment under this item:
 - 1. T-branch as indicated on the drawings or in the proposal for standard service lateral or riser.
 - 2. Riser for standard service sewer.
 - 3. Standard service sewer.
 - 4. Reconnecting existing service sewer.
- B. All T-branches, risers and service laterals shall be 6-inches in diameter unless specifically shown or called for as of a different size.
- C. All stoppers, which shall be approved by the Engineer, shall be sealed in the pipe in such a manner that they will be watertight and will not move during testing for leakage. All stoppers for T-branches shall be painted yellow for the sanitary sewer connection.
- D. Each T-branch for standard service laterals or service risers shall consist of the furnishing and placing of a T-branch in the trunk or street sewer complete with stopper, joint materials, required excavation, bedding, backfill and location marker. T- branches for service connections installed at locations shown on the contract drawings shall be "Kor-N-Tee" type as manufactured by National Pollution Control Systems, Inc.; or equal.
- E. Each riser for a standard service lateral, or sewers, shall consist of the furnishing and placing of a straight pipe riser (and curved pipe riser, if necessary) from the T-branch in the trunk or street sewer, 90 degree long radius bend or double Y-branch at the top of the riser, stoppers, concrete encasement, required excavation and location marker. A riser will be used whenever directed by the Engineer or shown on the drawings. Payment for only one (1) riser will be made whether a 90 degree long radius bend or a double Y-branch is used at the top of the riser.
- F. Each standard service lateral shall consist of furnishing and installing all curved and straight pipe at the grade determined by the Engineer from the T- branch or riser to the property line, unless otherwise shown on the drawings, including bedding, backfill, excavation and location marker.
- G. Reconnecting of existing service laterals shall each consist of the furnishing and installing of the T- branch and all curved and straight pipe as required, the removal of such existing service laterals as is necessary, and the furnishing and placing of all materials to securely plug the discontinued service to the old sewer and make proper connection to the new sewer. All excavation required to complete the reconnection shall be included.
- H. The Contractor shall furnish and place all pipe, specials, joint materials, bedding and concrete encasement or supports for all service connections as shown on the drawings. All pipe and specials shall be new and no salvaged materials shall be used.
- I. Risers, T-branches, service laterals and reconnections, shall be constructed at the location shown on the drawings or where ordered by the Engineer.

- J. The location of T-branches, risers and the ends of the service connections shall, unless otherwise ordered, be marked by a vertical oak strip two (2) inches in cross-section, extending from the end of the branch to the bottom of the pavement or to within one (1) foot of the surface of the ground.
- K. Where curbs are available the location of the end of each service connection shall be marked by a two (2) inch cross cut into the top of the curb on the side of the street to be served by the connections.
- L. In all cases, the open ends of pipe shall be securely closed with carefully fitted stoppers and sealed to prevent the entrance of water, earth or other substance into the sewer. Approved plastic stoppers may be used if they properly fit into the bell.

END OF SECTION 333100.17