

SECTION 01 14 00

WORK RESTRICTIONS

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK.** Provide the labor, materials, tools, and equipment necessary, temporary or permanent, required to construct the project and improvements in accordance with the drawings and specifications, including the work restrictions specified herein.
- 1.3 **QUALITY ASSURANCE** (Not used.)
- 1.4 **SUBMITTALS**
 - A. **Construction Schedule.** The Contractor shall prepare and submit to the Engineer/Architect in writing proposed schedule and overall sequence of construction and schedule for this project.
 - B. **Construction Staging Area.** The Contractor shall prepare and submit to the Engineer/Architect a site plan showing the proposed construction staging area.
- 1.5 **JOB CONDITIONS**
 - A. **General Requirements.** It is imperative that existing facilities remain functional during the construction to the extent that the present (preconstruction) facilities will not be reduced.
 - B. **Construction Staging Area.** Storage of equipment and materials for construction shall be limited to the staging area. The Contractor shall prepare and submit to the Engineer/Architect a site plan showing the proposed construction staging area.
 - C. **Construction Start.** No construction shall commence until approval of the Contractor's proposed schedule and overall sequence of construction for the project.
 - D. **Coordination**
 1. The General Contractor shall coordinate the work of all subcontractors, crafts, and trades engaged in the work.
 2. The General Contractor shall coordinate the work of all the Prime Contractors on-site.
 3. The General Contractor shall develop and have final responsibility with respect to coordination of the work in developing and enforcing the schedule.

E. **Site Accessibility**

1. Keep driveways and entrances clear and available to the Owner at all times. Do not use these areas for parking or storage.
2. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

F. **Noise, Dust, and Odor Control**

1. Conduct all construction activities to minimize all unnecessary noise, dust, and odors.
2. Do not use oil, or other materials which may cause tracking, to control dust.

G. **Specific Requirements**

1. Meet with the Engineer/Architect and Owner to determine which systems or facilities must be maintained in use or operation. Also determine possible hours and time use or service may be interrupted.
2. The Owner has the authority to stop or prohibit work which would interfere with or jeopardize the continuous and reliable operation of the facility.
3. Contractor shall review bypass pumping and maintenance of traffic plan sheets for specific requirements.

1.6 **DELIVERY, STORAGE, AND HANDLING** (Not used.)

1.7 **SPECIAL WARRANTY** (Not used.)

PART 2 - PRODUCTS

2.1 **GENERAL.** The Contractor shall prepare and provide the Owner and Engineer/Architect the following products:

- A. **Projected Construction Schedule.** The Contractor, and in the case of multiprime contracts, all Contractors shall jointly prepare a projected construction schedule in the form of a horizontal bar chart.
- B. **Revised Construction Schedule.** A revised construction schedule incorporating any changes resulting from the schedule review.
- C. **Updated Construction Schedule.** Updated projected construction schedule as the work progresses. Updating would reflect changes in the schedule due to changes in scope, materials delay, or abnormal weather conditions.
- D. **Written Sequence of Construction.** An overall written sequence of construction.
- E. **Proposed Methods of Construction.** The proposed methods of construction including excavation equipment, storage of material, and disposal of excess material.

- F. **Construction Staging Area.** A site plan of the project site showing the location of storage and activity plan during construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification.

1. Confirm and verify all requirements, conditions, dimensions, and time intervals prior to beginning actual construction in any given area and that the conditions have not changed since preparation, submission, and approval of the sequence of construction.
2. Notify the Owner and Engineer/Architect prior to commencing the work if the proposed work is incompatible or incomplete.

3.2 PREPARATION

- A. **Safety.** All required or appropriate safety measures, methods, devices, or equipment shall be available and in place prior to beginning any construction.
- B. **Permits.** All required permits and approvals shall be on-site at the time of beginning construction.

3.3 REQUIREMENTS

- A. **Sequences and Interferences.** Since alterations, additions, and/or tie-ins are included in this work that potentially could interfere with the existing facilities' function, the Contractor shall take any and all steps necessary to avoid this interference. The Contractor shall, in general, complete as much noninterfering work as possible before making tie-ins, switchovers, and interrupting service.

When avoidance of interference is impractical by the above methods, the Contractor shall take the following additional steps:

1. The Contractor shall schedule his work so as to minimize the time interval and/or frequency that the sewer/lateral is out of service.
2. The Contractor shall coordinate all labor, materials, and equipment to be on the site at the start of a shutdown.
3. The Contractor shall work continuously (24 hours per day, 7 days per week) until service is restored.
4. The Contractor shall schedule his work to correspond with minimum demands on any system or facilities. This may include weekend or evening work.
5. The Contractor shall coordinate with and notify the Owner 72 hours in advance of a shutdown so that the Owner can make the necessary preparations.

- B. **Construction Staging Area.** The General Contractor shall construct and maintain a construction staging area. Area developed and maintained shall be suitable in size to meet the needs of the Contractor. Construction staging area shall be returned to original condition by the General Contractor following the completion of the project. Returning areas to original condition shall include removal of all roadway materials, discing of soil, regrading, and seeding.
- C. **Construction Compliance.** Judgments of practicality of compliance will be made by the Engineer/Architect and approval by the Engineer/Architect will be given for proposed sequence only. The Contractor shall furnish all labor, equipment, and materials, temporary or permanent, required for compliance at no additional cost to the Owner.
- D. **Coordination.**
1. The Contractor shall be responsible for coordinating and scheduling the activities of his subcontractors and utility work forces with the Owner.
 2. The CIPP lining Contractor and the manhole rehabilitation Contractor shall coordinate work so both contractors can utilize the same bypass pumping setup (if required).
- E. **Sequence of Construction.** The following sequence of construction is to be followed, unless otherwise directed by the Engineer/Architect or Owner. Because of the necessity of coordinating the sewer lining, manholes, and laterals, the following general task list has been developed to identify primary work tasks.
1. Submit detailed comprehensive CIPP Lining plan which describes and shows proposed lining runs, flow control/bypass pumping; and maintenance of traffic plans (MOT) for approval.
 2. Above ground preconstruction televising.
 3. Cleaning and pre-televising.
 4. Submit all pre DVDs for approval.
 5. Install sewer main liner, and reinstate laterals.
 6. Seal existing sanitary sewer laterals.
 7. Rehabilitate existing manholes.
 8. Perform final post televising.
 9. Submit all post DVDs for approval.

3.4 DEMONSTRATION

- A. **Records and Responsibility.** The Contractor shall maintain all approved schedules, sequences of construction, copies of communications of all coordination, and other information as required at the construction site. A single point of coordination shall be designated in one responsible individual by the Contractor.

END OF SECTION

SECTION 01 32 34

PRECONSTRUCTION AUDIO-VISUAL RECORDING

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK.** Provide the labor, tools, equipment, and materials necessary to furnish the audiovisual recording in accordance with the drawings and specifications.
- 1.3 **QUALITY ASSURANCE**
 - A. **Codes and Standards.** Perform all work in providing the audiovisual recording in compliance with applicable requirements of governing agencies having jurisdiction.
- 1.4 **SUBMITTALS.** Submit all submittals in accordance with the Division 1 Submittal Requirements and the requirements within this specification section.
 - A. **Submittal Package No. 1 – Sample DVD**
 1. At the start of the recording, submit a sample DVD of a portion of this project. No taping shall occur before the sample DVD is approved.
 - B. **Submittal Package No. 2 – DVDs and Logs**
 1. DVD Log. Provide a log that accurately catalogs the contents of each DVD in an acceptable manner. Information in the DVD logs will include the following:
 - a. Street name, easement, address, project name, contract no.
 - b. Sheet number or numbers relative to the line entry of a particular area of coverage.
 - c. DVD numbers.
 - d. Real-time code indexing for each segment of the project. Real-time code indexing will indicate hours, minutes, and seconds to cross reference with playback equipment to locate specific points of interest on the project.
 - e. Direction of travel for each specific segment.
 - f. Viewing side for each specific segment.
 - g. Starting point for each specific segment.
 - h. Ending point for each specific segment.
 - i. Project information (project title, Owner, date, location).

2. DVD. Label all DVDs with project information in an acceptable manner. Cross reference the information on the labels with the DVD logs. Information on labels shall include the following:
 - a. DVD number.
 - b. Project title.
 - c. Location of project.
 - d. Month and year of coverage.
 - e. DVDs must be marked as sets (Engineer set, Owner set, Contractor set).
 - f. Quick reference list of the contents of the DVD.

1.5 **JOB CONDITIONS**

- A. **Recording.** Record each area and submit DVDs before mobilization begins. All recording shall be witnessed unless waived in writing.
- B. **Visual Inspection.** Prior to recording, investigate all areas visually with notation made of features not readily visible by recording methods. This would include, but not be limited to, culverts (size, type, condition) and manholes that may be partially buried. Record all measurements made during the inspection.

1.6 **DELIVERY, STORAGE, AND HANDLING** (Not used)

1.7 **SPECIAL WARRANTY** (Not used)

PART 2 - PRODUCTS

2.1 **EQUIPMENT**

- A. **DVD.** DVDs shall be original, previously unrecorded, blank DVDs. If duplicate copies are required by the Owner, all copies shall be limited to direct copies of the original DVD and marked as such.
- B. **Camera/Camcorder.** The camera/camcorder shall have the following features:
 1. Color.
 2. High-resolution, digital recording.
 3. 1/4-inch, 1/3-inch, or 1/2-inch charged coupled device imaging systems.
 4. Optical Stabilization. No electronic stabilization.
 5. 20X minimum optical magnification.
 6. NTSC 525 lines resolution/60 fields/30 frames per second.
 7. Minimum illumination capabilities of at least 3 lux.
- C. **Portable DVD Player.** The portable DVD player, when used in conjunction with a separate color video camera, shall be alternating current (ac) or battery operated.
- D. **Wheeled Vehicles.** Clearly mark vehicles used for recording purposes with company's name and telephone number. Vehicles shall incorporate signs, flaggers, and lights as needed for safety purposes.

PART 3 - EXECUTION

3.1 VIDEO INFORMATION

- A. **Audio.** Begin each DVD with an audio tract that includes the current date, project name, municipality, and general location, i.e., name of the street or property owner; location of cross county line; viewing side; and direction of progress. Note the engineering stationing (where required) on the audio track. Identify houses and buildings audibly by an address when available.
- B. **Date and Time.** Display the month, day, year, hours, minutes, seconds, and location on all video recording.
- C. **Stationing/Positioning.** Stationing must be continuous and accurate and reflect the stationing within the field of view. The stationing must coincide with stationing on project plans and utilize standard engineering notation (10+00). Global positioning system (GPS) may be used with or in place of engineering stationing. Differential GPSs are to be used where available, with updates one per second at 5-meter or less spherical accuracy. Standard GPS accuracy is as dictated by United States Department of Defense mandate. GPS display will be at 1-meter-longitude and 1-meter-latitude increments (4032 N 639) (08216 W 401).

3.2 COVERAGE

- A. **General.** Recording shall include, but not be limited to:
 - 1. Existing pavement.
 - 2. Driveways.
 - 3. Sidewalks.
 - 4. Curbs.
 - 5. Ditches (drainage patterns are of particular concern).
 - 6. Streets (including condition of paving for full width).
 - 7. Landscaping (fencing; rocks; mailboxes; etc.)
 - 8. Shrubs.
 - 9. Trees.
 - 10. Culverts.
 - 11. Catch basins.
 - 12. Headwalls.
 - 13. Fences.
 - 14. Visible utilities.
 - 15. Signs
 - 16. Culverts and headwalls
 - 17. All buildings (interior and exterior) located within the zone of influence of construction. Of particular concern are existing faults, fractures, defects, or other imperfections.

- B. **Streets.** Record streets and street areas for the full width of the zone of influence of construction, including both sides of the street. The term "street" shall be understood to mean street, highway, avenue, boulevard, road, alley, lane, driveway, parking lot, etc., and all adjacent areas within the possible zone of influence of construction.
- C. **Easements.** Record easements for the full width of the permanent and temporary easements and all other adjacent areas lying within the zone of influence of construction. Easement means all areas not in streets that require record coverage. Include in this coverage any areas that are intended to be used for construction access, storage, or waste disposal.

3.3 RECORDING CONDITIONS

- A. **Visibility.** Record during times of good visibility. Do not record outside during the following conditions unless otherwise authorized:
 - 1. Darkness.
 - 2. During periods of visible precipitation.
 - 3. When the ground area is covered with snow, leaves, or debris.
- B. **Lighting.** In order to produce the proper detail and perspective, use adequate auxiliary lighting to fill in shadow areas, utility poles, road signs, and other such objects, as well as other conditions requiring artificial illumination.
- C. **Rate of Speed.** Do not exceed an average rate of speed of 50 feet per minute during recording. Panning rates and zoom-in/zoom-out rates shall not exceed 10 percent over a 3-second interval.
- D. **Distance.** When conventional wheeled vehicles are used for recording, the minimum distance from the camera lens to the ground shall be 8 feet.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK**
 - A. **Scope of Work.** Provide all labor and materials necessary to furnish the following submittals as required by each individual section of the specifications.
 1. Shop drawings.
 2. Product data.
 3. Samples/mock-ups.
 4. Operation and Maintenance (O&M) manuals.
 5. Personnel qualifications.
 6. Source quality control documents.
 7. Material field test reports.
 8. Product/material certifications.
 9. Special warranties.
 10. Project record documents.
 11. Schedules
 12. Work plans
 13. Others (as specified in the individual technical specifications).
- 1.3 **QUALITY ASSURANCE** (Not used)
- 1.4 **SUBMITTALS**
 - A. **General.** Submit all submittals in accordance with the requirements within this specification section.
 - B. **Submittal Package No. 1 – Submittal Schedule**
 1. Submit a submittal schedule according to paragraph 2.05 of Section 00 70 00, "General Conditions."
 - a. This schedule shall include all submittals (including all Prime Contractors' submittals) that are required to be used on the project, and the date of submittal to the Engineer/Architect.
 - b. Include in schedule a milestone for notification of the Engineer/Architect prior to field-verifying operation and maintenance manuals.
 - c. Submittals requiring multiple submissions shall include multiple listings on the documents.

- d. The Engineer/Architect will review the list and make any necessary comments.
- e. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
- f. Coordinate transmittal of different types of submittals for related elements of the work so processing will not be delayed by the need to review submittals concurrently.
- g. Multiple Prime Contracts. Allow time in schedule for all submittals to go through the Prime General Contractor for coordination purposes before they are forwarded to the Engineer/Architect.
- h. Processing. Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals, depending upon the complexity of the submittal.
 - 1) Allow 2 weeks for processing each submittal.
 - 2) No extension of the Contract Time will be authorized because of failure to transmit submittals to the Engineer/Architect sufficiently in advance of the work to permit processing.

1.5 **JOB CONDITIONS** (Not used)

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. **Store and protect large samples and mock-ups** until the Project is completed, then properly dispose of off-site.
- B. **Maintain and make available** to the Engineer/Architect, at the job site, a complete file of all approved submittals as part of the project record documents.

1.7 **SPECIAL WARRANTY** (Not used)

PART 2 - PRODUCTS

2.1 **SUBMITTAL TRANSMITTAL**

- A. **Transmit each submittal** from the Contractor to Engineer/Architect using a transmittal form. Include the following on the transmittal form.
 - 1. Relevant information and requests for data.
 - 2. Deviations from Contract Document requirements, including minor variations and limitations.
 - 3. The specification section number.
 - 4. Other pertinent information to identify the items being submitted.

2.2 GENERAL REQUIREMENTS FOR SUBMITTALS

- A. **Originals.** The Contractor, the subcontractors, or suppliers shall generate submittal information. No reproductions of partial (or complete) versions of the plans, sections, details, schematics, specification pages, etc., from the Contract Documents are acceptable.
- B. **Complete Submittals.** Clearly describe the equipment to be furnished with complete and detailed submittal information.
- C. **Identification.** Properly identify all submittal-related documents and arrange in a logical order to best present the information. Provide an index that includes the following on every submittal.
 - 1. Manufacturer's name and address.
 - 2. Submittal date and revision number, if applicable.
 - 3. Contract identification and specification section.
 - 4. Drawing scale and orientation.
 - 5. Submittal page number or sequence of pages.
 - 6. Drawing number.
- D. **Verification.** Where existing conditions or structures exist, field-verify dimensions, elevations, clearances, etc. The submittal shall not be accepted for review until such verified data is clearly indicated.
- E. **Legends.** All submittal diagrams, drawings, schematics, etc., shall include complete keys, legends or similar explanation as to the graphics, and symbols and abbreviations used. In general, all graphics, symbols, abbreviations, and equipment nomenclature used for a submittal shall duplicate those used on the Contract Drawings.
- F. **Approvals.** Provide the following on each submittal.
 - 1. A space approximately 4" x 5" on to record the Contractor's review and approval markings and the action taken. These shall include the Contractor's:
 - a. Approval stamp.
 - b. Signature.
 - c. Date of approval.
 - d. Deviations from the Contract Documents.
 - 2. An equal area beside the Contractor's review and approval markings for the Engineer/Architect's review stamp.
- G. **One Section per Submittal.** Each submittal shall pertain to only one specification section.

- H. **All submittal information shall be:**
1. Neatly arranged.
 2. Legible.
 3. Not distorted or faded.
 4. English.
 5. In United States standard units.
 6. Typed.
- I. **All letters, certifications, and similar documents** shall be submitted in their entirety. Single pages of multiple-page letters, or letters with deleted passages will not be acceptable for submittal purposes.
- J. **"Generic" letters, test reports,** material certifications, or similar documents which do not specifically address the requirements of the Contract Documents for the actual materials being furnished will not be acceptable.
- K. **Mark all submittals** to clearly indicate the full extent of the equipment to be furnished.
1. Indicate all options to be provided, materials of construction, dimensions, and other information pertinent to the submittal.
 2. Options, materials, and dimensions which do not pertain to the materials or equipment to be furnished shall be neatly marked out so as to avoid confusion and doubt during review, delivery, and installation.
- L. **Resubmittals must clearly identify** all changes and revisions. Mark the drawing "revised" with the revision date indicated. Each resubmittal shall reference the previous submittal by the Engineer/Architect's log number.
- M. **"By Others."** All submittals are reviewed as if prepared by the Prime Contractor. The term "By Others" is appropriate to indicate supply by the Owner or another Prime Contractor. Where a subcontractor or supplier uses the term "By Others" to indicate work by the Prime Contractor or another subcontractor or supplier, the Prime Contractor shall change "By Others" to indicate the actual source.
- N. **Deviations from Contract.** Highlight, encircle, or otherwise indicate deviations from the Contract Documents in all submittals.

2.3 SPECIFIC SUBMITTAL-TYPE REQUIREMENTS

- A. **Shop Drawings.** The following paragraphs detail the general requirements for shop drawings and specific requirements for specific types of shop drawings.
1. General Requirements.
 - a. A shop drawing is a detailed representation of the work to be performed to demonstrate compliance with the Contract Drawings including:

- 1) Material and equipment layout.
 - 2) Fabrication drawings.
 - 3) System and electrical schematic diagrams.
 - 4) Equipment and material schedules.
 - 5) Installation details.
- b. Submit newly prepared information, drawn to accurate scale.
- c. Standard information prepared without specific reference to the project is not considered shop drawings.
2. Equipment/Material Layout Drawings.
- a. Include:
- 1) Plot plans.
 - 2) Plant site maps.
 - 3) Equipment location plans.
 - 4) Equipment and material layout plans and sectional views.
 - 5) Connection detail drawings.
 - 6) Similar drawings showing the incorporation of materials and equipment into the work.
 - 7) The physical layout to scale, including elevations, plant grid coordinates, dimensions to new/existing structures, and other items of the work.
 - 8) Dimensions.
 - 9) Labeling.
 - 10) Notes.
 - 11) Legends.
 - 12) Bills of materials.
 - 13) All other information required to graphically describe the proposed work.

B. Product Data. Product data is submittal information that fully describes the item to be incorporated into the work. Product data shall include when applicable:

1. Manufacturer name.
2. Catalog cut-sheets.
3. General descriptive bulletins/brochures/specifications.
4. Materials of construction data and parts list.
5. Finish/treatment data.
6. Equipment/material weight/loading data.
7. Engineering design data, calculations, and system analyses.
8. Digital system documentation.
9. Any deviations from the contract documents.
10. Material Certifications. These include signed certificates or declarations by the Contractor, supplier, manufacturer, testing laboratory, or

recognized certification agency which document that materials and product composition or construction comply with specified requirements and stated reference standards.

11. Manufacturer's printed recommendations.
12. Compliance with recognized trade association and testing agency standards.
13. Application of testing agency labels and seals.
14. Notation of dimensions verified by field measurement.
15. Notation of coordination requirements.
16. Specific response to detailed specification requirements.
17. Maximum operating pressure and temperature ratings.
18. Other information specifically called for under the sections of Divisions 1 through 33 shall be included in this category.

C. Samples or Mock-Ups

1. Samples. Samples are portions of or complete units of the precise article proposed to be furnished.
2. Color and Pattern Charts. When the precise color and pattern are not specifically prescribed in the Contract Documents, or when the Contract Documents require that a product be furnished in a color or pattern directed by the Owner or Owner's Representative, submit accurate color charts and pattern charts of the available ranges for review and selection.
3. Mock-Ups. Build mock-ups with full-size products to match the scale of the proposed construction to demonstrate compliance with specified requirements and construction standards.

D. O&M Manuals

1. General.
 - a. Bind each copy in an appropriately sized three-ring notebook a cover designating the name of equipment, maintenance, and specification section number.
 - b. Bind operation and maintenance instructions for each specification section in a separate notebook.
2. Required Information. Include the following information to provide with a description of the incorporation of the equipment into the work and with functional data to evaluate equipment operation.
 - 1) Installation, routine preventive maintenance, troubleshooting, and lubrication instructions.
 - 2) Procedures for moving, supporting, and anchoring of equipment, including tolerances for settings and adjustment.
 - 3) Storage requirements to protect products prior to installation and during periods of prolonged shutdown.
 - 4) Storage requirements of extra materials.

- b. Parts List. Include assembly, exploded-view illustrations, or sectional drawings with all parts identified. Also include descriptions, quantity (per assembly) required, and original equipment manufacturer's part numbers.
- c. Supplier Data. Provide addresses, telephone numbers, and names of contact persons for equipment manufacturer and manufacturer's representative. Include both regional (local) and home offices.
- d. Warranties and Guarantees. Include copies of the approved draft warranties in the initial operation and maintenance manual submittal. Following substantial completion, provide copies of the executed final warranties for insertion into the final operation and maintenance manual.
- e. Approved Submittals. Provide a complete list (including submittal numbers) of all approved submittals pertaining to the operation and maintenance instructions.
- f. Copies of all materials shipped with the equipment.
- g. Copies of all approved submittals including control wiring diagrams.

E. Personnel Qualifications

- 1. General. These qualification statements and information pertain to personnel and entities employed in the prosecution of the work.
- 2. Specific Information. Provide the following information regarding the proposed personnel or entity.
 - a. Education/training.
 - b. Company employment history.
 - c. Professional experience.
 - d. References.
 - e. Certifications or licenses.

Stated qualifications shall be pertinent to the specific task for which qualifications are requested.

F. Source Quality Control Documents

- 1. Inspection. Inspection data includes inspection procedures and results of factory inspections of products, equipment, or systems. Within this type of submittal information are factory witness test procedures, schedules and reports, and similar data.
- 2. Testing. Test data is the information leading to or resulting from tests performed on materials, equipment, or systems at the manufacturer's

facilities or in testing laboratories. This also includes data on testing equipment. Examples of test data include all information, test arrangement, drawings, illustrations, diagrams, curve plots, graphs, and other data which substantiates or establishes a material or product characteristic, quality, or other trait as a result of test required by the Contract Documents.

G. Material Field Test Reports

1. Report Data. Written reports of each inspection, test, or similar service shall include, but not be limited to:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making the inspection or test.
 - f. Designation of the work and test method.
 - g. Identification of product and specification section.
 - h. Complete inspection or test data.
 - i. Test results and interpretations of test results.
 - j. Ambient conditions at the time of sample taking and testing.
 - k. Comments or professional opinion as to whether inspected or tested work complies with Contract Document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on testing.
2. Example reports covered by this paragraph include compaction tests and concrete, leakage, and disinfection tests.

H. Special Warranties

1. There are two general types of warranties covered by this specification.
 - a. Manufacturer's Express Warranties.
 - 1) These are formal statements of certifications by manufacturers which warrant to the Owner that products and equipment are free from defects in material and workmanship.
 - 2) These are standard warranties issued with products and equipment which supplement the Contractor's warranty and may also extend coverage past the expiration of the Contractor's warranty.
 - 3) Include with the manufacturer's warranty data shall be a notification of the availability of an extension to the standard warranty including terms.
 - b. Special Express Warranties.

- 1) The form, format, and conditions of special warranties are described in the various specification sections of the Contract Documents.
 - 2) These are formal warranties above and beyond the Contractor's warranty and manufacturer's standard warranties.
 - 3) These warranties may be based on performance, power consumption, maintenance projects, or other operating parameters.
 - 4) Extended warranties, service contracts, and performance bonds are also included under this category.
2. Term or Period. Unless otherwise established by individual sections in Divisions 2 through 33, all Contractor express warranties shall extend for 1 calendar year from the date of substantial completion of the project or acceptance date of the product or portion of work thereof, whichever is the later date.
 3. Content of Warranty. The warranty shall contain, as applicable:
 - a. Effective starting date of the warranty period.
 - b. Statement of the terms and conditions of the warranty, if any.

I. Project Record Documents

1. Project record documents are to be in accordance with paragraph 6.12 of Section 00 70 00, "General Conditions."
2. Record Contract Drawings. Legibly mark contract drawings to record actual construction including:
 - a. Depths of various elements of foundation in relation to data.
 - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - d. Field changes of dimension and detail.
 - e. Changes made by change order or field order.

J. Extra Materials/Spare Parts

1. Coat or package extra materials to prevent corrosion or deterioration during long-term indoor storage.
2. Clearly label all packaging with:
 - a. Part name.
 - b. Part number.
 - c. Associated equipment name and number.
 - d. Manufacturer's name and address.

- e. The required storage environment for the materials.
- K. **Other.** These include special tools/repair parts list, photographs, videos, certificates, construction schedules, drawings, reports, meeting minutes, data, and information required by the Contract Documents which do not logically fall into the submittal types defined above.

PART 3 - EXECUTION

3.1 SUBMITTAL PREPARATION AND TRANSMITTAL

A. Coordination

1. Coordinate preparation and processing of submittals with performance of construction activities.
2. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay and in accordance with the submittal schedule.
3. The General Contractor is responsible for resolving any disputes between Prime Contractors over submittals.

B. Verification

1. Verify the correctness and completeness of all submittals prior to forwarding same for review.
2. All submittals shall comply with the Contract Documents.

C. **Package each submittal** appropriately for transmittal and handling including a transmittal form.

D. **The Prime General Contractor shall submit** the minimum number of submittals as listed in paragraph 3.3 of this specification.

E. **Submittals received from sources** other than the Prime General Contractor will be returned without action.

F. **Other Prime Contractors shall submit** all submittals through the Prime General Contractor.

3.2 ENGINEER/ARCHITECT'S REVIEW AND ACTION

A. General

1. Except for submittals for record, information, or similar purposes where action and return is not required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return promptly.
2. Cost to review any submittal more than twice will be deducted from Contractor's monthly estimates and final payments.
3. The Engineer/Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- B. **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 action taken.
1. Final Unrestricted Release. Where submittals are marked "Approved," that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
 2. Final-but-Restricted Release. When submittals are marked "Approved as Noted," that part of the work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
 3. Returned for Resubmittal.
 - a. When submittal is marked "Not Approved" and/or "Revise and Resubmit," do not proceed with that part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity.
 - b. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
 - c. Do not permit submittals marked "Not Approved" and/or "Revise and Resubmit" to be used at the project site or elsewhere where work is in progress.

3.3 MINIMUM NUMBER OF SUBMITTALS AND DISTRIBUTION

- A. **After a submittal has been approved,** the Engineer/Architect will make the following distribution:

Submittal	Minimum No. of Submittals	Distribution		Engineer/ Architect
		Owner	Contractor	
1. Shop Drawings	6	2	2	2
2. Product Data	6	2	2	2
3. Samples/Mock-Ups	2	1	0	1
4. O&M Manuals	6	4	1	1
5. Personnel Qualifications	4	2	1	1
6. Training Documents	4	2	1	1
7. Source Quality Control Documents	4	1	1	2
8. Material Field Test Reports	4	1	1	2
9. Start-Up Documents	4	1	1	2
10. Operational Demonstration Documents	4	1	1	2
11. Special Warranties	4	2	1	1

12. Project Record Documents	1	1	0	0
13. Extra Materials	1	1	0	0
14. Others	4	1	1	2

- A. **Multiprime Contract Distribution.** The Engineer/Architect will forward all reviewed submittals to the Prime General Contractor only. The Prime General Contractor is then responsible to send each submittal to every Prime Contractor that it affects for their use.

3.4 SPECIFIC SUBMITTAL-TYPE EXECUTION REQUIREMENTS

A. **O&M Manuals**

1. Submittal Procedure. Submit one initial copy of the O&M manual for review. After approval of the initial copy, submit the remainder of the revised manuals.
2. Verification. Verify the accuracy of the initial O&M manual by visual and physical inspection of the installed equipment during start-up.
 - a. Perform field verification in the presence of the Owner or Owner's Representative.
 - b. Physically trace and document as required all wiring and piping.
 - c. Visually inspect equipment and components and compare configurations and nameplate information to O&M manual.
 - d. Make any changes, additions, or deletions to the O&M manual identified during field verification.
 - e. In the event changes are made to the equipment following field verification, submit a final supplement of the revisions of the O&M manuals before approval.

- B. **Samples for Tests.** Furnish samples of material as may be required for examination and test. Take all samples of materials for tests according to standard methods or as provided in the Contract Documents.

END OF SECTION

SECTION 01 55 27

INTERFERENCE WITH TRAFFIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. **General.** Provide the labor, tools, equipment, and materials necessary to maintain traffic in accordance with the drawings and as specified herein.

1.3 QUALITY ASSURANCE

- A. **Codes and Standards.** Perform all work in the maintenance of traffic in compliance with applicable requirements of governing agencies having jurisdiction.
- B. **Maintenance of Traffic.** Maintain traffic in accordance with the *Manual of Uniform Traffic Control Devices*.
- C. **Coordination and Submittals.** Contractor shall adhere to the standards and regulations of; submit detailed MOT plans to; and coordinate daily with; the governmental entity having jurisdiction of the roadways subjected to work. Said entities shall include but not be limited to: ODOT, County, Townships, and Villages.
 - 1. Contractor shall not proceed with implementing MOT without prior review and approval of Contractor's proposed MOT plan from the appropriate jurisdictional entity.

1.4 SUBMITTALS (Not used.)

1.5 JOB CONDITIONS

- A. **Owner Requirements.** If proper maintenance of traffic facilities and proper provision for traffic control are not being provided and the safety of the public is thus endangered, the Owner may take the necessary steps to place them in proper condition and the cost of such services will be deducted from any payment which may be due or become due the Contractor.

1.6 DELIVERY, STORAGE, AND HANDLING (Not used.)

1.7 SPECIAL WARRANTY (Not used.)

PART 2 - PRODUCTS (Not applicable.)

PART 3 - EXECUTION

- 3.1 **DESCRIPTION.** Furnish, erect, maintain, and remove lights, signs, barricades, temporary guardrails, and other traffic control devices, and furnish watchpersons and flag persons as may be necessary to maintain safe traffic conditions.
- 3.2 **MAINTAINING TRAFFIC**
- A. **Traffic Diversion.** Whenever it is necessary to divert traffic from its normal channel, mark the diversion clearly by cones, drums, barricades, or temporary guardrail. Provide and maintain suitable lights if the markers are left in place at night.
- B. **One-Way Traffic.** One-way traffic will not be permitted. Contractor shall maintain at least one lane of traffic in each direction at all times.
- 3.3 **CLOSED TO TRAFFIC.** Street closings will not be permitted.

END OF SECTION

SECTION 01 57 13

SEDIMENT AND EROSION CONTROL

PART 1 - GENERAL

1.1 **RELATED DOCUMENTS.** Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to work in this section.

1.2 **DESCRIPTION OF WORK**

A. **Scope of Work.** Provide all labor, tools, equipment, and materials necessary to furnish and maintain the soil erosion controls where shown, where shown on the Contractor's Storm Water Pollution Prevention Plan (SWP3), where directed, and as specified herein.

B. **SWP3 Preparation.** As the scope of work and limits of disturbance require, the Contractor will prepare an SWP3 for this project, obtain necessary permits, provide dust control, and terminate coverage under the permits, if necessary, upon completion of the work. *Due to the trenchless technology nature of this project, it is not anticipated that an SWP3 will be required, however the Contractor shall be prepared to provide and implement sediment and erosion control products and methods discussed herein as necessary over the course of the project.*

1.3 **QUALITY ASSURANCE**

A. **Codes and Standards.** Perform all work required in the control of erosion during construction in compliance with the following standards as referenced herein:

1. ODOT – Ohio Department of Transportation. Construction and Material Specifications (most recent edition).
2. ODNR – Ohio Department of Natural Resources. "Rainwater and Land Development Ohio's Standards for Stormwater Management Land Development and Urban Stream Protection" (Rainwater and Land Development) current edition.
3. Ohio EPA – Ohio Environmental Protection Agency.
 - a. National Pollutant Discharge Elimination System (NPDES) Permit No. OHC000004, "Authorization for Storm Water Discharges Associated with Construction Activity Under the National Pollutant Discharge Elimination System" (General NPDES Permit).

B. **Conflicts.** In the event of a conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, regulations, or standards shall apply.

1.4 SUBMITTALS

- A. **General.** Submit all submittals in accordance with the Division 1 Submittal Requirements and the requirements within this specification section.
- B. **Submittal Package No. 1 – SWP3 and Notice of Intent (NOI) Form (as needed)**
 - 1. Submit the Contractor's SWP3 including associated drawings and details of sediment and erosion control measures that will be employed during the project.

1.5 JOB CONDITIONS

- A. **Construction Sites Less than 1 Acre**
 - 1. SWP3. Develop and implement an SWP3 for the control of sediment and erosion at this project site throughout construction. At a minimum the SWP3 shall include the following:
 - a. Site drawing showing the limits of all earth-disturbing activities, location of proposed temporary access roads or stockpiles, and location of all proposed sediment and erosion control features (i.e., silt fencing, sediment basins, temporary seeding, etc.). Include details for installation and material specifications for each erosion control feature.
 - b. Written description of the proposed sediment and erosion control measures that will be employed, including a schedule for installation and removal of temporary controls as they are related to actual site construction. Also include information regarding site soils, any permanent or temporary seeding, an inspection and maintenance schedule, and all measures that will be employed by any subcontractors.
- B. **Sediment and Erosion Control Shown on the Plans.** The sediment and erosion control measures shown on the plans, if any, are considered to be the minimum level of control required. Prepare the final SWP3 and use, if appropriate, alternate methods and locations of sediment and erosion control to meet the site requirements provided they are approved.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **General.** Handle all sediment and erosion control materials in accordance with the manufacturer's recommendations.
- B. **Storage.** Store all seeds for temporary seeding in a safe, dry location protected from weather conditions that may affect the seed viability.

1.7 SPECIAL WARRANTY (Not used)

PART 2 - PRODUCTS

2.1 **GENERAL.** The SWP3 shall incorporate some or all of the following equipment and materials for sediment and erosion control measures, as appropriate. Alternative materials and methods as presented in ODOT Item 832 or ODNR's Rainwater and Land Development manual may be considered.

A. **Sediment Barriers.** Sediment barriers are temporary measures using woven wire or other approved material attached to posts with filter cloth of burlap and plastic filter fabric to intercept, detain, and control sediment and erosion from leaving the construction site.

1. Filter Fabric/Silt Fence. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester, or ethylene yarn. Fabric shall be ODOT Item 712.09, Type C or equal.
2. Wire Fencing. Wire fence reinforcement for silt fences at storm drain inlets shall be a minimum of 42 inches in height and a minimum of 14 gauge, and shall have a maximum mesh spacing of 6 inches.
3. Silt Fence Posts. Posts for silt fences shall be either 2-inch-by-2-inch hardwood or equivalent steel with a minimum length of 32 inches. Steel posts shall have projections for fastening wire to them.
4. Storm Drain Inlet Protection Framing. Stakes and framing for yard, drainage ditch, or parking lot inlet protection shall be 2-inch-by-4-inch wood (preferred) or equivalent metal with a minimum length of 3 feet for the stakes/posts.

B. **Matting.** Matting shall be agricultural straw or coconut fiber within photodegradable netting, jute, excelsior, or approved equal synthetic material as specified in ODOT Items 671 and 712.11.

C. **Temporary Seeding and Mulching.** Temporary seeding and mulching are measures consisting of seeding, mulching, fertilizing, and matting used to reduce erosion. All cut-and-fill slopes including borrow pits shall be seeded and/or mulched where and when necessary to eliminate erosion.

1. Materials. Mulch.
 - a. Straw. Straw mulch shall be unrotted small-grain straw, free of sticks or other foreign material.
 - b. Wood Cellulose Fiber. Wood cellulose fiber mulch shall be dyed green and not inhibit seed germination.
2. Fertilizer. Fertilizer shall contain 12 percent total nitrogen, 12 percent available phosphoric acid, and 12 percent water-soluble potash. The name of plant nutrients, weight, and quarantined percentages shall be marked on the sealed containers.

D. **Sediment Structures.** Sediment basins, dams, and dikes are prepared storage areas to trap and store sediment from construction areas and to protect properties and stream channels below the construction areas from siltation.

- E. **Rock Channel Protection.** Aggregate for the rock channel protection, dams, erosion control, or other uses indicated on the drawings, shall be provided in accordance with ODOT Item 601. Gradation/type shall be as noted on the drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. **Examination.** Inspect the existing and proposed site drainage patterns in order that the most efficient methods of erosion control may be selected through the duration of construction.
- B. **Fill material and equipment storage** is prohibited within 200 feet of the stream bank, in the floodplain, in wooded areas, or in other environmentally sensitive areas. Dispose of surplus excavated materials off-site.
- C. **Maintenance.** Be responsible for ongoing inspection and maintenance of the sediment and control features. At a minimum, complete an inspection log at least every 7 calendar days and within 7 days of each rainfall event. Repair/replace damaged features.
- D. **Dust Control.** Minimize dust generation, including wetting down unpaved areas during the construction activities.

3.2 PREPARATION

A. General

1. Limit the surface area of erodible earth material exposed by the clearing and grubbing, excavation, borrow, and fill operations and provide immediate permanent or temporary control measures to prevent contamination of adjacent streams or other water courses, lakes, ponds, or other areas of water impoundment.
2. Such work will involve the construction of temporary ditch checks, filters, benches, dikes, dams, sediment basins, and slope drains, and use of temporary mulches, mats, seeding, or other control devices or methods necessary to control erosion and sedimentation.
3. Prepare and submit an SWP3 in advance of the work.
4. Limit the area of excavation, borrow, and embankment operations in progress commensurate with capability.
5. Deliver sediment and erosion control materials at appropriate times so that the project is not delayed.
6. Do not commence with any earth-disturbing activity until the appropriate sediment and erosion control features are in place.

- B. **Sediment and Erosion Control Devices.** Minimization of denuded areas and the length of time that any area is denuded is the primary method of sediment and erosion control at any site. Adequate scheduling and the use of permanent and temporary seeding or mulching as described in paragraph 3.3 can accomplish this.

Areas that are to be denuded shall have structural control measures in place prior to exposure of the soil and such measures shall remain until the area is established and permanent measures are in place. In the case of silt fencing, which may require the rough grading to be completed prior to installation, it shall be installed as soon as practical. Structural measures shall include at a minimum:

1. Sediment basins for all drainage areas greater than 5 acres.
2. Aggregate construction entrances at all points of construction traffic egress from the site onto pavement.
3. Silt fencing at all areas of sheet flow.
4. Inlet protection at all storm water inlets.
5. Matting at all slopes greater than 3:1 and drainage swales/ditches.
6. Sediment traps or basins at all drainage areas that can not be adequately protected with silt fencing as determined by the Contractor developing the SWP3.
7. Silt fencing around soil stockpiles or cover them with tarps.

3.3 **EROSION CONTROL**

A. **Permanent Erosion Control**

1. Incorporate all permanent erosion control features into the project at the earliest practicable time.
2. Perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available.
3. Establish final grades and application of fertilizer, seed, and mulch.
4. Maintain sediment barriers until grass has grown.

B. **Temporary Erosion Control**

1. Provide temporary seeding and mulching as delineated in the SWP3, as directed, as specified in the general NPDES permit, and for all denuded areas that are to remain dormant for more than 14 days.
2. Apply temporary erosion control within 7 days after final or temporary grade has been reached that will remain dormant for more than 14 days.
3. Install temporary erosion control measures including seeding and mulching immediately if seasonal limitations make permanent control measures unrealistic.

Temporary seed shall be of the type specified in ODNR's Rainwater and Land Development manual for the time of year that it is applied. Temporary seeding shall also include application of 12-12-12 fertilizer at the rate of 6 pounds per 1,000 square feet and mulching in accordance with ODNR's Rainwater and Land Development manual.

3.4 **SEDIMENT BARRIERS**

A. **Filter Barriers (FB).** Construct the FBs using synthetic filter fabric. They are designed for sediment removal and erosion control of low or moderate channelized flows not exceeding 1 cubic foot per second (cfs).

1. The height of an FB shall be between 15 inches and 18 inches.
2. Purchase filter fabric in a continuous roll and avoid the use of joints by cutting to the length of the barrier.
3. Space the stakes a maximum of 3 feet apart at the barrier location and drive them securely into the ground (minimum of 8 inches).
4. Excavate a trench approximately 4 inches wide and 4 inches deep along the line of stakes and upslope from the barrier.
5. Staple the filter material to the wooden stakes, and extend 8 inches of the fabric into the trench. Use heavy-duty wire staples at least 1/2 inch long. Do not staple filter material to trees.
6. Backfill the trench and compact the soil over the filter material.
7. Install straw bales on the downstream side of all filter barriers. Install bales in a single row and securely anchor them with a minimum of two stakes per bale.
8. If an FB is to be constructed across a ditch line or swale, the barrier shall be of sufficient length to eliminate end flow, and the plan configuration shall resemble an arc or horseshoe with the ends oriented upslope.
9. Remove FB when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

B. **Silt Fence (SF).** SF is designed for situations in which only sheet or overland flows are expected, and the following drainage area limits are applied.

Silt Fence Maximum Drainage Area (Based on Slope of Drainage Area)	
Slope	Maximum Drainage Area (Acres) to 100 Linear Feet of Silt Fence
0-2% (<50:1)	0.5
2%-20%	0.25
>20%	0.125

SF details are included on the plans or within ODNR’s Rainwater and Land Development manual.

1. Locate the silt fence at the flattest area available and follow a level contour of the land so that flows are dissipated into uniform sheet flow.
2. The height of an SF shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).
3. Purchase the filter fabric in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are necessary, splice filter cloth together only at a support post, with a minimum 6-inch overlap, and securely seal.

4. Drive posts securely into the ground (minimum of 12 inches).
5. Excavate a trench approximately 4 inches wide and 6 inches deep along the line of posts and upslope from the barrier.
6. Staple or wire the filter fabric to the fence, and extend 8 inches of the fabric into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Do not staple filter fabric to trees.
7. Backfill the trench and compact the soil over the filter fabric.
8. Remove SF when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

C. Maintenance

1. Inspect SF and FB a minimum of every 7 days and immediately after each rainfall or at least daily during prolonged rainfall. Make any required repairs immediately.
2. Should the fabric on an SF or FB decompose or become ineffective prior to the end of the expected useable life and the barrier is still necessary, replace the fabric promptly.
3. Remove sediment deposits after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.
4. Dress any sediment deposits remaining in place after the SF or FB is no longer required to conform with the existing grade, and prepare and seed them.

3.5 MATTING

A. General. Matting details are included in ODNR's Rainwater and Land Development manual. Provide matting:

1. On all final slopes 3:1 or greater.
2. Along the bottom of all drainage ditches until permanent seeding has grown and is established.
3. In areas where establishing vegetation is difficult.
4. Where mulch is difficult to hold in place due to wind or water.
5. Where water velocities exceed 3.5 feet per second.

B. Securing. Secure matting in accordance with the manufacturer's instructions or with No. 11 gauge, or heavier, sod staples that are a minimum of 6 inches in length.

C. Erosion Stops

1. Erosion stops are narrow trenches (6 to 12 inches deep) across the full channel section to prevent undermining and gullies from forming below the matting.
2. Provide them at a maximum spacing of 50 feet apart (more frequently if recommended by the matting supplier) in areas of high erosion potential and at the leading edge of a matting roll.
3. High erosion potential is in rocky areas that prevent soil-to-matting contact, erosive soils, and steep slopes.

4. Place the leading edge or piece of matting (for intermediate stops) within the narrow trench and secure it in place before backfilling the trench.

3.6 **STORM DRAIN INLET PROTECTION (IP)**

A. **General**

1. Provide temporary sediment control around all storm inlets until the tributary drainage area is permanently stabilized.
2. This shall consist of an inlet sediment filter or silt fencing as specified and detailed herein.
3. Utilize storm drain IP at all storm drain inlets in addition to matting and sediment barriers previously discussed.

B. **Yard, Drainage Ditch, or Parking Lot Inlet Protection.** Details are included in ODNR's Rainwater and Land Development manual.

1. Filter Fabric.
 - a. Excavate earth to a minimum depth of 18 inches around inlet.
 - b. Construct wood framing with a minimum burial depth of 8 inches at each corner of the inlet.
 - c. Filter fabric shall include a wire mesh backing for structural support.
 - d. Place backfill in 6-inch compacted lifts.
 - e. Install a compacted earth check dam in the ditch line below the inlet if runoff bypassing the inlet will not flow to a sediment pond.
2. Drop Inlet Sediment Protection. Inlets may utilize an excavated drop inlet consisting of a 1- to 2-foot-deep excavation around the inlet to serve as a sediment trap.
 - a. Expanded trap volume shall be in accordance with the requirements for sediment traps contained in this specification.
 - b. Install 1-inch-diameter weep holes in the side of the inlet near the bottom of the excavated areas. Provide a gravel filter around weep holes. Weep holes shall be grouted before filling excavated area.
 - c. Remove accumulated sediment when it has reached 40 percent of the trap depth.

C. **Curb Inlet Protection.** Details are included in ODNR's Rainwater and Land Development manual.

1. Frame. Construct a wooden frame that is anchored to the soil located behind the curb.
2. Screen. Form a geotextile fabric screen with wire mesh backing to the concrete gutter and against the face of the curb. Extend the screen 2 feet beyond the inlet throat on either end and fasten to the frame.
3. Stone. Place 2-inch stone over the screen to prevent water from entering the inlet under or around the geotextile fabric.

3.7 **TOP SOIL STOCKPILE.** Provide temporary drainage diversion of runoff around the topsoil stockpile to control soil erosion. Provide silt fencing around stockpiles or cover stockpiles with tarps to prevent erosion for sediment control.

3.8 **CONSTRUCTION ENTRANCES/EXITS.** Install a stabilized pad of aggregate over geotextile fabric at all locations where construction vehicles leave construction areas onto surfaces where runoff is not checked by sediment controls, and at all points of egress to paved roads.

A. **Design**

1. **Bedding.** Provide a geotextile fabric bedding at the base of the construction entrance.
2. **Stone.** Place 2-inch stone in a layer 6 inches thick over the fabric bedding.
3. **Dimensions.** Entrance/exit pad shall be a minimum of 14 feet wide by 50 feet long.

B. **Maintenance.** Apply additional stone as necessary to replenish the entrance/exit. Remove sediment from paved roads immediately through sweeping, scraping, or other appropriate measure.

3.9 **DEWATERING**

A. **General**

1. Give special attention to dewatering activities to minimize release of silt-laden water into the stream.
2. The discharges shall be free of sediment and released into only storm sewers, stream channels, or other stabilized drainage sources and not onto exposed soils or any other site where flows could cause further erosion.
3. If trench or ground water contains sediment, it shall pass through a sediment settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by de-watering into a sump pit, filter bag or comparable practice. Ground water which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

3.10 **ADDITIONAL MEASURES.** Select the sediment and erosion control measures utilized for a site based on the proposed construction activities, existing and proposed contours, site drainage system, and other site requirements or restrictions. Additional or alternative erosion and sediment control measures may be utilized with approval. Such measures include those specified in ODNR's Rainwater and Land Development manual.

END OF SECTION

SECTION 31 23 00

EXCAVATION, BACKFILL, AND EMBANKMENT

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK**
- A. **Scope of Work.** Complete the excavation, backfill, and embankment necessary to construct the work as shown and specified herein. This section includes the following where applicable: structures, underground utilities, and preparing subgrade for pavements, walks, or slabs.
- B. **Other Work.** Final grading together with placement and preparation of topsoil for lawns and planting is specified in Section 32 90 02, "Grading and Seeding." Excavation and backfill for buried piping are covered in Division 33.
- C. **Definitions**
1. Excavation. The removal of material to required subgrade elevations and disposal of excavated materials.
 2. Backfill. Below grade placement and compaction of specified materials to required elevations.
 3. Unauthorized Excavation. The removal of materials beyond required subgrade elevations or dimensions without specific direction.
 4. Subgrade. The undisturbed earth or the compacted soil layer immediately below foundations, pipe trenches, mud mats, pavement, slabs, walks, base, compacted foundation, embankment, or as shown.
 5. Embankment. An engineered fill constructed of compacted, suitable earthen materials used to raise grade to the required elevations.
- 1.3 **QUALITY ASSURANCE.** Conform all work and materials to the following standards.
- A. **ASTM.** American Society for Testing and Materials.
- B. **OSHA.** Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) Part 1926.650 to .652, Subpart P. Construction Standard for Excavations.
- 1.4 **SUBMITTALS.** Submit all submittals in accordance with the Division 1 Submittal Requirements and this specification section. Do not deliver or install any materials before Submittal Packages 1 and 2 are approved.

A. Submittal Package No. 1 – Product Data and Test Laboratory Qualifications

1. Submittal package shall include:
 - a. Product data noting each material source, location, sieve analysis, and other information which will show that the source and supplier are capable of furnishing materials meeting the requirements of these specifications. Submit name and location of all borrow pits.
 - b. Name and address of acceptable test laboratory including the name and experience of the Engineer assigned to the field testing.

B. Submittal Package No. 2 – Samples

1. Samples shall include:
 - a. Aggregate samples not less than 1/4 cubic foot each for the following:
 - 1) Granular backfill.

C. Submittal Package No. 3 – Field Test Reports

1. Submit test reports within 48 hours of completion, suspension, or termination of testing the material including a copy of each test report called for in this section.

1.5 JOB CONDITIONS

A. Utilities

1. Existing Utilities.
 - a. Notify utility companies and locate existing underground utilities in area of work.
 - b. Where utilities are to remain in place, provide adequate means of support and protection during construction operations.
 - c. Repair any Contractor-damaged utilities to the owner's satisfaction at the Contractor's expense.
2. Unforeseen Utility Location.
 - a. Should a utility which is encountered during excavation be unrecorded or recorded incorrectly, consult the utility immediately for directions.
 - b. Cooperate with the utility or Owner in keeping respective services or facilities in operation.
 - c. Repair damaged utilities to the satisfaction of the utility owner.

3. Interruption.
 - a. Do not disrupt existing utilities except when approved.
 - b. Provide acceptable temporary utility services unless approved otherwise.
4. Notification. Provide a minimum of 48 hours notice to utility companies and Owner or Engineer/Architect before excavating or interrupting utilities.

B. **Blasting.** Do not blast.

1.6 DELIVERY, STORAGE, AND HANDLING

A. **Topsoil**

1. Remove, stockpile, and place in the areas to be seeded topsoil that is available as a part of the excavated materials.
2. Shape stockpile and grade to drain.

B. **Excavated Material.** Stockpile excavated material when suitable for use as backfill or embankments onsite as directed.

1.7 SPECIAL WARRANTY (Not used)

PART 2 - PRODUCTS

2.1 MATERIALS

A. **General.** All materials shall be free of elastic soil materials, debris, waste, frozen material, vegetation, organics, peats, or other deleterious material.

B. **Backfill and Embankment**

1. Soil.
 - a. Earth materials which have resulted from natural processes such as weathering, decay, and chemical action.
 - b. More than 35 percent weight of the grains or particles will pass a No. 200 sieve and have a plastic index of 4 or more.
 - c. Free of aggregate or rock larger than 2 inches in any dimension.
2. Aggregate Material.
 - a. Natural mineral aggregate such as gravel, crushed gravel, crushed rock, or sand.
 - b. At least 65 percent by weight of the grains or particles will be retained on a No. 200 sieve.
 - c. At least 90 percent by weight of the grains or particles shall pass the 3-inch sieve.
 - d. Remove rock pieces larger than 6 inches in any dimension.

- e. When the major portion of the unsound material in a coarse aggregate acquires a mud-like condition when tested for soundness, ensure that the maximum loss for all uses is 5 percent.
 - 3. Shale. Finely stratified, laminated material formed by consolidation in nature, mudstone, claystone, siltstone, and clay bedrock. Break into predominantly fine particles which can be readily tested for compaction requirements as soil.
 - 4. Rock. Sandstone, limestone, dolomite, glacial boulders, and old concrete which are crushed into pieces that can readily be incorporated into a specified lift thickness and compacted according to requirements for granular aggregate materials.
- C. **Granular Backfill.**
- 1. Granular backfill shall be crushed or uncrushed granular material meeting the grading requirements of ODOT 304.
 - 2. The fraction passing a No. 40 sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than 6.
- D. **Topsoil.** In accordance with Section 32 90 02, "Grading and Seeding."

PART 3 - EXECUTION

- 3.1 **EXAMINATION.** Verify actual field/site conditions and confirm grades, elevation, and other pertinent information before beginning excavation.
- 3.2 **PREPARATION**
- A. **Notify all utilities** and adjacent owners of structures or pavements of the excavation.
 - B. **Notify owners** of adjoining properties or utilities in case of emergencies.
- 3.3 **EXCAVATION**
- A. **Topsoil.** Remove topsoil and place in separate stockpile.
 - B. **Protection**
 - 1. Excavations. Protect all excavations by bracing, sheeting, piling, slope benching, or other acceptable means in accordance with OSHA 29 CFR Part 1926.650 to .652, Subpart P. Be responsible for protection of the excavation at all times.
 - 2. Existing Structures. Protect existing structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by construction operations including dewatering operations.
 - 3. Barricade open excavations.

C. Drainage

1. Direct surface water away from excavations to prevent erosion and undermining of foundations.
2. Provide and maintain diversion ditches, dikes, and grading as necessary during construction.
3. Protect excavated slopes and backfill surfaces to prevent erosion and sloughing.
4. Perform excavation so that the site and the area immediately surrounding the site and affecting operations at the site shall be continually and effectively drained.

D. Dewatering

1. Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift, and heave in the excavation.
2. Do not use French drains, sumps, ditches, or trenches within 3 feet of the foundation of any structure unless authorized.
3. Take control measures by the time the excavation reaches the groundwater level in order to maintain the integrity of the in situ material.
4. While the excavation is open, maintain the water level a sufficient distance below the working level to provide a stable working surface.

E. Rock Excavation

1. Definition.
 - a. Rock excavation is defined as the removal of:
 - 1) Unanticipated solid concrete (excluding pavements), unanticipated solid masonry, or boulders each of which has a volume greater than 1 cubic yard.
 - 2) Bedrock which requires for its removal drilling and blasting, wedging, sledging, barring, or breaking up with a power-operated tool.
 - b. Rock excavation is not excavating:
 - 1) Existing concrete or masonry structures or pavements shown.
 - 2) Material which can be excavated using an appropriately sized, heavy-duty, power-operated excavator, backhoe, or shovel, all of which are equipped with bucket-mounted ripping teeth.
 - 3) Material that can be excavated with a hand pick and shovel.
 - 4) Soft or disintegrated bedrock such as weathered shale, clay shale, claystone, or mudstone, or overconsolidated soils such as "hardpan."

- 5) Previously blasted materials or materials that are intermittently drilled and blasted to merely increase production.
2. Blasting. Do not blast unless approved.
 3. Limits. Unless otherwise noted, excavate rock to the bottom of structures and to a minimum clear width of 6 inches around the outer limits of the structures.
- F. **Disposal.** Dispose of all excavated material unless otherwise shown.
1. Excavated material which is satisfactory may be used for backfill and embankments.
 2. Dispose of excavated material which is unsatisfactory or surplus off-site.
- G. **Excavation for Pavements.** Excavate under pavements to comply with required cross sections, elevations, and grades.

3.4 SUBGRADE

- A. **Shape the subgrade** at all foundations, slabs, and pavements so that the required thickness of the foundations, slabs, pavements, and granular material can be maintained.
- B. **Pavement and Slab Subgrade**
1. Compact all pavement and slab subgrades to a depth of 12 inches.
 2. Replace subgrade soils with a maximum dry density of less than 100 pounds per cubic foot under pavement and slabs with suitable soil or granular material.
 3. Compact soil subgrades with a maximum dry density of 100 to 105 pounds per cubic foot to at least 102 percent.
 4. Compact all other soil subgrades to at least 100 percent.
 5. The moisture content shall be between the optimum moisture content and 3 percent above the optimum moisture content.
- C. **Proofrolling**
1. Unless directed otherwise, proofroll all subgrades for pavements, slabs, and embankments.
 2. Remove debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to proofrolling and placement of fill for embankment.
 3. The proofrolling equipment shall consist of an acceptable pneumatic-tired vehicle such as a loaded dump truck.
 4. The gross load of the vehicle shall be at least 25 tons.
 5. Roll the entire plan area of the subgrade with at least two passes of the vehicle or as directed.
 6. Adjacent passes shall be offset no more than 6 inches to provide complete coverage of the area.

7. Remove and replace any soft, wet, or weak areas detected by the proofrolling with acceptable material or scarify, moisture-condition, and recompact.

3.5 BACKFILL AND EMBANKMENTS

A. General

1. Place and compact backfill material as shown and specified in this section.
2. Adjacent to structures:
 - a. Use backfill where it will support landscaping.
 - b. Use granular backfill where it will support structures and slabs.
3. Backfill excavations as promptly as work permits, but not until completion of the following:
 - a. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - b. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
 - c. Removal of concrete formwork.
 - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - e. Removal of trash and debris from excavation.

B. Placement

1. Backfill against other work shall be in a manner and at such time as not to endanger the stability or damage the work.
2. Do not place any lift on surfaces that are muddy or frozen, or contain frost or ice.
3. Place backfill and fill materials evenly around structures, piping, or conduit to required elevations.
4. Place granular materials after the subgrades have been leveled.
5. Unless noted otherwise, all references to degree of compaction are expressed as a percentage of the maximum dry density in accordance with ASTM D 698 (standard Proctor).
6. Before compaction, moisten or aerate each lift as necessary to provide appropriate moisture content.
7. Place and compact materials in lifts as specified in the following paragraph.

- a. Backfill.
 - 1) Maximum 6-inch loose layers unless using hand tampers.
 - 2) Maximum 4-inch loose layers when hand-operated tampers are used.
 - 3) Compact each layer to at least 95 percent unless noted otherwise.
 - 4) Compact backfill for voids, depressions, or holes resulting from the demolition of existing structures to 100 percent.
 - 5) Moisture content between 1 percent below optimum and 3 percent above optimum.

- b. Granular Backfill.
 - 1) Maximum 6-inch loose layers unless using hand tampers.
 - 2) Maximum 4-inch loose layers when hand operated tampers are used.
 - 3) Compact each layer to at least 100 percent.
 - 4) Moisture content at or near optimum.

- c. Base.
 - 1) Maximum 6-inch compacted layers.
 - 2) When shown as more than 6 inches thick, place material in equal layers but no layer more than 6 inches compacted thickness.
 - 3) In all other situations, compact each layer to at least 98 percent.
 - 4) Moisture content within 1 percent of the optimum.
 - 5) Maximum 6-inch compacted layers.
 - 6) When shown as more than 6 inches thick, place material in equal layers but no layer more than 6-inch compacted thickness.
 - 7) Compact each layer to at least 100 percent.

C. Grading

- 1. Smooth the finished surface within specified tolerances.
- 2. Grade and compact areas with uniform slopes between required elevations or between such points and existing grades.
- 3. Grade areas to drain away from structures and to prevent ponding.
- 4. Finish surfaces free from irregular surface changes and as follows:
 - a. Lawn or Unpaved Areas. Grade areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.

- b. Pavements and Walks. Shape surface of areas under pavement to line, grade, and cross section, with surface not more than 1/2 inch above or below required subgrade elevation.

3.6 FIELD QUALITY CONTROL

A. Field-Testing

1. Test Laboratory. Employ an acceptable soils testing laboratory to determine the following:
 - a. Moisture density relationship of the materials to be compacted.
 - b. Field moisture/density to verify degree of compaction obtained.
2. The soils testing laboratory personnel shall be on-site continuously during all placement and compaction activities including backfills and embankments to determine compliance with this specification section.
3. Tests will be located by the Engineer/Architect.
4. Allow testing services to inspect and approve subgrades, backfill, and embankment layers before further construction work is performed.
5. Perform field density tests as follows, in accordance with ASTM D 1556 or D 2922.
 - a. Building Slab or Paved Areas. Make at least one field density subgrade test for every 2,000 square feet, but in no case less than three.
 - b. Backfill, Base, and Embankment. Field density tests shall be made at least once for every 50 cubic yards, or fraction thereof, and at least one test per lift (compacted layer).
6. If the subgrade, backfill, or embankment is below specified density, provide additional compaction/testing at no additional cost to the Owner.

- B. **Settling.** Where settling is measurable or observable during the general project warranty period, remove the surface (pavement, lawn, or other finish), add backfill, compact, and replace surface at no cost to the Owner.

3.7 GRADING FOR SEEDING

A. Rough Grading

1. Trim and grade all areas to within 4 inches of the finished grades.
2. These areas are to be free from rock or other foreign material 3 inches or greater in any dimension.

- B. **Finished Grading.** Spread topsoil to conform to the required finished grades.

END OF SECTION

SECTION 31 23 23.14

TRENCH BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. **General.** Provide the labor, tools, equipment, and materials necessary to furnish and place the trench granular backfill in accordance with the plans and as specified herein.

1.3 QUALITY ASSURANCE

- A. **Codes and Standards.** Perform all work required to furnish and place the granular backfill in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these plans and as specified herein.

1.4 SUBMITTALS

- A. **Transmittals.** Furnish manufacturer's product data, test reports, and materials certifications as required.

1.5 JOB CONDITIONS (Not used)

1.6 DELIVERY, STORAGE, AND HANDLING (Not used)

1.7 SPECIAL WARRANTY (Not used)

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Low Strength Mortar Backfill.** Low strength mortar will be used for backfill under pavement as described and detailed in the plan sheets and in accordance with City standards.
- B. **Granular Backfill.** Granular backfill material shall be gravel, crushed gravel, or crushed stone or crushed rock (slag and crushed concrete will not be permitted). Granular backfill will be used for trench backfill for areas not under pavement, which are within the 1:1 influence line from the edge of pavement down to the top of pipe. Granular backfill will meet the following ODOT 304 grading requirements:

Sieve	Total Percent Passing
2 inch	100
1 inch	70-100
¾ inch	50 to 90
No. 4 (3/16 inch)	30-60
No. 30	9-33
No. 200	0-15

The fraction passing a No. 30 sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than 6.

- C. **Backfill Bedding.** Backfill (bedding) around water line pipe shall be in accordance with trench bedding/backfill details in plans.
- D. **Trench-Excavated Material.** Trench excavated material as described in trench backfill details may be used for trench backfill for areas not under pavement, outside the 1:1 influence line from the edge of pavement down to the top of pipe.

PART 3 - EXECUTION

3.1 **INSTALLATION.** General. Place material in layers to required elevations for each area classification listed below, using materials specified in Part 2 of this section.

- 1. Under walks and pavements, use base material, backfill, or a combination.
- 2. Adjacent to structures, use backfill material.
- 3. Under piping, conduit, and equipment, use base materials where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder. From bottom of piping and conduit to 12 inches above piping and conduit, use fill except 100 percent of aggregate should pass 1-inch sieve.
- 4. Backfill excavations as promptly as work permits, but not until completion of the following:
 - a. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded. Backfill trenches when authorized.
 - b. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 - c. Removal of trash and debris from excavation.

B. **Placement.** Place no material until such work has been observed by the Engineer/Architect and approved. Place no material over snow or frozen material.

- 1. Place materials specified in Part 2 in lifts as specified below. Before compaction, moisten or aerate each lift as necessary to provide

appropriate moisture content. Compact each lift to required percentage of maximum dry density for each area classification. Do not place any lift on surfaces that are muddy or frozen, or contain frost or ice.

2. Place backfill and fill materials evenly adjacent to piping, or conduit to required elevations. Use care in backfilling of trenches to avoid damage or displacement of piping and conduits.
3. Control all compaction and provide minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts of soils if soil density tests indicate inadequate compaction.
4. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances; compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
5. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
 - a. Lawn or Unpaved Areas. Grade areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
 - b. Walks. Shape surface of areas under walks to line, grade, and cross section, with surface not more than 0.05 foot above or below required subgrade elevation.
 - c. Pavements. Shape surface of areas under pavement to line, grade, and cross section, with surface not more than 1/2 inch above or below required subgrade elevation.
6. Placement. Type of granular material shall be placed where shown on the drawings and as specified.

C. Compaction

1. Compact each layer to not less than 95 percent of maximum dry density. The moisture content shall be not greater than 1 percentage point below optimum moisture content and not greater than 3 percentage points above optimum moisture content.
2. Granular Backfill. Place granular backfill in not more than 6-inch loose layers, 4-inch loose layers when hand operated tampers are used, and compact each layer to not less than 100 percent of maximum dry density. The moisture content shall be at or near optimum moisture content.

3.2 **FIELD QUALITY CONTROL**

A. **Testing**

1. Allow testing services to inspect and approve backfill, and fill layers before further construction work is performed.
2. Perform field density or strength tests as follows, in accordance with American Society for Testing and Materials (ASTM) D 698, D 1556, and D 2922.
 - a. Building Slab or Paved Areas. Make at least one field density test of subgrade for every 2,000 square feet, but in no case less than three.
 - b. Backfill and Drainage Base. Make field density tests at least once for every 250 cubic yards, or fraction thereof, of compacted material.
3. If the specified compacted materials are found to be below specified density, provide additional compaction and testing at no additional cost to the Owner.
4. Settling. Where settling is measurable or observable during the general project warranty period, remove the surface (pavement, or other finish), add backfill, compact, and replace surface at no cost to the Owner.

END OF SECTION

SECTION 31 50 00

EXCAVATION SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **General.** Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. **Scope of Work.** Provide the labor, tools, equipment, and materials necessary to furnish and install excavation support systems in accordance with the drawings and as specified herein.
- B. **General.** This section includes, but is not limited to, the following:
1. Shoring and bracing necessary to protect existing structures, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.
 2. Maintenance of shoring and bracing.
 3. Removal of shoring and bracing, as required.
- C. **Support Systems.** Types of shoring and bracing systems include, but are not limited to, the following:
1. Steel H-section (soldier) piles and timber lagging.
 2. Steel sheet piles.
 3. Auger cast pile walls.

1.3 QUALITY ASSURANCE

- A. **Codes and Regulatory Agencies.** Perform excavation and backfill work in compliance with all federal, state, and local codes and regulatory agencies including the following:
1. OSHA – Occupational Safety and Health Administration.
 - a. OSHA 29 Code of Federal Regulations (CFR) Part 1926.650 to .652, Subpart P. Construction Standard for Excavations.
- B. **Engineer Qualifications.** When required, retain the services of a qualified professional engineer to design and lay out the excavation support systems. The engineer shall be legally authorized to practice in jurisdiction where project is located and experienced in providing successful engineering services for excavation support systems similar in extent required for this project.
- C. **Supervision.** When required, engage and assign supervision of excavation support system to a qualified professional engineer foundation consultant.

1.4 SUBMITTALS

A. General

1. Submit all submittals in accordance with the Division 1 Submittal Requirements and the requirements within this specification section.

B. Submittal Package No. 1 – Shop Drawings, Engineer Qualifications, and Product Data

1. Shop drawings, engineer qualifications, and product data shall be submitted to the Engineer for review. No equipment shall be delivered or installed before this submittal package has been reviewed and commented on by the Engineer. Submittal package shall include:
 - a. Shop Drawings. Submit layout drawings, details, and calculations for excavation support system for review and comment. The review and comment of shop drawings by the Engineer/Architect shall not be construed as an approval of the Contractor's design. The Contractor and the Contractor's consultant shall be totally responsible for the design and construction of the excavation support system.
 - b. Engineer Qualifications. Submit name and experience of engaged consultant.
 - c. Product Data. Submit manufacturer's product data, test reports, and material certifications as required.

1.5 JOB CONDITIONS

- A. **Coordination - Interfacing.** Coordinate excavation support systems with all other trades to prevent delays, errors, or omissions.
- B. **Preconstruction Survey.** Before starting work, verify governing dimensions and elevations of pertinent structures. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by video recording and dated photographs, and signed by Contractor and others conducting investigation.
- C. **Survey.** Survey adjacent structures and improvements, employing qualified professional surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. Resurvey benchmarks weekly and during critical points of the excavation, maintaining accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer/Architect if changes in elevations occur or if cracks, sags, or other damage is evident.
- D. **Existing Utilities.** Protect existing active sewers, water, gas, electricity, and other utility services and structures. Notify municipal agencies and service utility companies having jurisdiction prior to performing excavation. Comply

with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

1.6 **DELIVERY, STORAGE, AND HANDLING** (Not used)

1.7 **SPECIAL WARRANTY** (Not used)

PART 2 – PRODUCTS

2.1 **MATERIALS**

- A. **General.** Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but shall be in serviceable condition.
- B. **Structural Steel.** American Society for Testing and Materials (ASTM) A 36.
- C. **Steel Sheet Piles.** ASTM A 328.
- D. **Timber Lagging.** Any species, rough cut, mixed hardwood, minimum nominal 3 inches thick, unless otherwise indicated or required.

PART 3 - EXECUTION

3.1 **EXAMINATION.** Verify actual field/site conditions and confirm grades, elevations, and other pertinent information prior to installing excavation support systems.

3.2 **PREPARATION**

- A. **Protection.** Protect existing and proposed structures from damage during installation and removal of excavation support systems.

3.3 **SHORING**

- A. **Location.** Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth, surcharge, and hydrostatic pressures.
- B. **Existing Structures.** Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work unless indicated otherwise.

3.4 **BRACING**

- A. **Location.** Locate bracing to clear columns, floor framing construction, walls, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace. Do not place bracing where it will be cast into, boxed out for, or included in permanent concrete work, except as otherwise acceptable to Engineer/Architect.
- B. **Internal Bracing.** Install internal bracing, if required, to prevent spreading or distortion of braced frames.

- C. **Maintenance.** Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth, surcharge, and hydrostatic pressures.

3.5 EXCAVATION SUPPORT SYSTEM REMOVAL

- A. **Removal.** When no longer required, remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and excavation walls, and damage to structures, pavements, facilities, and utilities.

3.6 REPAIR/RESTORATION

- A. **Damages.** Repair or replace, as acceptable to the Owner and Engineer/Architect, adjacent work or structures damaged or displaced through installation, removal, or inadequacy of excavation support systems.
- B. **Site Work.** Repair site to a condition acceptable to the Owner and similar to the existing site conditions prior to performing excavation support work. This includes filling holes, trenches, pits, and depressions in a satisfactory manner.

END OF SECTION

SECTION 32 10 01.01

PAVEMENT

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK.** Provide the labor, tools, equipment, and materials necessary to construct the pavement and walks in accordance with plans and specifications.
- 1.3 **QUALITY ASSURANCE**
- A. **Standards.** Material and work shall be in conformance with:
1. Detail sheets in plan set.
- B. **Testing Laboratory.** Engage an acceptable testing laboratory to perform subgrade inspection and compaction tests.
- 1.4 **SUBMITTALS.** Submit all submittals in accordance with the Division 1 Submittal Requirements and the requirements within this specification section.
- A. **Submittal Package No. 1 – Product Data**
1. Product Data on all materials.
 2. Written certification that all materials and mixes are in conformance with specifications.
- 1.5 **JOB CONDITIONS** (Not used)
- 1.6 **DELIVERY, STORAGE, AND HANDLING**
- A. **Delivery.** Comply with ODOT Item 401.11 hauling requirements.
- B. **Storage.** Comply with ODOT Item 106.05.
- C. **Handling.** Comply with ODOT Item 106.06.
- 1.7 **SPECIAL WARRANTY** (Not used)

PART 2 - PRODUCTS

- 2.1 **MATERIAL.** All materials shall be in accordance with ODOT "Construction and Material Specifications."
- A. **Bases**
1. Aggregate. Aggregate base shall be in accordance with ODOT Item 304. Do not use slag.

2. Asphalt Concrete. Asphalt concrete base shall meet the specifications of ODOT Item 301.
- B. **Prime Coat.** Prime coat shall be in accordance with ODOT Item 408. Materials shall conform to the applicable requirements of 702 for the asphalt material and use one of the following types: 702.02 RC-70, RC-250, MC-30, MC-70, or MC-250; or 702.03 Primer 20.
 - C. **Tack Coat.** Tack coat shall be in accordance with ODOT Item 407. Materials shall conform to the applicable requirements of 702 for the asphalt material and use one of the following types: 702.04 RS-1, SS-1, SS-1h, CRS-1, CSS-1, CSS-1h; or 702.13.
 - D. **Asphalt Concrete**
 1. Surface Course. Asphalt concrete surface course shall be in accordance with ODOT Items 441, 446, and/or 448 and as indicated on the plans. The surface course type shall be as indicated on the plans.
 2. Intermediate Course. Asphalt concrete intermediate course shall be in accordance with ODOT Items 441, 446, and/or 448 and as indicated on the plans. The intermediate course type shall be as indicated on the plans.
 - E. **Concrete with Portland Cement.** Concrete shall be in accordance with Section 03 30 00, "Cast-in-Place Concrete," Class A or ODOT Item 452.
 - F. **Expansion Joint.** Expansion joints shall be 1/2-inch-thick premolded, nonextruding type.

PART 3 - EXECUTION

3.1 PREPARATION

- A. **Coordination.** Coordinate all pavement installation with proper authorities and with other work of contract such that there is minimum disruption of the completed pavement and/or delays of other work.
- B. **Verification of Conditions.** Verify that subgrade is at proper elevation and slope where required and that moisture will not interfere with compaction.
- C. **Topsoil.** Remove topsoil. See Section 32 90 02, "Grading and Seeding."
- D. **Subgrade**
 1. See Sections 31 23 00, "Excavation, Backfill, and Embankments," for compaction requirements.
 2. Remove all loose and foreign materials.
 3. Place base material when the subgrade is free of ruts and standing water.
- E. **Slope**
 1. Slope pavement to drain away from buildings and structures.

2. Driveways in open areas shall have a center crown.
3. Cross slope for driveways and walks shall be 3/16 inch per foot unless otherwise shown.

F. Existing Pavement

1. Conform pavement to the grade of existing pavements or walks unless noted otherwise.
2. Where it is necessary to disturb existing Portland cement concrete pavements or walks, saw-cut in neat, straight lines a minimum depth of 2 inches.
3. Where it is necessary to disturb existing asphalt concrete pavement or walks, saw-cut the asphalt concrete with straight vertical edges. Seal all cut bituminous surfaces with a bituminous material.

G. Arrange for inspection and testing as work progresses.

3.2 PAVEMENT. All construction shall be in accordance with ODOT "Construction and Material Specifications."

A. Asphalt Pavement

1. Aggregate Base.
 - a. Aggregate base shall consist of compacted aggregate applied in layers of equal thickness to a depth shown and in accordance with Item 304.04.
 - b. Maximum lift thickness shall be 8 inches when vibratory rollers greater than 12 tons are used, 6 inches when vibratory rollers between 10 and 12 tons are used, and 4 inches when vibratory rollers are not used.
 - c. Compaction shall be in accordance with ODOT Item 304.05.
2. Prime Coat. Apply according to ODOT Item 408 at the rate of 0.40 gallon per square yard.
3. Install asphalt concrete base in two layers each 3 inches thick after compaction.
4. Wearing Surface.
 - a. Unless otherwise shown, wearing surface shall consist of 3 inches of asphalt concrete applied in two layers.
 - b. The surface course shall be 1-1/4 inches thick after compaction.
 - c. The intermediate course shall be 1-3/4 inches thick after compaction.
5. Install asphalt concrete base and asphalt pavement in accordance with ODOT Items 301, 441, 446 or 448 surface course, and 446 or 448 intermediate course. The surface course type and intermediate course type shall be as shown.

B. Gravel Pavement

1. Gravel pavement shall consist of an 8 inch course of compacted aggregate base applied in two layers, each 4 inches thick after compaction.
2. Place in accordance with ODOT Item 304.04.
3. Compact in accordance with ODOT Item 304.05.

C. Resurfacing

1. Surface Preparation. Place no material until the existing surface areas have been examined and all holes, broken edges, cracks, and damaged areas have been repaired.
2. Tack Coat. Apply according to ODOT Item 407 at the rate of 0.15 gallon per square yard.
3. Wearing Surfaces. Resurface existing areas shown on the plans with a minimum of 2 inches of ODOT Item 448 asphalt concrete after compaction.

D. Temporary Pavement

1. Temporary pavement is limited for use as temporary patches in existing streets, drives, and walks.
2. Temporary pavement shall be the asphalt concrete surface course specified in this section.
3. The surface on which the temporary pavement is to be placed shall be cleaned and maintained free of materials that would contaminate the mixture or preclude proper placement.
4. All temporary pavement shall be a minimum of 2 inches thick unless noted otherwise.
5. Conform pavement to the grade of the existing street, drive, or walk.

3.3 FIELD QUALITY CONTROL

- A. **Spreading and Surface Tolerances.** The variation of the aggregate surface shall be in accordance with ODOT 301, 304, and 401 after compaction.
- B. **Compaction.** In addition to requirements of ODOT 301, 304, 401, and 441, test the aggregate by proofrolling with vehicle loads equal to or exceeding 80,000 pounds per four axles or 20,000 pounds per single axle.
- C. **Tolerance of Completed Surface.** The variation of the completed surface courses shall not exceed the requirements of ODOT 401.16.

END OF SECTION

SECTION 32 90 02

GRADING AND SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **General.** Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1, and all related specification sections, apply to this section.

1.2 DESCRIPTION OF WORK

- A. **Scope of Work.** Provide the grading and seeding as shown and specified herein.

1.3 QUALITY ASSURANCE

A. **Certificate of Inspection**

1. Ship all seeds with a certificate of inspection in accordance with the governing authorities.
2. Label all bags of seed and fertilizer with legible waterproof tags or directly on the bag.

1.4 SUBMITTALS

A. **General**

1. Submit all submittals in accordance with the Division 1 Submittal Requirements and this specification section.

B. **Submittal Package No. 1 – Product Data and Certified Statement**

1. Submit seed vendor's certified statement for each grass seed mixture required that includes:
 - a. Botanical and common name.
 - b. Percentage by weight.
 - c. Percentages of purity, germination, and weed seed for each grass seed species.
2. Product Data. Submit information on all materials included in this specification.

1.5 JOB CONDITIONS

- A. **General.** Proceed with grading and seeding as soon as portions of the site become available, working within seasonal limitations and the seed manufacturer's recommended limitations regarding weather conditions and temperatures.

1.6 **DELIVERY, STORAGE, AND HANDLING**

A. **Delivery**

1. Deliver seed only when site conditions are ready.
2. Deliver materials in unopened containers showing weight, mixture analysis, package date, and manufacturer.

B. **Storage and Handling**

1. Store and cover material to prevent wetting and deterioration.
2. Remove packages from the site that have become wet, moldy, or damaged, or show water marks.

1.7 **SPECIAL WARRANTY** (Not used)

PART 2 - PRODUCTS

2.1 **MATERIAL**

A. **Topsoil.** Topsoil shall contain:

1. A maximum of 40 percent clay in that portion passing a No. 10 sieve.
2. Between 5 and 20 percent organic matter as determined by loss on ignition of samples oven-dried at 212 degrees Fahrenheit (° F.) to a constant weight.

B. **Fertilizer.** Fertilizer shall contain the specified percentages of total nitrogen, available phosphoric acid, and water soluble potash. The weight, name of plant nutrients, and guaranteed percentages shall be marked on the sealed fertilizer containers.

1. 12-12-12. This fertilizer shall be used with Seed Mixes 1, 2, 3, and 5.
2. 5-10-10. This fertilizer shall be used with Seed Mix 4 (Crownvetch).

C. **Inoculant.** Treat Seed Mix 4 (Crownvetch) with inoculant culture of nitrogen fixing bacteria less than 1 year old.

D. **Seed.** Percentages are by weight.

	Minimum Germination	Minimum Purity
1. Seed Mix 1		
40% Kentucky Bluegrass (<i>Pos pratensis</i>)	75%	85%
40% Creeping Red Fescue (<i>Festuca rubra</i>)	85%	98%
20% Annual Ryegrass (<i>Lolium multiflorum</i>)	85%	95%

		Minimum Germination	Minimum Purity
2.	Seed Mix 2 30% Kentucky Bluegrass (<i>Poa pratensis</i>) 50% Kentucky 31 Fescue (<i>Festuca arundinacea</i> var. Ky. 31) 20% Annual Ryegrass (<i>Lolium multiflorum</i>)	75% 85% 85%	85% 95% 95%
3.	Seed Mix 3 90% Perennial Ryegrass (<i>Lolium perenne</i>) 10% Alsike Clover (<i>Trifolium hybridum</i>)	85% 85%*	95% 98%
4.	Seed Mix 4 (Crownvetch) 30% Crownvetch (<i>Coronilla varia</i>) 30% Kentucky 31 Fescue (<i>Festuca arundinacea</i> var. Ky. 31) 30% (Pennlawn) Red Fescue (<i>Festuca rubra</i>) 10% Annual Ryegrass (<i>Lolium multiflorum</i>)	70%* 85% 85% 85%	99% 95% 98% 95%
5.	Seed Mix 5 80% Kentucky Bluegrass (<i>Poa pratensis</i>) 20% Annual Ryegrass (<i>Lolium multiflorum</i>)	75% 85%	85% 95%

*Germination includes a total of quick germination plus hard seeds.

E. Mulch

1. Straw. Straw mulch shall be baled wheat or oat straw free of weed seed, sticks, or other foreign material.
2. Wood Cellulose Fiber. Dye the wood cellulose fiber mulch green.

F. Asphalt Emulsion. Do not use asphalt emulsions.

G. Mow Strip Blocks

1. Install concrete mow strips as shown and specified herein. Mow strips shall be precast concrete. Provide two anchor pins for each block. Field-cut blocks to achieve necessary radii.
2. Description.
 - a. Height. 6 inches.
 - b. Width. 8 inches.

- c. Length. 8 feet.
- d. Securing Holes. 7/8-inch diameter.
- e. Anchor Pins. No. 6 reinforcement bar, galvanized, 16 inches long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Verification.** Verify that final grades and elevations have been achieved in all areas. Remove all exposed debris and stones larger than 3/4 inch in any dimension from seeded areas.

3.2 PREPARATION

- A. **Soil Tests.** Test soil as necessary to ensure acceptable seeding conditions.

3.3 SEEDING

- A. **Seed Mix.** Seed all privately owned lawns with Seed Mix 5. On all privately owned cultivated fields, place the seedbed but do not seed. Seed all other disturbed areas with Seed Mix 1, unless otherwise noted.

- B. **Preparation of Seedbed**

- 1. Remove, stockpile, and use for seedbed topsoil that is available as part of the excavated material.
- 2. Remove all grass, weeds, roots, sticks, stones, and other debris and finish the seedbed with careful hand raking.
- 3. If there is a deficiency of topsoil as part of the excavated materials, provide topsoil from another source at no cost to the Owner.
- 4. The seedbed shall be a minimum of 4 inches of topsoil.
- 5. Prepare a smooth seedbed before seeding.

- C. **Dry Seeding.** When a seed mix is sown dry, apply the materials as follows:

- 1. Fertilizing.
 - a. Apply fertilizer uniformly to all areas to be seeded at the rate of 10 pounds per 1,000 square feet.
 - b. Disk, harrow, or rake the fertilizer into the seedbed to a depth of 2 inches.
- 2. Seeding. Mix thoroughly and sow uniformly the seed over the prepared areas. After sowing, rake, drag, or otherwise treat the area to cover the seed with soil to a depth of 1/4 inch.
 - a. Seed Mixes 1, 2, 3, and 5. Sow these seed mixes at a rate of 3 pounds per 1,000 square feet.
 - b. Seed Mix 4 (Crownvetch). Sow this seed mix at a rate of 2 pounds per 1,000 square feet. Before sowing, inoculate it in

accordance with manufacturer's directions. Sow this seed mix only from November through August.

3. Water. Water the seeded areas at the completion of the sowing and weekly thereafter until accepted by the Owner.
4. Mulching.
 - a. Place straw mulching material evenly over all seeded areas within 48 hours of seeding at a rate of 2 tons per acre between March 15 and October 15 and at a rate of 3 tons per acre between October 16 and March 14.
 - b. Secure straw mulching material by approved methods.
 - c. When mulching is displaced, replace it and reseed the area; repair other work damaged as a result of mulch displacement.

D. Hydraulic Seeding

1. When seed is applied hydraulically, use a combined slurry of fertilizer, inoculant when required, seed, and wood cellulose fiber mulch in one operation.
2. Increase the inoculant for Seed Mix 4 (Crownvetch) to five times the manufacturer's recommended rate for dry seeding.
3. Mix wood cellulose fiber at a rate of 1,500 pounds per acre.
4. Mix fertilizer and seed at the rate specified for dry seeding.

3.4 MAINTENANCE

- A. **General.** Maintain seeded areas. Fill, grade, and reseed settled and eroded areas. Seeding will not be accepted unless it is alive and healthy.

3.5 DEMONSTRATION

- A. **Seeded Area.** Before final acceptance the seeded area shall have:
1. A minimum of 100 grass plants per square foot and less than 2 percent bare spots over the entire area.
 2. No individual bare spots larger than 6 square inches

END OF SECTION

SECTION 33 01 32.02

TELEVISION OBSERVATION OF SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. **General.** The Contractor shall provide the labor, tools, equipment, and materials necessary to televise the sewers in accordance with the plans and as specified herein before and after all work has been completed.

1.3 QUALITY ASSURANCE

- A. **Codes and Standards.** All work shall meet or exceed the requirements of the National Association of Sewer Service Companies Recommended Specifications for Sewer Collection System Rehabilitation (latest edition), except as otherwise specified herein.
 - 1. Workers shall have completed Pipeline Assessment Certification Program (PACP) training. Contractor shall provide proof of certification for workers on-site.

1.4 SUBMITTALS

- A. **Television Inspection Logs.** Written logs shall be kept by the Contractor showing the location, in relation to adjacent manholes, of each infiltration point, laterals, joints, offset joints, unusual conditions, roots, deposits, scale and corrosion, cracked or deformed pipe, unusual conditions, and other discernible features. The logs will be put into a final report. Three copies of the final report shall be submitted to the Engineer.
 - 1. Television inspection logs should contain, but not limited to, the following information:
 - a. Owner's Name.
 - b. Resident Project Representative's Name.
 - c. Crew Chief's Name.
 - d. Date.
 - e. From MH No. _____ located at _____.
 - f. To MH No. _____ located at _____.
 - g. Direction of Flow.
 - h. Type of Pipe.
 - i. Type of Joints, if apparent.
 - j. Joint Spacing.
 - k. Cleanliness.
 - l. Manhole Conditions.

- m. Section Length.
- n. Pipe Size.
- o. Depth of Pipe.
- p. Direction of Inspection (camera movement).
- q. Pipe Defects.
 - 1) Pipe defects should be located by footage and clock reference and may be described using the following terms in the television log.

B. **Media.** The Contractor may record the television observation of sewers in DVD format. The Contractor shall submit the finished television observation of sewers to the Owner/Engineer in DVD format as specified below. Videotape format will not be accepted.

1. DVD shall be original, previously unrecorded MPEG-2 format. The Contractor shall furnish the Owner color DVD recordings of all internal inspections. All DVDs (DVDs and cases) shall be identified by number, location, and project name in a manner acceptable to the Owner's representative. All DVD recordings shall have a continuous on-screen display indicating sewer section identification and distance from the entering manhole. Pre and post video for each section of sewer (MH to MH), shall be combined on a single DVD, the pre followed immediately by the post. Multiple sections of sewer (MH to MH) may be put on each DVD provided each DVD is labeled accordingly. All DVDs shall be indexed and provide an index interface on a MH No. ___ to MH No. ___ basis, to allow for easy and quick viewing of specific sewer runs between specific manholes.
2. Date and Time. All video recordings shall, by electronic means, continuously display the month, day, year, hours, minutes, and seconds and display the location of the camera and pipe identification within the area.
3. All DVDs and written records shall become the property of the Owner.

1.5 JOB CONDITIONS

- A. **Coordination.** The Contractor performing television observation will be required to coordinate his work with other trades and the Owner. See the Appendix for previous videotaping performed by the OWNER.
- B. **Sewer Cleaning.** Each sewer pipe section shall be cleaned prior to performing the television inspection. Refer to Section 33 01 33, "Sewer Cleaning."
- C. **Flow Conditions.** Sewer line flows shall at no time exceed one fifth of the pipe diameter during the television inspection. If flows exceed this limit, either the plugging or blocking method or the pumping and bypassing method of flow control shall be used without surcharging the sewer system. Cleaning jet heads may be used to pull and hold back flow levels.

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. **Televising.** Televising performed prior (pre) to sewer rehabilitation shall be completed and submitted by the Contractor to be reviewed and approved by the Engineer before rehabilitation work begins.

1.7 **SPECIAL WARRANTY** (Not used.)

PART 2 - PRODUCTS (Not applicable.)

PART 3 - EXECUTION

3.1 **EXAMINATION**

- A. **Verification.** Verify actual field/site conditions, locations, possible interference with other utilities, expected sewer flow conditions, and potential traffic patterns.

3.2 **PREPARATION**

- A. **Notification.** Provide notification to proper authorities when incurring any interference with traffic or other utilities.
- B. **Safety.** Provide for any barriers, barricades, traffic control, and lighting required for safe operating at the site locations.

- 3.3 **EQUIPMENT.** The television camera shall be specifically designed and constructed for sewer inspection with a capacity for radial viewing (360 degrees) to allow proper inspection of service lateral connections. The radial-view camera must be solid-state color and have remote control of the rotational lens. The camera shall be capable of viewing the complete circumference of the pipe. Cameras incorporating mirrors for viewing sides or using exposed rotating heads are not acceptable. The camera lens shall be an auto-iris type with remote-controlled manual override. The camera light head shall include a high-intensity side viewing lighting system to allow illumination of internal sections of lateral sewer connections. Lighting for the camera shall illuminate the entire periphery of the sewer for a distance of 15 feet ahead of the camera. **Inadequate lighting will be just cause for requiring the sewer to be retelevised.** The camera shall have a minimum resolution of 600 lines and shall be operable in 100 percent humidity conditions. Picture quality and definition shall be to the satisfaction of the Engineer. Communications shall be provided for controlling the winches, pumping unit, and monitor control.

- 3.4 **TELEVISIONING.** Television inspection shall be performed prior (pre) to and after (post) the installation of the sewer pipe liner. The inspection will be done one sewer section at a time and the section being inspected will be isolated from the remainder of the sewer system. The camera shall be moved through the sewer in either direction at a uniform slow rate by means of cable winches at each manhole. In no case will the video camera be pulled at a speed greater than 30 feet per minute. Measurement for location of laterals, defects, and other features shall be at the ground level by means of a metering device. The importance of accurate distance measurements is emphasized. Marking on the cable or the like which would require interpolation for depth of manhole, will not be allowed. Measurement for location of defects shall be at the ground level by means of a

metering device accurate to 0.2 of a foot. Accuracy of the distance meter shall be checked by use of a suitable device. A measuring target or sealing packer in front of the television camera shall be used as the measurement reference point, and the meter reading shall show the location of the measurement reference point. DVDs with inaccurate distance measurements will not be accepted. Sewer section identification and accurate and continuous footage readings shall be shown on the video at all times. A measuring target or sealing packer in front of the television camera shall be used as the measurement reference point, and the meter reading shall show the location of the measurement reference point. When sewer conditions prevent forward movement of the camera, the Contractor shall withdraw the camera and televise the line from the opposite direction. Sewer line flows shall at no time exceed one fifth of the pipe diameter during the television inspection. If flows exceed this limit, then bypassing of flow shall be performed by the Contractor.

END OF SECTION

SECTION 33 01 33

SEWER CLEANING

PART 1 - GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK.** Provide the labor, tools, equipment, and materials necessary to clean the sewer and manholes in accordance with the plans and as specified herein.
- 1.3 **QUALITY ASSURANCE**
 - A. **Codes and Standards.** All work shall meet or exceed the requirements of the National Association of Sewer Service Companies Recommended Specifications for Sewer Collection System Rehabilitation (latest edition), except as otherwise specified herein.
- 1.4 **SUBMITTALS**
 - A. **Transmittals.** Furnish equipment data and daily logs of work performed.
- 1.5 **JOB CONDITIONS**
 - A. **Water Supply.** The Contractor must have Owner approval prior to connection of his water intake lines to any fire hydrant. The Owner shall provide the water meter. The Contractor shall exercise care in utilizing the Owner's water meters. Final payment will be contingent upon returning water meters to the Owner undamaged and in working condition. Replacement of damaged water meters shall be the responsibility of the Contractor. The Contractor shall provide the necessary valves, backflow preventers, hoses, and temporary piping for each hydrant connection. All equipment, fittings, and valves used for connecting to the Owner's water system shall be subject to the Owner's approval. Water will be provided from the Owner's fire hydrants, free of charge. However, the Contractor shall record the amount of water used daily and report to the Owner monthly the amount of water used during the performance of this work.
- 1.6 **DELIVERY, STORAGE, AND HANDLING** (Not used.)
- 1.7 **SPECIAL WARRANTY** (Not used.)

PART 2- PRODUCTS (Not applicable.)

PART 3- EXECUTION

- 3.1 **DESCRIPTION.** All sewers to be televised and lined shall first be cleaned by the Contractor in a good workmanlike manner as specified herein.
 - A. **General.** The sewer shall be cleaned of sand, dirt, roots, grease, and any other solid or semisolid material using high velocity hydraulic sewer cleaning equipment. Selection of the equipment used shall be based on the condition of

the sewer at the time the work commences. The equipment for cleaning shall be capable of removing all foreign materials from the sewer and manholes. Cleaning shall be completed to allow for thorough pipe inspection and the proper installation of CIPP liners.

3.2 **CLEANING EQUIPMENT**

- A. **High Velocity Hydraulic.** High velocity hydraulic sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a minimum of 750 feet of 3/4 inch inside diameter high pressure hose with a selection of two or more high velocity nozzles. The nozzles shall have a minimum capacity of 30 gallons per minute (gpm) at a working pressure of 1,000 to 1,500 pounds per square inch (psi). The nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all size sewers. Equipment shall also include a high velocity gun for washing and scouring manhole walls and floor. The gun capacity shall be capable of producing flows from a fine spray to a long distance solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel. All controls shall be located so that the equipment can be operated above ground.

- 3.3 **PRECAUTIONS.** During sewer cleaning operation, precautions shall be taken to protect the sewer from damage that might be inflicted by the improper use of cleaning equipment. If during the performance of sewer cleaning activities the Contractor experiences unanticipated difficulties with cleaning a sewer and/or observes mud or soil laden wastewater in the flow, the Contractor shall immediately cease all sewer cleaning work and notify the Owner. Whenever hydraulically propelled cleaning tools or any tools that retard the flow of water in the sewer are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to property. The flow of wastewater in the sewer shall be utilized whenever possible to provide necessary pressures for hydraulic cleaning devices. When water from a fire hydrant is necessary to supplement sewer flows, the following requirements shall govern:

- A. A vacuum break shall be provided.
- B. Hoses connected to fire hydrants shall not be placed within areas of vehicular traffic. If this is unavoidable, the Contractor shall provide ramps covering the hoses to protect them from motor vehicles. The Contractor shall be responsible for any damage caused to the Owner's water distribution system resulting from inadequately protecting the hoses.
- C. Fire hydrants and their watch valves shall be closed slowly to prevent damage to the Owner's water distribution system.
- D. Water shall be conserved and metered.

- 3.4 **ROOT REMOVAL.** All roots shall be removed from the interior of the sewer.

- A. **Mechanical.** Root removal may include the use of mechanical devices, such as rodding machines, expanding root cutters and porcupines, and hydraulic cleaning equipment.
- B. **Chemical.** Chemical treatment to remove roots may be used. The application of an approved label herbicide to the roots shall be performed in accordance with the manufacturer's recommendations in such a manner to prevent any damage to

the sewer and surrounding vegetation. Any damaged sewer or vegetation shall be replaced. Chemical herbicides used shall have no adverse effects on the materials used for sewer lining, nor shall they interfere with bonding of liner materials to the sewer wall. All precautions, as recommended by the manufacturer, shall be adhered to concerning handling and application of the herbicide.

3.5 **MATERIAL REMOVAL AND DISPOSAL.** The Contractor is responsible for disposal of all construction debris including but not limited to excess soil, rock, or any other type materials. The Contractor shall not fill any wetlands, low lands, flood plains, or drainage ways with said debris without obtaining proper approvals, permits, licenses, etc. from local, state, or federal agencies. All foreign material resulting from the cleaning operation shall be removed at the downstream manhole of the sewer section being cleaned. Passing material from sewer section to sewer section will not be permitted. All solids or semisolids resulting from the cleaning operations shall be removed from the site and hauled and disposed at the Parkersburg Utility Board Wastewater Treatment Plant, 125 19th Street, Parkersburg, West Virginia 26101, telephone (304) 424-8535. All materials shall be removed from the site at the end of each workday. Under no circumstances will the Contractor be allowed to accumulate debris on the site of work beyond the stated time, except in totally enclosed containers and if approved by the Owner. Pull a double squeegee, with each squeegee the same size as the sewer, through each sewer section as evidence of being adequately cleaned.

A. **Hydraulically Cleaned Material.** When hydraulic cleaning equipment is used, a suitable weir or dam shall be constructed in the downstream manhole such that both the solids and water shall be trapped. This trapped solution shall be pumped from the manhole into a retention chamber aboveground. The retention chamber shall be of a size suitable for solid settlement and shall be truck mounted. The chamber shall contain not less than two baffles to ensure settlement of the solids before returning the liquid to the sewer.

END OF SECTION

SECTION 33 01 36.03

MANHOLE REHABILITATION MULTI-LAYERED POLYMERIC LINING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **General.** Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 specification sections, apply to this section.
- B. **Television Inspection.** See section 33 01 32.02 for "Television Observation of Sewers."
- C. **Sewer Cleaning.** See section 33 01 39 for "Sewer Cleaning."
- D. **Pipe Lining.** See section 33 01 38.03 for "Cured-In-Place Pipe Liner."
- E. **Bypass Pumping.** See Section 33 06 00 for "Bypass Pumping."

- 1.2 **DESCRIPTION OF WORK.** Provide the labor, tools, equipment, and materials necessary to rehabilitate manholes in accordance with the plans and as specified herein.

1.3 QUALITY ASSURANCE

- A. **Codes and Standards.** All work shall be in accordance with applicable requirements of governing agencies having jurisdiction, except as otherwise specified herein. All work shall be in compliance with the following standards unless otherwise noted in the specifications:
 - 1. American Society for Testing and Materials (ASTM) F-1216.
 - 2. National Association of Sewer Service Companies (NASSCO).
 - 3. The Society of Protective Coatings (SSPC) SP13.
 - 4. International Concrete Repair Institute 310.2.
- B. **Personnel**
 - 1. All work shall be performed by factory and certified and trained applicators. In addition, the spray applicator technician shall have applied the specified spray system to a minimum of five hundred manholes and have five years experience with the specified system. Contractor shall be fully licensed and approved by the coating process manufacturer. All personnel working on the project shall be certified by the manufacturer for the specified system.
 - 2. If the contractor's spray applicator is not able to meet the above experience requirements, the contractor may have on-site a product technician provided by the multi-layered polymeric liner manufacturer who will be responsible for supervising the work of all manholes being rehabilitated. This shall include the approval of all surface preparation and repair of the existing manholes before the application of the multi-layered polymeric liner. In addition, the manufacturer's technician must

remain on-site at all times and supervise the installation of the multi-layered polymeric liner product and final testing of the manholes. Installation of the product in the manholes will not be permitted without the presence of the manufacturer's technician.

- C. **Acceptance.** Completed manholes must be leak free and have a smooth, uniform interior finish.

1.4 SUBMITTALS

- A. **General.** Submittals shall be submitted in accordance with the requirements of this specification section.

- B. **Submittal Package No. 1 – Shop Drawings and Product Data**

- 1. Shop drawings and product data shall be submitted to the Engineer for review and approval. No products shall be delivered or installed before this submittal package has been reviewed and approved by the Engineer. Shop drawings and product data shall include:

- a. Transmittals. Furnish manufacturer's product data, test reports, and materials certifications prior to the start of work.
 - b. Material Certification. Written certification is required from the manufacturer of the coating system that all materials used in the work were manufactured and tested in accordance with the appropriate ASTM specification, and are being used or installed in conformance with the manufacturer's recommendation.
 - c. Manhole Coating System. Furnish to the Engineer a work plan for the rehabilitation of the manholes identified in the plans and specifications. The work plan shall include the manhole coating thickness for each manhole along with the manufacturer's detailed installation procedures and calculations for coating thickness vs. manhole depth. Each manhole shall be designed to withstand hydrostatic loading assuming a groundwater elevation at ground level. Manufacturer's design calculations and a spreadsheet determining material usage shall be submitted for each manhole to be rehabilitated. Each material usage spreadsheet shall include, at a minimum, the following:
 - 1) Total weight of material used for the manhole.
 - 2) Weight of material used per manhole section.
 - 3) Depth and square footage of each manhole section.
 - 4) Millage needed for each section.
 - d. Testing. Prior to the use of any materials, the Contractor shall furnish, at his expense, the results of testing of the proposed materials by an approved laboratory in conformance with these specifications. Any material not meeting the requirements of these specifications shall be completely removed from the

project. Materials acceptable to the Engineer shall be substituted for rejected items at the Contractor's expense.

- e. Submit a detailed plan for channel reconstruction prior to performing work.
 - f. Submit a detailed plan for overspray containment during the manhole rehabilitation work.
2. The following submittal (a) shall be made two (2) days prior to manhole rehabilitation:
- a. Pre-rehabilitation photographs. The Contractor shall submit a minimum of two (2) pre-photographs to the Engineer before performing manhole lining work. One photograph shall be taken from the ground surface looking into the manhole and one shall be taken from the bottom of the manhole, as close to the invert as possible, looking upwards. A third photograph shall be taken showing the exposed portion of the manhole for any manholes that are above grade. Additional photographs of other pertinent features shall be taken, if necessary. Submittal shall be in DVD format. Digital photo files and DVDs shall be accurately labeled

The following submittal (b) shall be made immediately after manhole rehabilitation:

- b. Post-rehabilitation photographs. The Contractor shall submit post-photographs to the Engineer immediately following completion of the manhole rehabilitation. The same areas of the manholes will be photographed at the same angles as submitted in the pre-photographs. Submittal shall be in DVD format. Digital photo files and DVDs shall be accurately labeled

1.5 **JOB CONDITIONS**

- A. **Safety.** See Section 01 00 00, "General Requirements."
- B. **Debris.** All debris resulting from the cleaning, repairing, reconstruction, and sealing of manholes shall be removed from the manhole immediately and shall not be allowed to enter any sewer pipe or to wash downstream. Debris resulting from work performed at grade around the manhole shall be prevented from entering the manhole.

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. **Storage and Handling.** Storage and handling of materials shall be in accordance with the manufacturer's instructions and recommendations and applicable codes. Damaged materials shall not be incorporated into the work.

1.7 **SPECIAL WARRANTY**

- B. **Sealed manholes shall carry** a minimum 10-year warranty against any and all leakage, excessive cracking, delamination, and spalling. The Contractor shall provide the Owner with one original copy of the warranty documents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Water Plug.** Rapid setting hand mixed and applied cementitious compound specifically formulated for use in stopping infiltrating water. Use "Ipanex-R" by IPA Systems with Portland Cement (Type I or Type II, ASTM C 150), "Strong Plug" by Strong Seal Systems, or equal.
- B. **Patching Mortar.** Rapid setting hand-mixed and applied cementitious compound specifically formulated for use in filling voids and repairing inverts. Use "Octocrete" by IPA Systems, "Strong Seal QSR" by Strong Seal Systems, or equal.

2.2 MULTI-LAYERED POLYMERIC LINER COATING SYSTEM

- A. All materials shall be delivered to the job site in original unopened package and clearly labeled with the manufacturer's identification and printed instructions. All material shall be stored and handled in accordance with recommendations of the manufacturer. The Contractor shall furnish and maintain, in good condition, all equipment necessary for proper execution and inspection of work.
- B. **Moisture barrier and final corrosion barrier** shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment.

1. Typical Physical Properties

- a. Tensile Strength, PSI >3,600
- b. Elongation, % >300
- c. Tear Strength, PLI >500
- d. Shore A Hardness 96
- e. 100% Modulus, PSI >2,400

- C. **Surfacer** shall be polyurethane rigid structural foam, low viscosity two-component, containing flame retardents.

1. Typical Physical Properties

- a. Density, normal, core, lbs/ft³, ASTM 4-10
- b. D-1622 @ 74° F
- c. Compression Strength, ASTM D-1621 @ 74° F parallel rise; PSI 90-150
- d. Closed Cell Content, % @ 74° F over 95
- e. Shear Strength, PSI – ASTM C-273 @ 74° F 225-250

- D. **Layer Thicknesses.** The multi-layered Polymeric liner system dry film thickness (DFT) above the profile peaks, in mils, shall meet the following criteria:

- | | | |
|----|------------------------------------|-------------------|
| 1. | Moisture Barrier: | 50 mils (minimum) |
| 2. | Polyurethane Rigid Structure Foam: | 400 – 500 mils |
| 3. | Final Corrosion Barrier: | 75 – 80 mils |
| 4. | Total DFT of Liner System: | 525 – 630 mils |

E. **Product and Manufacturer.** The following products and manufacturers, or approved equals, will be considered:

1. SpectraShield by CCI Spectrum
2. Or equal.

PART 3- EXECUTION

3.1 PREPARATION

- A. **Wastewater Flow Control.** The Contractor will bypass existing sewage flow where force mains or gravity lines restrict the installation procedure. Contractor will work at such hours as to cause the least sewage flow control problems to the Owner. The contractor will not perform installation in structures until a plan for bypassing sewage flow has been implemented. Additionally, no plugging of the utility system gravity lines will be made without the approval of the Owner and the Engineer. Manhole rehabilitation contractor shall coordinate work with the sanitary sewer CIPP lining contractor so both contractors can utilize the same bypass pumping setup. See specification section 33 06 00 – Bypass Pumping.
- B. **Steps.** All existing metal steps shall be removed completely from those manholes receiving interior sealing. Existing plastic/polypropylene step shall remain installed. Care must be taken to minimize damage to the manhole wall during removal of the steps. Steps shall not be replaced.
- C. **Foreign Objects.** All foreign objects including valves, gates, miscellaneous piping, and any other object located within the manhole shall be completely removed from the manhole to be rehabilitated. Care must be taken to minimize the damage to the manhole during removal. All items removed will not be replaced.
- D. **Surface Preparation.** Prior to any repair work inside the manhole, all interior wall and invert surfaces shall be cleaned using a minimum 4,000 psi water blast to remove all foreign matter, loose mortar, grease, oil residues, etc. If initial water blast does not remove all deposits, then a solution of muriatic acid (hydrochloric acid) at a ratio of one part acid to ten parts water shall be applied by spraying from above the manhole. After the acid solution is applied, it shall be washed off completely and the manhole allowed to dry. The mixing, application, and removal of the acid solution shall be done in strict accordance with the manufacturer's specifications and safety procedures. All waste materials resulting from the cleaning operation shall be removed from the manhole being cleaned and properly disposed of by the Contractor.
- E. **Television Inspection.** The Contractor shall televise all sewer laterals entering into the manhole in accordance with Section 33 01 32.02, "Television Inspection," prior to manhole rehabilitation. Should any lateral be determined to be an illegal connection, the contractor shall notify the Owner's Representative immediately. The Owner shall be responsible for informing the resident of the

illegal connection. The lateral shall then be plugged using brick and mortar prior to any manhole rehabilitation.

3.2 REPAIR

- A. **Stopping Infiltration.** Wall repair shall begin with the plugging of all visible leaks with the specified water plug material. If infiltration through the manhole walls is heavy, up to four 5/8-inch-diameter holes may be drilled around the base of the manhole to act as relief ports allowing the water to seep into the manhole flow channel. Once the leaking walls have been plugged, the drilled holes shall be plugged in the same manner.
- B. **Patching.** Patching of manhole walls shall be required in areas where voids exist (i.e., bricks missing in manhole wall, step removals, frames, pipes, and mortar joints). All cracked or disintegrated material shall be removed from the area to be patched, exposing a sound substrate. The patching mortar specified shall be applied to a dampened surface. The repairs shall be made smooth and flush with the face of the manhole wall.
- C. **Channel Reconstruction.** The manhole base for all manholes being sealed shall be repaired or reconstructed as necessary, matching the existing bench and channel depth. Minor adjustments in bench slopes can be made by varying the thickness of the sealing material. Where major adjustments are required, concrete shall be poured with a minimum thickness of 1 inch. In existing manholes without channels, full depth benches and full depth channels shall be installed with cast-in-place concrete, preformed inserts, or approved alternate method prior to manhole rehabilitation. Necessary chipping of the existing bench shall be to a minimum depth of 1 inch below the required finished surface. Areas of removed concrete shall have vertical edges. Prior to placement of new concrete, the chipped surface shall be thoroughly cleaned of all dirt, grease, and loose material, and coated with an approved bonding compound. The bench areas shall be given a non-slip broom finish parallel to the main flow channel. Flow channels, if reconstructed, shall receive a trowel finish. Concrete for bench and invert reconstruction shall be 3,000 psi, 28-day compressive strength, w/c ratio 0.50 maximum; minimum cement, 5.75 bags (541 pounds) per cy, 6 percent air. Water plug and patching mortar may be used for minor repairs. Rebuild channel by reshaping and repairing slope of shelves or benches. Work shall include aligning inflow and outflow ports in such a manner as to prevent the deposition of solids at the transition point. Invert(s) shall follow the grade of the inlet pipe. Channels shall have a consistent curve of as large a radius as the manhole bench and invert will permit, and shaped to allow easy entrance of maintenance equipment, including buckets, ladders, TV camera, rodders, etc. Regardless of the rehabilitation methodology used, the finished invert surfaces shall be smooth, free of ridges and sloped in the direction of flow. Special care shall be used to insure a smooth transition between the new manhole invert and the intersecting pipeline inverts such that flow will not be impaired. The Contractor shall submit for approval a detailed plan for bench and channel reconstruction prior to performing the work.
- D. **The Contractor shall submit** for approval a detailed plan for channel reconstruction prior to performing the work. The manhole rehabilitation

contractor shall be required to provide any necessary channel reconstruction work.

3.3 **INSTALLATION**

A. **Manhole Sealing.** Multi-Layered Polymeric Liner Coating System.

1. **Equipment.** Spray equipment shall be specifically designed to accurately ratio and apply the liner system.
2. **Application.**
 - a. The lining system shall not be applied until any required cementitious liner or grout has cured in accordance with the manufacturer's recommendation for both products.
 - b. The manhole must be completely dried and brought to an acceptable temperature for application of the multi-layered polymeric liner according to the manufacturer's recommendations.
 - c. Application procedures shall conform manufacturer's recommendations, including materials handling, mixing, environmental controls during application, safety and spray equipment.
 - d. Application of liner system shall be in strict accordance with manufacturer's recommendation. Final installation shall be a minimum of 500 mils.
 - e. Application shall proceed from bottom to top. The finished surface of the lining shall be smooth and uniform. The application shall provide a monolithic lining system covering all interior surfaces of the manhole, including the invert and bench.
 - f. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
 - g. Provide final written report to Owner detailing the location, date of report, and description of rehabilitation.
3. **Curing.** Curing procedures shall be performed in strict conformance with the manufacturer's recommendations.
4. The system shall have finished invert surfaces that are smooth, free of ridges and sloped properly in the direction of flow. Special care shall be used to insure a smooth transition between the new manhole invert and intersecting pipeline inverts so that flow will not be impaired.
5. Flow through the manhole shall be re-established as soon as practicable and following the material manufacturer's recommendation for appropriate curing.
6. Contractor shall submit for approval a detailed plan for overspray containment during manhole rehabilitation work. Contractor shall be responsible for any damage or clean-up resulting from overspray during lining process.

3.4 FINAL ACCEPTANCE

- A. **Manhole Testing.** Official results of all testing shall be submitted to the Owner and Engineer. Contractor shall coordinate testing to be completed in the presence of the Owner/Engineer.
1. Visual Inspection. Manhole sealing will be visually inspected by the Contractor from inside the manhole for watertightness. All visible leaks and defects shall be repaired to the Owner's satisfaction by the Contractor at no additional cost.
 2. Spark (Holiday) Test. The Contractor shall perform Spark (Holiday) Test on all interior manhole surfaces. After the coating has sufficiently cured, it shall be inspected with high-voltage holiday detection equipment. An induced holiday shall be made on the coated surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil of film thickness applied but may be adjusted as necessary to detect the induced holiday. All holidays detected shall be repaired according this specification. All costs for any repairs and additional testing due to spark test failures shall be at the Contractor's expense.
 3. Verify approved design thickness via:
 - a. Official record of total weight of material applied per each manhole section per manhole, and related calculation verifying approved material design thickness per each manhole section per manhole.
 - b. Measure and record material thickness utilizing electronic density gauge at two locations (180 degrees apart) at each casting, each manhole design section, and bench.
- B. **Compliance and Acceptance.** Compliance with this contract shall be complete when all conditions set forth in these specifications have been met, including the following:
1. The structure interior shall exhibit a smooth, even finish with uniform bonding to the original substrate.
 2. The finish product shall conform to the walls of the original substrate.
 3. The Contractor shall field verify structure depths and various other dimensions.
 4. No longitudinal or circumferential shrinkage, gap or annular space between the finished product and existing substrate shall be allowed.
 5. There shall be no visible infiltration throughout the rehabilitated portion of the structure including the rehabilitation product's terminations.
 6. The finished liner shall be homogeneous throughout and free of any holes, visible cracks, foreign material, blisters, or other deleterious faults or any other defects, which in the opinion of the Owner, will affect the structural integrity, strength, water tightness, future maintenance access, and overall performance of the finished product.

C. **Defects and Repair Methods.**

1. Defects, in the opinion of the Owner, which will not meet this specification, or will affect the structural integrity, strength, water tightness, future maintenance access, and overall performance of the finished product shall be repaired or the manhole replaced at the Contractor's expense. All materials and procedures should be in accordance with coating/lining manufacturer's specifications or as further indicated in this specification. Any manholes exhibiting these defects will be rejected for payment until such time repairs have been made to the satisfaction of the Owner.
2. The following methods of repair shall be implemented by the Contractor to resolve common defects unless otherwise approved by the Owner:

Defect	Repair Method
Infiltration	Stop leaks and patch area according to manufacturer's specifications. Re-prep and Re-coat entire manhole if leaks reoccur.
Damaged incoming pipe terminations.	Repair with structural grout or point repair.
Cracks, voids, or holiday spots.	Re-coat area to 125% of proper thickness.
Final thickness less than required.	Re-coat to 125% of proper thickness.

3. The final project thickness shall not be less than the required thickness specified. At its discretion, the Owner will measure final product thickness utilizing non-destructive ultrasonic thickness testing equipment. Installer must submit proof of product thickness from manufacturer.

- D. **Warranty Period.** The Owner reserves the right to inspect the completed manholes any time during the warranty period. Any leakage or defects in the work found by this inspection shall be corrected by the Contractor within 10 years at no additional cost to the Owner.

END OF SECTION

SECTION 33 01 38.03

CURED-IN-PLACE SEWER PIPE LINER (WATER OR STEAM CURED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **General.** Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 100 and all related specification sections, apply to this section.

1.2 DESCRIPTION OF WORK

- A. **Scope of Work.** Furnish and install the cured-in-place resin impregnated flexible tube pipe liner in accordance with the plans and as specified herein. When installed, cured, and complete, the liner shall extend from one manhole to the next in a continuous tight fitting, watertight, pipe-within-a-pipe manner.

Provide the mobilization; labor; tools; equipment and materials; cleaning including grease and root removal; notifications; disposal of all waste material; pre and post-inspection; mainline liner; Hydrophilic O-Rings; obtaining and providing liner samples for testing; perform testing on liner samples; leakage testing; cleanup; maintenance of traffic and all other related items and expenses, where specifically mentioned or not, necessary for trenchless rehabilitation of the lateral in accordance with the plans and as specified herein.

- B. **Project Description.** The project consists of cleaning as necessary, internal television inspection before and after rehabilitation, and lining of the various diameter sanitary sewers as shown on the plans.

1.3 QUALITY ASSURANCE

- A. **Codes.** Perform all work in compliance with all federal, state, and local codes.
- B. **Standards.** All work shall be in compliance with the following standards:
1. ASTM – American Society for Testing and Materials.
 2. NASSCO – National Association of Sewer Service Companies.
- C. **Regulatory Agency**
1. OSHA – Occupational Safety and Health Administration.
- D. **Contractor.** Installation of the sewer pipe lining system shall be performed by an experienced contractor fully licensed by the lining process manufacturer.
- E. **Installer's Qualifications.** The installer of work shall have 5 years' minimum proven experience in such work and shall have satisfactorily completed three jobs of similar size and type within the last 5 years. Installer shall be certified in writing by the manufacturer of the product system that the installer is approved by the manufacturer for installing the specified product system.

1.4 SUBMITTALS

- A. **Data.** Furnish manufacturer's product data, test reports, progress schedules, and material certifications as required. Receive, check, approve as required, and submit all items listed herein by the time indicated, accompanied by a transmittal letter. Keep an accurate record of the date of submittal and the date received on the project. Following is a general list of required submittals and the time frame for submittal.
1. Prior to contract signing:
 - a. Installer Qualification Form.
 - b. Subcontractor and material lists.
 2. Prior to start of work:
 - a. Progress schedule.
 - b. List of submittals.
 3. As work progresses:
 - a. Updated progress schedule, if required.
 - b. Materials certifications.
 - c. Test reports.
 - d. Shop drawings.
 - e. Product data.
 - f. Samples.
 - g. Affidavits and waivers of lien.
 - h. Manufacturer's service representative's report.
 - i. DVDs.
 4. With request for final payment:
 - a. Final affidavits and waivers of lien.
 - b. Final records and logbooks.
- B. **Installer Qualifications.** Submit copy of certificate with a material list prior to contract signing.
- C. **Material Certification.** Written certification is required from the manufacturer that all materials used in the work were manufactured and tested in accordance with the appropriate ASTM specification, and are being used or installed in conformance with the manufacturer's recommendations.
- D. **Progress Schedule.** Prior to the start of work, submit a graphic progress schedule showing the proposed critical dates for starting and finishing the work of each trade, which will enable meeting the established completion dates. Prepare the schedule in the form of a bar chart as approved. Keep the schedule current and submit a revised copy with the application and certificate for payment. Modification or updating of the schedule shall not constitute the basis

for a claim for extra payment if portions of the work do not become available at the established dates.

- E. **Pipe Liner.** Furnish the liner thickness for each manhole to manhole section, the resulting capacity of the reconstructed pipe and the liner manufacturer's detailed installation procedures. Each tube shall be designed to withstand internal and/or external loads as dictated by site and pipe conditions or as directed.
- F. **Testing.** When so directed and prior to the use of any materials, at own expense, the results of testing of the proposed materials by an approved laboratory in conformance with these specifications. Remove any material not meeting the requirements of these specifications. Substitute acceptable materials for rejected items at own expense.

1.5 **JOB CONDITIONS**

- A. **Coordination.** Coordinate with other trades to prevent delays, omissions, or errors.
- B. **Environmental Requirements**
 - 1. Do not work in rain, snow, or in presence of water.
 - 2. Do not work in temperatures below the manufacturer's recommended temperature to obtain proper curing.
- C. **Sequence of Work.** Complete sewer cleaning, television inspection, and point repair prior to delivery of the material for the liner. Lateral rehabilitation and manhole lining shall be performed after main line CIPP activities.
- D. **Water Supply.** Have Owner approval prior to connection of his water supply lines to any fire hydrant. Provide the necessary gate valves, backflow preventers, and flow meter for each hydrant connection. All equipment, fittings, and valves shall be in accordance with the Owner's standards.

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. **Delivery**
 - 1. Deliver materials in sufficient quantity to effectively span the distance from the inlet to the outlet of the respective manholes.
 - 2. Deliver material to job site in a covered truck to minimize exposure to sunlight and to maintain the temperature of the product within manufacturer's recommendation to avoid curing.
 - 3. Coordinate delivery of material with other trades to avoid delays.
- B. **Storage of Materials**
 - 1. Store material in the truck delivering the material in order to minimize the exposure to sunlight and to maintain the temperature of the product to within manufacturer's recommendation to avoid curing.
 - 2. Store no material in the open or in contact with the ground.

C. Handling

1. Handle all products with care. Only sound, undamaged products shall be used.
2. Limit tube installation forces or pressures so as not to stretch the tube longitudinally by more than 5 percent of the original length.

1.7 SPECIAL WARRANTY

- A. System Warranty.** Upon project completion, warrant all work as stated in the General Conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Liner.

1. The liner consists of resin-impregnated flexible felt or fiber tube inverted through the existing pipe to the terminal manhole using either hydrostatic or air pressure.
2. Cure the resin into a hard impermeable pipe of the desired thickness, providing a structurally sound, uniformly smooth, and tight fitting liner within the existing pipe.
3. Accomplish curing by circulating hot water or steam throughout the tube.
4. Fabricate the liner from materials which, when cured, will be chemically resistant to internal exposure of sewage containing normal levels of hydrogen sulfide, carbon monoxide, carbon dioxide, methane, traces of mercaptans, and dilute sulphuric acid.
5. The material must also withstand saturation with moisture and external exposure to soil bacteria.
6. Projected changes in groundwater level, temperature, and other loading factors shall cause no significant changes in the service characteristics or service life of the sanitary sewer pipe liner.
7. In industrial areas subject to possible flows other than domestic sewage, the Owner will obtain samples of the dry weather flow to be analyzed for chemical content.
8. This analysis will be supplied to the manufacturer for their information and use in determining whether a nontypical polyester, vinyl ester, or epoxy should be substituted for the standard polyester resin.
9. The flexible fiber or felt tube shall be manufactured and fabricated under quality controlled conditions set by the manufacturer to a size that when installed will snugly fit the internal circumference of the existing sewer and provide the required thickness when cured.
10. Make allowance for longitudinal and circumferential stretching of the liner during installation.
11. The wall thickness of the finished product shall not be less than the minimum required by ASTM F 1216, Appendix XI.

12. Determine the length of the liner to effectively carry out the insertion and seal the liner at the inlet and outlet of the respective manholes.
 13. Verify the lengths in the field before cutting the liner to length.
 14. Individual liner runs can be made over one or more manhole to manhole sections as determined in the field and approved.
 15. Contractor shall include a price for any increase or decrease of pipe wall thickness of 1.5 mm increments
- A. **Pre-Liner.** If active I/I is observed during the pre-construction video severe enough to inhibit the installation of the liner the contractor shall install a pre liner with the cured in place pipe liner.
- B. **Resin Components.** Unless otherwise specified, use a polyester resin and catalyst system compatible with the inversion process.
- C. **Reference Specifications and Tests.** This section references the ASTM Standard and Test Methods, which are made part of the specification. ASTM F 1216, "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube" shall be the general guide for the resin, tube, installation, curing, and testing for the cured-in-place sewer pipe liner. No change during the course of the contract shall be allowed without the prior written approval of the Engineer/Architect.
- 2.2 **EQUIPMENT.** All equipment required for the installation and curing of the resin impregnated flexible tube, including cables, sleeves, rollers, compressors, generators, pumps, valves, gauges, and accessories required for complete installation, shall be in accordance with manufacturer's recommendations.
- 2.3 **SOURCE QUALITY CONTROL**
- A. **Tests.** Physical properties of the approved resin components of the materials used, as well as the cured liner, shall conform with the minimum structural properties as listed in Table 1 of ASTM F-1216. Submit certified copies of all test reports on the properties of the selected resin and on the liner coupons taken. Provide the name and designation of all in-house quality control tests and the sampling frequency of the tests on the resin and liner materials. The Owner may also run tests on random samples at no cost to the Contractor. Whenever possible, place a short section of sewer pipe very similar to the existing pipe in the manhole to run the liner through, under restrained conditions, for later testing and thickness measurements at no additional cost to the Owner. Label all samples before shipment for testing and provide a duplicate piece for inspection and/or testing by an independent laboratory, if required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **General.** Examine areas and conditions within the sewer system in which materials and products are to be installed. Do not proceed with work until satisfactory conditions are present.

- B. **Material.** All sewer pipe liner materials shall be carefully inspected for defects prior to installation. All material found during the progress of the work to have flaws or defects shall be rejected. Promptly remove all defective materials furnished from the project site.
- C. **Responsibility.** Be responsible for all materials furnished and replace at own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

3.2 PREPARATION

- A. **Resident Notification.** Notify all residents affected by this construction of any utility service disruptions 2 working days prior to commencement of the work. Working days are defined as any day other than Saturday or Sunday.
- B. **Cleaning.** Clean debris out of the sewer line in accordance with NASSCO Specifications for Sewer Collection System Rehabilitation. Clean all sewers to be lined to permit proper installation of the liner. The term "cleaned" shall mean the removal of all sand, dirt, roots, grease, and all other solids or semisolid materials from the interior face of the sewer lines.
- C. **Television Inspection.** Televiser the sewer in accordance with specification Section 33 01 32.02, "Television Inspections," and the Supplemental Specifications.
- D. **Bypassing Sewage.** Bypass pumping for this project is to be provided by the Contractor. It is the Contractor's responsibility to verify the need for bypass pumping. Perform bypass pumping in accordance with specification Section 33 01 38.04.
- E. **Line Obstruction.** Clear the line of obstructions, solids, dropped joints, protruding services, or collapsed pipe that will prevent the installation of the liner. If inspection reveals an obstruction (a badly dropped or misaligned joint, or service protrusion) that cannot be removed by conventional sewer cleaning equipment, make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Owner prior to commencement of the work.
- F. **Trimming Protruding Laterals.** Lateral sewer pipes protruding into the main sewer shall be trimmed flush with the inside of the main sewer wall prior to lining. Trimming must be done in a neat, workmanlike manner, causing no damage to the lateral pipe beyond the inside face of the main sewer. This item shall be included in the unit price bid for Trimming Protruding Lateral.

3.3 INSTALLATION PROCEDURE

- A. **General.**
 - 1. If requested, supply design calculations indicating how the liner thickness dimensions were obtained.

2. Design liners to withstand internal and/or external pressures as indicated by site conditions.
3. Submit the recommended liner thickness for each manhole to manhole section at least 72 hours prior to commencing work.
4. Deliver the liner to the site and provide all equipment required to insert the liner into the sewer and cure it in place.
5. Allow the Owner to inspect the materials and the "wet-out" procedure.
6. All procedures to prepare the liner for installation will be in strict compliance with the manufacturer's recommendation.
7. Reject any material not properly prepared and replace with acceptable materials at own expense

B. **Active Infiltration.** If there is active infiltration severe enough to inhibit the installation of the Liner then a pre-liner shall be used to prevent washout and resin migration. The Engineer shall be notified prior to any pre-liner installation.

C. **Installation.** Erect a scaffold or elevated platform at the upstream access point. Invert the tube using an "inversion elbow" at the bottom of the manhole or an "inversion ring" above ground. Invert the tube (turned inside-out) with water or air pressure.

D. **Curing.**

1. After the inversion is complete, supply a suitable heat source and water or steam recirculation equipment.
2. The equipment shall be capable of uniformly raising the water temperature to a level required to effectively cure the resin.
3. Fit the heat source with suitable monitors to gauge the temperature of the incoming and outgoing water supply.
4. Place another such gauge between the tube and the host pipe in the downstream manhole at or near the bottom to determine the temperatures during cure.
5. Water temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.
6. Initial cure shall be deemed complete when the exposed portions of the tube appear to be hard and sound and the temperature sensor indicates the recommended temperature of the manufacturer.
7. The cure period shall be of the duration recommended by the resin manufacturer and may require continuous recirculation of the water to maintain the temperature.

E. **Cooldown.** Cool the hardened pipe to a temperature below 100 degrees Fahrenheit (° F.) before relieving the head pressure. Accomplish cooldown by the introduction of cool water or air into the inversion standpipe to replace water or steam being pumped out of the manhole.

F. **Finish.** Cut off the new pipe in the manhole at a suitable location. The finished product shall be continuous over the length of the pipe reconstructed and be free from dry spots, delamination, and lifts. During the warranty period, repair any defects which will affect the integrity or strength of the product at the own expense, in a manner mutually agreed upon with the Owner.

- G. **Sealing Pipe in Manholes.** The cured-in-place liner shall make a tight seal at each manhole opening with no annular gaps. Provide an LMK Insignia® End Seal, or approved equal at each manhole. Install per manufacturer's instructions. For lined through manholes, the cured-in-place liner shall also make a tight seal with the channel.
- H. **Leakage Testing.** After the installation procedures have been performed and curing is complete, but before any service connections are reinstated, conduct a leakage test on the sewer line to determine if it is watertight. Perform the leakage test in accordance with Section 01 89 19.
- I. **Service Connections.** After the pipe has been reconstructed, reinstate all existing service connections unless otherwise indicated on the plans. Accomplish the reestablishment of services without excavation, unless otherwise specified. Accomplish reestablishment of services from the interior of the pipeline by means of a television camera directed cutting device. Free all recut service connections burrs, frayed edges, or any restriction preventing free wastewater flow. Make location of the service connections by inspection of the preconstruction television tape.
- J. **Video Taping.** After the work is completed, supply DVDs showing before and after conditions of the lined section of sewer including service lateral connections. Utilize a radial view camera to allow proper inspection of service lateral reconnections.

3.4 RESTORATION SITE

- A. **Where portions of the site,** either inside or outside the contract limits, not designated for change or new work become damaged during the course of construction, repair or replace such damage to original or better condition in conformance with the Contract Documents.

3.5 FIELD QUALITY CONTROL

- A. **General.** The reconstructed pipe shall be continuous (without joints) over the entire length of an insertion run between to manholes. The liner shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The liner surface shall be free of leaks, cracks, and crazing with a smooth finish. An average of not over two pits per square foot is permitted. The pits should be less than 3 millimeters (mm) diameter and not over 1 mm deep. Some minor waviness that, in the Owner's opinion, will not appreciably decrease the flow cross section or affect the flow characteristics shall be permissible.

3.6 CLEANING

- A. **Final Cleanup.** Upon completion of the work, and prior to submittal of application and certificate for final payment, the following general cleaning shall be performed.
 - 1. Remove from the site all temporary facilities, tools and equipment, surplus materials, and rubbish of every kind.

2. Remove all temporary protective devices.
3. Repair, patch, and touch-up damaged surfaces to specified finish to match adjacent surfaces. Replace damaged materials which cannot be satisfactorily repaired.
4. Broom clean paved surfaces and rake clean other surfaces of the site.

3.7 SAFETY AND PROTECTION

A. General

1. Erect and maintain, as required by existing conditions and progress of the work, all responsible safeguards for safety and protection, including but not limited to, posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying Owners and users of adjacent utilities.
2. Provide protection for the work, materials, and equipment at all times against damage from vandalism, theft, weather, and other causes.
3. Protect existing trees, plantings, structures, road, and walks during the progress of the work.
4. Designate a responsible employee at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing.
5. Do not load or permit any part of the work to be loaded so as to endanger its safety.
6. Safety shall be in strict accordance with all applicable OSHA standards. Particular attention is drawn to those safety requirements involving entry into a confined space.

B. **Snow and Ice.** Remove all snow and ice for proper protection and prosecution of the work.

C. **Security.** Maintain site security at all times.

D. **Safety Devices.** Provide all fences, barricades, bridges, railings, and guards for protection of construction personnel and the public in compliance with all local, state, and federal regulations.

E. Streets and Sidewalks

1. Protect streets and sidewalks and repair damage caused by operations under the Contract Documents.
2. Comply with governing authority in connection with use and cleaning of streets and control of traffic.
3. Clean mud and debris from wheels of vehicles leaving the site. Mud shall not be tracked on streets. If tracking occurs, the Contractor shall remove the mud or debris from the street immediately.
4. Protect all private roads and walks.

F. **Fire Protection.** Schedule means of fire protection for all construction, materials, and personnel prior to starting work in accordance with governing

authorities. Secure approval of the local fire department and other governing authorities as required.

- G. **Hazardous Materials.** When the use or storage of hazardous materials or equipment is necessary for the execution of the work, exercise the utmost care and carry out such activities under the supervision of properly qualified personnel. Such use and storage shall also be in accordance with governing authorities.

3.8 FINAL INSPECTION/PAYMENT

- A. **General.** When the work is complete, a final inspection will be made upon the submission of a written certification that:

1. All items on the punchlists have been completed or corrected and recommended for approval.
2. Contract Documents have been reviewed.
3. Work has been inspected for compliance with Contract Documents.
4. Work has been completed in accordance with Contract Documents.
5. Work is completed and ready for final inspection.

Upon receipt of written notice that the work is ready for final inspection and acceptance and upon receipt of a final application and certificate for payment, the Engineer/Architect shall promptly make such final inspection.

- B. **Work Incomplete or Defective.** If the Engineer/Architect considers the work incomplete or defective, he will promptly notify the Contractor in writing, listing the incomplete or defective work.

1. Take immediate steps to remedy the stated deficiencies and send a second written certification to the Engineer/Architect that the work is complete.
2. The Engineer/Architect will reinspect the work.

During the final inspection, make any and all adjustments to the satisfaction of the Engineer/Architect.

When the Engineer/Architect finds that the work is acceptable under the Contract Documents, he shall request the Contractor to submit the final application for payment.

- C. **Basis of Payment.** The cost of the work shall be included in the unit price bid per various size Cured In Place Pipe Liner. The cost of a pre-liner, if needed, shall be included in the unit price bid per various size Cured In Place Pipe Pre Liner.
- D. **Final Application for Payment.** Submit the final application and certificate for payment in accordance with requirements stated in the conditions of the contract.

END OF SECTION

SECTION 33 01 38.06

CURED -IN-PLACE SEWER LATERAL CONNECTION REHABILITATION

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. **Scope of Work.** The Contractor shall rehabilitate connections between the sanitary sewers and sanitary laterals, including a portion of the lateral as directed by the Owner. These connections and the laterals shall be rehabilitated using a trenchless technology Connection Liner, in accordance with requirements more fully described and specified herein:

1. This specification covers requirements and test methods for the reconstruction of a sewer service lateral pipe and a full-circle short section of the mainline pipe without excavation accomplished using the T-Liner®Stubby product as manufactured by LMK Enterprises or approved equal. The lateral pipe shall be remotely accessed from the mainline pipe. This shall be accomplished by the installation of a resin impregnated one-piece main and lateral lining by means of air inflation and inversion. The liner is pressed against the host pipe by pressurizing a bladder that is held in place until the thermo-set resins have cured. When cured, the liner shall extend over a predetermined length of the service lateral and a particular section of the main pipe as a continuous, one piece, tight fitting, corrosion resistant and verifiable non-leaking cured in-place pipe. The Connection Liner shall be in accordance with ASTM F2561-06, “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. The Contractor shall furnish all labor, components, materials, tools, and appurtenances necessary for the performance and completion of the contract.
3. Only the T-Liner®Stubby as manufactured by LMK Technologies or approved equals listed herein shall be considered for use under the terms of this contract unless otherwise indicated.

1.2 QUALITY ASSURANCE

- A. **Standards.** All work and materials used shall be in compliance with the following standards that are made part of this specification:
1. National Association of Sewer Service Companies (NASSCO).
 2. ASTM F2561-06, “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”.
 3. ASTM F-1216, “Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the inversion and Curing of a Resin Impregnated Tube.”
 4. ASTM D2412, “Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.”

5. ASTM D5813, "Standard Specification for Cured In Place Thermosetting Resin Sewer Piping Systems."
6. ASTM D-790, "Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials."

B. **Contractor's Qualifications.** Installation of the sewer pipe lining system shall be performed by an experienced Contractor fully licensed and approved by the lining process manufacturer. The Contractor shall have a minimum of three (3) years of experience in such work and shall have satisfactorily completed ten (10) similar regional projects for at least three (3) different utilities or agencies.

1.3 SUBMITTALS

- A. **Contractor's Qualifications.** Submit copy of manufacturer's licensee certificate. Submit list of all similar regional jobs within the past three (3) years as well. Provide project information such as number of laterals, total length of project, date complete, and project cost.
- B. **Product Data.** Furnish manufacturer's general product data.
1. Statement of Warranty – An unconditional, non-prorated warranty covering all labor and materials, to stop infiltration, material failures, deterioration, defects, etc. will be required by the installer and the manufacturer for the time period specified below:
 - a. Five year warranty.
 - b. All other additional warranties as provided by the manufacturers will be applicable.
 2. Material Certifications – Written certification is required from the manufacturer that all materials used in the work were manufactured and tested in accordance with the appropriate ASTM specification, and are being used or installed in conformance with the manufacturer's recommendations.
- C. **Resident Notifications.** The Contractor shall submit copies of the resident notifications as described in Section 3.2.A.
- D. **Storage and Delivery Procedures.** The Contractor shall provide the liner manufacturer's recommended storage and delivery procedures. This shall include storage and delivery temperatures, maximum time from wet-out to installation, and other pertinent information.
- E. **Material Safety Data Sheets.** The Contractor shall submit Material Safety Data Sheets (MSDS) for each component of the CIPP system.
- F. **Test Results.** Prior to the use of any materials, the Contractor shall furnish, at his expense, the results of testing of the proposed materials by an independent laboratory in conformance with these specifications. All submitted test data shall have been performed on field installed samples within the last twelve (12) months. Any material not meeting the requirements of these specifications shall be completely removed from the project. Materials acceptable to the Engineer

shall be substituted for rejected items at the Contractor's expense.

The following submittals (G-K) shall be made a minimum of ten (10) working days prior to lining:

- G. **Pre-lining video and logs.** The Contractor shall submit two (2) copies of the pre-lining video and logs to the Engineer that document existing conditions after the Contractor has cleaned the line.
- H. **Resident Notifications.** The Contractor shall submit a copy of the resident notifications.
- I. **Liner Thickness Calculations.** The Contractor shall perform liner thickness calculations for each lateral length to be lined and furnish them to the Engineer with supporting assumptions. Calculations shall be done after cleaning, televising, and other field inspections have been accomplished. Design parameters given in Section 2.1.D shall be used in calculations.
- J. **Wet-Out Report.** The Contractor shall submit a report of the wet-out process identifying each liner by address and shall contain the wet-out length, diameter, liner thickness, wet-out date, wet-out manager, type of resin, and resin and catalyst volumes or weights with supporting calculations for each liner.
- K. **Curing Cycle and Cooling Rate.** The Contractor shall submit the resin manufacturer's recommended curing cycle as well as the recommended cooling rate.

The following submittals (L-M) shall be made immediately after lining:

- L. **Cure Logs.** The Contractor shall submit a copy of the cure logs for each lateral installation. Each cure log shall clearly indicate the project name, CIP number, and the address and date of lining.
- M. **Post-lining tapes and logs.** The Contractor shall submit two (2) copies of the final television inspection that show the entire rehabilitated lateral length from the mainline sewer.

1.4 **JOB CONDITIONS**

A. **Environmental Requirements**

- 1. Contractor will be required to monitor styrene odors as necessary in businesses and residences to ensure that concentration levels are under recommended limits.
- 2. Contractor shall use caution when working in combined sewers. During rain events, combined sewers may reach capacity quickly and/or head up.

- B. **Safety.** All work to be completed in conformance with all applicable safety standards, in particular OSHA Standard 29CFR 1910.146, Permit Required Confined Space Entry.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery.

1. CIPP material (not wet-out on site) shall be delivered to the job site in a covered refrigerated truck to minimize exposure to sunlight and to maintain the temperature of the product within manufacturer's recommendations to avoid premature curing.
2. Delivery of material shall be coordinated with other trades to avoid delays.
3. Pipe preparations and field inspections shall be completed prior to delivery of liner to site.

B. Storage of Materials.

1. Material shall be stored in the delivery truck in order to minimize exposure to sunlight and to maintain the temperature of the product to within manufacturer's recommendation to avoid premature curing.
2. No material shall be stored in the open or in contact with the ground.
3. Temperature logs of liner from time of wet-out to installation shall be given to the Engineer's representative on site at the time of installation.

C. Handling.

1. Handle all products with care. Only sound, undamaged products shall be accepted.

PART 2 – PRODUCTS

2.1 MATERIALS

Only materials approved by the Engineer may be used for this project.

A. **Products.** Subject to compliance with requirements, provide one of the following:

1. T-liner®Stubby.
2. Or approved equal.

B. **Resin.**

1. The resin/liner system shall conform to ASTM D5813 Section 8.2.2 - 10,000-hour test.
2. The resin shall be a corrosion resistant polyester, vinylester, 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 Connection Liner, for this project.

The resin for the Connection Liner will comply with the structural and chemical resistance requirements of ASTM F1216.

Table 1 - Main to Lateral Connection Liner Initial Structural Properties

Physical Property	ASTM Standard, Latest Revision	Minimum Value
Flexural Stress	ASTM D-790	4,500 psi
Flexural Modulus of Elasticity	ASTM D-790	250,000 psi

C. Liner Assembly.

1. 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 braid that meet the requirements of ASTM F1216 and ASTM D5813 Sections 6 and 8. 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 and allow for resin migration.

2. Bladder Assembly – The outside layer of the textile tube (before inversion) and interior of the textile sheet shall be coated with an impermeable, translucent flexible membrane. The textile sheet before insertion shall be permanently marked as a “Lateral Identification” correlating to the address of the building and the lateral pipe services. The sheet and tube shall be surrounded by a second impermeable, 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.

3. Mainline Connection – The mainsheet and lateral tube shall be a one-piece assembly formed in the shape of a “T” or WYE. A “one-size fits all” type of liner will not be accepted. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause de-lamination in the cured in-place pipe. Liner coating shall not be perforated. 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 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, and disfigured pipe sections. The tube shall be continuous in length and consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216 and ASTM D5812 Sections 6 and 8, to produce a Type III class of Connection Liner. In the event of a discrepancy between the referenced ASTM requirement and this Specification, this Specification will govern.

4. The wall color of the interior liner surface after installation shall be a light-reflective color so that a clear, detailed inspection with closed-circuit television equipment may be conducted.

5. The minimum length of the lateral liner from the connection with the main sewer pipeline shall be six (6) inches. The line lengths shall be verified in the field before impregnation of the tube with resin, and shall allow for adequate bladder stretch, proper circulation and proper ventilation.
6. The liner tube utilized for sanitary sewer service laterals shall be continuous. No sectionalized or overlapping liner segments will be allowed.

D. Sewer Main to Sewer Lateral Connection Liner Design.

1. Liner thickness. The Contractor shall submit liner thickness calculations to the Engineer for review. The Connection Liner shall be designed in accordance with the applicable provisions of F1216, Appendix X1 and D2412 for “fully deteriorated gravity pipe conditions” and shall meet the following design conditions:
 - a. AASHTO H-20 Live Load with two trucks passing for Connection Liners in streets (16,000 lbs.).
 - b. A soil modulus of elasticity of 600 psi, soil weight of 120 pounds per cubic foot and a coefficient of friction of $Ku' = 0.130r$.
 - c. Short-term flexural modulus of 250,000 psi and long-term modulus of 125,000 psi. Flexural strength of 4,500 psi.
 - d. Safety factor of 2.0 shall be used.
 - e. Groundwater elevation one foot below ground surface.
 - f. Pipe ovality of 2%.
 - g. Poisson ratio of 0.3.
 - h. Enhancement factor (K) of 7.
 - i. Service temperature range shall be 40 to 140 degrees F.
 - j. Maximum long-term deflection shall be 5%.
 - k. The installed, cured thickness shall be the largest thickness as calculated for deflection, bending, buckling and minimum stiffness.

2. The Connection Liner shall also conform to the minimum requirements demonstrated in the following table:

Physical Property	ASTM Standard, Latest Revision	Minimum Value
Flexural Stress	ASTM D-790	4,500 psi
Flexural Modulus of Elasticity	ASTM D-790	250,000 psi

3. Minimum Acceptable Pipe Thickness (Selected Diameters). The minimum installed, cured liner thickness shall be as follows, regardless of what the calculations indicate as the required minimum thickness:
- a. 4-inch sewer:
0 to 15 feet deep – 3mm
depths > 15 feet deep – 4.5mm
 - b. 6-inch sewer:
0 to 17 feet deep – 4.0mm
depths > 17 feet deep – 6mm
 - c. 8-inch sewer:
0 to 17 feet deep - 6mm
depths > 17 feet deep – 7.5m

The Contractor shall submit his proposed plan for ensuring that the installed Connector Liner meets the above minimum thickness requirements. The plan shall include the proposed Connection Liner thickness to be installed (pre-installation thickness) and detailed inversion procedures to reduce stretching and resin loss.

2.2 EQUIPMENT

- A. **All equipment** required for the installation and curing of the resin impregnated flexible fabric tube, including cables, sleeves, rollers, compressors, generators, pumps, valves, gauges, water heaters, and accessories required for complete installation shall be in accordance with manufacturer's recommendations.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. **General.** Examine areas and conditions within the lateral in which materials and products are to be installed.
- B. **Material.** All lateral liner materials shall be carefully inspected for defects prior to installation. The liner shall be homogeneous throughout, uniform in color, free of tears, holes, foreign materials, blisters, or other deleterious faults. Any material found during the progress of the work to have flaws or defects shall be

rejected. All defective materials furnished by the Contractor shall be promptly removed by the Contractor from the project site.

- C. **Responsibility.** The Contractor shall be responsible for all materials furnished and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

3.2 PREPARATION FOR INSTALLATION OF T-LINER®STUBBY

- A. **Resident Notification.** The Contractor shall be responsible for resident notification which shall include three (3) separate notices. The initial notification shall contain general information about the project and the cured-in-place pipe process using graphics as necessary to illustrate the procedure. Other information to be included shall be project CIP number, project name, description of the work to be performed, time frames for the work, and precautions to take during the course of the project (keeping water in the trap, keeping toilet lids down, etc.). The Contractor shall list the superintendent on the job along with his mobile telephone number as the primary contact. Secondary contact information shall be the company name, address, and telephone number. This initial resident notification shall be submitted **at the pre-construction meeting** for approval by the Engineer. Upon approval, the Contractor shall immediately distribute this information to all residents affected by the work.

The second resident notification shall alert residents to any utility disruptions and to advise minimal water usage. This notification shall provide the beginning date and time of the disruption, the length of the disruption, and the ending date and time of the disruption. Contact information shall be repeated on this notification. The second resident notification shall be distributed by the Contractor two (2) working days prior to commencement of the work.

The third resident notification shall inform residents that work on their lateral is complete and they may resume normal water usage. The Contractor shall distribute this notice immediately upon completion of the work.

- B. **Cleaning.** All sewers to be lined shall be cleaned as required prior to lining with CIPP. The term “cleaned” shall mean the removal of all sand, dirt, roots, grease, and all other solids or semisolid materials from the interior face of the sewer lines.
- C. **Existing (Pre-Lining) Television Inspection.** The Contractor shall televise the lateral to provide a detailed record of existing (pre-lining) conditions. Two copies of the pre-lining inspection shall be submitted to the Engineer. The Contractor shall be responsible for having a copy of the pre-lining inspections in the field as well. Immediately prior to liner insertion, the camera shall traverse the sewer to inspect for debris which may have entered the line after the existing condition videotaping.

- D. **“T-Liner®Stubby”** or Approved Equal Connection Liner. Lateral sewer pipes protruding into the main sewer shall be trimmed flush with the inside of the main sewer wall prior to lining. Trimming must be done in a neat, workmanlike manner, causing no damage to the lateral pipe beyond the inside face of the main sewer. This item shall be included in the unit price bid for CIPP.
- E. **Line Obstruction.** It shall be the responsibility of the Contractor to clear the sewer of obstructions, solids, or collapsed pipe that will prevent the proper installation of the liner. 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 the inside pipe diameter. The lateral lining tube **MUST** be custom manufactured to accommodate a diameter transition. A liner designed for a four-inch inside diameter **CANNOT** be stretched to fit six-inch lateral.
- Any equipment that is lost, broken, wedged, or stuck in a line section shall be removed by the Contractor at the Contractor’s expense. In additional any Open Cut repairs made for the convenience of the contractor will be at the contractor’s expense.**
- F. **Protective Measures.** To prevent burnt grass, the Contractor shall provide protective measures (e.g. felt, blocks of wood) to create a barrier between the boiler hoses and the grass for each installation.

3.3 **INSTALLATION PROCEDURE T-Liner®Stubby or Approved Equal**

- A. **General.** The Contractor shall deliver the “T-Liner Stubby” to the site and provide all equipment required to insert the liner into the sewer and cure it in place. The Contractor shall designate the location where the tube will be vacuum impregnated prior to installation. The Contractor shall allow the Owner to inspect the materials and the “wet-out” procedure upon request. All procedures to prepare the liner for installation will be in strict compliance with the manufacturer’s recommendation. Any material not properly prepared shall be rejected and replaced with acceptable materials at the Contractor’s expense. Contractor shall not proceed with work until satisfactory conditions are present in the sewer, and the previously installed main sewer CIPP liner has been verified to have been properly cured and installed.
- B. **Active Infiltration.** If there is active infiltration severe enough to inhibit the installation of the Connection Liner then chemical grout shall be used to stop the leaks. The Engineer shall be notified prior to any grouting. Grouting for Active infiltration shall be included in the unit price for lateral grouting.
- C. **Installation.** The lateral tube and mainline sheet shall be encapsulated within the translucent bladder (liner/bladder assembly) shall be vacuum-impregnated with resin (wet-out) under controlled 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. The lateral tube and inversion bladder will be inserted into the

carrying device. The mainline liner and bladder shall be wrapped around the “T” launching device and held firmly by placing four (4) hydrophilic O-rings around the main liner. An adhesive sealant 300ml in volume is applied to the sewer main to sewer 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 lateral connection and mainline sewer 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. 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 feet. The Connection Liner bladder assembly shall extend past all ends of the liner, as no cutting and trimming shall be required.

- D. **Curing.** After liner placement is complete; pressure is maintained pressing the liner firmly against the inner pipe wall. The liner is chemically 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 uniformly raise the temperature above the temperature required to cure the resin. The curing of the Connection Liner 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. 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 cool down process will also be affected by actual field conditions and may be modified in cases of severe conditions or below normal ground temperatures. Steam curing may be used in lieu of water; it shall be performed in accordance with ASTM F-1216. Curing water or steam shall be discharged to a sanitary sewer. Discharge to a storm sewer, ditch, stream, curb, ground, etc. is prohibited. Steam condensate must be contained and captured and properly disposed of. The finished Connection Liner shall be continuous over the entire length of the rehabilitated sewer service lateral and 18-inch of the main pipe (6-inch on either side of a 6-inch lateral or 7-inch on either side of a 4-inch lateral connection). The Connection Liner shall provide a smooth bore interior with a Manning’s co-efficient factor of $n=0.011$. The Connection Liner shall be free of dry spots, lifts, and delaminated portions. The Connection Liner shall taper at each end so as to accept video equipment and maintain a proper flow. After the work is completed, the installer will provide the owner with video footage documenting the repair and the visual markings identifying the sewer lateral address. The finished product must provide an airtight/watertight verifiable non-leaking connection between the main sewer and sewer service lateral.

- E. **Cool Down.** The Contractor shall cool the hardened pipe to a temperature below 100 degrees Fahrenheit before relieving the hydrostatic head. Rate of cooling shall not exceed resin manufacturer's recommendations.
- F. **Finish.** The new pipe shall be cut off at the clean-out at a suitable location. The finished product shall be continuous over the length of the lateral reconstructed and be free from dry spots, delamination, lifts, and debris under the liner. If any unsatisfactory condition is present in the lined pipe, the Engineer reserves the right to require a suitable repair.
- G. **Sealing Lateral at Manhole.** Where lateral services terminate inside a manhole, the CIPP liner/insertion bladder shall fully breach the full cross-sectional area of the lateral opening. Once proper cure has been accomplished, the CIPP shall be cut flush with the lateral opening. The lateral liner must contain a hydrophilic O-Ring in the upstream and an Insignia™ end seal in the downstream portion of the liner.
- H. **Final (Post-Lining) Television Inspection.** The Contractor shall televise the mainline to provide a detailed record of finished conditions and lateral connections. Lateral connections shall be observed while the camera is stopped and viewing the connection squarely. When complete, the Contractor shall submit two (2) copies of the rehabilitated lateral inspection, along with the accompanying logs, which shall be printed clearly or typed. Post installation air testing is not required.

3.4 RESTORATION

- A. **Where portions of the site** become damaged during the course of construction by the Contractor's operations, the Contractor shall repair or replace at no additional cost such damage to original or better condition in conformance with the Contract Documents. This shall include, but not be limited to, reseeding, replacing shrubbery in kind, replacing damaged fence, etc.

3.5 FIELD QUALITY CONTROL

- A. **General.** The reconstructed lateral shall be continuous (without joints) over the entire length of an insertion run between the mainline and clean-out. The liner shall be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes, and delamination. The liner surface shall be free of leaks, cracks, and crazing with a smooth finish. Some minor waviness that, in the Engineers' opinion, will not appreciably decrease the flow cross section or affect the flow characteristics shall be permissible.

Any defects in the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Owner and Contractor. The Contractor shall re-inspect these repairs before the five (5) year guarantee period expires. During the five (5) year guarantee period, any defects that are discovered that will affect the integrity or strength of the product shall be repaired at the Contractor's expense in a manner mutually agreed upon by the Owner and the Contractor.

- B. **Final Installed Liner Thickness.** The final installed liner thickness shall not be less than the specified thickness, nor more than ten (10) percent greater than, the required thickness specified in the Contract Documents. The final installed liner thickness measurement shall be determined from pipe samples, or as deemed necessary by the Engineer.

END OF SECTION

SECTION 33 01 39.01

LATERAL CONNECTION GROUTING AND TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. **General.** Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.
- B. **Television Inspection.** See Section 33 01 32.02 for "Television Inspection."
- C. **Sewer Cleaning.** See Section 33 01 33 for "Sewer Cleaning."

1.2 **DESCRIPTION OF WORK.** Provide the labor, tools, equipment, and materials necessary to seal the lateral sewer joints from the main line to an effective length of at least 6-feet up the lateral connection in accordance with the plans and specifications. This shall also include any laterals entering into manholes.

1.3 **QUALITY ASSURANCE** (Not used)

1.4 **SUBMITTALS.** Submit all submittals in accordance with Division 1 submittal requirements and the requirements within this specification section.

A. **Submittal Package No. 1 – Shop Drawings and Product Data**

- 1. Deliver or install no products before this submittal package has been approved.
- 2. Include manufacturer's product data, test reports, and materials certifications, as required.

B. **Submittal Package No. 2 – Field Test Reports**

- 1. Submit field test reports on each installed and completed product as specified in this section.
- 2. These are due within 21 days of the field testing being completed and include:
 - a. Sealing Log. A log containing the location station and amount of sealant required for each joint sealed.
 - b. Video recordings of complete sealing and air testing operation.

1.5 **JOB CONDITIONS** (Not used)

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. **Delivery.** Deliver sealant to the site in sealed containers bearing a label which shall list the manufacturer's name, trade name, application rate, precautionary methods required, and mixing ratio.
- B. **Storage.** Store materials in an enclosed dry area, protected from damage and moisture. Keep storage areas clean and neat at all times.

1.7 **SPECIAL WARRANTY** (Not used)

PART 2- PRODUCTS

2.1 **GROUT**

- A. **All chemical sealing materials** used must have the following characteristics:
 - 1. While being injected, the chemical sealant must be able to react/perform in the presence of water (groundwater).
 - 2. The cured material must withstand submergence in water without degradation.
 - 3. The resultant sealant (grout) formation must prevent the passage of water (infiltration) through the sewer pipe joint.
 - 4. The sealant material, after curing, must be flexible as opposed to brittle.
 - 5. In place, the sealant formation should be able to withstand freeze/thaw and wet/day cycles without adversely affecting the seal.
 - 6. The sealant formation must not be biodegradable.
 - 7. The cured sealant should be chemically stable and resistant to the mild 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 the component materials must be compatible with field operations and not require precise measurements of the ingredients by field personnel.
 - 10. Cleanup must be done without inordinate use of flammable or hazardous chemicals.
 - 11. Residual sealing materials must be easily removable from the sewer line to prevent blockage of the sewage flow.

12. Toxicity.

- a. Mixing and handling of the sealants may be toxic by passing through unbroken skin, by inhalation of dust or droplets of the materials or by swallowing. Therefore, mixing, handling, and pumping of the chemicals shall be done by personnel familiar with the handling of the chemicals involved and in accordance with manufacturer's directions.
- b. All chemicals shall be approved by the U.S. Environmental Protection Agency.
- c. Occupational Safety and Health Administration Material Safety Data Sheets shall be made available for each material, outlining proper fire and explosion hazard data, health hazard data, spill and leak procedures, and special protection information.

B. **Acrylamide Base Gel Sealing Material.** The sealing material shall be AV-100 by Avanti International or equal. The basic requirements, properties, and characteristics of the material is as follows:

1. A minimum of 10 percent acrylamide base material by weight in the total sealant mix. A higher concentration of acrylamide base material may be used to increase strength or offset dilution during injection.
2. Tolerate some dilution and react in moving water during injection.
3. A viscosity of approximately 2 centipoise which can be increased with additives.
4. A constant viscosity during the reaction period.
5. A controllable reaction time from 10 seconds to 1 hour.
6. A reaction (curing) which produces a homogeneous, chemically stable, non-biodegradable, firm, flexible gel.
7. Increase mix viscosity, density and gel strength by the use of additives.

C. **Acrylic Base Gel Chemical Sealing Material.** The sealing material shall be AV-118 Duriflex by Avanti International, or equal. The basic requirements, properties, and characteristics of the material is as follows:

1. A minimum of 10 percent acrylic base material by weight in the total sealant mix. A higher concentration (percent) of acrylic base material may be used to increase strength of set dilution during injection.
2. Tolerate some dilution and react in moving water during injection.
3. A viscosity of approximately 2 centipoise which can be increased with additives.
4. A constant viscosity during the reaction period.
5. A controllable reaction time from 5 seconds to 6 hours.
6. A reaction (curing) which produces a homogeneous, chemically stable, non-biodegradable, flexible gel.
7. Increase mix viscosity, density and gel strength by the use of additives.

PART 3 - EXECUTION

3.1 PREPARATORY PROCEDURES

- A. **Perform cleaning** as specified in Section 33 01 33, "Sewer Cleaning," so conditions are adequate for seating a lateral packer. If the main sewer is not cleaned adequately for seating a lateral packer and/or accessing lateral connections, repeat the cleaning process and reinspect until the laterals are accessible.
- B. **Accomplish television inspection** with pan-and-tilt camera and note obstructions, offset joints, debris, and location of lateral connections, and the general condition of each lateral.
 - 1. Video record inspection.
 - 2. During this inspection, determine which laterals can be accessed, and if there is enough clearance for the lateral sealing packer.
 - 3. Identify the service connections which can not be grouted from the main or required any correction before grouting.
 - 4. Submit this list with recommendations.
- C. **Cut back protruding services or taps** to the main sewer inside wall or otherwise removed so testing and sealing equipment will pass.
 - 1. Remove protruding taps at the main with robotics holesaws or routers.
 - 2. Complete this work without any excavation utilizing access from upstream or downstream manholes only.
 - 3. As a general rule, cut back service connections protruding more than 5/8-inch into an 8-inch diameter sewer.

- 3.2 **EQUIPMENT.** The lateral inversion tube used shall accommodate 4-inch- to 6-inch-diameter laterals. The inversion tube shall handle sealing the laterals to an effective length of 6 feet up into the lateral connection.

3.3 PROCEDURES

- A. **Air-Testing Laterals (only for laterals sealed via grouting)**
 - 1. Air-test laterals by isolating the area to be tested with the packer and inversion sleeve and applying positive pressure into the isolated void area up the lateral of at least 6 feet.
 - 2. Use a sensing unit located within the void area for continuous pressure monitoring.
 - 3. This testing unit accurately transmits a pressure readout to the control panel inside the TV/Seal Unit.
 - 4. Apply air pressure into each isolated void area.
 - 5. To isolate a void, position the lateral sealing packer straddling the lateral.
 - 6. Inflate the inversion tube up the lateral and then inflate the packer ends to isolate the lateral.

7. Apply an air pressure of 5 pounds per square inch (psi) into the isolated void area.
8. The test is considered positive if the time for a drop of pressure from 5 psi to 3 psi exceeds 15 seconds.
9. Otherwise the lateral is considered to have failed the air test and shall be sealed.
10. After completing the air test for each individual lateral, deflate the lateral packer, with the pressure meter continuing to display void pressure.
11. If the void pressure does not drop to approximately zero, adjust the equipment to provide a zero pressure reading at the monitor.
12. Test all laterals regardless of whether they are leaking or not.

B. Sealing Laterals. Seal laterals if the lateral does not pass the air test as described above.

1. The lateral packer remains in position, maintaining the isolated void.
2. Pressure-inject a two-component chemical grout sealant through the lateral packer into the isolated void.
3. Force the grout material out into the soil through leaking joints and pipe defects.
4. Choose the pumping and reaction or gel time to place enough grout outside the pipe to provide an effective seal.
5. The minimum gel times allowed is 30 seconds.
6. This will vary depending on the exact equipment used and the pumping rate at which the equipment can place the grout.
7. The pump capacity must be sufficient to initially fill up the isolated void before the gelling of the two component grout.
8. After filling up the isolated void, adjust the pumping rate to bring up and maintain a backpressure of 10 psi into the isolated void.
9. Measure this backpressure at the void area and not at the pump.
10. Establish an appropriate gel time for this equipment and have it reviewed. When submitting, provide information on the pumping capacity of the unit and the volume of the isolated void.
11. Provide an above ground lateral and pipe connection set up for the size and distance to be tested and grouted.
12. Use this control test to determine the void pumping time, based on a pumping rate and void volume for each size and length of lateral to be completed.
13. Base the amount of chemical grout pumped on the number of pump strokes delivered to each lateral.
14. Record the volume of grout used on the sealing log with the gel time used and the outside temperature.
15. The internal void area created by the packer should be known to determine how much chemical was actually placed outside the lateral.

C. Lateral Retesting

1. Upon completion of the lateral sealing procedure, air-test the lateral a second time to verify the sealing of the connection.
2. The air test is the same as outlined above.

3. If the lateral fails the air test a second time, repeat the grouting procedure.
 4. Repeat this sequence of air testing, grouting, and subsequent air testing until either the lateral is sealed or it is determined that the grout consumption is too high and may result in the blockage of the lateral pipe.
 5. The final determination to stop subsequent sealing attempts will be made jointly between the Owner's Representative and the Contractor.
- D. **Flow Verification.** Verify lateral flow after the successful sealing of each lateral with a television camera by attempting a water flush by the occupant. If no water is viewed during this procedure, assume the building sewer is blocked with grout and clear the lateral.
- E. **Video Recording.** Video record the complete air testing and sealing procedure. Submit two copies of the recordings for review and permanent record. The recording shall continuously display the date, manhole numbers, footage to the lateral, and void pressure readout. In addition, record the data obtained during this operation on a lateral testing and sealing log.
- 3.4 **FLOWS.** Sewer line flows shall at no time exceed one-eighth of the pipe diameter during the joint sealing. If flows exceed this limit, use either the plugging or blocking method or the pumping and bypassing method of flow control without surcharging the sewer system.

END OF SECTION

SECTION 33 06 00

BYPASS PUMPING/FLOW CONTROL

PART 1- GENERAL

- 1.1 **RELATED DOCUMENTS.** Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to this section.
- 1.2 **DESCRIPTION OF WORK.** Provide all labor, materials and equipment, set-up and tear down, moving bypass in coordination with rehabilitation activities, bypass pumps, suction hose, discharge piping, sewer plugs and all other expenses whether specifically mentioned or not necessary to reduce/control or eliminate flows via bypass pumping, chases, fluming or other appropriate methods through a segment or segments of pipe, or structure designated for inspection and/or rehabilitation. The Contractor shall be solely responsible for controlling and maintaining all sewage flows within the system while conducting work. Plugging of any sewer line shall not be permitted without bypass pumping.
- A. Bypass pumping/flow control the sewage around/through the following:
1. Sections of host pipe that are to be lined.
 2. Any portion of the host pipe invert that will require repair prior to lining.
 3. Manholes that require manhole bench, channel, and/or coating rehabilitation.
 4. Portions of sewer and/or manholes to be video recorded, inspected, cleaned, and/or tested.
 5. Any branch sewer that could surcharge during performance of work.
- 1.3 **QUALITY ASSURANCE**
- A. **Codes and Standards.** Perform all work in compliance with current applicable requirements of governing agencies having jurisdiction.
- 1.4 **SUBMITTALS**
- A. Provide for approval by the Owner and Engineer/Architect, a detailed and comprehensive plan for the method of bypassing the sewage that will include, but not be limited to:
1. Recommended sequence of operations.
 2. Sketches or drawings showing locations of the bypass sewer and construction procedures for crossing streets, all required permit information, applications, fees, etc., to obtain access to the streets when required by the bypass method selected by the Contractor.
 3. Locations of manholes from which sewage is to be pumped and locations of receiving manholes.
 4. Method for crossing roadways where traffic is to be maintained, and method for handling traffic where streets are to be excavated and/or require closure.
 5. A contingency plan to prevent damage during high flows.

- B. Submit a copy of all property owner/resident notifications for review and approval to the Owner/Engineer prior to distribution of notifications.

1.5 **JOB CONDITIONS**

- A. **Work Limits.** All work performed and all equipment, materials, vehicles, etc., used to carry out the work, shall be kept within the existing easements and rights-of-way, unless noted otherwise. The Contractor shall adhere to all conditions of the existing easements and rights-of-way over which work must be performed.
- B. **Keep driveways and entrances clear** and available to the property Owner at all times, unless noted otherwise.
- C. **Noise, Dust, and Odor Control.** The Contractor's construction activities shall be conducted so as to eliminate all unnecessary noise, dust, and odors.
- D. **Safety.** The Contractor shall be solely responsible for complying with all federal, state, and local safety requirements together with exercising precautions at all times for the protection of persons (including employees) and property. It is also the sole responsibility of the Contractor to initiate, maintain, and supervise all safety requirements, precautions, and programs in connection with the work.
- E. **Burial of Waste Materials.** Waste materials shall not be buried within the project site.
- F. **Confined Space Entry.** The Contractor shall follow the Occupational Safety and Health Administration (OSHA) requirements for confined space entry, Title 29 of the Code of Federal Regulations, Part 1910.146 while performing work inside any manhole or other permit-required confined space.

1.6 **DELIVERY, STORAGE, AND HANDLING**

- A. **Storage and Handling.** Storage and handling of materials must be in accordance with the manufacturer's instructions and recommendations, and applicable codes. Damaged materials shall not be incorporated into the work.

1.7 **SPECIAL WARRANTY** (Not used.)

PART 2- PRODUCTS (Not applicable.)

PART 3- EXECUTION

3.1 **BYPASS PUMPING**

- A. Bypass pumping shall be established prior to sewer video recording and inspection, cleaning, lining, and open-cut point repairs.
- B. Contractor shall bypass pump wastewater around the sections of sewers that are to be lined. The temporary bypass line shall be made by interrupting the sewer from an upstream manhole, by plugging if necessary, and pumping the sewage into a downstream manhole or adjacent system approved by the Owner/Engineer. The pumps and bypass lines shall be of adequate capacity and size to convey the wastewater flow. Bypass pumping, when required, shall continue until the particular item of work that is being performed in the section of sewer involved

has been completed, at which time bypass pumping operations shall be shut down and wastewater flows shall be directed into the newly lined and existing sewers.

- C. Temporary bypass line(s) shall be buried or conveyed via road ramps (by Godwin Pumps or equal) rated for local traffic where crossing private access drives or public streets and shall either have temporary pavement or be securely plated (if approved by the Owner). Temporary bypass line(s) may be laid over ground in all other instances, unless otherwise noted. The temporary bypass line shall be a header for all bypass and dewatering pumping. Check valves shall be placed ahead of all pumping connections.
- D. Capacity of the bypass pumping system shall be sufficient to convey the peak daily wastewater flow, inclusive of rain events, at the project locations. The Owner has provided flow monitoring data for the Contractor's information. These results are assumed to be neither complete, correct, nor representative of the conditions that the Contractor will encounter during the performance of this work, and may not represent maximum wet weather peak flow conditions. Differences in actual flows encountered during work vs. flow monitoring data will not be grounds for claims and change orders. The surcharge of the sewers shall not be allowed due to insufficient pumping. The Contractor shall have a contingency plan to prevent damage during peak flows. The Contractor shall provide significant increases in the bypass pumping system capacity and release the Owner from all claims and damages resulting from any inadequacy of the Contractor-furnished bypass pumping systems, or the Contractor may ensure full flow capacity through the sewers at the moment flows exceed the capacity of the bypass pumping system. The Contractor shall be solely responsible for the proper operation and maintenance of pumping equipment and continuous monitoring of its performance. The Owner shall not be responsible for any damages caused during peak flows.
- E. Provide a minimum of two pumps (one as a primary and the second as a back-up pump), each capable of discharging the peak wastewater flow rate. All pumps provided for bypassing shall be solids-handling and suitable for use in wastewater operations.
- F. Contractor may suggest alternate methods of bypassing the sewage but, in any event, the method used shall be approved by the Owner/Engineer.
- G. Bypass pumping operations shall be shut down and wastewater flows shall be directed into the newly lined and existing sewers at the end of the lining process for each segment.
- H. Under no circumstances will the discharge or dumping of wastewater onto private property, into storm sewers, drainage courses, bodies of water, or onto city streets be allowed. Raw wastewater spillage shall be cleaned and disinfected by the Contractor using means, methods, and disinfectants approved by the West Virginia Department of Environmental Protection.
- I. Under no circumstances will bypass pumping be permitted at times other than and during hours of inspections and lining.
- J. Contractor shall be responsible for monitoring the bypass pumping operations and levels in tributary sewers that are plugged and/or used for diversion, in order

to prevent flooding of customers and buildings upstream from the sewer sections being lined. If the Contractor's operations cause any flooding of customers and buildings, he shall be responsible for any and all resulting claims for damages to property.

- K. Contractor shall coordinate bypass pumping and maintenance of traffic plans.
- L. CIPP lining Contractor and sub-contractors shall coordinate as necessary to keep bypass pumping setups operational and in place to allow for pre-lining operations, CIPP lining, post CCTV inspection, lateral reinstatement and sealing, and manhole rehabilitation to be completed with one bypass pumping setup.

3.2 **PROPERTY OWNER AND/OR RESIDENT NOTIFICATION**

- A. Contractor shall provide 48-hour prior written notification to all property owners and residents that may be affected by the diversion of flow in the sewer, explaining work that is to take place and its time frame. The notification shall include the approximate time when sewage cannot be received during sewer work as well as when the sewer will be available again for receiving sewage. All commercial establishments shall be provided with temporary sewer service. The means and methods shall be coordinated with the managers and the affected residents.
- B. A door hanger reminder shall be placed 24 hours prior to reducing the sanitary service.

END OF SECTION