SET NO. _____

PROJECT MANUAL

BID SET

CITY OF GRAND JUNCTION

2025 CIPP PROJECT

CITY OF Grand Junction COLORADO

PUBLIC WORKS & PLANNING

APRIL 2025

PROJECT MANUAL

BID SET

CITY OF GRAND JUNCTION

2025 CIPP PROJECT

JVA, Inc.
1319 Spruce Street
Boulder, CO 80302

JVA Job No. 241385.env

April 2025

PROJECT MANUAL

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2025 CIPP PROJECT

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1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work will include all necessary labor, supervision, equipment, tools and materials for the construction of approximately 19,890 linear feet of Cured-In-Place Pipe (CIPP) lining varying in diameter from 6-inches to 24-inches and the lateral connection sealing. Work includes but is not limited to: video surveying the existing pipes, jetting and cleaning existing pipes, installing CIPP liners, bypass pumping, lateral connection sealing, video surveying of the CIPP pipes, and completion of all associated site work relating to the project.

B. Contractor shall furnish and pay for all materials, equipment, supplies, appurtenances; provide all construction equipment and tools; and perform all necessary labor and supervision

C. Contractor shall coordinate the progress of the Work including coordination between trades, subcontractors, suppliers, public utilities, and contractor performing work on site and Owner to insure the progress of Work

D. It is the intent of this contract that Work proceed in the most expeditious manner possible

E. Construct the Work under contract indicated in the Bid Form

F. The cross-referencing of specification sections under the heading "Related Sections" and elsewhere within each specification section is intended as an aid to the Contractor and shall not relieve the Contractor from his responsibility to coordinate the Work under the Contract Documents. Listings of cross-references are not intended to be comprehensive. The omission of a cross-reference to an additional or related requirement shall not relieve the Contractor of his obligation to provide a complete Project.

1.3 WORK BY OTHERS

A. Construct work to allow for work by others. Coordinate construction schedule with the Owner.

1.4 CONTRACTOR USE OF SITE AND PREMISES

A. Contractor shall limit use of the premises for Work and will use the designated staging area for field offices, equipment, and material storage. Contractor shall submit staging area plan that identifies the extents of each required staging area to complete the work and traffic control plan to the Owner for approval prior to starting work.

B. Coordinate use of premises under direction of Engineer and/or Owner

C. Assume full responsibility for the protection and safekeeping of equipment and products stored on site under this Contract

D. Contractor may use only those areas coordinated with the Owner for storage and additional areas as designated by the Owner.

E. Contractor should plan for normal workdays, Monday through Friday, within the hours of 7:00 am to 5:00 pm. Other work hours and days may be allowed by City of Grand Junction and Engineer upon 48 hours written notice

1.5 WORK SEQUENCE AND WORK RESTRICTIONS

A. Construct work to allow for work by others. Coordinate construction schedule with the Owner.

B. Provide access to Owner’s to property and private properties at all times during construction. Maintain minimum width clearance for access of City and Contractor personnel and emergency vehicles at all times.

C. Contractor shall submit a detailed CPM format schedule outlining all steps required to assure complete and satisfactory construction, testing of work. Address all work sequence and constraints described in this Section.

D. Sanitary sewer service interruptions will not be permitted outside of business hours
   1. Schedule each outage with Engineer, Owner, and Property Owner. Contractor must notify affected homeowners and/or businesses of planned service outages a minimum of two (2) days prior.
      a. Number of outages to be kept to a minimum
      b. Contractor shall provide temporary sewer service if service outage exceeds two (2) hours, unless approved by the Owner or Engineer.
      c. A bypass pumping plan will need to be submitted and approved by the City & Engineer prior to the start of any sanitary sewer construction

E. Sequences other than those specified will be considered by Engineer, provided they afford equivalent continuity of operations.

1.6 EASEMENTS AND RIGHT-OF-WAY

A. Construction access to the site is indicated on the Drawings by public roads. Access across private property is strictly prohibited.

B. Work will be performed in the dedicated street Right-of-Way and utility easements.

C. Construction Area Limits
   1. Confine construction operations to the immediate vicinity of the location indicated on Drawings and in accordance with the Owner.
   2. Areas not designated for access roads, parking areas, storage areas, existing facilities areas, and construction areas, Contractor shall not trespass in or on these areas.
      a. Contractor shall be responsible for keeping all their personnel out of areas not designated for Contractor use except in case of isolated Work located within these areas for which the Contractor shall coordinate with Owner and shall not proceed with such work without Owner approval.
   3. Contractor shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies, so as to cause the least possible damage to property and existing vegetation and landscaping.
      a. Responsibility for protection and safekeeping of materials and equipment on or near the work site shall be entirely that of the Contractor and no claim shall be made against the Owner for any reason.
      b. If the Owner needs access to the sites occupied by stored materials or equipment, Contractor shall provide access.

D. On Private Property
   1. Do not enter for material delivery or occupy for any purpose with personnel, tools, equipment, construction materials, or excavated materials, any private property outside the designated construction easement without written permission of the owner and tenant.

E. Within Street Right-of-Way and Utility Easement

1. Perform all work and conduct all operations of Contractor, his employees, and his subcontractors in accordance with the requirements of the City and/or Mesa County and/or CDOT.

1.7 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Protect, shore, brace, support, and maintain underground conduits, drains, and other underground construction uncovered or otherwise affected by construction operations

B. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, street lighting and/or signage, embankments, culverts, location or character, which may be caused by transporting equipment, materials, or personnel to or from the Work or any part or site thereof, whether by him or his subcontractors

C. Make satisfactory and acceptable arrangements with the Owner of, or the agency or authority having jurisdiction over, any damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage

1.8 PROTECTION OF WORK AND FACILITIES

A. Contractor shall be solely responsible for the protection of Work until final acceptance

B. Contractor shall protect all and any previously performed Work, work in progress or completed by others, and existing facilities from damage during the performance of Work in the area

1.9 MAINTENANCE OF TRAFFIC

A. Conduct Work to interfere as little as possible with public travel, whether vehicular or pedestrian
   1. Whenever it is necessary to cross, close, or obstruct private roads, driveways, multi use paths, and walks, provide and maintain suitable and safe detours, or other temporary expedients for accommodation of private travel
      a. Submit traffic control plan for work within right-of-ways for approval by City of Grand Junction Engineering, Mesa County, and Transportation Department prior to commencing any work. Traffic control plan shall include staging area plan provided by contractor and approved by the City.
   2. Maintenance of traffic is not required if Contractor obtains written permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point

1.10 BARRICADES AND LIGHTS

A. Protect streets, roads, highways, and other public thorough fares which are closed to traffic by effective barricades with acceptable warning and directional signs

B. Locate barricades at the street intersecting public thoroughfare on each side of the blocked section

C. Provide suitable barriers, signs, and lights to the extent required to adequately protect the public

D. Provide similar warning signs and lights at obstructions such as material piles and equipment

E. Illuminate barricades and obstructions with warning lights from sunset to sunrise

F. Store materials and conduct work to cause the minimum obstruction to the other contracts

G. Install and maintain barricades, signs, lights, and other protective devices in conformity with applicable statutory requirements including the Manual of Uniform Traffic Control Devices and as required by Mesa County

1.11 LINES, GRADES AND EXISTING INFORMATION

A. Construct all Work to the lines, grades, and elevations indicated on the Drawings
   1. The Owner may employ a separate surveyor to perform a verification survey to check final layout.

B. Existing Site information has been provided by the Mesa County and the City of Grand Junction Data Download Portal
   1. Existing site features from the city's data were provided on the WGS84 coordinate system and projected into the Mesa County Local Coordinate System horizontal coordinate system.
   2. No horizontal control coordinates are provided. The plans are provided on the Mesa County Local Coordinate System.

C. Provide all survey, layout, and measurement work required
   1. Work performed by a qualified professional engineer or registered land surveyor acceptable to Engineer
   2. Locate and protect control points prior to starting site work, and preserve all permanent reference points during construction
      a. Make no changes or relocations without prior written notice to Engineer
      b. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations
      c. Require surveyor to replace Project control points which may be lost or destroyed
      d. Establish replacements based on original survey control
   3. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means
      a. Temporary project benchmark
      b. Stakes for grading, fill and topsoil placement
      c. Utility slopes and invert elevations
   4. From time to time, verify layouts by the same methods
   5. Maintain a complete, accurate log of all control and survey work as it progresses
   6. On request of Engineer, submit documentation to verify accuracy or field engineering work

1.12 REGULATORY REQUIREMENTS

A. Comply with all federal, state, and local laws, regulations, codes, and ordinances applicable to the Work.

B. References in the Contract Document to local codes shall mean the codes in effect in the City of Grand Junction and Mesa County according to the jurisdiction in which the Work is performed.

C. Other standards and codes which apply to the Work are designated in the specific technical specifications.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01039

COORDINATION AND MEETINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General requirements

B. Coordination

C. Field engineering

D. Alteration project procedures

E. Preconstruction conference

F. Progress meetings

G. Requests for information

1.2 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01340 – Shop Drawings and Product Data

C. Section 01700 – Contract Closeout

1.3 GENERAL REQUIREMENTS

A. Refer to General Conditions for Owner meetings and other requirements

B. Engineer will schedule and administer pre-construction meeting according to agenda
   1. Prepare agenda for meetings including items required by Owner and Contractor
   2. Notify Contractor and Owner 4 days in advance of meeting date
   3. Preside at meeting

C. Contractor will schedule and administer site mobilization and weekly progress meetings. Contractor will also be responsible for coordination, field engineering, alteration, project procedures, cutting and patching procedures outlined herein. If work progress does not warrant a meeting, all parties can mutually agree to postpone meeting.
   1. Arrange for the attendance of Contractor's agents, employees, subcontractors, and suppliers as appropriate to the agenda
   2. Record the minutes; include all significant proceedings and decisions
   3. Reproduce and distribute copies of minutes within one week after each meeting
      a. To all participants in the meetings

b. To Engineer
c. To Owner

4. Owner and other inspecting parties such as the geotechnical engineer/technician as well as plant operators may attend meetings
5. Engineer will attend weekly meetings either via phone or on site

D. Representatives of contractors, subcontractors, and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents

1.4 COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later by others.

B. Verify that utility requirement characteristics of operating equipment are compatible with available utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment, and coordinate preparation of grading and other requirements for installation utility work by others.

C. Coordinate completion and clean-up of Work of separate Sections in preparation for final completion and for portions of Work designated for Owner’s use

D. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.5 FIELD ENGINEERING

A. Employ a Land Surveyor registered in the State of Colorado and acceptable to the Engineer and Owner.

B. Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

1.6 ALTERATION PROJECT PROCEDURES

A. Materials: As specified in product Sections; match existing products and work for patching and extending work.

B. Where new work abuts or aligns with existing, perform a smooth and even transition. Patched work to match existing adjacent work in texture and appearance.

C. When finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

D. Where a change of plane of 1/4-inch or more occurs, submit recommendation for providing a smooth transition for Engineer review.

E. Patch or replace portions of existing surfaces, which are damaged, lifted, or showing other imperfections.

F. Finish surfaces as specified in individual product sections.

1.7 PRECONSTRUCTION CONFERENCE

A. Engineer will schedule a conference after Notice of Award

B. Location: On site

C. Attendance
1. Owner's Representative
2. Engineer and his professional consultants
3. Geotechnical Engineer
4. Contractor's Project Manager
5. Contractor's Superintendent
6. Major Subcontractors
7. Others as Appropriate

D. Agenda:
1. Execution of Owner Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors and suppliers, list of products, Schedule of Values, and Construction Project Schedule in critical path format.
5. Designation of personnel representing the parties in Contractor, Owner, and the Engineer.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, cost proposal requests, Change Orders and Contract closeout procedures.
7. Construction scheduling and updates.
8. Scheduling activities of other field tests
9. Critical work sequencing
10. Deliveries and priorities
11. Procedures for maintaining Record Documents
12. Construction facilities, controls and construction aids
13. Temporary utilities
14. Safety and first-aid procedures
15. Security and housekeeping procedures
16. Procedures for testing and required tests

1.8 PROGRESS MEETINGS

A. Contractor will schedule and administer meetings throughout progress of the Work at weekly intervals. If work progress does not warrant meeting, all parties can mutually agree to postpone the weekly meeting.

B. Location of the Meetings: The project field office of the Contractor, or other locations arranged for by Contractor, convenient to all parties

C. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within one week to Contractor, Owner, participants, and those affected by decisions made.

D. Attendance
   1. Owner's Representative
   2. Engineer, and his professional consultants as needed
   3. Contractor's Superintendent
   4. Subcontractors as appropriate to the agenda
   5. Suppliers as appropriate to the agenda
   6. Others, as appropriate

E. Suggested Agenda
   1. Review Minutes of Previous meetings
   2. Review Unresolved issues from Last Meeting
   3. Review of Work Progress
   4. Field Observations, Problems, Conflicts and Decisions
   5. RFI Review
   6. Review of Submittals Schedule and Status of Submittals
   7. Schedule
      a. General Schedule Issues
      b. Planned progress during succeeding work period (3-week “Look ahead”)
      c. Maintenance of construction project schedule
      d. Corrective measures to regain project schedules
   8. Maintenance of Quality and Work Standards
   9. Change Orders
   10. New PR’s
   11. Accepted Change Orders
   12. Pay Requests
   13. Other Business

1.9 REQUESTS FOR INFORMATION (RFI)

A. The Contractor shall prepare and submit an RFI upon the discovery of the need for interpretation of the Contract Documents or additional information.
   1. Only the Contractor shall submit RFIs to the Engineer.
   2. RFIs shall be submitted on Engineer’s RFI form. Engineer will provide a template for the Contractor upon request.

B. RFI shall include:
   1. Project Name
   2. Engineer Job Number
   3. Date
   4. Name of Contractor
   5. Name of Engineer
   6. RFI number, numbered sequentially
   7. Related specification section number, title, and related paragraphs, as needed
   8. Drawing number and detail references, as needed
   9. Field conditions
   10. Contractor's proposed solution. If the Contractor's solution(s) affect contract times or contract price, Contractor shall state the effects on the RFI.
   11. Contractor's signature
   12. Relevant attachments including but not limited to drawings, descriptions, measurements, photos, product data, and shop drawings

C. Electronically Submitted RFIs
   1. Contractor shall submit one (1) complete RFI file in Adobe Acrobat PDF format

D. Engineer's Response
   1. Engineer will review each RFI, determine action required, and respond.
   2. Engineer will review and respond to each RFI within seven (7) working days
   3. If Engineer receives an RFI after 1:00 P.M. local time, the RFI will be considered as received the following working day.
   4. Engineer will not respond to RFIs requesting approval of submittals, approval of substitutions, coordination and information already indicated in Contract Documents, adjustment in contract time or contract amount, or erroneous RFIs.
   5. Engineer may respond to RFIs on related issues with a single response.
   6. If Engineer requests additional information as a result of the RFI, any further action or RFIs submitted by the Contractor will restart a new seven (7) day review period.
   7. Contractor shall submit any request for change of contract time or contract price utilizing proper Change Order forms.

E. Contractor shall log and track all RFIs submitted organized by RFI number.
   1. RFI log shall be submitted at each progress meeting
   2. RFI log shall include:
      a. Project name
      b. Name, address, and phone number of Contractor
      c. Contractor representative name
      d. RFI number
      e. RFI description
      f. RFI submittal date
      g. RFI response date
      h. Related Change Order number, as needed

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01200

PAYMENT PROCEDURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

B. This information is supplemental to the requirements as stated in the General Conditions.

1.2 SUMMARY

A. This Section includes additional administrative and procedural requirements necessary to prepare and process Applications for Payment. Refer to General Conditions for most requirements of the Owner.
   1. Unit Prices for administrative requirements governing use of unit prices
   2. Construction Progress Schedules

1.3 DEFINITIONS

A. Unit Price: An amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services.

1.4 PROCEDURES FOR UNIT PRICES

A. Unit bid prices, as quoted in the Bid Form, shall be in full compensation for labor, materials, equipment, rentals, freight, applicable taxes, overhead, profit and incidentals to complete all work for each pay item; and for all risk, loss, damage, or expense of whatever nature arising from the nature of the work or the prosecution thereof.

B. Work or materials that are essential to the work, but for which there are no pay items, will not be measured and paid for separately, but shall be included in other items of work.

C. Prices include all necessary material, for a complete installation, insurance, applicable taxes, overhead, and profit

D. Measurement and Payment: Refer to bid form and 1.5 (A) of this Section for establishment of unit prices

E. Owner reserves the right to reject Contractor’s measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor.

1.5 APPLICATION FOR PAYMENTS

A. General
   1. Submit itemized payment request as required in General Conditions together with Schedule of Values and other submittals as specified herein
   2. Contractor shall not "project" work completed beyond the date of Application for Payment submittal for the purpose of payment request

B. Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner.
   1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements

C. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement

D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   2. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application

E. Transmittal
   1. Submit copy of each Application for Payment to the Engineer by means ensuring receipt within 24 hours
   2. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Engineer

F. Initial Application for Payment
   1. Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
      a. List of subcontractors
      b. List of principal suppliers and fabricators
      c. Schedule of Values
      d. Contractor's Construction Schedule (preliminary if not final)
      e. Schedule of principal products
      f. List of Contractor's staff assignments
      g. Copies of authorizations and licenses from governing authorities for performance of the Work
      h. Certificates of insurance and insurance policies
      i. Performance and payment bonds, if required

G. Application for Payment at Substantial Completion
   1. Following issuance of the Certificate of Substantial Completion, submit an Application for Payment. This application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of Work
      a. Administrative actions and submittals that shall precede or coincide with this application include:
         i) Warranties (guarantees) and maintenance agreements
         ii) Test records
         iii) Maintenance instructions
         iv) Start-up performance reports
         v) Final cleaning
         vi) Application for reduction of retainage, and consent of surety
         vii) Advice on shifting insurance coverages
      b. List of incomplete Work, recognized as exceptions to Engineer's Certificate of Substantial Completion

H. Application for Final Payment
   1. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Price, previous payments, and sum remaining due.
   2. Application for Final Payment will not be considered until the following have been accomplished:
      a. Completion of Project closeout requirements
      b. Completion of items specified for completion after Substantial Completion
      c. Assurance that unsettled claims will be settled
      d. Assurance that Work not complete and accepted will be completed without undue delay
      e. Transmittal of required Project construction records to Owner
      f. Proof that taxes, fees and similar obligations have been paid
      g. Removal of temporary facilities and services
      h. Removal of surplus materials, rubbish and similar elements

1.6 PROCEDURES FOR THE CONSTRUCTION PROGRESS SCHEDULE

A. Coordination: coordinate preparation and updates of Contractor's Construction Schedule with the preparation of Schedule of Values.
   1. Correlate line items in the Construction Schedule with required project tasks, including the following:
      a. Mobilization/demobilization
      b. Permits and regulatory requirements
      c. Submittals
      d. O&M Manuals
      e. Work breakdown of major project work
      f. Major subcontractors work
      g. Substantial completion
      h. Final completion
      i. Milestones

B. Utilize the Critical Path Method (CPM) type construction schedule to establish preliminary progress schedule and track Work progress
    1. After acceptance by Engineer of preliminary Progress Schedule submitted per requirements of General Conditions, set preliminary Progress Schedule as the Construction Baseline Schedule
    2. Update and submit the construction progress schedule on a monthly basis with the pay application
        a. Monthly submittal should indicate progress of tasks, changes to baseline schedule logic, work additions such as change orders, milestone and contract date changes
        b. Submit two (2) color print copies, 11" x 17" size, and one Adobe pdf copy
        c. Upon request provide copy of project schedule CPM data file

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

A. Provide a list of unit prices as indicated in Section 00310 – Bid Form
    1. Bid Item No. 1: Mobilization/Demobilization
        a. Description: No separate measurement for payment will be made for any labor, equipment, materials, and incidental work required for this item. The lump sum price will include all of Contractor's costs. This bid item includes but is not limited to the following items installed or conducted in accordance with the Drawings and Specifications or as otherwise directed by Engineer: preparing and installing temporary fencing around project work and staging areas, and any other fencing/security items as deemed necessary by Contractor and not covered by another bid item; establishing Contractor's staging area, construction trailers, offices, buildings, other necessary facilities, and temporary power and communications; obtaining permits; providing required bonds and insurance; preparing the project schedule. Item also includes demobilization at the completion of the project including the removal of the Contractor's equipment, supplies, temporary facilities, excess materials, and cleaning up the site; and providing all other related and necessary labor, equipment, and materials to complete the Work not covered by other items in this section.
        b. Unit of Measurement: No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price based upon the percentage completed and accepted of the work required by this bid item. Fifty percent (50%) of the lump sum price will be paid at the time of the first monthly progress payment; an additional thirty percent (30%) will be paid when one-half of the original Contract amount is earned. The remaining twenty percent (20%) will be paid upon final acceptance of the Project.

    2. Bid Item No. 2 – Traffic Control
        a. Description: Item includes all material, equipment and labor to safely control traffic around the work area throughout the project. Contractor is required to submit staging area plan that identifies the extents of each required staging area to

complete the work and traffic control plan for approval by City prior to beginning CIPP work.

b. Unit of Measurement: No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price based upon the percentage of work completed in accordance with the plans and specifications.

3. Bid Item No. 3 – CIPP Water Line – 20”
   a. Description: This item includes all items required for the installation of CIPP liner in the water mains identified on the drawings. The existing pipe material is polyvinyl chloride (PVC). The work includes accessing the existing water line via access pits which will require excavation down to the existing water line, breaking the line for access, and reconnecting with appropriate fittings and pipe. The work also includes cleaning and flushing the line, performing CCTV inspection before and after the liner is installed, resign impregnation, liner installation, curing, cooling down of the installed liner, terminating the CIPP lining with end termination fittings, and backfilling the access pits. The water line will also have to be pressure tested and disinfected after the liner has been installed. All labor and equipment required to complete the work is included. This item also includes all required items to provide sediment and erosion control.
   b. Unit of Measurement: Per actual number of completed linear feet of lining.

4. Bid Item No. 4 – CIPP Sewer Line – 6”, 8”, 10”, 12”, 15”, 18”, 21”, and 24”
   a. Description: This item includes all items required for the installation of CIPP liner in the sanitary sewer mains identified on the drawings. The existing pipe material is either concrete, vitrified clay pipe (VCP), polyvinyl chloride (PVC) or steel pipe. The work includes cleaning the existing sanitary sewer lines with a high velocity cleaner (3 or fewer passes), CCTV cameraing prior to installation of CIPP liner, establishing and maintaining bypass conveyance of existing sewer flows, CIPP lining the existing pipe, service lateral reinstatement by cutting out the liner coupon, installing hydrophilic rubber joint seals at all manhole walls, CCTV cameraing after the completion of the lining process, and performing field air testing on the sanitary sewer line. The work also includes point repairing all defects identified by the contractor, Engineer, or City found prior to or after cleaning prior to lining where necessary, and all labor and equipment required to complete the work are included in this item. Existing sanitary sewer mains may have water, grease, roots or other obstructions. This item also includes all required items to provide sediment and erosion control.
   b. Unit of Measurement: Per actual number of completed linear feet of CIPP lining.

5. Bid Item No. 5 – Cut Protruding Service Taps
   a. Description: This item includes all materials, labor, and equipment required for the cutting of sanitary sewer services that protrude into the existing main, the protruding taps are cut to be flush with the sanitary sewer line via robot prior to the installation of CIPP liner.
   b. Unit of Measurement: Per actual number of protruding services that are cut.

6. Bid Item No. 5 – Top Hats for Services
    a. Description: This item includes all materials, labor, and equipment required for the installation of Top Hats in sanitary sewer service lines after the completion of the CIPP lining, the top hats are to be installed via robot, cured and pressure tested, then CCTV camera footage shall be taken and provided to the City showing the Top Hats have been installed.
    b. Unit of Measurement: Per actual number of Top Hats that are installed.

7. Bid Item No. 7 – Heavy Cleaning of Sewer
    a. Description: Item includes removal of debris, encrustation, roots, and other obstructions from sewer main prior to CIPP work by jetting or other means that access the sewer main by manholes and does not damage existing sanitary sewer infrastructure or the existing ground surface once the initial 3 passes have been completed as part of the CIPP liner installation. Also included is post-cleaning video inspection for efficacy of debris removal.
    b. Unit of Measurement: No measurement for payment will be made for this work. It shall be paid for at the Contract Lump Sum Price

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submission of all shop drawings and product data as required by the Contract Documents for all equipment and materials to be furnished under this contract unless specifically indicated otherwise

1.2 RELATED SECTIONS

A. Section 01600 – Materials and Equipment

B. Section 01730 – Operations and Maintenance Data

C. Specification Divisions 2 thru 16

1.3 SUBMITTALS

A. Definitions
   1. Technical submittals: Shop drawings, product data and samples prepared by Contractor, subcontractors, suppliers, or manufacturers
      a. Shall be submitted by the Contractor to Engineer for approval for the use of Equipment and Materials to complete the Work or as needed to describe the following:
         i) Operation and maintenance
         ii) Technical properties
         iii) Installation
      b. Shop drawings: Custom prepared data for the Project and Work including performance and capacity curves, diagrams, bills of material, instructions, and other information
      c. Product data: Non-custom prepared printed information for the Project and Work on materials and products
      d. Samples: Fabricated and non-fabricated tangible samples of products and material
         i) Used for visual inspection and testing and analysis
   2. Informational submittals: Reports, administrative informational submittals, certification and guarantees not including and defined as shop drawings, samples and product data
      a. Reports: Include laboratory reports and tests, technical procedures and records and design analysis
      b. Administrative informational submittals: Submittals necessary for administrative records such as construction photographs, work records, schedules, standards, record project data, safety data, and similar information submittals
      c. Certification: Includes manufacturer or supplier certificates and guarantees

B. General Requirements
   1. Quality
      a. Shall be of suitable quality for legibility and reproduction purposes
      b. Shall be useable for reproduction yielding legible hard copy
      c. Submittals not conforming to specified requirements herein and as specified in Divisions 2 through 16 shall be subject to rejection by Engineer and upon Engineer request, Contractor shall resubmit documents that are in conformance
   2. Dimensions
      a. English units shall be provided on submittals
      b. Metric units are acceptable in addition to English units
      c. English units shall govern
   3. Form of submittals
      a. Submittals shall be transmitted in electronic format as specified herein
      b. Scanned submittals are acceptable
      c. Electronic project documents and submittals shall be transmitted in the following format:
         i) Native electronic format, nonproprietary
         ii) Adobe PDF produced from native electronic format
      d. Filename:
         i) Shall be consistent for the initial and any subsequent submission revisions for a single submittal
         ii) Contractor shall use a consistent naming convention for all submittals
            a) Use number of original submittal followed directly by a capital letter corresponding to the number of times a submittal is resubmitted (i.e., #001, #001A, #001B, etc.)
   4. Non-conforming submittals shall be subject to rejection by Owner and/or Engineer
   5. Submittal completion requirements
      a. Submittals shall include design criteria, dimensions, construction materials and all other information specified for a complete submittal to facilitate Engineer review of the submittal information adequately
      b. In the event various drawings are included a submittal for a class of Equipment, Contractor shall annotate clearly which parts apply to furnished Equipment
         i) Information not pertaining to the submittal shall be clearly annotated. Highlighting of such information will cause rejection of the submittal by the Engineer
      c. Contract Drawings
         i) Copies or portions thereof will not be allowed as acceptable fabrication or erection drawings
         ii) In the event Contract Drawings are used by the Engineer for erection drawings to annotate information on erection or identify reference details, Engineer title block and professional seal shall be removed and replaced with the Contractor's title block on the Contract Drawing(s). Contractor shall revise such erection drawings for subsequent revisions by the Engineer to Contract Drawings

C. Preparation
   1. Shop Drawings

a. Drawings shall be presented in a clear and thorough manner:
b. Identify details by reference to sheet and detail, schedule or room numbers shown on Contract Drawings
c. Identify equipment by reference to equipment name and tag number shown on Contract Drawings
d. Scale and Measurements: Make drawings accurate to a scale with sufficient detail to show the kind, size, arrangement and function of component materials and devices
e. Minimum sheet size: 8.5" by 11"
f. Fabrication drawing size: 11" by 17" or 24" by 36"

2. Product Data
   a. Clearly mark each copy to identify pertinent products or models submitted for review
   b. Identify equipment by reference to equipment name and P&ID number
   c. Catalog cut sheets: Cross-out or hatch irrelevant data

D. Technical Submittals: Shop Drawings and Product Data Submittal Requirements
   1. Shop Drawings and Product Data shall include the following, at a minimum:
      a. Specifications of manufacturer(s)
      b. Equipment parts and catalogs
      c. Bills of materials, material lists, and schedules
      d. Shop erection and fabrication drawings
      e. Drawings shall include equipment dimensions, weights, installation location requirements, plates required, main components, support details, anchor bolt details/sizes/locations, support base sizes, baseplate sizes, spacing and clearance requirements for installation, erection, operation and maintenance disassembly
      f. Electrical requirements:
         i) Shall include schematic diagrams including one-line diagrams, terminal block numbers, internal wiring diagrams, external connections, controls, and any other information as requested in individual specification sections
      g. List of spare parts
      h. Instruction and Operation and Maintenance (O&M) manuals
         i) As specified herein and in Specification Section 01730
      i. Manufacturer’s performance testing of equipment
      j. Concrete mix design data and information
      k. Performance characteristics and capacities
      l. External connections, anchorages, and supports required
      m. Other drawings, parts, catalogs, specifications, samples, or data necessary for the Engineer to determine conformance with Contract Documents
   2. Samples – Office samples shall be of sufficient size and quantity to clearly illustrate:
      a. Functional characteristics of the product, with integrally related parts and attachment devices
      b. Full range of color, texture and pattern
      c. Comply with requirements identified in individual specification sections

E. Construction Schedule: Designate in the construction schedule, or in a separate coordinated shop drawing schedule, the dates for submission and the dates that reviewed Shop Drawings and Product Data will be needed, if accelerated review is requested

F. Field samples and Mock-ups:
   1. Contractor shall erect, at the Project Site, at a location acceptable to the Engineer and Owner
   2. Size or area: as specified in the respective specification section
   3. Fabricate each sample and mock-up complete and finished
   4. Remove mock-ups at conclusion of Work or when acceptable to Engineer

1.4 CONTRACTOR RESPONSIBILITIES

A. Review shop drawings and product data prior to submission for accuracy and completeness of each submission

B. Approve and stamp each submission before submitting to Engineer

C. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Catalog numbers and similar data
   4. Conformance with specifications and identification of all deviations
   5. Confirm assignment of unit responsibility

D. Prior to each submission, carefully review and coordinate all aspects of each item being submitted

E. Verify that each item and the corresponding submittal conform in all respects with specified requirements of the Work and of the Contract Documents with respect to means, methods, techniques, sequences, and operations of construction, and safety precautions and programs incidental thereto

F. Make submissions promptly in accordance with Construction Schedule, and in such sequence as to cause no delay in the Work or in the work of any other Contractor

G. Limit requirement for accelerated submittal review by Engineer to no more than 10% percent of total number of submittals
   1. Accelerated submittal review period: less than 14 calendar days

H. Notify Engineer in writing, at time of submission, of any deviations in the submittals from Contract Document requirements:
   1. Identify and tabulate all deviations in transmittal letter
   2. Indicate essential details of all changes proposed, including modifications to other facilities that may be a result of the deviation
   3. Include required piping and wiring diagrams

1.5 SUBMISSION REQUIREMENTS

A. Make submissions far enough in advance of scheduled dates for installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmissions, and for placing orders and securing delivery

B. In scheduling, allow fourteen (14) calendar days for review by Engineer following receipt of submission in Engineer's office:
   1. Time required to mail submissions or resubmissions is not considered a part of review period

C. Submittal Naming and Numbering
   1. Assign a unique number to include all shop drawings, product data and other information required for individual specification sections, beginning with #001.
   2. Resubmissions shall have the original number with a letter, starting with "A". If the first submittal required resubmission, it would be labeled #001A.
   3. Each specification section may still have more than one submittal number for later submissions (i.e., Preliminary O&M Manuals, Final O&M Manuals, etc.)
   4. Contractor shall use a consistent naming convention for all submittals

D. Quantity of Submittals Required
   1. Shop Drawings and Product Data:
      a. Initial submittal:
         i) Electronic – One (1) copy to Engineer
      b. Resubmittal:
         i) Electronic – One (1) copy to Engineer
      c. Final Submittal for Distribution
         i) One (1) electronic copy to Engineer
      d. As –constructed document submittals
         i) Electronic – One (1) copy to Engineer and one (1) copy to Owner
   2. Samples
      a. Initial submittal:
         i) Submit three (3) of each sample unless specified otherwise in individual specification section
      b. Resubmittal:
         i) Submit three (3) to Engineer
      c. One (1) sample of approved sample submittal will be returned to Contractor
   3. Informational submittals
      a. Technical reports and administrative submittals
         i) Electronic – One (1) copy to Engineer
         ii) Paper: Three (3) copies to Engineer
      b. Certificates and guarantees:
         i) Electronic – One (1) copy to Engineer
         ii) Paper: Three (3) copies to Engineer
      c. Test reports
         i) Paper
            a) Owner: Two (2) copies
            b) Engineer: One (1) copy

c) Contractor: Two (2) copies
d) Manufacturer/supplier: One (1) copy

4. Instruction and O&M manuals
   a. In accordance to Specification Section 01730
5. At no additional cost to the Owner and whether or not submittals are copyrighted, the Owner may copy and use for staff training and/or internal operations any submittals approved for final distribution as well as required by this Contract

E. Submittal Transmittal Requirements
1. Accompany each submittal with a letter of transmittal showing all information required for identification and checking
2. Shall include:
   a. Drawing numbers and titles
   b. Revision number
   c. Electronic filename
   d. Deviations from Contract Documents: As specified herein
   e. Submittals unidentifiable will be returned for proper identification
   f. Date

F. Submittals Requirements
1. Submittal number
2. Date of submission and dates of any previous submissions
3. Project title and number
4. Owner Contract identification number if applicable
5. Names of:
   a. Contractor
   b. Supplier
   c. Manufacturer
6. Identification of the product, with the specification section number
7. Field dimensions, clearly identified as such
8. Relation to adjacent or critical features of the Work or materials
9. Applicable standards, such as ASTM or Federal Specification numbers
10. Identification of deviations from Contract Documents:
    a. If Contractor proposes to provide material or equipment of Work which deviates from the Project Manual, Contractor shall indicate so under “deviations” on the transmittal form accompanying the submittal copies
    b. Identify all requested deviations as specified and on the copies of Specifications and Drawings required by paragraph below.
11. Confirmation of compliance with Contract Documents and, if applicable, identification of deviations from Contract Documents:
    a. Provide the following documents to demonstrate compliance with the contract specifications:
       i) A copy of the relevant Drawing(s) with all addendum updates that apply to the equipment in various Divisions marked to show specific changes necessary for the equipment proposed in the Contractor’s submittal
          a) If no changes are required, the Drawing(s) shall be clearly marked “No Changes Required”

b) Failure to include copies of relevant Drawing(s) with the submittal, whether changes are required or not, shall be cause for rejection of the entire submittal with no further review by Engineer
c) Relevant Drawing(s) include as a minimum the control diagrams, process and instrumentation diagrams (P&IDs), and Process (P) drawings.

ii) A copy of each pertinent specification section with all addendum updates included, all referenced and applicable specifications sections, with their respective addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate the requested deviations from the specification requirements:
a) If deviations from the specifications are indicated and, therefore requested, by the Contractor, the submittal shall be accompanied by a detailed, written justification for each deviation
b) Failure to include a copy of the marked up specification sections, along with justification for any requested deviations to the specification requirements, with the submittal shall be cause for rejection of the entire submittal with no further review by Engineer

12. Identification of revisions on resubmissions
13. An 8" by 4" blank space for Contractor's and Engineer's stamps
14. Stamp cover sheet of each submittal as identified in letter of transmittal
15. Contractor's stamp: Initialed or signed, certifying review and approval of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents. Use stamp to include wording similar to the following:

> This submittal has been reviewed by [*Name of Contractor*] and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. [*Name of Contractor*] also warrants that this submittal complies with contract documents and comprises no deviations thereto:
> Section No:___ Submittal No:
> Date:_____ By:

G. For equipment that is provided directly by manufacturer without specification provide:
1. Shop drawings: Illustrate complete assembly of products; foundation, installation and anchor requirements; dimensions and total weights of each, electrical wiring diagrams
2. Product data: Provide manufacturer’s literature including general assembly, materials of construction, model and type, detailed data describing parts and accessories, sufficient data to verify compliance with specifications
3. Manufacturer’s installation instructions: Provide detailed connection requirements and startup instructions
4. Manufacturer’s field report: Indicate personnel present and actual start-up procedures that were performed by manufacturer’s representative
5. Field report and test results shall be submitted to the Engineer by the Contractor

H. Submittal Log:
   1. Maintain an accurate submittal log for duration of the Work showing current status of all submissions
   2. Show submittal number, section number, section title, submittal description, dates and disposition of submittal
   3. Make submittal log available to Engineer for Engineer's review upon request

I. Unless specified otherwise, make submissions in groups to facilitate efficient review and approval:
   1. Include all associated items from individual specification sections to assure that all information is available for checking each item when it is received
   2. Submit a complete initial submittal including all components when an item consists of components from several sources
   3. Partial submittals may be rejected as not complying with provisions of the Contract
   4. Engineer will not be held liable for delays due to poorly organized or incomplete submissions
   5. Do not include items from more than one specification section for any one submittal number

J. Contractor may require subcontractors to provide drawings, setting diagrams and similar information to help coordinate the Work, but such data shall remain between Contractor and his subcontractors and will not be reviewed by Engineer unless specifically called for within the Contract Documents

K. All submittals for each component of multi-component systems shall be compiled and submitted through the Contractor to the Engineer by the manufacturer having System Responsibility

1.6 DISPOSITION OF SHOP DRAWINGS, PRODUCT DATA, AND INFORMATION SUBMITTALS

A. "No Exceptions Taken": Approved with No Corrections Noted
   1. One copy sent to Owner
   2. One copy sent to Resident Project Representative
   3. One copy retained in Engineer's file
   4. Remaining copies returned to Contractor for his use
      a. One copy to be kept on file at Contractor's office at job site
      b. Remaining copies for Contractor's office file, suppliers, or subcontractors
   5. No corrections or comments noted on the submittal or on a Submittal Response Summary Sheet
   6. Issues or miscellaneous comments pertaining to other related items of the Work may be included in transmittal letter
   7. Resubmission not required

B. "Exceptions Noted": Approved with Corrections Noted
   1. One copy sent to Owner
   2. One copy sent to Resident Project Representative
   3. One copy retained in Engineer's file

4. Remaining copies returned to Contractor for his use
    a. One copy to be kept on file at Contractor's office at job site
    b. Remaining copies for Contractor's office file, suppliers or subcontractors
    c. Copies of submittal data in operation and maintenance manuals to be revised according to corrections
5. Comply with corrections or comments as noted on the submittal or on a Submittal Response Summary Sheet
6. Resubmission not required

C. "Revise And Resubmit": Incorrect information provided or Significant Information Still Required
1. One copy sent to Resident Project Representative
2. One copy retained in Engineer's file
3. All remaining copies returned to Contractor for revision and re-submittal
4. Copy of transmittal letter and/or Submittal Response Summary Sheet sent to Owner. A "No Exceptions Taken" or "Exceptions Noted" submittal it will be forwarded to Owner after review per above disposition requirements
5. Submittal is either: incorrectly annotated; specific comments need to be addressed and incorporated in re-submittal; and/or additional information may be required as noted on the submittal or on a Submittal Response Summary Sheet
6. Submitted information may not include or address specific item required per the specification as identified on the submittal or on a Submittal Response Summary Sheet
7. Specific information related to identified item may be required for final approval of submittal
8. Resubmission of entire submittal may be required or resubmission of specific item may be required as identified on the submittal or on a Submittal Response Summary Sheet

D. "Rejected": Returned for Correction
1. One copy sent to Resident Project Representative
2. One copy retained in Engineer's file
3. All remaining copies returned to Contractor
4. Copy of transmittal letter and/or Submittal Response sent to Owner
5. Contractor required to resubmit complete submittal package in accordance with Contract Documents
6. Submittal does not comply with provisions of Contract Documents as noted on the submittal or on a Submittal Response Summary Sheet
7. Resubmission required

E. “Receipt Acknowledged”: For Reference Purposes Only, or for Record Copy:
1. Applicable to manufacturer or Contractor provided calculations and other miscellaneous documentation no subject to Engineer review and approval
2. One copy sent to Resident Project Representative
3. One copy retained in Engineer's file
4. One copy returned to Contractor
5. Copy of transmittal letter sent to Owner
6. Remaining submittal copies destroyed

7. Detailed review and comment by Engineer not required
8. Resubmission not required

1.7 DISPOSITION OF SAMPLES

A. "No Exceptions Taken": Approved with No Corrections Noted
   1. One sample sent to Owner
   2. One sample sent to Resident Project Representative
   3. One sample retained in Engineer's file
   4. Acknowledgement: Copy of transmittal letter sent to Contractor
   5. Resubmission not required

B. "Exceptions Noted": Approved with Corrections Noted
   1. One sample sent to Owner
   2. One sample sent to Resident Project Representative
   3. One sample retained in Engineer's file
   4. Acknowledgement: Copy of transmittal letter sent to Contractor
   5. Work performed or products furnished to comply with exceptions noted in acknowledgement
   6. Resubmission not required

C. "Rejected": Returned for Correction
   1. One sample retained in Engineer's file
   2. Remaining samples sent to Contractor for resubmittal and compliance with the Contract Documents as noted in transmittal letter
   3. Copy of transmittal letter sent to Owner
   4. Resubmission required

1.8 RESUBMISSION REQUIREMENTS

A. Make any corrections or changes in submittals required by Engineer and resubmit until approved

B. Transmit each resubmission under new letter of transmittal. Use number of original submittal followed directly by a capital letter corresponding to the number of times a submittal is resubmitted (i.e., #001, #001A, #001B, etc.)

C. Shop Drawings and Product Data
   1. Revise initial drawings or data and resubmit as specified for the initial submittal
   2. Indicate any changes which have been made other than those requested by Engineer

D. Samples: Submit new samples as required for initial submittal

E. Reimbursement of Resubmission Review Costs:
   1. Review of first submittal and one resubmittal will be performed by Engineer at no cost to Contractor
   2. Cost for review of subsequent resubmissions will be directly paid by Contractor
   3. Engineer will document work-hours required for review and costs for Engineer review will be deducted from payments due Contractor as Change Order deducts

4. Charges for review of resubmissions will include Engineer at maximum rate of $150 per hour and administrative staff at maximum rate of $75 per hour

1.9 PROJECT RECORD SUBMITTALS

A. After completion of the Work and prior to final payment, Contractor shall furnish record documents and final approved shop drawings and samples (as-constructed shop drawings and samples) in the number of copies specified herein.
   1. Contractor shall provide additional copies of final approved shop drawings and samples for insertion in Equipment instruction and O&M manuals as required
   2. All copies shall be clearly marked “Project Record”

1.10 ENGINEER'S DUTIES

A. Review submittals with reasonable promptness and in accordance with approved submission schedule provided that each submittal has been called for by the Contract Documents and is stamped by Contractor as indicated above
   1. No extensions of time are allowed due to Engineer’s delay in reviewing submittals unless all the following criteria are met:
      a. Contractor has notified Engineer in writing that timely review of particular submittal in question is critical to the progress of the Work and Contractor has identified the requested submittal return date.
      b. Engineer has failed to return submittal within 21 days of receipt of the submittal or receipt of said notice, whichever is later
      c. Contractor demonstrates that delay in progress of the Work was directly attributable to Engineer’s failure to return submittal within 21 days
   2. No extensions of time are allowed due to delays in progress of the Work caused by rejection and subsequent resubmission of data, including multiple resubmissions
   3. Engineer’s review shall not extend to means, methods, techniques, sequences, construction operations, and safety precautions and programs incidental thereto. No information regarding these items will be reviewed whether or not included in submittals
   4. In the event that Engineer will require more than 21 calendar days to perform review, Engineer shall so notify Contractor

B. Review drawings and data submitted only for general conformity with Contract Documents
   1. Engineer’s review of drawings and data returned marked No Exceptions Taken or Exceptions Noted does not indicate a thorough review of all dimensions, quantities, and details of material, equipment device or items shown
   2. Engineer’s review does not relieve Contractor of responsibility for errors, omissions or deviations nor responsibility for compliance with the Contract Documents

C. Assume that no shop drawing or related submittal comprises a deviation to the Contract Documents unless Contractor advises Engineer otherwise in writing which is acknowledged by Engineer in writing:
   1. Consider and review only those deviations from the Contract Documents clearly identified as such on the submittal and tabulated on the Contractor’s transmittal sheet.

D. Review informational submittals for indications of Work or Material deficiencies and will respond to Contractor regarding such deficiencies

E. Return submittals to Contractor for distribution or for resubmission

F. Transmit, unreviewed, to Contractor all copies of submittals received directly from suppliers, manufacturers and subcontractors

G. Transmit, unreviewed, to Contractor all copies of submittals not called for by the Contract Documents or which have not been approved by Contractor

H. Engineer will not review uncalled-for shop drawings or product data except by special arrangement

I. Affix stamp and indicate approval for submittal or resubmission requirements with the following stamp:

JVA, Inc. Received: _____

☐ No Exceptions Noted ☐ Exceptions Noted

☐ Revise and Resubmit ☐ Rejected

JVA's review is limited to general conformance with the design intent as expressed in the Construction Documents. Notations and comments made on the product submittal or shop drawing during this review do not relieve the Contractor from compliance with the Construction Documents, as well as applicable laws, codes, and regulations. Review of a specific item shall not be construed to include review of an assembly of which the item is a component. The Contractor is responsible for dimensions and quantities to be confirmed and correlated at the job site; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences, and procedures of construction; coordination of the Work with that of all other trades; and performing all Work in a safe and satisfactory manner.

By: _____ Date: _____ 10/21

1.11 SUBMITTAL SCHEDULE

A. Unless indicated otherwise, provide all submittals required by individual sections of the Contract Documents to establish compliance with the specified requirements.

B. Contractor to produce schedule of submittals for Engineer review

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01380

CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construction record photographs prior to commencing and during the course of the Work

1.2 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01700 – Contract Closeout: Project Record Documents

1.3 PHOTOGRAPHY REQUIRED

A. Take photographs of the existing conditions prior to commencing work to document existing conditions

B. Take photographs on the date on which each scheduled Application for Payment is due. Intent is for digital photos to be kept as project record

C. CD of Digital photos become the property of Owner

1.4 COSTS OF PHOTOGRAPHY

A. Pay all costs for specified photography and printing
   1. Parties requiring additional photography or prints will pay for them directly

1.5 DELIVERY OF PHOTOS

A. Submit digital photos to the Engineer with monthly pay requests or within 20 days of photo date

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 TECHNIQUE

A. Factual Presentation

B. Correct Exposure and Focus
   1. High resolution and sharpness

2. Maximum depth-of-field
3. Minimum distortion

3.2 VIEWS REQUIRED

A. Photograph from locations to adequately illustrate the condition of construction and the state of the Project
   1. Photographic survey of the existing site
      a. Show all areas to be modified
      b. Show all areas in which Contractor will conduct operations or store equipment
   2. Weekly photographs
      a. Minimum of eight (8) views weekly until final acceptance
      b. Views as designated by the Engineer or Owner

3.3 PHOTOGRAPH REQUIREMENTS FOR PROGRESS SITE PHOTOGRAPHS

A. Responsibility
   1. Site photographs for Owner record of construction progress shall be the responsibility of the Contractor
   2. Contractor shall be responsible for site photographs including the existing and progress of Work

B. Photographs shall include, but not limited to, the following:
   1. Existing site: Photographs of existing site conditions before site work commences
      a. Number of views shall be sufficient to cover the existing site conditions
   2. Progress of work: Shall include photographs from clearing throughout construction
      a. Number of views shall be sufficient to cover progress in Work and shall include a minimum of eight (8) different views
   3. After completion of Work: Shall be sufficient to show completed and finished Work

C. Digital images
   1. Provide images in uncompressed JPEG format
   2. Minimum resolution: 1500 x 2200
   3. Submitted digital images shall not be cropped

D. Identify each digital image file
   1. Name of project
   2. Orientation and description of view
   3. Date and time of exposure

3.4 ADDITIONAL PHOTOGRAPHS

A. Contractor shall provide additional photographs upon the request of the Engineer

B. Additional photographs may include, but not limited to, the following:
   1. Publicity photographs
   2. Special events at Project site
   3. Major phase of Work

4. Substantial Completion
5. Follow-up investigations for on-site events such as construction damage or losses
6. Additional record photographs during final acceptance

3.5 PROJECT RECORD

A. Submit CD of all photos, grouped by date

B. Engineer will distribute, after review
   1. One copy of each view to Owner
   2. One copy of each view to Engineer's file
   3. One copy of each view returned to Contractor for inclusion in Project Record Document

END OF SECTION

SECTION 01400

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality assurance / Control of installation

B. Inspection and testing laboratory services

C. Qualification of laboratory

D. Laboratory duties

E. Limitations of authority of testing laboratory

F. Contractor's responsibilities

G. Field testing

H. Testing and services schedule

1.2 RELATED SECTIONS

A. Section 01010 - Summary of Work

B. Section 01340 - Shop Drawings, Product Data, and Samples

C. Section 01600 - Material and Equipment

1.3 REFERENCES

A. Conform to reference standard by date of issue current on date of Contract Documents

B. Obtain copies of standards when required by Contract Documents

C. Where specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding

D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document

1.4 SUBMITTALS

A. Submit under provisions of Section 01340

B. Provide copies of written reports for materials, equipment or systems as scheduled at the end of this section. Reference each report by respective section number.

C. Laboratory Test Reports: Provide written reports of each test and inspection to Engineer. Each report shall include:
   1. Date issued
   2. Project title and number
   3. Testing laboratory name, address and telephone number
   4. Name and signature of laboratory inspector
   5. Date and time of sampling or inspection
   6. Record of temperature and weather conditions
   7. Date of test
   8. Identification of product and specification section
   9. Location of sample or test in the Project
   10. Type of inspection or test
   11. Results of tests and compliance with Contract Documents
   12. Interpretation of test results when requested by Engineer

D. Shop Test Reports: Provide reports detailing results of tests and certification from manufacturer to verify compliance with specifications

E. Field Test Reports: Provide reports detailing results of the tests. Indicate compliance or non-compliance with Contract Documents. Identify corrective action for materials and equipment which fails to pass field tests.

1.5 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality

B. Comply fully with manufacturer's instructions, including each step in sequence

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer before proceeding

D. Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship

E. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement

F. Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities: Conditions of the Contract

G. Certification of products: Respective sections of specifications

H. Laboratory tests required and standards for testing: Respective sections of specifications

1.6 INSPECTION AND TESTING LABORATORY SERVICES

A. Owner will employ and pay for the services of a testing agency to perform specified laboratory testing of materials where the technical specifications specifically obligate the Owner to provide the services
   1. It is the Contractor’s responsibility to initiate and coordinate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide the testing agency no less than two (2) working days advance notification to schedule tests.
   2. Employment of the testing agency shall in no way relieve Contractor's obligations to perform the Work of the Contract
   3. Contractor shall employ and pay for the services of a testing agency to perform all specified services and testing not specifically identified in the technical specifications to be provided by Owner related to the design of mixes, products and equipment, to Engineer's review of proposed materials and equipment before, during and after incorporation in the Work and to retest materials and equipment which fail original tests

B. Retesting required because of non-conformance to specified requirements shall be performed by the same testing agency on instructions by the Engineer. Payment for retesting will be charged to the Contractor by deducting inspection or testing charges from the Contract Sum/Price

1.7 QUALIFICATION OF TESTING AGENCY

A. Meet "Recommended Requirements for Independent Laboratory Qualification", published by American Council of Independent Laboratories

B. Meet basic requirements of ASTM E 329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction" as applicable

C. Authorized to operate in the State in which the Project is located

1.8 TESTING AGENCY DUTIES

A. Cooperate with Engineer and Contractor; provide qualified personnel after due notice

B. Perform specified inspections, sampling, and testing of materials and methods of construction
   1. Comply with specified standards
   2. Ascertain compliance of materials with requirements of Contract Documents

C. Promptly notify Engineer and Contractor of observed irregularities or deficiencies of work or products

1.9 LIMITATIONS OF AUTHORITY OF TESTING AGENCY

A. Testing Agency Is Not Authorized To
   1. Release, revoke, alter or enlarge on requirements of Contract Documents
   2. Approve or accept any portion of the Work
   3. Owner employed testing agency shall not perform any duties of the Contractor

1.10 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory and testing agency personnel and provide access to Work

B. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other material mixes which require control by the testing laboratory

D. Furnish copies of product test reports as required

E. Furnish Incidental Labor and Facilities
   1. To provide access to Work to be tested
   2. To obtain and handle samples at the project site or at the source of the product to be tested
   3. To facilitate inspections and tests
   4. For storage and curing of test samples

F. Cooperate with testing agency; furnish samples of materials, design mix, equipment, tools, storage and assistance as requested
   1. Notify Engineer and testing agency 24 hours prior to expected time for operations requiring services to allow for scheduling of tests and laboratory assignment of personnel
   2. Make arrangements with testing agency and pay for additional samples and tests required for Contractor's use

1.11 FIELD TESTING

A. Owner shall pay all costs associated with standard field testing of materials as detailed in these specifications. Contractor] shall pay all costs for testing of piping and equipment as detailed in these specifications. Owner’s testing agency will take concrete samples, cure and break samples and report results. Owner's testing agency will also provide compaction testing and proctors for backfill operations. Contractor shall pay for all retesting due to tests indicating failed conditions.

B. Provide all required materials, labor, equipment, water, and power required for testing

C. Perform all tests in presence of Engineer and provide one copy of field test results to Engineer same day of tests

D. Repair with no additional compensation all materials and equipment which fail during testing

1.12 LABORATORY TESTING AND SERVICES SCHEDULE

A. Testing laboratory services shall be provided for, but shall not be limited to, the following:

Specification Section	Type of Material, Equipment, or System	Owner (O) or Contractor (C) Provided
02300	Earthwork	O
02740	Asphalt Mixes	O
02750	Concrete Mixes	O

1.13 FIELD TESTING AND SERVICES SCHEDULE

A. Field testing shall be provided for, but shall not be limited to, the following:

Specification Section	Type of Material, Equipment, or System	Owner (O) or Contractor (C) Provided
02300	Earthwork	O
02530	Sanitary Sewerage System	C
02540	CIP Thermosetting Resin Pipe - Mains	C
02740	Flexible Paving	O
02750	Rigid Paving	O
02770	Service Lateral and Connection Seals	C

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Administrative and procedural requirements governing Contractor's selection of products for use in Project and for Work including, but not limited to, the following:
   1. Definitions
   2. General Requirements for Materials and Equipment
   3. Environmental Conditions
   4. Submittals
   5. Quality Assurance and Qualifications
   6. System Responsibility
   7. Transportation and Shipment
   8. Delivery, Storage and Handling
   9. Maintenance Materials
   10. Warranty
   11. Equipment and Product Selection and Identification
   12. Examination, Installation, Adjusting and Cleaning

1.2 RELATED SECTIONS

A. Section 01010 – Summary of Work

B. Section 01340 – Shop Drawings, Product Data, and Samples

C. Section 01400 – Quality Control

D. Section 02300 – Earthwork

E. Section 02370 – Erosion and Sedimentation Control

F. Section 02530 – Sanitary Sewer System

G. Section 02740 – Flexible Paving

H. Section 02750 – Rigid Paving

I. Section 02920 – Seeding

1.3 REFERENCES

A. American Bearing Manufacturers Association (AFBMA)
   1. Std 9-90 – Load Ratings and Fatigue Life for Ball Bearings
   2. Std 11-90 – Load Ratings and Fatigue Life for Roller Bearings

B. American Gear Manufacturer Association (AGMA)

C. ANSI B1.1-89 – Unified Screw Threads

D. ANSI B 1.20. 1-83-Pipe Threads, General Purpose (Inch)

E. ANSI B16.1-89-Cast Iron Pipe Flanges and Flanged Fittings, Class 125

F. ANSI B18.2.1-81-Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Cap Screws, and Log Screws

G. ANSI B18.2.2-87-Square and Hex Nuts

H. NSF/ANSI 60-2012 – Drinking Water Treatment Chemicals – Health Effects

I. NSF/ANSI 61-2012 – Drinking Water System Components – Health Effects

J. Hazardous (Classified) Locations: Conform to requirements of NFPA70 Articles 500 through 504

1.4 DEFINITIONS

A. Definitions used in this specification section are not intended to change the meaning of other terms used in the Contract Documents, such as “specialties,” “systems,” “structure,” “finished,” “accessories,” and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry

B. Products: Items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term “product” includes the terms “material”, “equipment”, “system”, and terms of similar intent

C. Named products: Items identified by manufacturer’s product name, including make or model number of other designation, shown or listed in the manufacturer’s published product literature that is current as of date of Contract Documents

D. Foreign products: Distinguished from “domestic products” are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions. Products produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens or, nor living within, the United States and its possessions are also considered to be foreign products

E. Materials: Products substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work

F. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping

G. Special tools, instruments, devices, or accessories: Any tools, instruments, devices or accessories required for repair, adjustment or maintenance of equipment which are

designed especially for the equipment in question or which are not normally kept in stock by local tool suppliers

H. Responsible manufacturer: Unless otherwise specified, responsible manufacturer shall be manufacturer of driven equipment. Agents, representatives or other entities who are not a direct component of manufacturing corporation will not be acceptable as a substitute for manufacturer's corporation in meeting this requirement

1.5 GENERAL REQUIREMENTS

A. The section applies to all equipment provided under this contract

B. The requirements of detailed specifications take precedence over this section in the event of an apparent conflict

C. Provide all new equipment and materials, except as specified or required by testing

D. Equipment and materials removed from existing structure: Do not use in completed Work except where specifically indicated or specified

E. Contractor to coordinate equipment with other parts of the Work, including verification or compatibility of structures, piping, wiring and equipment components

F. Contractor is responsible for all alterations in the Work to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Drawings or specifications:
   1. The arrangement of equipment shown on the Drawings is based upon information available to the Owner at the time of the design and is not intended to show exact dimensions unique to a specific manufacturer
   2. More than one manufacturer has been used for mechanical layout and design to accommodate all named manufacturer's
   3. The Drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revision to meet actual equipment installation requirements as provided by the Contractor
   4. Structural supports, foundations, connected piping, valves and electrical conduit specified may have to be altered as coordinated by the Contractor during the submittal process to accommodate the actual equipment provided by the Contractor
   5. No additional payment will be made to the Contractor for such revisions and alterations

G. Do not use any material or equipment for any purpose other than that for which is designed or specified

H. Equipment lists presented in these specifications and as specified on the Drawings are included for the convenience of the Engineer and Contractor and are not to be considered as complete listings of all equipment, devices and material to be provided under this contract:

1. Contractor shall prepare his own material and equipment take-off lists as necessary from the contract Drawings, addenda and this project manual to meet the requirements of this project

1.6 ENVIRONMENTAL CONDITIONS

A. Project work includes an existing sanitary sewer where dilute concentrations of corrosive or hazardous gasses, high humidity, and other constituents may be expected to be present

B. Minimum Design Criteria:
   1. Altitude: 4,500 feet above mean sea level
   2. Outdoor air temperature: 10 to 100 degrees F
   3. Relative Humidity:
      a. Summer time: 60 percent
      b. Winter time: 30 percent

1.7 SUBMITTALS

A. Provide submittals in accordance with Section 01340 – Shop Drawings, Product Data, and Samples

B. Submittals for products are specified in Section 01340 – Shop Drawings, Product Data, and Samples and in Divisions 2 through 16

C. All submittals for each component of multi-component systems shall be compiled and submitted through the Contractor to the Engineer by the manufacturer having system responsibility

D. Provide a copy of this specification section with all addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate the requested deviations from the specification requirements.

E. Provide Certificate of System Responsibility

1.8 QUALITY ASSURANCE AND QUALIFICATIONS

A. Source limitations and interchangeability: To the fullest extent possible, provide products of the same kind from a single source

B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplate or trademarks on exposed surface of products that will be exposed to view in occupied spaces or on the exterior
   1. Labels: Locate required product labels and stamps on concealed surfaces, or where required for observation after installation, on inconspicuous, accessible surfaces.
   2. Equipment nameplates: Provide a permanent nameplate on each item of service – connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. Nameplate shall contain, but not limited to, the following information and other essential operating data:

a. Name of product and manufacturer
b. Model and serial number
c. Capacity
d. Speed
e. Ratings
f. Operating and power characteristics
g. Labels of tested compliance with codes and standards

3. Refer to additional requirements specified in Divisions 2 through 16

C. Installers Qualifications:
1. Equipment and material: Installed and placed in service by or under guidance of qualified personnel having knowledge and experience necessary for proper results
2. Where Contractor's or subcontractor's employees are not properly qualified, use personnel such as factory authorized field representative of equipment supplier

1.9 SYSTEM RESPONSIBILITY

A. Equipment systems made up of two or more components shall be provided as a single system by the responsible manufacturer. Unless otherwise specified, the Contractor shall assign system responsibility to, and obtain each system from the manufacturer of the driven equipment. The manufacturer shall design and provide all components of the system to enhance proper operation, compatibility of all components, ease of construction and efficient maintenance. The responsible manufacturer shall coordinate selection and design of all system components such that all equipment is compatible and operates properly to achieve the performance requirements specified. The Contractor is responsible to the Owner for performance of all systems as provided in the General and Special Conditions.

B. Nothing in this provision shall be construed as relieving the Contractor of overall responsibility for the Work of this Contract and the performance of all systems as specified under paragraphs 00700 – Standard General Conditions, Article 13

1.10 TRANSPORTATION AND SHIPMENT

A. Shipment preparation: Contractor shall require manufacturers and suppliers to prepare equipment and materials for shipment in a manner to facilitate unloading and handling, and to protect against damage or unnecessary exposure in transit and storage, for contractor supplied equipment. Provisions for protection shall include the following:
1. Crates or other suitable packaging materials
2. Covers and other means to prevent corrosion, moisture damage, mechanical, injury, and accumulation of dirt in motors, electrical equipment, and machinery
3. Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel
4. Grease packing or oil lubrication in all bearings and similar items

B. Marking
1. Each item of equipment and material shall be tagged or marked as identified in the delivery schedule or on submittals

2. Complete packing lists and bills of material shall be included with each shipment.
3. Each piece of every item need not be marked separately, provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged or marked

1.11 DELIVERY, STORAGE, AND HANDLING

A. Delivery
1. Arrange deliveries of equipment and materials in accordance with construction schedules, in ample time to facilitate inspection prior to installation and to avoid delay of Work. Coordinate to avoid conflict with work and conditions at the site
2. Deliver products in undamaged condition, in manufacturer's sealed, weather tight, original container or packaging, with identifying labels intact and legible, all in accordance with manufacturer's instructions and recommendations using means and methods that will prevent damage, deterioration, and loss, including theft
3. Control delivery schedules to minimize long-term storage at the Site and to prevent overcrowding of construction spaces. Coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss
4. Products delivered to Work site shall be in undamaged condition, in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing
5. Mark deliveries of component parts of equipment to identify the equipment, to permit easy accumulation of parts, and to facilitate inspection and measurement of quantity or counting of units
6. Immediately on delivery, inspect shipment to ensure:
    a. Product complies with requirements of Contract Documents and reviewed Submittals
    b. Quantities are correct
    c. Containers and packages are intact and labels are legible
    d. Equipment and materials are properly protected and undamaged
7. Include complete packing lists and bills of material with each shipment including equipment identification number assigned by Drawings and Specifications of this Contract
8. Deliver anchor bolts together with templates sufficiently early to permit setting when structural concrete is placed

B. Storage
1. If there is no interior space available from the Owner for storage of delivered equipment and material at the project site:
    a. Provide adequate facilities for storage in accordance with Section 01500
    b. Provide off-site storage and protection when site does not permit on-site storage or protection and if acceptable to Owner in accordance with the General Conditions
2. Submit and maintain insurance for equipment and materials at off-site storage

3. Requests for payment of stored equipment and materials by the Contractor may be rejected if storage facilities do not conform to these specifications or manufacturer's written recommendations.
4. Store equipment and materials immediately on delivery, and protect until completion of the Work. Store in accordance with manufacturer's instructions with seals and labels intact and legible
5. Store equipment and materials in a manner that will not endanger the supporting construction
6. Store equipment and materials that are subject to damage by elements in weathertight enclosures
7. Maintain temperature and humidity within ranges required by manufacturer
8. Protect motors, electrical equipment, plumbing fixtures, and machinery of all kinds against corrosion, moisture deteriorations, mechanical injury, and accumulation of dirt or other foreign matter
9. Protect electrical equipment, controls, and insulation against moisture, water, and dust damage
10. Immediately after delivery and inspection, connect and operate continuously all space heaters furnished in electrical equipment
11. Protect exposed-machined surfaces and unpainted iron and steel as necessary with suitable rust-preventive compounds
12. Protect bearings and similar items with grease packing or oil lubrication
13. Handle and store steel plate, sheet metal, and similar items in a manner to prevent deformation
14. Exterior storage:
    a. Provide substantial platforms, blocking, or skids to support fabricated products aboveground and to prevent soiling or staining. Cover products subject to discoloration or deterioration from exposure to elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation
    b. Store loose granular materials on solid surface areas to prevent mixing with foreign matter
    c. Provide surface drainage to prevent flow or ponding of rainwater
15. Equipment and materials shall not show any pitting, rust, decay or other deleterious effects of storage prior to final acceptance of Work
16. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure products are maintained under specified conditions and free from damage or deterioration
    a. Prepare stored materials lists with schedules of maintenance activities and frequency of activities required to maintain the quality of the equipment and the warranty from the manufacturer
    b. List dates and activities of storage requirements such as rotating moveable parts
    c. Update lists weekly and include in progress meeting agenda
17. Protect painted surfaces against impact, abrasion, discoloration or other damage:
    a. Repaint any damaged areas with manufacturer provided touch-up paint
18. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation
19. Installed products stored prior to start-up:

a. Equipment and materials shall not show any pitting, rust, decay or other deleterious effects of storage when installed in the Work
b. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations, dust, dirt, water and paint. Remove when no longer needed

C. Handling
1. Provide equipment and personnel necessary to unload and handle equipment and materials, by methods to prevent damage or soiling to equipment and materials or packaging
2. Handle by methods to prevent bending or overstressing. Where lifting points are designated, lift components only at those points
3. Provide additional protection to surrounding surfaces as necessary to prevent damage

D. Maintenance of storage
1. Inspect stored equipment and materials on a scheduled basis
2. Verify that storage facilities comply with manufacturer's product storage requirements, including environmental conditions continually maintained
3. Verify that surfaces of products exposed to elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents
4. For mechanical and electrical equipment in long-term storage, provide manufacturers service instructions to accompany each item, with notice of enclosed instructions on exterior of package. Service equipment on a regularly scheduled basis.

E. Protection after installation
1. Provide substantial coverings as necessary to protect installed equipment and materials from damage from subsequent construction operations
2. Remove when no longer needed or as specified

1.12 MAINTENANCE MATERIALS

A. Spare Parts:
1. Store spare parts, wherever required by detailed technical specification sections, in accordance with the provisions of this paragraph
2. Tag all spare parts with permanent, labeled tags or packaging by equipment designation number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate)
3. Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping
4. Unless otherwise specified, spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a wooden box:
a. Provide box with a hinged wooden cover and locking hasp
b. Hinges to be strap type
c. Paint the box and identify with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts"

5. Prepare and provide a neatly typed inventory of spare parts taped to the underside of the box cover

1.13 WARRANTY

A. Warranty all equipment and materials against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, leakage, breakage or other failure

B. Unless otherwise specified, for all equipment and materials provide manufacturer's warranty for a period of 2 years from the date of Substantial Completion

C. Warranties that begin at the time of shipment, delivery or within a limited time period from date of shipment or delivery or any other qualification that does not conform to the definition of Substantial Completion are not acceptable

D. Cost of all manufacturer warranties are considered as part of the Bid price

PART 2 PRODUCTS

2.1 MATERIALS

A. Suitable for the intended service conditions

B. Structural and miscellaneous fabricated steel in equipment shall conform to American Institute of Steel Construction (AISC) standards, except as otherwise specified

2.2 FABRICATION

A. Design, fabricate, and assemble in accordance with the best modern manufacturing and shop practices

B. Manufacture parts to standard sizes and gages

C. Two or more items of the same type shall be identical by the same manufacturer and interchangeable

2.3 EQUIPMENT AND PRODUCT SELECTION

A. General product requirements: Provide products that comply with the Contract Document, are undamaged, and unless otherwise indicated or specified, are new at time of installation
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect
   2. Standard products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects

3. Continued availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced product for which the manufacturer has published assurances that the product and its parts shall be available to the Owner at a later date. A reasonable doubt regarding such future availability will be grounds for rejection of products other than named products
4. As specified in each applicable Specification Sections, Drawings, codes, standards, and regulatory agencies
5. Fabricated products:
    a. Design, fabricate, and assemble products in accordance with best engineering and shop practices
    b. Manufacture like parts of duplicate units to standard interchangeable sizes and gauges. Two or more items of same kind shall be identically made by the same manufacturer
    c. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically accepted in writing by Owner
    d. Ensure that material or equipment are not used for any purpose other than that for which it is designed or is specified
    e. Labels and nameplates shall be provided where required by regulatory agencies or in accordance to state identification and essential operation data
6. Provide products of the same kind from a single source to the fullest extent possible

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install any equipment showing such effects. Replace damaged equipment with identical new equipment

3.2 INSTALLATION

A. Install all equipment, accessories and materials in accordance with the manufacturer's written recommendations unless otherwise specified in the individual equipment detailed technical specifications

B. Each product shall be securely anchored in place except as required for proper movement and performance

C. Each product shall be located and aligned with other Work

D. Manufacturer’s Instructions
    1. Contractor shall obtain and distribute hard copies and electronic copies of manufacturer’s instructions and recommendations to parties involved in installation including a copy to Engineer

2. Maintain one (1) set of complete instructions at job site during installation and until completion
3. Handle, install, connect, clean, conditions, and adjust products in accordance with such instructions and in conformity with specified requirements

3.3 ADJUSTING

A. Perform all required adjustment tests, operation checks, and other startup activities required

3.4 CLEANING

A. Perform under provisions of Section 01700 – Contract Closeout

B. Repaint all painted surfaces which are damaged prior to final equipment acceptance to Owner's satisfaction

C. Clean exposed surfaces and protect as necessary and required to prevent any damage or deterioration at the time of Substantial Completion

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Substantial completion

B. Final acceptance

C. Project record documents

D. Closeout procedures

E. Final cleaning

F. Final adjustment of accounts

G. Final application for payment

1.2 RELATED SECTIONS

A. Section 00700 – General Conditions

B. Section 01500 – Construction Facilities and Temporary Controls

C. Section 01340 – Shop Drawings and Product Data

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Prior to requesting inspection for certification of Substantial Completion, complete the following and list exceptions in the request:
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the Work claimed as Substantially Complete
      a. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Price
      b. If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete Work, and reasons the Work is not complete. All items remaining outstanding on the Contractor's punch list shall include a projected date of completion and/or correction with an explanation of why such item is not presently completed
   2. Advise Owner of pending insurance changeover requirements
   3. Submit specific warranties, workmanship Bonds, maintenance agreements, final certifications, and similar documents

4. Obtain and submit releases enabling Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases
5. Submit record drawings, instruction books and operating manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information
6. Deliver tools, spare parts, extra stock, and similar items
7. Make final changeover of permanent locks and transmit keys to Owner. Advise Owner's personnel of changeover in security provisions
8. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes

B. Inspection Procedures: On receipt of a request for inspection, Engineer will either proceed with inspection or advise Contractor of unfilled requirements. Engineer will prepare the Certificate of Substantial Completion following inspection or advise Contractor of construction that must be completed or corrected before the certificate will be issued
   1. Engineering will repeat inspection when requested and assured by Contractor that the Work is Substantially Complete.
   2. Results of the completed inspection will form the basis of requirements for final acceptance

1.4 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
   1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required
   2. Submit an updated final statement, accounting for final additional changes to the Contract Price
   3. Submit a certified copy of Engineer’s final inspection list of items to be completed or corrected, endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by Engineer.
   4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the Date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work
   5. Submit consent of surety to final payment
   6. Submit evidence of final, continuing insurance coverage complying with insurance requirements

B. Reinspection Procedure: Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to Engineer.

1. Upon completion of reinspection, Engineer will prepare a certificate of final acceptance. If the Work is incomplete, Engineer will advise Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance
2. If necessary, reinspection will be repeated, but at the expense of the Contractor who will reimburse the Owner for these services by the Engineer

1.5 PROJECT RECORD DOCUMENTS

A. General
1. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Engineer's reference during normal working hours
2. Maintain on site, one set of the following record documents; record actual revisions to the Work:
   a. Contract Drawings
   b. Specifications
   c. Addenda
   d. Change Orders and other Modifications to the Contract
   e. Reviewed shop drawings, product data, and samples
   f. Field test reports
   g. Construction photographs
3. Store Record Documents and samples separate from documents used for construction
   a. Provide files and racks for storage of documents
   b. Provide locked cabinet or secure storage space for samples

B. Record Drawings
1. Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings
2. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown
3. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings
4. Give particular attention to concealed elements that would be difficult to measure and record at a later date
   a. Record information concurrently with construction progress
   b. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Mark each document "Project Record" in neat, large, printed letters
   c. Mark new information that is important to Owner but was not shown on Contract Drawings or Shop Drawings
   d. Note related Change Order numbers where applicable
   e. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set

f. Upon completion of the Work, submit record drawings to Engineer for Owner's records

5. Contract Drawings and approved Shop Drawings: Legibly mark each item to record actual construction, including:
   a. Measured depths of elements of foundation in relation to finish grade or first floor datum
   b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvement
   c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
   d. Field changes of dimensions and details
   e. Changes made by Addenda or Change Order(s), if any
   f. Details not on original Contract Drawings
   g. References to related Shop Drawings and Modifications

C. Record Specifications: Maintain one complete copy of the Project Manual including addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and Modifications issued in printed form during construction
   1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
   2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
   3. Note related record drawing information and product data.
   4. Upon completion of the Work, submit record Specifications to Engineer for Owner's records

D. Record Product Data: Maintain one copy of each product data Submittal. Note related Change Orders and markup of record drawings and specifications.
   1. Mark record documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Site and from the manufacturer's installation instructions and recommendations.
   2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
   3. Upon completion of markup, submit complete set of record product data to Engineer for Owner's records
   4. Legibly mark and record at each Product section description of actual Products installed, including the following:
      a. Manufacturer's name, product model, number, trade name and supplies
      b. Product substitutions or alternates utilized
      c. Changes made by Addenda, field order or change order

E. Record Samples Submitted: Immediately prior to Substantial Completion, Contractor shall meet with Engineer and Owner's personnel at the Project Site to determine which Samples are to be transmitted to Owner for record purposes. Comply with Owner's instructions regarding packaging, identification, and delivery to Owner.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record keeping and Submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records, and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to Engineer for Owner's records

G. Maintenance Manuals: Contractor shall organize operation and maintenance data as specified in Section 01730

H. Submit documents to Engineer with claim for final Application for Payment

I. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes

J. Make documents and samples available at all times for inspection by Engineer

K. Label each document "Project Record" in neat, large printed letters

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 CLOSEOUT PROCEDURES

A. General
   1. Comply with requirements stated in the Owner's General Conditions of the Contract and in these specifications for administrative procedures in closing out the Work
   2. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection
   3. Provide submittals to Engineer/Owner that are required by governing or other authorities
   4. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due

3.2 FINAL CLEANING

A. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
   1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion
      a. Remove labels that are not permanent labels

b. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances. Restore reflective surfaces to their original condition
c. Wipe surfaces of mechanical and electrical Equipment. Remove excess lubrication and other substances

2. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction
3. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Site and dispose of lawfully.
   a. Where extra materials of value remaining after completion of associated Work become Owner's property. Dispose of these materials as directed by Owner

3.3 CONTRACTOR'S CLOSEOUT SUBMITTALS

A. Evidence of Payment and Release of Liens: As specified in the General Conditions

B. Final inspection reports by all regulatory agencies demonstrating the agencies' final approval

C. At Contract close-out, deliver Record Documents to Engineer for the Owner

D. Accompany Submittal with Transmittal Letter in Duplicate, Containing
   1. Date
   2. Project title and number
   3. Contractor's name and address
   4. Title and number of each Record Document
   5. Signature of Contractor or his authorized representative

3.4 FINAL ADJUSTMENTS OF ACCOUNTS

A. Submit a Final Statement of Accounting to Engineer

B. Statement Shall Reflect All Adjustments to the Contract Sum
   1. The original Contract Sum
   2. Additions and deductions resulting from
      a. Previous Change Orders
      b. Deductions for uncorrected Work
      c. Deductions for liquidated damages
      d. Deductions for reinspection payments
      e. Other adjustments
   3. Total Contract Sum, as adjusted
   4. Previous payments
   5. Sum remaining due

3.5 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the General Conditions of the Contract

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, and Division One and other related specification sections apply to work of this section.

1.2 SECTION INCLUDES

A. Clearing, grubbing and site preparation

B. Removal and disposal of debris

C. Handling, storage, transportation, and disposal of excavated material

D. Sheeting, shoring, bracing and protection work

E. Pumping and dewatering as required or necessary

F. Backfilling

G. Pipe embedment

H. Construction of fills and embankments

I. Excavation for buildings & structures

J. Trench Stabilization

K. Final grading

L. Slope Stabilization

M. Appurtenant work

1.3 RELATED SECTIONS

A. Section 02370 – Erosion and Sedimentation Control

1.4 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)

B. American Society for Testing and Materials (ASTM):

1. C33 – Concrete Aggregates
2. C136 – Sieve Analysis of Fine and Coarse Aggregates
3. D698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-Inch Drop
4. D1241 – Material for Soil Aggregate Subbase, Base and Surface Courses
5. D1557 – Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
6. D4253 – Test Methods for Maximum Index Density of Soils and Unit Weight of Soils Using a Vibratory Table
7. D4254 – Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
8. D4318 – Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
9. D6938 – Test Method for In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):
   1. 229 – Controlled Low-Strength Materials

D. Council of American Building Officials/American National Standards Institute (CABO/ANSI):
   1. A117.1 – Accessible and Useable Buildings and Facilities Standards

E. Colorado Department of Transportation (CDOT)

F. Occupational Safety and Health Administration (OSHA):
   1. Part 1926 – Safety and Health Regulations for Construction

1.5 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Product Data: Submit on all products or materials supplied herein

C. Test Reports: Indicate supplier, sieve analysis, optimum moisture content and density in accordance with ASTM D698 if appropriate for crushed rock or gravel, pipe embedment and material for fills and embankment

1.6 REGULATORY REQUIREMENTS

A. Burning will not be allowed on-site. Comply with all applicable codes, regulations, and laws.

B. Comply with applicable requirements of CABO/ANSI A117.1 for accessibility requirements related to walks, ramps, parking areas, drives, curb ramps, etc.

C. Obtain and comply with all requirements of City of Grand Junction and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

D. For public improvements only, in the event of a conflict between municipal standards and this specification, municipal standards for products and installation will govern.

E. Excavation work will be performed in compliance with City of grand Junciton and current OSHA requirements.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Protect adjacent structures and surrounding areas from damage during excavation, filling, and backfilling

B. Protect work from erosion or other similar types of damage until the project has been accepted. Leave protection in place for subsequent contractors' use.

C. Do not backfill or construct fills during freezing weather. Backfill or construct fills only when temperature is 35°F and rising

D. Do not use frozen materials, snow, or ice in any backfill or fill area

E. Do not backfill or construct fill on frozen surfaces

F. Protect excavated material from becoming frozen

G. Do not backfill or construct fills or embankments during periods of heavy rainfall or precipitation when soil moisture conditions will not allow proper compaction to be achieved

H. Do not remove trees from outside excavation or fill areas unless authorized by the Owner; protect from permanent damage by construction activities

I. Provide temporary bridges for roadways, walkways, driveways, etc.

1.8 QUALITY ASSURANCE

A. All imported material to be free of hazardous and organic wastes, "clean" as defined by EPA, and approved for its intended use by the Owner or project Geotechnical Engineer.

PART 2 PRODUCTS

2.1 MATERIALS

A. General - Soil materials, whether from sources on or off the site must be approved by the Geotechnical Engineer as suitable for intended use and specifically for required location or purpose.

B. Classification of Excavated Materials:
   1. No classification applies. Remove and handle all excavated materials regardless of its type, character, composition, condition, or depth. This includes all material that is not

classified as rock excavation as described in Paragraph 2.1.B.2 Rock Excavation is included herein.

2. Rock Excavation shall be conducted according to part 103.11 of the City of Grand Junction Standard Specifications for the construction of underground utilities.
3. Waste Materials:
   a. Waste materials are considered unacceptable materials for compaction or placement fill. Site fills will not include environmental pollutants, hazardous substances or waste, hazardous products or by-products.
   b. Transport and properly dispose of any rubble and waste materials found in excavation off the Owner's property
   c. If hazardous, transite or asbestos containing materials are found in excavation, stop work immediately and notify the Owner within one hour of discovery. Comply with special handling requirements.

C. Fills and Embankments
   1. To the maximum extent practical use excess earth from onsite excavation for fills and embankments.
   2. Free from rocks or stones larger than 12 inch in greatest dimension and free from brush, stumps, logs, roots, debris, and organic and other deleterious materials
   3. Fill and embankment material must be acceptable to Engineer
   4. No rocks or stones larger than 6 inch in upper 18 inches of fill or embankment. Where allowed, distribute rocks and stones through the fill to not interfere with compaction.

D. Imported Fill for Fills and Embankments:
   1. The Contractor is responsible for obtaining additional material for fills and embankments as necessary to meet the requirements shown on the Drawings.
   2. Imported fill conforming to the following:
      a. Gradation (percent finer by weight ASTM C136): 3" – 100% passing, No. 4 Sieve – 50-100% passing, and No. 200 Sieve – 35% passing (maximum)
      b. Liquid Limit: 35 (maximum), Plasticity Index: 15 (maximum), Group Index: 10 (maximum)

E. Topsoil
   1. Topsoil is defined as fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of rocks, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth for areas to be seeded or planted. Coordinate testing requirements with Owner.
   2. Clean topsoil free of plants and seeds will be spread to 4-inch minimum depth or as specified by Drawings, whichever is greater.

F. Grubbings
   1. Grubbings are defined as the first 1 inch of surface vegetation and topsoil consisting of primarily existing grass groundcover free of roots, brush, and other objectionable material and debris.

2. Reuse grubbing and surface topsoil containing plants and seeds in designated revegetation areas only.

G. Pipe Embedment: Graded gravel
   1. Comply with City of Grand Junction requirements for pipe embedment for public utilities.

H. Compacted Trench Backfill
   1. Comply with City of Grand Junction requirements for backfilling pipe.

I. Coarse Base Rock
   1. Granular material, maximum 3 inches, less than 10% passing 1-inch sieve.
   2. Free of trash, clay and dust

J. Road Base
   1. Will meet ASTM specification for Class II aggregate base and CDOT Class 6 gradation

Sieve Size	Percent Passing by Weight
3/4"	90-100
No. 4	30-65
No. 8	22-55
No. 200	3-12

2.2 ACCESSORIES

A. Controlled Low Strength Material (Flow Fill)
   1. Comply with City of Grand Junction requirements and ACI 229 for the use of flowable fill within the right-of-way or for public utility trench backfill.
   2. Product will be a lean, sand-cement slurry, “flowable fill” or similar material with a 28-day unconfined compressive strength between 50 and 200 psi.

B. Non-woven geotextile fabric
   1. Needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Product must be inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids. Product must meet AASHTO M288-06 Class 3 for elongation > 50%.
      a. Mirafi 140N or accepted substitution

PART 3 EXECUTION

3.1 EXAMINATION

A. Field verify the location of all underground utilities, pipelines and structures prior to excavation

3.2 PERFORMANCE — GENERAL

A. Contractor to verify quantities of cuts and fills and perform all earthwork required to meet the grades as shown on the Drawings, including but not limited to, additional import or export required to handle compaction, building and pavement subgrade preparation, and pipe bedding.

B. Perform work in a safe and proper manner with appropriate precautions against hazard

C. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

D. Contain all construction activity on the designated site and within the limits of work. Cost of restoration offsite will be the responsibility of the Contractor

E. Maintain service to pipelines and utilities indicated on Drawings during construction

3.3 PREPARATION

A. Clearing and Grubbing
   1. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris.
   2. Strip subgrade for fills and embankments of surface vegetation, sod, tree stumps and organic topsoil. Strip and stockpile all on-site material meeting the topsoil definition for all areas receiving grading where shown on Drawings
   3. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.
   4. Remove and dispose of tree stumps and roots over 3 inches in diameter to a minimum depth of 18 inches below the natural surface or 5 feet below finished surface level, whichever is lower.
   5. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted
   6. Backfill all excavated depression include grub holes with approved material

B. Preservation of Trees
   1. Do not remove trees outside fill or excavated areas, except as authorized by Engineer
   2. Protect trees and their roots within the drip line that are to remain from permanent damage by construction operation
   3. Trim standing trees in conflict with construction operations as directed by Owner and Engineer.

C. Topsoil Stripping
   1. Strip onsite material meeting the topsoil definition to minimum depth of 4 inches from areas to receive grading as shown on Drawings.
   2. Stockpile topsoil in areas designated by Owner and indicated on Drawings where it will not interfere with construction operations and activities and existing facilities

3. At the completion of work in each area, place and grade topsoil to maintain gradient as indicated and required. Roughen surface as required for erosion control.

D. Waste and Debris
   1. Stockpile all acceptable grubbing for reuse in native revegetation areas
   2. Remove and dispose of all waste materials and debris from clearing, grubbing, stripping and demolition off site

E. Stockpiles
   1. Segregate materials suitable for the following:
      a. Topsoil
      b. Embankments and fills
      c. Backfill
      d. Spoils and waste only
   2. No excavation will be deposited or stockpiled at any time so as to endanger stability of banks or structures, health of trees and shrubs to be protected, or portions of the Work, either by direct pressure or indirectly by overloading banks contiguous to the operation
   3. Stockpile soil materials away from edge of excavations
   4. Do not obstruct or prevent access to roads, driveways, ditches, natural drainage channels, and utility control devices
   5. If in result of adjacent structures, easement limitations, or other restrictions sufficient storage is not available within Project limits, Contractor will arrange for off-site areas for stockpiling and for moving material to and from the storage area at no additional cost to the Owner

3.4 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations will be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work.

B. Backfill will be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs will be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Owner

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage will be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Engineer, will be borne by the Contractor at no additional expense to the Owner

3.5 DEWATERING

A. General

1. All dewatering activities in accordance with all federal, state, and local regulations regarding site drainage, dewatering, and erosion and sediment control including permitting requirements
2. Design and provide dewatering system using accepted and professional methods consistent with current industry practice to eliminate water entering the excavation under hydrostatic head from the bottom and/or sides. Design system to prevent differential hydrostatic head, which would result in floating out soil particles in a manner, termed as a "quick" or "boiling" condition. System will not be dependent solely upon sumps and/or pumping water from within the excavation where differential head would result in a quick condition, which would continue to worsen the integrity of the excavation's stability
3. Provide and maintain adequate dewatering equipment including power supply, if necessary, to remove and dispose of surface and groundwater entering excavations, trenches, and other parts of the Work
4. Provide dewatering system of sufficient size and capacity to prevent ground and surface water flow into the excavation and to allow all Work to be installed in a dry condition
5. Control groundwater in a manner that preserves strength of foundation soils, does not cause instability or raveling of excavation slopes, and does not result in damage to existing structures. Where necessary to these purposes, lower water level in advance of excavation, utilizing wells, wellpoints, jet educators, or similar positive methods
6. Keep each excavation dry during subgrade preparation and continually thereafter until the structure to be built or the pipe to be installed is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result
7. Dewater excavations which extend to or below groundwater by lowering and keeping the groundwater level beneath such excavation at least 12 inches below the bottom of the excavation
8. Design, furnish, install, test, operate, monitor and maintain dewatering system of sufficient scope, size and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of groundwater and permit excavation and construction to proceed on dry, stable subgrades
9. Divert surface water or otherwise prevent it from entering excavated areas or trenches to the extent practical without damaging adjacent property
10. Maintain all drainage pipes, keep clean and free of sediment during construction and final cleanup
11. Open pumping with sumps and ditches will be allowed, provided it does not result in boils, loss of fines, softening of the ground, or instability of slopes
12. No additional payment will be made for any supplemental measures to control seepage, groundwater, or artesian head
13. Dewatering to surface waterways requires Colorado Department of Public Health and Environment dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, including water treatment prior to discharge, if necessary

B. Design
   1. Contractor will be responsible for the accuracy of the Drawings, design data, and operational records required

2. Contractor will be solely responsible for the design, installation, operation, maintenance, and any failure of any component of the system

C. Damages
   1. Contractor will be responsible for and will repair without cost to the Owner any damage to work in place, or other contractor's equipment, utilities, residences, highways, roads, railroads, private and municipal well systems, adjacent structures, natural resources, habitat, existing wells, and the excavation including, damage to the bottom due to heave and including but not limited to, removal and pumping out of the excavated area that may result from Contractor's negligence, inadequate or improper design and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system
   2. Remove sub grade materials rendered unsuitable by excessive wetting and replace with approved backfill material at no additional cost to the Owner

D. Maintaining Excavation in Dewatered Condition
   1. Dewatering will be a continuous operation. Interruptions due to power outages, or any other reason will not be permitted
   2. Continuously maintain excavation in a dry condition with positive dewatering methods during preparation of subgrade, installation of pipe, and construction of structures until the critical period of construction and/or backfill is completed to prevent damage of subgrade support, piping, structure, side slopes, or adjacent facilities from flotation or other hydrostatic pressure imbalance
   3. Provide standby equipment on site, installed, wired, and available for immediate operation if required to maintain dewatering on a continuous basis in the event any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional cost to Owner
   4. System maintenance will include supervision by personnel skilled in the operation, maintenance, and replacement of system components, and any other work required to maintain excavation in dewatered condition

E. System Removal
   1. Remove dewatering equipment from the site, including related temporary electrical service
   2. Wells will be removed or cut off a minimum of 3 feet below final ground surface, capped, and abandoned in accordance with regulations by agencies having jurisdiction

3.6 SHEETING, SHORING AND BRACING

A. Bracing and sheeting of trenches shall be conducted according to part 103.4 of the City of Grand Junction Standard Specifications for the Construction of Underground Utilities.

B. All sheeting, shoring and bracing in accordance with OSHA and IBC requirements

C. Prevent undermining and damage to all structures, buildings, underground facilities, pavements and slabs

D. Contractor will responsible for obtaining all required permits or easements for encroachments into the public right-of-way and for coordinating any encroachments onto adjacent properties.

E. If sheet pile cut off walls are required, submit design calculations, stamped by a Colorado licensed Professional Engineer

F. Contractor will be solely responsible for proper design, installation, operation, maintenance, and any failure of any system component
   1. Engineer review of Contractor's design and data does not relieve the Contractor from full responsibility for errors or from the entire responsibility for complete and adequate design and performance of the sheeting, shoring and bracing system

G. Provide proper and substantial sheeting, shoring, and bracing, in accordance with OSHA Standards as required, to prevent caving or sliding, to protect workmen and the Work, and to protect existing structures and facilities

H. Design, furnish, build, maintain and subsequently remove, to extent required a system of temporary supports for cut and cover, open cut, temporary bypass road, or trench excavations, including bracing, dewatering, and all associated items to support the sides and ends of excavations where excavation slopes may endanger in-place or proposed improvements, extend beyond construction right-of-ways or as otherwise specified or indicated in the Drawings
   1. Design and build sheeting, shoring, and bracing to withstand all loads that might be caused by earth movement or pressure
   2. Design and build sheeting, shoring and bracing to be rigid, maintain shape and position under all circumstances.

I. Design excavation support system and components for the following to allow safe and expeditious construction of permanent structures without movement/settlement of the ground and to prevent damage to or movement of adjacent buildings, structures, other improvements and underground facilities
   1. To support lateral earth pressures
   2. Loads from utilities, traffic, construction, buildings and surcharge loads

J. Provide sheeting, shoring and bracing equipment and materials onsite prior to start of excavation in each section, making adjustments as required to meet unexpected conditions

K. Contractor will make his own assessment of existing conditions including adjacent property, the possible effects of his proposed temporary works and construction methods, and will select and design support systems, methods, and details as will assure safety to the public, adjacent property, and the completed Work.

L. Employ caution in areas of underground facilities, which will be exposed by hand or other excavation methods acceptable to Owner or Engineer.

M. Space and arrange sheeting and bracing as required to exclude adjacent material and according to the stability of excavation slopes

N. Do not pull trench sheeting before backfilling

O. Do not brace sheeting left in place against the pipe, but support it in a manner that precludes concentrated loads or horizontal thrusts on pipe

P. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment is completed

Q. Damages
   1. Contractor will document and all existing damage to adjacent facilities and submit written documentation to Owner and Engineer prior to performing any excavation. Documentation will include written description of existing damages, measurements, diagrams, maps and associated photographs
   2. Repair all damage resulting from excavation and remove and place any existing structure or underground facility damaged during shoring and sheeting and all undermined pavements with Owner-approved equal, concrete or asphalt, at no cost to the Owner.

3.7 TRENCH STABILIZATION

A. Thoroughly compact and consolidate subgrades for concrete structures, precast structures, and utility trench bottoms so they remain firm, dense and intact during required construction activities

B. Remove all mud and muck during excavation

C. Reinforce subgrades with crushed rock or gravel if they become mucky during construction activities

D. Finished elevation of stabilized subgrades are to be at or below subgrade elevations indicated on Drawings

E. Allow no more than ½ inch depth of mud or muck to remain on trench bottoms when pipe bedding material is placed thereon

F. Scarify trench subgrade to a depth of 6 to 8 inches before compaction

3.8 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure as described herein.

C. Percentage of Maximum Dry Density Requirements: Moisture treat and compact soil to not less than the following percentages of maximum dry density and to within the specified moisture content range of optimum moisture content according to ASTM D698 as follows:

Surface Improvement	Compaction %	Moisture Content
Structures	98%	-2 to +2
Utility Trenches	95%	-2 to +2
Lawns or Unpaved Areas	90%	-2 to +2
Public Right-of-way	Per municipal standards	

1. Do not deposit or compact tamped or otherwise mechanically compacted backfill if frozen or if in water.
2. Take particular care to compact backfill which will be beneath slabs, pipes, drives, roads, parking areas, curb, gutters, or other surface construction.

3.9 DISPOSAL OF EXCESS EXCAVATED MATERIALS

A. Use excess excavated materials in fills and embankments as indicated on the Drawings to the extent needed. Coordinate with Owner and Engineer on locations for excess material placement.

B. The Contractor is responsible for disposing of all excess excavated materials from the site to a location approved by the Owner or Engineer and permitted with the local authorities.

C. Remove debris, junk, broken concrete, broken asphalt, rock, stones, stumps, logs, roots, and other unsuitable material from the site and dispose of it.

3.10 BLASTING

A. Blasting or other use of explosives is not permitted without City of Grand Junction approval

3.11 TRENCH EXCAVATION

A. Establish alignment and grade or elevation from offset stakes provided by the Contractor's surveyor.

B. Excavate trenches so pipes can be laid straight at uniform grade without dips or bumps, between the terminal elevations indicated on the Drawings

C. Comply with pipe specification sections regarding vertical and horizontal alignment and maximum joint deflection

D. Measure pipe cover depth vertically from top of pipe to finished ground or surface elevation

E. Do not open more trench in advance of pipe laying than is necessary to expedite the work; not more than 200 feet

F. Total length of open trench will be limited to 200 feet unless otherwise approved by the Engineer

G. Except where tunneling or boring is indicated on the Drawings, specified, required by jurisdictional agency or permitted by Engineer, excavate trenches by open cut from the surface

H. Limiting trench widths
   1. Excavate to a width which will provide adequate working space and pipe clearances for proper pipe installation, jointing, embedment
   2. If needed to reduce earth loads to prevent sliding, cut banks back on slopes which extend not lower than 1 foot above the top of the pipe
   3. Stipulated minimum clearances are minimum clear distances, not minimum average distances
   4. Maximum trench width from six inches above the top of pipe to trench bottom is the pipe outside diameter plus 24 inches
   5. Limiting trench widths and permissible clearances from 6 inches above top of pipe to trench bottom for installed pressure and non-pressure piping

Pipe Size (inch)	Minimum Trench Width	Maximum Trench Width
3	1’ 6”	2’ 6”
4	1’ 6”	2’ 6”
6	1’ 6”	2’ 6”
8	1’ 8”	2” 8”
10	2’ 0”	3’ 0”
12	2’ 0”	3’ 0”
16	2’ 8”	3’ 8”
18	3’ 0”	4’ 0”
24	3’ 6”	4’ 6”
36	4’ 6”	5’ 0”

   6. If the width of the lower portion of the trench exceeds the maximum permitted, provide special pipe embedment, or concrete encasement as required by loading conditions
   7. No excessive trench widths will be allowed to avoid the use of sheeting or shoring and bracing

I. Trench Side Walls
   1. Will be sloped, shored, sheeted, braced, or otherwise supported by means of sufficient strength to protect workmen in accordance with applicable rules and regulations established for construction by the federal, state, and local ordinances and regulations
   2. Sheet and brace where necessary and as specified herein
   3. Excavate without undercutting

J. Trench Bottom
   1. Will be thoroughly protected and maintained when suitable natural materials are encountered
   2. Will be thoroughly compacted and in approved condition prior to placing gravel bedding, if required
   3. Where in earth, trench bottoms for 6 inches and smaller pipe may be excavated below pipe subgrade and granular embedment provided or the trench may be graded to provide uniform and continuous support between bell holes or end joints of the installed pipe at the Contractor's option
   4. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material approved by Engineer
   5. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined
   6. PVC pipe will not be laid directly on trench bottom

K. Mechanical excavation
   1. Do not use where its operation would damage buildings, culverts, or other existing property, structures, or utilities above or below ground; hand excavate only in such areas
   2. Use mechanical equipment of a type and design which can be operated to provide the following:
      a. Rough trench bottom to a controlled elevation
      b. Uniform trench widths and vertical sidewalls are obtained from 1 foot above the top of the installed pipe to the bottom of the trench
      c. Trench alignment is such that pipe is accurately laid to specified alignment and is centered in the trench with adequate clearance between pipe and trench sidewalls
   3. Do not undercut trench sidewalls
   4. Recompact trench bottom disturbed by bucket teeth prior to placement of embedment material

L. Except as otherwise required, excavate trenches below the underside of pipes as indicated in the Drawings to provide for installation of granular embedment pipe foundation material

M. Whenever so directed by Engineer, excavate to such depth below grade as Engineer directs and bring the trench bottom to grade with such material as Engineer may direct

N. For unstable soils, provide concrete or other bedding as directed by Engineer

O. Do not allow any part of bells or couplings to contact the trench bottom, walls, or granular embedment when pipe is joined

P. Cuts in existing surface construction
   1. No larger than necessary to provide adequate working space
   2. Cut a clean groove not less than 1½ inch deep along each side of trench or around perimeter of excavation area

3.12 PIPE EMBEDMENT

A. Embed pipes above and below the bottom of pipe as indicated on the Drawings and as specified herein

B. Granular embedment
   1. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
      a. Level bottom layer at proper grade to receive and uniformly support pipe barrel throughout length
      b. Barrel of pipe will have a bearing for its full length
   2. Form depressions under each joint to permit the proper jointing. No part of joint will be in contact with trench when pipe is placed in position
   3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe to hold the pipe in proper position and alignment during subsequent operations
   4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent displacement
   5. Complete embedment promptly after jointing operations and approval to proceed by Engineer
   6. Granular embedment compaction by slicing with shovel or vibrating
      a. Maximum uncompacted thickness of layers: 6 inch
   7. Compacted embedment will be compacted to 90 percent maximum density per ASTM D1557
      a. Maximum uncompacted depth thickness of horizontal layers: 8 inch

C. Arch and concrete encasement
   1. Include in locations indicated on Drawings or where over-width trench conditions need correction as approved by Engineer
   2. Install and form as indicated on Drawings or as specified
   3. Concrete will have a 28-day minimum 3,000 psi compressive strength

D. Do not backfill until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems

3.13 TRENCH BACKFILL

A. Backfilling will be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible. Backfilling procedures will be in accordance with additional requirements, if any, of local authorities or private right-of-way agreements.

B. Compacted backfill
   1. Provide full depth of trench above embedment at all locations
   2. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures
   3. In street or highway shoulders

4. Beneath fills and embankments

C. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench

D. Site excavated materials
   1. Place job excavated materials in 8 inches maximum uncompacted thickness, uniform layers
   2. Increased layer thickness may be permitted for incohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved
   3. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe
   4. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

E. Graded gravel
   1. Deposit in uniform layers of 9 inches maximum uncompacted thickness
   2. Compact with suitable vibrating roller or platform vibrator to not less than 70 percent relative density per ASTM D4253/D4254

F. Uncompacted backfill
   1. Compaction of backfill above pipe embedment in locations other than those specified, is required only to prevent future settlement
   2. May be placed by any method acceptable to Engineer which will not impose excessive concentrated or unbalanced loads, shock, or impact on, and will not result in displacement of installed pipe
   3. Until compacted depth over conduit exceeds 3 feet, do not drop fill material over 5 feet. Distance may be increased 2 feet for each additional 1 foot of cover

G. Finish the top portion of backfill with at least 4 inches of topsoil or as specified by landscaping specifications, whichever is greater, corresponding to, or better than, that underlying adjoining turf areas.

H. Trench backfill within the public right-of-way will conform to municipal street and utility standards.

I. Trench backfills through unimproved areas should be restored to previous conditions and left 3” above adjacent grades to allow for settlement. Seed all disturbed areas according to erosion control and landscape specifications.

J. Protection of trench backfill
   1. Where trenches are constructed in ditches or other water courses, protect backfill from erosion
   2. Install ditch checks where the ditch grade exceeds 1 percent
      a. Minimum depth: 2 feet below the original ditch or water course bottom for the full bottom width
      b. Minimum width: 18 inches into the side slopes

c. Minimum thickness: 12 inches

3.14 DRAINAGE MAINTENANCE

A. Do not backfill trenches across roadways, drives, walks or other trafficways adjacent to drainage ditches or water courses prior to backfilling the trench on the upstream side of the trafficway to prevent impounding water after pipe is laid

B. Backfill so that water does not accumulate in unfilled or partially filled trenches

C. Remove materials deposited in roadway ditches or other water courses crossed by the trench line immediately after backfilling is completed and restore ditches and water courses to original section, grade, and contours

D. Do not obstruct surface drainage any longer than necessary

E. Provide and maintain temporary bridges and other structures across unfilled trenches as required to maintain traffic

F. Provide adequate storm flow conveyance through the site at all times during construction to avoid flooding of any buildings or adjacent property. Provide overland drainage routing when storm sewer inlets are not fully functioning due to erosion and sediment control measures.

3.15 FINAL GRADING

A. After completion of all other outside work and after backfilling is completed and settled, bring to grade at the indicated elevations, slopes and contours, all areas being graded on site

B. Graders and other power equipment may be used for final grading and slope dressing if the result is uniform and equivalent to hand work

C. Grade all surfaces for effective drainage, provide a 2 percent minimum slope except as otherwise shown on the Drawings

D. Provide a smooth transition between adjacent existing grades and new grades

E. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances

F. Slope grades to direct water away from buildings and prevent ponds from forming where not intended

G. Finish subgrades at lawns and unpaved areas to required elevations within a tolerance of plus or minus one (1) inch

H. Finish grades will be no more than 0.1 foot above or below those indicated

I. Finish all ditches, swales and gutters to drain readily

J. Coordinate final subgrade depth with finish landscape treatment and required topsoil depths

K. Topsoil
   1. Clean topsoil, free of plants and seed will be spread to 4-inch minimum depth.
   2. Reuse grubbings and surface topsoil containing plants and seeds in designated revegetation areas only.

3.16 SLOPE AND CHANNEL STABILIZATION

A. Cover channel banks, slopes, bottom and thalweg (water flowline at lowest point in channel) with erosion control fabric mat where grade is steeper than 4H to 1V and where indicated on the Drawings

B. Lay fabric smoothly on surface, bury top end of each section in 6-inch deep excavated topsoil trench. Provide 6-inch overlap minimum of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil

C. Secure outside edges and overlaps at 48 inch intervals with 4-inch to 6-inch U-shaped type pins or wooden stakes depending on ground condition

D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil

E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches

F. Maintain integrity of erosion control fabric

G. Prior to laying fabric, seed disturbed areas under provisions of related seeding and landscaping specification sections

3.17 SETTLEMENT

A. Warranty for settlement of all fills, embankments, and backfills is stipulated in the General Conditions from final completion of Contract under which Work is performed

B. Repair or replace within 30 days after notice by Engineer or Owner

3.18 FIELD QUALITY CONTROL

A. Provide under provisions of General Conditions and Division One Specifications

B. Coordinate testing with Owner. Owner will employ testing agency for field testing to determine compliance of in-place and backfill materials and compaction in accordance with the specifications, and to verify design bearing capacities.

C. It is the Contractor's responsibility to initiate, coordinate and accommodate all required tests and inspections including conformance with requirements of all applicable public agencies and authorities. Contractor will be responsible for coordinating the testing requirement with testing agency and provide the testing agency 48 hour advance notification to schedule tests.

D. Fills and Embankment Testing
   1. Two moisture-density relationship tests, ASTM D698, on each type of fill material
   2. One in-place compaction test for each 5,000 square feet every 1.5 feet of vertical lift of material placed
   3. Additional in-place compaction tests at the discretion of the Owner

E. Pipe Embedment and Backfill Testing
   1. Two moisture-density relationship tests, ASTM D698, or two relative density tests, ASTM D4253/D4254, as appropriate for each type of embedment on backfill material proposed, except granular embedment material
   2. One in-place compaction test every 200 lineal feet of trench in the compacted embedment zone and at every 1.5 feet of vertical lift of backfill materials, per ASTM D6938
   3. One in-place compaction test near top of trench for trench depth of 2 feet or less, per ASTM D6938
   4. Additional in-place compaction tests at the discretion of the Owner

F. Inspection and approval
   1. A qualified Geotechnical Engineer will inspect the natural soil at bottom of excavations for structures
   2. Do not prepare subgrade or place concrete until Geotechnical Engineer's inspection has taken place and any resulting recommendations of the Geotechnical Engineer have been fulfilled or until the inspection has been waived by the Geotechnical Engineer
   3. Prior to placement of structural fill, overexcavated foundations subgrades will be observed and tested by a qualified Geotechnical Engineer to ensure suitable bearing materials exist
   4. Geotechnical Engineer will provide a letter to Engineer to confirm the presence of suitable subgrade material and properly placed fill materials by Contractor in accordance with Drawings and geotechnical report.

G. Retesting of failed compaction will be performed by Geotechnical Engineer for Owner, but paid for the Contractor

END OF SECTION

SECTION 02370

EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This work consists of temporary measures needed to control erosion and water pollution. These temporary measures will include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the project and during site restoration, and as directed by ENGINEER, and as shown on the drawings.

B. The Erosion Control Plan presented in the drawings serves as a minimum for the requirements of erosion control during construction. Contractor has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the project. Therefore, if the provided plan is not working sufficiently to protect the project areas, then Contractor shall provide additional measures as required to obtain the required protection.

1.2 RELATED SECTIONS

A. Section 02220 – Demolition

1.3 REFERENCES AND STANDARDS

A. City of Grand Junction Engineering Division Standard Specifications for Construction of Underground Utilities – Waterlines, Sanitary Sewers, Storm Drains, Underdrains, and Irrigation Systems

B. City of Grand Junction Engineering Division Standard Specifications for Road and Bridge Construction

C. CDOT – Colorado Department of Transportation

D. UDFCD – Urban Drainage and Flood Control District

E. CDPHE – Colorado Department of Public Health and Environment

1.4 SUBMITTALS

A. Submit under provisions of Division One specifications.

B. Submit the following information:

1. Erosion Control Plan,
2. Construction schedule for Erosion Control per Article Scheduling,
3. Sequencing Plan per Article Scheduling,
4. All applicable permits for Erosion Control.

C. Product data: Submit on all products or materials supplied herein.

1.5 REGULATORY REQUIREMENTS

A. Obtain and comply with all requirements of City of Grand Junction and CDPHE Stormwater and/or Groundwater Discharge Permits, as required.

B. 401 Construction Dewatering Industrial Wastewater Permit (Construction Dewatering Permit 401):
1. Contractor shall apply for and obtain a Construction Dewatering Permit 401 from the Colorado Department of Public Health and Environment.
2. All costs for this permit shall be the responsibility of Contractor.
3. This permit requires that specific actions be performed at designated times.
4. Contractor is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
5. Contractor shall allow the Colorado Department of Public Health and Environment or other representatives to enter the site to test for compliance with the permit.
6. Non-compliance with the permit can result in stoppage of all work.

C. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.6 SCHEDULING

A. Sequencing Plan:
1. Contractor shall submit a sequencing plan for approval for erosion control in conformance with Contractor's overall Construction Plan for approval by Owner
2. Changes to the Erosion Control Sequencing Plan may be considered by Owner only if presented in writing by the Contractor.

B. Temporary Erosion Control:
1. When so indicated in the Contract Documents, or when directed by City of Grand Junction. Contractor shall prepare construction schedules for accomplishing temporary erosion control work including all maintenance procedures.
2. These schedules shall be applicable to clearing and grubbing, grading, structural work, construction, etc.

C. Contractor shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.

D. Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the accepted schedule. Temporary

erosion control measures shall then be used to correct conditions that develop during construction.

E. Work shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Comply with all applicable municipal or local Municipal Separate Storm Sewer System (MS4) requirements.

B. All materials shall be submitted for approval prior to installation.

C. Natural or biodegradable materials shall be reasonably clean, free of deleterious materials, and certified weed free. Materials may include, but are not limited to, hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel.

D. Grass Seed:
   1. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
   2. All grass seed shall be approved by Owner and Engineer and in accordance with local regulations prior to installation.

E. Fertilizer and soil conditioners shall be approved by Owner and in accordance with local regulations prior to installation.

F. Silt Fence Fabric: woven polypropylene
   1. Mirafi 100X, "Envirofence"
   2. Or accepted substitution

G. Temporary Slope Stabilization Mat (short term): 1.5 pound photodegradable polypropylene top and bottom nets, 100% straw fiber matrix, with a longevity of 12 months.
   1. North American Green S150
   2. Or accepted substitution

H. Temporary Slope Stabilization Mat (extended term): 3.0 pound UV-stable polypropylene top net, 1.5 pound photodegradable polypropylene bottom net, 70% straw/30% coconut fiber matrix with a longevity of 24 months.
   1. North American Green SC150
   2. Or accepted substitution

I. Biodegradable Slope Stabilization Mat (short term): 9.3 pound leno-woven biodegradable jute top net, 7.7 pound woven biodegradable jute bottom net, 100% straw fiber matrix with a longevity of 12 months.
   1. North American Green S150BN
   2. Or accepted substitution

J. Biodegradable Slope Stabilization Mat (extended term): 9.3 pound leno-woven biodegradable jute top net, 7.7 pound woven biodegradable jute bottom net, 70% straw/30% coconut fiber matrix with a longevity of 18 months.
   1. North American Green SC150BN
   2. Or accepted substitution

K. Permanent Channel Stabilization Mat [flow velocities between 9.5 (unvegetated) and 15 (vegetated) fps]: 5.0 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 70% straw/30% coconut fiber matrix.
   1. North American Green SC250
   2. Or accepted substitution

L. Permanent Channel Stabilization Mat [flow velocities between 10.5 (unvegetated) and 20 (vegetated) fps]: 8.0 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 100% coconut fiber matrix.
   1. North American Green SC350
   2. Or accepted substitution

M. Permanent Channel Stabilization Mat [flow velocities between 12.5 (unvegetated) and 25 (vegetated) fps]: 24 pound UV-stable polypropylene top and bottom nets, 24 pound UV-stable polypropylene corrugated center net, 100% polypropylene fiber matrix.
   1. North American Green P550
   2. Or accepted substitution

PART 3 EXECUTION

3.1 GENERAL

A. All temporary and permanent erosion and sediment control practices will be maintained and repaired as needed to ensure continued performance of their intended function.

B. Owner will monitor Contractor's erosion control methods. If the overall function and intent of erosion control is not being met, Owner will require Contractor to provide additional measures as required to obtain the desired results.

C. The erosion control features installed by Contractor shall be adequately maintained by Contractor until the project is accepted.

3.2 PROTECTION OF ADJACENT PROPERITES

A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.

B. In addition to the erosion control measures required on the drawings, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
   1. Vegetated buffer strip around the lower perimeter of the land disturbance.
      a. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
   2. Sediment barriers such as straw bales, erosion logs, and silt fences.
   3. Sediment basins and porous landscape detention ponds.
   4. Combination of above measures.

3.3 CONSTRUCTION

A. Stabilization of Disturbed Areas:
   1. Temporary sediment control measures shall be established within five (5) days from time of exposure or disturbance.
   2. Permanent erosion protection measures shall be stablished within five (5) days after final grading of areas.

B. Stabilization of Sediment and Erosion Control Measures:
   1. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
   2. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
   3. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.

C. Stabilization of Waterways and Outlets:
   1. All onsite stormwater conveyance channels used by Contractor for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
   2. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.

D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.

E. Construction Access Routes:
   1. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.

2. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
3. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area.
4. Street washing shall be allowed only after sediment is removed in the manner described above.

3.4 DISPOSITION OF TEMPORARY MEASURES

A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by Owner

B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.

C. Substantial Completion of Erosion Control Measures:
1. At the time specified in the Contract Documents, and subject to compliance with specified materials and installation requirements, Contractor shall receive a Substantial Completion Certificate for temporary erosion control measures.
2. Maintenance of Erosion Control Measures after Substantial Completion: Contractor shall be responsible for maintaining temporary erosion control measures as specified in the drawings and Contract Documents until such time as work has been accepted by Ownerand as specified in Division 1 for Closeout Procedures.

PART 4 MEASUREMENT FOR PAYMENT

4.1 LUMP SUM

A. Contractor shall include in the bid price for erosion and sedimentation control work a minimum of all items shown on the Erosion Control Plan, as required by City of Grand Junction, and any additional items that may be needed to control erosion and water pollution throughout all phases of the project.

END OF SECTION

SECTION 02540

CURED-IN-PLACE THERMOSETTING RESIN PIPE – SEWER MAINS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This Specification includes the minimum requirements for the rehabilitation of sanitary sewer pipelines by the installation of Cured-In-Place Pipe (CIPP) within the existing, deteriorated pipe as shown on the plans included as part of these contract documents. It also includes the cleaning, cameraing and flushing of existing sanitary sewers, and repair of all deficiencies shown in the contract documents and in the cameraing prior to installation of CIPP.

B. The rehabilitation of sanitary sewer pipelines shall be done by the installation of a resin-impregnated flexible tube which, when cured, shall be continuous and tight-fitting throughout the entire length of the original pipe. The CIPP shall extend the full length of the original pipe and provide a structurally sound, jointless and water-tight new pipe within the pipe. The Contractor is responsible for proper, accurate and complete installation of the CIPP using the system selected by the Contractor. Domestic sewerage with potential ground water infiltration will be present in the existing sanitary sewer. Service connections shall be reestablished after the CIPP is cured.

1.2 RELATED SECTIONS

A. 02770 – Cured-In-Place Thermosetting Resin - Laterals

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))
   2. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
   3. D1330 – Standard Specification for Rubber Sheet Gaskets
   4. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
   5. D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC)
   6. D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
   7. D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
   8. D2240 – Standard Test Method for Rubber Property – Durometer Hardness
   9. D2321 – Standard Specification for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

10. D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
11. D2774 – Standard Specification for Underground Installation of Thermoplastic Pressure Piping
12. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
13. D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
14. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
15. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
16. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
17. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
18. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
19. D790 – Test methods for flexural properties of non-reinforced plastics
20. F412 – Standard Terminology Relating to Plastic Piping Systems
21. F1216 – Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube
22. F1743 – Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe
23. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
24. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
25. F679 – Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
26. F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
27. F2164 – Standard Specification for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure

B. City of Grand Junction Design Standards and Specifications

1.4 SUBMITTALS

A. Submit under provisions of Division 1 Specifications

B. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications

C. Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight.

1. Pipe materials
2. Special, fitting, and coupling details
3. Gasket materials
4. Laying and installation schedule
5. Specifications and data sheets
6. Affidavits of compliance for protective shop coatings and linings

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

E. Manufacturer's Field Start-up Report
1. Indicate personnel present and actual tests procedures that were performed by manufacturer's representative
2. Manufacturer to submit field verification of proper assembly

F. TV Inspection Files: Submit videos and reports outlining all sanitary sewer deficiencies and the contractor’s proposed repair by actual location. The report should also include all service locations by location and pipe diameter confirmation.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1 Specifications

B. Accurately record actual locations of piping mains, connections, invert elevations, and any mapped or unmapped utilities

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with City of Grand Junction’s the construction documents, and as specified herein.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 10 years

C. All CIPP liner, regardless of diameter, shall be supplied by a single manufacturer

D. Perform Work in accordance with the Colorado Department of Public Health and Environment (CDPHE) and City of Grand Junction

E. Contractor shall conduct visual inspection and repair all deficiencies before installation of CIPP liner

F. Provide manufacturer's name and pressure rating marked on piping

G. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines

1.7 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of City of Grand Junction, City of Grand Junction, CDPHE, contract documents and as specified herein.

B. Contractor, not Owner, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1 Specifications

B. During loading, transporting and unloading, exercise care to prevent damage to material
1. Use nylon slings only
2. Do not drop pipe or fittings
3. Do not roll or skid against pipe already on ground
4. Repair any damage done to coating or lining
5. Handle per manufacturer's recommendations
6. Store rubber gaskets in cool dark location
7. Store all material on wood pallets or timbers

C. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Owner

D. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Owner

E. Pipe
1. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation
2. CIPP liner has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling CIPP pipe during cold weather
3. Do not store CIPP liner uncovered in direct UV light
4. Pipe stored along the trench side shall be suitably supported off the ground to avoid damage to the coating

1.9 JOB CONDITIONS

A. All work which requires the interruption of active sanitary sewer service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the City of Grand Junction and coordinated as specified in Division 1

B. Contractor shall coordinate all service outages with property owners and the City of Grand Junction at least 48 hours in advance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CIPP Liner
   1. Insituform Technologies, Inc.
   2. Layne, Inc
   3. LMK Technologies, LLC
   4. Or accepted substitution prior to bid

2.2 DESIGN CONSIDERATIONS

A. CIPP shall be designed in accordance with ASTM F1216 and D5813

B. CIPP design for the main sheet shall assume no bonding to the original pipe

C. The resin saturated main sheet must place the resin in full contact with the host pipe. The cured liner must provide coating on the interior of the lateral piping for an improved flow rate.

D. The liner must be smooth and have an average roughness coefficient “n” factor of 0.011 or lower.

2.3 GENERAL

A. The CIPP liner shall be constructed of materials and methods that provide a jointless and continuous structurally sound liner able to withstand all imposed static, and dynamic loads on a long-term basis.

B. Design lining material to have sufficient structural strength to support dead loads, live loads, and groundwater load imposed, assuming existing pipe cannot share loading or contribute to structural integrity of liner.

C. Field measurements of the existing pipe diameters, ovality and length shall be taken.

D. Pipe liner shall be capable of installation with water in the carrier pipe and surrounding groundwater.

E. The flexible tube shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.

F. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise shown or specified. The Contractor shall verify the lengths in the field before impregnation.

2.4 CURED-IN-PLACE-LINER

A. Unless otherwise specified, the Contractor shall furnish a general purpose, unsaturated, polyester or thermosetting vinyl esther resin and catalyst system compatible with the reconstruction inversion process that provides cured physical strengths specified herein, and complies with ASTM D5813, F1216, F1743, and F2019.

B. Liner material shall be manufactured with resins pre impregnated within the liner to eliminate the possibility of air bubbles and voids. Resin shall be a corrosion-resistant polyester or vinyl ester resin and catalyst system that, when properly cured within tube composite, meets requirements of ASTM F1216, F1743, and F2019

C. The liner thickness shall be sized for a minimum hydrostatic load of 8.0 feet and maximum depth of earth cover as measured in the field. The hydrostatic load shall be increased to the manhole depth plus 1.0 foot for bury depths in excess of 8.0 feet.

D. The finished pipe liner in place shall be fabricated from materials which when complete is chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperature of 150ºF.

E. Minimum Design Criteria:
1. Minimum flexural strength: 4,500 PSI
2. Initial Modulus of Elasticity: 250,000 PSI
3. Nominal CIPP Thickness: Per ASTM F1216, Minimum of 6mm

2.5 HYDROPHILIC GASKET SEAL

A. The rubber joint seal shall be an extended hydrophilic rubber compounded from chloroprene (Neoprene) rubber and a hydrophilic resin, which expands on contact with water.

B. The rubber joint seal shall be bonded with adhesive on one face to hold it in place during assembly.

C. On contact with water, the rubber shall swell by up to 10 times its original volume if necessary and mold itself to completely fill any gaps and exert pressure evenly to ensure the seal. High compression or bolt up forces shall not be necessary to effect a complete and watertight seal.

D. Hydrophilic rubber joint seals shall be installed at all manhole walls for all lining products.

E. The mainline tube shall include a seamless molded flange shaped gasket attached to the main liner tube at the connection or four molded hydrophilic O-rings at the mainline termination ends.

F. The gaskets must be a minimum of 2.5mm thick and must retain this consistent thickness under installation pressures.

G. The hydrophilic gasket seals must be manufactured in a controlled factory environment with strict quality control and quality assurance protocols.

H. A liquid sealant, adhesives or other fluid like materials having paste like consistency will not be accepted.

2.6 SOURCE QUALITY CONTROL

A. Inspect extruded material for defects and physical properties according to ASTM D1785. Verify liner material is homogeneous and free of defects, cracks, holes, blisters, protrusions, foreign materials, or other deleterious faults.

B. Marking:
   1. For testing purposes, mark each production lot with identical marking number.
   2. Mark each reel of folded PVC pipe at intervals not to exceed 5 feet with coded number identifying manufacturer, size, cell class, machine, shift, and date when liner was extruded.

C. Chemical and Physical Testing: Test cured samples according to ASTM D526

PART 3 EXECUTION

3.1 PREPARATION

A. Cleaning: Clean existing sewer pipes of debris, sedimentation, and mineral deposits with high-velocity cleaner, bucket and scraper, root saws, rolling or balling units, or other appropriate means. Heavy cleaning shall be used in locations where standard cleaning procedures are unable to clean the existing main to the required level.

B. Cameraing: Existing pipes are to be cameraed after cleaning and prior to installation of CIPP liner

C. Bypassing Sewage:
   1. Set up bypassing pump system to isolate each section of piping for relining.
   2. Maintain bypass pumping until lining is totally formed and service connections reestablished.

3.2 ACCESS SAFETY

A. Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations.

3.3 SANITARY SEWER REHABILITATION PROCEDURES

A. Pipe Rehabilitation (CIPP) for limits between manholes, or as shown.

B. Sewer lines with no indication for pipe rehabilitation (CIPP) are to have no work performed on them.

C. Where practicable, liners should be installed in continuous runs where there are two or more continuous manhole segments. This is especially desirable to connect several short manhole segments with a continuous lining.

D. Pipe rehabilitation with cured in place thermosetting resin pipe (CIPP) methods must adhere to ASTM F1216 and F2019 for pulled in place installation.
   1. Work includes installation of continuous lengths of homogeneous resin impregnated flexible tube cured tight to existing pipe wall with UV curing, pressurized steam, or in accordance with the manufacturer's recommendations.
   2. Work includes:
      a. Field air testing
      b. Point repair prior to lining where necessary

E. Contractor Responsibilities Include:
   1. Contractor to install the specified system must be responsible for complete performances of such, including, but not limited to:
      a. Materials
      b. Application
      c. Quality Control
   2. Contractor will supply owner with documentation showing past installation experience and licensing prior to construction.
   3. Contractor prequalification may be required by individual product manufacturers.
   4. Contractor shall inspect all surfaces and sewers prior to construction and notify owner of any discrepancies or disparities that may interfere with proper preparation or installation.
   5. Contractor must comply with all requirements of the manufacturer.
   6. Contractor is responsible for all quality assurance testing of systems after construction.
   7. Contractor must submit staging area plan that identifies the extents of each required staging area to complete the work and traffic control plan to Owner for approval prior to beginning CIPP work.
   8. Contractor is responsible for all sewage bypass equipment and traffic control.
   9. After the liner has been installed, as directed by Engineer, existing services shall be temporarily reinstated to 95% of the original opening.

a. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360-degree television camera and a cutting device that reestablishes the service connection.
b. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service shall also be used to assist the operator in cutting or trimming.
c. Restored openings should be neatly and smoothly cut and without rough edges. Care must be exercised not to damage the CIPP or the existing main or lateral pipes. Service Top Hats shall be installed where required.
d. Connections should not be over-cut as this could damage the pipe, break the CIPP watertight seal and/or interfere with future lining of the lateral. Any damage to the liner or lateral while reinstating services will be repaired by a hat or injection sealing method, no grouting will be allowed and no separate payment shall be made for such repair.

3.4 FINISHED CIPP

A. It shall be a homogenous CIPP liner assembly from manhole to manhole.

B. The CIPP shall be smooth with minimal wrinkling and shall increase flow rate.

C. The profile of the hydrophilic molded gaskets should be visible and verifiable during post-video inspection on liners 6mm or thinner thickness.

D. The CIPP shall be free of dry spots, lifts, and delamination.

E. The CIPP shall include a textile taper at each end providing a smooth transition to the host mainline liner for accommodating video equipment and maintaining proper flow in the mainline.

3.5 TESTING

A. The wall thickness shall be measured in accordance with the applicable sections of ASTM Test Method D5813 and D3567. One test shall be taken for every 500 LF of lining completed.

B. Flexural strength and flexural modulus of elasticity shall be determined in accordance with ASTM D-790. One test shall be taken for every 500 LF of lining completed.

C. After installation or during the curing/installation process, Contractor shall conduct a mainline integrity pressure test. The test must demonstrate CIPP mainline is watertight.
1. The Contractor shall furnish all necessary equipment to conduct the test. An acceptable method is a low-pressure air test, conducted as follows:
2. Pressurize the test section to 4.0 psi and hold above 3.5 psi for not less than 2 minutes. Add air if necessary to keep the pressure above 3.5 psi. At the end of this 2-minute stabilization period, note the pressure (must be a 3.5 psi minimum) and begin the timed period. If the pressure drops 0.5 psi in less than the time given in the table below, the section of pipe shall have failed the test.

3. When the prevailing groundwater is above the sewer being tested, test pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer
4. If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be re-pressurized to 3.5 psi and the test repeated.
5. The pressure gage used shall be supplied by the Contractor and have minimum divisions of 0.10 psi and be oil filled. Chemical Resistance – The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.
6. Hydraulic Capacity – Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.
7. CIPP Field Samples – When requested by the Owner, the Contractor shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in Section 5.5 have been achieved in previous field applications. Samples for this project shall be made and tested as described in Section 10.1.

3.6 PROSECUTION OF WORK

A. All sewer services connected to the main shall be reinstated after the sewer main has been lined or replaced due to defects. The Contractor shall note that not all sewer lines segments have been televised in their entirety due to obstructions blocking further entry, etc. These obstructions shall be cleared to allow TV viewing of the entire segment length and all pipe deficiencies repaired before lining is commenced. Existing sanitary sewer segments may be broken and contribute considerable ground water to the sewer main or contain considerable amounts of grease, roots or other debris.

3.7 FINAL ACCEPTANCE

A. All CIPP sample testing and repairs to the installed CIPP as applicable shall be completed, before final acceptance, meeting the requirements of these specifications and documented in written form.

B. The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, after installation of the CIPP liner and reconnection of the side sewers. The finished liner shall be continuous over the entire length of the installation and shall be free of significant visual defects, damage, deflection, holes, leaks and other defects. Unedited digital recordings of the inspection shall be provided to the Owner within ten (10) working days of the liner installation. The data shall note the inspection date, manhole depths from rim to inverts, location of all reconnected side sewers, debris, defects in the liner, including but not limited to gouges, cracks, bulges, or bumps and repair of all pipe deficiencies at no additional cost to the owner. Immediately prior to conducting the video

inspection, the Contractor shall thoroughly clean the newly installed liner removing all debris and build-up that may have accumulated, at no additional cost to the Owner.

C. Bypass pumping from the upstream manhole shall be utilized to minimize sewage from entering the line during the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the inspection. A bypass pumping plan shall be provided to the engineer and owner for each segment of sanitary sewer pipe to be lined for review and approval.

D. Provide video files of TV inspection for review and approval

END OF SECTION

SECTION 02550

CURED-IN-PLACE PRESSURIZED PIPE - WATER MAINS

PART 1 GENERAL

1.01 SUMMARY

A. It is the intent of this specification to provide the reconstruction of the designated pressure pipe by installation of a new cured-in-place-pipe (CIPP) within the existing (host) pipe. The CIPP shall be designed as a fully structural Class IV pipe, not relying on the remaining strength or water tightness of the host pipe to withstand long-term external loading and internal pressure.

B. The proposed product shall also be certified as complying with the requirements of NSF/ANSI Standard 61.

C. In case of conflicting requirements between this specification and the AWWA standards, this specification will govern.

1.02 REFERENCES

A. ASTM D578 – Standard Specification Glass Fiber Strands

B. ASTM D638 – Standard Test Method for Tensile Properties of Plastics

C. ASTM D790 – Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials

D. ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

E. ASTM D3567 – Standard Practice for Determining Dimensions of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

F. ASTM D5813 – Standard Specification for Cured-in-Place Thermosetting Resin Sewer Piping Systems

G. ASTM F1216 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube

H. ASTM F1743 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)

I. ASTM F2019 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic Cured-in-Place (GRP-CIPP) Using the UV-Light Curing Method

J. AWWA M28 – Rehabilitation of Water Mains

K. AWWA Committee Report – Structural Classifications of Pressure Pipe Linings

L. NSF/ANSI Standard 61 – Drinking Water System Components

M. 29 CFR 1910.146 – Permit Required Confined Spaces

1.03 SUBMITTALS

A. INSTALLER QUALIFICATIONS

1. All trenchless rehabilitation installers must submit a project history list of at least five recent successful jobs performed in the past two years detailing the total length in feet and size of installed CIPP for each project, total project duration, and project cost to allow the Owner to see prior work experience and confirm installers are qualified for the work required.

B. INSTALLER PRODUCT MATERIALS

1. The following submittals to the Owner & Engineer are required:

a. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications.

b. The CIPP tube manufacturer, resin impregnation facility, and lining installer all shall operate under a quality management system which is third-party certified to ISO 9000 or other internationally recognized organization standards. Additionally, if the lining installer is not the CIPP tube manufacturer, the lining installer must be formally licensed by the CIPP tube manufacturer to install the product. Proof of ISO certification and licensing status, as applicable, shall be required for approval.

c. Detailed design calculations for both the internal and external loading parameters specified in Section 2.01. shall be submitted for review and approval. The CIPP shall be designed as per ASTM F1216, Appendix X1.3.2 for the Fully Deteriorated Pressure Pipe condition and shall follow the requirements specified in Section 2.01.

C. INSTALLER MEANS AND METHOD

1. The Contractor shall submit an access point plan to the Owner for review and approval with all details, dimensions, traffic control, and any other information required for the installation, disinfection, and testing of liner.

D. PRODUCT, MANUFACTURER APPROVALS

1. To ensure that the finished product meets the quality control standards set forth by the Owner, all CIPP liners shall be impregnated by a facility that is approved by the product's Manufacturer (both dry liner and resin).

PART 2 PRODUCTS

2.01 MATERIALS

Materials that are defective, damaged, or otherwise deemed unacceptable by Owner or Engineer for use prior to installation shall be rejected and replaced at Contractor's expense.

1. CIPP LINER

A. The fully structural, Class IV CIPP liner system utilized for reconstruction of the designated pressure pipe shall be manufactured by:
   I. Insituform Technologies, LLC
   II. RS BlueLine
   III. CIPP H20®
   IV. Or approved equal

B. The CIPP tube product shall consist of one or more layers of absorbent woven and/or non-woven synthetic fiber, with glass or woven fiber reinforcement, which is fabricated in the USA. The CIPP tube is then impregnated with a thermoset resin system that is compatible with the installation process being used. For potable water applications, the completed liner shall meet NSF/ANSI 61 certification requirements.

C. The tube shall be fabricated to dimensions such that when installed will fit tightly to the internal circumference of the host pipe being lined, making allowance for stretching during installation. Accurate measurement, in at least four clock angles (E.g. 3 o'clock to 9 o'clock; 12 o'clock to 6 o'clock; 10 o'clock to 4 o'clock; 2 o'clock to 8 o'clock), of the host pipe internal diameter shall be undertaken prior to ordering/fabricating the tube.

D. In the installed state, the inside layer of the tube shall be coated with a translucent, flexible plastic material that acts to separate the curing heat medium from the thermoset resin system undergoing cure.

E. The tube shall provide a finished thickness that complies with CIPP industry standards that when compressed at installation pressures will meet or exceed the minimum required thickness specified in the design submittals (see Section 1.03-A.2.c).

F. Fabricate tube from materials which, when cured, will be chemically resistant to internal exposure to drinking water treated with common chemical additives.

G. The tube shall contain no intermediate or encapsulated elastomeric layers. The tube shall contain reinforcement (glass, woven fiber, or equal) to withstand the internal pressure design requirements, in a configuration determined by the manufacturer. This may result in an anisotropic cross-section.

H. The wall color of the interior pipe surface of the CIPP after installation shall be a light reflective color so that a clear detail examination may be made of the final product.

I. Liner materials damaged during installation shall be repaired or replaced as recommended by the Contractor and approved by the Owner.

J. The liner shall be characterized and proven as detailed in AWWA Manual M28, with appropriate reference to AWWA Committee Report, Structural Classification of Pressure Pipe Liners. It shall be designated and designed to provide a Class III Semi-structural Liner or Class IV Fully Structural Liner as identified by the Owner's Design Intent and requirements.

K. The CIPP shall be designed as per ASTM F1216, Appendix X1.3.2 for the Fully Deteriorated Pressure Pipe condition and shall be provided as a prequalification submittal (see Section 1.03-A.2.c). These detailed calculations shall provide the input data as well as the actual calculation for Eqs X1.1, X1.3, X1.4 and X1.7 of Appendix X1. of ASTM F1216. The design submittal shall also clearly identify the physical properties used for design. Design shall also verify axial strength to meet specifications. The liner design shall not require or infer full length adhesion or bond to the host pipe, providing a liner totally independent of the host pipe.

L. Other than what is allowed in ASTM F1216, the CIPP design shall assume no contribution from the original host pipe.

M. The design of the CIPP shall be based on the following parameters:

Diameter	*20* inch
Internal Design Pressure	*90* psi
Ovality	2 %
Soil Depth (above invert)	*4.5* feet
Ground Water Depth (above invert)	N/A
Type of Live Load	8 Railroad Tracks
Modulus of Soil Reaction	Contractor to Determine psi
Soil Density	Contractor to Determine pcf
Surge	Contractor to Determine psi

N. The physical properties used in the design submittal (see Section 1.03-A.2.c) shall be clearly identified. At a minimum, the CIPP shall have the following physical

properties:

PROPERTY	ASTM TEST METHOD	MINIMUM VALUE*
Initial Flexural Modulus of Elasticity	D790	400,000 psi
Initial Flexural Strength	D790	7,000 psi
Initial Tensile Strength	D638**	6,500 psi

*Values are for design conditions @ 75°F (25°C)

** For materials that do not allow sufficiently accurate hoop/weft testing per ASTM D638, initial tensile strength may also be substantiated by short-term burst testing results or ASTM D2290 hoop test results.

PART 3 EXECUTION

3.01 INSTALLATION

A. Project Planning

1. The Contractor shall provide adequate notice to the Owner prior to mobilization. The Contractor will notify customers and local fire department of work being performed in the area.

2. Contractor shall supply all necessary equipment including piping, flexible hoses, fittings, and approved backflow prevention devices required for cleaning, flushing, and pressure testing the waterline. Contractor is also responsible for acquiring the water required for all cleaning, flushing, and pressure testing as well as disposing of all water according to federal, state, and Mesa County requirements.

B. Access, Cleaning and Inspection

1. Prior to entering any permit required confined space the Contractor shall make an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen. This shall be undertaken in accordance with local, state, or federal safety regulations.

2. The Contractor shall identify the number and location of access points required and is responsible for the installation of all access pits. The Owner shall provide rights of access to the pipeline. The Contractor shall provide the excavation, pipe work, reconnection, and restoration for access points.

3. Immediately upon opening the host main at the access points and prior to installation of liner, the ends of the adjacent existing water main that are not to be lined at the insertion/extraction points shall be covered/plugged by the Contractor so that no debris shall enter into them during reconstruction work.

4. The Contractor shall remove all internal debris out of the pipeline that will interfere with the installation. Pipes shall be cleaned by the Contractor, as needed, with high-velocity jet cleaners, mechanically powered equipment, cable-attached devices or fluid-propelled devices (e.g., pipe pigs). If required, the Contractor shall coordinate with Owner to locate a proper dump site for all debris removed from the pipe during the cleaning operation.

5. Verification of readiness to install liner shall be performed by experienced personnel trained in locating services, breaks, obstacles, etc. This may include pipe mandrels or other devices up to and including closed-circuit television or man entry. The interior of the pipeline shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the impregnated tube. A video tape or suitable log shall be kept for reference. It will be the Contractor's responsibility to remove any unforeseen obstructions that may prevent liner installation at no additional charge.

6. Any external water leaking back into the existing pipeline shall be kept to a minimum to the installer's requirements so as not to interfere with the proper installation and cure of the CIPP liner

7. The Contractor shall field verify the length of water main sections to be cleaned and lined.

8. The Contractor shall isolate or remove any air release valves, other valves or other appurtenances that require replacement or that could impede the lining operation from the pressure pipe section prior to liner installation.

9. The Contractor shall flush the host pipe with clean water to remove any loose debris from the pipe surface. Wherever practical, remove standing water from the inside surfaces of the cleaned pipeline by passing oversized foam swabs through the main or use a progressive expansion method to remove standing water.

10. The specified lining system is independent of the host pipe, and full-length bond is not required; therefore, surface moisture to the manufacturer's recommendations may be tolerated.

11. The Contractor is responsible for all dewatering efforts for access pits and liner installation as well as all dewatering permits and discharge permits required to complete the work.

12. For lining work within railroad right-of-way the Contractor is responsible for obtaining all access permits and meeting all applicable requirements of the railroad owner.

C. Television Inspection

1. The Contractor shall include a report that identifies all defects, the location of defects, and the proposed repair to the Owner for review and approval.

2. The Contractor shall perform closed circuit television inspection of existing water mains at two intervals: after pipe preparation/prior to water main lining and upon completion of the lining process. The Contractor shall provide the Owner with a complete set of all CCTV inspections in a format acceptable to the Owner. The picture quality and definition shall be acceptable for viewing and the files shall be compatible with standard DVD or storage device equipment compatible with Owner specified viewing software. Information in the files shall identify the water main section, direction of taping, and the date of inspection. The CCTV files shall include voice description of the location of any identified defects

D. Resin Impregnation

1. The quantity of resin used for tube impregnation as well as the required gap setting under which the liner is to be impregnated shall be specified by the dry liner manufacturer. During saturation, a vacuum impregnation process (or approved equal) shall be used to ensure thorough resin saturation throughout the length of the felt tube.

2. During resin injection, resin samples shall be collected and tested for exotherm time in a "gel test bath". These tests will serve as a quality control measure for the proper catalyst-resin ratio. Samples shall be collected at the beginning and end of the resin pump based on the resin manufacturer's recommendations, as well as a minimum of (2) gel tests per tube and a minimum of (1) gel test every 2,000 pounds pumped.

3. Evidence of proper saturation and catalyzation shall be provided with every liner installed on the job. This will be in the form of "gel test" logs as well as wetout report documenting including the following:

    a. Dry liner and resin manufacturer LOT numbers
    b. Diameter, thickness, length information
    c. Actual pounds of resin per liner
    d. Recommended gap setting
    e. Liner manufacturer's maximum/minimum/ideal heads/pressures
    f. Resin manufacturer's recommended cure times at minimum interface temperatures.
    g. Proper DOT Compliance for shipping of wet-out tubes, and proper truck placarding

4. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Installer uses an alternate method of resin

impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven and accepted by the liner manufacturer.

E. Installation

1. The wet out tube shall be inserted through an approved access point by means of a pull-in place method or a direct inversion process, or a combination of the two. The installation pressure or head used to extend the liner tube though the entire length of pipe being rehabilitated shall be sufficient to fully extend and expand the tube both circumferentially and longitudinally. The installation head may be provided by water or air pressure. The Manufacturer shall provide installation head envelope for each installation.

2. Before the installation begins, the Contractor shall determine the minimum pressure required to hold the tube tight against the existing pipeline, and the maximum allowable pressure to prevent tube damage. In order to ensure a proper fit of the CIPP tube to the host pipe, the pressure shall be maintained between the minimum and maximum pressures until the installation has been completed. The Manufacturer shall provide installation pressure envelope for each liner.

3. The use of a lubricant during the installation process may be needed to reduce friction. The lubricant used shall be nontoxic and certified for use by the tube manufacturer.

F. Curing

1. After tube installation into the host pipe is completed, the curing process shall be initiated. Appropriate curing procedures are to be followed depending on the curing method selected. For photoinitiated curing, a UV-light system is to be utilized. For heat cured liners, equipment to deliver hot water or steam is to be utilized. The curing process as developed by the Manufacturer shall be followed. The process equipment that is utilized must be certified by the Manufacturer for curing their liner product.

2. NSF/ANSI Standard 61 potable water requirements are required, the curing process must follow the steps laid out as part of the Manufacturer's certification.

3. For lines where no service connections are included, a Distributed Temperature Sensing (DTS) system that captures a continuous temperature profile along the length of the pipe shall be utilized to monitor curing. The temperature sensing device shall be placed prior to installing the lining system between the impregnated tube and the invert of the existing pipe.

G. Cool-Down

1. Manufacturer's directions for cool-down, NSF/ANSI Standard 61 certified CIPP the cool-down procedures laid out in the certification, shall be followed. Care shall be taken in the release of the internal head so that a vacuum will not be developed which could damage the newly installed CIPP.

3.02 INSPECTION AND TESTING

A. All testing shall be performed by the Contractor and meet the requirements of ASTM F1216, and shall include consideration of AWWA guidelines referenced herein.

B. After the cured lining system has been cooled down, a preliminary television inspection of the newly installed liner shall be performed to determine that the liner is properly installed. The CIPP is to be pressure tested, the post video will be delayed until after the successful testing.

C. Confirm fit and finish meets the visual classification standards of ASTM D5813 and that the liner is free of excess wrinkling or other feature(s) that reasonably may compromise its functional or structural performance design objective. The finished lining shall be continuous over the entire length and be free from visual defects such as foreign inclusions, pinholes and delaminations. Other defects, such as lifts, folds, fins or wrinkles will only be acceptable if it can be proven that the reinforcing fabric is not present in this defect. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to the inside of the lined pipe. Secure representative samples for testing. Confined samples for testing to confirm the CIPP flexural strength, flexural modulus and thickness in accordance with the requirements of ASTM D5813, D790, and ASTM D3567 for each liner installed.

D. Confined samples may not permit required testing in the hoop direction, which is the critical orientation to confirm strength in pressure pipe liners. In these cases, a flat plate sample shall be prepared to industry standards to accommodate appropriate testing.

E. The tested samples shall meet or exceed the structural properties as per ASTM F1216, or meet or exceed the structural properties specified in the design, whichever are greater.

3.03 PRESSURE TESTING FOR WATER-TIGHTNESS

A. Hydrostatic pressure testing for water-tightness shall be undertaken on all CIPP sections identified by the Owner in the contract documents and shall be completed after the installation but before the inspection and any reinstatement of the pipe's connections. Testing procedures must follow section 105.4 – Testing Pressure Pipelines of Grand Junction's Construction Standards.

3.04 SERVICE CONNECTIONS AND END FITTINGS

A. Mechanical Service Connections for Water Mains

1. Prior to installation of the liner, the Contractor shall locate all existing service connections and internally plug by video camera directed internal robotics these corporation valve connections as recommended by the manufacturer. All plugs shall be sized for the respective water taps and shall be designed to prevent resin migration into the service. The service plugs used in this process shall be able to withstand the temperatures and pressures expected during the cure of up the CIPP.

2. After the lining is complete and after the pressure test is successfully performed, reconnect existing services from the interior of the water main using video camera directed robotics that removes a small, circular section of the liner to expose the corporation valve opening, then insert a stainless steel, flow-thru mechanical fitting into the existing corporation valve. The stainless steel insert wall thickness shall be minimized to maximize the available service opening at the confluence with the mainline pipe. The fitting shall be equipped with a polymeric sealing gasket that ensures a watertight seal to the liner.

3. Reconnection of the service opening, and removal of the plug shall result in a finish free of burrs, frayed edges, and other restrictions which may prevent a watertight seal with the stainless steel and gasket insert. If required, back flush the reinstated service line from the house or meter.

4. Any services that cannot be reinstated internally by robotics because of technical limitations, shall be reinstated externally thru local excavations and shall be done at the Contractor’s expense. These shall be reconnected by use of City of Grand Junction approved mechanical fittings. This may exclude saddled style services which may be specified for external reconnection.

B. Adhesive Water Main Service Connections

1. Prior to installation of the liner that require the CIPP to be adhesively bonded at the service connections, appurtenances or the host pipe barrel section, the Contractor shall clean and prepare the pipeline surface to a condition that provides suitable surface finish for bonding in the vicinity of the service connection.

2. To achieve appropriate surface preparation for adhesive service reinstatement, the pipe shall be prepared using a dry cleaning process in accordance with SSPC-SP 7/NACE No. 4 standards and prepare the protruding service connections in accordance with SSPC-SP 6/NACE No. 3. Previously applied coatings present in the pipeline shall be completely removed in order to provide a fully prepared metallic surface. The dry

cleaning preparation methodology shall be the Tomahawk System by Envirologics, or prior approved equal.

3. Prior to installation of the liner, the Contractor shall locate all existing service connections and internally plug by video camera directed internal robotics these corporation valve connections as recommended by the manufacturer. All plugs shall be sized for the respective water taps and shall be designed to prevent resin migration into the service. The service plugs used in this process shall be able to withstand the temperatures and pressures expected during the installation and cure of the CIPP.

4. After both the lining is complete and the pressure testing is performed, reconnect existing services from the interior of the water main using video camera directed robotics that remove a small, circular section of the liner to expose the corporation valve opening.

5. Reconnections shall be free of burrs, frayed edges, and other restrictions preventing free water flow, and shall be opened to the size of their original diameter and to a depth required to completely open the water service connection to the residence served. If required, back flush the reinstated service line from the house or meter.

6. Any services that cannot be reinstated internally by robotics because of technical limitations, shall be reinstated externally thru local excavations and shall be done at the Contractor's expense. These shall be reconnected by use of agency approved mechanical fittings. This may exclude saddled style services which may be specified for external reconnection.

C. CIPP End Termination Fittings

1. Terminating CIPP linings can be performed in one of the following manners:

a. If the end of the host pipe is determined to be structurally sound and its inside surface is not deteriorated, the CIPP can be terminated near the end of the host pipe and made watertight using a WEKO® Internal End Seal; or equal. An elastomeric internal seal is mechanically secured onto the inside surface of the cut back CIPP end and at the end of the host pipe inner surface.

b. The CIPP can be terminated within a short Fiber Reinforced Polymer (FRP), or other material approved by the Owner, pipe spool section having the same inside diameter as the rehabilitated host pipe and a conventional outside diameter matching the closure pipe used to reconnect the piping system. The selected spool section, with appropriate surface preparation, offers a repeatable, high quality adhesive bond to a clean, dry and prepared material inner surface creating a watertight seal and a secure CIPP connection to

accommodate all the stresses that may be created by the CIPP installation. If the Contractor, at his discretion, may also elect to install a WEKO® Internal End Seal at the end of the termination spool section to ensure water tightness.

c. Adhesive sealing which attempts to provide a seal between the CIPP and the rehabilitated host pipe wall at the termination will not be accepted.

2. The mechanical end fittings shall be rated by the Manufacturer for the operating pressure specified and be independently tested in conjunction with the proposed liner to ensure a long-term watertight connection, independent of the host pipe.

3.05 PIPELINE RECONNECTION AND CLEAN-UP

A. After project completion, the Contractor, as specified by contract documents, shall return the piping system to service by closure of all access pits with appropriate pipe spools, valves, and other relevant pipe fittings. Backfilling of all access pits shall be performed with care to ensure material is properly placed and not dropped onto closure pipes and fittings until a suitable depth of material is above the closure pipes/fittings.

B. Upon acceptance of the installation, the Contractor shall reinstate the project area affected by the operation.

SECTION 02676

DISINFECTION OF WATER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection of potable water piping, potable water storage facilities, treatment unit equipment and piping, pumping equipment and piping; testing and reporting results

1.2 RELATED SECTIONS

1.3 Section 02550 – Cured-In-Place Pressurized Water Pipe – Water Mains

1.4 REFERENCES

A. American Water Works Association (AWWA):
   1. B300 – Standard for Hypochlorites
   2. B301 – Standard for Liquid Chlorine
   3. C651 – Disinfecting Water Mains
   4. C652 – Disinfection of Water Storage Facilities
   5. C653 – Disinfection of Water Treatment Plants

B. National Sanitation Foundation (NSF):
   1. Standard 60 – Drinking Water Treatment Chemicals – Health Effects

1.5 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700

B. Disinfection report; record:
   1. Type and form of disinfectant used
   2. Date and time of disinfectant injection start and time of completion
   3. Test locations
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in parts per million (ppm) or milligram per liter (mg/L) for each outlet tested
   5. Date and time of flushing start and completion
   6. Disinfectant residual after flushing in ppm for each outlet tested

C. Bacteriological (Bac-T) report; record:
   1. Date issued, project name, and testing laboratory name, address, and telephone number
   2. Time and date of water sample collection

3. Name of person collecting samples
4. Test locations
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested
6. Coliform bacteria test results for each outlet tested
7. Bacteriologist's signature and authority

1.7 QUALITY ASSURANCE

A. Perform work in accordance with AWWA C651, C652, C653, and the Colorado Department of Public Health and Environment (CDPHE)

1.8 REGULATORY REQUIREMENTS

A. Conform to AWWA C651, C652, C653, as appropriate, and CDPHE regulations for performing the work of this Section

PART 2 PRODUCTS

Follow Grand Junction Section 106 – Disinfection of Waterlines Construction Standards. If CDHPE and Grand Junction Standards are not applicable use this specification.

2.1 DISINFECTION CHEMICALS

A. Calcium and sodium hypochlorite shall conform to AWWA B300 and B301

B. Store hypochlorite in a cool, dark place away from flammable materials

PART 3 EXECUTION

3.1 CLEANING

A. Verify that all piping, fittings, and appurtenances have been cleaned and inspected

B. Verify that piping has been successfully pressure tested and flushed

C. Perform scheduling and disinfection activity with start-up, testing, adjusting, demonstration procedures, including coordination with related systems

3.2 DISINFECTION

A. Provide and attach required equipment to perform the work of this Section

B. Tablet, continuous, or slug disinfection may be followed in accordance with AWWA C651

C. The preferred method is continuous disinfection, summarized as follows:

1. Inject treatment disinfectant, free chlorine in liquid form into piping system to obtain 50 to 80 ppm residual
2. Bleed water from outlets to ensure distribution and test for disinfectant residual
3. Maintain disinfectant in system for 24 hours
4. If final disinfectant residual tests less than 25 ppm, repeat treatment
5. Flush, circulate and clean until residual equal to that of incoming potable water or 1.0 mg/L is achieved

D. Replace permanent system devices removed for disinfection

3.3 FINAL FLUSHING

A. Maintain a flushing velocity of 2.5 feet per second in piping

B. Collect chlorinated water for proper disposal and/or dechlorinate to less than 0.1 ppm free chlorine prior to discharge in accordance with State, County, and local regulations

C. Contractor to provide and pay for flushing water

3.4 FIELD QUALITY CONTROL

A. After final flush, and before main or equipment is placed in service, collect water samples from representative points along the main and field test for chlorine residual

B. Chlorine residual shall be within 50 percent of the chlorine residual prevailing in the source

C. If initial disinfection fails to provide satisfactory samples, repeat disinfection until satisfactory samples have been obtained

3.5 TESTING AND ACCEPTANCE

A. The Contractor will perform Bac-T sampling and testing after pipes have been disinfected and flushed as specified in Section 02510

B. If any portion of the piping fails Bacteriological testing, the Contractor is responsible for repeating disinfection procedures until passing Bac-T test is obtained

C. Contractor shall provide and pay for services of a certified laboratory to complete Bac-T testing

D. Submit test reports per Section 01700

END OF SECTION

SECTION 02770

SERVICE LATERAL AND CONNECTION SEALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. These Specifications include the minimum requirements for the rehabilitation of service laterals and their interface connections with the mainline pipes via Main-to-House Cured-In-Place Pipe (CIPP) Service Lateral and Connection (SL&C) seals.
   1. All SL&C seal lining work will be performed from mainline sewers (Main-to-House). The SL&C seal system shall not require the use of clean-outs on the service lateral pipeline; use of clean-outs shall only be approved by the Owner as an exception on a case-by-case basis. Cost of installing such a clean-out, if needed, shall be considered incidental to the SL&C Seal installation work and shall be included in the cost to furnish and install the SL&C Seal. No separate bid item is allowed for clean-out installation work.
   2. The mainline sewer may be lined (e.g. CIPP or F&F) or unlined pipe. Existing service lateral connections shall be flush with the mainline sewer wall prior to SL&C Seal installation.
   3. The SL&C Seal will include an Owner specified length of lateral pipeline that will also be rehabilitated in conjunction with the service lateral/mainline connection, as a one piece integrated sealing system.
   4. Service lateral connections may have varying configurations, including tees, wyes or break-in taps. Service lateral connections may have varying sizes and angles ranging from 30 to 90 degrees. Service laterals may connect to the main line sewer at any point on the circumference including perpendicular, tangential, etc. The SL&C seal system shall have the versatility to accommodate such various field conditions as described.
   5. The SL&C Seal shall be properly aligned at the service lateral connection by rotating the launching device using a rotary drive; alignment shall be confirmed by mechanical extension of a Pathfinder basket into the lateral connection opening prior to inverting the integral lateral liner into place from the mainline sewer.
   6. The SL&C Seal system shall be designed and installed to be leak tight, including the microannulus between the host pipe and the SL&C Seal. The System Supplier shall provide validation testing data that supports the leak tightness of the SL&C Seal system.
      a. Regardless of any additional “localized measures” prospectively employed in the pursuit of leak tightness, the installed SL&C Seal shall ensure the elimination of infiltration and ex-filtration through a global seal over the entire length and area of the SL&C seal as primarily achieved by a tight, frictional interface.
      b. To achieve a tight, frictional interface, the SL&C Seal shall utilize a thermoset resin system comprised of base resin and hardener, cured with ambient temperatures having:
         i) a shrinkage value less than 0.5% when measured in accordance with either ISO 2577 or ASTM D6289; and

ii) a maximum allowable coefficient of linear thermal expansion (CLTE) of 100 X 10^{-6} / K for the cured resin when tested in accordance with ISO 11359-2 over a temperature variation from −30°C to 30°C (−22°F to +86°F).

7. To minimize community risk and disruption, only "No VOC" resins shall be permitted for use; without access to a clean-out for venting the processing steam, "No VOC" resins are mandatory, especially with steam cured liners, in order to control the risk of noxious odors from entering buildings or from adversely impacting passersby.
8. All materials furnished as part of this contract shall be marked with detailed product information providing complete materials traceability, stored in a manner specified by the System Supplier, and tested to the requirements of this contract.
9. The installed SL&C Seal shall be free of all defects that will affect the design, service life, and operation of the lateral and applicable portion of the main-line.
10. The SL&C Seal shall be designed against corrosion and typical chemicals found in domestic sewage, unless more stringent requirements are otherwise specified in the detailed section of the contract documents. The System Supplier shall provide testing data that supports the chemical resistance in accordance with ASTM F1216 on the exact SL&C Seal system to be used.
11. The mainline and lateral portion of the SL&C Seal shall be designed for "Partially" or "Fully Deteriorated" design conditions as per ASTM F1216 as specified by the Owner. Partially deteriorated design conditions assume the CIPP liner is designed to support groundwater loads, while fully deteriorated design conditions assume the CIPP liner is designed to structurally replace the host pipe completely. Where requested, sample wall thickness design calculations shall be submitted as per the site condition design variables, which design variable assumptions shall be provided by the Responsible Project Engineer. All material design properties must be supported by the System Supplier's third party validation and verification testing with documentation for the exact product components to be utilized.
12. Flow entering the lateral shall be by-passed if necessary for the installation of the SL&C Seal. Where possible, by-pass pumping of the sewer main shall be utilized to avoid unnecessary exposure to the sewage contaminants during installation. The contractor shall coordinate the SL&C Seal with the property owner and the City of Grand Junction at least 48 hours in advance.
13. The SL&C Seal prices submitted by the Contractor, shall include all costs for the various bid items necessary for furnishing and installing, complete and in place, the SL&C Seal in accordance with these specifications (including all materials; use of System Supplier's recommended equipment; and implementation of System Supplier's installation procedures; etc.), except for any line items specified otherwise by the Owner.

1.2 RELATED SECTIONS

A. 01200 – Payment Procedures

B. 02540 – Cured-In-Place Thermosetting Resin Pipe – Mains

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. D790 – Standard Test Methods of Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
2. F1743 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
3. D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
4. D5813 - Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems
5. D578 - Standard Specification for Glass Fiber Strands
6. D1600 - Standard Terminology for Abbreviated Terms Relating to Plastics
7. D638 - Standard Test Method for Tensile Properties of Plastics
8. F2019 - Standard Practice For Rehabilitation Of Existing Pipelines And Conduits By The Pulled In Place Installation Of Glass Reinforced Plastic (GRP) Cured-In-Place Thermosetting Resin Pipe (CIPP)
9. F1216 – 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.
10. D2990 – Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
11. NASSCO Guideline Specification for the Installation of CIPP (June 2011)
12. NASSCO Guideline Specifications for Cleaning and Televising Pipelines

B. City of Grand Junction Design Standards and Construction Specifications

1.4 SUBMITTALS

A. Submit under provisions of Section 01340

B. Shop Drawings and Product Data (after Contract Award) required for all Main-to-House SL&C systems proposed for installation in accordance with these specifications shall include:
   1. System material type and System Supplier to be used, including: catalog data sheets, ASTM references, material composition, System Supplier's recommended specifications, component physical properties and chemical resistance.
   2. Qualifications of the proposed SL&C Seal system to meet the requirements of the Contract, including: Third party validation testing of the physical properties, corrosion resistance, abrasion resistance, hydro-jetting resistance, and sealing method. Copies of independent verification testing performed on the CIPP liner composite, as field constructed, verifying the product meets the requirements as specified in these contract documents and the System Supplier's design.
   3. Required installation equipment and availability of back-up equipment. Available equipment shall include a remote launch (from the main) CCTV camera system capable of televising the maximum length of lateral to be lined, and suitable equipment for cleaning the maximum length of lateral to be lined (as remotely launched from the main).
   4. System Supplier's detailed description of the recommended procedures for handling and storing of materials

5. System Supplier's detailed description of the recommended SL&C Seal installation process
6. Qualifications of the Contractor to install the SL&C Seal system, including certification from the System Supplier that the Contractor/System Installer is an approved customer for the SL&C Seal system with applicable certificates of completed training for each relevant crew member involved. This requirement shall comply with the specific system requirements specified in the contract documents.
7. By-Pass Pumping Plan, if applicable, for the SL&C Seal system being installed.
8. Health and Safety plan detailing the site specific safety requirements.
9. Staging Area plan & Traffic Control plan, for the SL&C Seal system being installed.
10. Sample CIPP wall thickness design calculations based upon ASTM F1216, assuming either Fully or Partially Deteriorated conditions, as specified by the Owner. Sample wall thickness design calculations shall be submitted as per the site condition design variables, which design variable assumptions shall be provided by the Responsible Project Engineer. All material design properties must be supported by the System Supplier's third party validation and verification testing with documentation for the exact product components to be utilized. The designs shall be stamped by a Professional Engineer if required by the Owner.

C. Product Data Submittals (After Construction) required for all Main-to-House SL&C Seal systems installed under this contract shall include:

1.5 QUALITY CONTROL PLAN (QCP)

A. A detailed quality control plan (QCP) shall be submitted to the Owner that fully represents and conforms to the quality control requirements of these specifications. At a minimum the QCP shall include the following:
   1. How the system is prepared for installation;
   2. How the system is installed;
   3. How the completed system is confirmed to be in compliance with the requirements of the Contract;
   4. Training/Qualifications of personnel preparing and installing the system

B. Proposed procedures for quality control, product sampling and testing shall be defined.

C. Proposed methods for product performance controls, including method of and frequency of product sampling and testing as applicable.

1.6 SAFETY

A. The Contractor shall conform to all work safety requirements of pertinent regulatory agencies, and shall secure the site for working conditions in compliance with the same. The Contractor shall erect such signs and other devices as are necessary for the safety of the work site.

B. The Contractor shall perform all of the Work in accordance with applicable OSHA safety standards. Emphasis shall be placed upon the requirements for entering confined spaces.

C. The Contractor shall have on the job site at all times at a minimum the following safety equipment:
   1. Gas monitor capable of testing and detecting for combustible gas, oxygen deficiency and hydrogen sulfide.
   2. Confined space access and retrieval winch system.
   3. Ventilating fans with large diameter ventilating hose.
   4. Safety harness and life lines.
   5. Other equipment as may be required for a specific project
   6. All equipment to be available for use, in sufficient quantity, by the Contractor, Engineer, Owner's Representative, and Owner for the duration of the project.

D. All entries into or work within confined spaces shall be conducted in accordance with the U.S. Department of Health and Human Services/National Institute for Occupational Safety and Health [DHHS (NIOSH)] Publication No. 87-113, A Guide to Safety in Confined Spaces.

1.7 WARRANTY

A. Material Warranty
   1. All SLC seals shall be certified by the manufacturer for specified material properties for the repair. The manufacturer shall warranty the liner to be free from defects in raw materials for ten years from the date of installation. During the warranty period, any defects which affect the integrity, strength or water tightness of the installed pipe shall be repaired at the contractor's expense.

B. Installation Warranty
   1. The Installer shall guarantee the SLC seals against defects in installation and workmanship for the period of two years commencing with the date of substantial completion of the CIPP system
   2. During the warranty period, any defects which will affect the structural integrity of the SL&C Seal or allow leaks shall be repaired at the Contractor's expense in a manner mutually agreed upon by the System Supplier, Owner, and the Contractor.

C. Warranty Inspections
   1. The Owner shall perform, at its own cost, warranty inspections with its own personnel or personnel independent of the Contractor. Any defects found shall be repaired or replaced by the Contractor according to System Supplier's recommendations, as approved by the Owner.

1.8 COORDINATION

A. Coordinate Work of this Section with users connected to the system.

B. Notify homeowners and businesses at least 48 hours in advance of expected disruption of sanitary service.

C. Limit disruption of service to individual properties to one-time occurrence for maximum of eight hour

D. Do not disrupt customer service between hours of 5:00 P.M. and 8:00 A.M.

E. Provide and maintain temporary facilities, including piping and pumps, to meet Town requirements

1.9 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One Specifications

1.10 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the Owner's Representative.

B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products. Protect material from moisture.

C. Store hydrophilic end seal gaskets inside, in a dry, humidity-controlled environment. The end seal will swell when exposed to moisture, either direct or indirect.

1.11 EXISTING CONDITIONS

A. Verify field measurements prior to fabrications

B. Indicated field measurements on Shop Drawings

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CIPP Lateral Tube
   1. LMK Technologies
   2. Cosmic
   3. Accepted substitution approved prior to bid

2.2 SERVICE LATERAL AND CONNECTION (SL&C) SEALS

A. General
   1. The SL&C Seal is normally constructed without excavation by the curing of a “No VOC” resin-impregnated, flexible laminate installed into the existing service lateral, lapping over the main-line pipe, and thereby sealing the connection from the main-line pipe to the lateral pipeline.
   2. The integrated lateral liner shall extend continuously from the sewer main into the lateral for a minimum distance of 12-inches.
   3. The system shall be generally capable of lining a lateral from the mainline without a clean-out, including available measures to:

a. avoid bunching of the SL&C Seal lateral liner at the connection without a camera in the lateral, such as by extending a mechanical Pathfinder basket into the lateral opening to reliably verify proper alignment at the main to lateral connection.
b. ensure full and proper deployment of the SL&C Seal lateral liner to the Owner specified length, such as with a cable to measure the distance that the lateral liner has deployed, so as to avoid having to cut open the upstream lateral end.
c. ensure fully open SL&C Seal liner ends that are tightly pressed against the host pipe in the main and at the upstream lateral end, thereby avoiding the need for a clean-out to cut open the upstream lateral end. For example, this can be accomplished by having the main packer bladder extend past the termination points of the main sheet and the lateral liner end cap extending past the end of the lateral liner causing all ends to remain open and fully pressed against the host pipe, whereby no cutting for reinstatement is required.
d. ensure that resin slugs do not form at the upstream SL&C Seal lateral end, such as with the use of a lateral liner end cap extended past the lateral liner termination point, in order to distribute and taper any excess resin; such measures are required to avoid having to cut out a resin slug blockage at the upstream lateral end.
e. ensure that noxious odors do not enter a building so as to limit community risk and disruption, such as with the required use of "no VOC" resins.

4. The textile SL&C Seal shall be manufactured in a factory setting prior to its arrival on site. No permanent component of the seal (i.e. lateral tube to mainline piece) shall be glued, sewn or fused at the jobsite prior to installation. Both the textile SL&C Seal and the resin components from the System Supplier shall be provided by one manufacturer, with ISO 9001 quality certification, as a complete Main-to-House SL&C Seal system.
5. The SL&C Seal system shall be offered by the System Supplier in multiple angles to include "tees" (90 degrees) and "wyes" (45 degrees) in order to limit bunching of materials at the connection; the Contractor shall utilize the most appropriate SL&C Seal liner angle for the lateral connection.
6. The Contractor shall prepare the host pipe in accordance with the System Supplier's recommendations; third party validation testing and prior field installation verification testing shall be provided to document the leak tightness of the as-installed SL&C Seal system.
7. The resin shall be cured to form the SL&C Seal into a structural, water-tight Cured-in-Place pipe-within-a-pipe. When cured, the SL&C Seal shall seal the lateral and its connection to the mainline in a continuous tight-fitting, leak-proof seal. The SL&C Seal shall eliminate any visible leakage between the lateral and the mainline and shall provide a water-tight seal to prevent root intrusion, infiltration, and ex-filtration between the SL&C Seal and the host pipe.
8. The installation of the SL&C Seal system requires the product to be capable of being installed without external access to the upstream side of the lateral pipe and capable of navigating bends or other transitions in alignment, as identified by the Owner in the contract bid documents.

B. Materials
1. Absorbent Textile Sheet and Tube
a. The main sheet and lateral tube shall consist of one or more layers of absorbent textile including fabrics made from polyester fiber (i.e. needle punched felt/fleece

or circular knit) in general accordance with Section 5.1 of Practice F1216 and meet the requirements of Section 6.1 of ASTM D5813. The textile tube shall:

i) be capable of absorbing and carrying resins;
ii) be constructed to withstand installation pressures and curing temperatures;
iii) have sufficient strength to bridge missing pipe segments; and
iv) stretch to fit irregular pipe sections.

b. The wet-out SL&C Seal shall have a uniform thickness and 5 – 10% excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.

c. The Contractor shall measure the inside diameter and length of the existing pipelines in the field prior to ordering the SL&C Seal. The SL&C Seal shall be manufactured to a size that when installed will tightly fit the internal circumference; allowance shall be made for circumferential stretching during installation. The lateral tube shall be properly sized to the diameter of the existing pipe and to the length to be rehabilitated; the lateral tube shall be able to stretch to fit irregular pipe sections and to negotiate bends. The Contractor shall determine the minimum tube length necessary to effectively span the designated run. The Contractor shall verify the lengths in the field prior to ordering and prior to impregnation of the tube with resin, to ensure that the tube will have sufficient length to extend the entire length of the run.

d. The eventual lumen of the textile SL&C Seal (before installation) shall be coated with a translucent, flexible, air and water-tight coating; this coating serves solely as a construction aid that will:

i) contain the resin and facilitate vacuum impregnation and monitoring of the resin saturation during the resin impregnation (wet-out) procedure, and
ii) contain and protect the resin during installation
iii) prevent resin blow-out from pressurized air penetration
iv) resist steam and exotherm temperatures. The coating shall be a translucent, flexible, water-tight coating, or equal performance in regards to temperature resistance and flexibility

e. No material shall be included in the textile tube that may cause de-lamination in the installed CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between the textile tube and the activated resin containing a colorant.

f. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made; the hue of the color shall also be dark enough to distinguish a contrast between the fully resin saturated textile and dry or resin lean areas.

g. Seams in the textile tube shall meet the requirements of ASTM D5813. The seam tape shall be made from the same material as the liner coating with the same material characteristics, including coefficient of linear thermal expansion (CLTE). The seam flexural strength shall be the same or greater than the liner material, including the coating.

h. The textile SL&C Seal shall be marked on the lumen side with the name of the System Supplier, the manufacturing lot number, and the production footage, as applicable. The print shall be visible during final CCTV inspection.

i. The minimum length of the lateral tube shall be that deemed necessary by the System Installer shall be a minimum service lateral length of 12-inches measured from the interface of the lateral and main; the System Supplier shall provide the Contractor and the Owner with validated guidance regarding the expected tube length changes based upon bends and diameter expansion.
j. The quantity of resin used in the impregnation shall be sufficient to fill all of the voids for the nominal textile thickness.
k. The lateral liner shall be constructed with diameter transitions as applicable.

2. Resin
   a. Only the System Supplier's validated resin and hardener system shall be utilized; the resin shall be a corrosion resistant epoxy. No styrenated or other VOC resins shall be permitted.
   b. The System Supplier's method of wet-out instructions along with a wet-out log shall be on-site and available for review by the Owner or the Owner's Representative at all times. Wet-out shall be conducted as per the System Supplier's validated Method Statement, including:
      i) resin to tube ratio, by volume
      ii) use of vacuum impregnation
      iii) use of pinch rollers
      iv) use of spike rollers on coating at overlap
      v) protection of coating from damage during wet-out
   c. The System Supplier's method of cure instructions along with a cure log shall be on-site and available for review by the Owner or the Owner's Representative at all times. Curing shall be conducted according to the System Supplier's recommendations, using the System Supplier's recommended heat source as per the System Supplier's validated Method Statement.
   d. When properly cured within the tube composite, the resin shall meet the requirements of ASTM F1216, the physical properties herein, and those design properties which are to be utilized for this project. The resin shall produce CIPP, which will comply with or exceed the structural and chemical resistance requirements of this specification.

C. Long-Term Performance & Durability
1. The physical properties and characteristics of the installed SL&C Seal will vary considerably, depending on the types of resin and tube materials used. It shall be the responsibility of the Contractor to utilize a pre-approved System Supplier's Main-to-House SL&C Seal system (requiring the same supplier and same grade of components) which has been validated and verified as a system which will meet or exceed the minimum properties specified herein.
2. When the resin is properly cured within the tube, the SL&C Seal system shall meet the physical properties herein, and those design properties which are to be utilized for this project. The resin and the carrier tube shall produce a SL&C Seal, which will comply with or exceed the structural and chemical resistance requirements of this specification.
3. The SL&C Seal shall be designed as per ASTM F1216 X.1 design appendix; the SL&C Seal structural design shall assume no bonding to the host pipe wall.
4. The SL&C Seal shall be designed assuming the following design data, unless otherwise modified by the Responsible Project Engineer:

a. Factor of Safety = 2
b. Soil Modulus = 1,000 psi
c. Soil Density = 120 pcf
d. Live Load = H20
e. Depth of Cover = as specified
f. Groundwater = ½ depth of cover
g. Ovality = 2%

5. The System Supplier shall submit independently validated long term 10,000 hour test data to establish the long term (50 year extrapolated) Creep Retention Factor (e.g. ASTM D2990) for use in the long-term design; the testing shall have been conducted upon the same SL&C Seal system (requiring the same supplier and same grade of components) to be utilized for the project.
6. The cured-in-place pipe (CIPP) SL&C Seal material shall, at a minimum, meet or exceed the structural properties, as listed in TABLE 1 below, as per ASTM F1216. Note: a typical SL&C Seal will exceed a 375,000 psi (2586 MPa) flexural modulus.

TABLE 1 one-piece main and lateral cured in-place liner Initial Physical Properties

Property	ASTM Test	Minimum Value	
		psi	(MPa)
Flexural Strength	D790	4500	(31)
Flexural Modulus	D790	250 000	(1724)

7. The structural performance of the installed SL&C Seal shall be adequate to accommodate all anticipated loads throughout its design life.
8. All data submitted to validate and verify the design properties and long-term durability of a SL&C Seal shall have been conducted on materials from the same supplier utilizing the same grade of system components as utilized for the project. No substitution of alternative (from those independently validated and verified, reviewed, and approved as part of the liner system) material components shall be permitted.

PART 3 EXECUTION

3.1 SERVICE LATERAL AND CONNECTION (SL&C) SEALS

A. General
1. SL&C Seals shall be installed from the lined main-line with a lateral CIPP portion that extends up the lateral a minimum of 12-inches.
2. The SL&C Seals shall be constructed of materials and methods, that when installed, shall provide a jointless, continuous, and structurally sound CIPP able to withstand all imposed static and dynamic loads on a long-term basis, as specified by the Owner.
3. SL&C seals shall be installed within the main-line and without the use of a clean-out.

B. Preparation

1. The Contractor may, under the direction of the Owner, utilize any of the existing manholes in the project area as installation access points or, with lateral by lateral approval from the Owner, may excavate access points at predetermined locations.
2. Preparation, cleaning, inspection, sewage by-passing and public notification are the responsibility of the Contractor, with the assistance of the Owner.
3. Pre-Cleaning CCTV – The Contractor shall utilize a lateral launch CCTV camera capable of televising the maximum length of lateral liner to be installed from the main. Only NASSCO PACP/LACP certified personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform the inspection. The CCTV inspection shall be recorded in the Owner specified video format.
4. Cleaning of Pipe Lines - The Contractor shall remove all internal debris from the pipe line that will interfere with the installation and the final delivery of the SL&C Seal as required in these specifications. The Contractor shall make use of commercially available industry standard cleaning equipment to prepare the pipe in advance for system installation. Adhered deposits, solid debris, and obstructions that will affect the installation and the final product shall be removed and disposed of properly by the Contractor. Precaution shall be taken, by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. If the pipe cannot be cleaned sufficiently using industry standard cleaning equipment then additional cleaning will be considered changed conditions.
5. Host Pipe Preparation for Lining – The Contractor shall televise and clean and prepare the surface of the existing host pipe immediately prior to installation of the SL&C Seal. All preparation shall be in accordance with the System Supplier's written installation procedures.
6. Bypass Existing Sewage Flows – The Contractor shall provide flow diversion or stoppage requirements to the Owner to assist in developing a plan for notifying upstream users to temporarily stop using their water/wastewater during the SL&C Seal installation. When circumstances require continuous service for the flow of the service connection (such as medical facilities or laboratories), the Contractor will install a temporary sewage by-pass system, if required by the Owner. Once the rehabilitation process has begun, existing sewage flows shall be maintained, until the SL&C Seal is fully installed. The Contractor shall coordinate sewer bypass and flow interruptions with the Owner at least 7 days in advance and with the property owners and businesses at least 1 business day in advance. The pump and bypass lines shall be of adequate capacity and size to handle typical flows.
7. Post-Cleaning CCTV – Upon completion of the cleaning, the Contractor shall then perform a Post-Cleaning CCTV Inspection, which typically acts as the Pre-Rehabilitation CCTV Inspection. Only NASSCO PACP/LACP certified personnel trained in locating breaks, obstacles and service connections by closed circuit television shall perform the inspection. The CCTV inspection shall be recorded in the Owner specified video format. The Contractor shall provide the Owner a copy of the pre-cleaning and post-cleaning video and suitable log, and/or in digital format for review prior to installation of the CIPP and for later reference by the Owner, if specifically required by the Owner.
8. Line Obstructions - It shall be the responsibility of the Contractor to clear the line of obstructions that will interfere with the installation and long-term performance of the

system. If pre-installation inspection reveals an obstruction, misalignment, broken or collapsed section or sag that was not identified as part of the original scope of work and will prohibit proper installation of the system, the Contractor may be directed by the Owner to correct the problem(s) prior to installing the SL&C Seal by utilizing open cut repair methods. This work will be considered changed conditions, or if there is an existing bid item for this work, the Contractor shall be compensated under the particular pay item designated for open cut point repairs.

9. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing and curing the SL&C Seal. If required in the contract documents, each connection will be dye tested to determine whether or not the connection is live or abandoned. The cost for dye testing of existing service connections shall be compensated at the unit price bid. In the event the status of a service connection cannot be adequately defined, the Owner will make the final decision, prior to installation and curing of the SL&C Seal, as to the status. Typically only service connections deemed "active" shall be lined by the Contractor.
10. The Contractor shall be allowed to use water from an owner-approved fire hydrant in the project vicinity. Use of an approved double check backflow assembly shall be required, unless an open gap exists in the Contractor's equipment. Contractor shall provide his own approved assembly. Contractor shall pay current market price for all water usage, unless otherwise specified by the Owner.

C. Wet-Out

1. Resin Mixing ─ The mixed components shall be of contrasting colors to provide a visual confirmation of complete mixing, wherein no marbling shall remain. System Supplier's recommended equipment, mixing volumes, and mixing times shall be followed by the System Installer.
   a. The volume of resin used shall be sufficient to fill all voids in the textile SL&C Seal material at nominal thickness and diameter.
   b. The volume shall be adjusted by adding 10 % excess resin to allow for any migration of resin into the cracks and joints in the host pipe.
2. Vacuum Impregnation ─ The entire SL&C Seal shall be wet-out using vacuum impregnation including the lateral tube and mainline sheet portions. Impregnation shall take place in a clean, temperature-controlled cab in which the materials are protected from direct sunlight and objects which may damage the coating. Impregnation shall not rely upon a manual roller for resin dispersion in lieu of vacuum impregnation; however, a manual roller can be utilized to assist the dispersion of resin into the corners of the main sheet of the SL&C Seal during vacuum impregnation. All the calculated resin shall be confined to the SL&C Seal to ensure the correct mechanical properties can be achieved.
3. Pinch Roller ─ A pinch roller shall be utilized during wet-out to establish the liner wall thickness and to assure even distribution of the resin; a roller gap shall be as calculated using equation 1 where t = the nominal liner thickness in mm, or other scientifically validated method of ensuring proper wall thickness with an alternative system.

$$RollerGap_{mm} = 2 + 2t$$ Equation 1

4. No dry or unsaturated area in the main sheet or lateral tube shall be acceptable upon visual inspection.
5. The wet-out main sheet and lateral liner of the SL&C Seal shall each have a uniform thickness and excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.
6. During and upon completion of the impregnation process the SL&C Seal should be stored in a container to avoid damage prior to loading the material into the installation device. Efforts should specifically be made to avoid any risk of damage to the coating.

D. Installation
1. The SL&C Seal shall be loaded on and inside a pressure apparatus. The pressure apparatus, attached to a robotic device, shall be positioned in the mainline host pipe at the service connection. A rotary drive on the robotic device, together with a CCTV camera, shall be used to align the lateral portion of the system with the service connection opening; alignment shall be confirmed mechanically such as by extension of a Pathfinder basket into the lateral opening prior to inverting the lateral tube into place from the mainline sewer. Air pressure, supplied to the pressure apparatus through an air hose, shall be used to invert the resin impregnated lateral liner into the lateral host pipe, and push the main-line portion of the system against the main-line host pipe (typically previously lined pipe). The pressure shall be adjusted to the System Supplier's recommended installation pressure to fully invert the lateral liner into the lateral host pipe and to hold the system tight to the host pipe walls; inversion shall be completed without pressure interruption. The main bladder shall extend past the termination points of the SL&C Seal main sheet and the liner end cap shall extend past the end of the SL&C lateral liner causing all ends to remain open and fully pressed against the host pipe, whereby cutting of the lateral liner end for reinstatement shall not be required.
2. After lateral liner insertion is completed, System Supplier's recommended pressure continues to be maintained on the impregnated SL&C Seal without pressure interruption for the duration of the curing process; care shall be taken during the curing process not to over-stress the lateral tube and liner end cap. The curing method shall be compatible with the resin selected and shall be in accordance with System Supplier's recommendations, as per the validated system Method Statement. The initial cure shall be deemed to be complete when the SL&C Seal has been exposed to the heat source or held in place for the time period specified by the System Supplier and as confirmed by installation system monitoring.
3. The Contractor shall permit the hardened CIPP SL&C Seal to cool before relieving the pressure in the installation apparatus. Cool-down may be accomplished by the introduction of cool air into the pressure apparatus. Care shall be taken to maintain, without interruption, proper pressure throughout the cure and cool-down period.

E. Finish
1. The installed SL&C Seal shall be continuous over the specified length of the sewer line section (including main-line and lateral) and be free from visual defects such as foreign inclusions, dry spots, pinholes, major wrinkles (greater than 2% of the pipe diameter) and de-lamination. The system shall be impervious and free of any leakage

including exfiltration from the pipe to the surrounding ground or infiltration from the ground to inside the lined pipe.

2. Any defect, which will or could affect the structural integrity of the system or allow leaks, shall be repaired at the Contractor's expense.
3. The SL&C Seal shall provide a watertight seal for the full length of the connection to the main-line pipe and for the full length of the CIPP lateral liner. Regardless of any additional localized measures prospectively employed in the pursuit of leak tightness, the installed SL&C Seal shall eliminate infiltration and ex-filtration over the entire length and area of the system with the use of resins having less than 0.5% shrinkage, thereby resulting in a tight, frictional interface.
4. Branch lateral connections or any other pre-existing connection to the service lateral shall preferentially be reinstated by a remote controlled robotic cutting device from within the pipeline, or if required and as approved by the Owner on a case by case basis, externally through a clean-out. The reinstated connection shall be brushed to allow for a smooth edge.
5. The Contractor shall clean up each project area after the work is completed and all testing is accepted. Remove and dispose of all excess materials and debris at each location as directed by the Owner.

3.2 TESTING

A. The wall thickness shall be measured in accordance with the applicable sections of ASTM Test Method D5813 and D3567.

B. Flexural strength and flexural modulus of elasticity shall be determined in accordance with ASTM D-790.

C. Porosity test shall be conducted in accordance with APS Water Porosity Standard.

3.3 FINAL ACCEPTANCE

A. All SL&C sample testing and repairs to the installed SL&C as applicable shall be completed, before final acceptance, meeting the requirements of these specifications and documented in written form.

B. The Contractor shall perform a detailed closed-circuit television inspection in accordance with ASTM standards, after installation of the SL&C seal and reconnection of the side sewers. The finished liner shall be continuous over the entire length of the installation and shall be free of significant visual defects, damage, deflection, holes, leaks and other defects. Unedited digital recordings of the inspection shall be provided to the Owner within ten (10) working days of the liner installation. The data shall note the inspection date, manhole depths from rim to inverts, location of all reconnected side sewers, debris, defects in the liner, including but not limited to gouges, cracks, bulges, or bumps. Immediately prior to conducting the video inspection, the Contractor shall thoroughly clean the newly installed liner removing all debris and build-up that may have accumulated, at no additional cost to the Owner.

C. Bypass pumping or plugging from the upstream manhole shall be utilized to minimize sewage from entering the line during the inspection. In the case of bellies in the line, the pipe shall be cleared of any standing water to provide continuous visibility during the inspection.

3.4 PROSECUTION OF WORK

A. All sewer service laterals connected to the main shall be reinstated after the sewer main has been lined or replaced due to defects. The Contractor shall note that not all sewer lines segments have been televised in their entirety due to obstructions blocking further entry, etc. These obstructions shall be cleared to allow TV viewing of the entire segment length before lining is commenced. Existing sanitary sewer segments may be broken and contribute considerable ground water to the sewer main or contain considerable amounts of grease, roots or other debris.

END OF SECTION