PART 1 - GENERAL

It is the intent of this specification to provide the requirements for the trenchless rehabilitation of the existing sanitary sewer lines shown on the drawings, and/or specified and directed by CCU.

The sanitary sewer lines trenchless rehabilitation shall consist of Cured-in-Place Pipe, PE Fold and Form Pipe, and Fold-and-Formed PVC Pipe Lining Rehabilitation systems as specified herein.

1.1 SCOPE

1.1.1 General:

The intent of trenchless sewer pipe Insertion is to rehabilitate the existing sewer line in a manner which will correct the following deficiencies:

- Cracked/broken/etc… pipe which may be caused by poor construction, unstable soil, earth movement, infiltration, root damage, destructive loading, cleaning tool damage, etc.
- Corrosion of pipe caused by acid attack above flow level.
- Erosion of pipe caused by abrasion below the flow level.
- Degradation/deformation of pipe caused by loss of masonry.
- Infiltration of groundwater and soil through leaking pipe joints and structural defects.
- Exfiltration of sewage through leaking pipe joints and structural defects.
- Inflow of surface water and infiltration of groundwater through abandoned or illegal connections.
- Root re-growth after removal.
- Pipe Capacity Problems; Smooth, tight fitting sewer pipe can usually improve the sewage flow characteristics of the existing line.

Note: sewer pipe refers to the installation of a structural pipe as opposed to coatings or membranes for corrosion or infiltration and exfiltration prevention.

1.1.2 Work Included

The Contractor shall, unless specified otherwise, furnish all labor, materials, equipment, supervision, tools, and all other associated appurtenances necessary to rehabilitate the designated gravity sanitary sewer lines for the purpose of eliminating infiltration, providing corrosion protection, repair of voids, and restoration of the structural integrity of the gravity sanitary sewer pipes as required under the contract.

The Contractor shall also furnish all labor, materials, equipment, tools, and all other associated appurtenances required to notify affected residents, prepare the construction site, including cleaning and flushing of existing piping; flow control bypass pumping; pre-installation and post-

installation closed-circuit television inspections, protection of existing conditions during installation work; unloading; hauling; distributing and installation; testing of all pipe, fittings, scaffolding, piping, valves, boilers, etc. and other accessories as required for the proper installation; protection of the site during the life of the Contract, including providing of necessary watchmen, warning lights, barricades, traffic control, dust control and maintenance of detours, as needed; and finally the cleanup of the work site, including maintenance of surfaces such as paving, and seeding, sodding and graveling, as needed, if damaged and all other item required to complete the rehabilitation.

The work shall consist of, but not necessarily be limited to, performing the following tasks where specified:

- Sewer Line Chemical Root Treatment
- Sewer Line Cleaning
- Sewer Flow Control
- Television Inspection, Main Sewers
- Sewer Pipe Joint Testing, Main Sewers
- Sewer Pipe Joint Sealing, Main Sewers
- Lateral Sewer Sealing
- Sewer Line Section Sealing
- Trenchless Point Repair
- Mainline Sewer Pipe Lining and Pipe Insertion
- Sewer Manhole Sealing

1.1.3 Location of the Work

- The area of work and the type of maintenance or rehabilitation to be performed shall be at those locations shown on the tables and/or drawings and made part of the specifications and Contract Documents.

- The potential project sites may be located at any of the existing sanitary sewer manholes that are a part of the Charlotte County Utilities (CCU) sanitary sewer collection and pumping system.

- The accessibility to the work sites shall vary, as manholes may be located in streets, alleys, utility easements, residential backyards, and various other locations. Accessibility to all manholes shall be the responsibility of the Contractor, and all expenses associated with work site accessibility should be taken into consideration as part of the Contractor's bid pricing. Damage to existing pavement surfaces and base courses, and/or other surface improvements, as a result of the Contractor's activities, shall be restored to like-new condition by the Contractor at his sole expense. The Contractor shall implement all required measures to provide CCU personnel and equipment with complete access to all work site areas during the entire course of performing this project.

1.1.4 Coordination of the Work

The Contractor shall be responsible for the satisfactory coordination of the sanitary sewer lines rehabilitation with other construction and activities in the area. Delays in work resulting from lack of such harmony shall not in any way be a cause for extra compensation by any of the parties.

1.1.5 Responsibilities

a) Safety: All aspects of the trenchless rehabilitation shall be done in strict accordance to the manufacturer's instructions and the requirements of NASSCO, the National Association of Sewer Service Companies. It is also the Contractor's responsibility to comply with OSHA standards and all regulations pertaining to work in confined space entry.

b) Notice of Residents: The contractor shall be responsible for notifying affected residents by the mean of door hangers to alert residents that a Sanitary sewer lines rehabilitation installer will be working on their street and what they can expect as far as service outages, water usage and unusual odors.

c) Licenses and Permits: The contractor shall be responsible for obtaining municipal and other Licenses and Permits and assistance in obtaining approvals or consent from utilities or carriers such as the telephone company or other persons or organizations upon whose property or authority performance of work under the contract might impinge or a written release from responsibility for the performance of work under the contract if and to the extent such work is precluded by the inability to obtain approvals or consent.

d) Work Access: The contractor shall be responsible for obtaining legal access to site of work to the extent that the CCU is legally able to so provide or, if not so able, a written release from responsibility for the performance of work at sites where access cannot be made available.

e) Clearance of Blockages or Obstructions in the Sewer System: The contractor shall be responsible for obtaining clearance of blockages or obstructions in the sewer system, if any, if such clearance is required for performance of work under the contract and if such clearance is not otherwise provided for within the contract.

f) Location and Exposure of Manholes: CCU shall be responsible for providing locations of all sanitary sewer structures. It shall be the responsibility of CCU to locate and designate all sanitary sewer structure access points, and to provide rights of access to these points. It shall be the responsibility of the Contractor to expose all sanitary sewer structure access points.

g) Manhole and wetwell numbering system: CCU shall be responsible for a manhole and wetwell numbering system for all areas of the project.

h) Pump Stations: CCU shall be responsible for shutting down or manually operate certain pump stations if such becomes necessary for performance of the work.

i) Water Access: The contractor shall be responsible for obtaining water access necessary for performance of work under the contract from fire hydrants at the site of work or other suitable designated sources.

j) Disposal: The Contractor shall be responsible for disposal of all materials removed from the sewers during the performance of the work at an appropriately permitted disposal site.

k) Secure Storage Area: The contractor shall be responsible for finding secure storage areas of a size adequate to accommodate the required vehicles, equipment and materials for the period of performance of the contract.

1.1.6 Working Hours

The work shall be carried out in accordance with local ordinance and not to cause any unreasonable nuisance to affected residents. Under emergency conditions, this limitation may be waived by the consent of Charlotte County Utilities (CCU).

1.2 METHOD OF MEASUREMENT & PAYMENT

1.2.1 General:

Payments to the Contractor shall be made on the basis of the proposal Bid Form as full and complete payment for furnishing all materials, labor, tools, and equipment, and for performing all operations necessary to complete the work included in the Contract Documents. Such compensation shall also include payments for any loss or damages arising directly or indirectly from the work, or from any discrepancies between the actual quantities of work and those shown in the Contract Documents, or from any unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the CCU.

The prices stated on the Bid Form include all costs and expenses for taxes, labor, equipment, materials, commissions, transportation charges and expenses, patent fees and royalties, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the details and specified herein. The Basis of Payment for an item at the price shown in the Bid Form shall be in accordance with its description of the item in this section and as related to the work specified. Unit prices will be applied to the actual quantities furnished and installed in conformance with the Contract Documents.

The bids for the various items of work are intended to establish a total price for completing the work in its entirety. Should the Contractor feel that the cost for any item of work has not been established in the Bid Form or this section, the cost for that work shall be included in some other applicable Bid Item, so that his proposal for the project reflects the total price for completing the work in its entirety.

1.2.2 Measurement

The quantities for payment under this Contract shall be full compensation determined by actual measurement of the completed items, in place, ready for service and accepted by CCU unless otherwise specified. CCU will witness all field measurements.

The quantities stated in the Bid Form are approximate only and are intended to serve as a basis for the comparison of bids and to fix the approximate amount of the cost of the project. CCU does not expressly or impliedly agree that the actual amount of the work to be done in the performance of the contract will correspond with the quantities in the Bid Form; the amount of work to be done may be more or less than the said quantities and may be increased or decreased by CCU as circumstances may require. The increase or decrease of any quantity

shall not be regarded as grounds for an increase in the unit price or in the time allowed for the completion of the work, except as provided in the Contract Documents.

CCU will not provide any space or place to store materials for this project. No payment will be made for stored materials.

It is intended that all work required to complete this Contract will be included in the various bid items as described in the following paragraphs.

a) Cured-in-Place Pipe Lining:

Each unit price bid shall include all necessary or required traffic control, preparation of the existing sewer, including blocking or plugging incoming lines; removal, transportation and disposal of material generated by cleaning and preparation; pre and post television inspections; chemical joint sealing if necessary; pipe liner; cleaning; testing; cleanup; all labor, materials and equipment required to provide a complete and acceptable liner installation, including all appurtenances, in accordance with the Contract Documents, the manufacturer's specifications and compliance with all applicable regulatory requirements.

This item will be measured and paid at the unit price per linear feet of Cured in Place Pipe Lining as delineated by the pipe size and depth in brackets named in the Bid Form. Measurement shall be made based on the horizontal projection of the centerline of the permanently installed liner between manholes, including the laying length of fittings along the run, measured to the nearest foot from inside wall of manhole to inside wall of manhole for each section lined, not including the manhole chamber.

Payment for bypass pumping (for main line only), if required (other than because of damage caused by the Contractor) will be paid under a separate item, Payment for bypass to reinstate service laterals shall be included in this line item.

Rear lot easement main line sewers are the sanitary sewer mains located in easements, usually behind residential or commercial properties or within easements through woods. Properties are not easily accessible from at least one (1) manhole in run.

Roadway right-of-way main line sewers are the sanitary sewer mains located in roadway right-of-way. Both manholes are easily accessible.

Also included in this item, if repairs are required due to damage caused by the Contractor's operation, shall be materials for repair, if required, including pipe, fittings and specials, pipe bedding, and materials for surface restoration; transportation and handling costs delivered to the work site; any bypass pumping; providing provisional sewers to maintain service; complying with the State of Florida Trench Safety Act, including shoring; removal, transportation and disposal of existing sewer excavation; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; furnishing and installing replacement pipe, fittings and repair couplings; unloading material and placing it in the trench; cutting pipe; furnishing and installing joint materials including lubricant; making all connections within the lines to existing sewers, laterals and structures; placing and compacting bedding and backfill; furnishing and installing additional suitable backfill material, If required; furnishing all materials and equipment required to clean and test the sewer; cleaning and testing the

sewer; temporary paving installation and removal; permanent paving replacement; replacement of pavement markings as existed before repair; replacing utilities, catch basins, manholes, trees, grass, shrubs, mail boxes, sprinkler systems, concrete or rock bed driveways, sidewalk and all other similar Items, to original locations and to equal or better than original conditions; obtaining and paying for any necessary permits; satisfying all requirements of the permits, and all other appurtenant and miscellaneous items and work including final cleanup.

b) PE Fold and Form Pipe Lining:

Each unit price bid shall include all necessary or required traffic control, preparation of the existing sewer, including blocking or plugging incoming lines; removal, transportation and disposal of material generated by cleaning and preparation; pre and post television inspections, chemical joint sealing if necessary; pipe liner; cleaning; testing; cleanup; and all labor, materials and equipment required to provide a complete and acceptable liner installation.

This item will be measured and paid at the unit price per linear feet of Fold and Formed Pipe Lining as delineated by the pipe size and depth in brackets named in the Bid Form. Measurement shall be made based on the horizontal projection of the centerline of the permanently installed liner between manholes, including the laying length of fillings along the run, measured to the nearest foot from inside wall of manhole to inside wall of manhole for each section lined.

Payment for bypass pumping (for main line only), if required (other than because of damage caused by the Contractor) will be paid under a separate item. Payment for bypass pumping of service laterals, if required, shall be included with the lining operation.

Rear lot easement main line sewers are the sanitary sewer mains located in easements usually behind residential or commercial properties or within easements through woods. Properties are not easily accessible from at least one (1) manhole in run.

Roadway right-of-way main line sewers are the sanitary sewer mains located in roadway right-of-way. Both manholes are easily accessible.

Also included in this item, if repairs are required due to damage caused by the Contractor's operation, shall be materials for repair, if required, including pipe, fittings and specials, pipe bedding, and materials for surface restoration; transportation and handling costs delivered to the work site; any bypass pumping; providing provisional sewers to maintain service; complying with the State of Florida Trench Safety Act, including shoring; removal, transportation and disposal of existing sewer excavation; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; furnishing and installing replacement pipe, fittings and repair couplings; unloading material and placing it in the trench; cutting pipe; furnishing and installing joint materials including lubricant; making all connections within the lines to existing sewers, laterals and structures; placing and compacting bedding and backfill; furnishing and installing additional suitable backfill material, If required; furnishing all materials and equipment required to clean and test the sewer; cleaning and testing the sewer; temporary paving installation and removal; permanent paving replacement; replacement of pavement markings as existed before repair; replacing utilities, catch basins, manholes, trees, grass, shrubs, mail boxes, sprinkler systems, concrete or rock bed driveways,

sidewalk and all other similar Items, to original locations and to equal or better than original conditions; obtaining and paying for any necessary permits; satisfying all requirements of the permits, and all other appurtenant and miscellaneous items and work including final cleanup.

c) Fold-and-Formed PVC Pipe Lining:

Each unit price bid shall include all necessary or required traffic control, preparation of the existing sewer, including blocking or plugging incoming lines; removal, transportation and disposal of material generated by cleaning and preparation; pre and post television inspections; chemical joint sealing if necessary; pipe liner; cleaning; testing; cleanup; all labor, materials and equipment required to provide a complete and acceptable liner installation.

This item will be measured and paid at the unit price per linear feet of Pipe Lining as delineated by the pipe size and depth in brackets named in the Bid Form. Measurement shall be made based on the horizontal projection of the centerline of, the permanently installed liner between manholes, including the laying length of fittings along the run, measured to the nearest foot from inside wall or manhole to inside wall of manhole for each section lined.

Payment for bypass pumping (for main line only), if required (other than because of damage paused by the Contractor) will be paid under a separate item. Payment for bypass pumping of service laterals, if required, shall be included with the lining operation.

Rear lot easement main line sewers are the sanitary sewer mains located in easements usually behind residential or commercial properties or within easements through woods. Properties are not easily accessible from at least one manhole in run.

Roadway right-of-way main line sewers are the sanitary sewer mains located in roadway right-of-way. Both manholes are easily accessible.

Also included in this item, if repairs are required due to damage caused by the Contractor's operation, shall be materials for repair, if required, including pipe, fittings and specials, pipe bedding, and materials for surface restoration; transportation and handling costs delivered to the work site; any bypass pumping; providing provisional sewers to maintain service; complying with the State of Florida Trench Safety Act, including shoring; removal, transportation and disposal of existing sewer excavation; supporting and protecting existing utilities as required; dewatering; sheeting and shoring, if necessary; furnishing and installing replacement pipe, fittings and repair couplings; unloading material and placing it in the trench; cutting pipe; furnishing and installing joint materials including lubricant; making all connections within the lines to existing sewers, laterals and structures; placing and compacting bedding and backfill; furnishing and installing additional suitable backfill material, If required; furnishing all materials and equipment required to clean and test the sewer; cleaning and testing the sewer; temporary paving installation and removal; permanent paving replacement; replacement of pavement markings as existed before repair; replacing utilities, catch basins, manholes, trees, grass, shrubs, mail boxes, sprinkler systems, concrete or rock bed driveways, sidewalk and all other similar Items, to original locations and to equal or better than original conditions; obtaining and paying for any necessary permits; satisfying all requirements of the permits, and all other appurtenant and miscellaneous items and work including final cleanup.

d) Reinstatement of Service Lateral:

Contractor shall reconnect sanitary sewer service laterals, any size, to the new liner which shall include, but not be limited to, blocking or plugging incoming line; removal, transportation and disposal of material generated by cleaning and preparation; television inspections; furnishing the equipment necessary to internally cut out, removing the liner to at least 95%, minimum, of the circumference of the lateral, cutting out and labeling the coupon in accordance with the "Quality Control" section of these specifications; recovering all waste material from the sewer; service pipe cleaning; sealing the lateral connection to the liner; grouting the service lateral; testing; locating and exposing clean-outs when necessary; using the clean-out to locate the sewer connection; performing all repairs required due to damage caused by the Contractor and all appurtenant and miscellaneous items and work.

A smoothing device shall be used to smooth rough edges of the re-established lateral connection. A locater log shall be provided to CCU to identify the location of the lateral connection and the connections that were re-established.

This item of work will be measured and paid at the unit price per each lateral connected. Payment for bypass pumping of service laterals if required, shall be included with the lining operation.

e) Hydraulic Cleaning & Inspection of Gravity Sewer and Mechanical Cleaning of Gravity Sewer:

The Contractor shall furnish all labor, materials, and equipment to provide cleaning and inspection of the existing gravity sewer prior to rehabilitation. Hydraulic cleaning requires use of standard water jet equipment regardless of the number of passes required. Mechanical cleaning includes the use of a porcupine, bucket, or any other additional cleaning equipment. Cleaning includes all dirt, grease and sludge removal from the existing sewer.

The work includes furnishing all related work to provide cleaning of the existing sewer and inspecting the cleaned sewer with a radial view, closed circuit television.

Hydraulic and Mechanical Cleaning & Inspection is considered incidental to the project and no direct compensation shall be made.

The cleaning methods (hydraulic or mechanical) to be employed shall be determined by the Contractor based upon the material and condition of the pipe, and shall be approved by CCU.

f) Cleaning & Inspection of Tuberculated Cast Iron or Ductile Iron Pipe:

The Contractor shall furnish all labor, materials, and equipment to provide cleaning and inspection of the existing gravity sewer prior to rehabilitation.

The work comprises cleaning of the existing tuberculated Cast Iron Pipe (C.I.P) or Ductile Iron Pipe (D.I.P) by hydraulic means including high pressure cleaning and by mechanical means including a radial chain cutter, as approved by CCU, inspecting the cleaned sewer in accordance with the Contract Specifications. High pressure cleaning includes the use of high pressure equipment to clean extremely tuberculated C.I.P. or D.I.P. Use of high pressure equipment shall be as approved by CCU prior to commencement of the work.

Measurement for payment will be the actual length in linear feet of tuberculated pipe cleaned and inspected.

Payment for Cleaning and Inspection of Tuberculated C.I.P. or D.I.P. will be made at the appropriate Contract Unit Price per linear feet.

g) Root Removal and Chemical Root Treatment in Sewer Lines:

This item of work will be measured and paid at the unit price per linear feet, Measurement of lines shall be made based on the horizontal projection of the centerline of the pipe between manholes, measured to the nearest foot from inside wall of manhole to inside wall of manhole, not including the manhole chamber, in the pipe which root removal/treatment was performed.

Each unit price bid for root removal and chemical root treatment in sewer lines shall include cleaning; all mechanical methods of root removal specified or not; all herbicides or chemical treatment specified or not; and/or all equipment, materials and labor which shall be used to provide an open sewer (no blockage or constrictions due to roots or vegetation) to an acceptable for television inspection and ready for any and all repairs.

h) Removal of protruding services:

The Contractor shall furnish all materials and equipment to remove the existing service connections that protrude into the existing gravity sewers.

The work includes the removal of the portion of the service lateral, which protrudes into the inner diameter of the existing gravity sewer.

The number of protruding services to be measured for payment will be the actual number of service removed.

Payment for Removal of Protruding Services will be made at the Contract Unit Price per removal.

i) Sewer Bypass Operations with Tanker Truck:

These pay items provide complete compensation for operations required for sewer liner installations, the Contractor shall first attempt to perform the sewer rehabilitation work without bypass operations.

However, if the Contractor deems bypass pumping to be necessary and if CCU agrees with the reasons, this request for bypass operations will be paid for with these pay items.

Further, if bypass operations are required due to difficulties encountered due to the methods of installation, the Contractor shall be held responsible for all bypass operations at no additional cost to CCU. If this situation requires CCU to perform all or some of the by-pass operations, the Contractor shall compensate CCU accordingly.

Plugging or blocking a sewer line shall be included in the appropriate bid item for which the flow must be stopped; this is considered incidental work and no additional payment shall be considered for the activities under this item.

Plugging or blocking of the sewer lines and bypass operations for the reinstatement of service laterals, if required, shall be considered incidental to the work and shall not be considered for payment.

The Contractor shall furnish all materials, labor, and equipment to operate the sewer tanker truck, which will effectively collect, pump, transport and discharge all sewage entering the construction area during the work. The discharge location will be designated by CCU.

The use and quantity of a tanker truck(s) for sewer bypass must be approved in advance by CCU. Precautions must be taken to make certain that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved.

The number of days for sewer bypass operations with Tanker Truck to be included for payment under the Contract Item will be the total number of 24-hour days or fraction thereof during which bypass operations is ordered by CCU in writing.

Payment for sewer bypass operations with Tanker Truck will be made at the appropriate Contract Item Unit Price per day of truck use.

j) Sewage Bypass Pumping:

These pay items provide complete compensation for operations required for sewer liner installations, the Contractor shall first attempt to perform the sewer rehabilitation work without bypass pumping.

However, if the Contractor deems bypass pumping to be necessary and if CCU agrees with the reasons, this request for bypass pumping will be paid for with these pay items.

Further, if bypass pumping is required due to difficulties caused by or encountered during the rehabilitation process, the Contractor shall be held responsible for all bypass pumping operations at no additional cost to CCU. If this situation requires CCU to perform all or some of the by-pass pumping, the Contractor shall compensate CCU accordingly.

Plugging or blocking a sewer line shall be included in the appropriate bid item for which the flow must be stopped; this is considered incidental work and no additional payment shall be considered for the activities under this item.

Plugging or blocking of the sewer line and bypass pumping for the reinstatement of service laterals, if required, shall be considered incidental to the work and shall not be considered for payment.

These items shall include, but are not limited to all necessary or required traffic controls; pumps; piping; gasoline/diesel fuel; maintenance; transportation and storage; temporary bypass and service piping; labor; materials and/or any other costs associated with bypass pumping.

The pay item is a one (1) time charge per day for all bypass pumping operations during lining installation, regardless of the number of pumps required or the duration of the pumping period, Bypass pumping of sewers shall be bid on the basis of sewer size which is bypassed.

k) Testing of coupon by an approved independent certified material testing laboratory

The pay item is a one (1) time charge for each coupon test against applicable ASTM specifications. CCU selected coupon shall be tested for thickness and initial physical properties (bending strength, flex modulus, long-term performance, and chemical resistivity) to determine if material standards have been met.

1.3 REFERENCED STANDARDS (LATEST REVISION)

Wherever reference is made to any published standards, codes, or standard specifications, it shall mean the latest standard code, specification, or tentative specification of the technical society, organization, or body referred to, which is in effect at the date of the opening of bids.

This specification references standards from:

- OSHA Standard and Regulations
- NAASCO Publications & Specifications
- The American Society for Testing and Materials (ASTM), such as:

ASTM	
F-1071	Standard Specification for Expanded-Metal Bulkhead Panels
F-1216	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
F-1504	Standard Specification for Folded Poly (Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation.
F-1871	Standard Specification for Folder/Formed Poly (Vinyl Chlorine) Pipe Type A for Existing Sewer and Conduit Rehabilitation
F-1533	Standard Specification for Deformed Polyethylene (PE) Liner
F-1743	Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
C-940	Standard test method for expansion and bleeding of freshly mixed grouts for preplaced-aggregate concrete in the laboratory
C-950	Standard Practice for Repair of a Rigid Cellular Polyurethane Insulation System on Outdoor Service Vessels
D-638	Standard Test Method for Tensile Properties of Plastics
D-790	Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D-1248	Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
D-1693	Standard Specification for Polyethylene Plastics Extrusion

Materials For Wire and Cable

D-1784 Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D-1928 Standard Practice for Preparation of Compression-Molded Polyethylene Test Sheets and Test Specimens (Withdrawn 2001)

D-2122 Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D-2152 Standard Test Method for Adequacy of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion

D-2444 Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D-2837 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

D-2990 Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof

D-3350 Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

D-5813 Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems

The Contractor shall, when required, furnish evidence satisfactory to CCU that materials and methods are in accordance with such standards where so specified. In the event any questions arise as to the application of these standards or codes, copies shall be supplied on site by the Contractor. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

1.4 PARTIAL LISTING OF RELATED SECTIONS

001570 - Erosion and Sediment Control
002930 - Grassing

Note: This is only a partial listing of related sections. The Contractor shall be responsible to review the entire contract documents.

1.5 SUBMITTALS

1.5.1 General

a) All sewer lines rehabilitation products shall meet this specification.

b) All submittals listed in this section must be provided in writing prior to the start of the project by the contractor to CCU for approval

c) Submittal shall be made in a timely manner so that the project schedule can be met.

d) The Contractor submittals shall include the statement that the submittals have been reviewed and meet the contract specifications and/or standard details. All submissions shall bear the Contractor's stamp certifying that they have been checked for conformance and accuracy. Submissions without the Contractor's stamp of approval will not be reviewed by CCU and will be returned to the Contractor.

e) All required submittals must be satisfactory to CCU.

1.5.2 Manufacturer/Installer Qualification Requirements

Acceptable documentation of the minimum requirements listed below must be submitted to CCU. These requirements include detailed resume of the field superintendent and installer(s).

a) Contractor Qualifications:

- The Contractor shall be specialized in the trenchless rehabilitation system for a minimum of 5 years.

- The Contractor shall have successfully installed at least 50,000 L.F. of the product in wastewater collection systems in the State of Florida and shall submit a minimum of five (5) references of completed projects in the State of Florida within the last five (5) years. Reference submittals shall include project names, locations, work performed, contract amounts, completion dates, contact persons and phone numbers, where similar works, in quantity and quality, as specified herein has been performed successfully.

- All installers shall be trained, approved and certified in writing by the manufacturer in the handling, mixing and application of the products to be used including leak repair and surface preparation.

- The field superintendent must have a minimum of two (2) years experience in trenchless pipeline rehabilitation and must be present during all steps of the entire rehabilitation process.

- The Contractor shall initiate and enforce quality control procedures consistent with applicable ASTM, NAASCO, NACE and SSPC standards and the lining manufacturer's recommendations.

1.5.3 Equipment Certifications

The contractor shall provide the following for CCU approval:

- Description of all the equipment to be used for the rehabilitation

- Certification that the equipment to be used for applying the products has been manufactured or approved by the product manufacturer and Applicator personnel have been trained and certified for proper use of the equipment.

- Safety plan describing all safety equipment to be utilized in compliance with OSHA standards pertaining to work in confined space entry.

1.5.4 Progress Schedule

- A progress schedule shall be prepared and be submitted to CCU for review and comments within fourteen (14) days of date issue of Purchase Order.

- The schedule shall detail the proposed sequence of the work and identify pertinent construction activities of each Bid Item. The schedule shall be time-scaled, identifying the estimated date of starting and completion of each bid item in order to complete the Purchase Order within the time specified in the Purchase Order.

- Subsequent changes to the schedule shall be accompanied by a letter of explanation with appropriate reference and revision date on the schedule.

- Review of schedule by Engineer does not relieve the Contractor of any errors or omissions.

1.5.5 Product Data

For each product proposed to be furnished, the contractor shall provide the following for CCU approval:

a) Vendor's specific technical data sheets showing full details about component materials and their complete physical properties, demonstrating compliance with the latest revisions of the ASTM requirements including independent ASTM test results indicating the product conforms to the published technical data. A certificate of "Compliance with Specification" shall be furnished for all materials supplied Bids containing exceptions to the material requirements shall be considered non-responsive.

b) Material Safety Data Sheets (MSDS)

c) Liner dimensions pertinent to this job

1.5.6 Independent Third Party Testing Verification

Sewer rehabilitation products submitted for approval must provide third party test results supporting the structural performance (short-term and long-term) of the product and such data shall be satisfactory to CCU. No product will be approved without independent third party testing verification.

1.5.7 Quality Management System Certification

Both the rehabilitation manufacturing and installation processes shall operate under a quality management system which is third-party certified to ISO 9000 or other recognized organization standards. Proof of certification shall be required for approval.

1.5.8 Labeling

Proposals must be labeled clearly on the outside of the proposal envelope, listing the product name and installer being proposed. Only proposals using pre-approved products and installers will be opened and read. Proposals submitted on products and/or from installers that have not been pre-approved will be returned unopened

1.5.9 Installation Procedures

a) The Contractor shall submit a work plan to CCU for acceptance. The work plan shall address preparation steps required for pre-installation

b) The procedure and steps to be followed for the pre-installation and installation of the liner with project specific guidelines and recommendations (even if the process is named in the specification)

c) Proof of any required federal, state or local permits or licenses necessary for the project.

d) Design details for any ancillary systems and equipment to be used in site and surface preparation, application and testing.

1.5.10 Samples

a) The Contractor shall furnish for review all samples as required by the Contract Documents or requested by CCU.

b) A minimum of two (2) samples shall be submitted. Samples shall be of sufficient size or quantity to clearly illustrate the quality, type, range of color, finish or texture and shall be properly labeled to show the nature of the work where the material represented by the sample will be used.

1.5.11 Schedule of Payment Values

a) The Contractor shall submit a separate Schedule of Payment Values for the work in accordance with the "Method of Measurement and Payment" section of these specifications for all items in the bid that are to be paid for on unit bid item basis. The schedule shall contain the installed value of the component parts of work for the purpose of making progress payments during the construction period.

b) The schedule shall be given in sufficient detail for the proper identification of work accomplished. Each item shall include a complete installation with all construction costs, the Contractor's overhead, contingencies and profit. The sum of all unit bid items multiplied by their respective quantities shall equal the total value of the Contract.

1.5.12 Television recordings

- The Contractor shall submit all pre and post television recordings in color DVD format to CCU for acceptance prior to payment.

1.5.13 Written warranty.

The Applicator shall warrant all work against defects in materials and workmanship for a period of five (5) years, unless otherwise noted, from the date of final acceptance of the project. This warranty shall be a guarantee against failure for the warranty period. Failure shall be defined to occur if the rehabilitation system fails to:

a) Prevent the internal damage or corrosion of the sewer line.

b) Prevent groundwater infiltration.

If any failures occur within the specified warranty period after final acceptance, the Contractor shall repair or restore the sewer lines to its previously accepted state including all materials, labor, and at no additional cost to CCU. Repair shall be completed within 30 days of written notification of the failure.

PART 2 - PRODUCTS

2.1 MATERIALS

2.1.1 General

a) Materials to be incorporated in the work shall be delivered sufficiently in advance of their installation and use to prevent delay in the execution of the work, and they shall be delivered as nearly as feasible in the order required for executing the work.

b) All materials and equipment to be incorporated into the work shall be properly designed for the use intended.

c) Actual Pipe Size: The nominal pipe size is not necessarily the size of the pipe in the field. The Contractor shall verify (and measure wherever it is exposed) the actual inside diameter of the actual sewer pipe prior to ordering pipe materials and before trenchless pipe insertion is undertaken.

d) All materials, products, or devices incorporated in this project shall be new and unused and shall conform to the requirements of all applicable laws, ordinances, and codes unless indicated otherwise in the Contract Documents and shall be the products of reliable manufacturers, which unless otherwise specified, have been regularly engaged in the manufacture of such material or devices. Procedures and additional requirements regarding manufacturer's experience and substitutions are included in the “Submittals" section of these specifications.

e) Pipe liner with gashes, nicks, abrasions, or any such physical damage which may have occurred during storage and/or handling, which are larger/deeper than 10% of the wall thickness shall not be used and shall be removed from the construction site.

f) Materials and/or equipment which, in the opinion of CCU, are inferior or of a lower grade than specified, or required, will not be accepted and shall be removed immediately from the project site.

g) The Contractor shall protect all devices and materials from deterioration and damage. All materials and equipment shall be handled and stored in strict accordance with the manufacturer's recommendations. Products shall also be stored and handled according to their Material Safety Data Sheets (MSDS). The materials shall be handled and stored by the manufacturer, fabricator supplier and Contractor before, during, and after shipment to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, damage or theft of any kind whatsoever. Any material exhibiting any of the above shall be removed and replaced at the Contractor's expense for both labor and materials.

h) The Contractor shall store his equipment and materials at the Contractor's base of operations in a secure storage area of a size adequate to accommodate the required vehicles, equipment and materials for the period of performance of the contract and in accordance with the manufacturer's recommendations. No storage facility is provided by CCU.

i) Only materials that meet the latest revisions of the applicable American Society of Testing and Materials (ASTM) material standards are acceptable for this work.

j) Design Loads: CCU usually determines the design loads for the pipe to be installed and determines the required thickness with regard to the materials specified. External loads (earth loads/live loads/hydrostatic pressure), construction loads (external grout pressure/jacking force), support developed by annulus grouting, long-term flexural strength/modulus, together with appropriate safety factors are engineering considerations. The Design is specific to the Process.

k) Corrosion Resistance: The finished pipe in place shall be fabricated from materials which, when installed, will be chemical resistant to withstand internal exposure to domestic sewage. All exposed surfaces shall remain corrosion resistant.

l) Dimensional Change: For certain processes, dimensional changes can occur during forming, installation or after installation. The liner shall be fabricated to a size that, when installed, will neatly and tightly fit the internal circumference of the conduit. Allowance for longitudinal stretching during insertion shall be made.

m) Length: The minimum length shall span the distance from inlet to the outlet of the respective pipe to be rehabilitated. The contractor shall verify the lengths in the field before starting work.

n) Thickness: The minimum thickness for the liner shall be as verified by design calculations prepared by a professional engineer for each specific pipe location

2.1.2 Cured In Place Pipe Lining

a) General

Cured in place pipe Lining introduced into sanitary sewers in order to rehabilitate the existing pipeline system without excavation, shall comply with ASTM F-1216 (Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube).

Liner shall be as manufactured by Insituform of North America, Inc., or equal.

Liner shall be neither accepted nor installed until design calculations are acceptable to CCU.

b) Material Composition

The polyester fiber felt tubing and resin material shall be in accordance with the requirements with ASTM F-1216

Tube - The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F-1216, Section 5.1 or ASTM F-1743, Section 5.2.1 or ASTM D-5813, Sections 5 and 6. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections. The tube may also contain felt layers reinforced with glass or carbon fibers.

Resin - The resin system shall be a corrosion resistant polyester or vinyl ester system including all required catalysts, initiators that when cured within the tube create a composite that satisfies the requirements of ASTM F-1216, ASTM D-5813 and ASTM F-1743, the physical properties herein, and those which are to be utilized in the submitted and approved design of the CIPP for this project. The resin shall produce a CIPP that will comply with the structural and chemical resistance requirements of this specification.

c) Material and Equipment Acceptance

At the time of manufacture, each lot of liner shall be reviewed for defects and tested in accordance with ASTM D-2837 and D-1693. At the time of delivery, the liner shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.

The Contractor shall provide certified test results for review by CCU, from the manufacturer that the material conforms to the applicable requirements.

For testing purposes, a production lot shall consist of all liner having the same marking number. It shall include any and all items produced during any given work shift and must be so identified as opposed to previous or ensuing production.

The wet out Tube shall have a relatively uniform thickness that when compressed at installation pressures will equal or exceed the calculated minimum design CIPP wall thickness.

The Tube shall be manufactured to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during installation.

The outside layer of the Tube shall be coated with an impermeable, flexible membrane that will contain the resin and allow the resin impregnation (wet out) procedure to be monitored.

The Tube shall contain no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

The wall color of the interior pipe surface of CIPP after installation shall be a relatively light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

Seams in the Tube shall be stronger than the non-seamed felt material.

d) Marking

The Tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings code shall identify the manufacturer name, SDR, size, material, date, and shift on which the liner was extruded. The tubes must be manufactured in the USA.

At the end of the production shift during which a production lot has been extruded, the marking code on the liner shall be changed to indicate that said time intervals have elapsed and then a new production shift has begun.

e) Chemical and Physical Testing

CCU may, at any time, direct the manufacturer to obtain compound samples and to prepare test specimens in accordance with ASTM D-1928. These specimens shall comply with the minimum property values as follows with the applicable ASTM F-1216 requirements.

The polyester fiber felt tubing and resin material shall be in accordance with the requirements with ASTM F-1216 and be fabricated to a size that when installed will neatly fit the interior of the host pipe. Allowance shall be made for circumferential stretching during inversion. The minimum tube length shall be that deemed necessary by the Contractor to effectively span the distance between the access points. Unless otherwise specified, the Contractor will use a polyester filter felt tube and an epoxy vinyl ester and catalyst system compatible with the inversion process and having the following physical properties for the cured pipe:

Property	Test Method	min. per ASTM F1216
Tensile Strength	ASTM D-638	3,000 psi
Flexural Stress	#101 (Modified ASTM D-790)	4,500 psi
Flexural Modulus of Elasticity	#101 (Modified ASTM D-790)	300,000 psi
Minimum Long-Term (50 Year)	Modulus of Elasticity	150,000 psi

The lining manufacturer shall submit to CCU for review complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations. The liner shall be designed to withstand a live load equivalent to two (2) H20 passing trucks plus all pertinent dead loads, hydrostatic pressure and grout pressure (if any). For design purposes, the water table shall be considered at grade elevation. The liner shall be designed in accordance with ASTM F-1216 and resist buckling in accordance with AWWA C-950. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure against the liner. Modulus of soil reaction shall not be taken higher than 1000, corresponding to a moderate degree of compaction of bedding (85% to 95% Proctor) and a fine-grained soil as shown on Table A4 of AWWA C-940.

As part of the design calculation submittal, the liner manufacturer shall submit a tabulation of time versus temperature. This tabulation shall show the lengths of time that exposed portions of the

liner will endure without self-initiated cure or other deterioration beginning. This tabulation shall be at 5' F. increments ranging from 70' F. to 100' F. The manufacturer shall also submit his analysis of the progressive effects of such "pre-cure" on the insertion and cured properties of the liner. This information shall be submitted in a timely fashion prior to the preconstruction conference so that CCU may set procedures for dealing with such an instance caused by construction delays. Bidders with materials with other characteristics must supply complete information on their bids of the values as listed for ascertaining minimum thickness.

2.1.3 Polyethylene Pipe Lining

a) General

Deformed polyethylene pipe introduced into sanitary sewers in order to rehabilitate the existing pipeline system without excavation, shall comply with ASTM F-1533 and D-3350- Specification for Deformed Polyethylene P.E. Liner. This method applies to the rehabilitation of 8-inch through 12-inch diameter pipe in terms of material and installation. Unless otherwise required by installation depth, liner shall have an SDR of 32.5, minimum. The polyethylene pipe liner shall be completely factory manufactured, jointless, seamless, deformed and/or folded under factory controlled temperature conditions, coiled, and packaged. The pipe liner producer's certification, in accordance with ASTM specifications, shall be furnished with the liner coils. The Contractor shall turn the pipe liner producer's certification and warranty over to CCU prior to installation. The deformed and reformed pipe lining shall be U-Liner pipe or equal.

b) Material Composition

Pipe shall be made from P.E. 3408 polyethylene resins complying with ASTM D-3350, cell classification: P.E. 345434 D for High Density. It shall be Type 3, Grade 4, Class D, according to ASTM D-1248. The Contractor shall provide certified test results for review by CCU, from the manufacturer that the material conforms to the applicable requirements.

c) Material and Equipment Acceptance

At the time of manufacture, each lot of liner shall be reviewed for defects and tested in accordance with ASTM D-2837 and D-1693. At the time of delivery, the liner shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters, or deleterious faults.

The Contractor shall provide certified test results for review by CCU, from the manufacturer that the material conforms to the applicable requirements.

For testing purposes, a production lot shall consist of all liner having the same marking number. It shall include any and all items produced during any given work shift and must be so identified as opposed to previous or ensuing production.

d) Marking

Liner shall be marked at five feet (5') intervals or less with a coded number which identifies the manufacturer, SDR, size, material, date, and shift on which the liner was extruded.

At the end of the production shift during which a production lot has been extruded, the marking code on the liner shall be changed to indicate that said time intervals have elapsed and then a new production shift has begun.

e) Chemical and Physical Testing

CCU may, at any time, direct the manufacturer to obtain compound samples and to prepare test specimens in accordance with ASTM D-1928. These specimens shall comply with the minimum property values as follows with the applicable ASTM F-1533 and ASTM D-3350 requirements for P.E. 3408.

ASTM 03350 Cell Classification Values

Physical Properties	STM Test Method	Cell Class	Cell Class Limits	Typical Values
Density	D1505	3	0.941 to 0.955	0.0947
Melt Index	D1238	4	<0.15	<0.1
Flexural Modulus	D790	5	110,000 to <160,000 psi	120,000 psi
Tensile Strength at Yield	D638	4	3000 to <3500	3300 psi
Environmental Stress Crack Resistance	D1693	3	Condition C 192 hrs, F 20	>5000 hrs
Hydrostatic Design Basis at 23 C	D2837	4	1600 psi	1600 psi
Color and Stabilizer		D	Natural with UV Stabilizer	

2.1.4 PVC or PVC Alloy Pipe Lining

a) General

Contractors must clearly identify the applicable cell designation that corresponds to its pipe.

F1504-97 - Standard Specification for Folded Poly (Vinyl Chloride) (PVC) Pipe for Existing Sewer and Conduit Rehabilitation.

F1871-98 - Standard Specification for Folder/Formed Poly (Vinyl Chlorine) Pipe Type A for Existing Sewer and Conduit Rehabilitation.

ASTM F-1071-98 and D-1784-99A - Standard Specification, for rigid poly-vinyl chloride (PVC) pipe and rigid poly-compounds.

b) Material and Equipment Acceptance

Each production lot of pipe liner shall be inspected and tested at the time of manufacture for defects in accordance with ASTM D-2444, ASTM D-2152, and ASTM D-2122. All pipe liner shall be homogeneous, uniform in color, free of cracks, holes, foreign material, blisters and deleterious

faults. Production lot of pipe liner shall include unique markings to clearly discern from other production lots.

c) Marking

The pipe liner shall be marked at maximum five-feet (5') intervals with coded number system to indicate manufacturer, size (diameter and SDR), material, extrusion date, and production shift that fabricated the pipe liner. The marking code shall be changed with each production shift change.

d) Chemical and Physical Testing

The outside diameter and minimum wall thickness shall be manufactured to a size that when installed will fit the internal circumference of the conduit specified (without annular space). Allowance shall be made for misaligned and missing conduit.

Standard Dimension Ration (SDR) of the pipe liner shall be as selected from the following table:

Liner Nominal Outside Diameter Inches	**Existing Pipe Inside Diameter Range. Inches** Minimum	Maximum	**Resulting SDR over Diameter** SDR35	SDR41	SDR5
4	3.70	4.20	33-42	39-50	48-61
6	5.60	6.30	33-42	39-50	48-61
8	7.40	8.40	33-42	39-50	48-61
9	8.30	9.40	33-42	39-50	48-61
10	9.30	10.50	33-42	39-50	48-61
12	11.30	12.80	33-42	39-50	48-61
15	13.90	15.70	33-42	39-50	48-61
18	17.50	19.50	33-42	39-50	48-61

The minimum length shall be that deemed necessary by the Contractor to effectively span the distance form the inlet to the outlet of the respective manholes unless otherwise specified. The Contractor shall verify the lengths in the field before manufacturing. Individual insertion runs can be made over one (1) or more manhole sections as determined in the field by the Contractor and approved by CCU.

2.2 QUALITY CONTROL

2.2.1 Review at Place of Manufacture

Unless otherwise specified, all products, materials, and time and equipment may be subject to review by CCU at the place of manufacture.

The presence of CCU at the place of manufacture, however, shall not relieve the Contractor of the responsibility for furnishing products, materials, and equipment which comply with all

requirements of the Contract Documents, and said duty shall not be avoided by any act or omission on the part of CCU.

2.2.2 Sampling and Testing

Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered.

The Contractor shall provide and identify a pipe "coupon" specimen from each run of pipe for testing after installation by an approved independent laboratory.

Each coupon shall be properly labeled with a permanent marker indicating the following information:

a) Date
b) Contractor's name
c) Line size
d) CCU Manhole identification numbers (both manholes)
e) Exact footage of the coupon location from the upstream manhole

CCU will keep all coupons and select which ones shall be sent for testing. The Contractor will be compensated for all expenses for the testing of these specimens as specified in the line item of the bid tabulation of this contract. The Contractor shall pay for all costs of retests made necessary by the failure of the samples of specimens to meet the specified ASTM requirements.

Any waiver by CCU of any specified testing or other quality assurance measures, whether or not waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any requirements of the Contract Documents.

Notwithstanding the existence of such waiver, CCU reserves the right to make independent additional investigations and tests and failure of any portion of the work to meet any of the requirements of the Contract Documents, shall be reasonable cause for CCU to require the removal or correction and reconstruction of any such work in accordance with the General Conditions.

2.2.3 Site Investigation and Control

The Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the work due to his failure to comply with this requirement.
The Contractor shall inspect related and appurtenant work and shall report in writing to CCU any conditions which will prevent proper completion of the work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair,

or replacement caused by unsuitable conditions shall be performed by the Contractor within the scope of the project.

2.2.4 Additional Review and Testing

CCU reserves the right to employ and pay for the services of an independent testing laboratory for additional specified testing.

The work or actions of the testing laboratory shall in no way relieve the Contractor of his obligations under the Contract. The laboratory testing work will include such review and testing required by the Contract Documents, existing laws, codes, and ordinances. The testing laboratory will have no authority to change the requirements of the Contract Documents, nor perform, accept, or approve any of the Contractor's work.

The Contractor shall allow CCU ample time and opportunity for review and testing materials to be used in the work. The Contractor shall advise CCU promptly upon placing orders for materials so that arrangements may be made, if desired, for review before shipment from the place of manufacture. The Contractor shall at all times furnish CCU and his representatives, facilities including labor, and allow proper time for reviewing and testing materials, equipment, and workmanship. The Contractor must anticipate that possible delays may occur in the execution of its work due to the necessity of materials and equipment being reviewed and accepted for use. The Contractor shall furnish, at his own expense, all samples of materials required by CCU for testing, and shall make his own arrangements for providing dater, electric power, or fuel for the various reviews and tests of lines and manholes.

CCU will bear the costs of all tests, reviews, or investigations undertaken by the order of CCU for the purpose of determining conformance with the Contract Documents if such tests, reviews, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by CCU as a result of such tests, reviews, or investigations, the Contractor shall bear the full costs of any additional tests and investigations, which are ordered by CCU to ascertain subsequent conformance with the Contract Documents.

2.2.5 Right of Rejection

CCU or its representative shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the work at the site. If CCU or its representative, through an oversight or otherwise, has accepted materials or work which is defective or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected by CCU or its representative.

The Contractor shall promptly remove rejected articles or materials from the site of the work after notification or rejection. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the Contractor.

2.2.6 Weather Conditions

Work that may be affected by inclement weather shall be suspended until proper conditions prevail. In the event of impending storms, the Contractor shall take necessary precautions to protect all work, materials and equipment from exposure.

2.2.7 Fire Protection

The Contractor shall take all necessary precautions to prevent fires at or adjacent to the work, including his own equipment and trailers. Adequate fire extinguisher stations shall be provided throughout the work area.

2.2.8 Final Remedy

If testing results do not meet the specifications, the Contractor shall be required to replace the liner.

PART 3 - EXECUTION

3.1 INSTALLATION PROCEDURES: GENERAL

3.1.1 Pipe Installation

- No pipe shall be relined without prior notification of CCU. Each prepared pipe shall be subject to inspection by CCU for cleanliness and smoothness immediately before the liner is installed and defective pipe may be rejected.

- Procedures for liner installation are specific to the method being used and may vary with material, thickness, pipe size, pipe shape, etc. When proprietary techniques are used, the licensor's Specification for proper installation should be used.

- All approved installation instructions and procedures submitted shall be carefully followed during installation.

- Any proposed changes in installation procedures shall require submittal of revised procedures and acceptance by CCU

- The contractor shall maintain in operating condition all active pipes encountered during the pipeline rehabilitation

3.1.2 Acceptance

- The finished pipe shall be continuous over the entire length of the host pipe from manhole to manhole in a continuous, jointless, tight fitting, watertight pipe.
- The liner shall be free as commercially practicable from visual defects (such as foreign inclusions, pin holes, concentrated ridges, discoloration, pitting, varying wall thickness and other deformities), damage, deflection, holes, delamination, uncured resin, and the like.

- The contractor shall make all required connections to existing pipes and manholes and carry out such work in accordance with local standards and requirements and as directed by CCU. Extreme care shall be used to prevent debris from entering existing pipe prior to rehabilitation.
- Cut-ins and attachments at service connections shall be neat and smooth.
- The pipe liner passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by CCU.
- The invert and benches shall be streamlined and improved for smooth flow.
- There shall be no visible infiltration through the liner or from behind the liner at manholes and service connections. The installed pipe liner shall meet the leakage requirements of the pressure test as specified.

3.1.3 Cleanup

- No trash, rubbish, or any other debris, shall be stored at any site, whether the work is in progress or not.

- After installation has been completed and accepted, the Contractor shall clean up the project area and return the site ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor.

- Sidewalks, driveways, and street surfaces disturbed by the installation shall be recovered and restored in conditions equal to that before the work began, to the satisfaction of CCU.

3.1.4 Warranty

During the warranty period any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by CCU and the Contractor.

If any failures occur within the specified warranty period after final acceptance, the Contractor shall repair or restore the structure to CCU standard specifications including all materials, labor, and at no additional cost to CCU. Repair shall be completed within 30 days of written notification of the failure.

3.2 PRE-INSTALLATION PREPARATIONS

The Contractor's work plan shall address the following minimum preparation/steps, unless approved otherwise by CCU:

3.2.1 Safety

The Contractor shall carry out operations under this section in strict accordance with all applicable OSHA Standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space. It shall be the Contractor's responsibility to comply with OSHA Standard and Regulations pertaining to all aspects of the work.

3.2.2 Cleaning of Sewer Lines

Immediately prior to the TV inspection and subsequent line installation, it shall be the responsibility of the Contractor to clean the existing sewer lines to be rehabilitated with a high-pressure water jet and to remove all internal debris out of the sewer in accordance with the "Preparatory Cleaning & Root Removal" and the "Cleaning and Inspecting Cast Iron Pipe or Ductile Iron Pipe" sections of these specifications.

3.2.3 Pre-Installation Television Inspection

It shall be the responsibility of the Contractor to video (TV) inspect the sewer pipe immediately before the pipe liner installation to assure that the existing pipe conditions are acceptable for proper pipe liner installation. These video inspections of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections using close circuit television (CCTV) inspection techniques. The pipeline interior shall be carefully inspected to determine the location of any conditions that may prevent proper installation of the liner. These shall be noted and corrected. DVDs and suitable written log for each line section shall be produced for later reference by CCU. Refer to the "Television Inspection" section of these specifications for more details.

3.2.4 Sewer repairs

If conditions such as broken pipe and major blockages are found that will prevent proper cleaning or liner installation, the Contractor, with the concurrence of CCU, shall perform the necessary point repair(s). All point repairs and costs thereof shall be defined in writing and approved by CCU prior to initiating. All estimated costs for point repairs shall be based on time and material costs (utilizing Florida Department of Transportation Specifications) necessary to complete the repair. CCU reserves the right to complete point repairs in-house or by alternative contractor.

3.2.5 Flow Control

If necessary for effective TV inspection and line installation, the Contractor shall bypass the effluent around the section or sections designated for pipe insertion by use of a diversion pump in accordance with the "Wastewater Flow Control" section of these specifications.

3.2.6 Public Notification

The Contractor shall make every effort to maintain sewer service usage throughout the duration of the project. In the event that a connection will be out of service, the longest period of no service shall be 8 hours. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

a) Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any potential problems.

b) Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.

3.2.7 Sewer Obstructions

It shall be the responsibility of the Contractor to clear the line of obstructions such as heavy solids, roots, dropped joints, protruding service connection or collapsed pipe that will prevent the insertion of the liner. If pre-installation inspection reveals an obstruction that will prevent the installation process, that was not evident on the pre-bid video and it cannot be removed by conventional sewer cleaning equipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by CCU's representative prior to the commencement of the work and shall be considered as a separate pay item.

3.2.8 Offset Joints

If pre-installation video (TV) inspection reveals an offset joint with less than 90% clearance, the Contractor shall take the necessary steps to eliminate the offset joint. The cost to do this elimination is incidental to the cost of the lines. If pre-installation video (TV) inspection reveals an offset joint with less than 80% clearance, the Contractor shall notify CCU. CCU may elect to correct the offset joint by use of a point repair. CCU shall be the individual to determine the percent of clearance.

3.2.9 Service Connection

The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing the liner.

3.3 TEMPORARY UTILITIES

3.3.1 General

The Contractor shall provide for utilities and services for his own operations. These shall include electrical power, water, ventilation, sanitary facilities and telephone service. The Contractor shall furnish, install and maintain all temporary utilities during the Contract period including removal upon completion of the work. Such facilities shall comply with regulations and requirements of the national Electrical Code, OSHA, Florida Power and Light, and applicable Federal, State, and Local codes, rules and regulations.

3.3.2 Temporary Water

The Contractor shall supply all water necessary for performance of work under the contract. The Contractor shall provide and maintain all piping, fittings, adapters, and valving required. It is the Contractor's responsibility to arrange through CCU for a water meter. A deposit to be paid by the Contractor is required or meter rental and all water shall be purchased by the Contractor at the prevailing rate.

3.3.3 Temporary Ventilation

The Contractor shall provide and maintain adequate ventilation for a safe working environment. In addition, forced air ventilation shall be provided for the curing of installed materials, humidity control, and the prevention of hazardous accumulations of dust, gases, or vapors.

3.3.4 Temporary Sanitary Facilities

The Contractor shall provide and maintain adequate and clean sanitary facilities for the construction work force and visitors. The facilities shall comply with Local codes and regulations and be situated at approved locations.

3.4 TEMPORARY ENVIRONMENTAL CONTROLS

3.4.1 Chemicals:

All chemicals used during project construction or furnished for testing of project operations, whether herbicide, pesticide, disinfectant, polymer, reactant of other classifications, will be required to show approval of either EPA or HUD. The handling, use, storage and disposal of such materials, containers or residues shall be in strict conformance with manufacturer and/or supplier's secured storage. Copies of antidotes shall be kept at the storage site and at the job site. The Contractor shall be responsible for any leaked chemical that has permeated into the soil. Costs incurred for cleanup of any such contamination shall be borne by the Contractor.

3.4.2 Dust

During all work for this Contract, the Contractor shall be the application of water and/or calcium chloride or other means, acceptable to CCU, eliminate dust annoyance to adjacent property CCUs and business establishments.
The Contractor shall take all protective measures, to the satisfaction of CCU, necessary to ensure that dust and debris does not enter any of the mechanical or electrical equipment. The Contractor shall be responsible for the cleanup of existing buildings and property which have become soiled due to the lack of proper dust control as determined by CCU.

3.4.3 Rubbish Control

During the progress of the work, the Contractor shall keep the site of the work and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the work site, and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to me particular requirements of Part 1926 or the OSHA Safety and Heath Standards for Construction.

3.4.4 Toilet Facilities

Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

Such facilities shall be made available when the first employees arrive on the work, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.

The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the work, on the lands of CCU, or an adjacent property.

CCU shall have the right to review any building or other facility erected, maintained, or used by the Contractor, to determine whether or not the sanitary regulations have been complied with.

3.4.5 Sanitary and Other Organic Wastes

The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to CCU and in accordance with all laws and regulations pertaining thereto.

3.4.6 Noise

Noise resulting from the Contractor's work shall not violate the local noise ordinances or exceed the noise levels and other requirements relating to noise abatement. The Contractor shall be responsible for curtailing noise resulting from his operation. He shall, upon written notification from CCU or the noise control officers, make any repairs, replacements, adjustments, additions, and furnish mufflers when necessary to fulfill requirements.

3.4.7 Erosion Abatement and Water Pollution

It is imperative that the Contractor's dewatering operations not contaminate or disturb properties adjacent to the work sites in accordance with the regulatory agencies having jurisdiction. The Contractor shall, therefore, schedule and control his operations to confine all runoff water from disturbed surfaces, water from dewatering and/or from excavation below the ground water table operations that becomes contaminated with lime silt, mulch, and other deleterious matter, fuels, oils, bituminous, calcium chloride, chemicals and other polluting materials.

The Contractor shall construct temporary stilling basin(s) of adequate size and provide all necessary temporary materials, operations and controls including, but not limited to, filters, coagulants, screens and other means necessary to attain the required discharge water quality.

The Contractor shall be responsible for providing, operating, and maintaining materials and equipment used for conveying the clear water to the point of discharge. All pollution prevention

procedures, materials, equipment, and related items shall be operated and maintained until such time as the dewatering operation is discontinued.
Upon the removal of the materials, equipment, and related items, the Contractor shall restore the area to the condition prior to his commencing work.

3.4.8 Precautions During Adverse Weather

During adverse weather, and against the possibility thereof, the Contractor shall take all necessary precautions so that the work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building paper, shelters, or other acceptable means. The Contractor shall be responsible for all changes caused by adverse weather.

3.4.9 Hurricane and Storm Warnings

The Contractor shall be required to remove from and/or secure all loose construction materials and equipment and protect structures under construction at the job site in the event of a hurricane watch. The Contractor shall also remove all bulkheads and plugs in pipelines that would impede drainage in case of flooding. Structures that may be in danger of floatation shall be flooded.

3.4.10 Pests and Rodents

The Contractor shall be responsible for maintaining the job site free from litter, rubbish, and garbage. He shall provide containers for the disposal of garbage and other materials that attract and are breeding places for pests and rodents. The Contractor shall provide the services of an exterminator to inspect the job site if pest and rodents are suspected and shall provide service.

3.4.11 Periodic Cleanup: Basic Site Restoration

During construction, the Contractor shall regularly remove from the site all accumulated debris and surplus materials of any kind which result from his operations. Unused equipment and tools shall be stored at the Contractor's yard or base of operations for the project.

When the work involves installation of sewers, drains, water mains, manholes, underground structures, or other disturbance of existing features in or across streets, rights-of-ways, easements, or private property, the Contractor shall (as the work progresses) promptly backfill, compact, grade, and otherwise restore the disturbed area to a basic condition which will permit resumption of pedestrian or vehicular traffic and any other critical activity or function consistent with the original use of the land. Unsightly mounds of each large stones, boulders, and debris shall be removed so that the site presents a neat appearance.

The Contractor shall perform the cleanup work on a regular basis and as frequently as requested by CCU. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required 'facilities in that area. Furthermore, such work shall also be accomplished, when ordered by CCU, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

Upon failure of the Contractor to perform period clean-up and basic restoration of the site to CCU's satisfaction, CCU may, upon five (5) days prior written notice to the Contractor, employ such labor and equipment as he deems necessary for the purpose, and all costs resulting there from shall be charged to the Contractor and deducted from the amounts of money that may be due him.

Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

3.5 WASTEWATER FLOW CONTROL

3.5.1 Scope of Work

The work specified in this section includes all labor, materials, accessories, equipment, and tools for performing all operations required to bypass pump sewage around a manhole or sewer section in which work is to be performed. The Contractor shall be prepared to bypass pump sewage as a part of his operations.

The Contractor shall provide all pumps, piping, and other equipment to accomplish this task; perform all construction; obtain all permits; pay all costs; and perform complete restoration of all existing facilities or equal or better condition to the satisfaction of CCU.

3.5.2 General

When sewer line flows at the upstream manhole of the manhole section being repaired are above the maximum allowable requirements for television inspection, or do not allow the proper sewer or manhole repair, the flows shall be reduced to the levels indicated by one of the following methods: manual operation of pumping stations by CCU Operation Department, by the Contractor plugging/blocking of the flows, or by the Contractor pumping/bypassing of the flows as acceptable to CCU.

In some applications, the wastewater flow may be plugged and contained within the capacity of the collections system. This shall only be done when it has been determined the system can accommodate the surcharging without any adverse impact.
For the initial television inspection, before and after a lining is installed, the sewer line shall be blocked completely. No flow, except infiltration/inflow, will be allowed through the respective sewer line being televised on the pre-repair television inspection.

For all other television inspections, including warranty inspections and joint testing and sealing, the depth of flow within the sewer shall not exceed that shown below for the respective pipe sizes as measured in the manhole and the camera lens shall always be clear of the flow.

Maximum Depth of Flow	Television Inspection
6" -10" Pipe	20% of pipe diameter
12" - 24" Pipe	25% of pipe diameter
Above 24" Pipe	30% of pipe diameter

Maximum Depth of Flow	Joint Testing/Sealing
6" -12" Pipe	25% of pipe diameter
15" - 24" Pipe	30% of pipe diameter
Above 24" Pipe	35% of pipe diameter

When sewer line flows at the upstream manhole of the line being repaired, in the opinion of CCU, are too excessive to plug while the rehabilitation is being performed; the Contractor shall submit a written plan and pump/bypass the flow as acceptable to CCU.

3.5.3 Submittals

The Contractor shall submit complete, detailed plans for this aspect of the work to the work to CCU for review in accordance with the “Submittals” section of these specifications.

3.5.4 Workmanship

a) Plugging and Blocking

A sewer line plug shall be inserted into the line at a manhole upstream from the section being inspected, rehabilitated and/or repaired. The plug shall be so designed that all or any portion of the operation flows can be released. During the inspection portion of the operation, flows shall be shut off or reduced to within the maximum flow limits specified. During rehabilitation and/or repairs, the flows shall be shut off or pumped/bypassed, as acceptable to CCU. After the work tasks have been completed, flows shall be restored to normal.

b) Pumping and Bypassing

When pumping/bypassing is required, as determined by CCU, the Contractor will supply the necessary pumps, conduits, and other equipment to divert the flow of sewage around the manhole section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during periods of rain storms. The Contractor will be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. A "setup" consists of the necessary pumps, conduits and other equipment to divert the flow of sewage around a manhole section, from the start to finish of work performed in the manhole section.

Pumps and equipment shall be continuously monitored by a maintenance system capable of starting, stopping, refueling and maintaining these pumps during the rehabilitation, If pumping is required on a 24-hour basis, engines shall be equipped in a manner to keep noise to a minimum.

c) Surcharging Sewers

Where the raw sewage flow is blocked or plugged, sufficient precautions must be taken to protect the public health. The sewer lines shall also be protected from damage. The following occurrences shall not be allowed:

c1) No sewage shall be allowed to back up into any homes or buildings,

c2) No sewage shall overflow any manholes, clean-outs, or any other access to the sewers.

c3) Users upstream of the repair area shall be able to use all their water and sewer utilities without interruption.

If any of the above occur or are expected to occur, the contractor shall bypass pump to alleviate one (1) or all of the conditions. Additionally, the Contractor is required to observe the conditions upstream of the plug and be prepared to immediately start bypass pumping, if needed.

d) Pumps discharge material

Any sump pumps, bypass pumps, trash pumps, or any other type pump which pulls sewage/water or any type of material out of the manhole or sewer shall discharge this material into another manhole, or appropriate vehicle or container acceptable to CCU. Under no circumstances shall this material be discharged, stored, or deposited on the ground, swale, or open environment.

e) Traffic Control

The Contractor shall take appropriate steps to ensure that all pumps, piping, and hoses that carry raw sewage are protected from traffic. Traffic control shall be performed in accordance with the contract documents.

f) Sanitary Sewer Overflow (SSO) and/or Discharge

- In case of an SSO and/or discharge, the Contractor is responsible for immediately notifying CCU and supplying all information pertaining to the incident.

- The Contractor is solely responsible for all fines, labor, materials, equipment, and all other associated costs incurred by the Contractor and CCU associated with an SSO and/or discharge to the environment resulting from the Contractor's actions or the Contractor's negligence.

- In the event, during any work task(s) involved in "Sewage Flow Control," that raw sewage is spilled, discharged, leaked, or otherwise deposited in the open environment, due to the Contractor's work, the Contractor also shall immediately control, contain, and stop the spill or discharge and shall repair any damage. The Contractor is responsible for any clean up of solids and disinfection of the area affected.

- This work shall be performed at the Contractor's sole expense with no additional cost to CCU.

3.6 PREPARATORY CLEANING & ROOT REMOVAL

3.6.1 Scope of Work

This section covers the preparatory cleaning of sewer lines and manholes as needed prior to the internal inspection of the sewer lines and the cleaning of manholes prior to rehabilitation. The Contractor shall furnish all necessary material, labor, equipment, and services required for cleaning the specific sewer lines and manholes.

3.6.2 General

The intent of sewer line cleaning is to remove foreign materials from the lines and manholes and restore the sewer to a minimum of 95% of the original carrying capacity or as required for proper seating of internal pipe joint sealing packers. Since the success of other phases of work depends a great deal on the cleanliness of the lines and manholes, the importance of this phase of the operation is emphasized. It is recognized that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where additional damage would result if cleaning were attempted or continued. Should such conditions be encountered, the Contractor will not be required to clean those specific sewer sections. If, in the course of normal cleaning operations, damage does result from pre-existing and unforeseen conditions such as broken pipe, the Contractor will not be held responsible.

Sewer line cleaning shall be performed with hydraulically propelled, high velocity jet, or mechanically powered equipment as approved by CCU. Selection of equipment shall be based on field conditions such as access to manholes, quantity of debris, size of sewer, depth of flow, etc. Reference is made to the NASSCO “Jetter Code of Practice”, a guide for the selection and operation of sewer Jetter equipment and the selection of nozzles for different applications.

3.6.3 Hydraulically Propelled Equipment

The equipment used shall be of a movable dam-type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. The movable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. If sewer cleaning balls or other equipment which cannot be collapsed is used, special precautions to prevent flooding of the sewers and public or private property shall be taken.

3.6.4 High Velocity Jet (Hydrocleaning) Equipment

All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two (2) or more high velocity nozzles. The nozzles shall be capable of producing a scouring action from 15" to 45" in all size lines designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

3.6.5 Mechanically Powered Equipment

Bucket machines shall be in pairs with sufficient power to perform the work in an efficient manner. Machines shall be belt operated or have an overload device. Machines with direct drive that could cause damage to the pipe will not be allowed. A power rodding machine shall be either a sectional or continuous rod-type capable of holding a minimum of 750 feet of rod. The rod shall be specifically heat-treated steel. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

3.6.6 Workmanship

a) General

The designated sewer manhole sections shall be cleaned using hydraulically propelled, high velocity jet, or mechanically powered equipment. The equipment shall be capable of removing dirt, grease, rocks, sand, and other materials and obstructions from the sewer lines and manholes. If cleaning of an entire sewer section cannot be successfully performed from one manhole, the equipment shall be set up on the other manhole and cleaning again attempted. If, again, successful cleaning cannot be performed or the equipment fails to traverse the entire manhole section, it will be assumed that a major blockage exists and the cleaning effort shall be abandoned.

b) Cleaning Precautions

During all cleaning and preparation operations, all necessary precautions shall be taken to protect the sewer from damage. During these operations, precautions shall also be taken to insure that no damage is caused to public or private property adjacent to or served by the sewer or its branches.

Satisfactory precautions shall be taken in the use of cleaning equipment. When hydraulically propelled cleaning tools (which -depend upon water pressure to provide their cleaning force) or tools which retard the flow in the sewer line are used, precautions shall be taken to insure that the water pressure created does not damage or cause flooding of public or private property being served by the sewer. When possible, the flow of sewage in the sewer shall be utilized to provide the necessary pressure for hydraulic cleaning devices. When additional water from fire hydrants is necessary to avoid delay in normal work procedures, the water shall be conserved and not used unnecessarily. No fire hydrant shall be obstructed in case of a fire in the area served by the hydrant.

c) Material Removal

All sludge, dirt, sand, rocks, grease, roots, and other solid or semisolid material resulting from the cleaning operation shall be removed at the downstream manhole of the section being cleaned. Passing material from manhole section to manhole section, which could cause line stoppages, accumulation of sand in wet wells, or damage pumping equipment, shall not be permitted.

Under no circumstances shall sludge or other debris removed during these operations be dumped or spilled into the streets, ditches, storm drains, or other sanitary sewers.

The Contractor is advised that he shall not dispose of this material by legal or illegal dumping on private or public property, by sale of others, or any means other than those given above. All sludge or other debris removed during these operations shall become the property of the Contractor and as such, any load of material, or any portion thereof, disposed of in a non permitted fashion shall become the sole responsibility of the Contractor. Any fines or clean-up costs associated with such dumping shall be paid by the Contractor; if necessary, monies shall be withheld from any monies due the Contractor until restitution is made.

d) Disposal of Materials

All solids or semisolids resulting from the cleaning operations shall be removed from the site and disposed of by the Contractor in a legal and sanitary manner as approved by appropriate authorities, at the Contractor's cost. Copies of records of all disposals shall be furnished to CCU, indicating disposal site, date, amount and a brief description of material disposed. All materials shall be removed form the site no less often than at the end of each work day. Under no circumstances will the Contractor be allowed to accumulate any type of debris on the site of work beyond the stated time, except in totally enclosed containers and as acceptable to CCU.

e) Root Removal

Roots shall be removed in the designated sections and manholes where root intrusion is indicated on the work order. Special attention should be used during the cleaning operation to assure almost complete removal of roots from the joints. Any roots which could prevent the seating of the packer or could prevent the proper application of chemical sealants, or could prevent the proper seating and application of cured-in-place, fold-and-formed, or sectional cured-in-place liners, shall be removed. Procedures may include the use of mechanical equipment such as rodding machines, bucket machines and winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners. Chemical root treatment shall be used before or at the completion of the root removal operation, depending on the manufacturer's recommendation, and grouting will take place to remove infiltration. Contractor shall capture and remove all roots from the line.

f) Chemical Root Treatment

To aid in the removal of roots, manhole sections that have root intrusion shall be treated with an acceptable, non-systemic herbicide which will kill roots but which will not permanently affect parts of trees distant from the treated roots. The application of the herbicide to the roots shall be done in accordance with the manufacturer's recommendations and specifications in such a manner to preclude damage to surrounding vegetation. The active ingredient shall not adversely affect the performance of the wastewater treatment facility. Any damaged vegetation so designated by CCU shall be replaced by the Contractor at no additional cost to CCU. All safety precautions as recommended by the manufacturer shall be adhered to concerning handling and application of the herbicide.

g) Acceptance of Cleaning Operation

Acceptance of sewer line cleaning shall be made upon the successful completion of the television inspection and shall be to the satisfaction of CCU. If television inspection shows the cleaning to be unsatisfactory, the Contractor shall be required to re-clean and re-inspect the

sewer line until the cleaning is shown to be satisfactory. In areas where television inspection is not performed, CCU may require the Contractor to pull a double squeegee (with each squeegee the same diameter as the sewer) through each manhole section as evidence of adequate cleaning. If internal sealing is to follow the television inspection, particular attention should be given to the adequacy of the cleaning to insure that proper seating of the sealing packer can be achieved.

In addition, on all those lines which have sags or dips, to an extent that the television camera lens becomes submerged for three (3) or more feet during the television inspection, the Contractor shall pull double squeegee and/or sponges through the line in order to remove the water form those dips or sags. Water removal through the squeegees and/or sponges shall be "performed until the television camera lens will no longer be submerged. This requirement may be waived by CCU if the water, in which the camera lens is submerged, is clean enough to allow the identification of pipe defects, cracks, holes, and location of service taps.

3.7 CLEANING AND INSPECTING CAST IRON PIPE OR DUCTILE IRON PIPE

3.7.1 General

In order to maximize the hydraulic capacity of the pipe and to prevent further tuberculation, the existing tuberculation must be removed until the internal diameter of the pipe is attained or until a smooth uniform surface is provided. In either case, it is not CCU's intent to remove sound metal. However, it is essential that a smooth, uniform surface is established to allow the liner resins to migrate along the pipe wall and encapsulate any remaining tuberculation.

3.7.2 Workmanship

Depending upon the class of pipe, the internal diameter of the pipe varies. For the purpose of this Contract, the pipe shall be cleaned to achieve the minimum internal diameter reflected in Table A. If a bare metal surface is established before achieving the specified internal diameter, then the Contractor shall stop the cleaning operation. If the specified internal diameter is attained, then the Contractor shall verify the internal diameter by passing a radial chain cutter, or other approved method, followed by a video camera through the pipeline. The chain cutter shall be equipped with lengths of chain sized so that the spinning motion of the cutter produces the required internal diameter. As the chain cutter passes through the pipeline, the chains cannot contact the pipe wall. Contact with the pipe wall shall be verified by observing sparks during the passage of the cutter or by measuring a reduction in the original length of chain.

After the internal diameter has been verified, the Contractor shall provide CCU with color DVD recordings of the cleaned sewer during normal working hours (as defined in the General Provisions). CCU will review the DVD recordings to determine if additional pipe cleaning will be required.

TABLE A

Nominal Diameter (Inches)	Ductile Iron Pipe Internal Diameter* (Inches)	Cast Iron Pipe Internal Diameter** (Inches)
6	6.16	5.94
8	8.27	8.01
10	10.28	9.98
12	12.34	12.00
14	14.41	14.02
16	16.48	16.04
18	18.56	18.04
20	20.64	20.04
24	24.84	24.10
30	30.90	30.10

** Based on an assumed Class 54 pipe.*
***Based on an assumed thickness Class 25 pipe.*

3.8 CURED-IN-PLACE PIPE LINING

3.8.1 Scope

The work specified in this section includes all labor, materials, accessories, equipment and tools necessary to install and test cured-in-place pipe lining in main lines.

3.8.2 Workmanship

The Contractor shall present to CCU, for review, a description of his methods for avoiding liner stoppage due to conflict and friction with such points as the manhole entrance and the bend into the pipe entrance. He shall also present plans for dealing with a liner stopped by snagging within the pipe. This information shall be rendered to CCU in a timely fashion prior to the pre-construction conference.

The Contractor shall have on hand at all times, for use by his personnel and CCU, a digital thermometer or other means of accurately and quickly checking the temperature of exposed portions of the liner.

The Contractor shall immediately notify CCU of any construction delays taking place during the insertion operation. Such delays shall possibly require sampling and testing by an independent laboratory of portions of the cured liner at CCU's discretion. The cost of such test shall be born by the Contractor and no extra compensation will be allowed. Any failure of sample tests or a lack of immediate notification of delay shall be automatic cause for rejection of that part of the work at CCU's discretion.

The Contractor shall designate a location where the tube will be vacuum impregnated prior to installation. The Contractor shall allow CCU to inspect the materials and the "wet-out" procedure.

Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the potential loss of resin during installation through cracks and irregularities in the original pipe wall, as applicable

A scaffold or elevated platform shall be erected at the upstream or downstream access point. The tube shall be inverted using an "inversion elbow" at the bottom of the manhole or an "inversion ring" above ground. If pulled into place, a power winch or its equivalent should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point, in accordance with manufacturer's recommendations, and fully extend to the next designated manhole or termination point.

With the tube in place, the Contractor shall supply a suitable heat source and water recirculation equipment. The equipment shall be capable of uniformly raising the water temperature to a level required to effectively cure the resin.

The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gage shall be placed between the tube and the host pipe in the downstream manhole at or near the bottom to determine the temperatures during the cure cycle. Water temperatures at both ends shall be recorded either electronically, or at 15-minute intervals for supply to CCU. Water temperature in the pipe during the cure period shall be' as recommended by the resin manufacturer.

Curing shall be accomplished by utilizing hot water under hydrostatic pressure or steam pressure in accordance with the manufacturer’s recommended cure schedule.

Initial cure shall be deemed complete when the exposed portions of the tube appear to be hard and sound and the temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of duration recommended by the resin manufacturer and may require continuous recirculation of the water to maintain the temperature.

A cool-down process shall be conducted that complies with the resin manufacturer’s specification. The Contractor shall cool the hardened pipe to a temperature below 100" F before relieving the hydrostatic head. Cool down may be accomplished by the Introduction of cool water to replace water being pumped out of the manhole.

The new pipe shall be cut off in the manhole at a suitable location. The finished product shall be continuous over the length of pipe reconstructed and be free from dry spots, delamination and lifts. Should the liner not make a tight seal at the inside manhole wall, a seal shall be made by use of extra polyester fiber felt and epoxy resin. Pipe entries and exits shall be smooth, free or irregularities, and watertight. No visible leaks shall be present and the Contractor shall be responsible for grouting to remove leaks or fill voids between the host pipe and the liner, During the warranty period, any defects which will affect the integrity or strength of the product

shall be repaired at the Contractors expense, in a manner mutually agreed upon by CCU and the Contractor.

3.9 DEFORMED AND REFORMED (PE) PIPE LINING

3.9.1 Scope

The work specified in this section includes all labor, accessories, equipment, and tools necessary to install and test the deformed and reformed pipe lining.

3.9.2 Workmanship

A cable shall be strung through the existing pipe to be rehabilitated and attached to the liner through an existing manhole or access point. The liner shall be pulled through the existing conduit by this cable. Care shall be taken not to damage the deformed pipe during installation. Appropriate sleeves and rollers shall be used to protect the liner.

When the deformed and reformed pipe is in place, it shall be cut and the processing manifolds (pipe end closing assembly used for heat and pressure control within liner) shall be attached in and secured at both pipe ends. The temperature and pressure measuring instruments shall be attached to the deformed and reformed pipe at both ends.

Through the use of steam and air pressure, the deformed pipe shall be progressively reformed to conform to the existing pipe wall. The deformed pipe shall be pressurized up to 14.5 psig maximum, while the termination point valves are kept open to provide heat flow. The pressure shall then be increased in increments up to a maximum of 26 psi depending upon material cell classification and Standard Dimensional Ratio (SDR).

The Contractor shall cool the deformed pipe to the manufacturer's recommendations, when the temperature reduces to 100' F, the Contractor shall then slowly raise the pressure to a maximum of 33 psig. (Pressure to be determined as per an existing pipe condition) while applying air or water for continued cooling. The equipment shall be disconnected after ambient temperature is attained.

Temperature and pressures shall be monitored and recorded throughout the installation process to ensure that each phase of the process is achieved at the manufacturer's recommended temperature and pressure levels. Copies of these records shall be given to CCU at the completion of each installation.

The beginning and end of the new polyethylene pipe shall be seated to the rehabilitated pipeline. The sealing material shall be compatible with the polyethylene pipe and shall provide a watertight seal.

All manhole reconnections shall have fused PE blocks applied to the protruding liner to resist pipe shrinking.

3.10 FOLD AND FORM PIPE INSTALLATION, PVC

3.10.1 Scope

This section specifies the method and process for furnishing all labor, materials, tools, equipment, and incidentals necessary to provide for the complete rehabilitation of deteriorated gravity and force main sewer lines by the use of a Fold and Form PVC pipe liner, excluding liner manufactured from reprocessed, recycled, or reclaimed PVC.

3.10.2 Definition

The Fold and Form Pipe liner process is defined as the reconstruction of gravity and force main sanitary sewers by insertion of a folded PVC pipe liner into the existing sewer and the reformation of the pipe liner into a circular pipe liner. The liner shall be reformed into its original extruded configuration by a combination of steam and pressurization, which biaxially reorients the molecules of the PVC and allows the liner to conform to the shape of the existing pipe while locking at each joint and expanding into each service to form a concave dimple. Thus the PVC pipe liner's new configuration is its new memory and is a continuous, tight fitting liner that allows no migration of water between the existing pipe and the pipe liner.

3.10.3 Workmanship

a) Liner Insertion

The pipe liner shall be inserted into the existing sewer with a power winch and steel cable connected to the end of the liner by use of an appropriate pulling head. The pipe to be lined shall be of equal 0.D. or greater than the liner, so that the liner can be fed into the existing sewer. Length of the pipe liner to be inserted at any time shall be governed by the winch drum capacity and winching power available, with consideration of the size and condition of the sewer.

During insertion, precautions such as some type of cover shall be provided on the leading edge of the pipe liner to prevent the ragged edges of the existing pipe from scarring the outside of the liner as it is pulled into the pipe. Once insertion is initiated, it is desirable to continue the pull at a rate of no greater than fifteen feet (15') to twenty feet (20') per minute to completion.

b) Liner Reformation and Processing

It is appropriate to check temperature and pressure while reforming and processing and may be accomplished through suitable temperature and pressure gauges placed at the insertion and termination points. Through the use of heat and pressure the PVC pipe liner should unfold and expand sufficiently to press against the wall of the existing sewer pipe, lock into the joints, and form dimples at the services. Processing temperatures range form 225º to 235º F. and pressures in the range of 5 to 10 psi, but may vary based on field conditions.

c) Pressure:

The Contractor shall maintain pressure on the liner, the heat should be discontinued, and cool air in sufficient volume should be injected to reduce the temperature to below 100º F before relieving the pressure. The pipe liner shall be continuous over the entire length of the insertion and be as

free as commercially practical from visual defects such as foreign inclusions. Pressure testing should be completed prior to reestablishing services.

3.11 SERVICE CONNECTION REINSTATEMENT

After the pipe has been rehabilitated, the Contractor shall reconnect the existing service connections.

This shall be done from the interior of the pipeline without excavation utilizing a remotely controlled cutting device (robotic cutter), monitored by a CCTV. The Contractor shall certify a minimum of two complete functional cutters plus key spare components are on the job site before each installation or are in the immediate area of the jobsite and can be quickly obtained.

Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the service connections. Cut-in service connections shall be opened to a minimum of 95% of the sewer service pipe inside diameter. Unless otherwise directed by CCU, all laterals will be reinstated. All coupons shall be recovered at the downstream manhole and removed. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability The Contractor shall stop all visible leaks, and grout all service connections. Active leaks at reinstated service lateral connections (between the liner and the existing pipe) shall be grouted associated with such excavation and restoration work.

Payment shall be as outlined in section the measurement and payment section of this specification.

The Contractor should not reactivate any line sections until accepted by CCU.

3.12 SEWER SERVICE RECONNECTION SEALING AND INSPECTION

Sewer service reconnections shall be sealed with the use of equipment which shall consist of a closed circuit television system and a special sealing packer device along with any necessary materials including but not limited to chemical sealant containers, pumps, controls, regulators, valves, and hoses. The special sealing packer shall be so constructed that it can straddle four-inch (4") to six-inch (6") diameter service connections in eight inches (8") or larger main sewer lines.

When properly positioned and with the end elements inflated, a special inflatable sealing tube shall be extended up the service connection. When properly positioned and with the end elements inflated, a special inflatable sealing tube shall be extended to a minimum past the first joint of the service connection.

The controlling unit for the device shall have "provisions for accurately controlling the packer functions in addition to monitoring the inflatable pressure and the void pressure in the isolated area to be sealed.

All sewer service reconnections shall be sealed by use of the special packer device. After the packer device has been properly positioned in the main line with the inflatable tube extended into the service connection, the connection shall be sealed by the injection of the chemical sealant.

The chemical sealant shall be injected through the special packer device into the annual space between the inflatable tube and the service connection. The injection of the chemical sealant shall continue until the chemical fluid back pressure is sufficient to insure the complete sealing of all the defects along the lengths of the inflatable tube.

After the service connection has been successfully sealed, the following procedures shall be performed to insure that the sealing operation did not block the service connection.

a) The inflatable tube shall be removed from the connection.

b) The packer and elements shall be deflated.

c) The special packer shall be moved forward and the closed circuit 360° camera shall be positioned in the center of the service connection and rotated to look up the service connection to insure that the chemical sealant did not cause blockage.

If blockage is observed, the chemical sealant shall be removed to insure the service connection is free flowing. The Contractor is to orient the camera in such a position to assure that blockage is not present.

The chemical sealant used shall be in accordance with the requirements set forth in specifications or as approved.

After the packer device has been properly positioned in the mainline, the connection shall be sealed by the injection of chemical sealant. The chemical sealant shall be injected through the packer device, through the controlled hole and into the annular space between the liner pipe material and the mainline host pipe. The injection of chemical sealant shall continue until the chemical fluid back pressure is sufficient to insure the complete sealing of all the defects.

3.13 MULTIPLE MANHOLE RUNS

The liner within the manhole shall be neatly cut off at a maximum of four inches (4") away from the manhole wall. The invert in the manhole shall be a smooth continuation of the pipes and shall be merged with other lines, if any. Channel cross section shall be U-shaped with a minimum height of half pipe diameter to three-fourths (3/4) of the pipe diameter for fifteen inch (15") and larger. The side channels shall be built up with mortar/concrete to provide benches at a maximum of 1 in 12 pitch towards the channel. CCU will individually inspect all manholes for water migration, cut-offs, benches, and invert works.

3.14 INFILTRATION PREVENTION

a) General:

If there is an annulus between the existing pipe and the liner, infiltration must be prevented from entering the sewer at manholes and service connections by one or more of the following means:

- Annulus grouting

- Sealing liner at manholes
- Chemical grouting at service connection

b) Annulus Grouting:
Methods or products which have an annular space between the two (2) pipes require annulus grouting to develop the required strength and to prevent groundwater from entering the sewer. Precautions should be taken to prevent collapsing the line with grouting pressure. Various grouts can be placed using low pressure and the newly installed pipe line can be hydrostatically pressurized during grouting. Grout must be prevented from flowing into service connections.

c) Sealing at Manholes:
Pulled-in-place pipes which are not sealed by the annulus grouting must be sealed where the line enters and exits each manhole. The annular space shall be sealed for a distance of at least one pipe diameter inside the host pipe. Foam sealant should not protrude into the manhole and should be finished over with a quick-set, nonshrink cement grout. Finishing inside the manhole shall be accomplished using a quickset cement type grout to raise the manhole trough to the invert of the liner pipe. NOTE: Only the upstream seal should be made prior to connecting services.

d) Chemical grouting at service connection
Chemical grouting at service connection shall be made as explain in the" Sewer Service Reconnection Sealing and Inspection" section of this specification.

3.15 TELEVISION INSPECTION

Television inspection shall be required to identify and document sewer line conditions and/or is performed in advance of, in conjunction with and after completion of pipe joint testing/sealing, pipe repair and pipe lining activities. All defects and pipe conditions shall be documented in accordance with the NASSCO Pipeline Assessment Certification Program (PACP) including the specific date and time of the inspection.

The work consists of furnishing all labor, materials, accessories, equipment tools, transportation services, and technical competence for performing all operations required to execute the internal closed circuit television inspection of sewers up to forty-eight inches (48") in diameter.

3.15.1 General

After cleaning and before and after rehabilitation work, the sewer line sections shall be visually inspected by means of closed-circuit television in the presence of CCU or its representative. The inspection shall be performed one sewer line section at a time and the flow in the section being inspected shall be suitable controlled as described in the "Wastewater Flow Control" section of these specifications.

3.15.2 Equipment

The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire

periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 700-line resolution color video picture. Picture quality and definition shall be to the satisfaction of CCU; and if unsatisfactory, equipment shall be removed and replaced with adequate equipment.

The video camera shall include a title feature capable of showing on the DVD recordings the following information:

- City and State
- Date
- Contractor's name
- Line size
- CCU Manhole identification numbers (both manholes)
- On-going footage counter

3.15.3 Submittals

The Contractor's submittals shall be in accordance with the “Submittals” section of these specifications and shall include color DVD recordings and a sample of the video titles to be used.

3.15.4 Products

Electronic media recording - VHS video tape are not acceptable. Only high quality color DVDs shall be supplied for all television inspections. All taping shall be performed at SP (Standard Play, 2hrs/DVD). All DVD recordings shall be submitted to CCU and will become the property of CCU.

3.15.5 Execution

a) Pre-construction Inspection

- Prior to any repair work, the entire sewer line (from manhole to manhole) shall be televised. The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case shall the television camera be pulled at a speed greater than thirty feet (30') per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line. The camera shall not be pulled through the sewer line by a hydraulic cleaning unit hose. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole.

- Whenever non remote-powered and controlled winches are used to pull the television camera through the line, telephones, or other suitable means of communication shall be set up between the two (2) manholes of the section being inspected to ensure good communications between members of the crew.

- The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters shall be accurate to tenths of a foot over the length of the section being inspected. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device tape, or other suitable device, and the accuracy shall be satisfactory to CCU's Representative.

- Movement of the television camera shall be temporarily halted at each visible point source of infiltration and/or inflow until the leakage rate from that source is quantified. The camera shall also be stopped at active service connections where flow is discharging. If the discharge persists, the property involved shall be checked to determine whether or not the discharge is sewage. If no flows are being discharged form the building, it shall be considered that the observed flow is infiltration/inflow.

- If the estimated flow form the service connection is greater than the total wastewater discharge from the fixture from the building, then the infiltration/inflow can be determined by calculating the difference of the two (2) flows.

b) Post-construction Inspection

- Upon completion of the sewer line rehabilitation, the entire sewer line (from manhole to manhole) shall be televised.

- The camera shall be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer repair. In no case shall the television camera be pulled at a speed greater than thirty feet (30') per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.

- The camera shall not be pulled through the sewer line by a hydraulic cleaning unit hose. If, during the inspection operation, the television camera will not pass through the entire manhole section, the Contractor shall set up his equipment so that the inspection can be performed from the opposite manhole.

- Whenever non remote-powered and controlled winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two (2) manholes of the section being inspected to insure good communications between members of the crew.

- Measurement for location of rehabilitations shall be above-ground by means of meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Measurement meters shall be accurate to tenths of a foot over the length of the section being inspected. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device.

- Movement of the television camera shall be temporarily halted at each repair. The camera shall also be stopped at any unnoticed or non-repaired point source of infiltration and/or inflow until the leakage rate from that source is quantified.

- The Contractor shall provide CCU color DVD recordings showing the completed work, including the condition of the restored service connection.

- The DVD recordings shall be taken by a pan and tilt radial viewing pipe inspection camera that pans more or less 275° and rotates 360°.

- The camera shall have an accurate footage counter which shall display on the monitor the exact distance of the camera from the center line of the starting manhole.

c) Field Documentation

- *Television Inspection Logs*: Printed location records shall be kept by the Contractor and will clearly show the location, by distance in 1/10 of a foot or nearest mm, from the manhole wall, in relation to an adjacent manhole of each infiltration/repair point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, cracks, fractures, broken pipe, presence of scale and corrosion, and other discernible features will be recorded and a copy of such records will be supplied to CCU.

- *Electronic media recordings (color DVDs)*: The purpose of color DVD recordings shall be to supply a visual and audio record of repaired sections of the line. DVD recordings playback shall be at the same speed that was recorded. Slow motion or stop motion playback features shall be supplied by the Contractor. Each original DVD recording of conditions and defects shall be delivered to CCU upon completion of a specific line section. Electronic media recordings become property of CCU.

  The Contractor shall have all DVD recordings and necessary playback equipment readily accessible for review by the CCU's representative during the project.

- *Photographs*: Digital photographs of the television picture of problems shall be taken by the Contractor upon request of CCU or its representative. Digital photographs of the pipe condition and all defects shall be taken by the Contractor. Photographs shall be located by distance in 1/10 of a foot or nearest mm, from the manhole wall, in relation to an adjacent manhole.

END OF SECTION