1.0 GENERAL

1.1 Scope

This Specification shall cover the repair of defective sewers at select locations by trenchless methods utilizing CIPP products.

1.2 The work to be completed by the Contractor under this Specification shall include the furnishing of all superintendence, overhead, labour, material, equipment, tools, supplies and all other things necessary for and incidental to the satisfactory performance and completion of all works shown on the Drawings and hereinafter specified.

1.3 Related Sections

1.3.1 Section 1300 – Sewer Mains

2.0 PRODUCTS

2.1 CIPP Point Repair Products

2.1.1 Minimum material requirements for Internal CIPP point repairs shall conform to ASTM D5813 "Standard Specification for Cured-In-Place Thermosetting Resin Sewer Pipe" and the supplemental requirements noted herein.

2.2 Verification of Existing Sewer Dimensions

2.2.1 Prior to manufacture of the point repair fabric tube for any location the contractor shall site verify dimensional requirements (diameter, length, etc.) for each section of sewer where point repairs are proposed.

3.0 DESIGN REQUIREMENTS

3.1 Point Repair Liner Design

3.1.1 Point repair liners shall be designed in accordance with Appendix XI of ASTM F1216 as a gravity pipe in a partially or fully deteriorated pipe condition and the supplemental requirements noted herein. The required design condition (partially or fully deteriorated) for each repair location is noted in Table A1 of Appendix A of these Specifications.

3.1.2 The liner shall be sized in accordance with the design objectives to provide a close-fit with the host pipe with no annulus with the exception of the maximum allowable diametric shrinkage due to curing permitted in ASTM D5813.

3.1.3 For both ***partially and fully deteriorated designs*** a design check shall be performed to confirm that the rehabilitated section of pipe will have a hydraulic capacity equal to or greater than the existing pipeline. This design check shall be based on full flow capacity and the use of

Manning's formula. The assumed long-term Manning's 'n' for the CIPP section shall be 0.012. The roughness of the existing section shall be estimated based on the observed condition of the pipeline from the CCTV inspection.

3.1.4 The design features of the point repair system shall also include:

.1 Tapered end section to promote a smooth transition from point repair to host pipe.

.2 A means to facilitate flow through by-pass of existing wastewater during the course of the repair.

3.2 Point Repair Design Partially Deteriorated

3.2.1 Partially deteriorated design, where specified, shall be designed in accordance with Appendix XI of ASTM F1216 and the following minimum drainage checks:

.1 Wall thickness determination by restrained buckling analysis.

.2 A design check to determine whether wall thickness will be governed by long term flexural stress.

3 Design checks to determine whether any localized thickening is required for missing segments or holes.

3.2.2 For partially deteriorated design unless stipulated otherwise, the following minimum design assumptions shall be employed:

.1 The groundwater load shall be calculated based on the assumption that the groundwater table is 2.0 m below the existing ground surface.

.2 An enhancement factor (K) of 7.

.3 The value assumed for ovality of the existing conduit shall be minimum of 3% unless a greater value is specified or warranted based on the Contractor's observation of the CCTV inspection prior to effecting the point repair.

.4 The long-term value for the flexural strength shall be deemed to be:

.1 The projected value at 50 years of continuous application of the design load based on the specific resin and felt composite proposed for use as established by ASTM D2990 – "Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics."

.2 In the case of having no ASTM D2990 values, 25% of the

flexural strength value as established by ASTM D790 – "Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials."

.5 The minimum factor of safety (N) to be utilized in the restrained buckling analysis shall be 2.

3.3 Point Repair Design – Fully Deteriorated

3.3.1 Fully deteriorated design, where specified, shall be based on the modified AWWA formula as detailed in Appendix XI of ASTM F1216 and unless stipulated otherwise, the following minimum design assumptions shall be employed:

.1 The total external pressure on the pipe shall include an allowance for an AASHTO HS20 concentrated live load. If the liner crosses under a railway line the minimum live load surcharge shall be calculated based on a Cooper E80 distributed load (for the portion of liner affected by that loading).

.2 The minimum soil density utilized in computation of the dead load shall be 1920 kg/m^3.

.3 The height of water above the pipe shall be based on the assumption that the groundwater table is 2.0 m below the existing ground surface.

.4 The ovality reduction factor shall be based on a minimum value of 3% unless a greater value is specified or warranted based on the Contractor's observation of the CCTV inspection prior to effecting the point repair.

.5 The long-term value for the flexural strength be deemed to be:

.1 The projected value at 50 years of continuous application of the design load based on the specific resin and felt composite proposed for use as established by ASTM D2990 – "Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture Plastics."

.2 In the case of having no ASTM D2990 values, 25% of the flexural strength value as established by ASTM D790 – "Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials."

.6 The modulus of soil reaction (E's) shall be assumed to be 6900 kPa unless a higher or lower value is specified herein.

.7 The minimum factor of safety (N) to be utilized in the fully deteriorated design analysis shall be 2.

3.4 Shop Drawing

3.4.1 The following submissions are required:

.1 A design submission detailing all liner thickness computations in accordance with these specifications sealed by a Professional Engineer licensed to practice in Canada.

.2 Independent third party verification of the flexural strength of the composite fabric tube and resin system(s) proposed for use based on ASTM D790 or ASTM D2990. If independent third party testing results are not available for the proposed fabric tube and resin system(s), samples of said system shall be provided to the Contract Administrator for independent test verification.

4.0 CONSTRUCTION METHODS

4.1 Sewer Cleaning and Preparation

4.1.1 The Contractor shall remove all loose and solid debris and intruding connections, in accordance with the requirements of SP:2 Sewer Cleaning and Preparation, to adequately prepare the sewer for internal point repairs.

4.2 Existing Sewer Flow During Construction

4.2.1 If the prevailing flow condition in the sewer to be repaired is substantially in excess of the flow through capacity of the Contractor's proposed point repair system the Contractor shall be responsible for bypassing existing sewer flow from upstream sewers during construction around the point of repair. Under no circumstances shall sewer flow be diverted directly to the environment, Land Drainage Sewers, or Storm Relief sewers.

4.3 Reinstatement of Sewer Connections

4.3.1 After the point repair has adequately cured, the Contractor shall reinstate any existing active sewer connections and catchbasin drains effected by the repair. Reinstatement shall be performed from the interior of the pipeline by means of a television camera and remote controlled cutting device or by manual means in man accessible and man entry diameter ranges. Sewer connection reinstatement shall be a minimum of 95% of the original cross sectional area of the service.

4.3.2 Reinstatement of service connection shall be performed in such a manner so as to remove the coupon with as much material intact as practical. All connection coupons shall be provided to Contract Administrator immediately subsequent to reinstatement.

4.3.3 Any voids between the point repair liner and the existing sewer connection shall be grouted with approved non-shrink cement grout material.

5.0 QUALITY CONTROL

5.1 Workmanship

5.1.1 Completed workmanship shall conform to Clause 6.2 of ASTM D5813 and the supplementary requirements noted herein.

5.1.2 If the point repair liner does not fit tight against the host pipe at its termination points or at connecting pipe(s), the annular space shall be completely filled with a resin mixture compatible with the point repair system.

5.1.3 The termination points of the repair shall provide a smooth and uniform flow transition from the host pipe to the repair for the full circumference of the repair.

5.2 Physical Samples

5.2.1 The Contractor shall prepare field samples for every 10 spot repair installations during the course of the work at locations where repairs terminate at or in close proximity to a manhole. Field samples shall be prepared at locations designated by the Engineer. Samples shall consist of a section of repair material that has been inserted through a like diameter form and cured in the invert of the manhole under existing flow conditions.

5.2.2 All physical samples shall be tested to confirm the flexural strength and flexural modulus in accordance with the requirements of ASTM D5813 and ASTM D790.

5.2.3 The point repair liner thickness will be measured in accordance with the requirements of ASTM D5813 and ASTM D3567 for conformance with the design requirements.

5.2.4 The City will bear the cost of testing.

5.3 Sewer Inspections

5.3.1 Upon completion of the work, the Contractor shall provide the Engineer with an inspection report containing the pre and post-lining inspections prior to Total Performance.

5.3.2 Payment shall be at the contract unit prices in the Form of Tender and shall be full compensation for the supply of all equipment and materials and the performing of all operations to complete the work as specified including any items incidental to work.