1.0 GENERAL

1.1 Work Included

1.1.1 Supply and installation of impregnated bi-directional woven fibreglass tissue with a predetermined epoxy resin. The impregnating tissue is rolled on a pneumatic tube (thermomandrel) corresponding in length with the length to be repaired. The thermomandrel will then be slipped inside the conduit (concrete, clay, brick, PVC, etc.) to repair using a nearby manhole.

1.1.2 Existing CCTV tapes, video logs and location plans of all spot repairs are available for review at the office of the Engineer.

1.2 Related Sections

1.2.1 Section 1300 – Sewer Mains

2.0 PRODUCTS

2.1 Materials include:

2.1.1 Balanced bi-directionally woven fiberglass tissue.

2.1.2 Two Component epoxy resin as binding matrix.

2.2 General Physical Properties of the Fiberglass

Tension Load	3.4×10^3 MPa (493,000 psi)
Tension Modulus	72×10^3 MPa (10,442,000 psi)
Thermal Expansion Coefficient	2.8×10^{-6} po/po/°C
Break Elongation	4.8%
Elastic Recovery	100%

2.3 General Physical Properties of the Resin

Tension Load	ASTM D638	60 MPa (8,700 psi)
Tension Modulus	ASTM D638	3.3×10^3 MPa (478,600 psi)
Flexion Load	ASTM D790	100 MPa (14,500 psi)
Flexion Modulus	ASTM D790	2.1×10^3 MPa (304,500 psi)
Elongation		4.5% to 12%
Barcol Hardness	ASTM D2583	50
Thermal Expansion	ASTM D696	52×10^{-6} po/po/°C

2.4 Composite Material

Tension Constraint	ASTM D638	250 MPa (36,250 psi)
Tension Modulus	ASTM D638	8.0 GPa (1,160,000 psi)
Flexion Constraint	ASTM D790	250 MPa (36,250 psi)
Flexion Modulus	ASTM D790	9.0 GPa (1,305,000 psi)
Hardness (Shore D)		> 80

2.5 Chemical Resistance

2.5.1 Resist sewer gas including carbon monoxide, dioxide, hydrogen sulphide etc. The fiberglass tissue shall not be affected by chemicals, bacteria, fungus or insects.

2.6 Resin Mix

2.6.1 Two component epoxydic resin mix controlled by volume. The homogenated mix shall be applied on the different layers of the bidirectional fiberglass tissue. The mixing and the wetting shall be made at the plant.

2.7 Fiberglass Stratification

2.7.1 The bi-directional tissue layers shall overlap when wetted.

2.8 Wall Thickness Design

2.8.1 The thickness shall be established by the Contractor, considering the size of the conduit to be lined.

2.9 Submittals

2.9.1 Submit information on material, procedure, wall thickness for each line prior to installation.

2.9.2 Submit as-build data to the Engineer indicating locations of lines repaired following installation.

2.9.3 Submit a field sample for every 10 spot repairs completed. Longer spot repairs which are completed in multiple segments will be considered as one spot repair. Typically sample locations will be adjacent to manholes so the repair material can be confined and subject to the same curing as the adjacent spot repair. The City will bear the costs of testing.

3.0 EXECUTION

3.1 Notification of Residents/Businesses

3.1.2 The Contractor is responsible for notification of residents/businesses of disruption of sewer service. Contractor must liaise with residents/businesses during spot repairs and advise when normal service is restored. Provide alternative service to residents/businesses as required.

3.1.3 Traffic Accommodation: Follow all requirements as set out in the City of Regina's Manual for Temporary Traffic Control.

3.2 Conduits Cleaning

3.2.1 The manholes and the conduits shall be cleaned to remove roots, debris and other deposits that could cause problems during installation.

3.3 Inspection

3.3.1 The section to be lined will be CCTV inspected before and after installation.

3.3.2 The laterals will be detected and thoroughly noted to minimize possible errors when reopening them after lining.

3.3.3 If the inspection reveals major defects, notify Engineer before remedial actions are undertaken.

3.4 Laterals Opening

3.4.1 The laterals shall be reopened with a remote controlled robotic cutter for non-accessible sewers. A CCTV camera shall be used to ascertain position.

3.5 Installation

3.5.1 Clean existing line and complete a CCTV inspection prior to installation. A digital file shall be made of the CCTV inspection.

3.5.2 The flow of water shall be by-passed above ground till the closest possible other manhole if required.

3.5.3 The composite (fibreglass and resins) shall be prepared in a shop under a total quality control. On-site preparation will be acceptable based on onsite preparation facilities which meet the approval of the Engineer.

3.5.4 The wetted composite materials shall be transported to the jobsite and slipped into the conduit to be lined.

3.5.5 Cure with steam for a predetermined time based on diameter and length (between 45 and 90 minutes).

3.5.6 Cool and retrieve the thermomandrel to be reused for other insertions.

3.5.7 Open the lateral connections to reinstate service.

3.5.8 Provide CCTV inspection report and video after installation.