1.0 GENERAL

1.1 Description

.1 The complete work under this trade shall be governed by the dictates of good practice in all details of materials and methods even if not minutely specified. The work shall be properly coordinated with the requirements of other units of work specified in other sections.

.2 This section specifies the requirements for T.V. inspection of sewer mains which shall consist of cleaning the mains, pulling a closed circuit T.V. (CCTV) camera through the mains and recording the condition of the inside periphery, providing traffic control around the work area and submission of recordings and reports. The work shall be completed within the limits of the contract documents.

.3 The Contractor shall obtain a current Contractor's License prior to commencement of the Contract.

1.2 Related Work

.1	Sanitary Sewers	Section 02537
.2	Storm Drainage Pipe and Fittings	Section 02635

1.3 Quality Control

.1 Provide a minimum one operator on site at all times with each inspection unit who holds a valid certificate from the National Association of Sewer Service Companies (NASSCO) in the Pipeline Assessment and Certification Program (PACP). Ensure each operator is fully trained in all aspects of sewer inspection and capable of making accurate observations and recording all conditions that may be encountered in the sewers.

.1 Perform inspection work only when PACP certified operators are on site.

.2 Submit a valid copy of the PACP Certificate for each operator to the Engineer at least 5 working days before starting the inspection work.

.2 The Work shall be comply with the standards of the National Association of Sewer Servicing Companies (NASSCO) and the Pipeline Assessment Certification Program (PACP).

.3 The Contractor shall be responsible for all works performed by the subcontractor, for traffic control and any other related work incidental to the completion of television inspection.

2.0 EQUIPMENT

2.1 General

.1 All tools, machinery, and equipment used in handling materials and executing any part of the work shall be subject to the approval of the Engineer. All such equipment shall be maintained in efficient working order and where any of the machinery or equipment is found to be unsatisfactory, it shall be improved or replaced by the Contractor to the satisfaction of the Engineer.

2.2 Inspection Unit

.1 Sewer and manhole inspection unit is to consist of a self-contained vehicle with separate areas for viewing and storage complete with the following equipment as a minimum.

.1 Cellular telephone and suitable communication system linking all crew members.

.2 Fans and blowers capable of removing fog that may be present in sewers at the time of the inspection.

.3 Video cameras, lighting, cables and power source.

.4 Video monitor, videocassette recorder and digital video recorder.

.5 Computer system with video capture card or dedicated unit and other related equipment.

2.3 CCTV Video Inspection Equipment

.1 Video inspection is to consist of the following.

.1 Video camera capable of panning 360° and tilting 270° with optimum picture quality provided by focus and iris adjustment. Focal range to be adjustable from 100 millimetres to infinity.

.2 Adjustable light source to allow an even distribution of light around the sewer or manhole perimeter without loss of contrast, flare out of picture, or shadowing. Ensure lighting illuminates the sewer or manhole ahead of the camera to be able to determine general condition, features and upcoming defects.

.3 Video overlay equipment capable of superimposing a minimum of 15 lines with up to 30 characters per line of alphanumeric information onto the video recording.

2.4 High Velocity Cleaning Equipment

.1 High velocity cleaning equipment is to be capable of producing a minimum flow rate of 4.1 litres per second at 13,800 kPa of pressure complete with the following.

.1 Selection of nozzles capable of effectively scouring and removing sediment from the sewer pipe wall and transporting debris in all sizes of the sewers to be cleaned.

.2 Water tank.

.3 Auxiliary engines.

.4 Pumps.

.5 Hydraulically driven hose reel with a wash down gun for cleaning manholes.

.6 Approved backflow prevention device for filling water tank from a hydrant.

.2 The equipment shall be of sufficient size, capacity, and condition to endure continuous operation in 150 mm through 1,200 mm diameter pipe.

2.5 Hazard Lights

.1 The mobile van, sewer flusher and service vehicles shall be equipped with rotating amber lights of sufficient number and height for the amber lights to be visible from all directions of approach.

2.6 Heating System

.1 A heating system or suitable alternative is required to prevent fogging of the lines during cold weather inspection.

2.7 Distance Meter

.1 The meter shall record distance travelled by the camera to 0.1 metres with an accuracy of plus or minus 0.2 percent.

.2 It must be connected to the video equipment in such a manner that the distance is automatically imprinted onto the video.

3.0 EXECUTION

3.1 General

.1 The Contractor shall inform the Public Works Department one week prior to the commencement of the Contract.

.2 The Public Works Department shall expose all manholes, which the Contractor has been unable to locate.

.3 The Public Works Department shall provide any bypass pumping, if required, at no cost to the Contractor.

.4 The Engineer may require that work on busy streets be done at off peak hours.

.5 The Contractor shall schedule the work so that the flows in the storm sewer trunks are at a minimum to maximize the information obtained by CCTV inspection.

3.2 Cleaning

.1 A high pressure sewer flusher and vacuum shall be used to clean the sewer. Cleaning shall be sufficient to produce recordings which are unobstructed by material in the sewer main.

.2 Start the cleaning operation with the upstream sewers in the system and proceed downstream with the direction of flow. Clean all contributing upstream sewers before proceeding with cleaning downstream sewers.

.3 Clean sewers and manholes completely of debris including sludge, dirt, sand, gravel, rocks, bricks and other solid and semi-solid materials.

.4 Advise the Engineer immediately when pipe material or backfill material is observed during the cleaning of a sewer. The Engineer will direct one of the following operations be performed.

.1 Complete or attempt to complete cleaning of the sewer.

.2 Suspend cleaning operations and inspect the sewer.

.3 Simultaneously clean and inspect the sewer.

.5 Continuously remove debris from the downstream manhole during sewer cleaning. Do not allow debris to be passed into the downstream sewer unless approved by the Engineer.

.6 The waste material dislodged during flushing shall be intercepted, decanted, and delivered to the City of Prince Albert Waste Water Treatment Plant sewage receiving station. The solids are to be disposed of at the at the City of Prince Albert Landfill.

.7 Take necessary precautions to ensure that no flooding of public or private property occurs during sewer and manhole cleaning. Reduce pressure of cleaning equipment as directed by the Engineer.

3.3 Access to Hydrants

.1 The Public Works Department shall designate a hydrant from which the Contractor can obtain water as required for sewer cleaning. The Public Works Department shall check the condition of the hydrant before commencement of the Contract and upon completion of the Contract. The hydrant shall only be operated by workers familiar with hydrant operation. Any damage to the hydrant or water mains due to the improper operation shall be repaired by City Forces. The cost of such repairs shall be deducted from payment for other work completed by the Contractor.

3.4 Pulling Camera

.1 Camera inspection is to be performed on one sewer section at a time, pulling the camera through the pipe in the direction of flow. Pulling against the flow will be permitted where an obstruction requires a reverse set up. The distance meter is to be zeroed at the beginning of each section of main televised. A sewer section is defined as the length of pipe between adjacent manholes.

.1 A sewer flusher may be required for pulling the camera. It is mandatory that a flusher be used for pulling where there are; high flows, dips and flat grades that may accumulate material that will obscure the camera lens and where there is light debris in the line. The flusher shall be used to lower flow levels and to move minor deposits of sludge and debris and clean the camera lens to ensure total viewing of the inside periphery of the pipe.

.2 Where the condition of the pipe permits, the method of pulling is optional and may be accomplished by directly pulling with a flusher or by prestringing the mains with a flusher and using a winch to pull the camera. The Engineer shall be advised of all mains which are prestrung, the string lines shall be taut and tied to manhole steps.

.3 Communication between the person pulling the camera and the person monitoring its progress must be adequate to quickly stop the camera if necessary to prevent jamming of the camera or damage to the sewer.

.4 Camera travelling speeds in the pipelines shall be as follows:

.1 0.10 m/s for diameters less than 200 mm

.2 0.15 m/s for diameters 200 mm to 310 mm

.3 0.20 m/s for diameters exceeding 310 mm

.5 The view of the camera is to be transmitted to a suitably sized monitor located in the mobile van, allowing continuous monitoring and recording of the progress of the colour T.V. camera. During recording a log is to be kept identifying the location of all defects and lateral connections. Still recordings shall be made of defects in the sewer.

3.5 Recording Defects in the Sewer

.1 The camera shall be stopped for 10 to 15 seconds to record defects. Defects shall include open and/or offset joints, cracked pipe, deflected or collapsed pipe, missing pipe segments, root infiltration, groundwater infiltration, pipe misalignment, corrosion and erosion.

.2 A separate log shall be kept of service connections with comments of condition.

.3 Photographs shall be taken as directed by the Engineer or at the discretion of the television scanning operator. A minimum of one photo per manhole reach is required plus one of every deficiency.

.4 Manhole identity shall be noted clearly as indicated on the drawings.

3.6 Recording Resolution

.1 Provide a minimum of 250 lines of resolution around the periphery of the picture for digital MPEG video playback.

.2 Confirm recording resolution if requested by the Engineer by recording a RETMA type resolution chart as follows.

.1 Set up camera and accessories for the recording to simulate an actual inspection i.e. video signal routed through the cable reel, video overlay system, etc.

.2 Record camera being introduced and reaching its final position for the test.

.3 Resolution chart is to fill the monitor screen;

.4 Resolution chart is to be illuminated evenly and uniformly without reflection and illumination source is to accurately simulate the lighting used in the sewer inspections.

.5 Record test for a minimum of 30 seconds.

.6 Identify the camera on the recording;

.7 Perform the test at the start of a tape or digital recording.

3.7 Screen Information on Video Recordings

.1 Clearly display in legible letters for 30 seconds on the monitor and video recording at the start of each inspection a video overlay system containing the following alpha-numeric information. Enter this information before beginning the inspection utilizing City GIS identifiers:

line 1:	Contract ID	e.g. 10-0061
line 2:	Street Name	e.g. MARQUIS RD
line 3:	Start MH to Finish MH ID	e.g. 2712 to 2711
line 4:	Pipe ID	e.g. 112967
line 4:	Sewer Size (diameter)	e.g. 2100 mm
line 8:	Contractor Name	e.g. XYZ LTD
line 9:	Date and Time of Inspection	e.g. 03/17/2014-14:15
line 10:	Direction of Inspection	e.g. WITH FLOW
line 11:	Start MH to Finish MH Steel Tape Measured Distance	e.g. 119.5 m
line 12:	Cable Calibration Distance	e.g. 1.5 m

.2 Clearly display in legible letters on the periphery of the monitor and video recording the following information during the inspection. Arrange the information to minimize interference with the inspection image:

bottom centre:	automatic update of the camera's distance from the centre of the start manhole	e.g. 15.3 m
top centre:	Street Name	e.g. MARQUIS RD

.3 Use the following naming convention when entering street and place names in sewer and manhole inspection records.

Term	Naming Convention	Term	Naming Convention
Street	ST	First	1ST
Avenue	AV	Second	2ND
Boulevard	BV	Third	3RD
Road	RD	Fourth	4TH
Bay	BY	Fifth	5TH
Crescent	CR	Sixth	6TH
Lane	LN	North of	N OF
Drive	DR	South of	S OF
Place	PL	East of	E OF
Way	WY	West of	W OF
Cove	CV	North Property Line	NPL
Highway	HW	South Property Line	SPL
		East Property Line	EPL
		West Property Line	WPL
		Centre Line	CL

.4 Use uppercase lettering for all street/place naming and location descriptions. Reference street locations relative to the direction of flow where possible. Reference sewer location using street name and start/end manhole locations as follows:

.1 Street/Place

Enter the street name, followed by a Naming Convention, if required, in brackets noting its location within the right of way, e.g. CENTRAL AV (N OF CL).

.2 Location/Description

Enter manhole number followed by “TO”, followed by manhole number, e.g. 2712 TO 2711.

3.8 Analog Format Video Recordings

.1 Analog format video recordings on VHS tape will not be acceptable.

3.9 Digital Format Video Recordings

.1 Capture the inspections in digital format in colour from the live video source on digital versatile discs, DVD-R format to the following minimum requirements. Adjust requirements as required to achieve 250 lines of resolution specified in clause 3.9 of this specification.

.1 XSVD MPEG2 format.
.2 Picture Size: NTSC 352 x 240 @ 29.97 frames per second.
.3 Data/Bit Rate: MPEG-2 @ 3.0 M-bits/sec.

.2 Obtain digital video inspections from first generation recordings using video capture equipment capable of capture with no frame loss.

.3 Digital video inspections can to be saved to a hard-drive and later transferred to recordable digital versatile disc, DVD-R media for submission.

.4 Provide file names containing up to a maximum of 64 characters for each digital video file in accordance with the following.

.1 STREET NAME-START MH TO END MH-DATE.MPG

Eg. CENTRAL AV –2712 TO 2711-17-Mar-14.MPG

.5 Submit digital files of the original video inspections to the Engineer on recordable digital versatile discs, DVD-R format in 5.2 millimetre slim-line clear “jewel cases” capable of displaying a summary sheet containing the information listed in this specification.

.6 Submit one complete single digital file for each inspection. Ensure the entire inspection of a particular sewer or manhole is contained on the same DVD-R disc. Record reverse set-up inspections of a sewer immediately after the original inspection where possible.

3.10 Reverse Set - Up Inspection

.1 Perform a reverse set-up inspection when a blockage in the sewer prevents completion of the inspection from the upstream manhole. Move the equipment to the downstream manhole and attempt to complete the inspection of the entire sewer to the upstream manhole.

3.11 Excavation to Remove Camera

.1 Advise the Engineer immediately if equipment becomes stuck in a sewer.

.2 The City of Prince Albert Public Works Department shall excavate, if required to free lodged camera equipment at no cost to the contractor. The Contractor shall bare any costs which arise for the Contractor due to delays

incurred while the equipment is retrieved. Camera equipment repairs caused by lodging of camera shall be borne by the Contractor.

.3 Repeat cleaning of the sewer to remove sediment and debris that may have entered the sewer during removal of the equipment.

4.0 REPORTING

4.1 General

.1 A final typewritten report with corresponding photograph secured properly and referenced to the text along with a copy of the video tape shall be submitted within two weeks after completion of inspection.

.2 Acceptance of the sewer video inspection shall be based on the City's review of all submitted reports and materials.

.3 The Contractor shall inform the Public Works Department of any sewers that could not be televised and shall state the reasons why they could not be televised.

4.2 Deliverables

.1 The Contractor shall submit a formal Multi-Sensor Inspection Report, in paper and digital (PDF) formats, that summarizes all inspection activities and includes all inspection data in their raw format, along with any software required to view or utilize the raw data.

.2 The Multi-Sensor Inspection Report shall include the following information:

.1 CCTV Video inspection:

a) Inspection video with standard video and audio overlays in XSVD MPEG-2 format.

b) Still images captured from the inspection video in JPEG or BMP format.

.3 The location, nature and extent of all defects in the sewer shall be recorded in the inspection report.

5.0 MEASUREMENT AND PAYMENT

5.1 General Requirements

.1 General requirements will be paid as a percentage of the lump sum bid in accordance with the overall completion of the work as it is accepted. This item includes mobilization, demobilization and any other contract requirements.

5.2 CCTV Video Inspections

.1 In-Line inspections will be measured on a length basis for each size and type of sewer and paid for at the Contract Unit Price with no distinction made between technologies employed. The length to be paid for will be the total length of sewer inspected by CCTV including traffic control, cleaning, inspection, coding and submission of deliverables in accordance with this specification as accepted, measured and reviewed by the Engineer.

.2 75% of the in-line inspection payment will be made upon satisfactory completion of the cleaning and CCTV work. The remaining 25% of the payment will be made upon final acceptance of the cleaning, in-line inspection work and upon acceptance of the project deliverables as determined by the review of the corresponding inspection and deliverables by the Engineer.

.3 Measurement will be made horizontally at grade above the centreline of the sewer from centre to centre of manholes or from center of the start manhole to the point of abandoned inspection as confirmed by tape measurement.

.4 Full payment will not be made until the required report submissions are accepted by the Engineer.

.5 Payment will not be made for inspections re-performed where the Engineer has determined the requirements of the specification have not been satisfied.

5.3 Inspection Coding, Reports and Deliverables

.1 Payment for inspection coding, reports and deliverables shall be included with the CCTV Video Inspection.

.2 Correction and re-submission of non-compliant submissions will be at Contractor’s expense.

5.4 Reverse Set Up-Inspection

.1 There will be no separate payment made for reverse set-up inspections.

5.5 Removal of Equipment that Becomes Stuck in a Sewer

.1 No payment extra payment or extra time will be given for equipment retrieval.

5.6 New Construction

.1 Cost of capturing camera recordings for new pipe installations shall be included in the unit price per the Contract as specified.

END OF SECTION