APPENDIX F – TECHNICAL SPECIFICATIONS

1.0 Services Definition, Measurement, and Payment

Service definition, measurement, and payment shall be determined within the invitational second-stage competitive process.

2.0 Submittals

For this Contract, the term Submittals, Samples and Shop Drawings are used interchangeably.

2.1 Submittal Generals

(a) The Contractor shall submit three (3) hard copies of each Deliverable Submittal to the County unless otherwise specified for a particular Submittal.

(b) Submission of electronic copies of Submittals (pdf) to the County via email may be acceptable with approval from the County. In the event that electronic submissions are allowed, the County reserves the right to request any Submittal as a hard copy in triplicate.

2.2 Submittal Requirements

(a) The Contractor shall provide all Submittals required in the specifications as well as any additional Submittals requested by the County, at the Contractor's expense.

(b) The Contractor is solely responsible for the initiation and timely submission of Submittals and resubmittals to the County. Schedule submissions well before reviewed Submittals will be needed.

(c) The Contractor shall initiate transmission of Submittals to the County soon after the Notice of Acceptance is issued to Contractor. The County will return reviewed Submittals and/or resubmittals within 14 calendar days of receiving them from Contractor.

(d) The County is in no way responsible for schedule impacts to the Contractor that may be affected by late, poorly timed or inadequate Submittals and resubmittals from the Contractor.

(e) The County may not complete a review of any Submittal or resubmittal in a time period less than 14 calendar days and County is in no way obligated to Contractor to complete a review in a time period less than 14 calendar days.

(f) All Submittals shall contain:

(i) The project name.

(ii) Contract number.

(iii) County name.

(iv) Original and unique Submittal number.

(v) Revision or resubmittal number, if applicable.

(vi) The date of submission to County.

(vii) The name of Contractor.

(viii) Identification of the item of Work and the relevant specification section number and clause.

(ix) All technical requirements, information or data including seal of Professional Engineer registered in Alberta if required.

(x) Contractor's stamp, initialed or signed by Contractor, shall certify Contractor's review of Submittal, completeness, verification of Products, measurements, technical criteria, and coordination of the information within the Submittal meets the requirements of the Contract.

2.3 Submittal Format

(a) The Contractor shall include a completed transmittal form with each submittal. Every page in a submittal should be numbered in sequence. Each copy of a submittal should be collated and stapled or bound, as appropriate.

(b) Where product data is submitted, the submittal shall be clearly mark to indicate which data is proposed and relevant to the Contract. Present a sufficient level of detail for assessment of compliance with the contract documents.

(c) Each Submittal shall be assigned a unique number. Submittals shall be numbered sequentially. The submittal numbers shall be clearly noted on the transmittal. Re-submittals shall bear the number of the original Submittal and a unique number representing the re-submittal.

(d) Submittals that do not meet the requirements above will be returned without review as a rejected Submittal.

(e) Submittals shall be sent to the County from the Contractor. Submittals received by the County directly from a sub-contractor, manufacturer, supplier or any party other than the Contractor will be returned and not reviewed.

(f) The Contractor will not request or imply a request for information, alternates, substitutions and equals as part of a Submittal. Submittals that are deemed by the County to be a request for information, alternate, substitution or equal will not be reviewed and will be returned to Contractor. Requests for Information will be vetted through the County contact for the project.

2.4 Resubmittals

Resubmittals will be reviewed and returned allowing the same 14 calendar day review period for the original Submittal.

3.0 Construction Meetings, Schedules, and Reports

3.1 General

(a) The Contractor shall attend construction meetings, provide a Contract Work Schedule and status report as well as reports as specified herein.

(b) There will be no separate payment items outlined in this section as it will be considered incidental to the Contract.

3.2 Pre-Construction Meeting

(a) The County will chair a pre-construction meeting to review items stated in the preliminary meeting agenda below and establish a working understanding between the parties as to their relationships during the Work. The meeting shall be attended by the following at a minimum:

(i) County

(ii) Contractor

(b) Preliminary Meeting Agenda:

(i) Health and Safety

(ii) Review Contract Documentation

(iii) Review Contract Work Schedule

(iv) Review Submittal requirements

(v) Review Payment Certification Process

(vi) Review Changes in the Work Process

(vii) Contractor Quality Control

(viii) County Quality Assurance Role

(ix) Roundtable Discussion

(c) Location of Meeting:

The pre-construction meeting will be held at the Parkland County Centre located at 53109A Highway 779, Parkland County, AB, T7Z 1R1.

(d) Meeting Minutes:

Within three (3) regular business days after the meeting, the County will prepare and distribute minutes of the Pre-Construction meeting to the Contractor.

3.3 Contract Work Schedule

(a) Contractor shall provide a Contract Work Schedule, in conformance with the Project Schedule and as specified herein.

(b) The Contract Work Schedule shall be submitted as required for each Construction Meeting or when it is anticipated that his status will vary significantly from the plan and within three business days following a request by the County.

(c) The Contract Work Schedule shall include a graphical component in a format agreed upon with the County, suitable for displaying planned scheduling and actual progress., The Contract Work Schedule shall include, but is not limited to the following:

(i) Timelines of work at each location – Hamlet of Entwistle, Hamlet of Tomahawk, and Acheson Industrial Park.

(ii) Date of Substantial Performance of the Work.

(iii) Typical shift length in days and hours of work per day.

(iv) Number of planned productive working days on Site Contractor plans to complete the Work to the Substantial Performance of the Work.

(v) Sheet size: 11 x 17 inches.

(d) The County will review and comment on Contract Work Schedule.

(e) Contractor shall not change the Contract Work Schedule without approval from the County.

3.4 Notification to Residents, Business Owners and Affected Parties

(a) Contractor shall develop and deliver a written notice to all affected residents, business owners and any other party that will be affected by the Contractor's activities in performing the Work a minimum of 3 business days prior to commencing Contractor operations on their affected property.

(b) It is the Contractor's responsibility to determine the potential effects of Contractor actions including without limitation; noise, access to properties, visual effects, utility service disruption and drainage. Contractor shall implement all reasonable measures to deal with and mitigate the effects of their activities.

(c) Submit to County a template of the notification as a Submittal according to Section 2.0 Submittals in Appendix F – Technical Specifications.

(d) The written notification shall include the following at a minimum:

(i) Contractor name

(ii) Project name

(iii) (Date notification delivered to affected party

(iv) Contractor contact person name and 24 hour contact information for Contractor's contact person

(v) Description of the activities that will affect the party and their property and mitigation measures the Contractor will employ

(vi) Accurate start and end dates for the activities that will affect the party and their property

4.0 Quality Control and Quality Assurance

4.1 County's Inspections

(a) At any time, upon request from the County, the Contractor shall provide access to The County for the purpose of inspecting any part of the Work for conformance with the Contract.

(b) The Contractor is solely responsible for the arrangement, staging and sequencing of all requests for County's inspections in a timely manner so as to cause no delay in Work.

4.2 Related Work Specified Elsewhere

Performance requirements are described specifically in the Contract specifications and are part of the standards specified within the Contract.

5.0 Sewer Cleaning & Debris Removal

This specification covers the flushing and cleaning of existing sewers, manholes and catch basins including removal of debris, encrustations and intrusions.

5.1 Definitions

Definitions for debris will generally be consistent with the nomenclature contained in the UK Water Industry Engineering and Operations Committee (WRc) "Manual of Sewer Condition Classification" and National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP)-Canadian Edition.

5.2 Referenced Standard Constructions

(a) Section 6.0 Sewer Inspection in Appendix F – Technical Specifications

(b) Section 7.0 Temporary Flow Control in Appendix F – Technical Specifications

5.3 Construction Methods

5.3.1. High Velocity Cleaning Equipment

High velocity cleaning equipment is to be capable of producing a minimum flow rate of 4.1 litres per second at 2,000 psi of pressure complete with the following:

(a) Selection of nozzles capable of effectively scouring and removing grease from the sewer pipe wall and transporting debris in all sizes of the sewers to be cleaned.

(b) Water tank.

(c) Auxiliary engines.

(d) Pumps.

(e) Hydraulically driven hose reel with a wash down gun for cleaning manholes.

(f) Backflow prevention device, approved for use by County and regulatory agencies, for filling water tank from a hydrant.

5.3.2. Debris Removal Equipment

(a) Vacuum unit(s) used for removing sewer debris from the sewer shall be equipped with;

(i) Positive displacement pumps or fans producing a minimum 700 litres per second of air movement.

(ii) Storage tank.

(iii) Minimum 150 millimetre diameter suction hoses attached to a hydraulic boom.

(b) Storage tank to be configured to allow the liquid portion of the debris to be separated and returned to the sewer if contractor has received written permission from the County to decant.

5.3.3. Solid Debris Cutting and Intruding Sewer Service and Lateral Removal

(a) Solid debris cutting equipment to consist of remote controlled hydraulically driven saw or blade cutters, remotely operated robots or other types of equipment capable of removing heavy roots and solid debris such as encrustation and grease.

(b) Intruding sewer service and lateral pipe removal equipment to consist of remote controlled hydraulically driven cutters and reamers and remotely operated robotic routers or grinders capable of cutting back intruding sewer service pipes.

(c) Select the cutting equipment to be used considering debris type, intruding sewer service pipe material and sewer pipe condition.

5.3.4. Communication Equipment

Cleaning crews will be equipped with cellular telephones and a suitable communication system linking all crewmembers.

5.3.5. Sewer Main Cleaning

The Contractor shall;

(a) Notify the County of the location where sewer, manhole or catch basin cleaning will be done one full business day before starting the cleaning work at that location. Deliver notices as required and directed by the County to landowners, residents and businesses.

(b) Clean sewers and manholes completely of debris including sludge, dirt, sand, gravel, rocks, bricks, grease and other loose floating, solid and semi-solid materials removed from the sewer by the equipment identified Section 5.0 in Appendix F – Technical Specifications Item 5.3.1 High Velocity Cleaning Equipment.

(c) Remove grease deposits on pipe walls to within 15 millimetres of the inside surface of the pipe wall or as directed by the County.

(d) The Contractor is solely responsible to take all necessary precautions to ensure that no sanitary backups into services and no flooding of public or private property occurs during sewer and manhole cleaning.

(e) Start the cleaning operation with the upstream sewers in the system and proceed downstream with the direction of flow.

(f) The Contractor shall remove the upstream manhole cover during sewer cleaning.

(g) Scour manhole walls and benching clean before cleaning the sewers downstream of manholes.

(h) Clean all contributing upstream sewers before proceeding with cleaning downstream sewers.

(i) The Contractor shall operate the equipment so that the pressurized nozzle continues to move at all times. The pressurized nozzle shall be turned off or reduced anytime it is stationary or delayed in order to prevent damage to the sewer and manhole.

(j) Stop flushing activities and advise the County immediately if pipe material or backfill material is observed during the cleaning of a sewer. The County will direct one of the following operations be performed.

(i) Complete or attempt to complete cleaning of the sewer.

(ii) Suspend cleaning operations and inspect the sewer.

(iii) Simultaneously clean and inspect the sewer.

5.3.6. Reverse Set - Up Cleaning

The Contractor shall;

(a) Perform a reverse set-up cleaning when a blockage in the sewer prevents completion of cleaning from the downstream manhole by moving equipment to the upstream manhole and attempting to complete the cleaning of the entire sewer.

(b) Attempt to remove a specific blockage in the sewer by making a bona fide effort for at least 1 hour before advising the County the blockage cannot be removed. Provide the County with the following information for blockages that cannot be removed:

(i) Location of the blockage indicated by a paint mark on the ground surface above the sewer and the distance from the nearest manhole.

(ii) An inspection photograph, video recording or digital file of the blockage.

(iii) The effect the blockage has on completion of the Work and the Contractor's proposal for action to deal with the blockage such as an emergency sewer repair or scheduled maintenance.

5.3.7. Emergency Sewer Repairs

(a) The County will arrange for an emergency repair of the sewer at blockage locations as soon as possible if the sewer condition prevents cleaning of the upstream sewer sections or poses an immediate operational or safety concern such as a complete collapse.

(b) The Contractor shall carry out cleaning of other sewers not affected by the emergency repair and complete cleaning of the sewer where the blockage was removed when notified by the County the emergency repair has been completed.

(c) The Contractor shall clean and remove all backfill, soil and debris that may have entered the sewer during emergency repairs.

5.3.8. Removal of Equipment That Becomes Stuck in a Sewer

The Contractor shall;

(a) Advise the County immediately if equipment becomes stuck in a sewer. Attempt to remove equipment that is stuck using whatever means are necessary for at least 4 hours. Advise the County if the equipment cannot be freed after 4 hours and mark the position on the surface over the sewer where the equipment is stuck.

(b) The Contractor shall be responsible for all costs relating to the recovery of or damage to the camera system or any other equipment in any sewer length forming part of the survey. The Contractor shall be liable for all costs and damages incurred by the County in the recovery of such equipment.

(c) At the Contractor's sole costs, the County will arrange to have an excavation made to the top of the sewer where the equipment is struck within 48 hours of notification the equipment cannot be freed.

(d) The Contractor will be responsible for all temporary flow control for the duration of the equipment retrieval operation.

(e) Be present during the excavation and once the top of the sewer is exposed and the excavation is secured remove the top of the sewer pipe and retrieve the equipment stuck in the sewer

(f) The County will arrange to have the sewer repaired after removal of the equipment that was stuck.

(g) Clean and remove backfill, soil and debris that may have entered the sewer during removal of the equipment and subsequent repair of the sewer

5.3.9. Debris Removal and Disposal

The Contractor shall;

(a) Continuously remove debris from the downstream manhole during sewer cleaning. Do not allow debris to be passed into the downstream sewer unless prior approved by the County.

(b) Store debris in totally sealed containers at all times and remove from the site at the end of each day. Vehicles used to transport sewage must be licensed.

(c) In accordance with Section 2.0 Submittals in Appendix F – Technical Specifications, the Contractor shall submit a written procedure for method of dewatering and debris disposal to County and receive written approval before beginning Work.

(d) Off-site debris dewatering facilities must meet Provincial environmental regulations and requirements. Obtain all necessary approvals and permits and provide copies of required licences, permits and relevant documentation required for dewatering facility to the County before starting the Work.

(e) Keep a log containing the following information for each debris disposal unit.

(i) Contract Name

(ii) Vehicle ID – License Number and driver's name

(iii) Location, Date and Time of Solids Disposal

(iv) Origin of Debris – Sewer segment identification

(v) Location, Date and Time where supernatant was decanted, if separate from solids disposal.

(vi) Volume (cubic meters) of decanted water

(vii) Net weight of each load and report of cumulative weight of debris under this Contract

(f) Provide log books and scale printouts to the County.

5.3.10. Solid Debris Cutting and Removal

(a) Cut and remove excessive roots and solid debris from the sewer for the limits identified by the County from any post-cleaning sewer inspection. Grease will not be considered solid debris.

(b) Remove solid debris to within 15 millimetres of the inside surface of the sewer.

(c) Monitor the entire cutting operation and while the cutting equipment is travelling within the pipe to reach the work area by closed circuit television (CCTV).

(d) Inspect the entire sewer section in accordance with Section 6.0 Sewer Inspection in Appendix F – Technical Specifications after completion of solid debris cutting.

(e) Disposal of Solid Debris shall be conducted as per 5.3.9 Debris Removal and Disposal of this specification.

5.3.11. Removal of Intruding Sewer Services and Laterals

(a) Cut and remove intruding sewer services and laterals from the sewer at the locations identified by the County from the post cleaning sewer inspection.

(b) Leave intruding sewer services finished smooth and within 15 millimetres of the inside surface of the sewer.

(c) Monitor the entire intruding sewer service removal by CCTV.

(d) Inspect the entire sewer section in accordance with Section 6.0 Sewer Inspection in Appendix F – Technical Specifications after completion of intruding sewer service and lateral removal.

(e) Disposal of Solid Debris shall be conducted as per 5.3.9 Debris Removal and Disposal of this specification.

5.3.12. Flow Control in a Sewer

(a) Refer to Specification 7.0 Temporary Flow Control in Appendix F –Technical Specifications

5.3.13. Water Supply for Sewer Cleaning

(a) Water source and supply information is found in Appendix E - Special Provisions.

(b) The Contractor is solely responsible to arrange, pay for and obtain all permit(s) and approvals for water supply for sewer cleaning.

(c) All water from a hydrant used for cleaning shall first be placed in a tank.

(d) Only one (1) hose/nozzle connection will be permitted per hydrant and only where permitted by the County.

(e) Two or more consecutive hydrants will not be permitted for water supply at the same time.

5.3.14. Acceptance of Work

(a) Acceptance of sewer cleaning will be based on the adequacy of the Contractor's performance to accomplish all sewer inspections as specified in the Contract.

(b) Submit required CCTV inspections performed according to Section 6.0 Sewer Inspection in Appendix F – Technical Specifications, of sewer and manhole cleaning, solid debris cutting and intruding sewer service and lateral removal to the County for review. The County will determine if the work performed is acceptable. The County will review the inspection videos within 14 calendar days of submission.

(c) Promptly perform remedial work for sewer, cutting of solid debris and removal of intruding sewer services and a re-inspection for the locations where the work was determined by the County as not being acceptable.

(d) Provide an additional copy of the written notification to the County for their files and as evidence the notification has been delivered by Contractor to the affected parties.

6.0 Sewer Inspection

6.1 Description

This specification covers inspection of sewers using internal video equipment with sufficient clarity for the purposes of assessing thoroughness of cleaning, observing and recording structural defects, operation and maintenance defects, construction and miscellaneous features and to verify new sewer construction and rehabilitation prior to acceptance for nominal pipe diameters up to 1,200 mm. Sewer and manhole inspections are to be in accordance with the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP)-Canadian Edition.

The Contractor is responsible for obtaining all information concerning depths of flow, manhole depths, air quality in the sewers, accessibility of manholes, traffic flows, and any other considerations that might affect the procedure for conducting the inspection. The Contractor's price for conducting the inspection shall provide for completing the inspection under existing conditions.

6.2 Referenced Standard Constructions

(a) Section 5.0 Sewer Cleaning in Appendix F – Technical Specifications.

(b) Section 7.0 Temporary Flow Control in Appendix F – Technical Specifications.

6.3 Quality Assurance

(a) Inspection pipe coding shall be performed by at least one (1) PACP certified operator or equivalent as approved by the County, who will be responsible for pipe coding.

(b) An additional representative of the Contractor must be certified to provide quality assurance audits as per Item 6.4.6.

6.4 Construction Methods

6.4.1. Inspection Unit

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

(a) Cellular telephone and suitable communication system linking all crew members.

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

(c) Video cameras, lighting, cables and power source.

(d) Video monitor and digital video recorder.

(e) Computer system with video capture card or dedicated unit and other related equipment

6.4.2. Video Inspection Equipment

Video inspection is to consist of the following:

(a) 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.

(b) 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

(c) 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.

6.4.3. Video Camera Transport Equipment

Video camera transport equipment to consist of the following:

(a) In-Line sewer inspection equipment shall be comprised of self-propelled rubber tired, crawler tractor or track mounted capable of passing over minor surface imperfections including but not limited to broken joints and solid debris up to 40 millimetres in height. The equipment shall be suitable for all diameter ranges and conditions required for the Work.

(b) Float or skid to mount video camera on and tow through sewers where the condition of the sewer prevents the use of a tractor. Obtain the County's approval before using a skid or float. Position the towing equipment to not impede the view of the sewer from the camera and ensure the float or skid is stable enough to provide a smooth progress and steady video recording for the intended purpose.

(c) Transport and cable capable of inspecting a minimum of 200 metres of sewer from a single access point and the complete inspection of the sewer from the centre of the start manhole to the centre of the finish manhole.

(d) Transport equipment must be capable of allowing for adjustable camera height.

(e) A device for manhole inspections that will securely orient the camera with the 12:00 video position facing north and capable of moving the camera through the entire vertical length of the manhole.

6.4.4. Operator Qualifications for Inspection and Condition Coding

(a) Ensure each operator is fully trained and qualified in all aspects of sewer inspection and that each is capable of making accurate observations and recording all conditions that may be encountered in the sewers in accordance with the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP)- Canadian Edition.

(b) Perform condition coding using operators who can demonstrate proficiency coding in accordance with the requirements of the PACP Reference Manual Version 7.0.1 or newer.

6.4.5. Sewer Condition Coding

Perform all sewer condition coding in accordance with the requirements of the PACP Reference Manual Version 7.0.1 or newer. Coding is required for all sewer inspections unless it is specifically stated that coding is not required for specific inspections.

6.4.6. Coding Accuracy

(a) Coding accuracy will be a function of the number of defects or construction features not recorded or omitted and the correctness of the coding and classification recorded. Coding accuracy is to satisfy the following requirements:

  (i) Header accuracy - 95%.

  (ii) Detail accuracy - 85%.

(b) Implement a formal coding accuracy verification system before starting the Work.

(c) Verify coding accuracy on a random basis on a minimum of 10% of the inspection reports.

(d) Submit coding accuracy checks with the corresponding video recording.

(e) Perform a minimum of two accuracy verifications for each operator during the first day working and promptly submit the results to the County for review. Operators failing to meet the accuracy requirements on two occasions will not be permitted to code on the remainder of the Work until they have successfully re-attained the qualifications required to perform PACP inspections in accordance with the PACP Reference Manual Version 7.0.1 or newer.

  (i) For longer duration inspection programs in excess of two weeks, operator accuracy verifications shall be performed every two weeks for each operator.

  (ii) Re-code inspections not satisfying the accuracy requirements and verify the accuracy of the inspection immediately following the non-compliant inspection. Repeat the process until subsequent inspections meet the accuracy requirements.

6.4.7. Recording Resolution

(a) Provide a minimum of 400 lines of resolution around the periphery of the picture for digital MPEG video playback.

(b) Confirm recording resolution if requested by the County by recording a RETMA type resolution chart as follows.

(i) 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.

(ii) Record camera being introduced and reaching its final position for the test.

(iii) Resolution chart is to fill the monitor screen;

(iv) 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.

(v) Record test for a minimum of 30 seconds.

(vi) Identify the camera on the recording;

(vii) Perform the test at the start of a tape or digital recording.

6.4.8. Screen Information on Video Recordings

(a) 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

line 1:	Contract ID	e.g. 2018 C180717EN
line 2:	Inspection Description	e.g. PRE-CLEANING
line 3:	Pipe ID	e.g. SSMTOM-019
line 4:	Street Name	e.g. Hwy 759
line 5:	Start MH to Finish MH ID	e.g. MHTOM-007 TO MHTOM-001
line 6:	Sewer Size	e.g. 200 mm
line 7:	Sewer Pipe Material	e.g. VCT
line 8:	Start MH Asset Number	e.g. MHTOM-001
line 9:	Finish MH Asset Number	e.g. MHTOM-007
line 10:	Contractor Name	e.g. <insert name of inspector>
line 11:	Date and Time of Inspection	e.g. 09/30/2018 - 14:15
line 12:	Direction of Inspection	e.g. US-AGAINST FLOW
line 13:	Steel Tape Measured Distance	e.g. 85.3 m

(b) 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	e.g. 35.3 m
Top centre:	Main ID	SSMENS-###
Top left:	Start MH Asset	MHENS-##
Top right:	Finish MH Asset	MHENS-13

(c) 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.

6.4.9. Analog Format Video Recordings

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

6.4.10. Digital Format Video Recordings

(a) Capture the inspections in digital format in colour from the live video source on archival grade digital versatile discs, DVD-R format to the following minimum requirements. Adjust requirements as required to achieve 400 lines of resolution specified in Section 6.0 Sewer Inspection in Appendix F – Technical Specifications.

(i) XDVD MPEG-2 or MPEG-4 format (MPEG-4 preferred).

(ii) Picture Size: NTSC 720 x 480 @ 29.97 frames per second.

(iii) Data/Bit Rate: 6.0 M-bits/sec.

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

(c) Digital video inspections can to be saved to a hard-drive and later transferred to recordable digital versatile disc, DVD-R media or USB or submission.

(d) Submit one complete single digital file for each inspection. Produce the final file in one of the following ways.

(i) Capture the original recording continuously using a computer system and video capture card regardless of the progress of the inspection. Edit the original raw digital file before submission to remove the pauses where inspection progress is not continuous. or

(ii) Capture the original recording intermittently using a computer system and video capture card.

(iii) Edit the original raw digital file before submission to form one continuous file. or

(iv) Capture original recording with specialized video recording equipment capable of pausing and resuming live recording to produce a single file for submission.

(v) Edit digital videos using non-linear video editing software. Do not recompress edited digital files.

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

(i) Pipe_ID Year from MH_ID to MH_ID LENGTHm _Run #

(ii) Eg. SSTOM-019 2018 from MHTOM-007 to MHTOM-001 85.3m Run 1

(f) Submit digital files of the original video inspections to the County on the following formats:

(i) 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 Item 6.3.10 - Digital Format Recordings of this specification.

(ii) USB or portable hard drive

(g) 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.

6.4.11. Sample Inspection Report

(a) Submit according to Section 2.0 Submittals in Appendix F – Technical Specifications, a sample inspection report, digital MPEG DVD-R video recording and corresponding magnetic data file of an actual sewer inspection performed by each camera that will be used to the County for review at least 2 weeks before beginning the inspection work.

(b) Clearly identify the camera make, model and serial number on each video. Demonstrate the resolution of each camera using the recording resolution in Item 2.8 of this Section.

(c) Use the report submission accepted by the County as a benchmark for subsequent inspection report submissions.

(d) No inspection work is to be performed until the sample inspection report has been accepted by the County.

6.4.12. Sewer Inspection Reports

(a) Provide on a weekly basis for the previous weeks work, sewer inspection reports consisting of the original first generation video recordings and the sewer inspection reports in digital format stipulated in 6.3.10 f).

(b) The Contractor shall maintain backup copies of all digital video and inspection data submissions for the duration of two (2) years after completing the work.

(c) The Contractor shall supply separately two (2), 2.5 inch portable hard disk drives (HDD), complete with all operating software, power adaptors and USB cables, containing all video inspections and coding data to the County within 14 calendar days of completion of the inspection for that sewer segment.

(d) The HDD's shall be sized appropriately to accommodate all above mentioned files and have dual USB 3.0 and USB 2.0 compatibility with a minimum data transfer rate of 480 Mb/s.

6.4.13. Video Inspection Labelling

(a) Label inspection reports, diskettes and DVD discs with the following information.

Contract Name: e.g. 2018 Sanitary and Storm CCTV Inspection Program

Submission ID: e.g. Sewers Inspected Week of 10/24/2018 - 1 of 5

(b) Label DVD-R discs with a marker certified by the manufacturer as being compatible with the DVD-R disc material. Do not apply stick-on labels to DVD-R discs.

(c) Provide a typed summary sheet in videotape and DVD-R disc cases containing the following information.

	From MH	To MH	Street Name	Inspection Direction	Measured Length	Inspection Length
e.g.	MHENS-14	MHENS-13	46th AVE	D/S	80.0 m	79.2 m

6.4.14. Camera Position and Speed

(a) Position the centre of the camera lens in the centre of circular sewers and manhole risers or as directed by the County.

(b) Ensure camera speed does not exceed 9 metres/minute during sewer and manhole inspections.

6.4.15. Sewer Measurements

(a) Measure the distance between the centers of the start and finish manholes on the ground surface above the sewer to the nearest 0.01 of a metre using a steel tape before beginning the sewer inspection.

(b) Measure the vertical distance from the sewer invert to the manhole frame to the nearest 0.01 of a metre with a steel tape before beginning the sewer or manhole inspection.

(c) Provide a remote reading counter to measure the distance to the nearest 0.10 metre the video camera has travelled within the sewer from the centre of the start manhole during the sewer inspection.

(d) Distance measurement within the sewer to be accurate to within 0.5% of the above ground steel tape measurement between start and finish manhole centres.

6.4.16. Sewer and Manhole Inspections

(a) Notify the County of the locations where sewer inspections will be performed one full business day before starting inspection work at that location.

(b) Perform sewer inspections after cleaning is completed and sample inspection report has been accepted unless directed otherwise by the County.

(i) Use the flusher continuously during inspection and implement flow control measures in accordance with Section 5.0 Sewer Cleaning in Appendix F – Technical Specifications where required to ensure the entire cross section of the sewer is visible and no debris is present during the sewer inspection.

(c) Evacuate fog from the sewer before beginning inspections and keep the sewer clear of fog during the entire inspection.

(d) Keep the camera lens clean during the entire sewer inspection.

(e) Ensure the picture is in focus and there is adequate, even lighting free of shadows and glare ahead of the sewer pipe or manhole riser at all times to be able to determine general condition, features and upcoming defects. Provide better lighting as directed by the County.

(f) Perform sewer inspections in accordance with the following.

(i) With the direction of flow unless a reverse set up is required.

(ii) Inspect from the centre of the start manhole to the centre of the finish manhole.

(iii) Begin inspections generally with the upstream sewer in the system and proceed downstream in a consecutive manner.

(iv) Schedule inspection of downstream sewers to be done after the contributing upstream sewers have been cleaned.

(v) Ensure the face of the start manhole is clearly visible at the start of the sewer inspection.

(vi) Record the length of sewer from the centre of the manhole to the cable calibration point at the start of the inspection and adjust the distance reading at the cable calibration point so that zero is at the centre of the start manhole.

(vii) Indicate on the monitor screen accurate automatic distance measurement that begins to move immediately as the camera moves. Ensure measurement is accurate from the cable calibration point to the centre of the finish manhole

(viii) Stop the camera, position the camera and focus the camera to provide a steady minimum 5 second focussed perpendicular view of connections, junctions, major branches and major defects including deformed sewers, displaced bricks, holes, large displaced joints, missing bricks, missing mortar, obstructions, and large open joints.

(g) Re-perform all sewer inspections at Contractor's expense where the County has determined the tolerance requirements for camera position, steadiness, speed, internal distance measurement and any other requirements in Section 6.0 Sewer Inspection in Appendix F – Technical Specifications have not been satisfied.

6.4.17. Reverse Set - Up Inspection

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.

6.4.18. Incomplete Inspections

(a) Immediately advise the County when a complete sewer inspection cannot be completed due to collapse, excessive deformation, intruding connections, obstructions or large displaced joints. Jointly decide with the County one of the following alternatives.

(i) Abandon the inspection, or;

(ii) Re-perform the inspection subsequent to one of the following actions:

- Performing solid debris cutting.
- Removing intruding connections.
- Modifying the camera setup position or method of transport.
- Completion of external or emergency repairs.

(b) Note in a log the manhole to manhole run, steel tape measurement, upstream and downstream length or manhole length inspected, length of missing video and the reason the inspection could not be completed and review with the County on a weekly basis.

6.4.19. Acceptance of Inspections

(a) The County will review inspection reports, video recordings and magnetic data files to ensure compliance with the specifications within 14 calendar days of submission. The County may adjust the frequency of reviews based on the results of previous reviews.

(b) Re-perform all sewer and manhole inspections where the County has determined the requirements of Section 6.0 Sewer Inspection in Appendix F – Technical Specifications have not been satisfied.

(c) Correct non-compliant inspection submissions and resubmit the corrected inspections to the County within 7 calendar days.

(d) Repeat the process until the inspection submissions are accepted by the County.

6.4.20. Removal of Equipment That Becomes Stuck in a Sewer

(h) Advise the County immediately if equipment becomes stuck in a sewer. Attempt to remove equipment that is stuck using whatever means are necessary for at least 4 hours. Advise the County if the equipment cannot be freed after 4 hours and mark the position on the surface over the sewer where the equipment is stuck.

(i) The Contractor shall be responsible for all costs relating to the recovery of or damage to the camera system or any other equipment in any sewer length forming part of the survey. The Contractor shall be liable for all costs and damages incurred by the County in the recovery of such equipment.

(j) At the Contractor's sole costs, the County will arrange to have an excavation made to the top of the sewer where the equipment is struck within 48 hours of notification the equipment cannot be freed.

(k) The Contractor will be responsible for all temporary flow control for the duration of the equipment retrieval operation.

(l) Be present during the excavation and once the top of the sewer is exposed and the excavation is secured remove the top of the sewer pipe and retrieve the equipment stuck in the sewer

(m) The County will arrange to have the sewer repaired after removal of the equipment that was stuck.

(n) Clean and remove backfill, soil and debris that may have entered the sewer during removal of the equipment and subsequent repair of the sewer

(o) Repeat cleaning of the sewer in accordance with Section 5.0 Sewer Cleaning in Appendix F – Technical Specifications to remove backfill and debris that may have entered the sewer during removal of the equipment and subsequent repair of the sewer.

6.4.21. Observed Failures During Sewer Inspections

(a) Capture photograph, videotape or digital images and notify the County immediately where a flow disparity, clear water infiltration, hole or missing bricks, collapse, void or deformation > 10% is observed during the sewer or manhole inspection. Provide the captured images to the County at the end of each work day.

(b) Place barricades around the location above the sewer or manhole where a void is visible or suspected to be outside of the sewer pipe or manhole and immediately notify the County.

(c) The County will arrange for emergency sewer or manhole repairs to be performed if required as soon as possible if the inspection cannot be completed or the sewer or manhole condition poses an immediate operational or safety concern such as a complete collapse.

(d) Emergency sewer or manhole repairs will be prioritized if more than one emergency repair arises at the same time.

(e) Carry out inspection of other sewers not affected by the emergency repair and complete inspection of the sewer when notified by the County the emergency repair has been completed.

(f) Repeat cleaning of the sewer in accordance with Section 5.0 Sewer Cleaning in Appendix F – Technical Specifications if required to remove backfill and debris that may have entered the sewer during emergency repairs.

7.0 Temporary Flow Control

7.1 Description

(a) This section specifies requirements for providing temporary sanitary sewer service and temporary flow control of sanitary or storm sewers including, but not limited to:

(i) Engineering services for the proposed temporary flow control scheme;

(ii) Traffic control and maintenance of access to properties;

(iii) Providing alternate sanitary service to affected properties;

(iv) Flow control; and

(v) Reinstatement of permanent sanitary services and normal flows.

(b) Restrictions

(i) Existing sewer services shall not be shut off for more than 48 consecutive hours.

(ii) A maximum of 25 services shall be out of service at one time, unless otherwise authorized by the County in writing.

7.2 Related Work

(a) Section 5.0 Sewer Cleaning in Appendix F – Technical Specifications

(b) Section 6.0 Sewer Inspection in Appendix F – Technical Specifications

7.3 Execution

7.3.1. General

(a) Where required for the performance of the Work, the Contractor will provide temporary flow control.

(b) The Contractor shall submit, in accordance with Section 2.0 Submittals in Appendix F – Technical Specifications, a proposed temporary flow control plan to the County for approval at least seven (7) business days prior to commencing work at the Site. The plan shall detail the anticipated normal sewer flows, temporary flow control method (including pump and piping capacities for flow bypassing), equipment data, scheduling, upstream flood prevention measures, and monitoring procedures.

(c) Refer to Appendix D – General Conditions for additional requirements related to disruption of traffic, utility services, and property access. Inform affected residents of the length of disruption to service, details of alternate services that will be provided, any traffic-related constraints, noise levels to be expected, hours of work, safety concerns, and contact information.

(d) Provide the County with at least 48 hours notice before undertaking flow control measures approved by submittal.

(e) The Contractor is solely responsible to arrange, pay for, obtain all permit(s) and approvals to achieve and monitor flow control considering the variable flows in a sanitary sewer. The Contractor is solely responsible for determining the flows that will be encountered during the periods the Contractor schedules the Work.

(f) Bypass pumping is permitted but only after the Contractor clearly demonstrates to the County that off peak-flow work, plugging, sewer cleaning equipment, or a combination of methods cannot effectively reduce the flow levels to the specified maximum without the use of bypass pumping.

7.3.2. Temporary Flow Control Methods

(a) Plugging and Blocking

(i) Where normal flows are such that the sewer main can be isolated and blocked without causing adverse affects upstream related to sewer backups, plugging and blocking may be used.

(ii) For sanitary sewers, this method shall be used only during off-peak periods where sewer flows are at a minimum.

(iii) For storm sewers, this method shall be used only when the prevailing weather conditions are such that there is limited risk of wet weather flows through the storm sewer.

(iv) A sewer line plug shall be inserted into the line at an upstream manhole.

(v) The plug shall be designed so that a portion or all of the sewer flows can be released.

(vi) Flows shall be suitably reduced or shut off completely to allow work to be completed.

(vii) The plug shall be installed with a suitable method for quick removal in the event of upstream flooding, a major wet weather event, emergency, or as directed by the County.

(viii) After work is completed, the plug shall be removed and flows shall be returned to normal.

(b) Flow Bypassing

(i) Where sewer flows are such that adequate flow control cannot be achieved by the plugging and blocking method, pumps or siphons shall be used to divert a portion or all of the sewer flows around the section to be isolated.

(ii) A sewer line plug shall be inserted into the line at an upstream manhole.

(iii) The plug shall be designed so that a portion or all of the sewer flows can be released.

(iv) Flows shall be suitably reduced or shut off completely to allow work to be completed.

(v) The plug shall be installed with a suitable method for quick removal in the event of upstream flooding, a major wet weather event, emergency, or as directed by the County.

(vi) Excess sewer flows shall be pumped through a closed pipeline from the upstream manhole to a downstream manhole. The pipeline will be suitably located and protected from traffic. Sufficient pumping capacity shall be provided to accommodate anticipated peak flows.

(vii) Alternatively, vacuum trucks may be used to remove excess sewer flows from the upstream manhole. The Contractor shall dispose of such sewer flows at sites to be located by the Contractor and approved by the County.

(viii) After work is completed, the plug shall be removed and flows shall be returned to normal.

7.3.3. Monitoring

(a) Provide continuous monitoring of liquid levels in the upstream manhole.

(b) Ensure that there is no contamination of basements, ditches, roadways, or sidewalks with raw sewage. In the event of such contamination, immediate action shall be taken to eliminate the source of the contamination. Proper cleanup of the affected areas shall be undertaken. Work shall not recommence until the temporary flow control plan has been re-evaluated and revised as necessary, and approved by the County.

(c) Where the Contractor uses temporary flow control to limit flows during an inspection, the Contractor shall note on the inspection report the depth of normal flow and the duration the flow control measure was in place.

7.3.4. Temporary Sanitary Service

(a) The Contractor shall provide temporary facilities as required to divert sewage from the sanitary service connections for commercial buildings, apartment buildings, and multi-family developments affected by the temporary flow control measures. Temporary facilities, such as portable toilet units, are not acceptable unless the affected property owner(s) sign a release.

(b) The Contractor shall supply residents of single-family houses or duplexes affected by the work with suitable temporary sanitary facilities for the duration of the temporary flow control measures. Temporary sanitary facilities are subject to the approval of the County.

7.3.5. Cleanup

Upon completion of temporary flow control procedures, cleanup and restore the affected areas to a condition at least equal to that existing prior to commencing such flow control procedures, and in accordance with other applicable sections of the Contract Documents.

8.0 Trenching, Backfilling, and Compaction for Utilities

This Section specifies requirement for excavating trenches and backfilling for installation of pipelines and appurtenances and for the removal and disposal of existing utilities.

8.1 Definitions

Nomenclature for material in the pipe embedment zone (foundation, bedding, haunch, initial, and final backfill) to conform to ASTM Standard Practice D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

8.2 Temporary Facilities

Shoring and Bracing:

(i) The Contractor is responsible for a stable excavation at all times and in all conditions during performance of the Work.

(ii) Contractor shall adequately slope, shore, brace or deploy a method of stabilization for excavations at his own cost in accordance with Occupational Health and Safety Regulations and in accordance with the loading, geotechnical and groundwater conditions encountered.

(iii) Whenever shoring, caging, trench box, sheeting, timbering or bracing of an excavation is required, the Contractor shall engage services of a Professional Engineer to design and assume responsibility for adequacy of the design for the conditions encountered. Professional Engineer shall be registered in Province of Alberta.

(iv) Contractor shall submit, in accordance with Section 2.0 Submittals in Appendix F – Technical Specifications, for review all shoring, caging, trench box, sheeting, timbering or bracing drawings and design calculations signed and stamped by the Professional Engineer responsible for their preparation. Professional Engineer shall be registered in Province of Alberta.

(v) Contractor shall install the designed shoring and bracing system in accordance with the design.

8.3 Submittals

Submit, in accordance with Section 2.0 Submittals in Appendix F – Technical Specifications, a sieve analysis performed in accordance with relevant standards for all granular materials specified in this Section.

8.4 Products

8.4.1. Materials

8.4.1.1 Pipe Embedment Zone Materials:

(a) The pipe embedment zone nomenclature shall be broken down into bedding, haunching, and initial backfill as identified in Figure 1 of ASTM Standard Practice D2321 and the drawing detail.

(b) Pipe embedment materials are as classified in Table 1 of ASTM Standard Practice D2321. They include natural, manufactured, and processed aggregates and soil classifications according to ASTM Test Method D2487.

(c) Class IA, Class IB or Class II embedment materials, in accordance with ASTM D2321 Table 1 are the only pipe embedment materials permitted for use in the pipe embedment zone including the bedding, haunch and initial backfill for this Contract. A suggested gradation is as follows:

ASTM Sieve Size	Per Cent Passing
25.00 mm	100
16.0 mm	20 -100
4.75 mm	20 - 80
2.0 mm	20 - 50
0.425 mm	5 - 20
0.075 mm	3 - 10

(d) Notwithstanding ASTM D2321 Table 1, pipe embedment materials shall consist of 100% particles passing the 25.0 mm sieve or to the maximum permissible particle size permissible by the pipe manufacturer, whichever is smaller.

(e) Class III, Class IV-A, Class IV-B, Class V soils and frozen materials of any Class are not permitted and shall not be used as pipe embedment zone material.

8.4.1.2 Crushed Rock:

(a) Crushed Rock is a poorly graded processed aggregate with little to no particles passing the 0.075 mm sieve.

(b) Crushed Rock includes screened processed crushed gravel, or crushed stone that does not require free moisture for compaction to the following gradation requirements:

ASTM Sieve Size	Per Cent Passing
37.5 mm	100
25.00 mm	80-100
4.75 Mm	0 - 10
2.00 mm	0 - 3
0.075 mm	0 - 1

(c) Crushed Rock shall be completely wrapped in geotextile according to geotextile manufacturer's recommendations as a barrier to prevent the migration of fines from adjacent soils.

8.4.1.3 Pipe Aggregate:

(a) Pipe Aggregate is a well graded processed aggregate.

(b) Pipe Aggregate includes screened processed crushed gravel, or crushed stone that requires free moisture for compaction to the following gradation requirements:

ASTM Sieve Size	Per Cent Passing
37.5 mm	100
25.00 mm	80-100
16.0 mm	40 - 95
4.75 mm	20 - 70
2.0 mm	20 - 50
0.425 mm	15 - 30
0.075 mm	5 - 10

8.4.1.4 Fillcrete:

Fillcrete shall be a controlled low strength material (CLSM) as defined by ACI Committee 229. CLSM is a flowable mixture of aggregate and cementitious material containing sufficient Portland cement to develop a 28-day minimum compressive strength for this application of 0.5 MPa, that self-compacts upon placement.

8.4.1.5 Final Backfill:

(a) Class I Final Backfill:

Class I Backfill shall contain clean, hard, durable uncoated particles, free from clay lumps, cementation, organic and other objectionable material, meeting following gradation limits:

ASTM Sieve Designation		Per Cent Passing	
37.5	mm		100
25.0	mm		70-100
16.0	mm	40	- 90
4.75	mm	25	- 60
2.0	mm	25	- 50
0.425	mm	10	- 25
0.075	mm	3	- 12

(b) Class II Final Backfill:

(i) Class II final backfill material shall be approved excavated material free of organics and objectionable material that would prevent adequate compaction and permit excessive settlement.

(ii) Rocks or stones in excess of 200 mm mean diameter are not permitted in Class II Final backfill.

(c) Class III Final Backfill:

(i) Class III final backfill material shall be approved excavated material free of organics and objectionable material that would prevent adequate compaction and permit excessive settlement.

(ii) Rocks or stones in excess of 200 mm mean diameter are not permitted in Class II Final backfill.

8.4.1.6 Concrete:

Concrete required for cradles, encasement, supports, thrust blocking to CAN A23.1-M90 and shall be 25 MPa CSA A3001 Type HS cement.

8.4.1.7 Pit Locations:

The Contractor shall be responsible for locating, organizing and obtaining approvals and permits for haul roads, screening or crushing to meet specified gradations, loading, hauling and all other associated work for the specific trenching, backfilling and compaction material requirements consistently throughout his performance of the Work.

8.4.1.8 Geotextile:

(a) Nonwoven geotextile Nilex 4553 or approved equal, supplied in rolls.

(i) Width: 3.8 m minimum.

(b) Physical Properties:

(i) Mass per unit area: minimum 265 g/m2.

(ii) Tensile strength and elongation (in any principal direction):

- Grab strength: minimum 900 N.
- Elongation at break: minimum 50%.
- Mullen Burst: minimum 2100 kPa.
- Puncture Strength: minimum 450 N.

(c) Hydraulic Properties

(i) Apparent Opening Size (AOS): minimum 0.12 mm.

(ii) Permittivity: 1.5 sec -1.

(d) Factory seams: sewn in accordance with manufacturer's recommendations

(e) Thread for sewn seams: equal or better resistance to chemical and biological degradation then geotextile.

8.5 Execution

8.5.1. Temporary Trench Support

(a) The Contractor shall provide and maintain temporary trench support where required for any installation to meet Occupational Health and Safety Regulations.

(b) There will be no separate payment for excavations requiring temporary support.

8.5.2. Trench Dewatering

(a) Trench dewatering may be required where excessive moisture conditions affect trench stability, moisture content of pipe embedment and the firmness of the pipe foundation. The costs, method and execution of dewatering are the responsibility of the Contractor and shall be designed such there is no detrimental impact on adjacent utilities and/or structures.

(b) Protect open excavations against flooding and damage due to surface runoff and flow through the storm sewer system.

(c) The Contractor shall submit, in accordance with Section 2.0 Submittals in Appendix F – Technical Specifications, a trench dewatering method statement, description of equipment and erosion and sediment control measures.

(d) Assume full responsibility for coordinating and managing the excavation in a state such that moisture conditions do not compromise the installation.

8.5.3. Excavation

(a) Excavations shall be in accordance with Occupational Health and Safety Regulations.

Minimum trench width shall conform to the drawing details. Where trench walls are stable, trench widths shall be of sufficient width, but no greater than necessary, to allow working room to properly and safely place and compact haunching and material in other pipe embedment zones. The space between the pipe and the trench wall must be wider than the compaction equipment used to construct the pipe embedment zone.

In addition to safety considerations, the trench width in unsupported, unstable soils may not provide the support required in the design of the pipe. Promptly notify the County when

unsupported, unstable soils are encountered so that actual structural support conditions may be considered.

(b) Excavate to lines, grades, elevations and dimensions indicated on drawings or as modified by the County.

(c) The foundation soil shall be moderately firm to hard in-situ soil, stabilized soil, or compacted fill material. Ledge rock, boulders and large stones shall be removed, where present, to provide a minimum separation of 150 mm from the pipe when installed.

(d) Notify County when soil at proposed elevation of trench bottom appears unsuitable as a foundation for the installation.

(e) The Contractor shall perform the excavation and earth handling to minimize disruption to traffic, residents, businesses and disturbance of land within the Site.

(f) Unless otherwise permitted by the County, the Contractor shall not excavate more than 20 m of trench in advance of pipe installation and shall not leave more than 10 m of trench excavation open at the end of the day.

(g) Stockpile suitable excavated materials required for trench backfill in accordance with Occupational Health and Safety Regulations.

(h) Excavated earthen material that will not be incorporated into the final backfill shall be hauled to a location agreeable to County.

(i) Excavated pipe to be replaced shall be separated from the earthen material. The excavated pipe shall be removed and disposed.

(j) Dispose of Unstable Subgrade material at locations approved by local regulatory agencies and County.

(k) Do not obstruct flow of surface drainage or natural water courses with stockpiles.

8.5.4. Trench Preparation

(a) If the County deems the foundation zone to be Unstable Subgrade, Contractor shall remove the unsuitable material (Unstable Subgrade) from the trench bottom to the length, width and depth approved by County and replace with the approved material indicated by County compacted to 95% Standard Proctor Maximum Dry Density and within 3% of optimum moisture content.

(b) If Contractor chooses to use a higher quality or more expensive foundation improvement material, payment will only be authorized for the material indicated by County.

(c) The cost of any approved material required to correct any unauthorized over- excavation shall be borne by the Contractor.

(d) Where Crushed Rock is required to stabilize the foundation (foundation improvement) or is to be used in the pipe embedment zone or final backfill zone, the migration of soil fines (<0.075 mm) shall be prevented by wrapping the open graded material in geotextile.

(e) There will be no separate payment for a geotextile barrier between soils as it will be considered incidental to the Contract as part of the Contractor's choice to use an open graded material.

(f) The potential for the migration of fines (<0.075 mm) and need for a geotextile barrier shall be reviewed by applying the criteria of ASTM D2321 X1.8 comparing the native soil or finer granular gradation to the coarser granular material gradation.

8.5.5. Pre-Installation Inspection

Excavations require inspection to confirm conditions meet design intent prior to commencement of pipe installation operations.

8.5.6. Pipe Embedment Zone Construction

Construction in the pipe embedment zone (i.e. bedding, haunching and initial backfill) shall conform to the requirements outlined in specific Sections for each pipe material.

8.5.7. Final Backfill

(a) Do not proceed with final backfilling operations until County has inspected the pipe installation and pipe embedment.

(b) The Contractor shall not push final backfill directly onto the pipe until there is at least 300 mm of carefully placed initial backfill over the pipe to avoid damage to the pipe.

(c) After the initial backfill is completed and meets specific requirements; the final backfill material shall be carefully placed.

(d) Suitable equipment working in and/or adjacent to the trench shall compact and moisture condition the final backfill to meet the specified requirements.

(e) Notwithstanding the above, under no circumstances shall equipment that exceeds the structural capacity of the pipe be allowed direct access over or near the pipe or appurtenance until sufficient soil cover has been obtained. The Contractor shall be solely responsible for ensuring the equipment used during final backfilling operations is carefully selected and staged such that the pipe or appurtenance is not damaged or displaced during final backfilling operations.

(f) Boulders and rock fragments with dimensions exceeding 75 mm shall not be placed within 400 mm of finished subgrade.

(g) Boulders in excess of 200 mm mean diameter will not be allowed in any of the final backfill.

8.5.8. Final Backfill

(a) Class I Backfill

Class I Backfill shall be constructed only where indicated on the drawings, in maximum 200 mm lifts and compacted to minimum 98% SPMDD.

(b) Class II Backfill

Class II Backfill shall be constructed for all trenches and unless noted otherwise on the drawings, in the Final Backfill zone extending from the top of the initial backfill zone to the bottom of proposed subgrade level, in maximum 200 mm lifts and compacted to minimum 98% SPMDD.

(c) Class III Backfill

Class III Backfill shall not be used for this Contract.

(d) Backfill Around Structures

Backfill around manholes and structures shall be Class I Final Backfill to the level of top of initial backfill of pipes penetrating the structure. Class II Backfill shall be used above the Class I Backfill to the level of design subgrade or bottom of topsoil replacement, depending on the locations of the structure.

(e) Backfilling around installations:

(i) Do not backfill around or over cast-in-place concrete that has been within 3 Days after placing. Alternatively, the Contractor shall backfill after demonstrating 35% of the design concrete compressive strength has been attained.

(ii) Place layers simultaneously on sides of installed work to equalize loading.

(iii) Place material by hand under, around and over installations until 300 mm of pipe embedment above pipe crown is provided. Dumping material directly on installations will not be permitted.

(iv) The Contractor shall add moisture or dry the final backfill material as necessary to achieve the compaction specifications.

(f) Placing frozen final backfill material during final backfilling operations will result in considerable consolidation of the final backfill material when it thaws. Obtain the necessary approvals prior to utilizing frozen or potentially frozen material as final backfill material. If frozen material is used, the Contractor is solely responsible for repairing the final backfill to the depth necessary as subsequent damage due to excessive consolidation of the material.

(g) Shoring, sheeting and bracing:

(i) Unless otherwise shown on drawings remove sheeting and shoring from trench during backfilling operations in a manner that does not disrupt the pipe embedment zone.

(ii) Do not remove bracing until backfilling has reached level of bracing.

8.5.9. Street Restoration

See other Sections.

8.5.10. Topsoil Replacement and Restoration

(a) Following final backfilling, the topsoil shall be spread evenly over the disturbed area to conform to the natural topography and drainage regime.

(b) The Contractor shall reinstate the topsoil according to:

(i) Remove all lumps, stones and rocks.

(ii) Harrow the topsoil and reseed with an approved native seed mix designed for the local area.

(iii) Unless required otherwise, the following seed mix shall be used:

- 10% Slender Wheat Grass
- 40% Northern Wheat grass
- 40% Western Wheat grass
- 10% Sandberg Blue grass

(iv) Submit the seed mix and a seed analysis report from an accredited seed lab in accordance with Section 2.0 Submittals in Appendix F – Technical Specifications.

(v) Perform seeding at times, rates and in accordance with supplier's instructions.

(vi) Sufficiently water, protect and harrow until the vegetation is established.

- The Contractor shall reseed areas as required to achieve establishment in 100% of the area disturbed by Contractor.

8.5.11. Site and Surface Restoration

(a) Restore all areas and surface features disturbed by the Contractor's operations in accordance with the Contract.

(b) No extra payment will be made for site restorations that are not itemized specifically on the Bid Form.

8.5.12. Trench Subsidence

(a) The Contractor shall be responsible correct settlements that exceed the following limits during the Warranty Period:

(i) Paved Streets – 15 mm

(ii) Non-paved Streets – 25 mm

(iii) Greenspace – 50 mm and not affecting natural drainage courses. If drainage is affected, the Contractor shall make all necessary repairs.

(b) Contractor shall bear the costs for repairs of subsidence beyond the limits.

8.5.13. Access to Properties

(a) Until the date of Substantial Performance, the Contractor, at his costs, shall be responsible for allowing access to all properties.

Such access to properties shall include providing proper drainage, temporary roads, levelling with use of motor patrol, and providing towing services when required.