

This specification covers the requirements for inspection of new and existing sanitary sewers, storm sewers and pipe culverts using closed-circuit television for the purposes of assessing thoroughness of cleaning, observing and recording structural and service defects and construction features and to verify new sewer construction prior to acceptance.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

International Organization for Standardization

ISO 16331-1

Optics and optical instruments — Laboratory procedures for testing surveying and construction instruments — Part 1: Performance of handheld laser distance meters

CSA Group

PLUS 4012 (2010)

Technical Guide: Visual Inspection of Sewer Pipe

National Association of Sewer Service Companies (NASSCO)

PACP

Pipeline Assessment and Certification Program Inspection

LACP

Lateral Assessment and Certification Program Inspection

MACP

Manhole Assessment and Certification Program

MSCC

Manual of Sewer Condition Classification, Water Research Centre (WRc)

NTSC

National Television Standards Committee

APWA

American Public Works Association

PART 2 GENERAL

2.1 SUBMISSION REQUIREMENTS

.1 The following information shall be submitted to the Owner ten (10) business days prior to the start of the CCTV inspection operations:

.1 Submit aA valid copy of the CCTV operator's certificate from NASSCO for PACP Certification Certificate or an equivalent industry recognized alternate training program acceptable to the Owner. A copy of said certificate is required for each CCTV operator working on the Contract. Operators shall have been

certified or re-certified within the three years prior to the start of the Contract.

.2 Submit A sample PACP and MACP inspection reports, resolution tests of digital video recording format, and digital data file, and sample observation photos.

.2.1 One submission is required for each camera proposed for use on the work.

.3.2 The camera make, model, and serial number shall be clearly identified on each video recording.

.4.3 The details of a formal the coding accuracy verification system that is to be used to verify inspection accuracy shall be submitted for approval.

.5.4

.2 Inspection Reports Survey reports shall be submitted to the Owner in the following formats, with the noted number of copies, within 10 business days of the completion of the fieldwork:

.1 3 copies of the printed survey report.

.2 2 portable hard disk drives, other digital storage devices and software database as specified in the Contract Documents, each containing the identical survey report information as in the printed copies.

.3 2 copies of the digital video recording.

.3 Inspection Reports to have the structure and meet the requirements of the Reports subsection of this Section.

2.2 OPERATOR QUALIFICATIONS FOR INSPECTION AND CODING

.1 Perform inspection work only when PACP certified operators are on site.
PACP certificates shall be available on site at all times.

.2 Each inspection unit shall have a minimum of one certified operator.

.3 Ensure that 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 and the maintenance holes.

.4 Perform condition coding using certified operators who hold a valid
certificate from NASSCO PACP Qualification or an alternate training
program acceptable to the Owner.

2.3 SEWER CONDITION CODING

.3.1 The CCTV inspection shall include condition, feature and defect
classification coding according to the National Association of Sewer

Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP).

.2 Flow type, start and finish depths to be identified in the inspection report.

2.4 SEWER INSPECTION STANDARDS AND DEFECT CODING

.1 CCTV inspection and defect coding shall be carried out by NASSCO PACP certified operators. New operators and operators with an expired PACP certification over three years must provide sufficient evidence of training by an approved entity such as an individual or association that has been approved by the Owner.

.2 The Owner may at any time during this contract specify a form of training or certification to be undertaken by inspection operators based on the current standard or any other industry standard the Owner adopts in the future.

2.22.5 CODING ACCURACY

.1 Implement Owner approved Prior to the commencement of the CCTV inspection, a formal coding accuracy verification system prior to the start of Work shall be developed and submitted to the Owner and implemented when approved.

.2 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 will satisfy the following requirements.

.1 header accuracy – 95 %.
.2 detail accuracy – 85 %.

.3 Verify coding accuracy on a random basis on a minimum of 10% of the inspection reports. A minimum of two accuracy verifications must be done for each operator for each week working. Submit coding accuracy checks with the corresponding video recording.

.4 Perform an accuracy verification for each operator for each week working and submit the results to the Owner, along with the corresponding video recording, for review. Operators failing to provide copies of their NASSCO certification and / or meet the accuracy requirements on two occasions will not be permitted to code on the remainder of the Contract until they can demonstrate to the Owner that they can code in accordance with the requirements of the NASSCO Level of Qualifications for PACP.

.4.5 Re-code inspections not satisfying the accuracy requirements and verify the accuracy of the inspection immediately preceding and following the

non-compliant inspection. Repeat the process until the proceeding and subsequent inspections meet the accuracy requirements.

~~.5.6 Coding accuracy checks shall be submitted to the Owner along with the corresponding video recording.~~

2.6 CCTV VIDEO TITLE SCREEN INFORMATION

~~.6.1 At the start of each inspection or maintenance hole length, a data generator shall electronically generate and clearly display on the viewing monitor and video recording, a record of data in alphanumeric form containing the following minimum information:~~

- ~~.1 Automatic update of the camera's metre-reading position in the pipeline from adjusted zero.~~
- ~~.2 Pipeline dimensions.~~
- ~~.3 Maintenance hole and pipe length reference numbers.~~
- ~~.4 Date of survey.~~
- ~~.5 Road name and location.~~
- ~~.6 Direction of survey.~~
- ~~.7 Time of start of survey.~~
- ~~.8 Pipeline use.~~

~~.2 This information will display for a minimum of 10 seconds.~~

~~.3 Inspection shall not proceed while the information screen is being displayed.~~

~~.4 During pipe inspection, where possible, the CCTV camera shall be used to perform an internal scan of the start, finish and any uncharted maintenance holes found~~

2.7 CCTV VIDEO RUNNING SCREEN

~~.1 Upon commencement of, and throughout the inspection, the following information shall be continuously displayed on-screen and captured on the screen:~~

- ~~.1 street name~~
- ~~.2 start maintenance hole~~
- ~~.3 finish maintenance hole~~
- ~~.4 chainage~~
- ~~.5 defect coding at defects~~

2.8 UNCHARTED ASSETS NAMING CONVENTION

- .1 Newly found maintenance holes will be assigned Asset IDs by referencing the upstream manhole and an alpha character starting with "A". Example MH123456789A, MH123456789B for 2 newly found maintenance holes.
- .2 Split pipe segments will be assigned an Asset ID by adding a numeric suffix to the original pipe asset id. Example SL12345678-1, SL12345678-2 after 2 new maintenance holes are found.

PART 3 PRODUCTS

3.1 MATERIALS

- .1 Digital photograph files shall meet or exceed a resolution of at least 800 x 600 pixels and be in JPEG format or as specified in the Contract Documents. Printed photographs where required, shall be in colour with a minimum size 90 x 70 mm and shall be reproduced on premium glossy photo quality paper.
- .2 Media storage and report presentation shall be cloud based unless prior approval is granted by the Owner. All software will be NASSCO import/export certified. (Refer to www.nassco.org for a full list of compatible software).
- .2.3 Digital storage device (if approved) will be a minimum USB 2.0 or higher compatibility shall be placed inside envelopes with labels displaying the following information:
 - .1 Owner's Name
 - .2 Contract Number or Project Name
 - .3 Sewer/Pipe Identification Number
 - .4 City or Town
 - .5 Street Name
 - .6 Inspection Date
 - .7 Consultant's/Contractor's name

3.2 INSPECTION SURVEY UNIT/VEHICLE

- .1 The survey vehicle shall contain a separate area for viewing, recording, and controlling the CCTV operation.
- .2 Seating accommodation for minimum one person shall be provided in addition to the operator seating to clearly view the monitor screen, which displays the inspection work in progress.
- .3 The viewing and control area shall be insulated against noise and extremes in temperature. External and internal sources of light shall be

controlled in a manner as to ensure the light does not impede the view of the monitor screen.

- .4 All equipment used within the pipeline shall be stored outside the viewing, recording, and control area.
- .5 Fans and blowers capable of removing fog that may be present in sewers at the time of the inspection.
- .5.6 The vehicle shall include a cell phone or suitable alternative communication system as agreed to by the Owner to link all crew members for the duration of the work.

3.3 VIDEO INSPECTION EQUIPMENT-QUALITY

- .1 The electronic systems, television camera, and monitor shall be of adequate quality to enable the following to be achieved:
 - .1 Video camera capable : the pan and tilt camera shall have the capability of panning the pipe at 360 degrees with tilting capability of 2705 degrees with optimum picture quality provided by remote focus and iris adjustment to ensure complete inspections and view of all laterals and deficiencies. Focal range to be adjustable from 100 millimetres to infinity.
 - .2 Sufficient, adjustable, waterproof high intensity light source to allow an even distribution of the light around the pipeline perimeter without the loss of contrast or flare out of picture shadowing. Ensure lighting illuminates the pipe or maintenance hole ahead of the camera to be able to determine general condition, features, and upcoming defects. Light heads shall be changed upon the request of the Owner.
 - .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.
 - .4 Equipment shall be capable of continuously capturing digital video from first generation recordings with no frame loss, regardless of the progression of the inspection.
 - .5 Equipment shall be used to acquire continuous digital video images of the pipe for the entire length being inspected.
 - .1 Resolution: the live picture shall be visible with no interference and capable of registering a minimum number of lines of resolution at the periphery as indicated below:
 - .1 Fixed view camera 350 lines of resolution.
 - .2.1 Pan and tilt camera 400 lines of resolution.

- .2.6 Colour Constancy: the lighting shall be set to intensity prior to commencing the survey to ensure the camera provides optimum results when used with its own illumination source. To ensure colour constancy, no variation in illumination shall take place during the survey.
- .3.7 ~~Focus, Iris, and Illumination: the adjustment of focus and iris shall allow optimum picture quality to be achieved and shall be remotely operated. The illumination shall be such as to allow an even distribution of the light around the pipeline perimeter without the loss of contrast or flare out of picture shadowing.~~
- .4.8 Monitor: monitors shall be a minimum size of 21 inches and shall support resolution equal to or greater than the corresponding video camera resolution.

3.4 VIDEO CAMERA TRANSPORT INSPECTION EQUIPMENT

- .1 Transport ~~The surveying~~ equipment and cable shall be capable of surveying a length of pipeline up to:
 - .1 300 m where entry to the pipeline may be obtained at each end of the pipeline;
 - .2 30 m where rodding is used; or
 - .3 150 m where a self-propelled unit is used when entry is at only one end of the pipeline.
 - .4 200 m when being towed.
- .2.1 ~~Work shall not commence in a work shift until the Owner is satisfied that all items of the survey equipment have been provided and are in full working order.~~
- .2 ~~Self-propelled rubber tired or tracked crawler tractor capable of maneuvering around bends and passing over minor surface imperfections including but not limited to broken joints and solid debris up to 40 mm in height.~~
- .3 ~~Mount camera to float or skid and tow through sewers where the condition of the sewer prevents the use of a tractor. Obtain the Owner's approval before using a float or skid. Position the towing equipment to not impede the view of the sewer from the camera and ensure the float or skid is stable to provide a smooth progression and steady video recording.~~
- .3 ~~Each survey unit shall contain a means of transporting the CCTV camera in a stable condition through the pipeline.~~
- .4 Where the CCTV camera is towed by winch and cable through the pipeline, all winches shall be stable during the entire CCTV inspection. All

cables shall be of steel or of an equally non-elastic material to ensure the smooth and steady progress of the CCTV camera.

- .5 Each unit shall carry sufficient number of guides and rollers such that, when surveying, all cables are supported away from pipe and maintenance hole edges. All CCTV cables and lines used to measure the camera's location within the pipeline shall be maintained in a taut manner and set at right angles, where possible, to run through or over the measuring equipment.
- .6 Tethered to facilitate the conveyance and extraction of the platform from the sewer, without causing damage to the sewer infrastructure, in the event the equipment fails or otherwise becomes uncontrollable within the sewer.
- .7 Operable under partially or fully submerged flow conditions, capable of inspecting a minimum distance of 200 m of sewer from a single access point and the complete inspection of the sewer from the start maintenance hole to the finish maintenance hole.
- .8 Operable in sewers of various cross-section, and constructed of standard pipe materials including brick, clay, concrete, PVC, HDPE, and steel.
- .9 Transport equipment must be capable of allowing for adjustable camera height.
- .10 A device for maintenance hole 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 maintenance hole.
- .11 Survey and camera equipment used to inspect water mains shall be used exclusively for work in water mains only.

3.5 RECORDING RESOLUTION

- .1 Resolution: the live picture shall be visible with no interference and capable of registering a minimum number of lines of resolution at the periphery as indicated below:
 - .1 Fixed view camera 350 lines of resolution.
 - .2 Pan and tilt camera 400 lines of resolution.
- .2 Prior to the start of the CCTV inspection, the resolution of digital MPEG video playback for each camera shall be confirmed by recording a RETMA type resolution chart approved by the Owner, using the following procedure:
 - .1 Set up the camera as is done for the actual inspection.
 - .2 Show the camera being introduced and reaching its final position for the test.

- .3 Fill the monitoring screen with the resolution chart.
- .4 Illuminate the resolution chart evenly and uniformly without reflections ensuring that the illumination source accurately simulates the lighting used in the sewer.
- .5 Record a test video for 30 seconds.
- .6 Identify the camera make, model, and serial number on the recording.
- .7 Record the test at the start of a digital recording.
- .8 The resolution test shall be submitted to the Owner.

3.53.6 DIGITAL VIDEO RECORDER

- .1 Digital video recorders shall be able to capture in colour from the live video source with the following requirements:
 - .1 MPEG-24 format or higher as required by the Owner.
 - .2 Minimum recorded video resolution shall be 420 lines
 - .3 with an Picture size: NTSC size of 720 x 480 @ 29.97 frames per second.
 - .4 Video imagery must not contain black or other coloured or other erroneous columns or bands where formatting of lesser resolution camera lens recordings have been resized to meet the Picture Size requirements of this specification. Video will be reviewed by the Owner with the potential for rejection if these bands or columns are observed.
 - .5 Data/Bit Rate: 6.0 Mbps.
- .2 Video capture equipment shall be capable of capturing digital video from first generation recordings with no frame loss.
- .3 Inspections shall be recorded in colour.
- .4 Digital video recordings may be saved to a computer hard drive and transferred to a portable hard disk drive, compact disc, or digital video for submission.
- .5 A digital format video recording of an inspection shall be produced in colour from a first generation recording by one of the following methods:
 - .1 A computer system and a video capture card shall be used to capture the recording continuously, regardless of the progression of the inspection. Prior to submission, the raw digital data shall be edited to remove pauses when the inspection progress was not continuous.
 - .2 A computer system and a video capture card shall be used to intermittently capture the recording. Prior to submission, the raw digital file shall be edited to form one continuous file.

- .3 Specialized video recording equipment capable of pausing and resuming live recording shall be used to capture original recording. A single file is to be produced for submission.
- .4 Non-linear video editing software shall be used to edit digital videos. Edited digital files shall not be recompressed.
- .6 The compression technology (codec) used in creating the MP4 digital video recordings shall be fully compatible with all the mainstream video players listed below:
 - .1 Windows Media Player, Windows and Mac
 - .2 Apple QuickTime Player, Windows and Mac
 - .3 VideoLAN VLC Player, Windows and Mac
- .7 Video files that do not play properly and completely on all the above players will not be accepted and will require re-doing the CCTV inspection or other corrective procedure. Ensure that the entire inspection of a particular sewer or maintenance hole is contained on the same USB media. Record reverse set-up inspections of a sewer immediately after the original inspection where possible.

PART 4 EXECUTION

4.1 PREPARATION

- .1 When specified in the Contract Documents, pipelines shall be cleaned and flushed immediately prior to CCTV inspection.
- .2 The sewer section under inspection shall be sufficiently dry so that any remaining fluid does not obscure any part of the interior of the sewer during CCTV inspection. Flow control measures as specified in the Contract Documents shall be implemented to ensure a minimum of 80 % of the height of the pipeline is visible for the entire inspection and shall be approved by the Owner.
- .3 All fog shall be evacuated from the pipeline and the pipeline kept clear of fog or vapour that obscures the view during the inspection.
- .4 Notify the Owner of the locations where sewer inspections will be performed a minimum of one Working Day before starting inspection work at that location.

4.2 CAMERA POSITION AND TRAVEL SPEED

- .1 Position the centre of the camera lens in the centre of circular and egg-shaped sewers and maintenance hole risers.

- .2 The camera lens shall be positioned centrally in a circular pipeline and at two-thirds of the vertical dimension in a non-circular pipeline with a positioning tolerance of $\pm 10\%$ of the vertical pipeline dimension. In all instances, the camera lens shall be positioned looking along the longitudinal axis of the pipeline.
- .3 The travelling speed of the camera in the pipeline shall be limited to:
 - .1 0.1 m/s for pipeline of diameter less than 200 mm;
 - .2 0.15 m/s for diameters exceeding 200 mm but not exceeding 310 mm; and
 - .3 0.20 m/s for diameters exceeding 310 mm.

4.3 CAMERA POSITION METRE-READING DEVICE

- .1 A suitable metre-reading device shall be used that enables the cable length to be accurately measured to indicate the location of the camera. The metre-reading device shall be accurate to $\pm 1\%$ of the length of the sewer being surveyed. The tolerance shall be demonstrated using one or both of the following methods in conjunction with a linear measurement audit form that shall be completed each day during the survey:
 - .1 Cable calibration device.
 - .2 Tape measurement of the surface distance between maintenance holes.
- .2 If the accuracy of the measuring device fails, it is to be replaced. The Owner may require that the lengths of pipeline first inspected with the original measuring device be resurveyed using the new measuring device.

4.4 SEWER PIPE AND MAINTENANCE HOLE INSPECTIONS

- .3.1 The work shall include a CCTV inspection of the pipeline and the preparation of all video, digital, and written reports. A certified, trained, and competent CCTV operator shall be used to operate the inspection equipment and code the inspection.
- .2 Work shall not commence in a work shift until the Owner is satisfied that all items of the survey equipment have been provided and are in full working order.
- .3 The Contractor to notify the Owner if any outfall screens, gates or platforms require removal for CCTV inspections to proceed.
- .4 Evacuate fog from the sewer and maintenance hole before beginning inspections and keep the sewer and maintenance hole clear of fog during the entire inspection.

.5 Keep the camera lens clean during the entire sewer and maintenance hole inspection.

.6 Ensure that the picture is in focus and there is adequate, even lighting free of shadows and glare ahead of the sewer pipe or maintenance hole riser at all times in order to be able to determine general condition, features and upcoming defects. Provide better lighting as directed by the Owner.

.7 Where required for a specific inspection, the CCTV camera shall stop and view each defect or service connection clearly and completely for at least five seconds.

.8 Perform sewer inspections according to the following requirements:

.1 Perform sewer inspection after cleaning unless otherwise directed by the Owner.

.2 With the direction of flow unless a reverse set up is required.

.3 Inspect from the centre of the first maintenance hole to be inspected to the centre of the last maintenance hole to be inspected. Counter should be zeroed at the maintenance hole wall.

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

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

.6 Ensure the face of the start maintenance hole is clearly visible at the start of the sewer inspection.

.7 Record the distance from the center of the maintenance hole cover to the cable calibration location at the start of the inspection and adjust the distance reading so that zero is at the center of the start maintenance hole cover. This distance is known as the cable calibration distance. The cable calibration location is the intersection point between the camera's widest horizontal viewing angle and the pipe's side periphery (3 and 9 o'clock) when the camera is level and looking forward. All defects are to be circumferentially located based on the side periphery only.

.8 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 center of finish maintenance hole.

.9 Stop the camera and position to provide a steady five second 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.

.10 Tap observation distances must occur at the centre of the tap and the side periphery. To determine use and deficiencies of the tap.

the camera must continue to travel, camera centred in the perspective view (to capture other observations), to stop perpendicular to the tap and pan so that the camera can view directly into the barrel of the lateral, to enable the inspector to apply modification and descriptor codes to the tap as per NASSCO PACP standards as necessary.

.4.9 A fixed camera may be used for pipelines less than 300 mm in diameter. For pipelines equal to or greater than 300 mm, a pan and tilt camera shall be used. Each camera shall have an accepted sample submissions report prior to being used for inspection work. The camera lens shall be kept clean at all times during the inspection.

.5.10 At the start of each pipeline being surveyed, the length of pipeline from zero chainage up to the cable calibration point shall be recorded and reported in order to obtain a full record of one of the following:

- .1 Pipe sewer length from the inside face of the maintenance hole to the inside face of the next maintenance hole or outlet end of the pipe sewer.
- .2 Pipe culvert length from one end of the pipe culvert to the other; or
- .3 water main length from the valve pit entry point to the valve pit exit point or termination of the cement mortar lining.

.6.11 The position metre-reading entered on to the data display at the cable calibration point shall allow for the distance from the start of the survey to the cable calibration point so that the metre-reading at the start of the survey is zero.

.7.12 In the case of surveying through a maintenance hole when a new header sheet is required, the metre-reading shall be set at zero with the camera focused on the outgoing pipe entrance.

.8.13 Once the survey of the maintenance hole length is underway, an automatic update of the camera's metre-reading position in the pipeline from zero in metres and tenths of a metre shall be continually displayed.

.9.14 The camera shall be stopped when defects are being noted on the coding sheet. Defects in each pipeline length shall be coded according to the standard being used (i.e., CSA Plus 4012, NASSCO Canadian Edition of the Pipeline and Assessment Certification Program (PACP), or WRc) or as specified in the Contract Documents. Any variation from the manual shall be noted in the survey report.

.10.15 The survey shall be restarted at the opposite end of the pipeline if a blockage or obstruction is encountered.

.16 Notify the Owner of the discovery of the following. Owner to advise Contractor of next steps:

- a) uncharted maintenance holes
- b) collapsed sewers
- c) buried maintenance holes
- d) blocked sewer
- e) surcharge sewers or maintenance holes that are holding water above the obvert of the sewer entrance.

.17 Re-perform sewer and maintenance hole inspections where the Owner has determined the tolerance requirements for camera position and speed and internal distance measurement requirements have not been satisfied.

4.5 SEWER REVERSAL AND ABANDONMENT OF INSPECTION SURVEY

- .1 Sewer survey abandonment shall occur for the following reasons:
 - .1 Category A – Loose Debris (e.g. silt, sand)
 - .2 Category B – High Water Level
 - .3 Category C – Hard debris such as encrustation, grease, concrete, roots, and so on.
 - .4 Category D – Obstruction in line
 - .5 Category E – MH inaccessible; for example, private area, off-road, buried, and so on.
- .11.2 The Contractor shall clearly document the reason for a survey abandonment including a comment in the database file and a photograph.
- .3 A reversal set-up inspection must be undertaken corresponding to each abandonment. Move the equipment to the downstream maintenance hole and attempt to complete the inspection of the entire sewer to the upstream maintenance hole
- .4 If a reversal must also be abandoned, it too must be documented with a comment in the database and a photograph.
- .12.5 Where it is critical to obtain a full and complete inspection of the pipe, the Owner shall be notified to assess the possibility of undertaking additional steps to complete the survey. These steps may include hydraulic flushing, mechanical cleaning, connection reaming, cross-bore removal and so on.

4.6 REMOVAL OF EQUIPMENT THAT BECOMES STUCK IN A SEWER

- .1 Advise the Owner 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 Owner if the equipment cannot be freed after 4 hours and mark the position on the surface over the sewer where the equipment is stuck.

- .2 The Owner will arrange to have an excavation made to the top of the sewer where the equipment is stuck within 48 hours of notification that the equipment cannot be freed.
- .3 Be present during the excavation and once the top of the sewer is exposed and the excavation is secured, do one of the following.
 - .1 Remove the top of the sewer pipe and retrieve the equipment stuck in the sewer or;
 - .2 Defer removal of the top of the sewer and retrieval of the stuck equipment to the excavation contractor. Damages caused to the stuck equipment will not be the responsibility of the excavation contractor. No claim for equipment damages will be made against the excavation contractor.
 - .3 The Owner will arrange to have the sewer repaired after removal of the equipment that was stuck.
 - .4 Clean and remove backfill and debris that may have entered the sewer during removal of the equipment and subsequent repair of the sewer.

4.7 EMERGENCY NOTIFICATION REQUIREMENTS AND REPAIRS

- .1 Immediately advise the Owner when a complete sewer inspection cannot be completed due to
 - .1 pipe collapse or imminent collapse
 - .2 90 % or more pipe blockage
 - .3 excessive deformation
 - .4 large displaced joints
 - .5 gas cross-bores
 - .6 missing maintenance hole covers
 - .7 collapse maintenance holes or maintenance holes on the verge of collapse
 - .8 illegal cross connections, for example sanitary into storm.
- .2 Jointly decide with the Owner one of the following alternatives:
 - .1 Attempt reversal CCTV inspection,
 - .2 Abandon the inspection; or
 - .3 Repeat the inspection subsequent to one of the following actions:
 - .1 Performing solid debris cutting,
 - .2 Removing intruding connections,
 - .3 Modifying the camera setup position or method of transport,
 - .4 Completion of external or emergency repairs.
- .3 Contractor to note in a log the sewer or maintenance hole Identification number, steel tape measurement, upstream and downstream length

inspected, length of missing video and the reason the inspection could not be completed and review with the Owner on a weekly basis.

.4 Where pipe collapse or cross-bores are found during CCTV, the road shall be marked with spray paint. This will allow to easily identify the location where digging will be required.

.5 Place barricades around the location above the sewer or maintenance hole where a void is visible or suspected to be outside of the sewer pipe or maintenance hole and immediately notify the Owner. Notify the appropriate Emergency Services after normal working hours if the Owner cannot be reached.

.6 The Owner will arrange for emergency sewer or maintenance hole repairs to be performed if required as soon as possible if the inspection cannot be completed or the sewer or maintenance hole condition poses an immediate operational or safety concern such as a complete collapse.

.7 Emergency sewer or maintenance hole repairs will be prioritized if more than one emergency repair arises at the same time.

.8 Carry out inspection of other sewers not affected by the emergency repair and complete inspection of the sewer when notified by the Owner the emergency repair has been completed.

.9 Repeat cleaning of the sewer if required to remove backfill and debris that may have entered the sewer during emergency repairs.

4.4.8 REPORT

.1 Survey reports shall be submitted to the Owner in the following formats, with the noted number of copies, within 10 business days of the completion of the fieldwork:

.1.1 3 copies of the printed survey report.

.1.2 2 portable hard disk drives, other digital storage devices and software database as specified in the Contract Documents, each containing the identical survey report information as in the printed copies.

.1.3 2 copies of the digital video recording.

.2.1 Entire inspections shall be contained within one digital file on a digital storage device, as applicable. When possible, reverse set-up inspections shall be recorded immediately after the original inspection.

.3.2 Each digital file shall contain the file name, as specified by the Owner and may include the following:

.1.1 Tender number

.1.2 E<Entity number>

- .3 F<From entity number>
- .4 T<To entity number>
- .5 Street Name
- .6 M<Measured length>
- .7 I<Inspected length>
- .8 <Inspection direction: DS or US>
- .9 <Letter designating inspection sequence> .MPEG

.4.3 For example: 910-200 E5329 F5328 T5350 BERRY M100.0 I39.2 US B.MPEG indicates that this is the second or “B” partial inspection of this entity, 39.2 m long.

.5.4 All required header information fields shall be completed and verified for correctness. The software used to produce the survey report shall not allow the operator to continue inputting information until the preceding field has been completed. The report shall be machine printed and presented according to the standard used.

.6.5 All dimensions in the survey report shall be metric.

.6 The survey report shall identify major defects and shall include photographs when the need for photographs is specified in the Contract Documents.

.7

- .1 The report shall include a standard cover sheet showing the following:
 - .1 Location
 - .2 Performed By
 - .3 Date
 - .4 Contractor

.8 Submit one (1) pdf copy of the maintenance hole inspection logs to the Owner. Logs shall record defects according to NASSCO's MACP.

.8.9 The report shall include a completed Index Page with the headers:

.9.10 Street Name, From M.H. No.; To M.H. No., Page No.

.10.11 Whether inspected at the same time or not, the complete report will be presented together, from upstream to downstream maintenance hole.

.11.12 For video inspection results and findings, the heading will state:

- .1 the street name
- .2 the maintenance hole numbers applicable to this section
- .3 the reference drawing number
- .4 prevailing weather on the day of the inspection

- .5 statement of soil condition in area of inspection, e.g., dry, wet, saturated, frozen
- .6 the date of the inspection

.12.13 The key plan will consist of a small drawing (not to scale) showing the appropriate location of the two maintenance holes in relation to any nearby reference points such as houses (with corresponding civic numbers), telephone poles (with corresponding pole numbers), etc. This drawing will denote:

- .1 the maintenance hole numbers
- .2 the horizontal distance between the maintenance holes
- .3 the direction of sewer flow

.13.14 The report shall include photographs of:

- .1 pipe joints that display gaps, spread, or offset;
- .2 signs of infiltration; protruding service lines; crushed, broken or cracked pipe;
- .3 variance of the grade of the pipe section; and
- .4 gravel or debris or other blockages which may impede flow.

.14.15 All photographs will be labelled and have a corresponding labelled description for the photograph.

.15.16 All photographs will be numbered in order. This number will appear beside them and will be the same number referred to in the description.

.16.17 The last page of the report will consist of an area sewer plan to scale, showing the street inspected for the report and applicable maintenance numbers.

.17.18 Typical Key Plan Templates for Inspection Report

DEPARTMENT PROJECT NO.:

MUNICIPALITY:

STREET NAME:

FROM MH#

TO MH#

REFERENCE DRAWING:

LINE SECTION LENGTH:

DATE:

PIPE SIZE:

WEATHER CONDITION:

PIPE MATERIAL:

PIPE SECTION LENGTH:

PIPE MATERIAL TYPE:

SKETCH	LINE LENGTH (M)	PHOTO #	TAPE REFERENCE	OBSERVATIO NS
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			(HOURS,MINUTES)	

4.54.9 **QUALITY ASSURANCE**

- .1 Upon submission, printed and digital inspection reports, and digital MPEG video recordings, magnetic data files, and coding accuracy checks shall be reviewed to ensure compliance with the Contract Documents based on an inspection rate of 1,000 m per day, unless otherwise indicated by the Owner. The review period will be proportionately extended for inspection rates greater than 1,000 m per day. The Owner may adjust the frequency of reviews based on the results of previous reviews.
- .2 Submittals shall be reviewed by the Owner and their acceptance confirmed within ten (10) business days of submission. Only inspections with minimum accuracy for header information of 95 % and minimum detail accuracy for defects and features of 85 % will be accepted. Non-compliant submissions will be returned for correction. Corrected submissions shall be returned to the Owner for review within five (5) business days.
- .3 Operators failing to meet the coding accuracy requirements on two occasions shall not be permitted to code on the remainder of the Contract, unless they successfully re-attain NASSCO qualification based on the standard being used, (i.e., that is to say the Canadian Edition of PACP or WRc.).
- .4 Re-perform sewer inspections where the Owner has determined the requirements of this specification have not been satisfied.
- .5 Correct non-compliant inspection submissions and resubmit the corrected inspections to the Owner within 5 Working Days.
- .6 Repeat the process until the inspection submissions are accepted by the Owner.

4.64.10 **DRAWINGS**

- .1 One clean set of the drawings showing maintenance hole numbers that coincide with the coding sheets and videos shall be returned to the Owner on completion of the survey. The drawings shall be clearly annotated to show any discrepancies between the drawings and the survey report. Such discrepancies shall be brought to the attention of the Owner during the survey.

4.74.11 MANAGEMENT OF EXCESS MATERIAL

.1 Management of excess material shall be as specified in the Contract Documents.

PART 5 PAYMENT

5.1 MEASUREMENT FOR PAYMENT

.1 Measurement for CCTV and camera inspection will be by the metre of pipe inspected and accepted.

.2 Measurement for a Closed Circuit Television (CCTV) inspection of pipeline shall be measured in metres on the ground surface along the centreline of the pipe sewer from the centre of one drainage structure to the centre of another drainage structure or outlet end of the pipe sewer. Measurement for pipe culverts shall be from one end of the pipe culvert to the other end of the pipe.

.3 In the event that a CCTV inspection is terminated due to a blockage or collapsed pipe or the pipe is inaccessible, measurement shall be in metres for the actual length of pipeline inspected as determined from the chainage indication on the record media.

.4 Non-compliant submission returned for correction shall be corrected and resubmitted at no extra cost the Owner.

.5 Removal of the top of the sewer pipe and the inspection equipment that was stuck in the sewer will be at Contractor's own expense.

.6 No payment or extra time will be given for equipment downtime and attempted equipment retrieval.

5.2 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment will be made to the maximum of 90 % of the value of sewers, fittings and appurtenances until the system (or sections of the system, if payment approved by the Owner) has passed all tests. The 10 % retained shall be called the CCTV and Camera test allowance.

.3 Payment will not be made until the required report submissions are accepted by the Owner.

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

Not For Construction

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