

This guide has been produced to assist Contractors and Consultants (in particular the RPEQ qualified Consulting Engineer for the Development) in arranging for the correct acceptance tests to be completed on all new works.

NOTE: The Developers Representative/Agent maybe the Contractor or the Consulting Engineer (RPEQ qualified) for the development.

Conformance with Codes

All tests shall conform with the relevant Southeast Queensland Water Supply and Sewerage Design and Construction Code (SEQ Code) and the Water Services Association of Australia (WSAA) requirements. It is the responsibility of the consulting engineers to ensure that all tests and CCTV investigations are completed as specified in the relevant SEQ Code and are acceptable without defects prior to submission to Unitywater.

What works require CCTV

CCTV inspection is a requirement on all new sewerage mains constructed by a contractor (i.e. Not constructed by Unitywater) that will be handed to Unitywater as contributed assets. The CCTV inspections also include manholes and must be completed prior to it being connected to Unitywater networks.

CCTV Submission Requirements

Unitywater requires all CCTV inspections (including hardcopies of the report) are to be submitted for review and acceptance as part of the development's construction process prior to the works being approved for an On-Maintenance inspection. Failure to produce adequate CCTV information and associated documentation will result in the required On-Maintenance inspection being delayed.

The Contractor will ensure that all construction works are fully completed and that all internal surfaces of the pipes and structures are clean before the CCTV inspection is undertaken. Failure to comply with this requirement will result in the CCTV being rejected by Unitywater.

CCTV inspections must be undertaken by certified/qualified CCTV operators using cameras in accordance with the *WSA05 Conduit Inspection Reporting Code* requirements.

The consulting engineer (RPEQ) for the development must review the CCTV inspection and report and certify: the:

1. Location description/s listed on the documentation stating where the tests were taken are correct,
2. CCTV inspection has been completed in accordance with the relevant SEQ Code
3. Actual construction has been completed in accordance with the relevant SEQ Code and the WSSA requirements; and
4. Evidence of no defects, prior to providing the information to Unitywater's Certification process.

The consulting engineer (RPEQ) for the development must focus on the following defects during their review of CCTV footage, in accordance with the *WSA 05 Conduit Inspection Reporting Code*:

- a. Constructed grade of pipe vs approved design grade and absolute minimum grade (WSA 02).
- b. Vertical (grade) tolerance along pipelines using inclination data.
- c. Deformation/collapse of pipes and/or joints.
- d. Joint displacement or defects.
- e. Obstructions within pipes, joints and junctions.
- f. Out of tolerance water levels within pipes, junctions and manholes.
- g. Deposits on walls or inverts of pipes and/or joints.
- h. Surface damage to internal surfaces of pipes and fittings.
- i. Surface damage to internal surfaces of manholes including benching.
- j. Damage or significant cracking of internal cement lining (where applicable).
- k. Linear measurement on footage is continuous.

Refer to the Appendix of this document for further information on the above defects and what is determined as acceptable and not acceptable.

The consulting engineer (RPEQ) must provide a written report as part of the CCTV submission to Unitywater's Certification process. This report shall include as a minimum:

- a. The name and address of the development, the business name of the Contractor and Consultancy, and the Unitywater Network Works reference number on the front of the cover; and
- b. Marked up layout plans (final approved version of the design drawings) indicating the overall layout of the new works, the maintenance structure numbers, the location of house junctions etc. These plans shall be marked up by the consulting engineer (RPEQ) as part of their review to ensure that all pipelines, fittings and structures have been CCTV investigated; and
- c. Detailed comments of what defects have been found in the CCTV and rectified (where applicable) during the consulting engineer (RPEQ) review process; and
- d. Detailed comments of what failed results have been received and what rectification works have been completed (where applicable) during the consulting engineer (RPEQ) review process; and

CCTV Review Technical Specification

- e. A copy of the "CCTV Review Check Sheet" (See example below, available on Unitywater website) shall be completed by both the contractor and consulting engineer (RPEQ), and provided with the CCTV digital and hardcopy in accordance with the SEQ Code.

CCTV Review Check Sheet

Development: _____
 Unitywater Network Works Reference Number: _____
 Contractor Company: _____
 Consultant Company: _____
 CCTV Date(s): _____
 Contractor Contact Name: _____
 Consulting Engineer (RPEQ) Contact Name: _____

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	Contractor			RPEQ		
	Yes	No	N/A	Yes	No	N/A
Have all mains, maintenance structures and junctions been fully constructed prior to CCTV inspection						
Have all cut ends of pipes been cut straight and cleanly and installed as per manufacturers recommendations without damage						
Have all mains, maintenance structures and junctions been thoroughly cleaned prior to CCTV inspection						
Have all mains, maintenance structures and junctions had CCTV inspections completed (provide marked up layout plan) and have all lines and structures been correctly titled						
Was the camera calibrated in accordance with WSA 05						
Did the CCTV operator have correct qualifications in accordance with WSA 05						
Is all footage clear and in focus						
Was the camera positioned in accordance with WSA 05						
Was the camera speed in accordance with WSA 05						
Was the measurement of linear distance shown on the footage in accordance with WSA 05						
Did all inspections start and end within maintenance structures (at centre) where maintenance structures are applicable						
Were all maintenance structures fully scanned in accordance with the SEQ Code						
Were all joints including pipe/structure interfaces inspected using 360 degree pan in accordance with the SEQ Code						
Have photographs been provided in accordance with WSA 05						
Has sandwich wall pipe been installed within the new works						
Have all defects found been noted on the footage and in the report in accordance with the WSA 05 (refer to table F5 and F6 of WSA 05 and the Appendix of this document)						
Have rocker pipe lengths/distances been provided on the CCTV and are the lengths within tolerance in accordance with WSA 05						
Have all changes in horizontal or vertical direction been noted on the footage and in the report in accordance with the SEQ Code						
Have inclination reports been provided for all lines in accordance with WSA 05						
Is a digital copy of the footage and a hardcopy copy of the report available for submission to Unitywater in accordance with the SEQ Code						
Have all defects found been rectified and has new CCTV and tests been redone, reviewed and submitted accordingly – No defects remain						
Have the CCTV footage and reports been reviewed by the contractor and the consulting engineer (RPEQ) and completed in accordance with the SEQ Code requirements						

CONTRACTOR COMMENTS:

SIGNATURE OF REVIEWING CONTRACTOR: _____ DATE: _____

Consulting Engineers (RPEQ) COMMENTS:

I confirm I have reviewed the CCTV inspection and report in accordance with the SEQ Code and the Conduit Inspection Reporting Code WSA05. I am satisfied that the work does not include any defects and has been constructed in accordance with the SEQ Code.

Signature of reviewing Consulting Engineer (RPEQ): _____ RPEQ number: _____

----- Date: _____

Appendix

As the final owner of newly constructed sewer networks, Unitywater has the responsibility to its customers to only accept new works that have been constructed in accordance with the SEQ Code. The quality of the construction shall be such that no defects exist at handover of the infrastructure.

The *Conduit Inspection Reporting Code of Australia WSA05* clearly states acceptance criteria for new sewer pipes and associated structures. Information provided in this appendix provides additional details of what Unitywater consider acceptable and not acceptable for handover of ownership for new gravity sewer assets. The Contractor and the consulting engineer (RPEQ) for the development must be familiar with the contents of the latest version of *The Conduit Inspection Reporting Code of Australia WSA05*, and this technical specification.

Both the contractor and consulting engineer (RPEQ) must undertake a review of the CCTV inspection and report to confirm that no defects exist which will impact on the future operation and maintenance of the system including the existing network downstream and any future extensions upstream.

A1 General Information

All CCTV inspection is to be clear and sharp so that review of the newly constructed works can be completed. CCTV inspection that is of poor resolution, out of focus, and/or has poor lighting is unacceptable. This type of footage will be rejected, and the contractor will be required to have the inspection completed again at their cost.

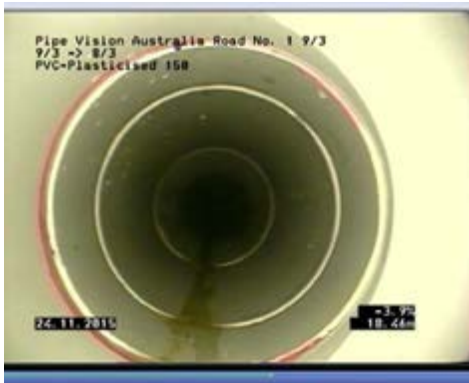


FIG A1.1: Example of good quality footage –acceptable



FIG A1.2: Example of poor quality footage – not acceptable



FIG A1.3: Example of poor quality footage of a joint - not acceptable



FIG A1.4: Example of poor quality footage of a joint - not acceptable

The CCTV inspection and report must conform with the requirements set out in the SEQ Code.

CCTV reports that are provided to Unitywater that do not accurately list all defects or features in the main will not be accepted. Inspections showing damaged joints, cracking, joint displacement, damaged house connections, major obstructions, etc. that has not been documented in the report will not be accepted. The contractor is responsible for ensuring that their CCTV contractor is noting all defects found during the investigations, and that these defects are listed in the reports and on the footage. Reports that are unacceptable will be sent back to the Contractor to rectify at their cost.

CCTV reports that incorrectly state the sewer main/maintenance structure number and location, render the report useless and will not be accepted. Care must be taken by the CCTV contractor to enter the asset identifier correctly, or the reports will not be accepted resulting in new CCTV being required at the cost to the contractor.

The following sections provide further detail to assist Contractors and consulting engineers (RPEQ) to understand the quality of review required to be completed prior to submission.

A2 Constructed grade of pipe vs approved design grade and absolute minimum grade (WSA 02)

The consulting engineer (RPEQ) for the development must review the CCTV inclination report grade against the design grade and determine whether the longitudinal grades between maintenance structures are within the acceptable tolerances listed in WSA02. The consulting engineer (RPEQ) is required to consider whether they can review this requirement by using the interpolated inclination grade against the design grade or whether further calculations or survey information is required due to changes in the longitudinal grade taking the camera off the interpolated inclination grade line.

NOTE: The SEQ Code (Amendment to WSA02) requires the CCTV inclinometer to be accurate to $\pm 1\%$ (*) providing some variance in the estimated constructed grade. Where the constructed grade is determined to be outside the acceptable tolerances, the consulting engineer (RPEQ) shall instruct the Contractor to relay the specific line or may wish to request the change by submitting a permissible change application which may or may not be accepted.

A3 Vertical (grade) tolerance along pipelines using inclination data

The SEQ Code (Amendment to WSA02) requires the CCTV inclinometer to be accurate to $\pm 1\%$ (*). The consulting engineer (RPEQ) for the development will determine from the CCTV inclination report and any survey information (as constructed information) whether the longitudinal grade between maintenance structures conform with the acceptable tolerances and the relevant tables in WSA02 adjusting to suit the inclinometer accuracy. This cannot be determined by the invert levels provided in the as constructed survey information at each maintenance structure, but can be determined where the as constructed survey information provides progressive construction levels along the pipe at suitable intervals and at the top of each junction.

The table below provides examples of how the consulting engineer (RPEQ) should review each line for:

- constructed grade vs approved design grade and absolute minimum grade, and
- vertical (grade) tolerance along pipelines.

Description	Approved Design Grade	Design with inclinometer Accuracy (*)	Inclination Grade	Grade Tolerance	Acceptable (Y/N)	Comment
Line 1/22 – 12/15	5.7%	4.7 % to 6.7%	5.8%		Y	
Line 1/22 – 12/15	5.7%	4.7 % to 6.7%	7.0%	$\pm 20\%$	Y	Review considered accuracy of inclinometer plus tolerance
Line 1/22 – 12/15	5.7%	4.7 % to 6.7%	Varies due to extra vertical bend being installed	$\pm 20\%$	N	Permissible change required for bend and change of grade
Line 1/22 – 12/15	5.7%	4.7 % to 6.7%	12.5%	$\pm 20\%$	N	Permissible change required for change of grade OR if error with inclination new CCTV required

No backfall is permitted along a pipe but Unitywater will allow for short sections less than 500mm long at joints.

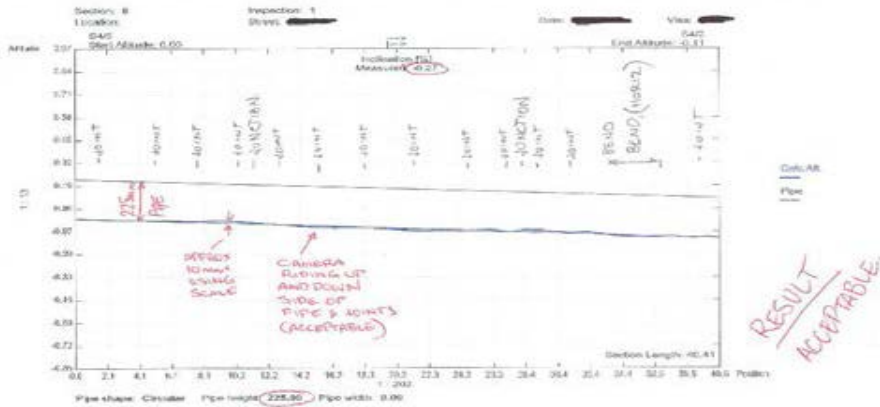


FIG A3.1: Example of how to review an inclination report – pipe acceptable

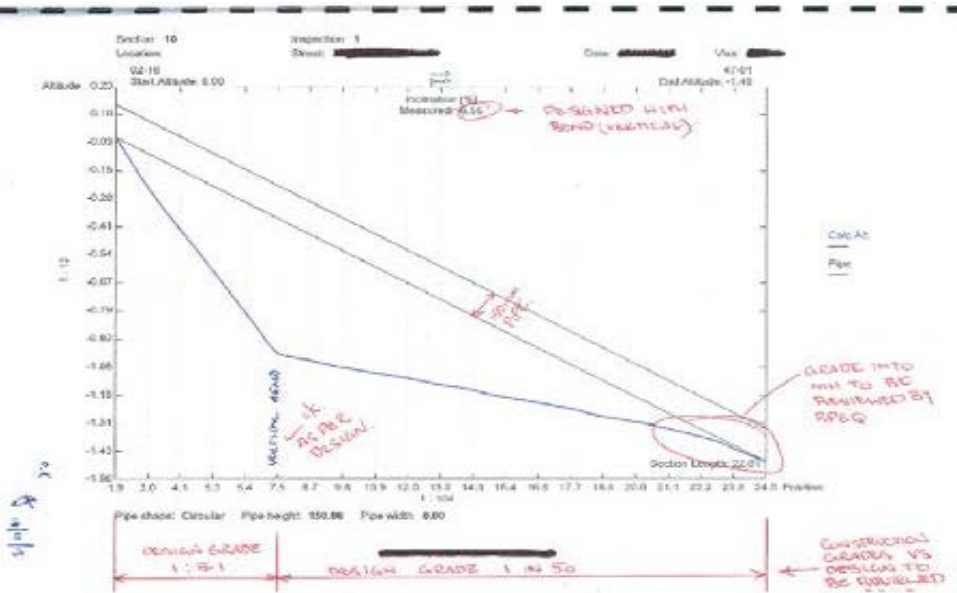


FIG A3.2: Example of how to review an inclination report – consulting engineer (RPEQ) to determine if acceptable

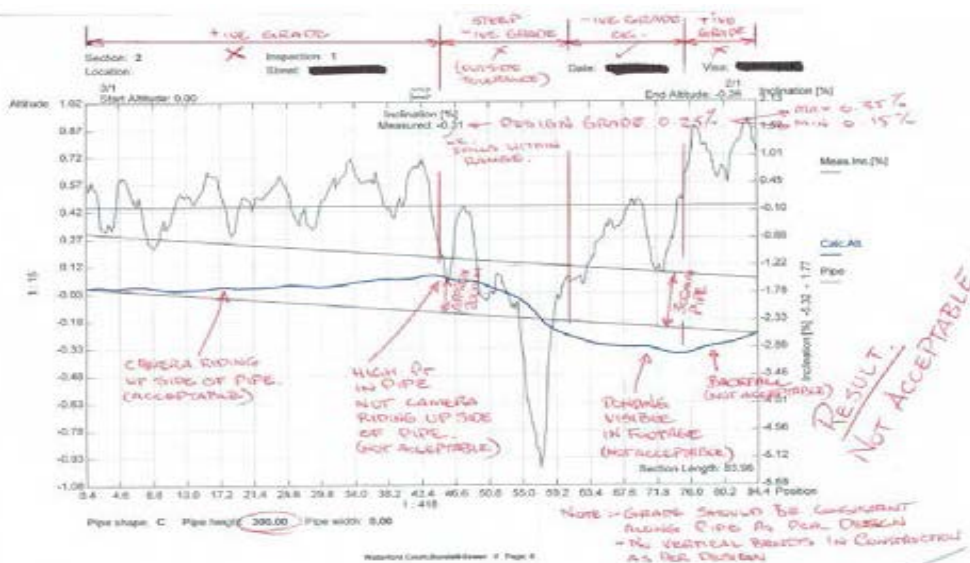


FIG A3.3: Example of how to review an inclination report – pipe not acceptable

A4 Deformation/collapse of pipes and/or joints

The *Conduit Inspection Reporting Code WSA05* states a maximum allowable percentage for any collapse in a pipe or junction. Any collapse above this is not acceptable. Unitywater will not accept collapsed pipes or junctions under any circumstance.



FIG A4.1: Example of collapse at a joint – not acceptable

The *Conduit Inspection Reporting Code WSA05* also provides the percentage of circumference deformation (ovality) allowable for newly installed sewer mains.



FIG A4.2: Example of deformation (ovality) – not acceptable

Where circumference deformation (ovality) is evident on the CCTV footage, and a deflection (ovality) test for the line has been completed more than 2 weeks prior to the CCTV investigation, the Contractor shall be required undertake a new ovality test to prove that the joint is acceptable. Where a successful deflection (ovality) test for the line has been completed within 2 weeks prior to the CCTV investigation the consulting engineer (RPEQ) will provide a copy of both test results and include the location in the written report as a non-defect.

A5 Joint displacement or defects

Unitywater determines any visible damage to the end of pipes as defects, and as such these will need to be repaired by the Contractor. Defects can include, but are not limited to:

- a. cracks, tears, burs, indentations or deformations resulting from bad construction techniques,
- b. end of pipes cut on site not cut square and cleaned in accordance with manufacturer's recommendations,
- c. foreign matter caught within the joint during installation,
- d. rolled rubbers protruding from the joint.

The camera shall be stopped at all defects and features and panned/tilted to provide a clear view of the entire defect or feature. If the feature is a lateral connection, the camera should be longitudinally positioned to allow the furthest view up the connection as possible.

The Contractor must ensure that the ends of pipes being installed are visually checked for any defects prior to installation, and any damaged pipes are not installed. Where pipes are required to be cut on site, the Contractor shall ensure that the technique used is in accordance with the manufacturer's recommendations. All cut ends shall be cut square and cleaned, and deburred on the inside and outside, with the correct chamfer length and angle provided on the outside.

Sandwich wall pipes are not to be used for gravity sewers. Contractors must ensure this type of pipe is not purchased or used.



FIG A5.1: Example of a defect at a joint – not acceptable



FIG A5.2: Example of defects at a joint – not acceptable

All manhole/pipe interface joints and rocker pipes must be included in the CCTV investigations so that the joints can be reviewed. The joints and rocker pipes shall be in accordance with the applicable SEQ Code Standard drawing.



FIG A5.3: Example of a defect at a joint – not acceptable



FIG A5.4: Example of a defective house junction – not acceptable FIG A5.5: Example of a defective joint – not acceptable

Heating of pvc pipes is not permitted under any circumstance. The process of heating pipes can result in damage to the pipe such as deformation of the socket or spigot.



FIG A5.6: Example of a defect at the manhole/pipe interface joint – not acceptable

The *Conduit Inspection Reporting Code WSA05* provides some information for the distances of displacement (longitudinal, radial and angular) at joints. To assist Contractors and consulting engineers (RPEQ) further with these requirements, minimum and maximum allowable widths (gaps) of joints have been determined by Unitywater to provide an understanding on what is acceptable to Unitywater.

The Contractor must use these measurements at all times, and where the widths are estimated during the review of the CCTV footage as being wider than these measurements, the Contractor shall be required to repair the joint accordingly. The width of the joint can easily be determined by the consulting engineer (RPEQ) by estimating the length of the total gap in regard to the length of the taper. If the footage is clear, the taper should be able to be seen. This removes any unknown due to possible footage magnification. The nominated gaps for both socket joints and couplings must be provided at all RRJ joints. Gaps allow for the movement of the pipes.

The following information details acceptable widths for socket joints.

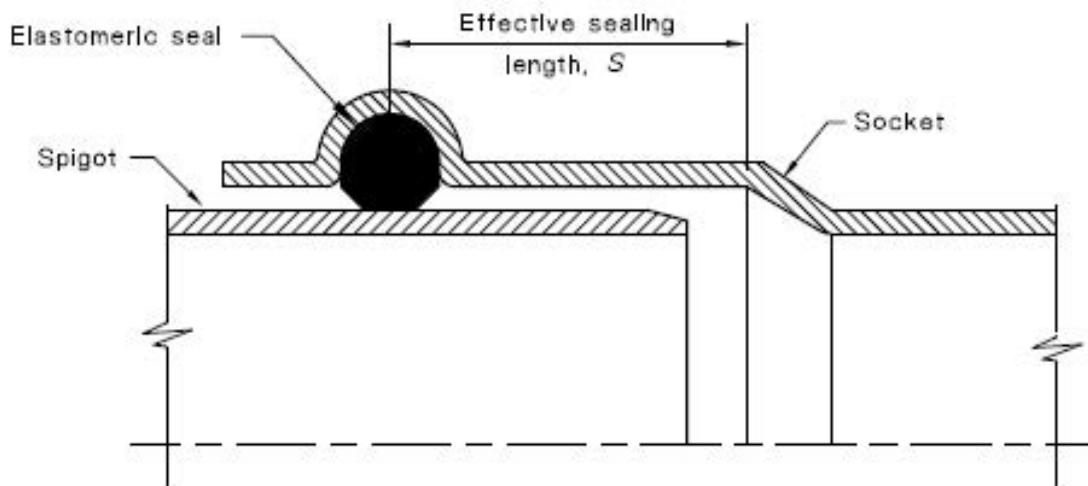
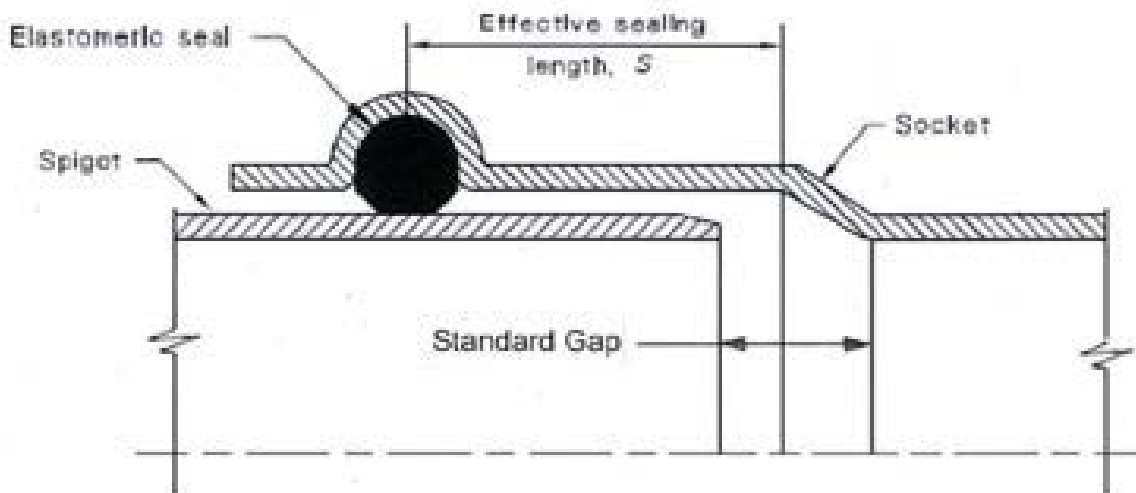


FIGURE 7.1 TYPICAL ELASTOMERIC SEAL JOINT ON PLAIN WALL PIPES AND FITTINGS

Typical PVC-U DWV Rubber Ring Joint shown by above extract copy of Figure 7.1 from AS/NZS1260.



Adjusted Figure 7.1 from AS/NZS1260 showing the "Standard Gap" that is defined in the following Table:

NOMINAL DIAMETER DWV PIPE	STANDARD GAP (mm)		
	ABSOLUTE MINIMUM ₁	MINIMUM ₂	MAXIMUM ₂
100mm	15	45	48
150mm	20	45	51
225mm	25	77	85
300mm	25	55	63

Notes:

1. The Absolute Minimum Standard Gap is based on the pipes ability to thermally react and/or be affected by reactive soil movement and close up the Minimum Standard Gap. Gaps smaller than the Absolute Minimum Standard Gap are not acceptable
2. The Minimum and Maximum Standard Gaps from Pipe Manufacturer. Gaps greater than the Maximum Standard Gap are not acceptable.



FIG A5.7: Example of a well constructed joint – acceptable

A note while watching the CCTV footage to assist in the determination of a wide joint, the camera normally produces a significant “bump” when the camera traverses over it.



FIG A5.8: Example of excessive width at a joint - not acceptable



FIG A5.9: Example of excessive width at a joint - not acceptable

The required gap width for various coupling types are noted on the applicable SEQ Code standard drawings.

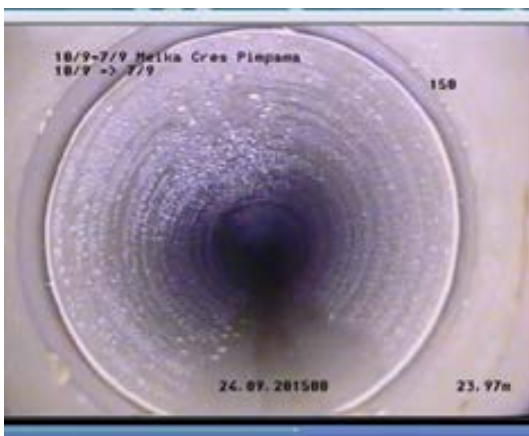


FIG A5.10: Example of excessive gap at a coupling - not acceptable



FIG A5.11: Example of no gap at a coupling - not acceptable

A6 Obstructions within pipes, joints and junctions

The *Conduit Inspection Reporting Code WSA05* states obstructions within a pipe or junction is not acceptable. Obstructions of any size within pipes or junctions are not acceptable under any circumstance.

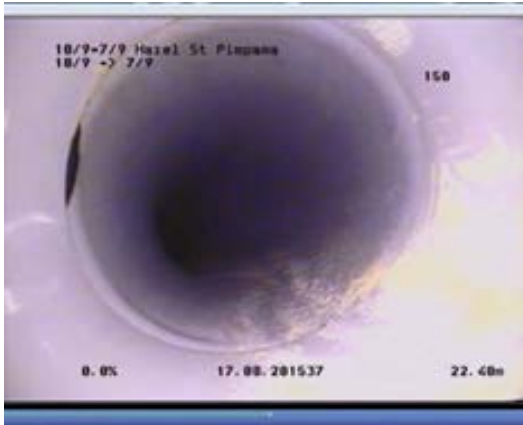


FIG A6.1: Example of an obstruction (rolled rubber) – not acceptable



FIG A6.2: Example of an obstruction (rolled rubber) – not acceptable



FIG A6.3: Example of an obstruction within a joint – not acceptable



FIG A6.4: Example of an obstruction within a pipe – not acceptable

A7 Out of tolerance water levels within pipes, junctions and manholes

The *Conduit Inspection Reporting Code WSA05* states acceptable water levels within a pipe. Water levels greater than those stated in the *Conduit Inspection Reporting Code WSA05* are not acceptable under any circumstance.



FIG A7.1: Example of minor ponding within a pipe – acceptable

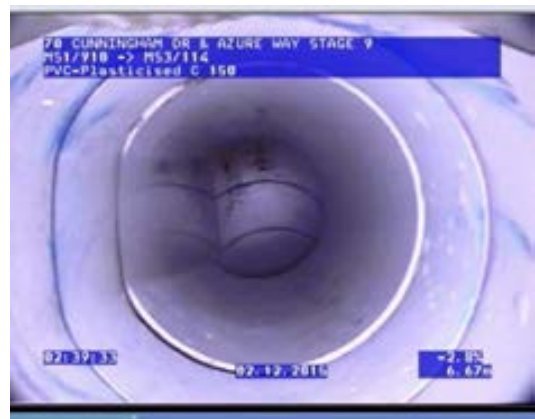


FIG A7.2: Example of minor ponding within a house junction – not acceptable

A8 Deposits on walls or inverts of pipes and/or junctions

All new work must be sufficiently cleaned prior to CCTV being undertaken and to handover to Unitywater. This allows all the pipes, joints, junctions and maintenance structures to be inspected using CCTV. Debris left in the new work also has the potential to create a blockage somewhere in the sewerage network and ultimately could damage pumps at pump stations.

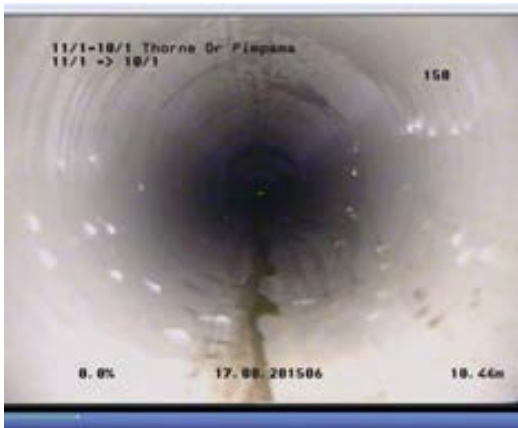


FIG A8.1: Example of a clean pipe – acceptable



FIG A8.2: Example of a not clean pipe – not acceptable

The deposits shown in FIG A8.2 are only acceptable for the last 10m maximum at the temporary plug at the connection point to existing network. This section of pipe shall be emptied by the Contractor prior to the CCTV investigations, but due to some silt possibly entering the new works during the construction, this section will not be able to be cleaned thoroughly but will be deemed acceptable only to the extent as shown in FIG A8.2 (no large deposits accepted). The Contractor must stop as much silt and foreign matter from entering the new works at all times during the construction. Stored new pipes should be cleaned inside prior to installation, and end caps or similar should be used on all exposed open ends of pipes within the trench, and silt fencing installed around maintenance structures during the construction.



FIG A8.3: Example of a minor deposits at the invert – acceptable

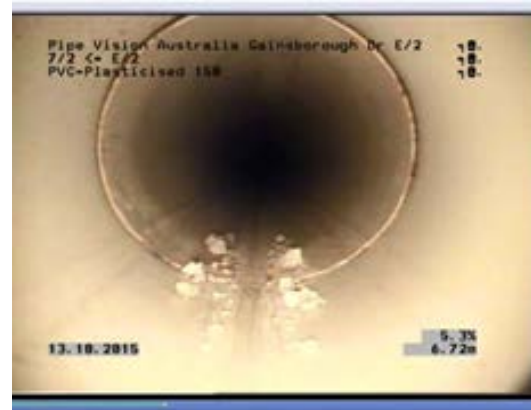


FIG A8.4: Example of a moderate deposits at the invert – not acceptable



FIG A8.5: Example of a major deposits at the invert – not acceptable

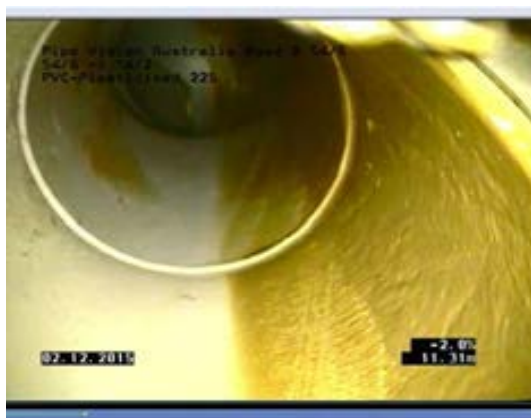


FIG A8.6: Example of a deposits in a junction – not acceptable



FIG A8.7: Example of a deposits in a junction – not acceptable.

A9 Surface damage to internal surfaces of manholes including benching

All inspections must start and finish at the centre of a manhole with the camera panned and tilted to provide a complete image of the manhole chamber and the manhole/pipe interface, where possible. This may require any natural light from an open manhole to be temporarily blocked while this is being carried out.

Any inspection that is not able to start or finish in manhole must have a comment included on video and report to explain why this was not physically possible to do so. Incomplete manholes will not be accepted as a reason why the inspection cannot start or finish inside a manhole, as all the manholes must be fully completed prior to the inspection being undertaken.

The camera should closely inspect the manhole/pipe interface joint prior to entering the pipeline by panning and tilting the camera to capture detailed footage of this area. A clear photograph should also be provided of all manhole/pipe interface joints showing the condition of the concrete around the joint up to the top of the manhole benching height.

The start point for distance measurement (0.0m) shall be the point at which the conduit passes through the wall (manhole/pipe interface) of the manhole chamber, not the centre of the manhole chamber.

A10 Damage or significant cracking of internal cement lining (where applicable)

The *Conduit Inspection Reporting Code WSA05*, provides information on the orientation and magnitude of acceptable cracks.

The CCTV footage must be clear and at a speed where the internal cement lining of pipes can be adequately assessed. Most DICL manufacturers permit a crack of 0.8mm wide maximum. Any cracks wider than this or sections of missing cement lining must be repaired by the Contractor following approval from Unitywater of the proposed repair technique and product.

A11 Linear measurement on footage is continuous

The footage must include a continuous linear measurement along the pipeline at all times. Footage without the linear measurement will not be accepted. Where excessive slippage occurs, the CCTV will not be accepted. Cutting and joining of CCTV footage along a pipeline is not acceptable.

The following fittings (as a minimum) must have their location along the pipe noted on the footage and in the report in conjunction with the linear measurement:

- a. Manhole/pipe interface shall be the point notes as 0.0m,
- b. Manhole couplings
- c. Rocker pipes
- d. Bends (vertical and horizontal)
- e. Junctions
- f. Couplings

The start point for distance measurement (0.0m) shall be the point at which the conduit passes through the wall (manhole/pipe interface) of the manhole chamber, not the centre of the manhole chamber.

All defects should have their location along the pipe noted on the footage and in the report in conjunction with the linear measurement.