

QA/QC Templates
For
General Civil
Construction Standard

No. CG

Ver.1.1

Date: 19 June 2019

| Revision | Description | Released By | Date |
|----------|---|---|------------|
| 0.1 | First draft | J de Villiers | 8/10/2015 |
| 1 | First release | J de Villiers – Principal Engineer, Standards | 14/10/2016 |
| 1.1 | Updates to pipeline testing, location of pipe services and standard references. Document formatting changes | J de Villiers | 19/06/2019 |

Reviewers:

Version 1.1:

Simon Porter – Head of Service Delivery, Operations
James Eardley - Projects Manager, Infrastructure Construction
Graham Nairn – Asset specialist, Civil Operations
Andrew Mercer – Site Engineering Manager

Version 1:

Martin Smith – General Manager Strategy and Planning, Watercare
Geof Stewart – Manager Asset Strategy, Watercare
Chris Allen – Wastewater Strategy Manager, Watercare
James Eardley - Projects Manager, Watercare
Brian Park – Discipline Engineer Water, Watercare

Table of contents

| | |
|---|-----------|
| C1. SITE ROADING | 5 |
| C1.8 QA/QC template | 5 |
| C2. EARTHWORKS | 5 |
| C2.21 QA/QC template | 5 |
| C3. PIPE AND DUCT LAYING | 6 |
| C3.1.8 QA/QC template | 6 |
| C3.2 Pipe jacking, boring or tunnelling and shaft sinking | 7 |
| C3.2.9 QA/QC template | 7 |
| C3.3 Horizontal directional drilling (HDD) | 7 |
| C3.3.8 QA/QC template | 7 |
| C3.4 Installation of polyethylene pipe | 8 |
| C3.4.4 QA/QC templates | 8 |
| C3.6 Installation of welded steel pipelines | 10 |
| C3.6.5 QA/QC templates | 10 |
| C3.7 Installation of PVC pipelines | 10 |
| C3.7.2 QA/QC template | 10 |
| C3.8 Installation of Ductile Iron (DI) pipe | 11 |
| C3.7.2 QA/QC template | 11 |
| C3.9 Concrete and Ceramic pipes (Wastewater only) | 11 |
| C3.9.8 QA/QC Template | 11 |
| C3.10 Pipe structural lining | 12 |
| C3.10.8 Record keeping | 12 |
| C3.10.9 QA/QC Template | 12 |
| C4. CONCRETE | 12 |
| C4.1 Construction of reinforced concrete structures | 12 |
| C4.1.9 QA/QC template | 12 |
| C4.2 Construction of enclosed chambers, manholes and small structures | 13 |
| C4.2.4 QA/QC template | 13 |
| C4.4 Shotcreting | 14 |
| C4.4.6 QA/QC template | 14 |
| C4.6 Concrete defect repairs | 14 |
| C4.6.3 QA/QC template | 14 |
| C4.7 Rehabilitation of wastewater pipe and structures with cement mortar | 15 |
| C4.7.4 Record keeping | 15 |
| C4.7.5 QA/QC Template | 15 |
| C5. PAINTING | 16 |
| C5.7 QA/QC template | 16 |
| C6. DEMOLITION AND ABANDONMENT | 17 |
| C6.5 QA/QC template | 17 |
| C7. MASONRY | 17 |
| C7.8 QA/QC template | 17 |
| C8. PLUMBING | 17 |
| C8.2 QA/QC template | 17 |
| C9. CARPENTRY | 18 |
| C9.8 QA/QC template | 18 |
| C10. METAL ROOFING | 18 |
| C10.5 QA/QC template | 18 |
| C11. POLYMER-TYPE CHAMBERS | 18 |
| C11.6 QA/QC template | 18 |
| 10.12 DIRECT CURRENT VOLTAGE GRADIENT (DCVG) COATING DEFECT SURVEY FOR NEW STEEL PIPELINES | 19 |

C1. Site roading

C1.8 QA/QC template

Quality control shall be demonstrated to meet the testing frequency within the production tolerances as set out in NZTA M10.

| Quality / Control | | Measurement | Certification | | |
|-------------------|--------------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Asphalt grading | DG7 grade, NZTA M10, Table 3.2 | Required | Required | As specified |
| 2 | Binder content | Quality control sheet supplied in compliance with Table 1 of TM6003 (Explanatory notes to NZTA M1) | Required | Required | As specified |
| 3 | Maximum specific gravity | Within limitations set by Table 9.2 of NZTA M10 | Required | Required | As specified |
| | | | Sign-off | | |

C2. Earthworks

C2.21 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Services located | Mark-outs and plans | Required | Required | N/A |
| 2 | Clearing and establishment | As consented, accepted construction plan | N/A | Required | As specified |
| 3 | Topsoil | Identified, graded, stored | N/A | Required | As specified |
| 4 | Geotechnical investigation | Recorded, surveyed, uploaded to AGD, restored | Required | Required | Required |
| 5 | WorksafeNZ notification | Notifiable works – response from Worksafe NZ | Required | Required | Required |
| 6 | Excavation | Material classification, test records and quantity records | Required | Required | N/A |
| 7 | | Temporary support design CS1, or PS1 if required | Required | Required | N/A |
| 8 | | Line and level correct (survey), clear of debris and defects | Required | Required | As specified |
| 9 | Backfill | Temporary support removal plan | Required | Required | N/A |
| 10 | | Backfill material grading | N/A | Required | Required |
| 11 | | Plastic index <30. NATA/IANZ test lab results | Required | Required | N/A |
| 12 | | Compaction test. NZS 4402, Test 5.1.2 and 5.1.4 – NATA/IANZ test lab results, or Clegg hammer impact tests to AS1289.6.9.1 | Required | Required | N/A |
| 13 | | Compaction test location records | Required | Required | N/A |
| 14 | Reinstatement | Topsoil replaced to 100mm depth, clear of stones and debris, 90% grass cover | N/A | Required | Required |
| 15 | | Controlling authority(ies) sign-off | Required | Required | Required |
| 16 | Surplus material removed | Site inspected. Tip facility records provided | Required | Required | N/A |

| Quality / Control | Measurement | Certification | | |
|-------------------|-------------|-------------------|-------------------------|------------------|
| | | Document supplied | Site supervisor witness | Engineer witness |
| | | Sign-off | | |

C3. Pipe and duct laying

C3.1.8 QA/QC template

Note – Where an installation techniques other than open excavation is employed the specific requirements are described in the following sections. The general requirements set out above also apply to these other techniques.

| Quality / Control | | Measurement | Certification | | |
|-------------------|---|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Storage and handling | Pipe ends capped, Stacked safely, less than 3 high, pipe ends clear | N/A | Required | N/A |
| 2 | Pipe inspection | Free from damage. Pipe lining cracks restored (as applicable to pipe material) | N/A | Required | Required |
| 3 | Trench installation | Warning strip installed | N/A | Required | As specified |
| 4 | Traceability | Non-metallic pipe with tracer wire, continuity test certified | Required | Required | Required |
| 5 | Position | Requirements of C3.1.1 | N/A | Required | As specified |
| 6 | Pipe through structures | Protective wrapping 150mm beyond each face | N/A | Required | As specified |
| 7 | Material outer protection, wrapping, joint inspection | Coating or wrapping completed as required for the specific material. | N/A | Required | As specified |
| 8 | Separation | Parallel according to table C3-1 | N/A | Required | Required |
| 9 | Vertical crossings | Min. 150mm, other services load protected | N/A | Required | Required |
| 10 | Pipe oval | Pipe pigging or bore scanning to be within acceptable design parameters | Required | Required | Review document |
| 11 | CCTV | CCTV inspection – Reviewed for defects. Lining repairs completed. | Required | Required | Review document |
| 12 | Deflection check | Pipe tested for deflection after backfill and compaction to AS/NZS2566. Rigid pipe test at manufacture and compared to installation | Required | Required | Required |
| 13 | Testing & disinfection | Testing requirements for pressure, non-pressure pipe, or sleeve as appropriate. Refer to Section 10 | Required | Required | Review document |
| | | | Sign-off | | |

C3.2 Pipe jacking, boring or tunnelling and shaft sinking

C3.2.9 QA/QC template

This template is in addition to C3.1.8

| Quality / Control | | Measurement | Certification | | |
|-------------------|-------------------------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Work method statement | Accepted to include best practice and regulatory requirements as enforced by Worksafe NZ | Required | Required | Review document |
| 2 | Tunnel machine suitability | Evaluation against expected soil conditions | Required | Required | N/A |
| 3 | Worksafe NZ notification | Worksafe NZ certification | Required | Required | Required |
| 4 | Tracking system accuracy check | Verification to accuracy tolerance per Section C3.1.1 | Required | Required | Review document |
| 5 | Construction daily records | Section C3.2.8 | Required | Required | As specified |
| 6 | Grouting plan | Quantity calculation comparison to actual measured | Required | Required | Required |
| 7 | Jacking pit/ shaft pit construction | CPEng, CS1 and CS4 to meet selected machine requirements | Required | Required | Required |
| | | | Sign-off | | |

C3.3 Horizontal directional drilling (HDD)

C3.3.8 QA/QC template

This template is in addition to C3.1.8

| Quality Control | | Measurement | Certification | | |
|-----------------|---------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Pre-qualification | Work method statement - Accepted to include best practice and regulatory requirements as enforced by Worksafe NZ | Required | Required | Review document |
| 2 | | HDD plant suitability - Evaluation against expected soil conditions; tool inspection | Required | Required | N/A |
| 3 | | Construction plan | Required | Required | Review document |
| 4 | | Pipe load force calculations | Required | Required | Review document |
| 5 | Site Setup | Worksafe NZ notification | Required | Required | N/A |
| 6 | | Entry and exit points and angles | Required | Required | Review |
| 7 | Pilot Hole Drilling | Steering calibration check | Required | Required | Review |
| 8 | | Pilot bore drill logs – drilling rate | Required | Required | Review |
| 9 | | Tooling inspection | Required | Required | Review |
| 10 | | Annular pressure limits set | Required | Required | N/A |
| 11 | | Pilot hole record - Within allowable tolerance Section C3.1.1 | Required | Required | Review |



| Quality Control | | Measurement | Certification | | |
|-----------------|----------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 12 | | Drill fluid ongoing tests - Test records | Required | Required | N/A |
| 13 | Reaming | Tooling inspection | Required | Required | N/A |
| 14 | | Cuttings tracking | Required | Required | N/A |
| 15 | | Back ream rate calculation - Data logged ream rate corresponds to calculation | Required | Required | Review document |
| 16 | Pipe Insertion | Review reaming and cleaning logs | Required | Required | Review document |
| 17 | | Tooling inspection | Required | Required | N/A |
| 18 | | Insertion loads - Conforms with calculation in item 4 | Required | Required | Review |
| 19 | Pipe Testing | Gauging record | Required | Required | Review |
| 20 | | Annulus grouting record (if required) - Measured values compared to calculated quantity. | Required | Required | Review |
| 21 | | Pipe pull visual inspection - Damage <10% gouge depth | Required | Required | Review |
| 22 | Records | Provide daily records as per C3.3.7 | Required | Required | Review |
| | | | Sign-off | | |

C3.4 Installation of polyethylene pipe

C3.4.4 QA/QC templates

This template is in addition to C3.1.8

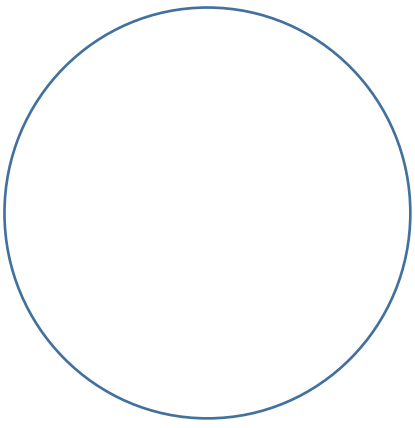
| Quality / Control | | Measurement | Certification | | |
|-------------------|--|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Work Method Statement | Document provided and accepted | Required | Required | Required |
| 2 | Pipe inspected | No visual damage, eccentricity and dimensions to AS/NZS 4130 | N/A | Required | As specified |
| 3 | Welding machine calibration | Calibration certification current | Required | Required | Required |
| 4 | Training & competency certification of operators | NZQA recognised qualification. Current experience in pipe size and type to be welded. | Required | Required | Required |
| 5 | Pre-qualification weld test results | All welds ductile. NATA/IANZ accredited laboratory test to ISO 13953/4/6, ISO 21751 | Required | Required | N/A |
| 6 | Welding data Logging | Excel format with required data | Required | Required | Review document |
| 7 | Tent/ shelter over welding | Site inspections | N/A | Required | As specified |
| 8 | Pipe ends sealed during welding | Site inspections | N/A | Required | As specified |
| 9 | Construction weld test results | Ductile. NATA/IANZ accredited laboratory test to ISO 13953/4/6 | Required | Required | Review document |

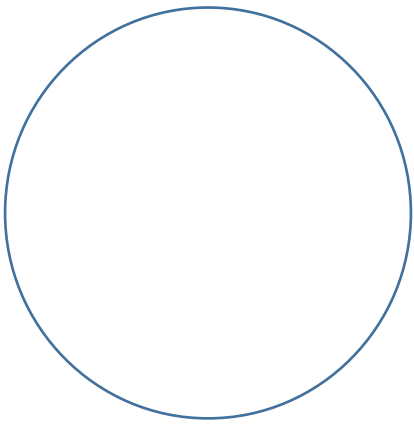


| | | | | | |
|-------------------------------|---|--|----------|----------|--------------|
| 10 | Clean working space, no mud or standing water on trench floor | Site inspection | N/A | Required | As specified |
| Butt weld specific | | | | | |
| 11 | Butt Weld parameters | Calculated by pipe size and type | Required | Required | N/A |
| 12 | Heater plate manual readings (4 per day) | Daily checks completed – forms supplied | Required | Required | N/A |
| 13 | Weld beads inspected (butt welding) | Tolerances to POP003 | N/A | Required | As specified |
| Electro-fusion joint specific | | | | | |
| 14 | Pipe surface preparation | Using mechanical peeling tool (no hand-scraping) >0.2mm < 0.5mm material removed | N/A | Required | As specified |

Daily Heater Plate Temperature QA Check Sheet

Contract No. _____ Date: _____ Welder: _____

| | |
|--|---|
| Time | |
| Pipe Size | |
|  | |
| Show position of pipe and temperature check locations | |
| Temperature at Position °C | |
| 1. | 2 |
| 3 | 4 |

| | |
|---|---|
| Time | |
| Pipe Size | |
|  | |
| Show position of pipe and temperature check locations | |
| Temperature at Position °C | |
| 1. | 2 |
| 3 | 4 |

| | |
|-----------|--|
| Time | |
| Pipe Size | |

| | |
|-----------|--|
| Time | |
| Pipe Size | |

| | |
|---|---|
| | |
| Show position of pipe and temperature check locations | Show position of pipe and temperature check locations |
| Temperature at Position °C | Temperature at Position °C |
| 1. 2 | 1. 2 |
| 3 4 | 3 4 |

C3.6 Installation of welded steel pipelines

C3.6.5 QA/QC templates

This template is in addition to C3.1.8

| Quality / Control | | Measurement | Certification | | |
|-------------------|---|---|----------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Socket deflection | Within limitations of table C3.6.2-1 (measure/survey) | (per joint) Required | Required | N/A |
| 2 | Weld band, socket and spigot joint test | Nitrogen/air test pipe ≥700mm test record | (per joint) Required | Required | Review document |
| 3.1 | Corrosion protection | 3 layer overlap (67% per lap) | N/A | Required | As specified |
| 3.2 | | Pull test as per AWWA C209 | Required | Required | Review document |
| 3.3 | | Visual inspection | N/A | Required | As specified |
| 3.4 | | DCVG survey test results | Required | Required | N/A |
| 4 | Components for use with potable water | AS/NZS4020 compliant | Required | Required | N/A |
| | | | Sign-off | | |

C3.7 Installation of PVC pipelines

C3.7.2 QA/QC template

This template is in addition to C3.1.8

| Quality / Control | | Measurement | Certification | | |
|-------------------|--|-------------|-------------------|------|------------------|
| | | | Document supplied | Site | Engineer witness |
| | | | | | |

| | | | supervisor witness | |
|---|----------------------|---------------------------------|--------------------|----------------------|
| 1 | Pipe joint lubricant | Compliant with AS/NZS4020 | Required | Required |
| 2 | Socket preparation | Pipe bevelled and free of burrs | N/A | (per joint) Required |
| 3 | Socket witness marks | Joints drawn fully home | N/A | (per joint) Required |
| | | | Sign-off | |

C3.8 Installation of Ductile Iron (DI) pipe

C3.7.2 QA/QC template

This template is in addition to C3.1.8

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Socket preparation | Pipe bevelled and free of burrs | N/A | (per joint) Required | As specified |
| 2 | Socket witness marks | Joints drawn fully home | N/A | (per joint) Required | As specified |
| 3 | Corrosion protection | Holiday testing for coating defects. Defect repaired | N/A | Required | As specified |
| | | | Sign-off | | |

C3.9 Concrete and Ceramic pipes (Wastewater only)

C3.9.8 QA/QC Template

This template is in addition to C3.1.8

| Quality / Control | | Measurement | Certification | | |
|-------------------|------------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Pipe inspection | Free from damage. Seals stored appropriately | N/A | Required | Required |
| 2 | Pipe cutting | 6mm tolerance | N/A | Required | As specified |
| 3 | Pipe laying | Bedding type as specified (per section). Type H2 normative if not specified | N/A | Required | As specified |
| 4 | | Laying on curve – under approval and to the required standard method | N/A | Required | As specified |
| 5 | Joints | Fully drawn, inspected for defects | N/A | Required | As specified |
| 6 | | Mechanical joints wrapped to manufacturer requirements | N/A | Required | As specified |
| 7 | CCTV | CCTV inspection – Reviewed for defects | Required | Required | Required |
| 8 | Testing & disinfection | Testing requirements for pressure or non-pressure pipe as appropriate | Required | Required | Required |
| | | | Sign-off | | |

C3.10 Pipe structural lining

C3.10.8 Record keeping

- The record form shall be completed per component rehabilitated or in the case of pipelines between access points, batches or shifts.
- Records for polymer lining systems shall follow the requirements for the material type within this standard. For mortar lining the following template shall be used:

| Structure information | | | |
|---------------------------|--|------------------------------|--|
| Contractor | | Installation site identifier | |
| Asset ID | | Address | |
| Access location | | | |
| Grout mix | | | |
| Date | | Time | |
| Manufacturer batch number | | | |
| Mix composition | | Mix Volume | |

C3.10.9 QA/QC Template

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | CCTV - start | Records evaluated against design stage records | Required | Required | Required |
| 2 | Pipe cleaning | AS/NZS 1516 preparation for lining. | N/A | Required | As specified |
| 3 | Product compliance | Watercare material standards | Required | Required | Required |
| 4 | Mortar application records | Min. 10mm, ± 1.5 mm. | Required | Required | Review document |
| 5 | Testing | Samples to AS 1012 part 24, tensile bond strength (mortar lining) | Required | Required | Review document |
| 6 | | Pressure testing and weld samples as per the general civil standard | Required | Required | As specified |
| 7 | CCTV – final | U3 finish. No visible slumping or cracking | Required | Required | Required |
| | | | Sign-off | | |

C4. Concrete

C4.1 Construction of reinforced concrete structures

C4.1.9 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Concrete construction plan | Including delivery scheduling plan to meet timeframes | Required | Required | N/A |

| Quality / Control | | Measurement | Certification | | |
|-------------------|-------------------------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 2 | Confirm required concrete strength | As specified or minimum required from this standard | Required | Required | Required |
| 3 | Reinforcing inspection | According to specific drawings | Required | Required | Required |
| 4 | | Deformed bar SEISMIC 500E. Test certification of steel required | Required | Required | Required |
| 5 | | Plain bar grade 300. Test certification of steel required | Required | Required | Required |
| 6 | | Welding 10x dia. from bends | Required | Required | Required |
| 4 | Formwork | Cover requirement met, Tables C4.1.1 -1/2 | Required | Required | Required |
| 5 | Concrete plant certification | Certification graded ready mixed concrete plant to NZS3104 (High grade or special grade) | Required | Required | Review document |
| 6 | Vibration | Witnessed to comply with requirements of NZS3109, any laitance replaced | N/A | Required | As specified |
| 7 | Test reports | Supply source | Required | Required | N/A |
| 8 | | Mix identification and compressive strength | Required | Required | Required |
| 9 | | Location of structure | Required | Required | N/A |
| 10 | | Batch number | Required | Required | N/A |
| 11 | | Time and date | Required | Required | N/A |
| 12 | | Time prepared | Required | Required | N/A |
| 13 | | Slump 0.5x values of table 9.1, NZS 3109 | Required | Required | Required |
| 14 | | 7 day test | Required | Required | Required |
| 15 | | 28 day test | Required | Required | Required |
| 8 | Construction and contraction joints | Inspected as per drawings | N/A | Required | As specified |
| 9 | Surface finish | Table C4.1.6-1 | N/A | Required | As specified |
| 10 | Testing tanks and reservoirs | Complete test to Section 10.5.4 | Required | Required | Required |
| | | | Sign-off | | |

C4.2 Construction of enclosed chambers, manholes and small structures

C4.2.4 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|--------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Set-out | Line and level in accordance with specific drawings | N/A | Required | N/A |
| 2 | Foundation | Inspected, sound/firm | N/A | Required | As specified |
| 3 | Concrete | Records: Min 25 MPa or higher as specified | Required | Required | Review document |
| 4 | Penetrations | All cast in place | N/A | Required | Required |
| 5 | Vertical | Survey | Required | Required | N/A |
| 6 | Infiltration | Applicable test per Section 10.5.2 | Required | Required | Required |

| Quality / Control | | Measurement | Certification | | |
|-------------------|---------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 7 | Roof slab/Lid | HN-HO-72 certified (where constructed in road-way) | Required | Required | Review document |
| 8 | Access lid | Appropriate load class fitted | Required | Required | Required |

C4.4 Shotcreting

C4.4.6 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Experienced operator | Demonstrated to be suitable for task | Required | Required | N/A |
| 2 | Trial | 5 samples tested per test panel at 7 days and 28 days. NATA/IANZ laboratory results complying with NZS 3109 | Required | Required | Review document |
| 3 | Site preparation | Inspected to be clean , cleared of debris, loose soil, sandblasted etc. | N/A | Required | Required |
| 4 | | Contact surfaces dampened | N/A | Required | Required |
| 5 | Placement | Ground wires in place/similar to gauge thickness | N/A | Required | As specified |
| 6 | | Probe for voids | N/A | Required | As specified |
| 7 | Joints | Per drawings | N/A | Required | Required |
| 8 | Testing | Test results of cores comply (NATA/IANZ lab tested, NZS3109) | Required | Required | Review document |
| 9 | | Ultrasonic/impact hammer test of finished area - no voids and thickness meeting as specified. | Required | Required | As specified |
| | | | Sign-off | | |

C4.6 Concrete defect repairs

C4.6.3 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Concrete defects | Finished concrete inspected for defects by structural engineer | N/A | Required | As specified |
| 2 | Methodology | Conformed to performance requirements | Required | Required | Required |
| 3 | Surface repair | Surface inspected - clean and free of loose debris or contaminants | N/A | Required | As specified |
| 4 | Product | Accepted for compliance with performance requirements of concrete | Required | Required | Required |

| Quality / Control | | Measurement | Certification | | |
|-------------------|---------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 5 | Repair test | Accepted methodology. Strength test by NATA/IANZ laboratory | Required | Required | Review document |
| 6 | Certification | Producer statements | Required | Required | Required |
| | | | Sign-off | | |

C4.7 Rehabilitation of wastewater pipe and structures with cement mortar

C4.7.4 Record keeping

The record form shall be completed per component that is being rehabilitated or in the case of pipelines between access points, batches or shifts.

| Structure information | | | |
|---------------------------|--|------------------------------|--|
| Contractor | | Installation site identifier | |
| Asset ID | | Address | |
| Access location | | | |
| Grout mix | | | |
| Date | | Time | |
| Manufacturer batch number | | | |
| Mix composition | | Mix Volume | |

C4.7.5 QA/QC Template

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | CCTV - start | Records evaluated against design stage records | Required | Required | Required |
| 2 | Pipe cleaning | HB84-2006 guidelines | N/A | Required | As specified |
| 3 | Product compliance | Accepted material | Required | Required | Required |
| 4 | Mortar application records | Min. 25mm, ± 1.5 mm. | Required | Required | Required |
| 5 | Testing | Samples to AS 1012 part 24, tensile bond strength | Required | Required | Review document |
| 6 | CCTV – final | U3 finish. No visible slumping or cracking | Required | Required | Required |
| | | | Sign-off | | |

C5. Painting

C5.7 QA/QC template

| Paint inspection record | | | | | | |
|----------------------------------|--------------|-----------|----------|--------|--------|--------|
| Project: | | | | | | |
| Engineer witness: | | | | | | |
| Contractor: | | | Sign-off | | | |
| Inspector/supervisor: | | | Sign-off | | | |
| Coating specification reference: | | | | | | |
| Items inspected | | | | | | |
| | | Substrate | Coat 1 | Coat 2 | Coat 3 | Coat 4 |
| Climate Data | Date/Time | | | | | |
| | % RH | | | | | |
| | Air Temp | | | | | |
| | Dew Point | | | | | |
| | Surface Temp | | | | | |
| Surface Preparation | Date/Time | | | | | |
| | Cleanliness | | | | | |
| | Profile | | | | | |
| Paint/ Application | Type | | | | | |
| | Date/Time | | | | | |
| | Batch Number | | | | | |
| | Mixing | | | | | |
| | Thinning | | | | | |
| Coating Inspection | Date/Time | | | | | |
| | W.F.T | | | | | |
| | | Number | | | | |
| | | Min | | | | |
| | D.F.T | Max | | | | |
| | | Average | | | | |
| | | Std Dev | | | | |
| | Holiday | | | | | |
| | Appearance | | | | | |
| Comments: | | | | | | |

C6. Demolition and abandonment

C6.5 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|------------------|-------------------------------------|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Preparation | Facility plans and specifications | Required | Required | N/A |
| 2 | | Utility service plans and mark-outs | Required | Required | N/A |
| 3 | | Pre-condition survey | Required | Required | N/A |
| 4 | Site management | Demolition plan | Required | Required | Required |
| 5 | Abandonment | Methodology and product approval | Required | Required | Required |
| 6 | Material removal | Appropriate tip site dockets | Required | Required | As specified |
| | | | Sign-off | | |

C7. Masonry

C7.8 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|----------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Qualification | Registered mason(s) | Required | Required | Required |
| 2 | Material inspection | Block without defects/unbroken | N/A | Required | As specified |
| 3 | Joints | 10mm even mitre | N/A | Required | As specified |
| 4 | Reinforcing | As per drawings and min Grade 300 for links, stirrups and ties. | N/A | Required | Required |
| 5 | Test mortar | Min. 3x successive samples at start (min 1 per day). NZS 4210 Appendix 2 | Required | Required | N/A |
| 6 | Grout spaces cleaned | Visual inspection | N/A | Required | As specified |
| 7 | All cores filled | Visual inspection | N/A | Required | As specified |
| | | | Sign-off | | |

C8. Plumbing

C8.2 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|--------------------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Qualifications | Registered as authorised | Required | Required | N/A |
| 2 | Pipework inspected | Pipe wrapping Dissimilar materials isolated Directional change with sweep bends | N/A | Required | Required |
| 3 | Test | Gravity – leakage test for non-pressurised pipes. Water – pressure tested for plumbing works (see section 10). No leaks | Required | Required | As specified |
| 4 | System flushed | Water running clear | N/A | Required | As specified |

| | | | | | |
|---|--------------------------------|-------------------------------|-----------------|----------|----------|
| 5 | Certificate of Code Compliance | As per the Building Act 2004. | Required | Required | Required |
| | | | Sign-off | | |

C9. Carpentry

C9.8 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|-------------------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Material storage | Dry, not exposed to elements | N/A | Required | As specified |
| 2 | Timber type | H3.1 to NZS3602 (H4 where fixed to concrete); MSG10 to AS/NZS1748 for floor and roof framing | Required | Required | As specified |
| 3 | Fasteners | No plated. | Required. | Required | As specified |
| 4 | Measure wood moisture content | General 16%-20% Heated functional area <10% | Required | Required | Required |
| 5 | Inspect framing | Irregularities less than 6mm in 3m Framing fixed to concrete H4 grade | N/A | Required | As specified |
| 6 | Cutting and jointing | Within limits of workmanship requirements. | N/A | Required | As specified |
| | | | Sign-off | | |

C10. Metal roofing

C10.5 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|--------------------------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Material per drawings | Gauge as specified. Material certified to NZS 3604 | N/A | Required | As specified |
| 2 | Material inspected for defects | No bends, no dents & scratches <1% of total area. | N/A | Required | As specified |
| 3 | Installer certified | | Required | Required | N/A |
| 4 | Joints inspected | Dissimilar material isolated, weather tight | N/A | Required | As specified |
| 5 | Guarantee provided | 5 year certification | Required | Required | N/A |
| | | | Sign-off | | |

C11. Polymer-type chambers

C11.6 QA/QC template

| Quality / Control | | Measurement | Certification | | |
|-------------------|---------|---|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 1 | Set-out | Line and level in accordance with specific drawings | N/A | Required | N/A |

| Quality / Control | | Measurement | Certification | | |
|-------------------|---------------|--|-------------------|-------------------------|------------------|
| | | | Document supplied | Site supervisor witness | Engineer witness |
| 2 | Foundation | Inspected, sound/firm | N/A | Required | As specified |
| 3 | Penetrations | Hole-sawed to size with suitable rubber seal | N/A | Required | Required |
| 4 | Vertical | Survey | Required | Required | N/A |
| 5 | Infiltration | Applicable test per Section 10.5.2 | Required | Required | Required |
| 6 | Roof slab/Lid | HN-HO-72 certified (where constructed in road-way) | Required | Required | Review document |
| 7 | Access lid | Appropriate load class fitted | Required | Required | Required |
| | | | Sign-off | | |

10.12 Direct current voltage gradient (DCVG) coating defect survey for new steel pipelines

| Defect Number | Metreage | GPS Coords East-North | Description of Location | IR (mV) |
|---------------|----------|-----------------------|-------------------------|---------|
| | | | | |
| | | | | |
| | | | | |

Example:

| Defect Number | Metreage | GPS Coords East-North | Description of Location | IR (mV) |
|---------------|----------|-----------------------|---------------------------------------|---------|
| - | 0 | 2661231-6491234 | Test point swing. TP1 | 1500 |
| 1 | 103 | 2661789-6491456 | 4m d/s of d/s edge d/way 200 Smith St | 5 |
| 2 | 622 | 2661756-6491789 | 2m u/s of power pole 21 Brown Rd | 7 |
| - | 850 | 2661900-6491551 | Test point swing. TP2 | 1200 |

Logging of defects and repairs:

| Defect Number | Metreage (m) | GPS Coords | Description of location | IR (mv) | %IR | | Description of defect | Likelihood of shielding (H)igh (M)edium (L)ow | Photo Number/ Name | Date Inspected/ Repaired | DCVG Survey |
|---------------|--------------|------------|-------------------------|---------|-----|---|-----------------------|--|-----------------------|-----------------------------|-------------|
| | | | | | | (I)nspected/ (R)epaired/ (N)ot Repaired | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

