

---

# CHRISTCHURCH CITY COUNCIL

## CONSTRUCTION STANDARD SPECIFICATION

### PART 3 – UTILITY DRAINAGE

#### CSS: PART 3 2025

#### TABLE OF CONTENTS

|            |                                                                                        |          |
|------------|----------------------------------------------------------------------------------------|----------|
| <b>1</b>   | <b>FOREWORD.....</b>                                                                   | <b>1</b> |
| <b>2</b>   | <b>RELATED DOCUMENTS .....</b>                                                         | <b>1</b> |
| <b>3</b>   | <b>APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP.....</b> | <b>3</b> |
| <b>3.1</b> | <b>Authorised Drainlayers .....</b>                                                    | <b>3</b> |
| <b>3.2</b> | <b>Polyethylene Welders .....</b>                                                      | <b>4</b> |
| <b>4</b>   | <b>PRIVATE PROPERTY .....</b>                                                          | <b>4</b> |
| <b>4.1</b> | <b>Progress of Work.....</b>                                                           | <b>4</b> |
| <b>4.2</b> | <b>Planting and Existing Structures .....</b>                                          | <b>4</b> |
| <b>4.3</b> | <b>Excavated Material.....</b>                                                         | <b>4</b> |
| <b>4.4</b> | <b>Approved Equipment .....</b>                                                        | <b>4</b> |
| <b>4.5</b> | <b>Temporary Fencing.....</b>                                                          | <b>4</b> |
| <b>4.6</b> | <b>Measurement of Work and Basis of Payment.....</b>                                   | <b>5</b> |
| <b>5</b>   | <b>EXISTING SERVICES.....</b>                                                          | <b>5</b> |
| <b>5.1</b> | <b>Support of Services .....</b>                                                       | <b>5</b> |
| 5.1.1      | Live Laterals Crossing the Excavation.....                                             | 5        |
| 5.1.2      | Support of Sewer or Stormwater Pipes Crossing the Excavation .....                     | 5        |
| 5.1.3      | Asbestos Watermains.....                                                               | 5        |
| <b>5.2</b> | <b>Service Conflicts .....</b>                                                         | <b>6</b> |
| 5.2.1      | Abandoned Services.....                                                                | 6        |
| 5.2.2      | Live Laterals Fouled by the Proposed Pipeline .....                                    | 6        |
| 5.2.3      | Unavoidable Diversion of Services .....                                                | 6        |
| 5.2.4      | Clearance to Other Services .....                                                      | 6        |
| <b>5.3</b> | <b>Abandoned Infrastructure .....</b>                                                  | <b>7</b> |
| 5.3.1      | Clashing Services.....                                                                 | 7        |
| 5.3.2      | Manholes.....                                                                          | 7        |
| 5.3.3      | Wastewater and stormwater pipes .....                                                  | 7        |
| 5.3.4      | Pressure Sanitary Sewer pipes (PSS).....                                               | 8        |
| <b>5.4</b> | <b>Measurement of Works and Basis for Payment .....</b>                                | <b>8</b> |
| 5.4.1      | Support of Services alongside the Excavation.....                                      | 8        |
| 5.4.2      | Support of Power Poles.....                                                            | 8        |
| 5.4.3      | Support of Services Crossing the Excavation.....                                       | 8        |

---

|          |                                                                 |           |
|----------|-----------------------------------------------------------------|-----------|
| 5.4.4    | Laterals Crossing the Excavation .....                          | 8         |
| 5.4.5    | Unavoidable Diversion of Services .....                         | 8         |
| 5.4.6    | Clearance to Other Services .....                               | 8         |
| 5.4.7    | Potholing Services .....                                        | 8         |
| 5.4.8    | Clashing Services.....                                          | 8         |
| 5.4.9    | Manholes.....                                                   | 8         |
| 5.4.10   | Wastewater and stormwater pipes .....                           | 9         |
| <b>6</b> | <b>EXCAVATION .....</b>                                         | <b>9</b>  |
| 6.1      | <b>Excavations in Legal Road .....</b>                          | <b>9</b>  |
| 6.2      | <b>Temporary Sealing .....</b>                                  | <b>9</b>  |
| 6.3      | <b>Removal and Disposal of Surplus Excavated Material .....</b> | <b>9</b>  |
| 6.4      | <b>Trench Excavation.....</b>                                   | <b>9</b>  |
| 6.4.1    | Length of Open Trench .....                                     | 9         |
| 6.4.2    | Trench Width.....                                               | 9         |
| 6.4.3    | Base of Excavation .....                                        | 10        |
| 6.4.4    | Trench Support .....                                            | 10        |
| 6.4.5    | Trench in an Existing Watercourse .....                         | 11        |
| 6.4.6    | Installation of Geotextiles .....                               | 11        |
| 6.5      | <b>Excavations for Structures.....</b>                          | <b>11</b> |
| 6.6      | <b>Rocks and Explosives .....</b>                               | <b>11</b> |
| 6.6.1    | Rock Definition .....                                           | 11        |
| 6.6.2    | Use of Explosives .....                                         | 11        |
| 6.7      | <b>Dewatering.....</b>                                          | <b>12</b> |
| 6.7.1    | Keeping the Excavation Free of Water .....                      | 12        |
| 6.7.2    | Control of Pumped Water .....                                   | 12        |
| 6.7.3    | Dewatering of Peat.....                                         | 12        |
| 6.8      | <b>Stumps and Subsurface Objects.....</b>                       | <b>12</b> |
| 6.8.1    | Stumps.....                                                     | 12        |
| 6.8.2    | Subsurface Objects .....                                        | 13        |
| 6.9      | <b>Measurement of Works and Basis of Payment.....</b>           | <b>13</b> |
| 6.9.1    | Excavation.....                                                 | 13        |
| 6.9.2    | Unsuitable Foundations.....                                     | 13        |
| 6.9.3    | Temporary Sealing.....                                          | 13        |
| 6.9.4    | Trench in an Existing Watercourse .....                         | 13        |
| 6.9.5    | Installation of Geotextiles .....                               | 13        |
| 6.9.6    | Trench Support Left in Position .....                           | 13        |
| 6.9.7    | Rock Excavation.....                                            | 14        |
| 6.9.8    | Keeping the Excavation Free of Water .....                      | 14        |
| 6.9.9    | Stumps and Subsurface Objects.....                              | 14        |

---

---

|          |                                                                              |           |
|----------|------------------------------------------------------------------------------|-----------|
| <b>7</b> | <b>JOINTING.....</b>                                                         | <b>14</b> |
| 7.1      | <b>Mechanical Jointing.....</b>                                              | <b>14</b> |
| 7.2      | <b>Jointing of PVC-M and PVC-U Pipe .....</b>                                | <b>15</b> |
| 7.3      | <b>Thermoplastic Jointing of Polyethylene by Electrofusion Welding .....</b> | <b>15</b> |
| 7.3.1    | Methodology .....                                                            | 15        |
| 7.3.2    | Quality Assurance Records .....                                              | 15        |
| 7.3.3    | Operator Qualifications .....                                                | 16        |
| 7.3.4    | Equipment .....                                                              | 16        |
| 7.3.5    | Pipe Preparation.....                                                        | 17        |
| 7.3.6    | Welding .....                                                                | 17        |
| 7.3.7    | Pipeline Recovery after Pulling in/Cooling of Heated Pipe .....              | 18        |
| 7.4      | <b>Site Butt Fusion Jointing of Polyethylene Pipe and Fittings .....</b>     | <b>18</b> |
| 7.4.1    | Methodology .....                                                            | 19        |
| 7.4.2    | Quality Assurance Records .....                                              | 19        |
| 7.4.3    | Operator Qualifications Butt Fusion .....                                    | 20        |
| 7.4.4    | Equipment .....                                                              | 20        |
| 7.4.5    | Pipe Preparation.....                                                        | 21        |
| 7.4.6    | Welding .....                                                                | 21        |
| 7.4.7    | Bead Profile.....                                                            | 22        |
| 7.4.8    | Joint Failure during Handling and Installation .....                         | 22        |
| 7.5      | <b>Measurement of Works and Basis of Payment .....</b>                       | <b>23</b> |
| <b>8</b> | <b>PIPE INSTALLATION.....</b>                                                | <b>23</b> |
| 8.1      | <b>Line and Level .....</b>                                                  | <b>23</b> |
| 8.1.1    | Lasers .....                                                                 | 23        |
| 8.1.2    | Use of Lasers .....                                                          | 23        |
| 8.2      | <b>Cutting of Concrete Pipe .....</b>                                        | <b>24</b> |
| 8.3      | <b>Cleanliness .....</b>                                                     | <b>24</b> |
| 8.4      | <b>Leaks.....</b>                                                            | <b>24</b> |
| 8.5      | <b>Foundations .....</b>                                                     | <b>24</b> |
| 8.5.1    | Pipe foundations .....                                                       | 24        |
| 8.5.2    | Treatment of Under-runners .....                                             | 24        |
| 8.6      | <b>Embedment.....</b>                                                        | <b>24</b> |
| 8.6.1    | Pipe Installation on Hillsides.....                                          | 25        |
| 8.6.2    | Geotextiles.....                                                             | 25        |
| 8.7      | <b>Pipe Protection.....</b>                                                  | <b>25</b> |
| 8.7.1    | Minimum Cover to Flexible Pipes.....                                         | 25        |
| 8.7.2    | Concrete Protection Slab to Flexible Pipes .....                             | 26        |
| 8.7.3    | Concrete Capping .....                                                       | 26        |
| 8.7.4    | Concrete Surround .....                                                      | 26        |
| 8.7.5    | Joint Formers.....                                                           | 26        |

---

---

|             |                                                              |           |
|-------------|--------------------------------------------------------------|-----------|
| <b>8.8</b>  | <b>Pressure Pipelines</b> .....                              | <b>26</b> |
| 8.8.1       | Thrust blocks .....                                          | 27        |
| 8.8.2       | Anchor blocks.....                                           | 27        |
| 8.8.3       | Valves and surface covers .....                              | 27        |
| <b>8.9</b>  | <b>Subsoil Drains</b> .....                                  | <b>27</b> |
| <b>8.10</b> | <b>Pipelaying at Structures</b> .....                        | <b>28</b> |
| 8.10.1      | Yield Joints.....                                            | 28        |
| 8.10.2      | Underchannel Piping.....                                     | 28        |
| 8.10.3      | Starters/Finishers .....                                     | 28        |
| 8.10.4      | Polyethylene Connection to Manholes.....                     | 28        |
| 8.10.5      | Long Socket Connectors .....                                 | 28        |
| 8.10.6      | Collector sewers .....                                       | 28        |
| <b>8.11</b> | <b>Measurement of Works and Basis of Payment</b> .....       | <b>28</b> |
| 8.11.1      | Pipe Installation .....                                      | 28        |
| 8.11.2      | Embedment.....                                               | 29        |
| 8.11.3      | Geotextiles.....                                             | 29        |
| 8.11.4      | Pipe Protection.....                                         | 29        |
| 8.11.5      | Treatment of Under-runners .....                             | 29        |
| 8.11.6      | Water stops.....                                             | 30        |
| 8.11.7      | Thrust blocks .....                                          | 30        |
| 8.11.8      | Subsoil Drains .....                                         | 30        |
| 8.11.9      | Pipelaying at Structures.....                                | 30        |
| <b>9</b>    | <b>POLYETHYLENE PIPE INSTALLATION</b> .....                  | <b>30</b> |
| <b>9.1</b>  | <b>Pipe Installation by Trenchless Technology</b> .....      | <b>30</b> |
| 9.1.1       | Polyethylene Pipe Installation by Pipebursting .....         | 31        |
| 9.1.2       | Polyethylene Pipe Installation by Slip Lining .....          | 31        |
| 9.1.3       | Polyethylene Pipe Installation by Directional Drilling ..... | 31        |
| <b>9.2</b>  | <b>Access Pits</b> .....                                     | <b>31</b> |
| <b>9.3</b>  | <b>Pressure Sewer Systems</b> .....                          | <b>32</b> |
| <b>9.4</b>  | <b>Measurement of Works and Basis of Payment</b> .....       | <b>32</b> |
| 9.4.1       | Pipe Installation in Open Trenches .....                     | 32        |
| 9.4.2       | Pipe Installation by Pipebursting .....                      | 32        |
| 9.4.3       | Pipe Installation by Slip Lining .....                       | 32        |
| 9.4.4       | Pipe Installation by Directional Drilling .....              | 33        |
| <b>10</b>   | <b>JUNCTIONS AND RISERS</b> .....                            | <b>33</b> |
| <b>10.1</b> | <b>Junctions</b> .....                                       | <b>33</b> |
| <b>10.2</b> | <b>Risers</b> .....                                          | <b>33</b> |
| <b>10.3</b> | <b>End Plugging</b> .....                                    | <b>33</b> |
| <b>10.4</b> | <b>Polyethylene Junctions and Adaptors</b> .....             | <b>33</b> |
| <b>10.5</b> | <b>Measurement of Works and Basis of Payment</b> .....       | <b>33</b> |

---

---

|           |                                                                |           |
|-----------|----------------------------------------------------------------|-----------|
| 10.5.1    | Junctions.....                                                 | 33        |
| 10.5.2    | Risers .....                                                   | 34        |
| <b>11</b> | <b>LATERALS.....</b>                                           | <b>34</b> |
| 11.1      | Laterals in Close Proximity to Trees.....                      | 34        |
| 11.2      | Sewer Lateral Cover at Lot Boundary.....                       | 34        |
| 11.3      | End Capping and Marking .....                                  | 34        |
| 11.4      | Lateral/Mainline Sequence.....                                 | 35        |
| 11.5      | Fluming of Disconnected Laterals.....                          | 35        |
| 11.6      | Laterals into Polyethylene Pipe .....                          | 35        |
| 11.7      | Connecting to Existing Laterals .....                          | 35        |
| 11.8      | Measurement of Works and Basis of Payment .....                | 35        |
| 11.8.1    | Laterals Requiring Structural Maintenance .....                | 35        |
| 11.8.2    | Laterals into Polyethylene Pipe .....                          | 35        |
| <b>12</b> | <b>STRUCTURES.....</b>                                         | <b>36</b> |
| 12.1      | Reference Documents .....                                      | 36        |
| 12.2      | Quality Assurance .....                                        | 36        |
| 12.2.1    | Contract Quality Plan.....                                     | 36        |
| 12.2.2    | Personnel.....                                                 | 36        |
| 12.3      | Reinforcement.....                                             | 37        |
| 12.4      | Formwork .....                                                 | 38        |
| 12.4.1    | Construction Requiring Support from Other Permanent Works..... | 38        |
| 12.5      | Precast Concrete Shop Drawings .....                           | 40        |
| 12.6      | Embedded Items .....                                           | 40        |
| 12.6.1    | Knock out Panels .....                                         | 41        |
| 12.7      | Construction Joints.....                                       | 41        |
| 12.8      | Supply of Concrete .....                                       | 42        |
| 12.9      | Concrete Placing, Finishing and Curing.....                    | 42        |
| 12.9.1    | Precast Concrete .....                                         | 44        |
| 12.9.2    | Slabs.....                                                     | 44        |
| 12.10     | Precast Concrete Handling, Transportation and Erection.....    | 45        |
| 12.10.1   | Tolerances .....                                               | 45        |
| 12.11     | Manholes.....                                                  | 45        |
| 12.11.1   | Special Construction Joint.....                                | 45        |
| 12.11.2   | Manhole Benching and Channelling.....                          | 46        |
| 12.11.3   | Joints between Precast Risers .....                            | 46        |
| 12.11.4   | Precast Manhole Tops.....                                      | 46        |
| 12.11.5   | New Manhole on an Existing Pipeline.....                       | 46        |
| 12.11.6   | New Pipe Invert in Existing Manhole.....                       | 46        |
| 12.11.7   | Manhole Openings.....                                          | 46        |
| 12.12     | Flush Tanks and Manholes .....                                 | 47        |
| 12.12.1   | Flush Tanks .....                                              | 47        |
| 12.12.2   | Flush Manholes.....                                            | 47        |

---

---

|         |                                                                                   |    |
|---------|-----------------------------------------------------------------------------------|----|
| 12.13   | Frames and Lids .....                                                             | 47 |
| 12.14   | Air Gap Separators .....                                                          | 47 |
| 12.15   | Other Minor Structures .....                                                      | 47 |
| 12.16   | Concrete Repair.....                                                              | 47 |
| 12.17   | Compliance Testing.....                                                           | 48 |
| 12.18   | Measurement of Works and Basis of Payment.....                                    | 48 |
| 12.18.1 | Concrete Construction.....                                                        | 48 |
| 12.18.2 | Manholes.....                                                                     | 48 |
| 12.18.3 | Flush Tanks and Manholes.....                                                     | 48 |
| 12.18.4 | Air Gap Separators.....                                                           | 48 |
| 12.18.5 | Other Minor Structures .....                                                      | 49 |
| 12.18.6 | Concrete Repair .....                                                             | 49 |
| 13      | CONNECTIONS AND ALTERATIONS TO EXISTING SYSTEM .....                              | 49 |
| 13.1    | Lined Pipes.....                                                                  | 49 |
| 13.2    | Measurement of Works and Basis of Payment.....                                    | 50 |
| 14      | PERFORMANCE TESTING .....                                                         | 50 |
| 14.1    | Equipment .....                                                                   | 50 |
| 14.2    | Gravity Pipelines .....                                                           | 50 |
| 14.2.1  | Structures.....                                                                   | 51 |
| 14.2.2  | Testing Junctions .....                                                           | 51 |
| 14.2.3  | Visual Inspection .....                                                           | 51 |
| 14.2.4  | 14.2.4 Hydrostatic Test .....                                                     | 51 |
| 14.2.5  | Air Test .....                                                                    | 52 |
| 14.3    | Pressure Pipelines.....                                                           | 52 |
| 14.3.1  | Concrete Pipe.....                                                                | 52 |
| 14.3.2  | Polyethylene Pipe up to DN 315.....                                               | 53 |
| 14.3.3  | Polyethylene Pipe over DN 315 .....                                               | 54 |
| 14.3.4  | Self Tapping Electrofusion Saddles.....                                           | 54 |
| 14.3.5  | PVC, Ductile Iron, Glass Reinforced Plastic Pipe.....                             | 54 |
| 14.4    | Vacuum Sewer Tests.....                                                           | 54 |
| 14.5    | Polyethylene Pipe Weld Tests.....                                                 | 54 |
| 14.5.1  | Pre-construction Joint Testing – Electrofusion.....                               | 55 |
| 14.5.2  | Pre-construction Joint Testing – Electrofusion Saddles.....                       | 56 |
| 14.5.3  | Pre-construction Joint Testing – Butt Fusion .....                                | 56 |
| 14.5.4  | Joint Testing During Construction – Electrofusion and Electrofusion Saddles<br>57 |    |
| 14.5.5  | Joint Testing During Construction – Butt Fusion.....                              | 57 |
| 14.5.6  | Joint Test Failures.....                                                          | 58 |
| 14.6    | Flexible Pipe Ovality Test.....                                                   | 60 |
| 14.7    | CCTV Inspection.....                                                              | 60 |
| 14.7.1  | Main Inspections.....                                                             | 60 |

---

---

|             |                                                                  |           |
|-------------|------------------------------------------------------------------|-----------|
| 14.7.2      | Lateral Inspections.....                                         | 61        |
| 14.7.3      | New Asset ID Naming Convention .....                             | 61        |
| <b>14.8</b> | <b>Measurement of Work and Basis of Payment.....</b>             | <b>61</b> |
| 14.8.1      | Testing Junctions .....                                          | 61        |
| 14.8.2      | CCTV inspection .....                                            | 61        |
| 14.8.3      | Polyethylene Pipe Weld Test.....                                 | 61        |
| <b>15</b>   | <b>BACKFILLING .....</b>                                         | <b>62</b> |
| 15.1        | Prior to Backfilling .....                                       | 62        |
| 15.2        | Materials .....                                                  | 62        |
| 15.3        | Backfill Procedure .....                                         | 62        |
| 15.4        | Quality Assurance .....                                          | 62        |
| 15.5        | Measurement of Works and Basis of Payment .....                  | 62        |
| 15.5.1      | Imported Backfill.....                                           | 62        |
| 15.5.2      | Filling to Unsuitable Foundations.....                           | 63        |
| 15.5.3      | Testing.....                                                     | 63        |
| <b>16</b>   | <b>ADJUSTING MANHOLES TO ALTERED SURFACE LEVELS .....</b>        | <b>63</b> |
| 16.1        | Materials .....                                                  | 63        |
| 16.2        | Raising of Manhole Frames.....                                   | 63        |
| 16.2.1      | Raising the Frame for a Standard Manhole within the Rebate ..... | 64        |
| 16.2.2      | Raising the Frame for a Bottleneck Manhole .....                 | 64        |
| 16.2.3      | Deepening the Rebate .....                                       | 64        |
| 16.3        | Raising of Manhole Tops.....                                     | 64        |
| 16.3.1      | Standard Manholes .....                                          | 64        |
| 16.3.2      | Bottleneck Manholes .....                                        | 64        |
| 16.3.3      | Precast Circular Manholes.....                                   | 64        |
| 16.4        | Lowering the Surface Level.....                                  | 65        |
| 16.4.1      | Standard Manholes without Vents.....                             | 65        |
| 16.4.2      | Standard Vented Manholes with Removable Vent Gratings .....      | 65        |
| 16.4.3      | Vented Manholes with a Fixed Vent Grating.....                   | 65        |
| 16.4.4      | Bottleneck Manholes .....                                        | 65        |
| 16.4.5      | Precast Circular Manholes.....                                   | 65        |
| 16.5        | Protection of System .....                                       | 65        |
| 16.6        | Protection of Structures .....                                   | 65        |
| 16.7        | Measurement of Works and Basis of Payment .....                  | 66        |
| 16.7.1      | Manholes Adjusted Separately from Drainage Works.....            | 66        |
| <b>17</b>   | <b>RESTORATION .....</b>                                         | <b>66</b> |
| 17.1        | Measurement of Works and Basis of Payment .....                  | 66        |
| <b>18</b>   | <b>PRESSURE SEWER SYSTEM COMMISSIONING .....</b>                 | <b>66</b> |
| 18.1        | Measurement of Works and Basis of Payment .....                  | 66        |
| <b>19</b>   | <b>AS-BUILT RECORDS.....</b>                                     | <b>67</b> |

---

---

COPYRIGHT © CHRISTCHURCH CITY COUNCIL, 2022

The information contained in this document (other than information or images that have been credited to a third party) may be reproduced subject to inclusion of acknowledgement of the source, and provided that no commercial usage or sale of the material occurs. Reproduction for commercial usage or sale requires prior written permission from Christchurch City Council. Copyright in information or images that have been credited to a third party remains that of the credited person or company. Reproduction of any credited image will require the permission of that third party. Contact details may be sought from Christchurch City Council.



## APPENDICES

- 1 Concrete Construction Checklist
- 2 General Requirements for Site Butt Fusion Jointing
- 3 Electrofusion Welding Check sheet
- 4 Compliance Requirements Check sheet
- 5 Pipe Butt Weld Record Log Sheet
- 6 Pipe Electrofusion Weld Record Log Sheet
- 7 PE Weld Testing Information Requirements
- 8 PVC Pipe Ovality Testing Guide (2022)

## STANDARD DETAILS

|                   |          |                                                                                              |
|-------------------|----------|----------------------------------------------------------------------------------------------|
| Iron Work Details | SD 301/1 | Circular Manhole Frames and Covers                                                           |
|                   | SD 301/2 | Manhole Vent & Trafficable House Drain Sump Frames & Covers                                  |
|                   | SD 301/3 | Corner Sump Frame & Covers                                                                   |
|                   | SD 301/4 | <i>detail deleted</i>                                                                        |
|                   | SD 301/5 | Wavy Sump Grating and Frame                                                                  |
|                   | SD 301/6 | Standard Sump Grating and Frame                                                              |
|                   | SD 301/7 | Rectangular & Double Manhole Frames & Covers                                                 |
|                   | SD 301/8 | Cycle Safe Sump Grating and Frame                                                            |
| Manholes          | SD 302/1 | Square Manholes                                                                              |
|                   | SD 302/2 | Square and Double Manhole Tops                                                               |
|                   | SD 302/3 | <i>detail deleted</i>                                                                        |
|                   | SD 303/1 | Circular Precast Manholes for Pipes Less than 450 OD                                         |
|                   | SD 303/2 | Circular Precast Manholes – Top Slabs Reinforcement                                          |
|                   | SD 303/3 | Square Base Precast Manholes for Pipes up to 750ø                                            |
|                   | SD 303/4 | Manhole Benching – Freehand                                                                  |
|                   | SD 303/5 | Manhole Benching – Tiled Invert                                                              |
|                   | SD 304   | Inaccessible Manhole                                                                         |
|                   | SD 305/1 | Gravity Drop Structure in Manholes                                                           |
|                   | SD 305/2 | Pressure Sewer Discharge into Manholes - Non-Turbulent Discharge for Diameters up to DN63mm  |
|                   | SD 305/3 | Pressure Sewer Discharge into Manholes – Turbulent Discharge for Diameters Greater Than 90mm |
|                   | SD 306/1 | Manhole Raising Top Adjustment                                                               |
|                   | SD 306/2 | Manhole Raising Bottleneck Frame Adjustment                                                  |
|                   | SD 307   | 600mm mini manhole for Pipes up to DN180                                                     |
|                   | SD 308/1 | Vacuum Pit and PE Manhole Lid Detail                                                         |
|                   | SD 308/2 | Pressure Sewer Tank Trafficable Lid Detail                                                   |

|                      |             |                                                           |
|----------------------|-------------|-----------------------------------------------------------|
| Flush Tanks          | SD 311/1, 2 | Flush Tanks                                               |
|                      | SD 312      | Flush Manholes                                            |
|                      | SD 313      | Air Gap Separator                                         |
| Sumps                | SD 321/1, 2 | Side Entry Sumps - Precast Kerb Unit                      |
|                      | SD 322/1    | Side Entry Enlarged Sump                                  |
|                      | SD 322/2    | Single Enlarged Sump                                      |
|                      | SD 323      | detail deleted Revision 1.0                               |
|                      | SD 324/1    | Hillside Sump                                             |
|                      | SD 324/2    | Special Entry to Double Sump in Hillside Channel          |
|                      | SD 325/1    | Single & Double Sumps - Flat Channel                      |
|                      | SD 325/2    | Cycleway Sump - Flat Channel                              |
|                      | SD 326      | <i>detail deleted</i>                                     |
|                      | SD 327      | Corner Sump                                               |
|                      | SD 328      | House Drain Sump and Small Trafficable Sump               |
|                      | SD 329      | Submerged Outlet                                          |
|                      | SD 330      | Dome Sump                                                 |
| Under Channel Piping | SD 331      | Concrete Surround for Under Channel Piping<br>225ø - 300ø |
|                      | SD 332      | Concrete Capping for Under Channel Piping 375ø -<br>525ø  |
| Pipelaying           | SD 341/1    | Pipelaying at Manholes & Sumps Concrete Pipes             |
|                      | SD 341/2    | Pipelaying at Manholes & Sumps for PVC Pipes              |
|                      | SD 341/3    | Pipelaying at Manholes for PE Pipes                       |
|                      | SD 341/4    | Corbels                                                   |
|                      | SD 341/5    | Pressure Pipelaying at Manholes for PE pipes              |
|                      | SD 342      | Pipe Protection                                           |
|                      | SD 343      | PVC Starters and Finishers                                |
|                      | SD 344/1    | Pipelaying Haunching Details for Concrete Pipes           |
|                      | SD 344/2    | Pipelaying Haunching Details for Flexible Pipes           |
|                      | SD 344/3    | Soft Ground Foundation                                    |
|                      | SD 345      | <i>detail renamed SD 344/2</i>                            |
|                      | SD 346      | Pressure Pipelines - Thrust Blocks                        |
|                      | SD 347      | Water Stops                                               |
|                      | SD 348      | <i>detail renamed SD 342</i>                              |
|                      | SD 349      | <i>detail deleted</i>                                     |
|                      | SD 352      | Stabilisation Raft to Outfall in Soft Ground              |
| Pipe Connections     | SD 361      | Direct Connections to Stormwater Pipe                     |
|                      | SD 362      | <i>detail deleted</i>                                     |
|                      | SD 363      | Pipelaying Junctions off Factory Moulded Riser            |
|                      | SD 364/1    | PE Junctions – Swept Bends, Inspections & Adaptors        |
|                      | SD 364/2    | PE Lateral to PVC Main Connector                          |
|                      | SD 365      | <i>detail combined with SD 364</i>                        |
|                      | SD 366/1    | CIPP Lined Main to lateral connection                     |

|                        |             |                                                      |
|------------------------|-------------|------------------------------------------------------|
|                        | SD 366/2    | Large Ø Lined Pipe lateral connection                |
|                        | SD 366/3    | Lined PVC-EW lateral connection                      |
| Stormwater Structures  | SD 350/1    | Bank Reinstatement to Outfall for Slopes 35-50 Deg   |
|                        | SD 350/2    | Bank Reinstatement to Outfall for Slopes >50 Deg     |
|                        | SD 351      | Rural Headwall                                       |
|                        | SD 371/1    | Concrete Headwalls (Non-Trafficable)                 |
|                        | SD 371/2    | Cut Pipe Rockwall                                    |
|                        | SD 372      | Standard Reinforced Concrete Beam                    |
|                        | SD 373      | <i>detail deleted</i>                                |
|                        | SD 374/1, 2 | <i>detail deleted</i>                                |
|                        | SD 375      | Inspection Chambers                                  |
|                        | SD 376      | Standard Circular Inspection Chamber                 |
|                        | SD 377/1, 2 | Subsoil Drains                                       |
|                        | SD 377/3    | Subsoil Drain Pipes                                  |
|                        | SD 378      | House Drain Inspection Box                           |
| Miscellaneous          | SD 381      | Vacuum Column Backflow Preventer                     |
|                        | SD 382      | Wastewater Spindle Cap                               |
| Pressure Sewer Systems | SD 383      | Pressure Sewer Flushing Point                        |
|                        | SD 384/1    | Pressure Sewer Trafficable Property Boundary Kit     |
|                        | SD 384/2    | Pressure Sewer Non-Trafficable Property Boundary Kit |
|                        | SD 384/3    | Pressure Sewer Boundary Kit Layout                   |
|                        | SD 384/4    | Pressure Sewer Boundary Kit Alternative Space        |
| Constrained Layout     | SD 385/1    | Pressure Sewer Valve Cover                           |
|                        | SD 385/2    | Service Cover Reinstatement                          |
|                        | SD 386/1    | Pressure Sewer System Chamber Typical Location       |
|                        | SD 386/2    | Pressure Sewer System Tank (Non-Trafficable)         |
|                        | SD 387/1    | Pressure Sewer Reticulation Details                  |
|                        | SD 387/2    | Pressure Sewer Reticulation Details                  |

## 1 FOREWORD

This Specification forms Part 3 of the Christchurch City Council Civil Engineering Construction Standard Specification (abbreviated as CSS). All parts of the CSS should be read in conjunction with each other and the Infrastructure Design Standard (abbreviated as IDS).

The full Specification includes the most recently published versions of the following Parts:

CSS: Part 1 - General  
CSS: Part 2 - Earthworks  
CSS: Part 3 - Utility Drainage  
CSS: Part 4 - Water Supply  
CSS: Part 5 - Lighting  
CSS: Part 6 - Roads  
CSS: Part 7 - Landscapes

Part 3 of the Standard Specification includes the Standard Details (SD) relating to this part only. The Standard Details (SD) are not to scale and all units are in millimetres (mm) unless otherwise shown. All rights reserved on Standard Details.

## 2 RELATED DOCUMENTS

The latest versions and amendments of the following documents shall be read and form part of this standard specification, together with revisions, replacements and amendments up to the date of calling tenders. The requirements of this specification supersede the requirements of any related documents listed or referred to within this specification, except acts of parliament.

Where this document is referred to in a contract, the requirements of that contract supersede the requirements of this specification.

Christchurch City Council Infrastructure Design Standards 2022 - <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/infrastructure-designstandards/download-the-ids/>

NZS 3101:2006 - Concrete structures standard

NZS 3104: 2003 - Specification for concrete production

NZS 3109: 1997 - Concrete construction

NZS 3114: 1987 - Specification for concrete surface finishes

NZS 5821.2: 1981 - Plain language code of practice for the safe use of lasers in surveying, levelling and alignment

AS/NZS 1554.3: 2008 -Structural steel welding - Welding of reinforcing steel

AS/NZS 2032: 2006 - Installation of PVC pipe systems

AS/NZS 2033: 2008 - Installation of polyethylene pipe systems

AS/NZS 2566.2: 2002 -Buried flexible pipelines - Installation

AS/NZS 4671: 2001 - Steel reinforcing materials

AS 1289.5.6.1: 1998 - Soil compaction and density tests - Compaction control test - Density index method for a cohesionless material.

AS 3996: 2006 - Access covers and grates

ISO 13953: 2001 Polyethylene (PE) pipes and fittings -- Determination of the tensile strength and failure mode of test pieces from a butt-fused joint

ISO 13954:1997 - Plastics pipes and fittings -- Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm

ISO 13956: 2010 - Decohesion test of polyethylene (PE) saddle fusion joints - Evaluation of ductility of fusion joint interface by tear test

ISO 21751: 2011 - Plastic pipes and fittings -- Decohesion test of electrofusion assemblies -- Strip-bend test

ASTM F2620 - 13 Standard Practice for Heat Fusion Joining of Polyethylene Pipe Fittings

WIS 4-32-08 - UK Water Industry Specification for the Fusion Jointing of Polyethylene Pressure Pipeline Systems Using PE 80 and PE 100 - Materials (may be referred to for general guidance)

<http://www.water.org.uk/publications/WIS-IGN/plastics-rubbers>

Transit New Zealand Standard Specifications

National Code for Utility Operators' Access to Transport Corridors <http://www.nzua.org.nz/national-code/CodeNov11.pdf>

Christchurch City Council Authorised Drainlayers - <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/>

Christchurch City Council Schedule of Local and Special Conditions to the National Code for Utility Operators' Access to Transport Corridors 2013

Christchurch City Council Guidance Notes: CCC As-Built CCTV Inspections - <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications/pipeline-cctv-inspections/>

Christchurch City Council Trench Support Best Practice Guideline - <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>

Christchurch City Council Dewatering Guideline - <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>

Christchurch City Council Wastewater Overpumping Best Practice Guide - <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>

Water Services Association of Australia WSA-06 Vacuum Sewerage Code of Australia

American Pre-stressed Concrete Institute Recommended Practice for Erection of Precast Concrete: 1985

New Zealand Waste Water Association New Zealand Pipe Inspection Manual 3rd edition 2006

Plastic Industry Pipe Association of Australia (PIPA) POP001 Industry Guidelines for Electrofusion Jointing of PE Pipe and Fittings for Pressure Applications Version 7.0 - <http://pipa.com.au/images/pdf/POP001.pdf>

Plastic Industry Pipe Association of Australia (PIPA) POP003 Industry Guidelines for Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters Version 6.0 - <http://pipa.com.au/images/pdf/POP003.pdf>

Worksafe Good Practice Guideline Excavation Safety - <http://construction.worksafe.govt.nz/guides/excavation-safety/>

### **3 APPROVAL OF MATERIALS, OPERATORS/CONTRACTORS, LABORATORIES AND WORKMANSHIP**

‘Approved’ in this document means

- A material listed on the Approved Materials List, with a current Certificate Status, and an Approval Status permitting that use;
- A Council-approved contractor authorised to do that specific work and listed on the relevant register;
- or
- Approved by the Engineer.

Schedules of approved materials and contractors can be found on the Christchurch City Council web page at: [www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-materials-list/search/www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/](http://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-materials-list/search/www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/)

Selected materials are specified in CSS: Part 1 - General. All pipe and fittings shall be approved.

Approved testing laboratories are IANZ accredited to carry out the particular test being requested.

Imported lime stabilised fill materials shall be centrally batched off site. Site batching shall only be permitted at the discretion of the Engineer and when the Engineer is satisfied that there is appropriate equipment and space on site for thorough mixing and that a lime dust nuisance will not be created for adjacent residential properties.

All fittings shall have a pressure rating at least equivalent to the rating of the adjacent pipe.

All pipe diameters are nominal internal, unless specifically stated otherwise.

#### **3.1 *Authorised Drainlayers***

Each work site shall have an Authorised Drainlayer of the approved category working full time on site, whenever drainage related infrastructure is being installed, including the placement of bedding and backfill up to subgrade level. This person shall carry out all works in accordance with the ‘Conditions for Approval as an Authorised Drainlayer’. The individual’s approval shall be removed where they contravene the requirements. Details of the Authorised Drainlayer shall be provided in the Contract Quality Plan, as detailed in IDS, clause 3.3 – Project Quality System.

This person must be in control of Council Drainage and Submain contracts, service connections, new subdivision reticulation works and their connection to the existing system and the connection of new pump stations to the existing system.

Details regarding Authorised Drainlayers are available at [www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/](http://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/)

### **3.2 *Polyethylene Welders***

An Authorised PE Welder of the approved category must be engaged to weld and test all the PE pipework, including providing test welds, as required. Note: the PE Welder must also be an approved LPSS Installer to install the LPSS, otherwise it must be installed by an Authorised Drainlayer, with an LPSS additional category.

## **4 PRIVATE PROPERTY**

### **4.1 *Progress of Work***

In order to hasten the work, rapid hardening cement and precast manholes and/or tops shall be used where possible.

### **4.2 *Planting and Existing Structures***

The Contractor shall remove trees and shrubs along the trench line before excavation starts. New trees and shrubs shall be planted after the surface restoration is completed where the owner desires. The Contractor shall replace any of these plants that die, in accordance with CSS: Part 7 - Landscapes.

Care shall be taken not to damage trees and shrubs that are not on the trench line. The Contractor shall be held responsible for any damage. The Contractor shall replace any hedges alongside or crossing the worksite that die. Where mature plants are replaced with smaller plants, temporary fencing shall be installed at the Contractor's cost and to the property owner's approval, if requested by the owner.

### **4.3 *Excavated Material***

The Contractor shall remove all topsoil along the line of the trench and stockpile it clear of the trench in an approved position so that it does not become mixed with other materials.

All excavated material shall be placed only where approved to minimise damage to lawns, garden etc. In some cases this may mean temporarily removing the spoil from the property.

Surplus excavated material and/or topsoil shall not be removed from the property without the approval of the owner. Material required by the owner shall be stockpiled in a location adjacent to the works as instructed by the owner.

### **4.4 *Approved Equipment***

Mechanical equipment that is approved by the Engineer can be used on private property except where the use of mechanical equipment is expressly excluded in the General Specification.

### **4.5 *Temporary Fencing***

The installation and maintenance of such temporary fencing as may be required to ensure the safety and security of the property owner and/or occupier shall be provided at the Contractor's cost.

#### **4.6 *Measurement of Work and Basis of Payment***

All site clearance, excavation, stockpiling and reinstatement on private property shall be included in the rate for the item concerned. There will be no payment for temporary fencing or replacement of plants damaged by the Contractor's operations.

The planting and establishment of trees and shrubs to replace removed plants shall be paid per item. The rate shall include the formation of planting holes, supply of plants and additional compost where required.

## **5 EXISTING SERVICES**

### **5.1 *Support of Services***

The Contractor shall support all services affected by the operations, whether these services cross or are alongside the excavation. Support shall be in accordance with the requirements of the service authorities concerned. All power poles destabilised by the Contractor's excavations shall be provided with additional support.

The requirements of this clause are additional to CSS: Part 1 - General.

#### **5.1.1 Live Laterals Crossing the Excavation**

100mm sanitary sewer and stormwater laterals crossing the trench shall be supported temporarily and kept functioning. Prior to completion of backfilling these laterals shall be replaced in accordance with clause 11.0 - Laterals, where directed. The replacement shall extend as far as required into undisturbed ground and sanitary sewer laterals shall have an inspection pipe installed at one end.

#### **5.1.2 Support of Sewer or Stormwater Pipes Crossing the Excavation**

Sewer or stormwater pipes shall be supported by extending the haunching metal around the new pipe and up to the pipe being supported so it is correctly haunched in accordance with SD 344 Haunching Type M.

#### **5.1.3 Asbestos Watermains**

When trenching for pipe sizes exceeding 110mm diameter exposes an existing AC watermain and while the original pipe is exposed across the excavation, it shall be temporarily supported by a steel or wooden beam which spans the trench.

Where the length exposed of an existing AC watermain of 200mm diameter or smaller is greater than 800mm, the following support will be provided:

- a) The pipe shall be further exposed on each side of the trench, and the length of AC pipe crossing the trench plus an additional 750mm each side, shall be cut out and replaced with PN16 PVC-U pipe of the equivalent size  
or



- b) Low strength flowable concrete, at least 600mm deep, shall be poured below the pipe to directly support it but no higher than mid-height of the pipe. The AC pipe shall be wrapped in polythene film prior to the concrete being poured to prevent the concrete adhering to the pipe.

Where the length exposed of an existing AC watermain of a diameter larger than 200mm is greater than 1200mm:

- a) The pipe shall be further exposed on each side of the trench, and the length of AC pipe crossing the trench plus an additional 750mm each side shall be cut out and replaced with Ductile Iron pipe of the equivalent size. Alternatively, the pipe may be replaced with a pipe material selected in accordance with IDS: Part 7 - Water Supply, Appendix 2.  
or
- b) Low strength flowable concrete, at least 600mm deep, shall be poured below the pipe to directly support it but no higher than mid-height of the pipe. The AC pipe shall be wrapped in polythene film prior to the concrete being poured to prevent the concrete adhering to the pipe.

## **5.2 Service Conflicts**

### **5.2.1 Abandoned Services**

Treat abandoned services that clash with the new pipeline in accordance with clause 5.3.1 Clashing services.

### **5.2.2 Live Laterals Fouled by the Proposed Pipeline**

Where the proposed pipeline fouls 100mm diameter laterals they shall be re-laid as necessary to clear the pipeline. Wherever possible the laterals shall be re-laid to a true grade falling continuously. No siphons shall be constructed.

### **5.2.3 Unavoidable Diversion of Services**

A clash in location between services and the permanent work may necessitate the diversion and reinstatement of the service. A clash in the form of coincident position and not merely proximity will be the sole reason for the Engineer ordering this diversion.

### **5.2.4 Clearance to Other Services**

Where the clearance between existing services and the proposed pipeline is limited, the Contractor shall arrange the lay, by incorporating short pipes, to maximise the clearance available.

### **5.3 *Abandoned Infrastructure***

#### **5.3.1 Clashing Services**

Where abandoned services clash with new pipelines, the abandoned service shall be cut and sealed to the satisfaction of the particular service authority and the Engineer. Abandoned pipelines shall be sealed with a concrete plug at all points where they are cut and at all structures. Concrete plugs shall have a minimum length, which is the greater of 500mm or the pipe diameter, and be watertight.

#### **5.3.2 Manholes**

Abandoned manholes shall be treated by removing the top, breaking the walls down to 500mm below the finished ground surface and backfilling the void with compacted CCC AP65 in accordance with CSS: Part 1 clause 32.0 - Backfilling. All connections shall be sealed using a concrete plug as specified in clause 5.3.1 – Clashing services.

#### **5.3.3 Wastewater and stormwater pipes**

Where the treatment of abandoned wastewater and stormwater pipes has been specified, pipes shall be retired, removed or filled. Asbestos cement pipes in Council land shall only be treated by filling due to the risk of asbestosis and related diseases. Asbestos cement pipes in private property must be removed following appropriate health and safety processes. Refer to CSS Part 1: clause

20.1 – Asbestos for health and safety requirements. Where all pipes connecting to a manhole have been filled or removed the manhole shall be treated in accordance with clause 5.3.2 – Manholes.

- Retirement: Abandoned pipes shall be sealed using a concrete plug in accordance with clause 5.3.1 – Clashing services. Abandoned laterals shall be exposed at the property boundary then cut and sealed (on both sides of the cut) using a concrete plug in accordance with clause 5.3.1 – Clashing services. Outfall pipes shall be removed for a minimum of 500mm from the face of the embankment and sealed using a concrete plug in accordance with clause 5.3. 1 – Clashing services.
- Removal - All pipes shall be removed and the trench backfilled to the requirements of CSS: Part 1 clause 32.0 - Backfilling. Abandoned laterals connecting to a main that has been removed shall be treated either by removal or filling to the private property boundary.
- Filling – Pipes shall be filled with a highly flowable fill or foam concrete with a minimum strength of 1.5MPa and maximum strength of 3.0MPa. Superplasticisers and other admixtures to aid flowability are acceptable. Abandoned laterals shall be exposed at the property boundary. The private property side shall be sealed with a concrete plug in accordance with clause 5.3.1 – Clashing services. The downstream side shall remain open to the atmosphere throughout the filling operation. A suitable construction methodology shall be provided to the Engineer for approval. The approved methodology will include but not be limited to confirming how

the total void, including all laterals to the private property boundary, will be filled.

**5.3.4 Pressure Sanitary Sewer pipes (PSS)**

Valves and flush points on abandoned PSS pipework shall be removed and disposed of. The abandoned pipe shall be capped at the transition from live to abandoned, but the pipework can remain untreated in the ground. As-built records shall be provided through the CAT template of changes in use. (add 'amendment' to as-built records to MOW).

**5.4 *Measurement of Works and Basis for Payment***

**5.4.1 Support of Services alongside the Excavation**

The temporary or permanent support of cables, ducts, gas pipes and water pipes of 40mm outside diameter and less alongside the excavation shall be included in the rate for pipe installation. Support of services of diameters greater than this is scheduled separately.

**5.4.2 Support of Power Poles**

Support of power poles shall be included in the rate for pipe installation.

**5.4.3 Support of Services Crossing the Excavation**

Temporary or permanent support shall be paid per item. Support of services under 40mm diameter is included in the pipe installation rate.

**5.4.4 Laterals Crossing the Excavation**

Payment for replacement up to 0.5 metres outside the excavation shall be included in the rate for service support. Where the Engineer orders replacement beyond this, payment for the additional piping will be made at the rate for laterals.

**5.4.5 Unavoidable Diversion of Services**

Unless specified, the diversion and reinstatement of services will be a variation ordered in writing by the Engineer.

**5.4.6 Clearance to Other Services**

Where the Engineer has ordered the use of short pipes to increase clearances to existing services, the difference in pipe costs will be paid as a variation.

**5.4.7 Potholing Services**

Potholes shall be paid per pothole ordered.

**5.4.8 Clashing Services**

The plugging of abandoned services shall be paid as scheduled.

**5.4.9 Manholes**

Treatment of a manhole includes removing the top and the walls as specified, disposal and backfilling of the void. Manholes shall be measured per item.

**5.4.10 Wastewater and stormwater pipes**

Treatment of abandoned pipes shall be per lineal metre to the nearest 0.1m. Removal of abandoned pipes includes excavation and disposal, supply of backfill and compaction. Filling of abandoned pipes includes pits, sealing of connected pipes if undertaken, supply and placement of filling material, supply of backfill to pits and compaction.

## **6 EXCAVATION**

**6.1 *Excavations in Legal Road***

Excavations carried out in legal roads shall be carried out in accordance with CSS: Part 1. The Contractor shall ensure that the erosion and sediment control measures prevent the discharge of sediment to roads.

Refer to the Council webpage 'Working on the Legal Road'  
<http://www.ccc.govt.nz/transport/working-on-the-legal-road/> for further information.

**6.2 *Temporary Sealing***

Temporary sealing shall provide a safe trafficable surface for the duration of its existence.

**6.3 *Removal and Disposal of Surplus Excavated Material***

Surplus material shall be removed from the site within 24 hours, or immediately if the material constitutes a hazard or nuisance, subject to the requirements of clause 4.3 – Excavated Material.

Should the Contractor fail to remove surplus excavated material from the site, the Engineer may arrange such removal at their cost.

**6.4 *Trench Excavation***

Trenching shall have vertical sides unless otherwise approved by the Engineer.

**6.4.1 Length of Open Trench**

The length of open trench shall not exceed the greater of one manhole length or 50m and when offsite this open trench shall be reduced to a maximum length of not more than 10 metres.

On the hillside, backfilling shall not be permitted for uncompleted pipe lengths less than 15 metres until the pipeline has been tested by the hydrostatic test. This length shall not be reduced unless the Engineer is satisfied that a reduction is necessary to carry out the work or to provide adequate and safe road widths for traffic purposes.

**6.4.2 Trench Width**

The minimum trench width shall be 300mm wider than the external diameter of the collar of the pipe being laid, providing the haunching metal is compacted under and at the sides of the pipe.

The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of foundation and haunching materials.

Dimension 'G' on SD 344 Sheets 1 & 2 is the trench width for which payment will normally be made. Dimension 'N' is the trench width necessary to accommodate extra trench support and is the greater of 900mm or 'G' + 200mm. The Engineer may approve trench widths greater than and including 'N'. For 1600mm or larger diameter pipes laid in deep trenches, the Engineer may increase 'G' by up to 200mm to provide increased working space. Availability of bucket sizes shall not be considered when approving increased trench widths.

#### 6.4.3 Base of Excavation

No construction or work upon the excavation bottom shall commence until the natural bottom of the excavation has been inspected and the method of treatment approved by the Engineer.

The base of the excavation shall be level and undisturbed. The removal of disturbed material and filling of any deficiencies, as the Engineer requires, shall be carried out by and at the Contractor's cost where excavating below or disturbing the required bottom.

#### 6.4.4 Trench Support

The Contractor shall provide trench support to comply with the requirements of New Zealand's government appointed workplace health and safety regulator, as described in Worksafe's Good Practice Guideline Excavation Safety. The Contractor shall ensure that the sides of the trench are sufficiently supported so that cracking of the surrounding ground does not occur.

Any cracking that does occur shall be repaired at the Contractor's cost to the standards of the controlling authority or property owner.

Where trench support extends below the invert of the proposed pipeline or structure special precautions may be required, including leaving part of the support in place, to ensure the foundation of the pipe or structure is not weakened.

Council's Trench Support Best Practice Guideline is available at <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>

**6.4.5**    Trench in an Existing Watercourse

Where the trench is in an existing watercourse, drain, or gully etc. the Contractor shall strip all vegetation and organic material from the sides and bottom before placing foundations or backfill.

**6.4.6**    Installation of Geotextiles

Should the trench bottom or sides be unsatisfactory, the Engineer may order an approved geotextile be placed prior to placing the foundation metal and during backfilling. Geotextiles shall be in accordance with TNZ F/7. Geotextiles shall have a minimum overlap of 300 mm up to DN375 and allowable bearing pressure greater than 50kPa or as shown in the Drawings.

**6.5**    ***Excavations for Structures***

Excavations for all structures must be of sufficient size to allow later removal of formwork and adequate compaction of backfill. However, in suitable stable ground the excavation may be made to the exact size required, the concrete being poured against the exposed surfaces. A waterproof membrane shall cover these surfaces except where the Engineer considers that the membrane is not necessary.

**6.6**    ***Rocks and Explosives***

**6.6.1**    Rock Definition

Rock is defined as inorganic material that cannot be excavated without the aid of explosives, drilling or rock breaking equipment. Isolated boulders that cannot be excavated without the aid of explosives, drilling or rock breaking equipment shall be included in this definition.

**6.6.2**    Use of Explosives

Explosives shall not be used unless expressly approved in writing by the Engineer.

This approval shall be dependent on the following conditions being met:

- Explosives and detonators shall be stored, handled and controlled in accordance with statutory requirements and Local Authority Bylaws.
- Any damage caused by blasting operations shall be made good at the Contractor's expense.
- The Engineer shall approve the time at which shots are to be fired and shall be notified in writing 24 hours in advance of firing. Evidence must be produced at that time by the Contractor to show of compliance with Statutes and Regulations.
- Explosives shall be used only in moderate charges.
- Every charge and all ground that might be shattered shall be adequately covered to prevent fragments flying.
- All householders and the general public in the danger area shall be warned of, and kept from, any risk.

- Traffic in the danger area shall be stopped, or diverted, while there is danger from the firing or clearing operation.
- Explosives shall be used only under the control of a competent person who is fully qualified under the relevant Regulations.

## **6.7 Dewatering**

All dewatering shall be carried out in terms of CSS: Part 1 - General.

### **6.7.1 Keeping the Excavation Free of Water**

Subsoil water shall be kept below the metal foundation.

Should the Contractor fail to take adequate steps to keep the subsoil water down, or should the Engineer consider the methods adopted by the Contractor are endangering the foundations of pipes, other services or structures, the Engineer shall require other methods to be adopted.

The Contractor shall be responsible for making good any lifting of the pipes due to the flooding of the trench.

Council's Dewatering Guideline is available at  
<https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>

### **6.7.2 Control of Pumped Water**

No stormwater or groundwater shall be permitted to enter the sewer system. No sewage shall be discharged to the stormwater system or to the road surface.

The Contractor shall not permit any flooding of property, footpaths or roadways to result from their operations.

### **6.7.3 Dewatering of Peat**

Dewatering of peat strata outside the trench shall not be permitted where services or structures etc. may be endangered by shrinkage of the peat.

## **6.8 Stumps and Subsurface Objects**

### **6.8.1 Stumps**

A "stump" shall be defined as a stump, root, branch or any part of a tree within the excavation that cannot be removed, or prevents the installation of trench support, by the equipment in use at the time, including an axe and a hand saw, provided that removal cannot be effected with the continuous efforts of all necessary manpower and equipment for 30 minutes.

6.8.2 Subsurface Objects

When man-made or man-placed subsurface objects including abandoned services, unknown or not previously located, adversely affect an excavation, the removal of such obstructions shall be paid as a variation, with quantities agreed with the Engineer.

**6.9 *Measurement of Works and Basis of Payment***

6.9.1 Excavation

Excavation shall include the cost of saw-cutting, excavation to the underside of the foundations and to trench width 'G' or 'N', keeping the excavation free of water, trench support, sorting of excavated material, disposal of surplus excavated material and all incidental work. Excavation shall be included in the rate for the relevant scheduled item.

The Engineer shall determine whether dimension 'G' or 'N' will be used in determining payment, where ground conditions and trench depth are such that trench support is appropriate.

The Contractor shall meet the cost of any additional excavation, crushed metal, imported backfill, change of pipe class, or any other measures required where excavating to trench widths greater than that approved.

6.9.2 Unsuitable Foundations

Unsuitable foundations shall be paid as a solid measure, to the nearest 0.1m<sup>3</sup>, the quantities being fixed by the depth, length and width of the excavation agreed. Unsuitable foundations shall include disposal of the excavated material.

6.9.3 Temporary Sealing

Temporary seal shall be paid by the lineal metre of trench sealed, to the nearest metre.

6.9.4 Trench in an Existing Watercourse

Where the existing watercourse is wider than trench width 'G', payment shall be made for the solid measure of imported backfill, to the nearest 0.1m<sup>3</sup>, calculated on the actual width of the trench.

6.9.5 Installation of Geotextiles

Geotextiles shall be measured by the square metre of surface covered, to the nearest m<sup>2</sup>. This area is to the trench width as detailed in clause 6.9.1 - Excavation and to the depth as ordered by the Engineer. This rate shall allow for laps in accordance with clause 6.4.6.

6.9.6 Trench Support Left in Position

Trench support shall be measured on the horizontal length installed on each side of the excavation, to the nearest metre. Trench support left in position



by the written order of the Engineer, as a variation, shall be paid at the market rate ruling at the time of the order.

**6.9.7 Rock Excavation**

The Engineer shall measure rock quantities, to the nearest 0.1m<sup>3</sup>, before excavation. The Contractor shall remove the overburden for a reasonable length and notify the Engineer as soon as possible so that the volume of rock may be determined.

Payment will be based on the actual trench width up to a maximum of nominal outside pipe diameter plus 600mm. Where explosives are used, payment will be based on a minimum width of 900mm.

Rock excavation shall include disposal of excavated material.

**6.9.8 Keeping the Excavation Free of Water**

Keeping the excavation free of water, including the provision of pumps etc. shall be included in the item for excavation. The Contractor shall provide and use all equipment necessary for the purpose.

**6.9.9 Stumps and Subsurface Objects**

The removal of a stump includes excavation, disposal and backfilling of the void with approved excavated material. Stumps shall be measured by item.

Where a stump enters the excavation more than once or where more than one part of the stump is in the trench, only one unit of payment will be made for the stump, unless the different parts enter the trench separately and must be removed separately.

## **7 JOINTING**

Jointing shall be carried out to present a smooth invert surface between pipes.

The Contractor shall minimise jointing on polyethylene pipe. Polyethylene pipe under DN63 shall not be jointed.

Council prefers polyethylene pipe to be butt welded where practicable.

### **7.1 *Mechanical Jointing***

Jointing shall be strictly in accordance with the manufacturer's instructions and to the Engineer's satisfaction. A support liner shall be used for all polyethylene mechanical couplers, as required by the Council's material approval. No jointing will be permitted under water unless expressly approved in writing by the Engineer.

Gibault joints and any other exposed metal components shall be thoroughly

wrapped in place with a petrolatum impregnated two layer tape system. Mastic filler shall be applied to fill voids and create a smooth surface for tape application. Primer, filler and tapes shall be applied in strict accordance with the manufacturer's specifications.

Mechanical couplers shall not be used to connect new polyethylene pipes.

## **7.2 *Jointing of PVC-M and PVC-U Pipe***

Jointing shall be carried out in accordance with AS/NZS 2032 "Installation of PVC pipe systems", the manufacturer's instructions and to the Engineer's satisfaction. Only off-site solvent weld joints carried out by the manufacturer are permitted.

Where connecting PVC pipes with rubber ring joints the socket depth shall be measured and a witness mark applied at the socket depth - 25mm from the spigot end. The spigot shall be inserted into the socket only until the witness mark is flush with the socket end of the pipe.

## **7.3 *Thermoplastic Jointing of Polyethylene by Electrofusion Welding***

Jointing shall be carried out by approved welders in accordance with AS/NZS 2033 "Installation of polyethylene pipe systems", the approved methodology and the pipe manufacturer's instructions. Jointing shall not be carried out until the Engineer has received passing results of pre- construction pipe tests carried out in accordance with clause 14.5 – Polyethylene Pipe Weld Tests.

Electrofusion couplings are not an acceptable jointing method for sections of PE pipeline that will be pulled into place.

### **7.3.1 Methodology**

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan.

Individual methodologies shall be submitted for each diameter range and material being jointed. The jointing method contained in POP001 "Industry Guidelines for Electrofusion Jointing of PE Pipes and Fittings for Pressure Applications" should form the basis of the methodology.

### **7.3.2 Quality Assurance Records**

The Contractor shall prepare a site welding log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site welding log sheet shall provide the specified and actual fusion and cooling times, ambient conditions and the actual temperature of the pipe and coupler prior to jointing, corresponding to each weld number and certification number. The log shall also clearly identify the location of each joint, unless the pipe is installed by trenchless methods.

The completed welding log shall be submitted to the Engineer as an as-built record.

A sample electrofusion welding log sheet is attached in Appendix 6.

#### 7.3.3 Operator Qualifications

Electrofusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders shall hold the applicable registration on the Council Approved PE Welders Register for the pipe diameter range being welded.

A copy of the operator's registration shall be submitted through the Contract Quality Plan.

Approved welders are listed on the Council webpage <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/pe-welders/>

Diameter ranges are up to and including 250mm and over 280mm.

#### 7.3.4 Equipment

Electrofusion jointing shall be carried out using automatic machinery designed for the pipe size. Manually operated welding machines are not acceptable. The machine shall not be changed without the Engineer's approval. The machine shall have either automatic logging facilities incorporated or be retrofitted with suitable logging facilities, where used to weld pipes over 300mm OD.

Two clamps supported on a frame shall ensure the alignment of the components and mating of the component ends. Re-rounding clamps of the appropriate size shall be used where necessary.

All equipment shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated regularly. The frequency at which this is carried out will be different for individual items of equipment and will also depend on usage but should be at least once every 12 months. Guidance should be sought from the equipment manufacturer and a scheme of calibration and servicing implemented.

Particular attention shall be given to the control box, the generator and the peeling tools. The sharpness of the cutter head tools shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves. If they have aluminium facer plates, use a cleaner that will remove aluminium oxide.

Suitable protection against inclement weather shall be provided, to prevent water, dirt and dust contamination and differential cooling of the pipes and couplings. Adequate working space shall be provided around the pipe in the trench to allow peeling and installation of equipment.

#### 7.3.5 Pipe Preparation

The spigot end of the component shall be cut square, and all rough edges and swarf shall be removed from the pipe ends.

The maximum 'out of roundness' of the pipe shall be 1.5% of the internal diameter. The maximum allowable gap between butted ends within an electrofusion fitting shall comply with the fitting manufacturer's requirements.

The pipe diameter, out-of-roundness and wall thickness shall be measured before peeling for compliance using the appropriate tools. Remove sections of the pipe experiencing pipe end reversion.

After cleaning pipe ends shall be peeled to 0.3mm depth and for a distance equal to half the length of the coupling plus 20mm to remove dirt and oxidation. This should be peeled to a smooth profile using a sharp rotational peeler. The exposed ends of the pipe strings shall be covered until cooling is complete, to prevent any air flow which may heat or cool the pipe. Covers on fittings shall be retained until immediately before welding.

All jointing surfaces shall be clean, dry and free of all contamination before being assembled. Iso-propyl alcohol complying with the manufacturer's concentration requirements and a lint-free disposable wipe shall be used to remove any oil or grease films. Mark witness marks with a non-contaminating marker.

The pipe and coupler shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and coupling through the Contract Quality Plan.

#### 7.3.6 Welding

Each electrofusion joint shall be identified with the operator's registration number and date welded, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet (refer appendices for an electrofusion log sheet example).

The manufacturer's recommended Standard Fusion Times (SFT) shall be entered into the control box using the appropriate methods required by the type and model of control box.

- For automated systems, the resistor lead shall be connected to the resistor terminal pin of the coupling.

- For bar code systems, the light pen shall be wiped across the code panel to enter the fusion times.
- For magnetic card systems, the card shall be placed into the control unit reader to enter the fusion times.

The pipe and fittings shall be pre-heated to manufacturer's requirements if required.

The pipes shall be restrained in position during welding at the centreline height of the coupling, to prevent movement and the application of stress during the fusion process. The pipes shall be horizontal either side of the clamps to prevent both pulling away from the coupling joint and the entry of water or dirt into the pipe, which may contaminate the weld zone.

The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

#### 7.3.7 Pipeline Recovery after Pulling in/Cooling of Heated Pipe

The polyethylene pipeline shall be allowed to recover from the effects of thermal expansion and installation stretching. The pipeline shall not be restrained by rigid connections until the pipeline temperature reaches ground or service temperature. Where the pipeline is installed by trenchless methods, a minimum period of 24 hours shall be allowed after installation before connecting the pipe to any rigid connections including previously installed pipelines, bends and valves.

### 7.4 ***Site Butt Fusion Jointing of Polyethylene Pipe and Fittings***

Jointing shall be carried out by approved contractors in accordance with AS/NZS 2033 "Installation of polyethylene pipe systems", the approved methodology and the manufacturer's instructions. Jointing shall not be carried out until the Engineer has received passing results of pre-construction pipe tests carried out in accordance with clause 14.5 – Polyethylene Pipe Weld Tests.

Unless the manufacturer gives explicit permission and provides details of specific welding procedures, butt fusion jointing shall only be used to join pipes and fittings that are:

- composed of similar materials (PE 80 shall be welded to PE 80, PE 100 shall be welded to PE 100).
- the same nominal diameter;
- the same wall thickness measured by Pressure Number (PN) or Standard Dimension Ratio (SDR).

The Contractor shall plan the jointing, installation and tensile testing to minimise the number of electrofusion couplers used.

#### 7.4.1 Methodology

The Contractor shall submit a detailed jointing methodology through the Contract Quality Plan. Individual methodologies shall be submitted for each diameter; wall thickness and pipe material type being jointed.

The methodology shall detail the parameters, as listed in clause 7.4.2 – Quality Assurance Records, which are necessary to meet the requirements of this specification. It shall also reference the procedures applied to achieve consistent and high-quality joints. This methodology shall include (but not necessarily be limited to) the following information:

- the make and model of the butt fusion jointing machine;
- the cylinder area;
- the weld method to be used (e.g. single phase or dual phase);
- the name and qualifications of the approved operator;
- details of the pressure gauge, including the make, dial diameter, pressure range, smallest graduation value and the date of last calibration;
- specific parameters for each nominal pipe diameter, wall thickness and pipe material type to be jointed;

The weld parameters contained in the latest version of POP003 “Industry Guidelines for Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters” should form the basis of the methodology.

Appendix 2 provides general requirements for site butt fusion jointing.

#### 7.4.2 Quality Assurance Records

The Contractor shall prepare a site jointing log sheet template and submit this through the Contract Quality Plan. The log sheet shall be used to provide a detailed record of all joints carried out. As a minimum, the site jointing log sheet shall provide the following details:

- Pipeline name/description
- Joint location, accurate enough to locate the joint within one pipe length, unless the pipe is pulled into place.
- Weld date and time
- Operator name and ID number
- Pipe nominal diameter
- Pipe SDR or PN
- Pipe material (PE 80, PE 100)
- Pipe manufacturer’s name and pipe identification
- Wall thickness (t, nearest 1 mm)
- Cooled bead height & width (mm)
- Confirmation that the weld parameters have been met (as below).
- Pipe annular area (A, mm<sup>2</sup>)
- Hydraulic cylinder area (a, mm<sup>2</sup>)
- Heater plate temperature (°C)
- Bead-up pressure (P1, kPa)
- Bead-up time (T1, seconds)

- Heat soak pressure (P2, kPa) (= drag pressure only)
- Heat soak time (T2, seconds)
- Change-over time (T3, seconds)
- Time to achieve welding pressure (T4, seconds)
- Welding and cooling pressure (P3, kPa)
- Cooling time (T5, seconds)

The results shall be presented in tabular form, along with the printouts from the fusion jointing machine.

The completed welding log shall be submitted to the Engineer as an as-built record.

#### 7.4.3 Operator Qualifications Butt Fusion

Butt fusion jointing shall only be carried out by approved welders who have been named in the Contract Quality Plan. Approved welders shall hold the applicable registration on the Council Approved PE Welders Register

A copy of the operator's registration shall be submitted through the Contract Quality Plan.

Approved welders are listed on the Council webpage –  
<https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/pe-welders/>  
[Polyethylene \(PE\) welders : Christchurch City Council](#)

Diameter ranges are up to and including 250mm and over 280mm.

#### 7.4.4 Equipment

The welder shall have previous experience on the nominated welding machine. The machine shall not be changed without the Engineer's approval.

The machine shall have either automatic logging facilities incorporated or be retrofitted with suitable logging facilities.

All equipment, but particularly the electrically heated plate, shall be well maintained and kept in a clean condition at all times. The equipment shall be serviced and calibrated as recommended by the manufacturer. The pressure gauge shall be graduated to be reliably readable to 10 kPa or less and calibrated at least within the last six months.

The heater plate shall be undamaged and temperature controlled to be between 205°C and 235°C over both sides of the whole plate. A portable surface probe pyrometer capable of measuring the plate surface temperature to  $\pm 1^\circ\text{C}$  shall be used to confirm this.

The sharpness of the planer or facing tool shall be monitored regularly and appropriate maintenance work carried out whenever the jointing surfaces show visible signs of ridges or grooves.

Suitable protection against inclement weather shall be provided, to prevent differential cooling of the pipes and dirt, dust or water contamination e.g. a tent.

Ancillary equipment shall include:

- the clamping device with one fixed and one movable clamp, supported on a rigid frame
- pipe support rollers or skids
- pipe end plugs or caps
- the weld bead measuring gauge
- iso-propyl and lint-free disposable wipe
- a clean ground sheet or baseboard

#### 7.4.5 Pipe Preparation

The Contractor shall follow the approved welding methodology.

The pipe and fittings shall have a minimum allowable temperature of 5°C prior to jointing. Where this cannot be achieved naturally, the Contractor shall submit a methodology for heating the pipe and fittings through the Contract Quality Plan.

All jointing surfaces, including the heater plate, shall be clean, dry and free of all contamination.

The proposed joint interface shall not show any misalignment of more than 1mm for pipe diameters between 90mm and 315mm and of 2mm for pipe diameters between 355mm and 630mm. The maximum allowable diametric mismatch ("step" in the pipe OD at any proposed butt fusion joint) is 10% of the measured wall thickness.

End gaps between faces to be welded shall not exceed the following values:

| <u>Pipe Diameter DN (mm)</u> | <u>Minimum Gap (mm)</u> |
|------------------------------|-------------------------|
| Up to 225                    | 0.3                     |
| 280 to 450                   | 0.5                     |
| 500 to 630                   | 0.6                     |
| 710 to 900                   | 0.7                     |
| 1000 and above               | 1.0                     |

#### 7.4.6 Welding

Each butt fusion joint shall be identified with the operator's registration number and date welded, applied in a legible and durable form. Individual joint details shall be recorded on the log sheet (refer appendices for a log sheet example).



The welded joint shall be kept immobile for the full cooling times, before removing clamps or moving the joint assembly. No attempts shall be made to accelerate the rate of cooling.

#### 7.4.7 Bead Profile

The bead faces shall be smooth and free from pitting bubbles. If pipes are any colour other than black, there shall be no discolouration of the weld bead material.

The joint beads shall be rounded and uniformly sized around the entire pipe circumference. In general, the "V-groove" between the beads should not be deeper than half the bead height above the pipe wall. However, provided that each half of the final bead is of a similar size and shape and tensile testing shows that the strength and failure mode meet the requirements of this specification, the overall width and height of the bead should not be a critical factor in the assessment of a butt fusion joint. Guidelines from POP 003 for the joint bead width are:

| <u>Minimum Wall Thickness (mm)</u> | <u>Width of Bead (mm)</u> |
|------------------------------------|---------------------------|
| 11                                 | 9-12                      |
| 13                                 | 10-14                     |
| 16                                 | 11-15                     |
| 18                                 | 12-16                     |
| 19                                 | 12-18                     |
| 22                                 | 13-18                     |
| 24                                 | 14-19                     |
| 28                                 | 15-20                     |
| 30                                 | 16-22                     |

Internal beads shall be removed from pressure pipelines on manufactured bends and from gravity pipelines. The removal shall leave a smooth surface flush with the internal pipe wall. External beads shall not be removed, unless specified.

Bead removal in gravity pipes shall be confirmed by CCTV inspection in accordance with clause 14.7 – CCTV inspection.

#### 7.4.8 Joint Failure during Handling and Installation

If a joint fails during handling and installation, the Contractor shall inform the Engineer immediately. The Contractor shall provide the Engineer with the failed joint identification number and details of proposed actions to determine if the failed joint is an isolated incident or if it is a symptom of a more widespread problem, through the provision of a Non-Conformance Report.

No further pipe installation shall take place until the corrective action is accepted.

#### **7.5 *Measurement of Works and Basis of Payment***

Jointing shall be included in the pipe installation rate.

## **8 PIPE INSTALLATION**

All pipes shall be laid in accordance with the relevant current code, as listed in clause 2.0 – Related Documents, and the manufacturer’s instructions.

Pipes shall not be backfilled until the Contractor has obtained as-built measurements, in accordance with CSS: Part 1 - General and IDS: Part 12 – As-Built Records. The Contractor shall ensure that as-built measurements have been taken before backfilling.

### **8.1 *Line and Level***

Pipe inverts shall be laid to  $\pm 10\text{mm}$  of the design vertical alignment. Pipes shall be individually aligned to grade. Gravity pipes shall not be laid at a negative grade. Vacuum sewer pipes shall be laid within 0.05% of the design gradient.

Pipe alignments shall be positioned horizontally within the greater of 50mm or 5% of the pipe diameter from the location specified.

Under no circumstances shall the Contractor be permitted to locate or suspend centre lines from sight bars. An independent bar shall be used, placed as close to the ground as possible.

#### **8.1.1 Lasers**

Lasers shall:

- be self-levelling within a range of  $\pm 5^\circ$
- be robust and suitable for construction applications
- be protected from the effects of vibration

Self-levelling equipment shall be accurate to within  $\pm 0.002\%$  and shall be calibrated every 12 months.

Lasers should have a warning indication if the system is off-grade by more than 1mm in 10 metres.

#### **8.1.2 Use of Lasers**

Laser use shall comply with NZS 5821.2 “Plain language code of practice for the safe use of lasers in surveying, levelling and alignment”.

Regular checks shall be carried out of the laser to ensure that:

- the light beam is on grade

- the light beam is on line
- the light beam is set at the correct level above the invert of the pipe to be laid

Level checks shall be made against the site datum at each new manhole.

If the laser beam is showing evidence of being affected by hot or cold air currents, the Contractor shall stop laying pipe and take all necessary steps to remedy the problem.

## **8.2 *Cutting of Concrete Pipe***

Concrete pipes shall be cut with a stonemasons saw and exposed reinforcing coated with 5mm minimum depth of epoxy coating, applied strictly in accordance with the manufacturer's instructions.

## **8.3 *Cleanliness***

Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, etc. shall be thoroughly cleaned before jointing.

## **8.4 *Leaks***

The Contractor shall repair all leaks noted within the contract or defects liability period, including pipelines that have passed performance tests.

## **8.5 *Foundations***

### **8.5.1 Pipe foundations**

Where a “soft ground foundation” is required for part of a manhole to manhole length, the foundation shall extend from the pipe joint before the length to be supported to the pipe joint past the end of the length to be supported.

Install water stops where the soft ground foundation could be subject to scouring.

### **8.5.2 Treatment of Under-runners**

The Contractor shall notify the Engineer of any under-runners, erosion cavities or tunnel gullies encountered during excavation. The Engineer shall advise on under-runner treatment.

## **8.6 *Embedment***

Embedment shall be in accordance with SD 344. Embedment shall be compacted to the greater of the manufacturer's requirements or a minimum dry density of 2,050kg/m<sup>3</sup> at any point on any embedment constructed of M/4: AP20 materials.

Embedment for underchannel pipes shall be laid to ensure that excavation for the carriageway adjacent to the pipeline does not allow the collapse of the embedment or remove support for the concrete capping and kerb and channel.

Embedment shall be thoroughly worked into place, particular care being taken to ensure that the material is thoroughly compacted under the full length of the pipe. Where the pipes are larger than 460mm diameter, material shall be compacted by a power vibrator.

In liquefaction prone areas the Engineer may require the embedment and foundation to be protected by an approved geotextile complying with TNZ F/7.

Nuclear densometer use shall comply with CSS: Part 1 clause 32.5.1 – Compaction Tests. The dry density shall be determined in accordance with NZS 4402.4.1.3 “New Zealand vibrating hammer compaction test”. The maximum dry density shall be determined in accordance with NZS 4402.4.1.1 “New Zealand Standard Compaction test”. All nuclear densometer testing and results must be provided by an IANZ accredited tester.

#### **8.6.1 Pipe Installation on Hillsides**

Pipes laid on hillsides, or any other location where trench scour may occur, shall be haunched and surrounded using lime stabilised materials. For flexible pipes this shall be as shown on SD344/2 Type PH and for concrete pipes as shown on SD344/1.

Water stops shall be constructed where specified in accordance with SD 347 or as specified.

#### **8.6.2 Geotextiles**

Geotextile supply and installation shall be in accordance with TNZ F/7. Geotextiles shall have a minimum overlap of 500 mm or as shown in the Drawings.

Where specified, geotextile wrapping of joints shall extend at least 0.5m each side of the joint. The geotextile shall be snugly secured around the pipe with cable ties or similar.

### **8.7 *Pipe Protection***

#### **8.7.1 Minimum Cover to Flexible Pipes**

The minimum cover over flexible pipes with no special protection shall be:

- 750mm in roads and streets,
- 600mm in driveways, similar areas subject to traffic, footpaths, gardens and open country.

Stormwater laterals that discharge to the kerb shall be laid with the maximum cover achievable, up to these requirements.

PVC piping shall be protected with 6mm thickness of Denso tape or 250 microns polyethylene film or equivalent where adjacent to concrete.

**8.7.2 Concrete Protection Slab to Flexible Pipes**

Where cover over flexible pipes is less than the minimum stated in clause 8.7.1 Minimum Cover to Flexible Pipes, including temporarily under construction traffic, a concrete protection slab shall be provided. For flexible pipe diameters smaller than or equal to 300mm, the protection slab shall be constructed in accordance with SD 342. For flexible pipe diameters greater than 300mm, specific design is required.

When reinstating a concrete protection slab, the slab shall extend onto undisturbed ground each side of the trench.

**8.7.3 Concrete Capping**

Concrete capping to underchannel pipes shall be in accordance with SD 332. Concrete capping to underchannel piping shall be reinforced in commercial vehicle crossings only.

**8.7.4 Concrete Surround**

Concrete surround shall be in accordance with SD 342 except for underchannel pipes that shall be in accordance with SD 331. Concrete surround to underchannel piping shall be reinforced in commercial vehicle crossings only. PVC pipes shall not be concrete surrounded. Flotation of the pipe during the placement of concrete surround shall be prevented.

**8.7.5 Joint Formers**

Contraction joints shall be formed in concrete capping and concrete surround at pipe joints at a maximum spacing of 10m.

Joints can be formed by placing a spacer of soft board or equivalent in the concrete at the pipe joint.

**8.8 *Pressure Pipelines***

Pressure pipelines shall be haunched and laid in accordance with SD 344 and clause 8.7 – Pipe Protection. The full length of the pipe barrel shall bear continuously upon the haunching. Pressure pipes shall have a maximum cover of 1.5m unless specified otherwise.

The bearing capacity of the side support material, for curved pipelines with approved deflection joints, shall be checked to confirm it exceeds the specified capacity.

Mechanical couplers shall not be used on polyethylene pressure pipe of 90mm OD or smaller. Saddle joints shall not be used on pipes that are supplied in coils. Brass fittings shall not be used on wastewater reticulation.

Saddle or self-tapping joints may be used on pipes with an outside diameter (OD) of 90mm or greater. Self-tapping joints on branch pipes shall be at a depth of not less than 600mm. For pipes under 90mm OD, only electrofusion tee joints shall be used.

The use of squeeze off tools is strictly prohibited.

**8.8.1 Thrust blocks**

Concrete thrust blocks shall be constructed either in accordance with SD 346 or as designed in the locations specified. Thrust blocks must have developed adequate compressive strength before the pipeline is pressure tested.

The thrust block dimensions specified are the minimum for installation at the specified pressure.

Thrust blocks shall be poured against natural ground. If this is not possible, approved material shall be carefully backfilled and compacted in layers around and behind the thrust block.

The bearing capacity of the natural or filled ground shall be checked, to ensure it complies with the design capacity, before construction. Proof of this testing shall be provided through the Inspection and Test Plan in the Contract Quality Plan.

**8.8.2 Anchor blocks**

Anchor blocks shall comply with CSS: Part 4 clause 12.6 –Anchor Blocks.

**8.8.3 Valves and surface covers**

Valves shall be installed in accordance with CSS: Part 4 clause 12.2.1 – Valves. Surface boxes shall be installed in accordance with CSS: Part 4 clause 12.2.3 - Surface boxes and SD 385. Triangular valve spindle caps complying with SD 382 shall be installed on all wastewater pressure valves within legal road.

Road marking shall be undertaken in accordance with CSS: Part 4 clause 19.0 – Location Marking of Fire Hydrants and Sluice Valves. Pressure sewer system (PSS) in-line valve surface boxes shall be painted white except the valve at the dead end of the PSS reticulation, which shall be painted red Flush point covers shall be painted red.

PSS boundary kits shall be placed within the service strip and installed to SD 384. The cover shall be placed flush with the surrounding surface with the longer side parallel to the legal boundary.

Where there is a likelihood of vehicles driving over boxes, trafficable property boundary kits shall be used.

**8.9 *Subsoil Drains***

Subsoil drains shall be laid in accordance with SD 377. Subsoil pipes shall have minimum cover of 750mm within the roadway, 600mm in driveways and rights of way, and 500mm in other applications unless otherwise specified.

## **8.10 Pipelaying at Structures**

If entry openings are required in a precast or existing manhole and no knock out panels have been left, the openings shall be made using a diamond-cutting blade or hole saw. Under no circumstances shall a hammer or impact tool be used.

### **8.10.1 Yield Joints**

Yield joints shall be formed in accordance with SD 341. Yield joints at sumps shall be constructed with one short pipe and two yield joints.

Jointing of cut pipes to form a closure shall be avoided if possible. If such jointing is necessary, it shall be done with a gibault joint or with purpose built fittings provided by the pipe manufacturer.

Any adjustment of the length of the lay necessary to obtain yield joints at the structure shall be done to the approval of the Engineer.

### **8.10.2 Underchannel Piping**

Yield joints shall be constructed on concrete capped underchannel piping at all sumps.

### **8.10.3 Starters/Finishers**

Structures shall not leak at the interface with the starter or finisher.

### **8.10.4 Polyethylene Connection to Manholes**

Connections to concrete access chambers shall be in accordance with SD 341/3. Plastic Chambers shall have an approved purpose made connection.

### **8.10.5 Long Socket Connectors**

Flexible joints shall be formed in accordance with SD 341/4. No laterals shall be connected to the first pipe length laid into the long socket connector i.e. within 4.0m of the manhole. Ensure benching does not prevent the internal pipe moving into the manhole. The benching should be to a larger diameter than the long socket.

### **8.10.6 Collector sewers**

Collector sewers shall enter both the upstream and downstream manholes when laid directly over the sewer main. Caps are not required on the upstream end of the collector sewer. Drop structures are not required on the outlet where there is less than 1.0m between the invert of the collector sewer and the soffit of the sewer main.

## **8.11 Measurement of Works and Basis of Payment**

### **8.11.1 Pipe Installation**

Payment shall be per lineal metre, to the nearest 0.1m, based on the horizontal length of pipe installed. Lengths shall be measured from the

centreline of the on-line structure or from the termination point of the pipeline e.g. headwall, inlet. All structures shall be regarded as “extra over” the pipe installation rate for payment purposes.

Each type of pipe shall be measured and paid separately.

Pipe installation shall include excavation, work around services, support of existing services under 40mm diameter, supplying and laying, haunching, jointing, geotextile wrapping to joints, pipe testing, backfill placing (including supply), compaction to subgrade level and compliance testing in accordance with clause 15.4 – Quality Assurance.

All costs involved in the obtaining and providing of as-built records are scheduled separately.

#### 8.11.2 Embedment

Embedment shall be included in the rate for pipe installation. Where embedment is scheduled separately, it shall be paid per lineal metre, to the nearest 0.1m.

Embedment shall include the supply and placing of all foundations, haunching and pipe surround materials. This includes to 150mm above the barrel for ceramic and flexible pipes in accordance with SD 344.

#### 8.11.3 Geotextiles

Geotextile surrounds, cover over embedment materials and raft foundations shall be paid per lineal metre, to the nearest 0.1m, based on the horizontal length of pipe treated. Excavation, pipe installation, work around services and haunching are included in the rate for pipe installation.

Geotextile wrapping to pipe joints shall be included in the pipe installation rate.

Geotextiles shall include supply, installation, lacing or fixing and testing. No extra payment will be made for laps or returns. Soft ground geotextiles shall be paid per square metre of geotextile laid. Raft foundations include geogrid, geotextile and GC65-40.

#### 8.11.4 Pipe Protection

Concrete capping, surround and protection slabs are paid per lineal metre, to the nearest 0.1m, and shall include joint formers.

#### 8.11.5 Treatment of Under-runners

The treatment of under-runners shall be measured by the volume of fill placed, to the nearest 0.1m<sup>3</sup>. This rate shall include any labour and equipment required to place this material.



8.11.6 Water stops

Payment shall be per item. Where water stops are modified, their cost will be adjusted in accordance with the rates provided.

8.11.7 Thrust blocks

Payment shall be per item. This shall include confirming through site testing the capacity of the ground on which the thrust block bears. Where thrust blocks are modified, their cost will be adjusted in accordance with the rates provided.

8.11.8 Subsoil Drains

Subsoil drains shall be paid in accordance with clause 8.11.1 – Pipe installation. Subsoil drains shall include the supply and placement of geotextiles.

8.11.9 Pipelaying at Structures

Pipelaying at structures shall be included in the pipe installation rate. This item shall include all short pipes and special connectors required.

## 9 POLYETHYLENE PIPE INSTALLATION

All pipes shall be transported, haunched and installed in accordance with clause 8.0 – Pipe Installation, AS/NZS 2033 “Installation of polyethylene pipe systems” and the pipe manufacturer’s recommendations. Pipe shall not be bent to a radius less than 35 times the pipe OD. Pinching or squashing of polyethylene pipe to facilitate the installation of fittings is not permitted.

Polyethylene pipe shall be installed with curving radii greater than 100 x OD of the pipe where the pipe may be tapped on the bend or radii greater than 75 x OD otherwise.

### 9.1 *Pipe Installation by Trenchless Technology*

Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe and 20% of the pipe wall thickness for gravity pipe. Pipe shall not be bent to a radius less than 35 times the pipe OD.

The specified allowable load on the pipe shall not be exceeded during pulling.

Where gouging or notching exceeds the above limits or if buckling of the pipe occurs, that length of pipe shall be removed and a new section welded in at the nearest join.

The Contractor shall overtop the pipe by one lineal metre for each length of pulled pipe that is the greater of one manhole length or 200m. The excess pipe length shall be supplied to the Engineer for a visual inspection.

**9.1.1 Polyethylene Pipe Installation by Pipebursting**

Where the polyethylene pipe is to replace a live pipeline, the line to be burst shall be inspected by CCTV to locate all laterals and to check for any obstructions. Live laterals shall be confirmed through the use of dye.

**9.1.2 Polyethylene Pipe Installation by Slip Lining**

The host pipe shall be cleaned to provide a clear pipe diameter that passes the new polyethylene pipe without gouging or notching the pipe.

Disposal of the cleanings shall be carried out in accordance with CSS: Part 1 - General.

The Contractor shall not detrimentally affect the host pipe when cleaning it. The most effective method of cleaning steel pipes in Christchurch is through physical scraping.

Prior to any attempt to pull in the new polyethylene pipe a plug, no less than the diameter of the new pipe, shall be passed through the host pipe to ensure there is sufficient clearance.

**9.1.3 Polyethylene Pipe Installation by Directional Drilling**

The constructed pipe alignment shall not vary more than 100mm horizontally from the design alignment and the tolerance on the vertical alignment shall not exceed the specified amount except where the grade of the pipe is specified, in which case it shall be  $\pm 5$ mm from the design grade.

Cover to pipes of 100mm diameter or greater shall not be less than 750mm, unless approved by the Engineer. Cover to pipes smaller than 100mm in diameter shall be 750mm in driveways, similar areas subject to traffic, and elsewhere shall be 600mm. The maximum cover shall be 1.5m, unless approved by the Engineer.

All liquid waste shall be disposed of in accordance with CSS: Part 1 - General.

Clearances to services shall be in accordance with the particular Utility Operator's requirements. The Contractor shall be liable for damages to any underground services.

The Contractor shall accurately monitor the position of the drilling head to achieve the above requirements.

**9.2 *Access Pits***

| Pit<br>Depth | Minimum pit length (m) for pipe diameter (mm) |    |    |    |     |     |     |     |     |     |
|--------------|-----------------------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|
|              | 50                                            | 63 | 75 | 90 | 110 | 125 | 160 | 180 | 200 | 250 |

|     |     |     |     |     |     |     |     |     |     |      |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 0.6 | 2.0 | 2.2 | 2.4 | 2.7 | 3.0 | 3.2 | 3.6 | 3.8 | 4.2 | 4.6  |
| 0.8 | 2.2 | 2.5 | 2.8 | 3.1 | 3.4 | 3.7 | 4.2 | 4.4 | 4.8 | 5.2  |
| 1.2 | 2.6 | 3.0 | 3.3 | 3.7 | 4.2 | 4.4 | 5.0 | 5.4 | 5.8 | 6.4  |
| 1.6 | 2.9 | 3.4 | 3.8 | 4.2 | 4.8 | 5.0 | 5.8 | 6.1 | 6.6 | 7.4  |
| 2.0 | 3.2 | 3.7 | 4.1 | 4.6 | 5.2 | 5.6 | 6.4 | 6.8 | 7.2 | 8.2  |
| 2.4 | 3.3 | 3.9 | 4.4 | 4.9 | 5.6 | 6.0 | 7.0 | 7.4 | 8.0 | 8.8  |
| 2.8 | 3.4 | 4.1 | 4.6 | 5.2 | 6.0 | 6.4 | 7.4 | 7.9 | 8.4 | 9.6  |
| 3.2 | 3.5 | 4.2 | 4.8 | 5.5 | 6.2 | 6.8 | 7.8 | 8.4 | 9.0 | 10.0 |
| 3.6 | 3.5 | 4.3 | 5.0 | 5.7 | 6.6 | 7.1 | 8.2 | 8.8 | 9.4 | 10.6 |

Assumptions:

- a) New pipe is parallel with the road at the start of the pit and parallel (and in line) with the old pipe at the end of the pit. If this does not apply, calculate the minimum pit length from (b).
- b) Table is based on a minimum PE pipe bend radius of 35 times pipe OD.

Pipes shall be haunched through any pits in accordance with clause 8.0 – Pipe Installation.

### **9.3 Pressure Sewer Systems**

90 degree deflections on pressure laterals shall be constructed using two individual bends of 45 degrees.

### **9.4 Measurement of Works and Basis of Payment**

Where additional pipe is pulled to provide a sample for visual inspection of notching and gouging, the Contractor will be paid for a one-metre sample only.

#### **9.4.1 Pipe Installation in Open Trenches**

Payment shall be per lineal metre, to the nearest 0.1m, including pits and welds. Pipe installation shall include excavation, work around existing services, supplying, jointing, laying, haunching, provision of samples and testing, backfill placing and compaction. The supply of imported backfill is scheduled separately.

#### **9.4.2 Pipe Installation by Pipebursting**

Payment for pipe installation shall be per lineal metre, to the nearest 0.1m, including pits and jointing. Pipe installation shall include location of services, pipe bursting, pulling the pipe, haunching and backfilling in pits, including the supply of all materials, provision of samples and testing.

#### **9.4.3 Pipe Installation by Slip Lining**

Payment for pipe installation shall be per lineal metre, to the nearest 0.1m, including pits and jointing. Pipe installation shall include cleaning the host pipe and checking for clearances, pulling the pipe, haunching and backfilling in pits, including the supply of all materials, provision of samples and testing. Special anchor blocks are scheduled separately.

**9.4.4 Pipe Installation by Directional Drilling**

Payment for pipe installation shall be per lineal metre, to the nearest 0.1m, including pits and jointing. Pipe installation shall include determining the alignment, drilling, haunching and backfilling in pits, including the supply of all materials, provision of samples and testing.

## **10 JUNCTIONS AND RISERS**

### **10.1 *Junctions***

PVC junctions shall be formed with factory moulded junction fittings and in accordance with SD 363. PVC side junctions, inspection bends and ramped risers shall be metal haunched and surrounded. All junctions except for risers shall be fitted with their permanent seal before testing.

### **10.2 *Risers***

Risers shall be constructed where the main is greater than 1.8m below the finished road level, unless ordered otherwise by the Engineer.

This elevation may be altered to provide cover to the lateral at the road boundary as specified in clause 11.0 - Laterals. It may also be altered due to the presence of other services, the location of the water table, land levels and convenience of connection.

### **10.3 *End Plugging***

The ends of all junctions and riser pipes, if not brought into immediate use, shall be plugged with glued fitting.

### **10.4 *Polyethylene Junctions and Adaptors***

Fittings shall be approved and factory made. Jointing shall be in accordance with clause 7.0 - Jointing. Junctions shall be constructed in accordance with SD 364. Cut edges shall be left smooth.

The Contractor shall horizontally over-excavate each junction hole by 200mm to allow the new line to be properly haunched.

The Contractor shall not backfill the trench until the Engineer has inspected the connections.

### **10.5 *Measurement of Works and Basis of Payment***

#### **10.5.1 Junctions**

Junctions shall be paid per item and shall include all costs over normal pipe installation, concrete surround, short pipes and end plugging. Junctions shall also include the replacement of up to 1.0 metre of each sewer lateral. Any subsequent length of renewal shall be paid under laterals.

The position and number of junctions specified is a guide only, and the actual position, number, type, and setting will be determined on site.

#### 10.5.2 Risers

Payment shall be per metre, to the nearest 0.1m, measured from the face of the junction socket. Risers shall include the replacement of up to 1.0 metre of each sewer lateral. Any subsequent length of renewal shall be paid under laterals.

## 11 LATERALS

Laterals shall be constructed in accordance with clause 8.0 – Pipe Installation.

The existing main and laterals shall be kept in continuous operation until connected to the proposed piping.

The Contractor shall note that the exact location of some laterals is unknown.

The Contractor shall verify the reconnection to the new main of all live laterals. This may require the isolation of sections of the new main and flushing water down drain entries, gully traps or toilets to ensure each house is connected.

Where the existing lateral does not already have one, a new inspection point shall be installed at approximately 600mm, but not greater than 1.0m, inside the private property boundary.

### ***11.1 Laterals in Close Proximity to Trees***

All adaptor joints in laterals shall be a minimum of 3 metres from the trunk of any tree.

Laterals that are located beneath the area occupied by the canopy of any tree or within 3 metres of its trunk shall be renewed using an approved trenchless method of installation.

### ***11.2 Sewer Lateral Cover at Lot Boundary***

The invert level of the sewer lateral at the lot boundary should be a minimum of 1100mm below the finished surface or at a depth sufficient to adequately serve the whole lot. The cover over the barrel of the sewer lateral at the kerb should not be less than 800mm.

### ***11.3 End Capping and Marking***

Where gravity and PSS laterals are not immediately connected to property drains, the blank end shall have a watertight end plug fitted. The blank end of the pipe shall be marked with a 100mm x 25mm stake, installed prior to backfilling from the pipe end vertically to 150mm below design finished level.

The timber stake will facilitate as-built measurements and location of the lateral for later connections.

#### **11.4 Lateral/Mainline Sequence**

Where the ground is soft and liable to settlement or a traffic hazard will result, the Contractor should lay laterals after the main pipeline trench has been backfilled and compacted.

#### **11.5 Fluming of Disconnected Laterals**

To eliminate uncontrolled sewerage discharge into any excavation or pit, the main and/or lateral in each excavation must be temporarily flumed within two hours of severing.

The Engineer shall approve the Contractor's proposed method prior to use.

Council's Wastewater Overpumping Best Practice Guide is available at:

<https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/authorised-drainlayers/best-practice-guidelines>

#### **11.6 Laterals into Polyethylene Pipe**

Laterals shall be constructed in accordance with clause 9.0 – Polyethylene Pipe Installation.

The Contractor shall overtop the pipe by one lineal metre at one of the longer laterals. The excess pipe length shall be supplied to the Engineer for a visual inspection.

#### **11.7 Connecting to Existing Laterals**

PVC-U adaptors shall be installed over rubber rings onto earthenware laterals. The epoxy shall be screed off at a 45-degree angle.

New PVC-U laterals shall be connected to existing concrete laterals using stepped gibaults only. Gibaults shall be wrapped as specified in clause 7.1 – Mechanical Jointing.

#### **11.8 Measurement of Works and Basis of Payment**

Payment shall be per lineal metre, to the nearest 0.1m. Laterals shall be measured from the face of the junction socket. Laterals shall include all those items in pipe installation under clause 8.0 – Pipe Installation, fluming and the verification that laterals are live and have been connected, fittings, service support, backfill (supply and placement) and restoration.

##### **11.8.1 Laterals Requiring Structural Maintenance**

Existing laterals requiring structural maintenance shall be re-laid as ordered and payment will be made at the rate for installing laterals.

##### **11.8.2 Laterals into Polyethylene Pipe**

Laterals shall also include all those items in polyethylene pipe installation under clause 9.0 – Polyethylene Pipe Installation.

## 12 STRUCTURES

Structures shall be positioned within 50mm horizontally of the location specified. All structures shall be watertight.

### 12.1 *Reference Documents*

A copy of NZS 3109 “Concrete construction” shall be kept on site. The below clause references shall extend and modify NZS 3109 as stated.

‘Recommended practice’, as stated in NZS 3109, clause 1.2.1, shall be adhered to unless specified below. The "Construction Reviewer", defined in NZS 3109, clause 2, shall mean the Engineer.

### 12.2 *Quality Assurance*

#### 12.2.1 Contract Quality Plan

The Contractor’s project quality system should encompass all aspects of the concrete construction, but be not necessarily limited to:

- Concrete assessment (submit details in the Inspection and Test Schedule with tender) to NZS 3109.
- Inspection prior to placement of concrete (Concrete Pour Card Records).
- Reinforcement compliance records (e.g. Certificates of origin or Certification by a registered laboratory).
- Details of Concrete Supply to meet the requirements of NZS 3109.
- Proposed concrete mix designs.
- Daily Concrete Batch Records (including water content and moisture content of aggregates).
- Tolerance checks of critical items (e.g. checking cast-in weld plates).
- Monitoring of off-site precast manufacture.

The Contractor shall supply evidence of production quality standards to the Engineer in advance of construction by provision of the Certificate of Audit, required by NZS 3104, clause 2.16 – Quality Audit.

Details of the proposed methods and frequency of such activities, and the reporting of these, shall be set out in the Contractor’s Contract Quality Plan.

#### 12.2.2 Personnel

The Contractor’s Quality Controller shall complete and sign a written quality control check sheet for each off-site or on-site concrete pour, prior to any concrete being poured, to confirm that all work complies with the Contract documents. A typical check sheet is in Appendix 1.

The Contractor shall be represented on site by a competent leading hand (reinforcing), while steel is being placed. During pouring, the Contractor shall have appropriately skilled personnel on call to identify and correct any damaged or displaced reinforcing.

### **12.3 Reinforcement**

All reinforcement shall be micro-alloy steel manufactured by Pacific Steel Limited. 'Reidbars' shall be supplied by Reid Engineering Systems Limited.

The Contractor shall prepare reinforcement schedules from the contract drawings. Reinforcing bar shall be notated on the drawings as follows, unless noted otherwise:

R – Plain Grade 300  
D – Deformed Grade 300E  
RH – Plain Grade 500E  
DH – Deformed Grade 500E  
RB – Reid Bar Grade 500E

Further to NZS 3109, clause 3.3.4, bending of reinforcement shall conform to the minimum bend radii given in NZS 3101. Any reinforcement that does not comply shall be rejected and replaced.

Further to NZS 3109, clause 3.3.8, re-bending of Grade 500E reinforcement shall not be allowed. Any reinforcement that has been re-bent shall be rejected and replaced.

Further to NZS 3109, clause 3.4, steel reinforcement shall be stored on supports clear of the ground and shall be protected from sea spray, on delivery to site.

Further to NZS 3109, clause 3.5.1, where top steel in slabs is supported from bottom steel, a plastic spacer shall be placed beneath the bottom steel immediately under the top steel support.

Further to NZS 3109, clause 3.9, under no circumstances shall reinforcement be displaced from the positions shown on the drawings for the purpose of accommodating conduits or service pipes etc. of any description without the written permission of, and to the details specified by, the Engineer.

Further to NZS 3109, clause 3.7.1, lapping bars necessitates the Engineer's approval.

Splices in adjacent bars shall be staggered by at least 600mm. Bars with kinks or bends not shown on the drawings shall not be used.

Further to NZS 3109, clause 3.7.2, welding of reinforcement necessitates the Engineer's approval. No site welding shall be permitted under any circumstances.

If permitted, welding shall comply with AS/NZS 1554.3 "Structural steel welding - Welding of reinforcing steel". Grade 500 reinforcement shall not be welded without the development of a specific shop welding procedure.

The Engineer shall approve welders and shall inspect welds, where specified.



#### **12.4 Formwork**

All concrete exposed in the finished structure, and in particular that which is in frequently used public spaces, shall have the formwork and spacer layout approved by the Engineer prior to construction commencing.

Further to NZS 3109, clause 5.1.1, all concrete shall be placed in formwork unless specified or approved otherwise.

Formwork shall be inspected and levels checked immediately preceding the placing of reinforcement and any bulging, warping or lack of fit shall be remedied. The formwork for each section of concrete placement shall be completely constructed before concreting of that section is commenced.

Steel formwork shall have all joints welded and ground smooth and flush. All internal corners shall be formed by folding the steel, not by butting.

Further to NZS 3109, clause 5.1.2, concrete work that is misshapen or in any other way defective due to the inadequacy of the formwork, shall be rejected, removed and replaced or the defect remedied as directed by the Engineer, at the Contractor's cost.

Further to NZS 3109, clause 5.1.4, all insertions shall have a slight bevel to ensure easy removal without damage to the concrete.

Further to NZS 3109, clause 5.1.6, before the reinforcement is placed, and the interior surfaces of forms shall be treated with a release agent to prevent adhesion of mortar. Release agents shall be of a non-staining type applied in a thin film.

##### **12.4.1 Construction Requiring Support from Other Permanent Works**

Further to NZS 3109, clause 5.1.8, at least ten Working Days prior to the commencement of construction requiring support, the Contractor shall supply to the Engineer the following information:

- Details of scheduled removal of props or loading of support elements, including age of various levels of construction at critical stages.
- Calculations or a Producer Statement from a Chartered Engineer, demonstrating that the requirements of this clause are satisfied.
- Details of any concrete strength testing, additional to clause 12.17 – Compliance testing of this part, to demonstrate that adequate strength is obtained prior to removal of props.

In providing support to construction from a previously constructed structure, the Contractor shall plan the removal of propping such that stresses and deflections are not excessive as follows:

##### ***Construction Loads***

The construction loads imposed on a structure of age 28 days or more shall be such that the strength requirements do not exceed those induced by the

design loading, unless it is demonstrated by calculation that the strength requirements are within the capacity of the supporting structure.

Where the structure is less than 28 days old, the allowable load shall be appropriately reduced.

The Contractor is warned that leaving props in place may in some cases lead to an unacceptable accumulation of stresses in lower construction.

#### *Deflections*

Where construction loads on a structure are such that strength requirements are greater than those due to the design loading, or where a structure shall be loaded at an age less than 28 days, the Contractor shall demonstrate that calculated final deflections (following removal of construction loads and application of design loads) are either less than the calculated deflections which would be caused by the application of the design loading, or within acceptable limits as defined by the Engineer. Such calculations shall take into account, where appropriate, non-recoverable deflections due to creep of young concrete.

Further to NZS 3109, clause 5.3.2, the straightness over a 3.0m straightedge shall not disclose out-of-plane exceeding 1mm.

Notwithstanding the tolerances specified, no tolerances shall be permitted to accumulate to such an extent that the accurate placing of precast units to meet the tolerances shown in the Drawings, fixings, equipment, reinforcement, etc., is jeopardised.

Where an error requires correction between one bay and the next or between one level and the next, the Engineer shall approve such corrections in advance.

Further to NZS 3109, clause 5.4, the following minimum stripping times shall apply for the following classes of work:

| Class of Work                                                      | Portland Cement | Rapid Hardening Portland Cement |
|--------------------------------------------------------------------|-----------------|---------------------------------|
| Removal of formwork from walls and risers.                         | 48 hours        | 24 hours                        |
| Removal of formwork from haunching, junctions, etc.                | 24 hours        | 18 hours                        |
| Removal of props from manhole and flush tank slabs, culverts, etc. | 21 days         | 7 days                          |

All formworks shall be removed before backfilling. All external angles in exposed members shall be protected against injury after stripping.

Once the formwork has been stripped all tie holes, honeycombing and excessive blowholes shall be filled and sufficiently compacted with mortar composed of one part of cement to two parts of clean plastering sand. Care shall be taken to apply sufficient mortar to fill the voids, as it is not intended that the whole surface be coated. After the mortar has dried, but not set, the mortared surfaces and all abrupt changes, as defined in NZS 3114 Figure 1, shall be rubbed with a coarse carborundum stone to produce a smooth surface free from honeycombing, excessive blowholes and sharp abrupt changes.

### **12.5 *Precast Concrete Shop Drawings***

The Contractor shall produce and provide, if specified, fully detailed shop drawings for all precast concrete. These drawings shall be sufficient to enable fabrication of the structures to the dimensions, shapes and standards specified. The Engineer shall receive the shop drawings at least 5 working days before fabrication.

The Contractor shall ensure that:

- shop drawings are co-ordinated with the requirements of all other trades and other trade's shop details, in particular electrical, plumbing, drainage and steelwork
- all necessary site measurement and checking has been undertaken
- the shop drawings are co-ordinated with all Contract requirements

The Contractor shall advise the Engineer of any errors, omissions or conflicts found in the Drawings during the shop drawing preparation.

The Engineer shall review the shop drawings for design concept and general arrangement only. Dimensional accuracy remains the Contractor's responsibility. Drawings shall be provided to the Engineer 10 working days prior to manufacture of the precast units.

### **12.6 *Embedded Items***

Further to NZS 3109, clause 5.5, the Contractor shall check the requirements of other trades and shall be wholly responsible for the accuracy of locating all such items. All embedded items shall be accurately set and supported in place until the concrete has set.

Where pipes, castings, or conduits pass through a wall or floor, the Contractor shall place such pipes or castings in the form before placing the concrete. The Contractor may alternatively build boxes in the forms, where specified or as approved by the Engineer.

To withstand water pressure and ensure watertightness around openings, the boxes or cores shall be provided with continuous keyways and shall have a slight flare to facilitate concreting in walls and the escape of air entrained during concreting. Where possible, boxed holes shall be orientated with an apex over the pipe. The face between the boxed opening and void to be concreted shall be treated as a cold joint.

The pipes, castings or conduits shall be concreted in place under a concrete head of at least 100mm. The concrete shall be worked into place to completely fill the space between the pipes, castings or conduits and the sides of the openings to obtain the same watertightness as through the wall itself. Pipes less than 75mm diameter in cored holes shall be fixed in place as specified.

Where the floor of the structure is poured separately, the concrete in the vicinity of the embedded pipe shall be kept sufficiently low to ensure the gap between pipe and floor is a minimum of 50mm when the pipe is laid.

In water retaining structures the minimum cover to embedded tie bolts shall be 40mm. Tie boltholes shall be filled with dry pack mortar or an approved equivalent, within two days of the removal of formwork.

#### 12.6.1 Knock out Panels

The Contractor shall make provision for future pipelines by forming 80mm thick square panels at the required levels, where specified or directed by the Engineer. The panels shall be formed by boxing out 150mm thick recesses on the outer side of the wall. Unused knockout panels shall be filled with concrete to the structure's full wall thickness.

### 12.7 *Construction Joints*

Further to NZS 3109, clause 5.6.1, where construction joints in slabs are not detailed, the Contractor shall ascertain the requirements of the Engineer before commencing. Walls may be poured in lifts exceeding 3000mm provided that the Contractor can demonstrate to the Engineer his ability to do so properly and consistently.

Further to NZS 3109, clause 5.6.2.3, the Engineer reserves the right to nominate the method of repair, if edges at construction joints are damaged.

Further to NZS 3109, clause 5.6.3, all construction joints shall be prepared and constructed to meet the requirements for 'Type B' construction joints, unless specified otherwise.

The Contractor shall take special care at all construction joints to ensure that no joint will be a source of future weakness or leakage and that the specified surface finish is obtained either side of the joint. Approved water stops shall be used where specified or required by the Engineer. This is likely to be where there may be a head of water across the joint.

In general, construction joints shall be perpendicular to the principal lines of stress. Construction joints across embedded pipes and lower than half pipe level should be avoided as a "V" is created between the concrete and pipe and it is difficult to get a proper seal in this section of the joint when the next lift is poured.

Vertical construction joints shall not be permitted except where unavoidable and approved. Horizontal joints shall be evenly spaced, horizontal and continuous round any structure unless otherwise specified.

The joint surface shall be treated within 24 hours of casting. Concrete shall not be placed against a construction joint face within 24 hours of an earlier placement.

The Engineer shall approve any alternative joint surface preparation.

### **12.8 Supply of Concrete**

Further to NZS 3109, clause 6.1, no calcium chloride accelerator or similar chloride-containing admixture shall be added to any mix.

Further to NZS 3109, clause 6.2, all concrete shall be Normal (N), with sufficient cement quantity to ensure satisfactory finish and durability. The nominal maximum aggregate size shall be 19mm. The water content shall not exceed 170 kg/m<sup>3</sup>.

Where specified, waterproof concrete shall contain XYPEX Admix C- 1000 NF waterproofing admixture in accordance with the manufacturer's specifications.

If concrete does not comply with the slump specification on site, the Contractor may add superplasticiser to bring the concrete up to the specified slump. In all cases, the mix shall have been designed to be tolerant to this on-site modification. Full records of the addition of superplasticiser on site shall be kept on the delivery docket and on the plant batching records, including minimum mixing time after the addition of the superplasticiser.

Further to NZS 3109, clause 6.3, the specified strengths are shown in the Drawings, but generally 10 MPa for site concrete, 50 MPa for piles, 40 MPa for foundation elements, 30 MPa for precast and in-situ walls and floor slabs and 20 MPa for footpaths.

### **12.9 Concrete Placing, Finishing and Curing**

The Engineer shall be notified and given a reasonable opportunity (a minimum of 24 hours) to inspect formwork, reinforcement and construction joints before pouring commences.

Concrete that has partially hardened or has been contaminated by foreign materials shall not be deposited in the works. Retempered concrete shall not be used in the works.

Further to NZS 3109, clause 7.1, concrete shall not be pumped without the Engineer's prior approval. If approval is given, the concrete mix shall not be adjusted but the specified slump may be altered with the addition of superplasticisers. The Engineer requires notification in writing at least five working days before placement for approval.

Further to NZS 3109, clause 7.2, concrete shall not be placed when the outdoor shade temperature exceeds 25°C and no concrete shall be placed in water without the Engineer's approval. If approved, the mix shall be adjusted and the work carried out as required by the Engineer.

Concrete shall not be exposed to rain or sea spray during mixing, transport or placing or until it has set.

Further to NZS 3109, clause 7.4, concrete shall be deposited as near as practicable to its final position. It shall not be dropped from a height in excess of 2m except with the prior permission of the Engineer, nor shall it be dumped away from its final position and worked along the forms.

Except at permitted construction joints, concrete in each section of the work shall be placed in a continuous operation such that new concrete is constantly being placed against unset concrete to produce a monolithic mass.

All barrow runs, chute runs, pipelines, walkways and any other means of conveying concrete shall be adequately supported by independent means directly from the formwork and in no case shall the means of conveying the concrete be supported from or allowed to displace the reinforcement.

The Contractor shall organise the delivery of concrete in such quantities as can be effectively handled by the labour and equipment available. The Engineer may at his discretion order the Contractor to provide additional equipment or men to assist in placing concrete and/or alter the method of placing.

Further to NZS 3109, clause 7.7 and unless specified otherwise, the required finish shall be:

- F5 for precast units and all other visible concrete, except as below
- F4 for in-situ concrete where surfaces are not visible, except as below
- F3 for interiors of manholes, flush tanks and culverts
- U3 for slabs and manhole tops, except as below
- U5 for footpaths and bridge deck surfaces
- U1 for site concrete

Set concrete shall not be cut, hacked or cored unless specific approval is obtained from the Engineer.

For concrete at all surfaces (except floors) which will be visible on completion of the works, the minimum cement content shall be 350 kg/m<sup>3</sup> mixed concrete, and the maximum water cement ratio shall be 0.40. The Contractor shall allow for supplying a greater cement content than this should it be necessary to achieve the finish specified.

Further to NZS 3109, clause 7.8, the Contractor shall take adequate steps to prevent surface evaporation of mix water, without increasing the water content of the concrete.

These measures may include the provision of windbreaks or the application of a fine mist spray during concreting operations or any other measure approved by the Engineer.

Traffic shall be kept off all structures until they have achieved the specified strength.

Care shall be taken that no shock or vibration reaches concrete after setting until it is at least 3 days old, and that any starters projecting from green concrete are not shaken or disturbed. Concrete in which the reinforcement has been displaced shall be declared defective and shall be demolished.

Further to NZS 3109, clause 7.8.2, all flat slab work shall be wet cured by flooding or continually sprinkling for 24 hours after concrete finishing. After 24 hours, the surface shall be dried by squeegee for the immediate application of a 90% efficiency-curing compound, in accordance with the manufacturer's instructions. The Contractor shall ensure the curing compound proposed is compatible with the subsequent floor covering or paint finish.

Further to NZS 3109, clause 7.8.3, all vertical work, such as columns and walls, shall be cured by either leaving enclosed with formwork or tightly wrapping with polythene for at least 7 days after pouring.

#### 12.9.1 Precast Concrete

Each unit shall be cast in one continuous pour and shall be properly cured as soon as practicable after casting. Curing shall be by steam, wrapping in polythene or other method approved by the Engineer.

Finished units shall be crack free.

#### 12.9.2 Slabs

Slab surfaces shall be finished to a hard, smooth, polished finish which does not vary more than 5mm from a 3-metre straight edge and is free from trowelling ridges or other irregularities.

The slab shall be screeded off to the lines and grades shown on the drawings with a vibrating screed, followed at intervals by power float compaction. Extreme care shall be taken to ensure that vertical starter rods are not disturbed during power floating.

Tradesmen expert and experienced in this type of work shall carry out power floating, as the time and intervals for the execution of the work requires close judgement. The Contractor shall arrange the placement of slabs to allow adequate time to achieve this requirement.

An excess of fines shall not be worked to the surface, and no hand trowelling in of dry cement, fines or cement plaster will be permitted.

Where required to make good levels, an approved floor levelling compound shall be used.

Joints for slabs on grade shall be saw-cut within 24 hours of pouring to the specified pattern.

The Contractor shall protect the slab from damage and shall demonstrate that the slab has sufficient strength to resist applied loads.

#### ***12.10 Precast Concrete Handling, Transportation and Erection***

Units shall be handled, transported and erected so that they are not damaged or soiled. The Engineer shall reject any damaged unit.

Units shall be lifted by appropriate lifting equipment, using specifically designed lifting inserts only. The Contractor shall be responsible for the design, provision and subsequent removal and making-good of any lifting inserts. The Contractor shall also engage a Chartered Engineer to design any additional reinforcement required for the handling or cartage of the precast concrete and of lifting inserts.

Where possible, lifting inserts and temporary lateral supports shall be located on faces/sections of the panels that are not visible.

The Contractor shall notify the Engineer prior to the removal of temporary lateral connections and props.

An approved tradesman shall carry out mortar packing between units and grouting of ducts. Both the mortar and grout used shall be Conbextra GP or approved equivalent, used in accordance with the manufacturer's instructions.

The Contractor shall take all reasonable steps to ensure the colour of the surface finish achieved on the cast-in-situ joints, mortar packing and grouting matches that of the precast units.

##### **12.10.1 Tolerances**

The Contractor shall advise the Engineer, before construction begins, if unable to meet the tolerances inherent in the specification. The Contractor should be aware that the total tolerance indicated by a detail may require the co-operation of several trades (e.g. Precaster for fixings in precast work, Metalworker for brackets and the like, and Concreter for cast-in-situ fixings).

#### ***12.11 Manholes***

Standard manholes shall be in accordance with SD 302 or SD 303. Narrow and drop manholes shall be in accordance with SD 304 and SD 305.

The neck of a new standard manhole with a 600mm circular manhole cover shall not be deeper than 600mm. The neck of a new flush manhole or any manhole with a 450mm circular or rectangular manhole cover shall not be deeper than 450mm.

##### **12.11.1 Special Construction Joint**

The Contractor shall place a layer of malthoid between the top of manhole wall and the cast in-situ slab to form a special construction joint to allow for



the future alteration of the level of the manhole top. For all precast manholes, a riser with a minimum depth of 100mm shall be used under the slab.

12.11.2 Manhole Benching and Channelling

Manhole benching and channelling etc., shall be in accordance with SD 302, SD 303, SD 304 and SD 305. Manhole benching and channelling shall be constructed with 25 MPa concrete. All ironwork shall be in accordance with SD 301.

For pipelines exceeding 750mm in diameter, toe-holds shall be provided in the channelling.

12.11.3 Joints between Precast Risers

The joint between adjacent precast risers shall not exceed 5mm at any point. Joints shall be positioned as high in the structure as possible. An approved sealing strip shall be used in all joints.

12.11.4 Precast Manhole Tops

Precast manhole tops shall be in accordance with SD 302, SD 303 and SD 304. The tops shall be approved, unless permission is given by the Engineer to precast on site.

12.11.5 New Manhole on an Existing Pipeline

Where a new manhole is to be built over an existing pipeline, the pipeline and any concrete foundation or haunching shall be left intact. The area under this shall be excavated out to a minimum depth of 225mm and the new manhole base poured completely under this to the outside dimension of the manhole in one operation. Care shall be taken to ensure that the new concrete foundation is grouted and bonded to the existing concrete. The existing pipeline and any surplus haunching shall not be cut away until after the new branch pipeline is inspected and passed.

12.11.6 New Pipe Invert in Existing Manhole

Where the manhole invert is being adjusted to a higher pipe level, the manhole shall be filled with flowable fill or concrete to a level 50 mm below the new invert. Where the new invert is less than 200mm above the old invert, the benching shall be broken out to 50mm below the new invert and for 100mm each side of the new pipe diameter. Re-benching shall be in accordance with clause 12.11.2 – Manhole Benching and Channelling.

12.11.7 Manhole Openings

If entry openings are required in a precast or existing manhole and no knock out panels have been left, the openings shall be made using a diamond-cutting blade or hole saw. Under no circumstances shall a hammer or impact tool be used.

### **12.12 Flush Tanks and Manholes**

#### **12.12.1 Flush Tanks**

Flush tanks shall be located where specified and constructed and equipped in accordance with SD 311.

#### **12.12.2 Flush Manholes**

Flush manholes shall be constructed in accordance with SD 302 and SD 312. The 25mm galvanised wrought iron supply pipe shall be fitted to a star socket cast into the precast wall at the time of manufacture.

### **12.13 Frames and Lids**

Frames shall be seated evenly on a bed of cement sand mortar. The mortar thickness shall not be less than 10mm or more than 25mm.

The frames shall be fixed into the rebates with asphaltic concrete, cement sand mortar or concrete with a 6mm maximum aggregate size. Accelerating admixtures may be used.

Frames shall be located to permit a solid 250mm diameter pipe free access to the base of the structure.

Where asphaltic concrete is used the surfaces of the frame and concrete rebate shall be primed with bituminous emulsion and the asphaltic concrete placed and thoroughly rammed in 300mm layers.

All concrete structures in grass areas are to have a concrete margin around the frame.

### **12.14 Air Gap Separators**

Air gap separators shall be installed where specified and in accordance with SD 313.

The Engineer shall verify the operation of the air gap separator and the watertightness of the plug in the flush tank or flush manhole.

### **12.15 Other Minor Structures**

Other structures shall include sumps, headwalls, beams, inspection chambers, house drain sumps and house drain inspection boxes. These structures shall be constructed in accordance with SD 321, SD 322, SD 324, SD 325, SD 327, SD 328, SD 371, SD 372, SD 375, SD 376 and SD 378.

### **12.16 Concrete Repair**

The Contractor shall advise the Engineer of any defective concrete. No repairs shall be undertaken without the approval of the Engineer. Provide a non-conformance report as detailed in IDS, clause 3.7 – Non-conformance and quality improvement.

The Contractor shall provide a method statement prior to commencing any repairs to concrete. The method statement shall include appropriate details of the extent of repair work proposed, the extent and type of preparation, type of repair materials and method of application, protection and curing methods, standard of finish which will be achieved and

other relevant details. The Contractor shall allow the Engineer reasonable time to review, comment, accept or reject the proposed repair method before commencing work. Such rejection may require the defective concrete to be removed and replaced.

Completed repair works shall comply with the specification or as otherwise accepted by the Engineer, which shall include a finish consistent with the surrounding areas. Special attention may be required to achieve acceptable long-term surface finish match (e.g. colour, texture, etc.) to visible areas.

#### ***12.17 Compliance Testing***

Further to NZS 3109, clause 9, all concrete shall have a slump of 80mm with a tolerance of +0mm - 20mm, unless specified otherwise. The Contractor shall carry out concrete compression tests and slump tests where ordered by the Engineer.

#### ***12.18 Measurement of Works and Basis of Payment***

##### ***12.18.1 Concrete Construction***

Concrete construction shall be included in the rate for the structure being constructed. This rate shall include all formwork, detailed inserts and fittings, reinforcing, joints, mortaring and materials. It shall also allow for any details specifically for associated trade work.

All specified testing of materials prior to, during and after placement shall be included in the rate for concrete construction. Unspecified complying tests shall be paid as a variation.

##### ***12.18.2 Manholes***

Manholes shall include excavation and disposal of spoil, metal foundations, supply and installation or construction of the structure, all benching, jointing, ironwork including frames and lids, restoration of unused knockout panels and backfilling.

Where a manhole location is altered and the depth of the altered manhole is within 300mm of the depth of a scheduled manhole it shall be paid at that rate. If outside this limit a variation will be ordered.

New pipe invert in existing manhole shall include breaking out and disposal, supply and placement of filling, benching, jointing, adjustments to ironwork.

##### ***12.18.3 Flush Tanks and Manholes***

Flush tanks and manholes shall include excavation and disposal of spoil, metal foundations, supply and installation or construction of the structure, all benching, jointing, iron work including frames and lids and backfilling.

##### ***12.18.4 Air Gap Separators***

Air gap separators shall include excavation and disposal of spoil, foundations, supply and installation or construction of the fitting, all jointing, plumbing and backfilling.

Where the air gap separator is installed as part of a Council contract, the Council shall supply the air gap separator parts shown on SD 313. The Contractor shall supply all benching, jointing, ironwork, restoration of unused knockout panels and backfilling.

For beams, the cost of pipelaying shall be included in the rate for Pipelaying unless otherwise specified.

House drain inspection boxes do not include the saddle in or kerb entry adaptor.

#### 12.18.5 Other Minor Structures

Other structures shall include excavation and disposal of spoil, metal foundations, supply and installation or construction of the structure, all benching, jointing, ironwork, restoration of unused knockout panels and backfilling.

The rate for sumps includes maintaining a clear sump well to at least 100mm below the invert of the lowest pipe over the Defects Liability period and to clean the sump well completely at the end of the Defects Liability period.

For beams, the cost of pipelaying shall be included in the rate for Pipelaying unless otherwise specified.

House drain inspection boxes do not include the saddle in or kerb entry adaptor.

#### 12.18.6 Concrete Repair

The Contractor shall not be entitled to additional payment for the repair of defective concrete construction.

### **13 CONNECTIONS AND ALTERATIONS TO EXISTING SYSTEM**

The Contractor shall ensure that no dirt or debris enters the existing system.

Where pipes are to be connected to existing pipes or structures the Contractor shall expose the existing system well ahead of the work so that levels and positions can be checked.

#### **13.1 *Lined Pipes***

Sealing of lateral connections lined pipes shall be achieved by installing a cured-in-place liner.

- A resin impregnated junction liner shall be inserted within the existing pipeline to the lateral junction position.
- The resin impregnated junction liner shall be pressed against the host pipe.

- The resin impregnated liner shall be cured in place, joining the cured liner to the existing adjacent lateral pipeline, and sealing the installed liner at lateral openings.

Lateral Junction Repairs (LJR) shall comprise of either:

- A tee that bonds to the full circumference of the main pipe liner or host pipe, and the lateral pipe; or
- A ‘Top Hat’, consisting of a tube that seals to the lateral pipeline and a ‘brim’ that seals to the liner or host pipe around the lateral opening.

The LJR shall be made of a resin that has low susceptibility to shrinkage and provides a bond between the LJR and the host pipe or liner, demonstrated by the fact that there shall be no visible annulus gap around the installed LJR. Polyester resins are not suitable as they will not satisfy these requirements.

The fabric used for the LJR shall be flexible enough to mould to the host pipe and lateral, providing a smooth finish with minimal wrinkles.

### ***13.2 Measurement of Works and Basis of Payment***

Connections and alterations shall be included in the rate for pipe installation, unless scheduled separately. This rate shall include exposing the existing system ahead of the work, any necessary dewatering and pumping or fluming of the existing pipe flow.

## **14 PERFORMANCE TESTING**

The Contractor shall perform tests as detailed below on all newly installed pipework. The Engineer shall be present at all site tests and shall be given 24 hours’ notice.

### ***14.1 Equipment***

Gauges used shall have a maximum reading of no more than twice the test pressure. Gauges and meters shall be calibrated at 12-month intervals.

The testing apparatus shall be equipped with a pressure relief device to prevent loading the test section with the full capacity of the compressor.

The Contractor shall arrange water supply for and the removal of water from pipelines or structures after each test.

### ***14.2 Gravity Pipelines***

All gravity pipelines irrespective of the material, shall be subjected to a hydrostatic and/or air test and a visual inspection. Pipes over 450mm diameter shall not be subject to an air test. Pipes shall be visually checked before final haunching of the pipeline or backfilling of the trench will be permitted.

Comply with the losses and test periods as tabulated in the Gravity Pipe Test Check sheets in Appendix XIV of IDS: Part 3 – Quality Assurance, as modified by the Engineer.

If the pipeline fails the air test, the cause of failure shall be detected by audible or visual means and rectified and the test repeated. If no defect can be detected the Contractor may either:

- wet the pipeline internally and/or externally and repeat the air test or
- carry out a hydrostatic test.

If the pipeline barely passes the air test, the Engineer may require a hydrostatic test. Concrete pipes over 600mm diameter may be subjected to an individual hydrostatic joint test to ASTM C1103M – 03 Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.

#### 14.2.1 Structures

The Engineer may request a hydrostatic test be applied to any structure. When applied to any flush manhole, flush tank or sump, the head shall be fixed at ground level.

#### 14.2.2 Testing Junctions

Testing junctions shall be installed where ordered. After testing, all testing junctions shall be plugged and concrete or ceramic pipes shall be surrounded with 100mm minimum thickness of concrete.

#### 14.2.3 Visual Inspection

Each pipe and joint shall be visually checked for ring location, leakage and defects before any concrete haunching of the pipeline or backfilling of the trench will be permitted.

Where pipes are to be metal haunched only sufficient foundation and haunching metal shall be placed prior to testing to ensure adequate stability of the pipes. Metal shall be placed to allow a full visual inspection of all joints and the maximum possible inspection of the barrel.

#### 14.2.4 14.2.4 Hydrostatic Test

The level of water in the testing equipment shall not drop more than the allowable loss over the period of the test under the specified pressure. The rate of drop in water level in the testing equipment will not be accepted as the only measure of water tightness of the line. No part of the pipeline shall be subjected to a head of water greater than 6 metres, for safety reasons.

The pipe shall be tested with a minimum head of water above the internal crown of the pipe at the upper end of the pipe equal to 1.2 metres.

The test pressure shall be maintained for a minimum period of 5 minutes or the time required to enable a full visual inspection of the pipeline under test where it is greater than 5 minutes. Concrete pipelines should be stabilised, i.e. soaked and bled of air, before commencing the test period.

#### 14.2.5 Air Test

The air test shall be carried out to the requirements of AS 2032 but the test pressure shall be 10 kPa and the pressure in the test section shall not drop more than 200mm (2 kPa) over the period of the test.

Concrete pipes should be water soaked for 24 hours before the test and stabilised for at least 15 minutes before commencing the test period.

For safety reasons, plugs must be well braced into position as the failure of a plug could result in serious injury.

### 14.3 *Pressure Pipelines*

Pressure pipelines shall be water tested in-situ, to the specified in-ground pressures, when fully haunched and backfilled. Complete the Pressure Pipe Test Check sheets in Appendices XV and XVI of IDS: Part 3 – Quality Assurance, as modified by the Engineer.

Polyethylene pressure tests shall only be carried out by approved testers who have been named in the Contract Quality Plan. Approved testers hold the applicable registration on the Council Approved PE Testers Register, as listed on the Council webpage: <https://www.ccc.govt.nz/consents-and-licences/construction-requirements/approved-contractors/pe-pressure-testers/>

The Contractor shall pressure test the whole pipeline. It is recommended that testing also be carried out in shorter lengths. The Contractor may carry out intermediate air tests to a maximum of 98kPa. These tests will not be accepted as compliance tests.

It is acceptable to test against a closed valve provided the rated pressure (PN rating) of the valve is not exceeded, and appropriate precautions are in place in the event of failure.

#### 14.3.1 Concrete Pipe

Test points in concrete pressure lines may comprise either three special short pipes, the central pipe being connected to the outer two by gibault type joints or alternatively a standard length pipe may be cut into three sections using a stonemason saw, the cut surfaces being protected as specified in clause 8.2 - Cutting of Concrete Pipe.

Pipes shall be left full of water for a minimum of 24 hours before the tests, to allow them to become fully hydrated.

Increase the pressure. The rate of pressure increase or decrease shall not exceed 70 kPa per minute and no pressure surges will be permitted.

Working Pressure Test

Increase the pressure to the specified working pressure. The pressure shall be maintained for a period of three hours and the pipe shall show no water loss.

#### Maximum Operating Pressure Test

Increase the pressure to the specified maximum operating pressure. The pressure shall be maintained for a period of five minutes and the water loss from the pipe (measured in millilitres per hour) shall not exceed  $0.3 \times \text{length (metres)} \times \text{diameter (millimetres)}$ .

The loss from the line shall be determined by measuring, with an accurate water meter, the amount of water required to hold the pipe at test pressure.

### 14.3.2 Polyethylene Pipe up to DN 315

A compliant pressure test is to be undertaken once all civil works have been completed, e.g. all roads and footpaths are fully constructed.

A pressure test shall be carried out in accordance with clause 6.3.4.4 and Appendix M Method 7 of AS/NZS 2566.2 “Buried flexible pipelines – Installation”. A graphical plot of the pressure test shall be supplied to the Engineer with the test readings.

Further to clause M7.6, the minimum monitoring period shall be 90 minutes (i.e. not 30 minutes to clause 6.3.4.4 (c) but 90 minutes to clause (d)) and the allowable pressure drop is from the maximum rebound pressure achieved over the monitoring period, typically experienced within the first 30 minutes.

The graphical plot shall be generated by a calibrated data logger and shall clearly show the pressure fluctuations, the rebound and the decay curve.

The Contractor shall ensure air does not enter the pipeline either during filling from a hydrant or if using a water blaster to pressurise the line. The Contractor shall present a methodology to remove the air, typically through swabbing, opening valves or flushing. This may require additional isolation valves for testing in sections or additional air egress points.

The test pressure shall not exceed 1.25 times the derated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.

For 25m or shorter sections of DN 50 PSS pipe and smaller, or shorter than 25 m, the Visual Test in accordance with AS/NZS 2566.2 clause 6.3.4.5 Appendix M8 ‘Visual Test for Small Pipelines’ for Small Pipes may be used (design pressure 1350 kPa).

All electrofusion saddle tees shall be tested using the Visual Test for Small Pipes prior to the wastewater main being cut (tapped).



#### 14.3.3 Polyethylene Pipe over DN 315

A compliant pressure test is to be undertaken once all civil works have been completed, e.g. all roads and footpaths are fully constructed.

A pressure test shall be carried out in accordance with clause 6.3.4.2 and Appendix M Method 5 of AS/NZS 2566.2. A graphical plot of the pressure test shall be supplied to the Engineer with the test readings. Swab the pipeline to remove air before carrying out the pressure test.

The test pressure shall not exceed 1.25 times the derated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.

#### 14.3.4 Self Tapping Electrofusion Saddles

A pressure test shall be carried out in accordance with clause 6.3.4.5 and Appendix M Method 8 of AS/NZS 2566.2.

#### 14.3.5 PVC, Ductile Iron, Glass Reinforced Plastic Pipe

A pressure test shall be carried out in accordance with clause 6.3.4.1 and Appendix M Method 4 of AS/NZS 2566.2.

The test pressure shall not exceed 1.25 times the rated pressure of the lowest rated component but shall be at least 1.25 times the specified maximum operating pressure.

### **14.4 *Vacuum Sewer Tests***

Vacuum testing of all vacuum mains, including vacuum service laterals, shall be undertaken in accordance with WSA-06 Vacuum Sewerage Code of Australia, Section 41.4. The 'Complete Sewer' vacuum test as specified in WSA-06 Section 41.4.4 may be applied to complete zones (mains) individually, or to the entire system.

Vacuum interface valves shall be removed and the pipe connection plugged, or alternatively if provided the isolation valve in each chamber shall be closed. Vacuum testing must not be carried out against interface valves as the valves may not seal perfectly during the test.

The vacuum pressure test record chart/plot shall be provided with the Compliance Requirements Check sheet.

### **14.5 *Polyethylene Pipe Weld Tests***

Welds shall be inspected in the field and assessed in accordance with the requirements of AS/NZS 2033 "Installation of polyethylene pipe systems".

Pipe and fitting batches are defined as per AS/NZS 4129, AS/NZS 4130 and AS/NZS 4131.

Testing shall be carried out in an approved laboratory. All weld samples submitted for testing shall be accompanied by a completed "PE Pipe Weld Sample Testing Submission Form". All pre-construction and during construction test results (passing and failing) shall be forwarded directly from the testing laboratory to Council via the following email address: [PEWeldTestResults@ccc.govt.nz](mailto:PEWeldTestResults@ccc.govt.nz). The Contractor shall collect all the samples after testing for Electrofusion, Butt fusion and Saddles, and store them securely until the end of the defects notification period.

Additional test joints shall be made and tested if there is any change to machine, operator, pipe supplier or PE material.

#### 14.5.1 Pre-construction Joint Testing – Electrofusion

For pipes with nominal diameters 90mm and larger and pipe wall thicknesses <50mm, joints shall first be tested in accordance with ISO 13954 "Peel decohesion test for polyethylene (PE) electrofusion assemblies of nominal outside diameter greater than or equal to 90 mm" and ISO 21751 "Plastic pipes and fittings – Decohesion test of electrofusion assemblies – Strip-bend test". For pipe diameters smaller than 90mm, joints shall be tested in accordance with ISO 13955 Crushing decohesion test. For pipes with wall thicknesses of 50mm and above, joints shall be tested to ISO 21751 only.

The Contractor shall complete two joints for each differing pipe batch (and batch of fittings as applicable), using the machine and operator named in the Contract Quality Plan.

The samples shall first be tested to ISO 13954. The percentage brittle failure (non-ductile including any air voids) for any sample shall be less than or equal to 33.3% of the measured length of the fitting's winding wires within the fusion zone. The brittle fracture length (non-ductile including any air voids) shall be the sum of the brittle (non-ductile) portions between the first and last winding in the electrofusion socket.

Any sample that does not peel (fail) through the coupler fusion zone shall then be tested to ISO 21751.

Results shall include a commentary on and photos of the failure mechanism, including: peel quality, gaps and insertion into the coupler, joint alignment, melt flow into cavity. Failed joint samples shall be made available to the Engineer if requested.

The jointing log sheet shall be supplied for each test.

14.5.2 Pre-construction Joint Testing – Electrofusion Saddles

Saddle joints shall be tested in accordance with ISO 13956 “Decohesion test of polyethylene (PE) saddle fusion joints - Evaluation of ductility of fusion joint interface by tear test”. Saddle joints on pipes with diameters greater than DN 250 shall only be tested to ISO 21751 “Plastic pipes and fittings – Decohesion test of electrofusion assemblies –Strip bend test”.

The Contractor shall complete two joints for each differing pipe batch (and batch of fittings as applicable), using the machine and operator named in the Contract Quality Plan.

The percentage brittle failure (non-ductile including air voids) for any sample shall be less than or equal to 50% of the measured length of the fitting’s winding wires within the fusion zone for the calculation of Ld (brittle length) and 25% for the calculating of Ad (brittle area). The brittle fracture length (non-ductile including any air voids) shall be the sum of the brittle (non-ductile) portions between the first and last winding in the electrofusion saddle.

Any pipe that returns a test result with no separation between the saddle and the pipe shall be retested to ISO 21751 to return the measurement for Ld.

Results shall include a commentary on and photos of the failure mechanism, including: peel quality, gaps and melt flow into cavity. Failed joint samples shall be made available to the Engineer if requested.

14.5.3 Pre-construction Joint Testing – Butt Fusion

One joint and one section of virgin pipe, for each pipe diameter and material type supplied for the project, shall be tested in accordance with ISO 13953 “Polyethylene (PE) Pipe and Fittings – Determination of the tensile strength and failure mode of test pieces from a butt-fused joint”.

Results shall include a commentary on the failure mechanism. Failed joint samples shall be made available to the Engineer if requested.

The Contractor shall complete the joint using the machine and operator named in the Contract Quality Plan, to demonstrate that the methodology and fusion parameters proposed will produce acceptable fusion joints. The weld bead shall comply with clause 7.4.7 – Bead Profile. The relevant jointing log sheet and a graphical plot of the load versus extension shall be supplied for each test. Ductility shall be evident through the plot showing a rounded top and an extended sloping recession leg. The load- extension graph may be used by the Engineer in assessing the results of the test.

The joint must fail at a stress which is greater than 90% of the virgin pipe material and shall rupture in a ductile manner.

The cut-out joints shall be of sufficient length to make test pieces that comply with the requirements of ISO 13953. Where the nominal pipe wall thickness > 40 mm, both modified Type A and Type B specimen shall be tested. A modified Type A test piece shall be produced by machining a similar amount from each side of the test piece to reduce the wall thickness to 22 mm  $\pm$  2 mm. Where the wall thickness is <40mm, standard test pieces shall be used as specified in ISO 13953.

If satisfactory tensile test results cannot be obtained and appropriate ductility of the rupture surface is not illustrated by the load-extension graph and associated photographs, the Contractor shall provide the Engineer with details of the proposed actions to determine the cause of the problem, through the provision of a Non-Conformance Report (NCR). The NCR shall include assessments of the welding parameters and cleanliness in particular, and include the methodology as defined in clause 7.3.1 - Methodology. It shall also address the ability of the welding machine to maintain parameter pressure and heater plate temperature. No further pipe installation shall take place until the corrective action is accepted.

#### 14.5.4 Joint Testing During Construction – Electrofusion and Electrofusion Saddles

One random site constructed joint shall be tested for every 20 joints constructed for each differing pipe batch (not fitting), in accordance with clause 14.5.1 – Pre-construction Joint Testing – Electrofusion or clause 14.5.2 – Pre-construction Joint Testing – Electrofusion Saddles.

Where the joints constructed are between 5 and 20, one joint shall be tested. Lengths comprising less than 5 joints shall require only pre-construction testing. The Engineer shall select the joints for testing.

| Joints Constructed | Joints Tested   |
|--------------------|-----------------|
| < 5                | 0*              |
| 5 - 20             | 1               |
| > 20               | 1 per 20 joints |

Note: \*Pre-construction test only

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in clause 14.5.6 – Joint Test Failures.

#### 14.5.5 Joint Testing During Construction – Butt Fusion

One random joint per pipeline for every 20 joints constructed shall be tested for each differing pipe batch in accordance with clause 14.5.3 – Preconstruction Joint Testing - Butt Fusion. Type B tests only are required where the nominal pipe wall thickness is greater than or equal to 25 mm.

Where the joints constructed are between 5 and 20, one joint shall be tested. Lengths comprising less than 5 joints shall require only pre-construction testing. The Engineer shall select the joints for testing.

The Contractor shall instruct the approved laboratory to immediately forward all weld test results directly to the Engineer. Failure of any joint test will require the Contractor to follow the process set out in clause 14.5.6 – Joint Test Failures.

#### 14.5.6 Joint Test Failures

Where a weld fails the test, the Contractor shall cease welding and no further pipe installation shall be carried out. The Contractor shall review the jointing process and test commentary to determine the cause of the unsatisfactory joint, the proposed corrective actions and report these to the Engineer, through a Non-Conformance Report (NCR) complying with IDS, clause 3.7.1 - Control of non-conforming work. The diagram illustrates the process. Council acceptance shall be obtained for all concessions.

If the Engineer considers that the weld has failed for reasons beyond the approved welder's control, the welding methodology shall be amended to incorporate any corrective actions arising from the NCR and then utilised for all subsequent welds.

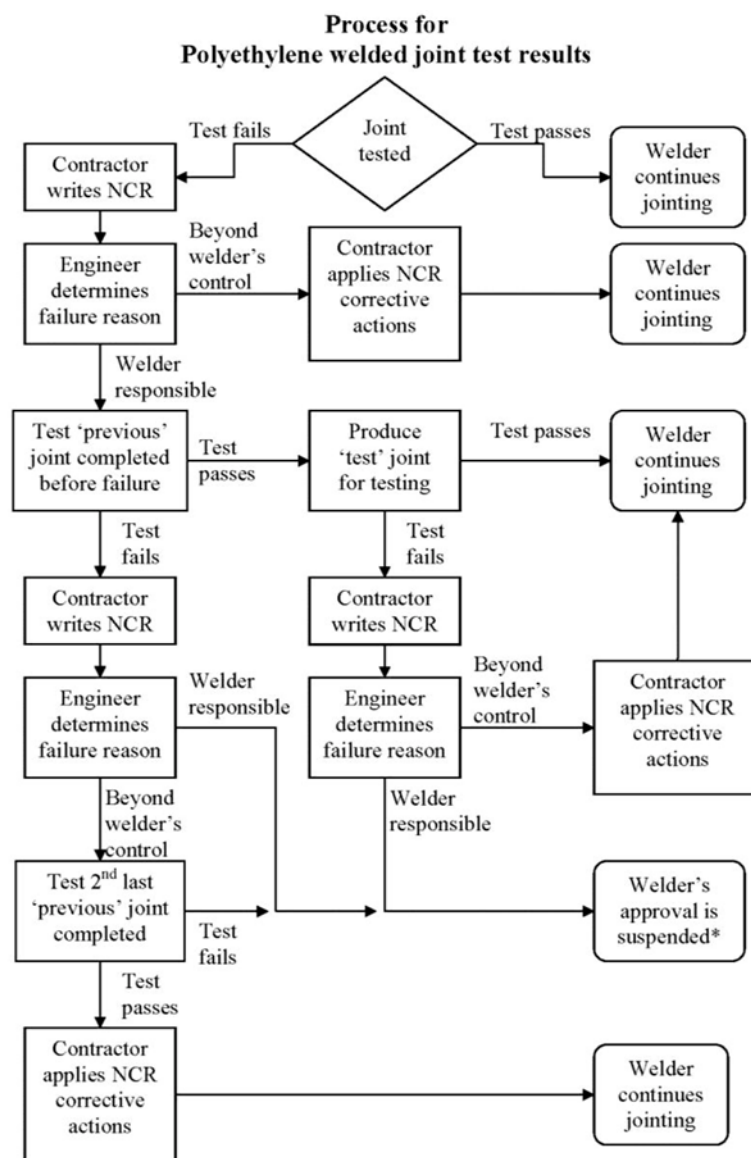
If the non-conforming weld is due to the approved welder's action, the Contractor shall remove the 'previous' joint for testing, as per the chronological order of jointing. The section of pipe from the location of the failed joint to the last passing test shall be quarantined and not installed.

If this joint complies, the welder shall produce a 'test' joint.

Jointing shall not recommence until the NCR process is completed as above and the welder has received complying weld test results from the 'previous' joint and from the 'test' joint, as set out in the flow chart.

If either of the second joint tests (the 'previous' and 'test' joints) are unsatisfactory an NCR shall be produced and assessed as above.

If the failure of the 'previous' joint is not attributable to the approved welder, the Contractor shall remove the second to last 'previous' joint for testing. If the failure of the 'test' joint is not attributable to the approved welder, the NCR process shall be completed as above and jointing can recommence.



\*The welder's approval to work on this project under the Contract Quality Plan is revoked. An application for approval of an alternative welder, with the applicable qualifications and experience, should be made as an amendment to the Contract Quality Plan.

If the failure is due to the approved welder's actions or the 2nd last 'previous' joint fails, the Contractor shall cease welding until an alternative approved welder is accepted through the Contract Quality Plan. The NCR shall be sent to Council via [PEWeldtestresults@ccc.govt.nz](mailto:PEWeldtestresults@ccc.govt.nz) to support a reassessment of the welder's continuing registration. If the 2nd last 'previous' joint passes, the NCR process shall be completed as above and jointing can recommence.

Continuing installation and backfill of pipe joints made prior to the 'previous' test failure may not occur until the Contractor has satisfied the Engineer that the joints in this pipe are satisfactory. This may require either that further joints are tested or that all the suspect joints are cut out and re-welded or a combination of both.

#### **14.6 Flexible Pipe Ovality Test**

An ovality test shall be carried out on gravity pipelines in accordance with clause 6.5 of AS/NZS 2566.2 “Buried flexible pipelines – Installation”. The test shall be carried out at least seven days after the pipe surround is laid. Deformation exceeding the specified amount shall be corrected or the pipe replaced.

Guidance on PVC pipe ovality testing is found in Appendix 8 – “PVC Pipe Ovality Testing Guide (Dec 2020)”.

#### **14.7 CCTV Inspection**

All gravity wastewater pipelines and laterals shall pass a CCTV inspection, carried out after completion of all construction works. This shall only apply to pipes to be vested in Council ownership, which cover one manhole length or more, and to laterals within legal road.

Stormwater pipelines of 225mm diameter and above shall pass a CCTV inspection, carried out after completion of all construction works. This includes all pipes or box culverts to be vested in Council ownership:

- connected to a manhole or inspection chamber;
- connected to an outfall structure;
- between sumps, located outside the legal road but to be vested;
- between headwalls, located outside the legal road but to be vested.

CCTV footage and electronic log sheets shall be processed into an InfoAsset compatible form by an approved CCTV data management provider and then provided through the web-based Feature Manipulation Engine (FME) portal to Council. Council approved CCTV data management requirements are listed in the latest Christchurch City Council Pipeline CCTV Specification.

The footage shall be assessed in accordance with the latest version of the Christchurch City Council CCTV Specification, and any defect not listed in the table of acceptable condition codes (refer to table 3 in Section 5.4 for newly constructed pipelines and Table 4 in Section 5.6 for newly lined pipelines) shall be rectified.

The CCTV summary sheets and as-built drawings shall be provided in electronic format directly to the Council as part of the as-built record submitted through the Contract Quality Plan. The as-built drawing shall clearly show pipe locations, pipe dimensions and IDs.

The latest version of the Christchurch City Council CCTV specification is available on the Council website at <https://ccc.govt.nz/consents-and-licences/construction-requirements/construction-standard-specifications/pipeline-cctv-inspections/>

##### **14.7.1 Main Inspections**

A qualified operator shall carry out the CCTV inspection in accordance with the latest version of the Christchurch City Council CCTV Specification, any guidance notes on the Council webpage and the technical specification of the New Zealand Gravity Pipe Inspection Manual.

14.7.2 Lateral Inspections

The operator shall photograph every joint and weld and check every lateral connection and defect. A colour photograph shall be taken of equivalent quality to the CCTV inspection. The photograph shall be taken from 0.3m upstream of the joint and shall include the whole joint.

Lateral joint inspections shall be carried out after the road base course is laid but may be carried out before the pipework is pressure tested. Joint inspections may be carried out by the drainage contractor.

The photographs showing the features and condition of all inspected pipe lengths shall be provided through the FME portal to Council as part of the as-built record. Photographs supplied without log sheets will not be accepted.

14.7.3 New Asset ID Naming Convention

New wastewater and stormwater pipelines shall be named according to IDS Part 2 Appendix I Section 5 and the Pipeline CCTV Specification Section (refer to the section on Pipe Asset Survey ID Naming).

**14.8 *Measurement of Work and Basis of Payment***

The Contractor shall include the cost of all testing and associated work in the rate for pipe installation. This shall include test points in pressure pipes but shall exclude testing junctions for gravity pipes.

The remedying of defects made apparent by testing shall be at the Contractor's cost.

14.8.1 Testing Junctions

Testing junctions shall include supply, installation and plugging after testing.

14.8.2 CCTV inspection

CCTV inspection shall include flushing and the provision of a video and written records to Council.

14.8.3 Polyethylene Pipe Weld Test

Payment for specified sampling, testing, re-jointing and reinstatement etc. of joints shall be for each complying joint. The rate for electrofusion joint testing shall include for all time related effects associated with set up, testing, approval, re-jointing etc.

If additional testing is required due to a change in machine, operator, pipe supplier or material or to prove defective work, the additional tests and any related costs shall be borne by the Contractor.



## **15 BACKFILLING**

Backfilling shall be carried out in accordance with CSS: Part 1 - General.

### **15.1 *Prior to Backfilling***

No backfilling shall be carried out until the Engineer has approved the method of backfilling and compaction.

No backfilling shall commence until all concrete, whether used in haunching, risers, manholes or other structures, has gained sufficient strength to support the loads that will be transmitted to it. All formwork shall be removed before backfilling.

### **15.2 *Materials***

Backfill to trenches shall be the specified imported material, unless the Engineer approves the use of the excavated material as backfill.

There will be no payment for handling of excavated material where used as backfill.

### **15.3 *Backfill Procedure***

Backfill shall be placed so that no sudden or excessive loading is transmitted to the pipeline or its accessories. The pipe shall not be moved or damaged during placing or compaction of backfill. Particular care shall be taken to compact the backfilling around risers.

Well point, well or test holes shall be completely filled with coarse sand or approved alternative.

Where watering-in is used, the surface layer of the backfill, if segregated, shall be removed or treated.

### **15.4 *Quality Assurance***

The Contractor shall provide records of compliance tests carried out on trench backfill as required by CSS: Part 1 - General, to comply with IDS: Part 3 - Quality Assurance.

Records of these tests shall be supplied at regular intervals, to provide confirmation of ongoing testing. Details of the proposed methods and frequency of such activities, and the reporting of these, shall be set out in the Contractor's Contract Quality Plan.

### **15.5 *Measurement of Works and Basis of Payment***

#### **15.5.1 Imported Backfill**

Imported backfill shall include the supply of backfill material to replace rejected material, any handling between the on-site stockpile and the trench and the removal and disposal of that rejected material.

For concrete pipes, the volume shall be determined from the excavation width and the depth from the subgrade to the centreline of the pipe where the pipe diameter is 525mm or less. Where the pipe is greater than 525mm

diameter, the depth shall be to the top of the pipe haunching and the volume shall be reduced by the volume of the pipe and surround above the level of the haunching. The trench width shall be 'G' or 'N' as specified for the excavation.

For flexible and ceramic pipes, the volume shall be determined from the trench width 'G' or 'N' and the depth from the subgrade to the top of the haunching or 150mm above the top of the pipe.

**15.5.2 Filling to Unsuitable Foundations**

Filling to unsuitable foundations shall be paid per m<sup>3</sup> solid volume of fill placed, to the nearest 0.1m<sup>3</sup>, and shall include supply, placing, compaction and testing. Measurement of filling shall be determined from the volume of unsuitable foundations being filled.

**15.5.3 Testing**

Benkelman Beam testing shall be paid per manhole length or per 100m for pressure pipe for complying results. Backfill testing ordered by the Engineer using the nuclear densometer shall be paid per complying result.

The cost of all backfill compliance testing required under clause 15.4 – Quality Assurance shall be included in the rates for pipe laying.

## **16 ADJUSTING MANHOLES TO ALTERED SURFACE LEVELS**

Manhole frames and tops shall be adjusted in accordance with SD 306 and SD 308.

### **16.1 *Materials***

All materials used shall comply with clause 15.4 – Quality Assurance.

Cast or ductile iron frames may be fixed into the rebates with asphaltic concrete or cement sand mortar or concrete with a 6mm maximum aggregate size. Accelerating admixtures may be used. Under no circumstances shall frames be concreted in at the time the margin is poured. Where asphaltic concrete is used the surfaces of the frame and concrete rebate shall be primed with bituminous emulsion and the asphaltic concrete placed and thoroughly rammed in 30mm layers.

### **16.2 *Raising of Manhole Frames***

The neck of a standard or flush manhole shall not be deeper than 600mm once adjusted.

Where the neck will not exceed this limit, apply the procedure relevant to the type of manhole.

16.2.1 Raising the Frame for a Standard Manhole within the Rebate

The 100mm frame of a standard manhole with a 100mm deep margin may be packed up on cement mortar or fine aggregate concrete and the top of the frame raised to a maximum of 65mm above the concrete surface provided the raised frame is laterally supported by asphaltic concrete. The maximum thickness of cement mortar to support frames shall not exceed 25mm. Concrete with a maximum aggregate size of 6mm shall be used to support frames for thicknesses over 25mm.

16.2.2 Raising the Frame for a Bottleneck Manhole

For “bottleneck” manholes the 200mm frames and concrete surround shall be removed and replaced with 100mm frames. The exterior dimensions of the cast in-situ manhole top shall not exceed the equivalent exterior dimensions of the manhole. The new concrete top shall be reinforced with one peripheral 16mm diameter bar with 50mm cover. The existing brickwork shall be prepared in all areas where new concrete shall be poured against it.

16.2.3 Deepening the Rebate

Perimeter concrete to the frame rebate shall be a minimum of 200mm wide at all points. Dimensions to the finished surface shall comply with SD 306.

**16.3 *Raising of Manhole Tops***

Where the depth from the top of the frame to the underside of the slab exceeds 600mm, the top and walls shall be raised.

Standard manhole slab tops may be reused but the tops of “bottleneck” manholes with 200mm frames shall not be reused. In flush tanks, flush manholes and manholes with turning valves, the chain hook shall be relocated.

16.3.1 Standard Manholes

Vent structures shall be extended, where the vent cover is being reused.

16.3.2 Bottleneck Manholes

The bottleneck shall be removed and either vertical walls constructed from the original springing or a precast manhole riser installed. Vent structures shall be broken down and sealed off and a vented circular manhole cover installed.

16.3.3 Precast Circular Manholes

Units shall be used to raise the top. If the adjustment required cannot be achieved solely by the use of riser rings then raise both the top and the frame.

## **16.4 Lowering the Surface Level**

### **16.4.1 Standard Manholes without Vents**

The concrete top shall be removed and the walls cut down the required amount. The top of the cut wall shall be made true and even with cement mortar and the top reset on a cement mortar bed.

### **16.4.2 Standard Vented Manholes with Removable Vent Gratings**

When lowering less than 125mm, the vent may be adapted by cutting down the walls, to provide a vent opening height of 50mm with a vent upstand above the vent drain of 150mm as shown in the right hand details on SD 306/2. The top shall be treated as described in clause 16.4.1 – Standard Manholes without Vents.

When lowering more than 125mm, a new style precast top with the vented circular manhole cover shall be installed to SD 306/1. The old vent shall be broken down and sealed off.

### **16.4.3 Vented Manholes with a Fixed Vent Grating**

The top may be lowered without altering the vent provided the soffit of the slab does not finish lower than the top of the vent opening pipe. Where this will occur a new style precast vented top shall be used installed to SD 306/1.

### **16.4.4 Bottleneck Manholes**

Lowering of less than 100mm may be accommodated by fitting 100mm frames to replace 200mm frames, as described in clause 16.2.2 – Raising the Frame for a Bottleneck Manhole. If the top is to be lowered more than 100mm, the alteration shall be carried out as described in clause 16.3.2 – Bottleneck Manholes.

### **16.4.5 Precast Circular Manholes**

The walls of the precast unit shall be cut down, taking special care to avoid spalling and/or cracking of the unit. After cutting down the top edge shall be reformed using the special former. An approved sealing strip shall be placed between any slab and extension to walls on precast manholes to form a watertight joint.

Alternatively, lowering may be achieved in some cases by removing one of the riser rings and replacing it with another of the appropriate height.

## **16.5 Protection of System**

Before any alteration work is carried out on manholes or flush tanks, the existing inverts etc. shall be covered with decking to prevent the entry of debris that could cause blockages.

## **16.6 Protection of Structures**

Traffic shall be kept off all structures until they have achieved a strength of 25 MPa.

The use of steel plates to cover new concrete work and prevent traffic loading shall be permitted in accordance with CSS: Part 1 - General. It is essential however that there is sufficient clearance between the underside of the plate and the new concrete margin or newly bedded frame to enable traffic to pass over the top of the manhole without the load being transmitted to the new concrete work.

#### ***16.7 Measurement of Works and Basis of Payment***

Adjusting manholes shall be paid as a lump sum per item. Adjustments to vents shall be included in this sum.

##### ***16.7.1 Manholes Adjusted Separately from Drainage Works***

The rate shall include the restoration of the surrounding surface.

### **17 RESTORATION**

Restoration shall be carried out in accordance with CSS: Part 1 - General and the Works Access Permit (WAP) conditions, where applicable. Apply for a Corridor Access Request (CAR) at [www.beforeudig.co.nz](http://www.beforeudig.co.nz).

#### ***17.1 Measurement of Works and Basis of Payment***

Restoration from subgrade level shall be measured on the lineal metre of pipe installed, to the nearest 0.1m, which shall include restoration to any structures installed on the pipe. Restoration includes additional saw-cutting, bandaging where necessary and additional sealing width as detailed in CSS: Part 1 clause 33.0 – Restoration and Final Surfacing.

### **18 PRESSURE SEWER SYSTEM COMMISSIONING**

The Contractor shall commission all newly installed pressure sewer systems prior to any wastewater entering the chamber, as specified and in conjunction with the chamber manufacturer. Commissioning of a storage chamber shall include a complying pressure test on the reticulation between the boundary kit and the chamber. The Engineer shall be present at all commissioning and shall be given 24 hours' notice of commissioning.

As built records and plans shall be provided to support the code compliance application, including the Construction Statement – pressure sewer system.

#### ***18.1 Measurement of Works and Basis of Payment***

All costs involved in commissioning the reticulation shall be included in the rates for the relevant item.

## **19 AS-BUILT RECORDS**

The Contractor shall provide Council with as-built records to the requirements set out in CSS: Part 1 clause 5.0 – Quality Assurance including those required by clause 8.0 – pipe installation, clause 7.3 - Thermoplastic jointing of PE pipe by EF and clause 7.4 - Site Butt Fusion Jointing of Polyethylene Pipe and Fittings.

The new asset ID naming convention in the CAT sheets and CCTV footage shall be consistent based on the new asset names as shown on the construction Drawings with format according to IDS Part 2 Section 2.9.1 and the Pipeline CCTV Specification (refer to the section on Pipe Asset Survey ID Naming).

**CONCRETE CONSTRUCTION CHECKSHEET**

Project: \_\_\_\_\_

Contractor: \_\_\_\_\_

Date of Inspection/Pour: \_\_\_\_\_

Location of Pour: \_\_\_\_\_

Volume of Pour: \_\_\_\_\_ m<sup>3</sup>      Grade: \_\_\_\_\_      MPa: \_\_\_\_\_

|   |                                        |          |
|---|----------------------------------------|----------|
| 1 | Formwork                               | Comments |
|   | - Adequately braced and supported      | _____    |
|   | - Grout tight                          | _____    |
|   | - Correct dimensions                   | _____    |
|   | - Cleaned and oiled                    | _____    |
|   | - Formed surfaces straight             | _____    |
|   | - Major penetrations located           | _____    |
|   | - Embedded Items located               | _____    |
|   | - Correct for specified surface finish | _____    |
|   | - Adequate seating P.C. Units          | _____    |
| 2 | Reinforcement                          |          |
|   | - Grade and size                       | _____    |
|   | - Placement, tolerance, clearance      | _____    |
|   | - Stability and cover                  | _____    |
|   | - Clean steel                          | _____    |
|   | - Lap location and lengths             | _____    |
|   | - Starters correctly located           | _____    |
| 3 | Construction joints                    |          |
|   | - Location                             | _____    |
|   | - Roughened                            | _____    |
|   | - Clean                                | _____    |
|   | - Water stop placed if specified       | _____    |
| 4 | Slabs on Grade                         |          |
|   | - Dowels correctly positioned          | _____    |
|   | - DPC or GPC                           | _____    |
|   | - Shear Keys                           | _____    |
|   | - Reinforcement cut at joints          | _____    |
| 5 | Testing                                |          |

|                      |       |     |
|----------------------|-------|-----|
| Compression Strength | _____ | MPa |
| Slump/Flow           | _____ | mm  |

## 6 Other

- Hard topping
- Additives

|       |       |
|-------|-------|
| _____ | _____ |
| _____ | _____ |

## 7 Special Requirements

- Local Authority informed prior to pour
- Engineer informed prior to pour

|       |       |
|-------|-------|
| _____ | _____ |
| _____ | _____ |

## Pre-Pour Check:

Concrete Inspector's Name/Signature/Date

Time of Commencement of Pour

\_\_\_\_\_

## Completion:

Pour satisfactorily complete Name/Signature/Date

\_\_\_\_\_

Sawcutting of slabs

\_\_\_\_\_

Curing being carried out

\_\_\_\_\_

(Note on reverse any problems experienced during the POUR)



## GENERAL REQUIREMENTS FOR SITE BUTT FUSION JOINTING

- a) Check the pipes and fittings to be welded to confirm they are as specified and of the same diameter, wall thickness and PE material.
- b) Provide a tent or shelter, if necessary, to protect the jointing process.
- c) Cover the exposed ends of the pipe strings until they are welded, to prevent any air flow which may heat or cool the pipe.
- d) The covers shall be carefully cleaned and wiped dry before proceeding.
- e) Site the butt fusion machine on a clean, level and firm surface that provides adequate stability.
- f) Cut the pipe ends square.
- g) Support the pipes to be jointed on rollers spaced to achieve the specified alignment and to minimise the drag pressure.
- h) Set the pipes so that the manufacturer's markings are aligned and the pipes can be laid uppermost in the trench, to allow for future identification without major excavation work.
- i) Open and close the clamps. Note the gauge pressure required to close the clamps is the drag pressure.
- j) Securely clamp the pipes or fittings in position so that they cannot move unless moved by the clamping device.
- k) Check the generator has sufficient fuel and is performing correctly before it is connected to the machine.
- l) Check it is compatible with the welding equipment (e.g. power output, rating etc).
- m) The pipe profiles should be re-rounded if necessary.
- n) Check the temperature of the pipe and/or fittings prior to jointing. Should low temperatures be encountered ( $< 5^{\circ}\text{C}$ ) operations should be delayed until the temperature has increased. If it is necessary to undertake jointing at temperatures  $< 5^{\circ}\text{C}$ , additional precautions may be necessary e.g. heating the jointing shelter or contacting the pipe manufacturer for additional guidance. Any joints carried out at temperatures  $< 5^{\circ}\text{C}$  shall be subjected to closer than normal scrutiny.
- o) Use the facing machine to trim and plane the pipe ends.
- p) Bring the mating faces together and check that the mismatch in alignment or diameter complies with the specification. Re-trim the ends and re-align the pipes if the mismatch doesn't comply.
- q) Remove all shavings and trimmings. The machined faces of the pipe or fitting shall not be touched as this will contaminate the joint interface. If the trimmed ends of the pipe/s become contaminated they shall be re-faced.
- r) Check the heater plate for any signs of damage.
- s) If the heater plate needs cleaning, allow it to cool first then wash with clean water and a lint-free cloth. Dry thoroughly. Non-depositing alcohol may be used to remove any oil or grease.
- t) Place the heater plate in the machine and bring it up to the specified temperature
- u) Check that the temperature on both sides of the plate is within the allowable range.
- v) At the start of each jointing session, a dummy joint (or joints) should be made to ensure that the heater plate has no fine adherent particles remaining. The dummy joint may be aborted at the end of the heat soak period. Pipe offcuts may be used for these dummy joints.
- w) Heat the pipe ends and make the joint.

- x) Hold the fused joint immobile under pressure for the minimum cooling time.
- y) Number each joint.
- z) Check the joint bead appearance, its width and height and record all joint details on the site jointing log sheet.

**ELECTROFUSION WELDING CHECKSHEET**

| Description                                                                 | Yes | No | Comments / Questions                                                                                                |
|-----------------------------------------------------------------------------|-----|----|---------------------------------------------------------------------------------------------------------------------|
| <b>Preliminary</b>                                                          |     |    |                                                                                                                     |
| Preconstruction Test                                                        |     |    | Have these been completed? Or is this observed weld to be used as a Preconstruction                                 |
| Environment weather and other site works                                    |     |    | What precautions are provided for the environmental conditions e.g. rain, hot temperatures, compactors diggers etc. |
| Temperature of pipe and fittings                                            |     |    | How are differential temp effects between pipe and coupler allowed for?                                             |
| <b>Equipment</b>                                                            |     |    |                                                                                                                     |
| 1. Are the tools used fit for purpose?                                      |     |    | Note down Peeler Type                                                                                               |
| Peeler Type                                                                 |     |    |                                                                                                                     |
| 2. EF Welding machine in good condition                                     |     |    | Note down EF machine Type and calibration date if visible                                                           |
| Electrofusion machine type                                                  |     |    |                                                                                                                     |
| 3. Generator adequate for welding machine                                   |     |    | Size to avoid welding process being stopped due to higher current draw                                              |
| <b>Pipe and Fittings</b>                                                    |     |    |                                                                                                                     |
| 4. Check pipe and fittings are compatible (SDR match)                       |     |    | Do the SDRs of pipe and fittings match?                                                                             |
| 5. Check pipe and take note of actual pipe diameter                         |     |    | Note: actual measure                                                                                                |
| 6. Ovality of pipeline(s) to be jointed.                                    | %   |    | How was % determined?<br>What are requirements if over 1.5%?                                                        |
| 7. Re-rounding of pipe ends if required                                     |     |    | Where are the certified pipe re-round tools?<br>Note them down                                                      |
| 8. Reversion Checked                                                        | mm  |    | What is the length of reversion?                                                                                    |
| 9. Fittings storage                                                         |     |    | Has the fitting been out of its packaging if it is not supplied within a bag how is it stored?                      |
| <b>Preparation</b>                                                          |     |    |                                                                                                                     |
| 10. Check pipeline for any damage (no scratches over 10% of Wall thickness) |     |    | What depth is the damage, % of pipe;                                                                                |
| 11. Pipe ends covered                                                       |     |    | Pipe ends covered if required to stop uncontrolled draught or water entering welding area                           |
| 12. External and internal pipe within weld area cleaned with damp rag       |     |    |                                                                                                                     |
| 13. Pipe ends cut square                                                    |     |    | Swarf removed?                                                                                                      |
| 14. Witness marks to allow for coupler plus 20mm                            |     |    | Ensure peeling of whole welding area                                                                                |
| 15. Pipe peeled as per PIPA Guidelines (0.25 – 0.4mm)                       |     |    | Peeling checked for completeness – what depth?                                                                      |

| Description                                                                                    | Yes | No | Comments / Questions                                                                         |
|------------------------------------------------------------------------------------------------|-----|----|----------------------------------------------------------------------------------------------|
| 16. Fittings and pipe surfaces cleaned                                                         |     |    | Fittings and pipe services cleaned as per PIPA guidelines using 100% ISO wipes               |
| 17. Electrofusion fittings aligned correctly                                                   |     |    | If unable to align pipe and fittings, how would this be resolved?                            |
| 18. Pipe Restraint                                                                             |     |    | Has the pipe been properly restrained? – what are the forces on the pipe                     |
| 19. Has the correct information been entered in to the welding machine                         |     |    | Including Job #, site and welder ID                                                          |
| 20. Was the welding process followed correctly                                                 |     |    | Install and removal of welding cords Cooling times adhered to<br>Joint examination completed |
| 21. Has the correct QA information been marked on fitting (i.e. Welder initials, weld #, etc.) |     |    | Note down information marked on fitting;                                                     |
| 22. Pipe Movement                                                                              |     |    | Has the pipe moved during the process? Has this been checked? How?                           |
| 23. Was the cooling time allowed for before cutting in of tapping saddle                       |     |    | Note the minimum cooling time before pressure test or drilling?                              |
| 24. Weld Records to be submitted for observed weld.                                            |     |    | Confirm inputted values (format may vary change with automatic machines)                     |

**COMPLIANCE REQUIREMENTS CHECKSHEET - DRAINAGE**

| ITEM     | CSS REF       | TASK                         | TEST STD/<br>DESCRIPTION                                                                                                                                             | COMPLIANCE REQUIREMENTS          | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|----------|---------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|---------------|----------------|------------|---------|
| <b>1</b> |               | <b>CONTRACT QUALITY PLAN</b> |                                                                                                                                                                      |                                  |               |                |            |         |
|          | Pt 1<br>10.0  | Confined Spaces Permit       | inspect                                                                                                                                                              | Present copy through CQP         |               |                |            |         |
|          | Pt 3<br>3.0   | Fittings and Materials       | <a href="http://www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx">www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx</a> | Materials comply                 |               |                |            |         |
| <b>2</b> |               | <b>EXCAVATION</b>            |                                                                                                                                                                      |                                  |               |                |            |         |
|          | Pt 3<br>5.1   | Support of services          | inspect                                                                                                                                                              | No existing services disrupted   |               |                |            |         |
|          | Pt 3<br>6.4.2 | Trench width                 | measure                                                                                                                                                              | 300mm wider than pipe collar     |               |                |            |         |
|          | Pt 3<br>6.4.4 | Trench support               | inspect                                                                                                                                                              | OSH requirements                 |               |                |            |         |
|          | Pt 3<br>6.4   | Trench depth                 | measure                                                                                                                                                              | To design level less haunching   |               |                |            |         |
|          | Pt 3<br>8.7   | Trench depth - PVC           | measure                                                                                                                                                              | 750mm cover + 300mm pipe + 200mm |               |                |            |         |
|          | Pt 3<br>6.4.3 | Inspect base of trench       | test                                                                                                                                                                 | Foundations sound and over 50kPa |               |                |            |         |

| ITEM     | CSS REF        | TASK                                       | TEST STD/<br>DESCRIPTION | COMPLIANCE REQUIREMENTS                                                    | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|----------|----------------|--------------------------------------------|--------------------------|----------------------------------------------------------------------------|---------------|----------------|------------|---------|
| <b>3</b> |                | <b>MECHANICAL JOINTING EXCEPT PLASTICS</b> |                          |                                                                            |               |                |            |         |
|          | Pt 3<br>7.1    | Fittings and materials                     | manuf reqs               | Diameters match, materials compatible and correct                          |               |                |            |         |
|          | Pt 3<br>7.1    | Jointing                                   | manuf reqs               | Workspace and materials clean and dry                                      |               |                |            |         |
|          | Pt 3<br>7.1    | Inspect completed joint                    | manuf reqs               | All fittings snug and firm, no movement or leakage, gibault joints wrapped |               |                |            |         |
| <b>4</b> |                | <b>MECHANICAL JOINTING OF PVC</b>          |                          |                                                                            |               |                |            |         |
|          | Pt 3<br>7.2    | Fittings and materials                     | AS/NZS 2032, manuf reqs  | Diameters match, materials compatible and correct                          |               |                |            |         |
|          | Pt 3<br>7.2    | Jointing                                   | AS/NZS 2032, manuf reqs  | Workspace and materials clean and dry, not using solvents                  |               |                |            |         |
|          | Pt 3<br>7.2    | Joint gap setting                          | CCC performance reqs     | Witness marks visible                                                      |               |                |            |         |
|          | Pt 3<br>7.2    | Inspect completed joint                    | AS/NZS 2032, manuf reqs  | All fittings snug and firm, no movement or leakage                         |               |                |            |         |
| <b>5</b> |                | <b>ELECTROFUSION WELDING</b>               |                          |                                                                            |               |                |            |         |
|          | Pt 3<br>14.5.1 | Preconstruction tests                      | ISO 13954, ISO 13956     | Passing tests received, pipe batch, machine and welder named               |               |                |            |         |
|          | Pt 3<br>7.3.1, | CQP documentation                          | methodology, welding log | Present methodology and QA record sheets through CQP                       |               |                |            |         |

| ITEM     | CSS REF        | TASK                      | TEST STD/ DESCRIPTION                                                                                                                                                | COMPLIANCE REQUIREMENTS                                                                                                                 | TEST FREQ. | PASS YES/NO | TEST BY | ACTIONS |
|----------|----------------|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|---------|---------|
|          | 7.3.2          |                           | sheet                                                                                                                                                                |                                                                                                                                         |            |             |         |         |
|          | Pt 3<br>7.3.3  | Operator qualified        | registered                                                                                                                                                           | Present copy through CQP                                                                                                                |            |             |         |         |
|          | Pt 3<br>7.3.4  | Equipment                 | AS/NZS 2033, manuf reqs                                                                                                                                              | Appropriate clean equipment, re-rounding clamps, specified cleaners                                                                     |            |             |         |         |
|          | Pt 3<br>3.0    | Fittings and materials    | <a href="http://www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx">www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx</a> | Manufacturer confirmed compatibility; witness mark location; fitting/pipe gap                                                           |            |             |         |         |
|          | Pt 3<br>7.3.5  | Pipe preparation          | measure                                                                                                                                                              | 'Out of roundness' less than 1.5%, end gaps, pipe dimensions comply, pipes peeled, cleaned and protected, witness marks, pipe insertion |            |             |         |         |
|          | Pt 3<br>7.3.6  | Welding                   | AS/NZS 2033, manuf reqs                                                                                                                                              | Correct parameters, pipe position, visual inspection satisfactory, weld marked, fusion times complied with, welding records kept        |            |             |         |         |
|          | Pt 3<br>14.5.3 | During construction tests | ISO 13954, ISO 13956                                                                                                                                                 | All test results received, acted on                                                                                                     |            |             |         |         |
|          | Pt 3<br>7.3.6  | Cooling period            | AS/NZS 2033, manuf reqs                                                                                                                                              | Pipe not moved for specified period.                                                                                                    |            |             |         |         |
| <b>6</b> |                | <b>BUTT WELDING</b>       |                                                                                                                                                                      |                                                                                                                                         |            |             |         |         |
|          | Pt 3<br>7.4    | Preconstruction tests     | ISO 13953                                                                                                                                                            | Passing tests received, pipe batch, machine and welder named                                                                            |            |             |         |         |
|          | Pt 3           | CQP documentation         | POP003                                                                                                                                                               | Present methodology and QA records                                                                                                      |            |             |         |         |

| ITEM     | CSS REF         | TASK                                  | TEST STD/<br>DESCRIPTION                                                                                                                                             | COMPLIANCE REQUIREMENTS                                                                                            | TEST FREQ. | PASS YES/NO | TEST BY | ACTIONS |
|----------|-----------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------|-------------|---------|---------|
|          | 7.4.1,<br>7.4.2 |                                       |                                                                                                                                                                      | through CQP                                                                                                        |            |             |         |         |
|          | Pt 3<br>7.4.3   | Operator qualified                    | registered                                                                                                                                                           | Present copy through CQP                                                                                           |            |             |         |         |
|          | Pt 3<br>7.4.4   | Equipment                             | AS/NZS 2033, manuf reqs                                                                                                                                              | Equipment clean, appropriate, plate temperature constant and as specified, re-rounding clamps, specified cleaners. |            |             |         |         |
|          | Pt 3<br>3.0     | Fittings and materials                | <a href="http://www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx">www.ccc.govt.nz/business/constructiondevelopment/approvedmaterials.aspx</a> | Manufacturer confirmed compatibility; witness mark location; fitting/pipe gap                                      |            |             |         |         |
|          | Pt 3<br>7.4.5   | Pipe preparation                      | Measure, manuf reqs, POP003                                                                                                                                          | End alignment and end gaps comply, pipes cleaned and protected, ends protected, air temperature above 4°C          |            |             |         |         |
|          | Pt 3<br>7.4.6   | Welding                               | AS/NZS 2033, manuf reqs                                                                                                                                              | Welding records kept, weld marked, visual inspection satisfactory                                                  |            |             |         |         |
|          | Pt 3<br>14.4.4  | During construction tests             | ISO 13953                                                                                                                                                            | Passing tests received, pipe batch, machine and welder named                                                       |            |             |         |         |
|          | Pt 3<br>7.4.7   | Bead profile                          | AS/NZS 2033, manuf reqs                                                                                                                                              | Bead profile visual inspection satisfactory, removed in gravity, pressure bends                                    |            |             |         |         |
| <b>7</b> |                 | <b>PIPE INSTALLATION BY TRENCHING</b> |                                                                                                                                                                      |                                                                                                                    |            |             |         |         |
|          | Pt 3<br>8.0     | As-buitling                           | measure                                                                                                                                                              | Records taken before backfilling                                                                                   |            |             |         |         |
|          | Pt 3<br>8.1     | Pipe laying                           | measure                                                                                                                                                              | To within ±10mm of design invert.                                                                                  |            |             |         |         |



| ITEM | CSS REF       | TASK                        | TEST STD/<br>DESCRIPTION  | COMPLIANCE REQUIREMENTS                                      | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|------|---------------|-----------------------------|---------------------------|--------------------------------------------------------------|---------------|----------------|------------|---------|
|      |               |                             |                           | Within 50mm or 5% of dia in horz plane                       |               |                |            |         |
|      | Pt 3<br>8.1.2 | Laser set up                | measure                   | Light beam on grade and line                                 |               |                |            |         |
|      | Pt 3<br>8.5   | Metal haunching material    | NZTA req or<br>CSS Part 1 | Grading                                                      |               |                |            |         |
|      | Pt 3<br>8.5   | Metal haunching depth       | SD 344                    | to table                                                     |               |                |            |         |
|      | Pt 3<br>8.5   | Metal haunching and bedding | test                      | Compaction complies                                          |               |                |            |         |
|      | Pt 3<br>8.6.1 | Concrete capping            | SD 332                    | to table                                                     |               |                |            |         |
|      | Pt 3<br>8.6.2 | Concrete surround           | SD 342                    | 100mm cover                                                  |               |                |            |         |
|      | Pt 3<br>8.6.3 | Concrete protection         | SD 342                    | 100mm depth                                                  |               |                |            |         |
|      | Pt 3<br>8.5.1 | Geotextiles                 | inspect                   | Joints wrapped if specified                                  |               |                |            |         |
|      | Pt 3<br>8.8   | Flexible pipe laying        | measure                   | 'Out of roundness' less than 5%<br>Radii of PE pipe complies |               |                |            |         |
|      | Pt 3<br>8.9   | Pressure pipe laying        | SD 344                    | To table                                                     |               |                |            |         |
|      | Pt 3<br>8.9   | Pressure pipe laying        | Site test                 | Soil capacity complies with design                           |               |                |            |         |
|      | Pt 3<br>8.9.1 | Thrust blocks               | SD 346                    | Soil capacity complies with design                           |               |                |            |         |
|      | Pt 3          | Anchor blocks               | measure                   | Built as specified                                           |               |                |            |         |

| ITEM      | CSS REF       | TASK                                              | TEST STD/<br>DESCRIPTION      | COMPLIANCE REQUIREMENTS                                                                                                              | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|-----------|---------------|---------------------------------------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------|----------------|------------|---------|
|           | 8.9.2         |                                                   |                               |                                                                                                                                      |               |                |            |         |
|           | Pt 3<br>8.10  | Subsoil pipe laying                               | SD 377                        | To detail                                                                                                                            |               |                |            |         |
|           | Pt 3<br>10.1  | Junction installation                             | SD 364                        | Metal haunched, fittings compatible and correct, no leakage                                                                          |               |                |            |         |
| <b>8</b>  |               | <b>PIPE INSTALLATION BY TRENCHLESS TECHNOLOGY</b> |                               |                                                                                                                                      |               |                |            |         |
|           | Pt 3<br>9.1   | Pipe pulling                                      | AS/NZS<br>2033, manuf<br>reqs | Load does not exceed that specified.<br>Gouging, notching under 10% wall<br>thickness for pressure pipe and 20% for<br>gravity pipe. |               |                |            |         |
| <b>9</b>  |               | <b>PIPE INSTALLATION BY DIRECTIONAL DRILLING</b>  |                               |                                                                                                                                      |               |                |            |         |
|           | Pt 3<br>9.1.3 | Horizontal alignment                              | measure                       | ± 100mm of design                                                                                                                    |               |                |            |         |
|           | Pt 3<br>9.1.3 | Vertical alignment                                | measure                       | ± 5mm of design                                                                                                                      |               |                |            |         |
|           | Pt 3<br>9.1.3 | Clearance to Existing<br>Services                 | measure                       | Water to sewer 1.0m, pressure sewer to<br>water 0.6m or 1.0m, stormwater to<br>watermain 0.45m, to submains 0.3m or<br>0.6m          |               |                |            |         |
|           | Pt 3<br>9.2   | Access pits                                       | measure                       | Exceed tabulated length                                                                                                              |               |                |            |         |
| <b>10</b> |               | <b>LATERALS</b>                                   |                               |                                                                                                                                      |               |                |            |         |
|           | Pt 3<br>11.1  | Install laterals<br>adjacent to trees             | measure                       | Joints at least 3m from tree                                                                                                         |               |                |            |         |

| ITEM      | CSS REF             | TASK                                         | TEST STD/<br>DESCRIPTION | COMPLIANCE REQUIREMENTS                                  | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|-----------|---------------------|----------------------------------------------|--------------------------|----------------------------------------------------------|---------------|----------------|------------|---------|
|           | Pt 3<br>11.2        | Install lateral                              | measure                  | Cover adequate for fall to outlet from<br>furthest point |               |                |            |         |
|           | Pt 3<br>11.5        | Working with live<br>laterals                | inspect                  | No uncontrolled sewage discharges                        |               |                |            |         |
| <b>11</b> |                     | <b>CONNECTIONS TO STRUCTURES</b>             |                          |                                                          |               |                |            |         |
|           | Pt 3<br>8.10        | Pipe laying at<br>structures                 |                          | No leakage                                               |               |                |            |         |
|           | Pt 3<br>8.10.1      | Yield joints                                 | SD 341                   | Yield joints comply                                      |               |                |            |         |
|           | Pt 3<br>8.10.4      | Polyethylene<br>connections                  | SD 341                   | Joints comply                                            |               |                |            |         |
| <b>12</b> |                     | <b>STRUCTURES (ADDITIONAL TO APPENDIX 1)</b> |                          |                                                          |               |                |            |         |
|           | Pt 3<br>12.0        | Locate structure                             | measure                  | Within 50mm of design horizontally                       |               |                |            |         |
|           | Pt 3<br>12.12       | Construct flushtank                          | SD 311                   | Structure is watertight.                                 |               |                |            |         |
|           | Pt 3<br>12.11       | Construct manhole                            | SD 303                   | Structure is watertight.                                 |               |                |            |         |
|           | Pt 3<br>12.11       | Fittings and materials                       | SD 301, SD<br>303        | Approved materials used.                                 |               |                |            |         |
|           | Pt 3<br>12.11.<br>2 | Construct benching                           | SD 303                   | Concrete is 25 MPa.                                      |               |                |            |         |
|           | Pt 3<br>12.11.      | Install risers                               | SD 303                   | Riser gaps less than 5mm.                                |               |                |            |         |

| ITEM      | CSS REF             | TASK                                    | TEST STD/<br>DESCRIPTION | COMPLIANCE REQUIREMENTS                                        | TEST FREQ. | PASS YES/NO | TEST BY | ACTIONS |
|-----------|---------------------|-----------------------------------------|--------------------------|----------------------------------------------------------------|------------|-------------|---------|---------|
|           | 3                   |                                         |                          |                                                                |            |             |         |         |
|           | Pt 3<br>12.11.<br>4 | Install tops                            | SD 303                   | Approved materials used.                                       |            |             |         |         |
|           | Pt 3<br>12.13       | Install ironwork                        | measure                  | Mortar between 10mm and 25mm.                                  |            |             |         |         |
|           | Pt 3<br>12.14       | Install AGS                             | SD 317                   | Operates correctly and connections watertight.                 |            |             |         |         |
| <b>13</b> |                     | <b>PERFORMANCE TESTING</b>              |                          |                                                                |            |             |         |         |
|           | Pt 3<br>14.1        | Test equipment                          | inspect                  | Gauges read twice test pressure. Gauges and meters calibrated. |            |             |         |         |
|           | Pt 3<br>14.2.5      | Gravity pipe air test                   | measure                  | Pressure drop shall not exceed 2 kPa in 2 mins.                |            |             |         |         |
|           | Pt 3<br>14.2.4      | Gravity pipe hydrostatic test           | measure                  | Water level does not drop for 5 mins                           |            |             |         |         |
|           | Pt 3<br>14.2.3      | Gravity pipe visual inspection          | inspect                  | No leaks or defects visible.                                   |            |             |         |         |
|           | Pt 3<br>14.7        | Gravity pipe CCTV inspection            | inspect                  | No defects visible.                                            |            |             |         |         |
|           | Pt 3<br>14.3.1      | Concrete pressure pipe water test       | measure                  | pressure loss within tolerances.                               |            |             |         |         |
|           | Pt 3<br>14.3        | Polyethylene pressure test              | Inspect                  | Approved tester recorded in CQP                                |            |             |         |         |
|           | Pt 3<br>14.3.2      | Polyethylene pipe < DN315 pressure test | measure                  | Shape of pressure plot within tolerances.                      |            |             |         |         |

| ITEM | CSS REF        | TASK                                                                                   | TEST STD/<br>DESCRIPTION | COMPLIANCE REQUIREMENTS                   | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|------|----------------|----------------------------------------------------------------------------------------|--------------------------|-------------------------------------------|---------------|----------------|------------|---------|
|      | Pt 3<br>14.3.3 | Polyethylene pipe ><br>DN315 pressure test                                             | measure                  | Shape of pressure plot within tolerances. |               |                |            |         |
|      | Pt 3<br>14.3.4 | EF saddles pressure<br>test                                                            | inspect                  | No leaks or defects visible.              |               |                |            |         |
|      | Pt 3<br>14.4   | Vacuum pipe pressure<br>test                                                           | WSA 06                   | Shape of pressure plot within tolerances. |               |                |            |         |
|      | Pt 3<br>14.3.5 | PVC DI GRP<br>pressure pipe water<br>test                                              | measure                  | pressure loss within tolerances           |               |                |            |         |
|      | Pt 3<br>14.5   | Polyethylene Pipe<br>Welds                                                             | AS/NZS 2033              | Satisfactory visual inspection            |               |                |            |         |
|      | Pt 3<br>14.5.1 | Polyethylene Pipe<br>Preconstruction Weld<br>Tests - Electrofusion                     | ISO 13954,<br>ISO 21751  | Joint shall pass test                     |               |                |            |         |
|      | Pt 3<br>14.5.2 | Polyethylene Pipe<br>Preconstruction Weld<br>Tests – Electrofusion<br>Saddle           | ISO 13954                | Joint shall pass test                     |               |                |            |         |
|      | Pt 3<br>14.5.3 | Polyethylene Pipe<br>Preconstruction Weld<br>Tests – Butt fusion                       | ISO 13953                | Ductile failure                           |               |                |            |         |
|      | Pt 3<br>14.5.4 | Polyethylene Pipe<br>Construction Tests –<br>Electrofusion and<br>Electrofusion Saddle | ISO 13954                | Joint shall pass test                     |               |                |            |         |
|      | Pt 3<br>14.5.5 | Polyethylene Pipe<br>Construction Tests –<br>Butt fusion                               | ISO 13953                | Ductile failure                           |               |                |            |         |

| ITEM      | CSS REF        | TASK                                               | TEST STD/<br>DESCRIPTION | COMPLIANCE REQUIREMENTS                                                                                                     | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|-----------|----------------|----------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------|----------------|------------|---------|
|           | Pt 3<br>14.6   | Flexible pipe ovality test                         | measure                  | 'Out of roundness within tolerances.                                                                                        |               |                |            |         |
| <b>14</b> |                | <b>BACKFILLING</b>                                 |                          |                                                                                                                             |               |                |            |         |
|           | Pt 3<br>15.2   | Backfill material in road                          | NZTA req                 | To be M/4:AP40                                                                                                              |               |                |            |         |
|           | Pt 1<br>29.3   | Determine dry density of backfill material in path | NZS 4402                 | Standard Proctor                                                                                                            |               |                |            |         |
|           | Pt 1<br>29.5.1 | Compact backfill                                   | Clegg hammer             | 35 in road, ROW or commercial crossing, 25 elsewhere                                                                        |               |                |            |         |
|           | Pt 1<br>29.0   | Compact backfill                                   | MDD by ND                | 2150 kg/m <sup>3</sup> min except 70% MDD in berm                                                                           |               |                |            |         |
| <b>15</b> |                | <b>RESTORATION</b>                                 |                          |                                                                                                                             |               |                |            |         |
|           | Pt 1<br>30.1   | Surface preparation                                | inspect                  | Sawcut edges in permanent surfaces, strip to fender where within 1.5m                                                       |               |                |            |         |
|           | Pt 6<br>6.5    | Presealing surface shape - path                    | measure                  | Max 10mm gap, cumulative total gap under 25mm                                                                               |               |                |            |         |
|           | Pt 2<br>9.3    | Presealing surface shape - berm                    | measure                  | 75mm below existing surface                                                                                                 |               |                |            |         |
|           | Pt 6<br>11.4   | Presealing surface shape - road                    | measure                  | Max 12mm gap, cumulative total gap under 25mm in both directions                                                            |               |                |            |         |
|           | Pt 6<br>6.8    | Sealed surface shape - path                        | measure                  | Max 5mm gap, cumulative total gap under 20mm for longitudinal 3m straightedge and under 10mm for transverse 1m straightedge |               |                |            |         |

| ITEM      | CSS<br>REF    | TASK                               | TEST STD/<br>DESCRIPTION | COMPLIANCE REQUIREMENTS                                                             | TEST<br>FREQ. | PASS<br>YES/NO | TEST<br>BY | ACTIONS |
|-----------|---------------|------------------------------------|--------------------------|-------------------------------------------------------------------------------------|---------------|----------------|------------|---------|
|           | Pt 2<br>9.5.3 | Finished surface<br>shape - berm   | measure                  | +10mm, -0mm of existing level                                                       |               |                |            |         |
|           | Pt 6<br>14.4  | Chipsealed surface<br>shape - road | measure                  | Surface to be convex, mate-ins to be flush                                          |               |                |            |         |
|           | Pt 6<br>17.5  | AC surface shape -<br>road         | measure                  | Max 5mm gap, cumulative total gap<br>under 10mm for longitudinal 3m<br>straightedge |               |                |            |         |
|           | Pt 1<br>30.1  | Surfacing                          | inspect                  | Bandage AC edges, overlap chipseal                                                  |               |                |            |         |
| <b>16</b> |               | <b>PSS COMMISSIONING</b>           |                          |                                                                                     |               |                |            |         |
|           | Pt 3<br>18.0  | Commissioning plan<br>prepared     | Inspect                  |                                                                                     |               |                |            |         |

HPT = Heater plate temperature

P1 = Initial bead pressure

P2 = Heat soak pressure

P3 = Welding pressure

T1 = Bead press time

T2 = Heat soak press time

T3 = change over time

T4 = Time to reach weld pressure

T5 = Welding + Cooling time

BUTT PIPE WELD LOG SHEET

Project

Welder Name, ID No

Pipe/Material Details

Weld Machine Details

| Date | Weld No | HPT °C | P1 kPa | T1 Sec | P2 kPa | T2 Sec | T3 Sec | T4 Sec | P3 kPa | T5 Sec | Operator Signature | Comments |
|------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------|----------|
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |
|      |         |        |        |        |        |        |        |        |        |        |                    |          |



O = Ovality of pipe  
D = Outside diameter (using pipe tape)

TA = Ambient temperature

RF = Recommended fusion time  
RC = Recommended cooling time  
AF = Actual fusion time  
AC = Actual cooling time

ELECTROFUSION PIPE WELD LOG SHEET

Project

Pipe Details

Details = manufacturer, PE rating, DN, wall thickness

Welder Name, ID No

Weld Machine Details

| Date | Weld No | Fitting Details* | Location of weld | Pipe Batch | O % | D mm | RF Sec | RC Sec | AF Sec | AC Sec | TA °C | Operator Signature | Comments |
|------|---------|------------------|------------------|------------|-----|------|--------|--------|--------|--------|-------|--------------------|----------|
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |
|      |         |                  |                  |            |     |      |        |        |        |        |       |                    |          |

\*Details = manufacturer, barcode number

**PE PIPE WELD SAMPLE TESTING SUBMISSION FORM**

*(details to be provided to the testing laboratory for all PE weld and tapping saddle samples tested in accordance with Christchurch City Council requirements)*

**Customer's Company Name** (entity paying for the laboratory testing)

|  |
|--|
|  |
|--|

**Welder's Details**

|                  |
|------------------|
| Welding Company: |
| Welder's Name:   |
| Registration No: |
| Machine Number:  |

**Project Details**

|                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------|
| Project Name:                                                                                                                          |
| Project Location (street name)                                                                                                         |
| Type of Work (tick one): <input type="checkbox"/> Water Supply <input type="checkbox"/> Wastewater <input type="checkbox"/> Stormwater |
| Lead Contractor:                                                                                                                       |
| Engineer to Contract:                                                                                                                  |

**Sample Details**

|                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------|
| Sample ID (weld number as marked on sample):                                                                                      |
| Date Weld Made:                                                                                                                   |
| Weld Sample Purpose (tick one): <input type="checkbox"/> Pre-Construction <input type="checkbox"/> During-Construction            |
| Weld Type (tick one): <input type="checkbox"/> Butt Weld <input type="checkbox"/> EF Weld <input type="checkbox"/> Tapping Saddle |
| Pipe or Fitting Size (outside diameter):                                                                                          |

**Declaration**

I, \_\_\_\_\_ (customer who pays for the testing), consent to the test results being sent to Christchurch City Council at: [PEWeldTestResults@ccc.govt.nz](mailto:PEWeldTestResults@ccc.govt.nz)

| Customer Name | Signature | Date |
|---------------|-----------|------|
|               |           |      |

## PVC PIPE OVALITY TESTING GUIDE

This guide is based on the references to AS/NZS 2566.2 (as amended Nov2018)

Clause 5.7: Deflection Criteria

Clause 6.5: Deflection Testing

Appendix O: Diametral Deflection Measurement

The outside diameter of prover ( $O_d$  in mm) is calculated from the equation below:

$$O_d = d_{v1} * (1 - \Delta_{ysall}/100) - 2.5 \quad [Equation O(1) from AS/NZS 2566.2 Appendix O2.1 (d)]$$

where:

$d_{v1}$  = mean internal diameter (mm)

$\Delta_{ysall}$  = max. allowable short term vertical pipe deflection (Example - 5% for PVC- Ex Table 5.6 – Deflection Control Criteria – Allowable Vertical Deflections of AS/NZ 2566.2)

Use AS/NZS 2566.2 Table 6.2 factors to adjust  $\Delta_{ysall}$  for time intervals other than 30 days.

**For PVC-U Gravity pipes manufactured to AS/NZS 1260, the table below shows the prover OD that can be used.**

| <i>DN<br/>(mm)</i> | <i>SN</i> | <i>NB*</i><br><i>(mm)</i> | <i>Pipe ID -<br/>Prover OD<br/>at 30 day 5%<br/>Ovality (mm)</i> | <i>Prover OD<br/>for Std NB<br/>Pipe<br/>(minimum)<br/>(mm)</i> |
|--------------------|-----------|---------------------------|------------------------------------------------------------------|-----------------------------------------------------------------|
| 100                | 16        | 102                       | 7.6                                                              | 94                                                              |
| 150                | 16        | 148                       | 9.9                                                              | 138                                                             |
| 175                | 16        | 185                       | 11.8                                                             | 173                                                             |
| 225                | 8         | 235                       | 14.3                                                             | 221                                                             |
| 300                | 8         | 297                       | 17.4                                                             | 280                                                             |
| 375                | 8         | 376                       | 21.3                                                             | 355                                                             |
| 475                | 8         | 469                       | 26.0                                                             | 443                                                             |
| 600                | 8         | 591                       | 32.1                                                             | 559                                                             |

\* Actual NB varies

**Use time factor adjustment of  $\Delta_{ysall}$  for other than 30 day testing from the table below.**

TABLE 6.2 TIME FACTORS FOR DEFLECTIONS [from AS/NZS 2566.2]

| <i>Time Interval</i> | <i>Factor</i> |
|----------------------|---------------|
| 24 hours             | 0.70          |
| 3 days               | 0.75          |
| 7 days               | 0.85          |
| 14 days              | 0.95          |
| 30 days              | 1.0           |
| 3 months             | 1.1           |

| <i><b>Time Interval</b></i> | <i><b>Factor</b></i> |
|-----------------------------|----------------------|
| 1 year                      | 1.2                  |
| 2 years                     | 1.3                  |

The preferred prover type will comprise of 8 ribs similar to the prover shown below:

