

## Policy 11: Land Development Guidelines

### SS2

#### Specification for Water Supply Mains and Associated Works

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## 1.0 General

This specification covers the construction of:

- a) Water reticulation and associated Works – Traditional Potable:
  - i) DN100 to DN300 water reticulation mains and associated appurtenances where the maximum working pressure is not more than 900kPa.
- b) Dual water reticulations and associated Works – Potable and Class A+ Recycled:
  - i) DN63 and DN110 MDPE and DN150mm to DN300 PVC and DICL potable water reticulation mains and associated appurtenances where the maximum working pressure is not more than 900kPa;
  - ii) DN100mm to DN300 PVC and DICL recycled water reticulation mains and associated appurtenances where the maximum working pressure is not more than 900kPa.
- c) Trunk water supply mains and associated Works – Water reticulation and Dual Water reticulation:
  - i) DN300 to DN1200 water supply mains, and associated appurtenances where the maximum working pressure is not more than 900 kPa.
- d) This specification covers reticulation and trunk water requirements and where needed, separately specifies requirements for reticulation and trunk water.
- e) The construction of mechanical installations, electrical installations and treatment plants is not covered by this specification.

## 2.0 Acts, Regulations and Local Laws

- a) The Contractor shall comply with all Acts, Local Laws and Regulations having jurisdiction over work under the Contract and shall be fully responsible for any breaches thereof.
- b) Notwithstanding the requirements of this specification the whole of the work under the Contract shall be executed in conformity with the relevant sections of the **Water Act 2000** (as amended), the **Environmental Protection Act**, the **Environmental Protection Regulation**, the **Workplace Health and Safety Act** and any **Construction Safety Plans** required by this Act and all other **Queensland** and **Australian Acts** and **Regulations**.
- c) The Contractor is advised that Council has **Occupational Health and Safety Guidelines** that shall be reviewed and used as appropriate. These Guidelines are available for viewing at Council's Nerang and Evandale Administration centres.

## 3.0 Existing Services

- a) It shall be the Contractor's responsibility to contact all public utility authorities to ascertain the location of services prior to commencing the Work under the Contract. In carrying out the Works, the Contractor shall be responsible for all damage caused to any public utility whatever.
- b) Before undertaking any work, which may interfere with any public utility, railway, road, watercourse or tidal waters or with any structure, the Contractor shall give the required notice in writing to the Department or Authority concerned. The Contractor shall not commence the work until it has received the necessary permits and it shall carry out the work in accordance with the conditions set out in these permits.
- c) If the Contractor damages any existing services it shall arrange for the relevant service authority to make good such damage and the cost thereof shall be borne by the Contractor.
- d) Where the design of the Works requires alterations to existing services and such alterations are to be organised by the Contractor then the Contractor shall liaise and arrange with the relevant Department or Authority to effect such alterations and the Contractor shall pay all costs, fees, and charges of the Department or Authority.
- e) All of the Contractor's costs in performing this function shall be deemed to be included in the relevant Bill Item (if part of the Contract) and the Lump Sum of the Contract generally.
- f) Prior to commencing the Works on-site, the Contractor shall physically locate and expose all services in the vicinity of the Works using non destructive vacuum excavation methods, unless approved otherwise, and assess if there is interference with the construction of the Works as designed.
- g) Where existing services interfere with the Works as designed the Contractor shall notify the Superintendent of the interference immediately. The Superintendent will then instruct the Contractor on how to proceed.

- h) Where the design of the Works is altered to overcome the existing services interference the Contractor shall undertake the work instructed.
- i) Actual additional construction costs associated with the alteration of the Works or services to overcome the existing services interference will be met by the Principal. No delay and disruption costs will be considered, as the additional Works will be instructed in response to notification by the Contractor prior to Works commencing on-site.

#### 4.0 Materials

##### 4.1 General

- a) All materials used in the Works shall be handled, transported and stored in accordance with the relevant Australian Standard and the manufacturer's recommendations.

##### 4.2 Concrete Structures, Reinforcing, Timber, Formwork

- a) The grade of concrete to be used in the Works shall be as shown on the drawings. The manufacture, supply, handling and placing of concrete shall comply with the requirements of **AS1379** and **AS3600**.
- b) Portland and blended cements shall comply with the requirements of **AS3972**.
- c) Steel reinforcing bars and welded wire reinforcing fabric shall comply with the requirements of **AS/NZS4671**.
- d) Structural steel shall comply with the requirement of **AS3678**, **AS/NZS3679** and **AS/NZS1554.5**.
- e) Galvanising shall comply with the requirements of **AS/NZS4680**.
- f) All structural timber shall comply with the requirements of **AS1720.1** and timber species shall conform to unseasoned stress Grade F17.
- g) Formwork shall comply with the requirements of **AS3610**.

##### 4.3 Effect on Potable Water

- a) All pipes, fittings and joint seals shall comply with the requirements of **AS4020** with regard to their effect on potable water.

##### 4.4 Colours of Pipe

- a) The colour purple shall be not lighter than RAL 310 70 15 and not darker than RAL 330 40 40/310 50 30 as defined by the **RAL DESIGN System (RAL German Institute for Quality Assurance and Certification)**.
- b) The colour blue shall be not lighter than RAL 200 90 10 and not darker than RAL 200 80 25 as defined by the **RAL DESIGN System**.

###### 4.4.1 Water Service Pipe Colours

- a) Water Service DN25 and DN32 pipes for potable water supply shall be coloured black with blue stripes. Water Service pipes of DN50 and DN63 may be coloured either blue or black with blue stripes. The colour blue is defined in **Clause 4.4 b)** herein.
- b) Water Service DN25 and DN32 pipes for recycled water supply shall be coloured purple. Water Service pipes of DN50 and DN63 may be coloured either purple or black with purple stripes. The colour purple is defined in **Clause 4.4 a)** herein.

###### 4.4.2 Water Main Pipe Colours

- a) Pipes for potable water supply shall be blue in colour as defined in **Clause 4.4 b)** herein.
- b) Pipes for recycled water supply shall be purple in colour as defined in **Clause 4.4 a)** herein.
- c) No main of another 'products' colour shall be used as a main for the other 'product'. The use of the correct coloured sleeving over an incorrectly coloured main is not permitted.
- d) Trunk mains shall use sleeving to define the 'product' contained within the main except as prohibited in **Clause 4.4.2 c)** herein.

## 5.0 Water Main Pressure Pipes

### 5.1 General

#### 5.1.1 Traditional Potable Reticulation Mains

- Pipes used for traditional potable mains shall comply with **Table 1** herein.
- Pipes used within roadways shall be Ductile Iron (DI) in accordance with the drawings.
- Pipes used within *cul-de-sac* ends shall be DN63 PE100 in accordance with the drawings.

**Table 1**

| Nominal Size (DN)       | Type of Pipe | Class of Pipe               |
|-------------------------|--------------|-----------------------------|
| 63                      | MDPE         | Series 1 PE100 – SDR11/PN16 |
| 100, 150, 200, 250, 300 | PVC          | Series 2 PN 16              |
|                         | Ductile Iron | PN20, PN35 & Flange Class   |

#### 5.1.2 Dual Water Reticulation System

##### 5.1.2.1 Potable Reticulation Mains

- Pipes used for potable mains in dual water reticulation systems shall comply with **Table 2** herein.
- DN150 and larger pipes for potable mains used within roadways shall be Ductile Iron in accordance with the drawings. PE mains at DN63 and DN110 may be lain within roadways where the main is one continuous length as shown in the drawings.

**Table 2**

| Nominal Size (DN)  | Type of Pipe | Class of Pipe               |
|--------------------|--------------|-----------------------------|
| 63 and 110         | MDPE         | Series 1 PE100 – SDR11/PN16 |
| 150, 200, 250, 300 | PVC          | Series 2 PN16               |
| 150, 200, 250, 300 | Ductile Iron | PN20, PN35 & Flange Class   |

##### 5.1.2.2 Recycled Reticulation Mains

- Pipes used for Class A+ recycled water mains in dual water reticulation systems shall comply with **Table 3** herein.
- Pipes for recycled water mains used within roadways shall be Ductile Iron in accordance with the drawings.
- Pipes used within *cul-de-sac* ends shall be DN63 PE100 in accordance with the drawings.

**Table 3**

| Nominal Size (DN)       | Type of Pipe | Class of Pipe               |
|-------------------------|--------------|-----------------------------|
| 63                      | MDPE         | Series 1 PE100 – SDR11/PN16 |
| 100, 150, 200, 250, 300 | PVC          | Series 2 PN16               |
| 100, 150, 200, 250, 300 | Ductile Iron | PN20, PN35 & Flange Class   |

#### 5.1.3 Trunk Water Supply Mains for Potable and Recycled Systems

- Pipes used for trunk water supply mains shall comply with **Table 4** herein.

**Table 4**

| Nominal Size (DN)                         | Type of Pipe             | Class of Pipe               |
|-------------------------------------------|--------------------------|-----------------------------|
| 610, 762, 914 & above                     | Steel                    | Rated pressure – 1.4 MPa    |
| 300, 375, 450, 525, 600, 750, 900 & above | Ductile Iron             | PN20, PN35 & Flange Class   |
|                                           | Glass Reinforced Plastic | SN 10,000 PN 16             |
|                                           | ≤ DN375 PVC              | Series 2 PN 16              |
|                                           | MDPE                     | Series 1 PE100 – SDR11/PN16 |

## 5.2 Medium Density Polyethylene (MDPE)

- a) DN63 polyethylene pressure (PE) pipe for potable or recycled main terminations at *cul-de-sac* ends shall comply with **AS/NZS4130** and shall be Series 1 DN63 SDR11/PN16 PE100 pipe.
- b) DN63 and DN110 polyethylene (PE) pressure pipe for Potable mains in dual water reticulation systems shall comply with **AS/NZS4130** and shall be Series 1 DN63 or DN110 SDR11/PN16 PE 100 pipe.
- c) A Council approved Series 1 SDR9 (PN16) PE 80B pipe may be acceptable where PE 100 pipe is unavailable in DN63 or DN110.
- d) Larger diameter polyethylene pressure (PE) pipe shall be Series 1 diameter SDR 11/PN16 PE 100 pipe.
- e) Pipe colours shall be as specified in **Clause 4.4** herein.

## 5.3 Polyvinyl Chloride Pipes (PVC)

- a) All types of PVC pipe shall be manufactured using lead free stabilisers.
- b) uPVC pipes shall comply with **AS/NZS1477**.
- c) PVC-M pipes shall comply with **AS/NZS4765**.
- d) PVC-O pipes shall comply with **AS/NZS4441** at a material classification of MRS400 or MRS450 only. MRS500 pipe shall not be used.
- e) PVC-O pipes shall not be used for pumped mains in locations where bad ground conditions exist and pipe support is poor due to low to very low soil modulus. Where shown on the drawings, PVC-O pipes may be used where certified calculations in accordance with **AS2566** show that pipe buckling due to external loads, depth of cover, water table level and traffic live loads, etc. is not an issue.
- f) No PVC pipe socket of any approved material shall be joined to a Ductile Iron Spigot. PVC pipes shall not be less than 600mm in length with pipes less than this length to be DI.
- g) Handling and storage of PVC pipes and fittings shall comply with the requirements of **AS2032**.
- h) Joint seals shall be as specified in **Clause 9.2** herein.
- i) Pipe colours shall be as specified in **Clause 4.4** herein.
- j) Rubber rings shall be as specified in **Clause 9.2.1** herein.

## 5.4 Ductile Iron (DI)

- a) DI pipes shall be internally lined with cement mortar as set out in **AS/NZS2280**. Pipes of DN450 and larger, in addition to the mortar lining, shall be internally coated with a Seal Coat that provides water quality management of the mortar lining.
- b) DI pipes shall comply with **AS/NZS2280** or **EN545** compliant DI pipes can be used with appropriate marking as ISO Pipe as specified in **Clause 8.0** herein.
- c) DI pipes shall be bitumen coated externally in accordance with **AS/NZS2280** and sleeved as specified in **Clause 8.0** herein.
- d) DI PN35 pipes shall be used for road crossings with the pipe or pipes to extend 1.0 metre past the NKL at each end. DI pipes for use in locations other than underground shall be either thermal bonded polymeric corrosion protective coating or epoxy painted in accordance with **Clause 12.0** herein.
- e) Joint Seals shall be as specified in **Clause 9.2** herein.
- f) Rubber rings shall be as specified in **Clause 9.2.1** herein.

## 5.5 Ductile Iron Flanged Pipe

- a) DI flanged pipework shall be manufactured in accordance with **AS/NZS2280** – Flange Class wall thickness ductile iron pipe to which has been fitted threaded boss flanges in accordance with **AS4087**. **EN545** compliant DI pipes can be used with appropriate marking as ISO Pipe as specified in **Clause 8.0** herein.
- b) Pipes may be of flange/ flange, flange/ socket or flange/ spigot configuration as specified. All flange faces shall be machined at right angles to and concentric with the axis of the internal diameter of the pipe. For all new work, flanges shall be drilled in accordance with **AS4087** – **Figure B5** unless connecting on to existing mains where the connecting flange shall match existing.
- c) All pipes shall be internally cement mortar lined and externally coated as specified in **Clause 5.4** herein in accordance with **AS/NZS2280** and sleeved as specified in **Clause 8.0** herein.
- d) Joint Seals shall be as specified in **Clause 9.2** herein.

## 5.6 Glass Reinforced Plastic (GRP)

- a) GRP pipes, fittings and couplings shall comply with either **AS3571** or **ISO10467**.
- b) GRP couplings shall not be jointed to ductile iron spigot.
- c) GRP pipes and fittings shall be joined with GRP couplings with full width rubber membranes. The rubber membranes shall comply with the requirements for rubber rings as specified in **Clause 9.2.1** herein.

## 5.7 Steel

- a) Steel pipes shall comply with **AS1579**.
- b) The minimum wall thickness shall be 5 mm.
- c) The pipes shall be cement lined in accordance with **AS1281** and shall be internally coated with a Seal Coat that provides water quality management of the mortar lining.
- d) The pipes shall be externally coated with a fusion bonded medium density polyethylene (FBMDPE) coating in accordance with **AS4321**.
- e) Pipe joints shall be either spigot and socket, or welded slip-in, or welded butt, or welded ball and socket, or welded collar or flanged. Joint seals shall be as specified in **Clause 9.2** herein.
- f) Pipe welding shall be in accordance with **Clause 29.0** herein.
- g) When cathodic protection is required on elastomeric ring jointed pipelines, cable attachment lugs shall be provided on all pipe ends approximately 125 mm from the end of the coating.

## 5.8 Steel Flanged Pipe

- a) Steel flanged pipework shall be manufactured from **AS1579** pipe to which has been fitted plate flanges in accordance with **AS4087 Figure B7** as raised face flanges.
- b) Pipes may be of flange/ flange, flange/ socket or flange/ spigot configuration as specified. All flange faces shall be machined at right angles to and concentric with the axis of the internal diameter of the pipe. For all new work flanges shall be drilled in accordance with **AS4087 Figure B7** unless connecting on to existing mains where the connecting flange shall match existing. All pipes shall be cement mortar lined and coated as specified in **Clause 12.0**.
- c) The pipes shall be externally coated with a fusion bonded medium density polyethylene (FBMDPE) coating in accordance with **AS4321**.
- d) Prior to welding the flange to the pipe, the FBMDPE coating shall be cut back to a neat edge 50mm clear of the weld. After the completion of welding and inspection, the pipe barrel and exposed parts of the flange shall be coated with an epoxy painted coating as specified in **Clause 10.9** herein.
- e) Pipe welding shall be in accordance with **Clause 29.0** herein.
- f) Steel flanged pipework shall be handled and tested as specified in **Clause 26.4** herein.
- g) The joint between the coatings shall be covered using a U.V. stabilised heat shrink sleeve.

## 6.0 Water Main Pressure Pipe Fittings

### 6.1 Ductile Iron Socket Fittings

- a) DI socket fittings shall comply with **AS/NZS2280** and shall be PN16 (min) and shall be rubber ring jointed as specified in **Clause 9.2.1** herein. **EN545** compliant DI socket fittings can be used with appropriate marking of the ISO Pipe as specified in **Clause 8.0** herein.
- b) DI reticulation fittings and pipe shorts shall be internally and externally coated as specified in **Clause 12.1.1** herein. Pipe or fittings with this coating system shall not be cut.
- c) Sockets shall be of a design which provides an effective sealing length. At assembly of the socketed fittings joints, care shall be taken when cutting pipes that the pipe ends are cut square and evenly, not excessively bevelled and that the end is fully inserted into the socket by use of the witness mark.
- d) DI trunk fittings shall be either internally lined with cement mortar and externally bitumen coated in accordance with **AS/NZS2280** or coated as nominated in **Clause 12.1.1** herein. DI fittings shall be rubber ring jointed as specified in **Clause 9.2.1** herein.
- e) Only bitumen coated cement mortar lined pipe and fittings in accordance with **AS/NZS2280** may be cut.

## 6.2 Ductile Iron Flanged Fittings

- a) Flanged pipe fittings shall be manufactured in accordance with **AS/NZS2280. EN545** compliant DI flanged pipe fittings can be used with appropriate marking of the **ISO** Pipe as specified in **Clause 8.0** herein. All flanged pipe fittings shall be in accordance with **AS4087 Figure B5** unless connecting onto existing mains, where the connecting flange shall match existing. DI reticulation fittings and pipe shorts shall be internally and externally coated as specified in **Clause 12.1.1** herein. Trunk fittings shall be either coated as nominated in **Clause 12.1.1** herein or internally lined with cement mortar and externally bitumen coated in accordance with **AS/NZS2280**.
- b) Flanges shall be raised face as detailed in **Appendix C** of **AS4087**. Joint Seals shall be as specified in **Clause 9.2** herein.
- c) Fittings for use underground shall be coated externally with a bituminous compound in accordance with **AS/NZS2280**. Fittings for use in locations other than underground shall be epoxy painted as specified in **Clause 12.1.2** herein.

## 6.3 Ductile Iron Puddle Flanges

- a) Puddle flanges shall comply to **AS/NZS2280** except that all nuts, bolts and washers used in the assembly of puddle flanges shall be of Grade 316 stainless steel.
- b) Puddle flanges shall be attached to Flange Class pipe by a machined groove complying with **AS/NZS2280**.

## 6.4 Steel Fittings

- a) Steel fittings shall comply with **AS1579** with a rated pressure of 1.4 MPa.
- b) Fittings shall be manufactured from sections of pipe which have been cement lined in accordance with **AS1281** and coated or lined and coated with fusion bonded medium density polyethylene in accordance with **AS4321**.
- c) Fittings shall have square plain spigot ends for collar jointing.
- d) Fittings shall generally comply with the suggested configurations and dimensions shown in **Appendix G** of **AS1579**.
- e) Fittings such as wyes, tees, angle branches, etc. shall be reinforced in accordance with the provisions of **American Water Works Association Manual M11, Clause 13.3**.
- f) At all welds, the FBMDPE coating shall be cut back to a neat edge 50mm clear of the weld. After the completion of welding and inspection, the exposed surface shall be coated with a spray application of the FB or FBMDPE coating material. Any gap in the cement mortar lining shall be packed with cement mortar.
- g) Pipe welding shall be in accordance with **Clause 29.0** herein.
- h) Steel flanged pipework shall be handled and tested as specified in **Clause 26.4** herein.

## 6.5 Polyethylene (PE) Fittings for Mains

- a) Reticulation main Polyethylene (Poly) fittings for DN63 and DN110 pipe, such as pipe couplings, tees and bends shall be PE electrofusion fittings compatible with the pipe specified in **Clause 5.0** herein and shall be manufactured in accordance with either/ or **EN 1555** and **EN 12201** and **EN 13244** and **UNI 10910** at **PN16** for water.
- b) Reticulation DI main fittings for Poly main connection offtakes shall be PN 16 flange restraint fittings equal to the Hawle Flange Adaptor, System 2000 fitting or the AVK Supa Plus Flange Adaptor 623/10 fitting that has been installed directly down stream from a restrained section of flanged DI pipe as shown in the drawings. The Poly restraint fittings flange shall be in accordance with **AS4087 – Figure B5**. All bolts used in the fitting shall be Grade A4 or shall comply with **Clause 10.0** herein.
- c) DN63 flushing point PE risers shall be terminated with a electrofusion Transition coupling with a brass 1½" Male BSP threaded offtake. Onto this BSP thread shall be attached either a Potable or Recycled Flushing Valve assembly as shown in the drawings.
- d) Tapping fittings shall comply with **Clause 7.2** herein.

## 7.0 Property Service Pressure Pipes And Fittings

### 7.1 Ductile Iron Pre-Tapped Property Service Fitting

#### 7.1.1 Reticulation Mains DN100 to DN300

- a) DI pre-tapped Property Service fittings shall comply with **AS/NZS2280**.
- b) For DN100 and DN150 Potable and Recycled reticulation mains, DI pre-tapped Property Service fittings shall be provided with four (4) factory machined 20 mm BSP tapping outlet ports and shall be treated as specified in **Clause 12.1.1** herein. Each port shall be provided with a brass plug that shall be provided with an approved thread sealing tape or sealing gasket prior to the plug being fixed in place where the service port is not used.
- c) For DN200 to DN300 Potable and Recycled reticulation mains, DI pre-tapped Property Service fittings shall be provided with one (1) factory machined 50 mm BSP tapping outlet port and shall be treated as specified in **Clause 12.0** herein. The ball valve(s) and fittings provided to support the property service shall be manufactured from dezincified copper alloy complying with **Clause 11.8 a)** herein.
- d) Where shown on the drawings, a tapped hydrant tee that has been provided with two (2) factory machined 20 mm BSP tapping outlet ports shall be used to provide Potable and Recycled reticulation water service offtakes. Such hydrant tees shall be treated as required in **Clause 12.1.1** herein and unused ports shall be sealed as required in **Clause 7.1.1 b)** herein.
- e) DI pre-tapped Property Service fittings shall be socket-socket and shall be rubber ring jointed as specified in **Clause 9.2.1** herein.
- f) Attached to the DI pre-tapped Property Service fitting shall be a maintap ball valve complying with the requirements of **Clause 11.9** herein that provides a mechanical coupling complying with **AS3688** and **AS/NZS4129** for the attachment of the DN25 or DN32 property service pipe specified in **Clause 7.3** herein.

### 7.2 PE Electrofusion Tapping Fitting

- a) Reticulation main Polyethylene (Poly) tapping fittings or saddles for DN63 and DN110 pipe shall be PE electrofusion fittings compatible with the pipe specified in **Clause 5.0** herein and shall be manufactured in accordance with either/ or **EN 1555** and **EN 12201** and **EN 13244** and **UNI 10910** at **PN16** for water.
- b) The temporary attachment bracket that holds the fitting in place on the main while the fusion process occurs may include bolts or screws that are cadmium plated carbon steel.
- c) The tapping fitting shall have an integral Stainless Steel or Brass cutter to tap the main following the fusion of the fitting to the main. The cutter shall retain the coupon from the main and be able to shut of and turn on the flow of water through the fitting. The cutter components shall be sealed from the external environment by the use of an O-ring sealed cap or the fitting may have an exposed SS316 cutter spindle with an approved steam sealing system.
- d) The tapping fittings DN25 of take shall permit the attachment of an electrofusion fitting for the connection of the DN25 or DN32 property service pipe specified in **Clause 7.3** herein.
- e) The Tapping saddle may be a Monobloc format where the service of take is perpendicular to the main or the saddle may incorporate the ability to rotate the of take to align with the property service pipe prior to fusion of the saddle.

### 7.3 Medium Density Polyethylene Property Service Pipe and Fittings

- a) Polyethylene property service pipe shall comply with **AS/NZS4130** and shall be Series 1 DN25 or DN32 SDR9/ PN16 PE80B pipe that is coloured as specified in **Clause 4.4** herein.
- b) A Council approved Series 1 DN25 or DN32 SDR11/PN16 PE100 pipe may be acceptable where PE80B pipe is unavailable.
- c) For the DI pre-tapped Property Service fittings specified in **Clause 7.1.1** herein, the above specified pipe shall connect to the 20mm BSP maintap ball valve with a DN25 or DN32 Property Service fitting that complies with **AS3688** and **AS/NZS4129** that is manufactured from either dezincified copper alloy complying with **Clause 11.9 a)** herein or polyethylene materials complying with **AS/NZS4129**. The dezincified copper alloy fittings associated thimble and olive shall be an approved plastic material.
- d) For the Poly electrofusion tapping saddles, the fitting for connecting the Property Service pipe specified in **Clause 7.3 a)** herein to the saddle shall be a DN25 or DN32 electrofusion fitting manufactured in accordance with either/ or **EN 1555** and **EN 12201** and **EN 13244** and **UNI 10910** at **PN16** for water.

- e) Twin Property Service pipe DN32 x DN25 x DN25 splitter tees and DN25 x DN25 x DN25 splitter tees shall comply with **Clause 7.3 d)** herein.
- f) PE100 and PE80B property service pipe may require the use of bends where the bending radius of the pipe is exceeded when connecting the main to the meter box. Only electrofusion bends complying with **Clause 7.3 d)** herein shall be used on any property service pipe.
- g) The Property Service pipe shall connect to the Property Service water meter box with a fitting that complies with **Clause 7.3 c)** herein.

### 7.3.1 Property Service Water Meter Box

- a) Water meter box systems shall provide either two Potable water meter assemblies within the box or a Potable water meter assembly and a recycled water meter assembly within the box. The assemblies shall be provided with a temporary drilled and threaded plastic tube Breach Piece at the time of installation.
- b) All fittings, ball valves, threaded tube, meter tails and locking nuts used within the different meter assemblies shall be de-zincified copper alloy complying with **Clause 11.9 a)** herein. The components shall be PN 16 and where possible Water Marked. The disassembly fitting shall be able to provide up to 20mm of axial movement when fixed in place within the meter assembly.
- c) The water meter ball valve shall comply with **Clause 11.9** herein and shall be provided with a locking handle.
- d) The water meter box shall be provided with a 500mm length of water service pipe on the property side of the box that will allow the installation to be flushed following the meters installation.
- e) The Contractor shall apply to Council for the installation of the water meters as a component of the compliance audit that is a part of the On Maintenance of the Works.
- f) Water meter box systems shall be approved by Council.
- g) The recycled water meter ball valve shall be coloured as specified to **Clause 4.4** herein.

### 7.4 Property Service Pipe Bedding

- a) Property Service pipe bedding material shall be sand that is reasonably uniform in particle size and free of organic matter, construction debris and salt. The sand shall have 100% of the material passing a 2.36mm AS metric sieve and shall have not more than 5% passing a 75 micron sieve.
- b) A minimum of 75mm of the Property Service pipe bedding material shall be provided around the PE service pipe as shown in the drawings.

### 7.5 Property Service Conduits

- a) Property Service conduits shall comply with **AS/NZS1477 Series 1**.
- b) All Property Service Conduits shall be either DN100 or DN150 PN12 PVC pressure pipes with solvent cement joints.
- c) The conduit ends shall be bevelled to remove any sharp edges on the internal pipe face.
- d) Provide a polystyrene plug in the up stream end of the conduit after the property service(s) have been installed.

## 8.0 Polyethylene Pipe Sleeving and Marker Tape

### 8.1 Australian Standard Pipe

- a) Polyethylene sleeving shall be manufactured to satisfy the requirements of **AS3680**.
- b) Polyethylene sleeving shall be installed on all DI pipes and fittings to satisfy the requirements of **AS3681**.
- c) Where shown on the drawings for pipe materials other than DI, Polyethylene sleeving shall be provided to satisfy the requirements of **AS3681**.
- d) The colour of Polyethylene sleeving installed on a pipe shall be in accordance with **Clause 4.4** herein.
- e) All mains shall be marked by the use of underground detectable warning tape.
- f) A coloured detection tape in accordance with **Clause 4.4** herein shall be located at a depth of 300 mm below finished surface and within the trench vertically above the pipeline being marked.
- g) Underground detection/ tracer tape shall conform to **AS2648.1**.
- h) The tape shall be coloured polyethylene as noted above with a continuous metal core. The tape shall feature sub-surface graphics incorporating a warning 'Caution Buried Water Line' or 'Caution Recycled Water – Do Not Drink'. The graphics shall be continuous along the tape.

## 8.2 ISO Standard Pipe

- a) ISO Standard pipe systems and fittings in addition to the requirements of **Clause 8.1** herein shall be clearly marked as an ISO pipe system.
- b) Marking shall be through the use of either **AS3681** compliant sleeving that additionally states that the pipe system is to an ISO Standard or the pipe system shall be marked over the standard sleeving with a spirally wound detection/ tracer tape that states that the pipe system is to an ISO Standard. The spirally wound tape shall be at 1.0 metre spaces circumferentially along the pipe.

## 9.0 Jointing Systems

### 9.1 Pipe Mechanical Joints

#### 9.1.1 Gibault Joints

- a) Only elongated gibault joints complying with **WSA 105** shall be used in the Works. They shall be approved by the Superintendent and shall be on Council's list of approved products.
- b) All bolts used in the joint shall comply with **Clause 10.0** herein.
- c) Gibault joints shall be tolerant of pipe axial deflection at the joint pipe and axial movement and forces applied perpendicular to the pipe axis.
- d) Joint Seals shall be as specified in **Clause 9.2.1** herein.

#### 9.1.2 Dismantling Joints

- a) Dismantling joints shall be PN16 minimum, either thrust type or non-thrust type depending on the pipeline arrangement.
- b) They shall be manufactured from ductile iron in conformance with **AS/NZS2280** and drilled to **Figure B5** of **AS4087** and be provided with natural rubber seals and flange gaskets in accordance with **Clause 9.2** herein. Bolts shall comply with **Clause 10.0** herein.
- c) The ductile iron components shall be provided with a thermal bonded polymeric corrosion protective coating as specified in **Clause 12.0** herein.

#### 9.1.3 Flanged Assembly Joints

- a) Flanged Assembly Joints (UniFlange or equal) shall be DI fittings manufactured in conformance with **AS/NZS2280** and drilled to **Figure B5** of **AS4087**. Jointing bolts shall be in accordance with **Clause 10.0** herein. Set screws shall be stainless steel Grade 431 that have been heat treated following manufacture.
- b) Joint Seals shall be as specified in **Clause 9.2.1** herein and coatings shall be as specified in **Clause 12.0**.
- c) The pressure rating shall be nominated by the manufacturer and shall be equal to the test pressure for the pipeline.
- d) Flanged Assembly Joints shall only be used on DI Flange Class pipe.

#### 9.1.4 Flexible Couplings/ Clamps

- a) Flexible couplings shall be suitable for jointing the type of pipe used in the work.
- b) Couplings such as the Straub Flex range shall be manufactured from Grade 316 stainless steel, with Grade 316 stainless steel fasteners and EPDM sealing sleeves. Washers shall be provided under all bolt head and nuts where rotation may occur to prevent damage to the coatings.
- c) Couplings shall be suitable for in ground installation on pipelines laid in soils which may be subject to ground movement. The couplings shall be tolerant of pipe axial deflection at the joint pipe and axial movement and forces applied perpendicular to the pipe axis. For axial restraint of metal pipes, the Straub Metal-Grip range is acceptable.

## 9.2 Pipe Joint Seals

### 9.2.1 Rubber Rings

- a) All socketed pipes shall be rubber ring joined.
- b) Unless otherwise specified rubber rings shall be either natural rubber, a Nitrile (NBR) compound or an Ethylene Propylene – Diene Terpolymer (EPDM) material complying with **AS1646**.
- c) Rubber rings for water reticulation shall not contain root inhibitor.

## 9.2.2 Flange Gaskets

- a) Flange Gaskets shall comply with the requirements of **Figure B5** and **Appendix D** of **AS4087**.
- b) Gaskets shall be manufactured from an elastomer complying with **AS1646** and may contain a reinforcement material. The minimum working pressure for gaskets shall be 1600 kPa at 3.0mm thick.
- c) Flange gaskets for DN600 and larger mains shall comply with the manufacturer's requirements.

## 10.0 Jointing Bolts

- a) All nuts, bolts and washers (including assembly nuts and bolts) shall be stainless steel Grade 316 Class 50 minimum, with an anti-seizing paste, such as Koprkote or equal, used in assembly.
- b) All stainless steel nuts and bolts, other than bolts which form an integral part of an article, shall comply with the metric standards **AS1111** and **AS1112**.
- c) Bolt length shall be equal to the sum of the thickness of the flanges, gaskets, nut and washer and rounded up to the nearest standard size. Flange gaskets shall comply with **Clause 9.2.2** herein.
- d) Bolts shall exhibit a clean cut thread with no burrs or torn peaks on the thread. Nuts must turn freely on the threads without binding.
- e) Torque used to tighten bolts with clean flat lubricated surfaces shall comply with the pipe manufacturer's recommendations or the bolt supplier's recommendations.

## 11.0 Valves

### 11.1 Sluice and Scour Valves ≤ DN600

- a) Sluice and scour valves shall be PN 16 resilient seated with double 'O' ring stem seals and shall comply with **AS2638.2**. In addition to the Standard Type Tests, each valve shall be tested in accordance with **Section 5.2** of **AS2638.2**.
- b) All nuts and bolts used in the assembly of valves shall be of Grade 316 stainless steel. Fasteners other than stainless steel shall be of high grade steel and shall be isolated from the external environment.
- c) Valves shall be treated as specified in **Clause 12.1.1** herein. Wedges shall be **fully** encapsulated in an approved synthetic rubber in accordance with **AS1646**.
- d) Potable and Recycles sluice and scour valves shall have anti-clockwise spindles for closing and shall be tested to the requirements of **Section 5** of **AS2638.1**. Spindles shall be turned out of high tensile brass or stainless steel.
- e) End configurations shall be either flanged or double socket or double spigot or combinations. Sockets shall incorporate an elastomeric sealing ring as specified in **Clause 9.2** herein.
- f) Valves shall be supplied with a standard square spindle cap.
- g) DN750 and larger sluice valves shall be provided with a gearbox that will allow the valve to be opened and closed against an unbalanced head of 100m (1,000kPa) by a person using a T key on the spindle cap and applying a torque no greater than 160 NM.
- h) For PE mains, the Hawle E2 System 2000 valve or the AVK Supa Plus Coupling Series 01/70 valve or equal DI bodied valve is acceptable. End configurations shall be double socket with a Council approved mechanical restraint system or factory fixed electrofusion stubs for fusion joining to the main. Mechanical restraint sockets shall incorporate an elastomeric sealing ring as specified in **Clause 9.2.1** herein.

### 11.2 DN750 and Larger By-Pass Valves

- a) Valves shall be PN 16 and similar to AVK Series 54 or the Tyco Figure 500 with By-pass.
- b) Unless specified otherwise, the By-pass Valve shall comply with **Clause 11.1** herein and shall be a minimum of DN100.
- c) The main valve and the By-pass valve shall be DI and coated as specified in **Clause 12.1.1** herein.
- d) The valves shall have a 316 Stainless Steel tag attached and be clearly labelled indicating size of valve (lettering not smaller than 5mm in height). The valve spindles and valve cover and surround shall be colour coded, white for the main valve and yellow for the DN100 By-pass valve.

## 11.3 Butterfly Valves $\geq$ DN450

- a) Butterfly valves shall be installed in a pit in accordance with the drawings and shall be manufactured in accordance with **AS4795**.
- b) Butterfly valves for waterworks purposes shall be double-flanged with replaceable resilient seat that is physically retained in the body and wraps onto the flange faces eliminating the need for gaskets, a disc of 316 stainless steel, a one piece stainless steel shaft, ductile iron body, corrosion resistant bearings and shaft seals.
- c) Valves such as the Keystone Figure 631 or equal shall be suitable at a pressure rating of PN16.
- d) The valve shall be suitable for installing onto **AS4087 Figure B5** flanges.
- e) The valve seat shall be field replaceable, with integral O-rings moulded to it that cover the flange face, eliminating the need for gaskets. It is to be retained by a bed groove design that fully encapsulates the wetted area of the valve body.
- f) The valve shaft shall use the dry shaft principle, with self lubricating bearings and a rigid shaft/disc connection.
- g) The valve shall be fitted with upper and lower bearings.
- h) The valve shall not require routine gland adjustment or lubrication.
- i) The butterfly valve bodies shall preferably be coated as specified in **Clause 12.1.1** herein.
- j) The butterfly valves shall be manually operated through a gearbox. The gearbox shall comply with **Clause 11.9 d)** herein.
- k) The butterfly valves shall be works tested. The test shall include:
  - i) a test to demonstrate that the valves will operate correctly from fully closed to fully open and return to fully closed;
  - ii) a disc test with pressure applied on upstream side. No leakage. Check operation of actuator under this condition;
  - iii) a body test with disc partly open. No leakage.
- l) The Contractor shall check that there is adequate clearance between the valve disc and the adjacent pipes when the valve is opened and closed.
- m) The sealing surfaces of the valves shall bed on the metal face of the pipework flanges, not on the cement lining. If the valve sealing surface does not bed on the metal face, the Contractor shall provide minimum 6mm thick Grade 316 stainless steel insertion rings and additional rubber insertion joint rings.

## 11.4 Air Valves

- a) The location, size and type of air valve together with an adequately sized valve chamber shall be as shown on the drawings.
- b) Smaller air valves up to and including 50mm in size shall have a base with a brass BSP threaded fitting where available and shall be fixed on top of a suitable size brass gate valve with a 50mm BSP threaded stainless steel riser pipe (where required to place the valve as shown in the drawings), with the riser pipe fitted to a 50mm BSP threaded DN80 blank flanged fitting drilled in accordance with **AS4087 Figure B5**.
- c) For small air valves, sealing of air bleed hole shall preferably be by a float made of non-corrosive non-flexible material sealing against a rolling flexible seat. Where the float is a flexible material, the float shall be restrained from rotating ie. it seals on the same place at all times. The A.R.I range of valves or equal is acceptable.
- d) Where specified in the drawings, each valve shall be supplied with a BSP threaded similar sized 3-way tee port stainless steel ball valve to allow for air valve isolation and water sampling.
- e) Small air valve assemblies shall be installed onto the main with a suitable size DN80 of take hydrant tee.
- f) Larger combination air valves of DN80 and larger shall have a flanged fitting connected to a suitable size flanged sluice valve with gear box or resilient seated butterfly valve with gear box. A flanged hydrant riser shall be installed on the butterfly valve installation. Flanges shall be drilled in accordance with **AS4087 Figure B5**.
- g) Combination air valves of DN80 and larger shall consist of both small orifice and large orifice valves. The small orifice part of the valve shall be as specified above. The large orifice part of the valve shall consist of a body casing housing a Polycarbonate float which seals against an EPDM seal that is restrained in place with a Bronze ring. The float shall remain stable under all air outflow and inflow conditions without any possibility of premature closing of the valve during air outflow. The A.R.I range of D-050 valves or equal are acceptable.

- h) The valve installation shall incorporate a resilient seated flanged sluice valve complying with **Clause 11.1** herein or a resilient seated butterfly valve complying with **Clause 11.5** herein and a gearbox for either valve format that complies with **Clause 11.9** herein.
- i) The butterfly valve shall be bolted between the mains flanged hydrant tee and a flanged hydrant riser in a manner that will allow removal of the air valve without removing the butterfly valve. All 80 mm diameter air valves shall connect to a 80 mm diameter hydrant tee or flanged pipe branch and all 100 mm diameter air valves shall connect to a 100 mm diameter hydrant tee or flanged pipe branch.
- j) The surface of the cast iron body and cover of the air valves and the body of the butterfly valves shall be coated as specified in **Clause 12.1.1** herein.

## 11.5 Air Valve Butterfly Control Valves

- a) The location, size and type of air valve Butterfly control valve together with an Actuator (gearbox) shall be as shown on the drawings. The installation shall be provided within an adequately sized valve box or chamber as shown on the drawings.
- b) Air valve Butterfly control valves shall:
  - i) be manufactured from Cast or Ductile iron. When components of the valve are manufactured from a corrosive material then these components shall be coated in accordance with **AS4158** thermal-bonded polymeric coatings on valves and fittings for water industry purposes;
  - ii) be of a wafer or lugged format incorporating integral o-rings that cover the flange faces and is suitable for installation between flanged fittings drilled in accordance with **AS4087 Figure B5**. Where a non-lugged wafer butterfly valve is used then a flanged hydrant riser short shall be used above the butterfly valve as shown in the drawings;
  - iii) be compatible to attach a 90 degree actuator (gearbox) with extension spindle brought to under side of pit cover. Refer **Clause 11.9** herein for actuator details;
  - iv) have a resilient valve seat of nitrile materials conforming to the requirements of **AS1646** and be pressure rated in full vacuum to 1200 kPa and have a minimum temperature rating of minus 10° C to plus 90° C. Wafer Butterfly valves shall be a Keystone AR1/ AR2 wafer type or equal.

## 11.6 Check Valves

- a) Check valves shall comply with the requirements of **AS4794** – Swing check non-return and shall incorporate a counterweight and extended spindle with flanges in accordance with **AS4087 Figure B5**.
- b) The counterweight lever shall control the valve disc for opening and closing. AVK valves or Dobbie Dico Valves or equal are acceptable. Non-lever controlled valves such as the Val-matic Swing-Flex check valves or equal are acceptable where a check valve by-pass valve and by-pass pipeline arrangement is provided that will allow the main to be drained.
- c) Check valves shall be coated internally and externally with an approved thermal bonded coating in accordance with **Clause 12.0** herein.
- d) Valves shall be suitable to operate within the pressure ranges of the system within which they are being installed and shall be located as shown on the drawings.
- e) The type and pressure rating of the check valve shall be as shown on the drawings.

### 11.6.1 Wafer Check Valves ≥ DN375

- a) Wafer check valves shall incorporate a wafer type ductile iron body suitable for installation between **AS4087 (Figures B5 or B7, as appropriate)** flanges, Grade 316 stainless steel disc and EPDM seal. The body shall be coated in accordance with **Clause 12.1.1** herein.
- b) The type and pressure rating of the Check valve shall be as shown on the drawings.

## 11.7 Pressure Reducing Valves

- a) Pressure reducing valves shall be installed as shown on the drawings.
- b) The type, size and range (setting) of the pressure reducing valve shall be as shown on the drawings.
- c) Pressure reducing valves, flow meter, sluice valves and associated pressure and flow controls and telemetry and fittings including the valve chamber shall be constructed to the details shown on the drawings.
- d) Within the pit, any discharge shall be directed out of the pit to the stormwater system or to a natural gully as shown on the drawings or as directed by the Superintendent.
- e) For non-trafficked areas, lightweight aluminium covers shall be coated as detailed in **Clause 37.0** herein.

- f) For trafficable areas, appropriately classed DI covers complying with **Standard Specification SS1 – Specification for Construction of Sewerage Mains and Associated Works** at a minimum diameter of 700mm shall be used.

## 11.8 Ball Valves

- a) Ball valves shall be manufactured from de-zincified copper alloy and shall comply with the following standards: **AS1565, AS1567, AS1568, AS2345**.
- b) The ball shall be manufactured from polytetrafluoroethylene (PTFE) coated copper alloy complying with the above or stainless steel complying with **AS2837, Series 300**, containing not less than 8% nickel. Grade 303 stainless steel is not permitted. Alternatively, the ball shall be manufactured from PTFE filled thermoplastic.
- c) Resilient seats shall be manufactured from PTFE, elastomeric material or PTFE filled thermoplastic.
- d) The main tap ball valves shall connect to the ductile iron Property Service fitting by a 20mm BSP male connection with the ball valves outlet to have a 20mm BSP male connection to provide for the DN25 or DN32 property service pipe fitting.
- e) The working pressure of the ball valve and it's integral or attached property service pipe fitting, refer **Clause 7.3** herein, shall not be less than 1600kPa.
- f) All ball valves shall have non-corrosive componentry such as de-zincified copper alloy or Grade 316 stainless steel.
- g) The ball valve shall have a minimum clear bore of 19mm with a de-zincified copper alloy handle of 38mm minimum length for the maintap ball valve and 50mm minimum length for the locking water meter ball valve that is located within the water meter box assembly, refer **Clause 7.3.1** herein. Pins used to attach the handle to the ball valve stem shall be Grade 316 stainless steel.

## 11.9 Valve Spindles, Actuators and Gearboxes

- a) Extension spindles for direct vertical attachment to sluice valves shall comply with **AS2638**. Spindle caps and keys shall be manufactured from Ductile iron and the extension shaft shall be solid alloy steel with the assembly of these components to be by the use of stainless steel spring pins. Welded joints on the extension spindle are not permitted.
- b) Extension spindles for off-set vertical attachment to sluice valves shall generally comply with **AS2638** and **Clause 11.6 a)** herein. The extension spindle shall be supported every 1800mm with 316SS triangular brackets with integral bearings and shall be extended into the pit top slab to be terminated with an approved spindle cap and surface box lid. Universal joints shall be attached where shown on the drawings and shall be provided by the Valve supplier and installed to the manufacturer's recommendations.
- c) Where shown on the drawings, sluice valves shall be provided with Spur Gear gearboxes that will allow the valve to be opened and closed against an unbalanced head of 100m (1,000kPa) by a person using a T key on the spindle cap and applying a torque no greater than 160 NM. Gearboxes shall be in the Rotork IS Range of multi turn Spur gear products or equal.
- d) Butterfly valves  $\geq$  DN450 shall be manually operated through a totally enclosed lubricated for life gearbox. The gearbox shall be of weatherproof ductile iron construction with carbon steel spur and worm gear, ductile iron segment gear, bronze bushes and ball thrust bearings. The gear box shall have open-shut position indication. All bolts, nuts and screws including those to cover plates and end cap fixings shall be 316 stainless steel.
- e) Where shown on the drawings, provide above ground automated valve controllers such as the Rotork range and associated supports, cabinets, power and telemetry.
- f) Unless approved otherwise, air valve wafer butterfly valve actuators (gearboxes) shall:
- be manufactured from Cast or Ductile iron or an approved alternative material for the housing and cover. When components of the actuator system are manufactured from a corrosive material then these components shall be coated in accordance with **AS4158** thermal-bonded polymeric coatings on valves and fittings for water industry purposes or other approved protective coating;
  - the Actuator input shafts, extension system (spindle) and triangular brackets with integral bearings shall be made of a non-corrosive material such as 316 stainless steel;
  - the Actuator shall have a minimum of 6 turns to close/ open the valve by worm and segment gear or bevel gear operation;
  - the Actuator shall be a 90 degree actuator (gearbox) with extension system (spindle) brought to under side of cover;
  - the Actuator shall be a Keystone F427 BAF gearbox type or similar and shall be provided with a non-corrosive handwheel.

## 11.10 Valve Installation

### 11.10.1 Valve Boxes

- a) All buried sluice valves shall be provided with a valve box and surround that enables personnel on ground access to the valve spindle cap or extension spindle cap. Valve boxes and lids shall be in accordance with the requirements of Council's **Standard Specification SS2** and **Standard Drawing No. 08-06-124** and **08-06-125**.
- b) Marking of valve boxes and lids shall comply with the requirements of **Clause 34.0** herein.

### 11.10.2 Valve Pits

- a) Valves for in ground water pumping stations, pressure reducing facilities and butterfly valves shall be installed within the chamber or pit in accordance with the drawings.
- b) Thrust restraining reinforced concrete valve pits shall be constructed in accordance with the drawings.
- c) Marking of valve chambers and pits shall comply with the requirements of **Clause 34.0** herein.

### 11.10.3 Valve Thrust Restraint

- a) Valve installations shall provide thrust restraint for the valve in accordance with Council's Standard Drawing or as shown on the job specific drawings.

## 11.11 Rural Valve Installation

- a) Rural valve installation shall be where there are no residential allotments or Park Domain allotments.
- b) The valve installation shall:
  - i) use an Iron Box with an Iron Lid; and
  - ii) have a 1000mm x 1000mm square concrete slab that is 100mm thick and contains reinforcement sheet; and
  - iii) have the concrete slab grade away from the valve box; and
  - iv) have the slab integral cast with the iron box with all cast at ground level; and
  - v) for Verge/ footway installations be provided with a **Standard Specification SS2** defined marker post with attached marker plate defining the valve function and contained product; or
  - vi) for all other installations be provided with a Gal Steel street sign post that has a concrete footing and is provided with a marker plate defining the valve function and contained product; and
  - vii) have the installation painted the appropriate product/ system colour as shown in the drawings; and
  - viii) where a roadway is adjoining the valve installation the asphalt paving marking shall be as shown in the drawings with a white V with no background for Potable and a white background with Purple V for recycled waters.

## 12.0 Protective Coatings

### 12.1.1 Thermal Bonded Polymeric Coatings

- a) Valves, fittings and pipe fittings shall be treated internally and externally with a factory applied thermal bonded polymeric corrosion protective coating that shall comply with the requirements of **AS/NZS4158** and be applied by the fluidized bed technique.

### 12.1.2 Epoxy Painted Coatings

- a) Where specified that ferrous fittings are to be painted with an epoxy painted coating, the surface shall be abrasive blast cleaned to **AS1627.4** Class 2½ and painted with a 2 coat system of two pack high build, solvent free cycloaliphatic amine cured epoxy coating such as Jotacote 410 or equal to a dry film thickness of 500 microns. All applications shall be strictly in accordance with the manufacturer's specification.

## 13.0 Flushing Facilities

### 13.1 Hydrants

- a) Spring hydrants shall only be installed on the designated 100mm and larger main supplying fire flows as shown in the drawings.
- b) Spring hydrants for 'On Line' installations shall be manufactured to satisfy the requirements of **AS3952**.
- c) Spring hydrants for 'At End Of Line and Head of *Cul-de-sac*' installations shall be manufactured to satisfy the requirements of **AS3952** and shall have a removable top and internal assembly providing a clean bore to permit the insertion and removal of swabbing pigs. These hydrants shall be identified by the use of a blue coloured dust cap.
- d) Spring hydrants shall have a protective coating in accordance with **Clause 12.1.1** herein.
- e) Flanges for hydrants used in the construction of new water mains shall be DN80 in accordance with **AS4087 Figure B5** and in addition shall have elongated holes to allow compatibility with **The Queensland Department of Local Government Standard** hydrant flange.
- f) The maximum distance between hydrants shall be 80 metres.
- g) Potable water system and recycled water system hydrants shall be provided with standard claws with the claws coloured, as defined in **Clause 4.4** herein, being Blue for Potable water and Purple for Recycled water. The nominated colouring of the Recycled water claws may be carried out by the use of Purple Recycled water marking systems attached to the claw that are approved by Council.

### 13.2 Potable Flushing Point Valves and Riser

- a) Potable Flushing point valves or Health Water access points shall be PN16 copper alloy Gate Valves complying with the requirements of **AS1628** and **AS/NZS4020**.
- b) Copper alloys shall meet the requirements of **AS2345** Dezincification resistance of copper alloys with a lead content to not exceed 4.5.
- c) Potable Flushing point gate valves shall be DN1½"/40mm with female BSP Series RP treads to **AS1722.1** that are suitable for attachment to the PE risers electrofusion Transition coupling and above the gate valve the attachment of an alloy 38 mm Storz coupling with 40mm male BSP thread. The Storz coupling shall be provided with an alloy dust cap with restraint chain.
- d) All components of the gate valve that are exposed to the external environment such as nuts, washers, spindle and handle shall be of the same grade of Copper alloy as the valve. Handles shall be a minimum of 40mm diameter.
- e) The maximum distance between Potable Flushing points shall be 160 metres.
- f) The box used for the flushing facility shall be as shown in the drawings.

### 13.3 Recycled Flushing Point Valves and Riser

- a) Recycled Flushing point valves shall be ball valves complying with the general requirements of **Clause 11.8** herein.
- b) Recycled Flushing point ball valves shall be DN1½"/40mm with female BSP treads that are suitable for attachment to the PE risers electrofusion Transition coupling and above the ball valve the attachment of the Polypropylene DN1½"/40mm camlock coupling with 40mm male BSP thread.
- c) All components of the valve that are exposed to the external environment such as nuts, washers and handles shall be Grade 316 stainless steel. Handles shall be a minimum of 75mm long.
- d) The maximum distance between Recycled Flushing points shall be 160 metres.
- e) The handle of the ball valve shall be installed so that the open position has the handle vertical and located above the valve with the valves closed position having the handle at horizontal.
- f) The box used for the flushing facility shall be as shown in the drawings.

## 14.0 Geotextile

- a) Geotextile shall be used where shown on the drawings or as directed by the Superintendent.
- b) The geotextile shall have the following minimum properties that shall be marked on the roll in accordance with **AS3705**:
  - i) Nominal weight 180g/m<sup>2</sup> (as per **AS3706**)
  - ii) Load 750N (as per **ASTM 1682**)
  - iii) Mean Trapezoidal Tear Strength 350N (as per **ASTMD 1117**)
  - iv) Mean CBR. Puncture Resistance 2500N
  - v) Percolation Rate 340 L/m<sup>2</sup>/ sec (as per **AS3706**)
- c) The geotextile shall be a non-woven fabric made from continuous filament, synthetic fibres.
- d) Minimum lap shall be 300mm.
- e) Installation shall be as shown in the drawings to the manufacturer's recommendations.

## 15.0 Setting Out Work

- a) The Contractor shall be responsible for setting out the centre line of the main in accordance with the survey data supplied on the drawings prior to the commencement of work. Where survey stations are installed along the Works, the Contractor shall protect these stations.

## 16.0 Care of Real Property Survey Pegs

- a) The Contractor shall locate and mark with a white painted stake all real property survey pegs within the area likely to be disturbed by the Works. The Contractor shall take care not to distribute any real property survey pegs.
- b) Any existing real property survey pegs beyond the limits of earthworks or excavations under this contract, which are disturbed by the Contractor, will be replaced by the Principal's Surveyors at the Contractor's expense.

## 17.0 Care of Existing Fences

- a) Fences, other than those specifically noted for removal, shall be maintained at all times with special care taken to prevent straying of stock if grazing is carried out on adjoining lands.
- b) If fences are required to be adjusted, relocated or removed, the Contractor shall erect temporary fences, if necessary, for stock containment as directed by the Superintendent.
- c) Where fences are to be cut for access, wire shall be drawn tight to end posts, suitably struted, and suitable gates provided, if directed, for closure after working hours or when no work is in hand on the site.
- d) Any fence adjusted, relocated or removed during this execution of work shall be replaced and reinstated to its original alignment unless otherwise directed by the Superintendent. It is the Contractor's responsibility to ensure that the fence is located correctly.

## 18.0 Work Within Private Property

- a) The Contractor shall confine all work within private property to a 6.0 metre wide construction swathe unless agreed otherwise with the Superintendent. If directed by the Superintendent, the Contractor shall erect a temporary barrier fence or marker to define the limits of the construction swathe. Activities outside the limits of the construction swathe shall not be permitted without the expressed permission of the Superintendent.
- b) It is the Contractor's responsibility to inform private property owners of any construction activities that may affect them or their property. Notification is to occur prior to commencing these activities.

## 19.0 Work Within Road Reserves

All work within road reserves shall comply with the following:

- a) Work shall proceed with minimum interruption to traffic and any steps necessary for the protection of the public during construction shall be taken.
- b) Warning signs, flashing lights and other traffic control devices shall be erected in accordance with the Traffic Management Plan.
- c) Work which is likely to reduce traffic flow shall be carried out between 9.00 a.m. and 3.00 p.m. only and shall be organised so as to cause minimum disruption to pedestrians and access to adjacent properties. One lane of traffic under 'STOP-GO' control must remain open at all times across all roads.
- d) Open trenches shall be constructed to the details shown on the drawings. Trenches shall not be left open overnight.
- e) Work shall be carried so as not to detrimentally affect the existing drainage provisions of the roadway.

## 20.0 Clearing and Grubbing

- a) Clearing and grubbing shall be carried out in accordance with the requirements of Council's **Standard Specification SS3** and the approved **Vegetation Management Plan**.
- b) The Contractor shall take all necessary steps to preserve vegetation along the route of the main. These steps shall include:
  - i) Limiting the construction disturbance area to a minimum. As a general rule, the disturbance area shall be no greater than 6.0m wide for pipes less than or equal to DN600 and 10 m wide for mains larger than DN450. Job specific limitations may be imposed within the project specification as an environmental consideration.
  - ii) The Contractor is advised that adherence to the Council's **Planning Scheme Specific Development Code 36 – Vegetation Management** is required when undertaking the Works. It is the Contractor's responsibility to make all necessary enquires with the relevant Council department.
  - iii) Superintendent approval is required prior to clearing any tree with a diameter greater than 300 mm.
  - iv) All vegetation cleared in the course of constructing the Works shall be disposed of in accordance with the approvals. Any material that cannot be disposed of in the approved manner due to its excessive size shall be removed to an approved dump site at the Contractor's expense.

## 21.0 Cover to Water Mains

- a) For all water mains, the hierarchy of main crossings shall be the Potable main above the Recycled main that shall be above any Sewage rising main based on the following minimum covers.
- b) For DI water mains, the minimum cover from finished ground level to the obvert of the main shall be:

|      |                                |                                                       |
|------|--------------------------------|-------------------------------------------------------|
| i)   | for footpath verge allocations | 450mm for DN100 to DN300 reticulation pipes           |
| ii)  | for footpath verge allocations | 600mm for $\geq$ DN375 to $\leq$ DN525 trunk pipes    |
| iii) | for roadways                   | 600mm for DN100 to DN300 reticulation pipes           |
| iv)  | for roadways                   | as shown on the drawings for $\geq$ DN375 trunk pipes |
- c) For DI water mains, the maximum cover from finished ground level to obvert of the main shall be 1000mm.
- d) For other water main pipe materials, the minimum cover from finished ground level to the obvert of the main for footpath verge allocations shall be 600mm for DN100 to DN300 reticulation pipes and as shown on the drawings for  $\geq$  DN375 trunk pipes.
- e) For other water main pipe materials, the maximum cover from finished ground level to obvert of the main shall be 1000mm.
- f) For trunk mains of  $\geq$  DN525 in any allocation, the minimum cover shall be by design and as shown on the drawings and the maximum cover from finished ground level to the obvert of the main shall be 1500mm.
- g) In the event that the cover specified in **Clauses 21.0** herein cannot be achieved in a particular location for any reason, the Contractor shall seek written instructions from the Superintendent prior to proceeding with construction of the water main at that location.
- h) In Dual reticulation installations, where a potable main offtakes from another potable main, then the potable main shall be laid over the recycled main with the cover for these mains to be in accordance with the drawings.

## 22.0 Erosion and Sediment Control

- a) The following erosion and sediment control measures shall be taken to ensure that sediment is contained within the perimeter of the disturbed area in accordance with the approved Erosion and Sediment Control Plan.
- b) The area of disturbance shall be kept to an absolute minimum.
- c) Topsoil shall be retained for rehabilitation purposes.

**Note:** *Stockpiles should not exceed 2 metres height, as this decreases the seed viability.*

- d) Runoff both external to the site and within the disturbed area shall be controlled. Clean water shall be redirected away from the disturbed area and into a stabilised overland flow path.
- e) The site shall be rehabilitated quickly, ie. stabilise/ vegetate within fourteen (14) days of completion of Works. Rehabilitation shall proceed as each stage is completed. The disturbed area shall be seeded and landscaped in line with Council's landscaping guidelines.
- f) Sediment fences shall be installed as directed by the Superintendent and shall be inspected after each rainfall event, repaired if necessary and all trapped sediment removed to a designated stockpile.
- g) Stockpiled material spoiled from trenching operations shall be placed on the upslope side, away from any drainage lines. These stockpiles are to have erosion and sediment control devices in place, eg. sediment fences placed around the base, and if left for an extended period, an erosion proof blanket should be used.
- h) Where the path of the pipe crosses minor drainage lines extra sediment fences shall be installed or small detention basins shall be constructed.

## 23.0 Excavation

- a) Excavation for water pipe laying shall be completed to the lines, levels and profiles shown on the drawings.
- b) When (in the Superintendent's opinion) weather, soil conditions, or any contingency exists that may be detrimental to pipe laying the Superintendent may limit the length of trench opening in advance of pipe laying.
- c) In any event, unless approved otherwise by the Superintendent, the length of trench opening ahead of pipe laying shall not exceed 40 metres.
- d) Where the Contractor over-excavates, it shall make good the over-excavation at its expense. The over excavation shall be made good with bedding material which satisfies the requirements of **Clause 24.0** herein and which is the material immediately below Zone 1 for the Type 2 construction shown on the drawings.
- e) The Contractor shall at its own expense do all things necessary to divert any water interfering with the progress of the Works, keep the excavations and trenches free from water while the Works are in progress and prevent any damage to the Works by water due to floods or other causes. The Contractor shall have approved pumping gear for keeping the excavation or trenches constantly dewatered during the times the Works are in progress. Any work or material damaged by water shall be made good by the Contractor.
- f) Where directed by the Superintendent the bottom of trenches or excavations shall be compacted prior to the placing of any bedding or concrete materials. Should (in the opinion of the Superintendent) the foundation material be incapable of effective compaction, the material shall be removed and replaced with bedding material as specified in **Clause 24.0** herein.
- g) If approved by the Superintendent excavated material may be used for backfill over pipes. This material shall remain the property of the Principal and any excess shall be spoiled or used as filling within the Site as directed by the Superintendent.
- h) All excavated material which is classified by the Superintendent as unsuitable shall be removed from the Site. The cost of this work shall be deemed to be included in the relevant Bill Items (if part of the Contract) and the Lump Sum of the Contract generally.
- i) The Contractor shall be solely responsible for the maintenance of excavations and is liable for any damage which may be caused to any public utility, conduit, etc. through the collapse of the excavation.
- j) Any excess spoil and all unsuitable material shall be disposed of at a location where directed by the Superintendent within a 10 km radius of the site.
- k) Unless a separate item is included in any applicable Bill of Quantities for rock excavation, the items entered in the Priced Bill of Quantities and the Lump Sum of the Contract generally shall be deemed to include full compensation for excavation of material of all types and subsequent backfill and compaction of the trench or excavation with approved material.

- l) Excavation volumes shall be calculated using the relevant trench shown on the drawings.
- m) **Extra over for Rock:** Where a Bill of Quantities is part of the Contract and this Bill contains a separate item for excavation in rock (as defined herein), extra payment will be made for the Bill Item for all rock removed within the limits of the excavation as defined or as ordered by the Superintendent. The quantity for payment shall be the nett quantity in place within the limits of the excavation shown on the drawings. No claim for excavation in rock will be entertained unless the method of measurement is agreed in writing with the Superintendent prior to material being excavated. Rock shall be defined as material which cannot be excavated at the rate of 15m<sup>3</sup>/hour by a hydraulic tracked excavator with engine gross power output of 148 kW at maximum RPM and a rated breakout force on the bucket of 148 kN with standard bucket. It shall be the responsibility of the Contractor to provide the excavator and bucket for this purpose at its cost. The Superintendent shall have the right to nominate an operator for the machine. In the event of disagreement with any decision made by the Superintendent in accordance with the above definition, rock shall be defined as material geologically in place of a hardness when first exposed of three or greater in the Mohr scale of material hardness. Testing of material to determine classification as rock (by the Mohr scale) shall be carried out by an approved laboratory at the expense of the Contractor.
- n) **Use of Explosives:** Where approved, rock may be carefully excavated by blasting procedures. Prior to commencing any blasting operation the Contractor shall, pursuant to **Clause 2.0** herein, obtain any blasting permit required. The depth, spacing, location, type of explosive and method of firing shall comply with any permit issued for blasting operations. In the handling, storage and use of explosives, the Contractor shall comply with all State and local authority laws and local laws, and with **AS2187, SAA Explosives Code**. The Contractor shall in particular comply with **Section 11.2** of the **Code**. Where directed the Contractor shall provide measurements from a vibograph or similar instrument. If these measurements indicate that the requirements specified herein are not being complied with the Contractor shall reduce the amount of charge used or take such other action as will ensure compliance with the **Code**. The Contractor may be required to carry out trial blasting in order that the Superintendent may determine the peak vibration effects caused by the trial charges and so limit the maximum charge to be employed. The Contractor shall be responsible for all costs associated with the supply, operation and reporting of the vibograph or similar instrument. The Contractor shall give the Superintendent at least three (3) days notice of any intention to excavate by blasting and shall furnish full details of the location thereof and the methods it proposes to adopt. Subject to approval by the Superintendent for blasting at any location, such blasting shall be carried out only at times approved by the Superintendent. The Contractor shall provide screens, barriers, mats and/or other protective devices as directed by the Superintendent to limit the effects of blasting. Notwithstanding the provision of such protective devices, the Contractor shall be responsible for any loss, damage or injury sustained by the public, workmen, the Works and for damage to property or public utilities of any description whatsoever caused directly or indirectly by such blasting. Secure storage places shall be provided for explosives and all such places shall be clearly marked with warning signs. Only persons trained and experienced in the handling of explosives shall be allowed to use them on the work under the Contract. No shot shall be fired until a warning has been sounded and all persons within the radius of danger removed. The warning device shall give an audible warning clearly different from any other sound normally heard on the Site. In the event that the vicinity of work under the Contract is accessible to the general public, the Contractor shall, before any shots are fired, post personnel about the Works in various directions to warn all persons of the danger existing and to prevent them approaching closer than safety will permit. Where blasting is likely to endanger life or property, the Superintendent shall have the power to prohibit the use of explosives or prescribe and enforce such rules and regulations as it may deem necessary but the prescribing or failure to prescribe such rules and regulations shall not relieve the Contractor from any responsibility under the Contract. No explosives shall be left in holes overnight. Where explosives are used in rock excavation, the charges shall be so proportioned and placed that they will not loosen the rock outside of the excavation lines shown on the drawings or as provided for in the Contract. If the rock below the line or slopes designated should be loosened by blasting to such an extent as to render it (in the Superintendent's opinion) liable to slide, fall or have a detrimental effect to the Works such loosened rock shall be removed by the Contractor. The removed material shall be made good with material acceptable to and in a manner approved by the Superintendent. All work associated with the use of explosives shall be deemed to be included in the relevant Bill Item (if part of the Contract) and/or the lump sum of the Contract generally.

## 24.0 Bedding Material

- a) Bedding shall be crushed rock material complying with **AS2758.1** and **AS1141** and of the nominal sizes shown in **Table 6** herein.

**Table 6**

| Percentage Passing By Weight |                               |                            |                                                 |
|------------------------------|-------------------------------|----------------------------|-------------------------------------------------|
| AS Sieve (mm)                | Crushed Rock Nom Size 5 – 7mm | Crushed Rock Nom Size 10mm | Crushed Rock Nom Size 30mm (Additional Bedding) |
| 37.5                         |                               |                            | 100                                             |
| 26.5                         |                               |                            | 80 – 100                                        |
| 19.0                         |                               |                            | 25 – 60                                         |
| 13.2                         |                               | 100                        | 5 – 20                                          |
| 9.5                          | 100                           | 85 – 100                   | 0 – 5                                           |
| 6.7                          | 85 – 100                      | 30 – 50                    |                                                 |
| 4.75                         | 30 – 85                       | 5 – 30                     |                                                 |
| 2.36                         | 0 – 30                        | 0 – 5                      |                                                 |
| 1.18                         | 0 – 5                         |                            |                                                 |

## 25.0 Trench Construction

### 25.1 General

- a) Construction types are detailed on the drawings. Bedding material shall comply with the requirements of **Clause 24.0** herein.
- b) Excavated material shall not be used as bedding material.
- c) Where crushed rock material nominal size 5-7mm cannot be sourced, then crushed rock nominal size 10mm is to be used and either a full trench width geotextile covering shall be placed above Bedding Zone 3 as shown in the drawings as Type 2 Construction for dry trenches, or a full geotextile wrapping shall be placed around Bedding Zones 1, 2 and 3 as shown in the drawings as Type 3 Construction for wet trenches.

### 25.2 Type 1 Construction

- a) The Bedding Zones 1, 2 and 3 shall consist of crushed rock material (nominal size 5-7mm) specified in **Clause 24.0** herein and shall be constructed to the details shown on the drawings.

#### 25.2.1 Bedding Zone 1

- a) This material shall be placed in the trench to the depths shown on the drawings and compacted for the full width of the trench by two passes of a vibrating plate.

#### 25.2.2 Bedding Zone 2

- a) Hand holes shall be made in Bedding Zone 1 material as detailed on the drawings. The pipe shall be laid on the compacted bed and the bedding material carefully added to fill the hand hole. Bedding Zone 2 material shall then be placed in 150mm (maximum) layers and compacted for the full trench width for each layer using hand tampers and ensuring that the Bedding Zone 2 material is in full and even contact with the pipe and pipe joints. Hand tamping shall be carried out to ensure that no damage occurs to the pipe or to the pipe sleeving where provided.

#### 25.2.3 Bedding Zone 3

- a) Bedding Zone 3 material shall be 150mm deep for sand backfill and 300mm deep for all other backfill materials. Bedding Zone 3 material shall be placed in layers of 150mm (maximum) depth and compacted for the full width of the trench for each layer using two passes of a small vibrating plate. The trench shall then be backfilled in accordance with **Clause 31.0** herein.

- b) Where the backfill material is classified by the Superintendent as sand, a layer of geotextile (complying with the requirements of **Clause 14.0** herein) shall be placed as shown on the drawings.
- c) Where a 10mm bedding material is used instead of a 5/7 material, then the Bedding Zones 1, 2 and 3 shall be geotextile covered or wrapped as detailed in **Clause 25.1 c)** herein.
- d) Selected backfill shall be the best of the excavated material, as directed by the Superintendent, in accordance with the general requirements of **Clause 30.0** herein.

### 25.3 Type 2 Construction

- a) Type 2 Construction shall be used where, in the opinion of the Superintendent, the trench bottom is too soft or too wet to provide sufficient support for the pipe. In these circumstances additional bedding (nominal size 30mm) complying with the requirements of **Clause 24.0** herein shall be placed and compacted immediately below the Bedding Zone 1 material for the full width of the trench.
- b) The depth of additional bedding shall be as directed by the Superintendent but not less than 150mm. In all other respects Type 2 Construction shall be as for Type 1 Construction.

### 25.4 Type 3 Construction

- a) Type 3 Construction shall be used in locations where the Superintendent directs that Bedding Zones 1, 2 and 3 and the additional bedding are to be wrapped with geotextile as shown on the drawings.
- b) The geotextile wrapping shall comply with the requirements of **Clause 14.0** herein.
- c) In all other respects, Type 3 Construction shall be as for Type 2 Construction.

### 25.5 Type 4 Construction

- a) Type 4 Construction shall be used where shown in the drawings or at locations designated by the Superintendent where trench construction crosses a roadway.
- b) Type 4 Construction shall be to the details shown on the drawings. Bedding Zones 1, 2 and 3 shall be constructed as specified in **Clause 25.2** herein.
- c) Where additional bedding for Type 4 Construction is directed by the Superintendent the requirements of **Clause 25.3** herein shall apply. Where directed by the Superintendent that geotextile wrapping to the Bedding Zones 1, 2 and 3 and the additional bedding is to be installed the provisions of **Clause 25.4** herein shall apply.
- d) Where shown on the drawings, bulkheads shall be installed on each side of the roadway crossing, at a location within the verge, to prevent the migration of embedment and backfill material.

### 25.6 Type 5 Construction

- a) Type 5 Construction shall be used at the location designated by the Superintendent where trench construction is along sealed roads.
- b) Type 5 Construction shall be to the details shown on the drawings. Bedding Zones 1, 2 and 3 shall be constructed as specified in **Clause 25.2** herein.
- c) Where additional bedding for Type 5 Construction is directed by the Superintendent the requirements of **Clause 25.3** herein shall apply. Where directed by the Superintendent that geotextile wrapping to the Bedding Zones 1, 2 and 3 and the additional bedding is to be installed the provisions of **Clause 25.4** herein shall apply.

### 25.7 Type 6 Construction

- a) Type 6 Construction shall be used where shown in the drawings or at the location designated by the Superintendent where trench construction is along unsealed road shoulders.
- b) Type 6 Construction shall be to the details shown on the drawings. Bedding Zones 1, 2 and 3 shall be constructed as specified in **Clause 25.2** herein.
- c) Where additional bedding for Type 6 Construction is directed by the Superintendent the requirements of **Clause 25.3** herein shall apply. Where directed by the Superintendent that geotextile wrapping to the Bedding Zones 1, 2 and 3 and the additional bedding is to be installed the provisions of **Clause 25.4** herein shall apply.

## 25.8 Type 7 Construction

- a) Type 7 Construction shall be to the details shown on the drawings. Unreinforced concrete shall be Grade N20. Pipe floatation and heat reversion of the pipe shall be managed by the pipe layer so that the pipe installation is not damaged.
- b) The minimum width of the concrete embedment shall be as shown on the drawings.
- c) Backfill material shall be placed between the trench wall and the concrete embedment and compacted in accordance with the requirements of **Clause 30.0** herein.

## 25.9 Type 8 Construction

- a) Type 8 Construction shall be used for all approved common trenching installations for dual water reticulation systems.
- b) Type 8 Construction shall generally be as for Type 1 Construction except that two mains shall occupy the trench as shown on the drawing. Common trenching installations shall maintain the standard depths of Bedding Zone 1 and Bedding Zone 3.
- c) For each pipe within the Zone 2 Bedding material, hand holes shall be made in Bedding Zone 1 or 2 material as appropriate and as detailed on the drawings. The pipe shall be laid individually on its compacted bed and the bedding material carefully added to fill the hand hole. Bedding Zone 2 material shall then be placed in 150mm (maximum) layers and compacted for the full trench width using hand tampers and ensuring that the Bedding Zone 2 material is in full and even contact with each pipe and pipe joint.
- d) To facilitate two mains of larger and/or different diameters, the depth of the Bedding Zone 2 material shall be increased as appropriate for one of the pipes. For different diameter mains the larger diameter pipe shall be laid first with Bedding Zone 2 material then placed in maximum layers of 150mm thick to provide a bed for the smaller diameter main ensuring that the dual mains are laid obvert to obvert.
- e) To provide sufficient support for the pipe, where, in the opinion of the Superintendent the trench bottom is too soft or the trench is too wet or the bedding requires full geotextile wrapping or the trench is located within a road carriageway or road shoulder then the requirements for Type 2 to Type 6 Construction shall be applied to the Type 8 Construction.
- f) Where a 10mm bedding material is used instead of a 5/7 material, then the Bedding Zones 1, 2 and 3 shall be geotextile covered or wrapped as detailed in **Clause 25.1 c)** herein.

## 25.10 State-Controlled Roads

- a) Where pursuant to the **Transport Infrastructure Act 1994** roads declared as State-controlled roads, bedding shall comply with this specification. Backfill, pavement, boring and jacking (where required) shall comply with the requirements of **Queensland Department of Main Roads**.

## 26.0 Laying of Pipes and Associated Fittings

### 26.1 Definition of Terms

- a) Reticulation Mains: consists of Potable water and Recycled water pressure pipes and fittings which provide Desired Standards of Service for property service installations for allotments to connect to and may provide fire flows subject to the main type and can support future large property service installations and future fire service installations.
- b) Trunk Mains: consists of Potable water and Recycled water pressure pipes and fittings which support the provision of Desired Standards of Service and extend from the existing trunk system to the trunk system or to a Reticulation main.

### 26.2 Approval of Pipe Layers

- a) All pipe laying shall be carried out by competent and accredited pipe-layers under the supervision of the Contractors accredited personnel. All personnel's accreditations in the type of pipe being laid are to be approved by the Superintendent before pipe laying commences.
- b) If, in the opinion of the Superintendent, pipe-layers are performing unsatisfactorily the Superintendent may reject the work under the Contract and furthermore may instruct that the pipe-layers be removed from Site. All cost of rectification associated therewith shall be borne by the Contractor. Any other costs associated therewith by the Principal may be treated as a debt due from the Contractor as the Principal under the Contract and deducted by the Superintendent from any Progress Certificate issued by the Superintendent.

## 26.3 Pipe Laying General

- a) Where materials are to be supplied by the Principal, the Contractor shall transfer pipes, fittings and materials from the place designated within the Contract to the place of work.
- b) All pipes must be laid in accordance with the manufacturer's specification.
- c) All pipelines shall be constructed of pipes of types and sizes specified in the drawings and laid in accordance with the construction tolerances prescribed below and in **Clause 45.0**.
- d) PVC and GRP mains for road crossings of DN100 pipe and larger shall use DI pipes for the road crossing that extend 1.0 metre past the back of the kerb and utilize flanged joints for all tees and spigot socket joints for all other fittings.
- e) Pipes shall be sorted and matched prior to laying and shall be laid so that the inverts are continuous and true to line and grade and no part of the pipeline shall be more than 6mm from its true position with respect to line. Spigots and sockets shall be cleaned and the interior of pipes shall be free from obstructions or any contaminate.
- f) Water shall not be allowed to lie in the trenches while the pipes are being laid and the trench shall be kept free from all water until after the completed pipeline has been inspected and backfilling commenced.
- g) Reticulation pipelines main tap ball valve or electrofusion tapping saddles shall be left fully open and the water meter ball valve fully closed within the meter box.
- h) All pipe lines subject to future extension shall be spigot ended and terminated with a hydrant or flushing point as detailed on the drawings. Pipelines terminating with any other format will be rejected.
- i) Where shown on the drawings, cross connections between the potable main and the recycled main shall be provided. The format of the cross connection shall be in accordance with the drawing and shall include a sluice valve conforming to the requirements of **Clause 11.1** herein.

## 26.4 Pipe Sleeving

- a) All iron pipes and fittings regardless of the type of pipe system or any pipe system that requires sleeving as required in the drawings shall be sleeved in coloured polyethylene in compliance with **Clause 4.4** herein, the pipe manufacturer's recommendations and **Clause 8.0** herein. The sleeving shall be continuous over the pipe system including gibault joints, bends, tees and other fittings including those fittings coated as specified in **Clause 12.0** herein.
- b) ISO pipe systems shall be provided with ISO identification polyethylene sleeving or standard sleeving with spirally wound ISO identification market tape in compliance with **Clause 8.0** herein.

## 26.5 PE Pipe Laying

- a) The laying of PE mains shall comply with **Clause 26.3** herein as appropriate and the following.
- b) Pipes shall be laid so that the inverts are continuous and true to line and grade and no part of the pipeline shall be more than 20mm from its true position with respect to line.
- c) In changing ambient temperatures, PE pipes can expand and contract. The Contractor shall control the installation of PE pipes so that the pipe is not installed where excessive strain or movement will occur to the assembled main or fittings and the pipe shall not be curved past the manufacturer's recommended minimum radius.

## 26.6 Additional Requirements for Laying and Jointing of Steel Pipes

### 26.6.1 Handling FBMDPE Coated Pipes

- a) When handling FBMDPE coated steel pipes, the greatest care shall be exercised to avoid damage to the pipe or coating. Under no circumstances shall a pipe be lifted by unprotected slings or levered or moved by implements without protecting pads.
- b) Lifting slings shall not be less than the width recommended by the pipe manufacturer. Where pipes are lowered onto the ground they shall rest on padded bolsters or on padded ramps or on padded cradles. Heaps of sand or soft earth as supports will be acceptable. Pipes with uncoated ends may be lowered onto the ground with chocks placed only under the ends left uncoated. Any damage to the pipe coating occurring after delivery shall be made good by the Contractor at his own expense.

## 26.6.2 Testing of Coating

- a) Before the pipe is placed onto Bedding Zone 1, the pipe shall be tested for defects in the external coating by means of a high voltage holiday testing apparatus capable of testing at 12,000 volts (+/- 1000V). Testing shall be in accordance with **AS3894.1**. Safety procedures must be strictly followed. The earth should be on the current mortar lining. At any place where the apparatus gives a spark or discharge through the coating to the steel pipe it will be taken that a defect in the coating exists and all such defects shall be repaired at the Contractor's own expense and retested to the satisfaction of the Superintendent.
- b) Repairs to the FBMDPE coating shall be in accordance with **AS4321**. The Contractor shall provide a skilled workman to do this work and in the first instance he shall arrange for the manufacturer to have one of their repairers to be on the job to supervise and train the Contractor's repairer in this work. All expenses in this regard will be at the Contractor's cost.

## 26.7 Laying of Rubber Ring Joint Pipes

- a) The Contractor shall obtain a copy of the pipe manufacturer's recommended laying practice for rubber ring jointed pipe. The pipes shall be laid in accordance with the instructions in this pipe laying manual except as modified by this specification.
- b) Where the grade of the pipeline is steeper than 10% then the pipe laying shall proceed in an uphill direction as shown in the pipe laying manual. Where necessary the Contractor shall cut and weld in a split collar joint so that the socket end of the pipes will face uphill.
- c) Extreme care shall be exercised to avoid damage to any external coating of the pipe when the joint is pulled together.
- d) The jacking system used for RRJ steel pipes shall have a capacity of not less than 30 kN where the wall thickness of the pipe is 8 mm or less and 50 kN for pipes with 10 mm wall thickness or greater and shall provide an even pull over the whole of the circumference of the joint. Jacking systems for other pipe materials shall be in accordance with the manufacturer's recommendation. A digging bucket shall not be used to push any pipe home.
- e) All spigot ends for rubber ring jointed pipes will be supplied with witness marks applied in the factory. The joint shall not be considered fully made unless the distance between the witness mark and the adjoining socket end is within the tolerance nominated by the pipe manufacturer.
- f) Where a deflection in the joint is required by the drawings or directed by the Superintendent this deflection shall be made after the joint has been fully entered and the pressure is still applied to the joint.
- g) After the completion of the joint a feeler gauge shall be used to probe the gap between spigot and socket to locate the rubber ring and the probing shall progress continuously around the joint so that the rubber ring is touched at intervals of not more than 12 mm. If there is any indication that the rubber ring has been displaced from its groove the joint shall be pulled apart and remade.

## 26.8 Laying of Property Service Connections

- a) Where shown on the drawings, for PVC and DI pipes, pre-tapped ductile iron Property Service fittings or pre-tapped hydrant tees shall be used in conjunction with a ball valve to effect the Property Service connection points and for PE pipes, electrofusion tapping saddle property service fittings shall be used to effect property service connection points. Connecting onto this fitting shall be a Property Service complete with water meter box – refer **Clause 7.0** herein.
- b) The DI pre-tapped Property Service fitting is pre-drilled and provided with blanking nuts that, where left in the fitting shall be sealed and tightened to the manufacturer's recommendation.
- c) For the DI pre-tapped Property Service fitting, where a DN32 upsized service is required then the standard DN20 BSP tapping points within the DI fitting shall be used and provided with a 20mm BSP ball valve that can support the attachment of the DN32 service pipe.
- d) For the PE electrofusion Tapping Saddle Property Service fitting, where a DN32 upsized service is required then a DN25 x DN32 electrofusion coupling shall be used.
- e) For single Property Services, the pipe shall be laid in a continuous length from the maintap ball valve or the electrofusion tapping saddle to the water meter box connection fitting, to the profile as shown on the drawings and shall be bedded on and fully surrounded with 75mm of bedding material as specified in **Clause 7.0** herein.
- f) For twin Property Services, the pipe shall be laid in a continuous length from the maintap ball valve or the electrofusion tapping saddle to the electrofusion splitter tee and then as another continuous length to the water meter box connection fitting, to the profile as shown on the drawings, and bedded on and fully surrounded with 75mm of bedding material as specified in **Clause 7.0** herein.

- g) The Property Service shall be terminated with a water meter box as shown in the drawings.
- h) Trenching for the Property Service pipe including the water meter box shall extend to the property boundary and following the provision of the 75mm of bedding material as specified in **Clause 7.0** herein, the remainder of the trench shall be backfilled with material as specified in **Clause 31.0** herein.
- i) Backfilling of the property service is a HOLD point. Backfilling shall only occur following Council's witnessing of the property services correct connections to it's appropriate main.
- j) In warm ambient temperatures, PE 80B service pipes shall not be curved past the manufacturer's recommended minimum radius of 20 times the pipe OD for DN25 and DN32 pipe and 25 times the pipe OD for DN63 pipe. The manufacturer's recommendations for bending radius shall be followed.
- k) Where the pipes bending radius is exceeded, the DN25 or DN32 Property Service pipe shall utilise electrofusion bends in either 45 or 90 degree formats.

### 26.9 Laying of Fittings

- a) The laying and jointing of reticulation water mains shall include the fixing in position of all valves, bends, fire hydrants, risers, flushing facilities, service fittings, air valves, scour valves, concrete anchor blocks, thrust blocks and all other fittings including the supply and installation of valve/ hydrant boxes and surrounds and their associated DI or PP base plates or concrete or brick supports, any additional bedding and the cast iron cover boxes or recycled plastic cover boxes and surrounds as specified or shown on the drawings.
- b) The laying and jointing of trunk water mains shall include the fixing in position of all valves, bends, risers, air valves, scour valves, concrete anchor blocks, thrust blocks and all other fittings including the supply and installation of valve/ hydrant boxes and surrounds and their associated DI or PP base plates or concrete or brick supports, any additional bedding and the cast iron cover boxes or recycled plastic cover boxes and surrounds as specified or shown on the drawings.
- c) The distance marked on the drawings and the position indicated thereon of pipes, valves and other fittings may be adjusted at the discretion of the Superintendent. If necessary, pipes shall be cut in order to secure the fixing of valves and other fittings in the positions required and all costs associated therewith shall be deemed to be included in the relevant Bill Item and the Lump sum of the Contract generally.
- d) All fittings shall be placed in position so as to be plumb and the correct distance from the surface. Risers shall be installed where necessary at air valves, hydrants and flushing points. If required, trenches shall be deepened and graded in the vicinity in order to achieve the correct depth below the surface.
- e) Reticulation main hydrants shall be bolted to the flange of the hydrant tee so that the lugs of the hydrant are either side of the main and the hydrant cover box fitted with its long axis along the centre line of the main as shown on the drawings.
- f) Reticulation main flushing points and hydrants shall be protected during backfilling in such a manner as will prevent earth or grit from damaging the valve seating.
- g) Except where the drawings show that concrete pits are required, cast iron cover boxes or recycled plastic cover boxes with integral surround shall be fixed over all valves, hydrants, air valves and scour valves. The shape of cover boxes shall be in accordance with the drawings.
- h) For iron box systems, pre-cast concrete surrounds shall be fixed around all valve, hydrant, air valve and scour valve cover boxes to the detail shown on the drawings.
- i) At valves, hydrants, flushing points, air valves and scour valves the bedding cover shall be increased locally to provide support to the base plate or brickwork or concrete surround on which the box is found so as to minimise the transference of weight or shock to the pipe to the details shown on the drawings.
- j) For large valve installations where shown the drawings, concrete valve pits shall be provided.
- k) Flushing points shall be provided with a ball valve and camlock fitting for Class A + Recycled water and shall be provided with a gate valve and Storz fitting for Potable water as shown in the drawings. The flushing point shall be provided in a suitably sized access box as shown in the drawings.
- l) The location, alignment and finish of the flushing point's access boxes shall be in accordance with the drawings. For all flushing facilities, the access box installation shall be painted with approved reflective paint of the appropriate colour that incorporates glass beads as shown in the drawings.

## 27.0 Jointing of Pipes and Associated Fittings

### 27.1 General

- a) Except as provided elsewhere in this specification, all joints shall be approved flexible joints, incorporating synthetic or natural rubber rings as specified in **Clause 9.2.1** herein. In jointing pipes with rubber ring joints, the pipes shall be cleaned before jointing and care shall be taken to ensure that the rubber ring is maintained in a plane at right angles to the axis of the pipe. Each pipe shall be jointed as recommended by the manufacturer and each joint checked with a feeler gauge to ensure that the ring is in place.
- b) Where shown on the drawings, bends shall be used to effect horizontal or vertical changes of direction. Where bends are not shown on the drawings (and with the permission of the Superintendent) changes of direction may be effected by angling the joints, by means of short lengths of pipes, or by means of cutting pipes and using thimbles or collars to join them. All such changes of direction shall be effected in curves of uniform radius.
- c) No joint shall be angled to such an extent as to impair its effectiveness or tightness. Pipes shall be jointed in a straight line and the deflection effected after the joint has been made. The maximum deflection for any type of pipe approved for use shall not under any circumstance exceed the recommendation of the manufacturer.
- d) No pipe to fitting joint shall be angled to such an extent as to impair its effectiveness or tightness. Pipes shall be jointed in a straight line and any pipeline deflection effected after the joint.
- e) Extreme care shall be exercised to avoid damage to any external coating of the pipe when the joint is pulled together.
- f) The jacking system used in the assembly of any main shall comply with the requirements of the pipe manufacturer. A digging bucket shall not be used to push any pipe home.
- g) All spigot ends for rubber ring jointed pipes will be supplied with witness marks applied in the factory. The joint shall not be considered fully made unless the distance between the witness mark and the adjoining socket end is within the tolerance nominated by the pipe manufacturer.
- h) Where a deflection in the joint is required by the drawings or directed by the Superintendent this deflection shall be made after the joint has been fully entered and the pressure is still applied to the joint.
- i) After the completion of the joint a feeler gauge shall be used to probe the gap between spigot and socket to locate the rubber ring and the probing shall progress continuously around the joint so that the rubber ring is touched at intervals of not more than 12 mm. If there is any indication that the rubber ring has been displaced from its groove the joint shall be pulled apart and remade.

### 27.2 PE Pipes

#### 27.2.1 General

- a) PE pipes and fittings shall be jointed using one of the following:
  - i) electrofusion couplings;
  - ii) butt welding;
  - iii) mechanical restraint flanged fittings.

#### 27.2.2 Electrofusion Couplings

- a) Only trained and certified welders shall perform the weld jointing of PE pipelines.
- b) For PE pipe systems, only approved electrofusion fittings complying with **Clause 6.5** shall be used.
- c) In jointing the pipe with the fitting, the pipes square cut face shall be lightly bevelled and the external joint end of the pipe thoroughly scraped and cleaned to remove all Oxidised material before jointing. It is recommended that the pipe and fitting be restrained during the fusion process. The manufacturer's recommendations for fusion jointing shall be followed and care shall be taken to ensure that the fusion process is not carried out while the pipe and fitting are above the recommended ambient air temperature for effective joint fusion. The recommended cooling time shall be allowed to occur before the joint restraints are removed and pipe laying continues. Each pipe joint shall be checked to ensure correct assembly and records of each electrofusion joint shall be kept.

- d) Welding pre-qualification shall be provided. The welder shall submit the proposed procedures to the Superintendent for approval prior to commencing work.
- e) A proposed procedure shall be submitted for each pipe diameter, wall thickness and material type and shall contain items listed under **Clause 29.2** in addition to the following:
  - i) the welding parameters to be used:
    - 1) standard fusion time;
    - 2) standard cooling time;
    - 3) welding equipment to be used;
    - 4) control box details.
  - ii) the welding equipment to be used;
  - iii) the name of the certified welder;
  - iv) a pilot weld for each welding machine, pipe diameter, wall thickness and material type with a record of the parameter values for each weld;
  - v) test results confirming the specification strength requirements;
  - vi) all welding to conform to the procedure;
  - vii) a test sampling plan to demonstrate ongoing quality;
  - viii) retention of QA records for each weld, numbered and located on a plan.

### 27.2.3 Butt Welding

- a) Only trained and certified welders shall perform the weld jointing of PE pipelines.
- b) Butt welding may be used for all pipe sizes.
- c) Welding pre-qualification shall be provided. The welder shall submit the proposed procedures to the Superintendent for approval prior to commencing work.
- d) A proposed welding procedure shall be submitted for each pipe diameter, wall thickness and material type and shall contain items listed under **Clause 29.2** in addition to the following:
  - i) the welding parameters to be used;
  - ii) the welding equipment to be used;
  - iii) the name of the certified welder;
  - iv) a pilot weld for each welding machine, pipe diameter, wall thickness and material type with a record of the parameter valve for each weld;
  - v) test results confirming the specification strength requirements;
  - vi) all welding to conform to the above procedure;
  - vii) a test sampling plan to demonstrate ongoing quality;
  - viii) retention of QA records for each weld, numbered and located on a plan.

### 27.2.4 Flanged PE Adaptor Fittings

- a) For PE pipe systems, where shown on the drawings, the connection to another pipe system shall be by a mechanical restraint fitting such as the Hawle Flange Adaptor System 2000 fitting or equal AVK fitting that can be directly attached to a flange that is drilled in accordance with **AS4087 Figure B5**.
- b) Approved mechanical restraint joints shall incorporate synthetic or natural rubber seals as specified in **Clause 9.2.1** herein together with a grip ring with interlocking teeth. In jointing the pipe with the fitting, the pipes cut face shall be bevelled and the pipe cleaned before jointing and care shall be taken to ensure that the rubber ring and gripper ring are maintained in a plane at right angles to the axis of the pipe. Each pipe shall be jointed as recommended by the manufacturer and each joint checked to ensure correct assembly.
- c) Jointing bolts at Class A4 shall comply with the requirements of **Clause 10.0**.
- d) Flange sealing gaskets shall comply with the requirements of **Clause 9.2.2** herein.

## 28.0 Wrapping of Flanges and Mechanical Joints

### 28.1 General

- a) All external areas of DI flanges and mechanical joints for mains of DN375 and larger and all steel main flanges and mechanical joints shall have an approved corrosion protection system applied. Systems such as the Denso Petrolatum or the Enviropeel Sprayable polymeric thermoplastic coating system or equal are suitable.
- b) All materials and procedures shall be by a recognised manufacturer of corrosion protection systems and shall be acceptable to the pipe manufacturer.
- c) The Contractor shall use only fully trained and accredited personnel for the wrapping of flanges and mechanical couplings.

### 28.2 Mechanical Joints

- a) Wire brush loose dirt and loose rust and clean all oil, grease and other impurities from the joint and 100mm onto the adjacent pipe.
- b) The Enviropeel system shall be applied by a purposefully designed applicator unit with a computer controlled heating and pumping unit. Gauze mesh shall be applied to flanges to minimize the migration of the coating into the flange gap. Two layers of the coating shall be applied.
- c) For Petrolatum systems apply primer to all metal surfaces. Fill between bolts and sleeve, and around bolts to top of the retaining rings with butyl mastic. Cover bolt heads, nuts and any protruding thread with butyl mastic. Commencing 100 mm clear of the butyl mastic and a minimum of 50 mm onto the factory applied coating apply flexible tape spirally with a 55% overlap and complete 100 mm past the butyl mastic on the other side or a minimum of 50 mm onto the factory applied coating.

### 28.3 Flanges

- a) Wire brush loose dirt and loose rust and clean all oil, grease and other impurities from the flange and 100 mm onto the adjacent pipe.
- b) The Enviropeel system shall be applied by a purposefully designed applicator unit with a computer controlled heating and pumping unit. Gauze mesh shall be applied to flanges to minimize the migration of the coating into the flange gap. Two layers of the coating shall be applied.
- c) For Petrolatum systems apply primer to all metal surfaces. Mould butyl mastic between individual bolts and nuts and over the heads of bolts, nuts and screw threads, with a minimum coverage of 5 mm. Taper onto flange face to provide a suitable contour for tape wrapping. Apply section of flexible tape longitudinally over the flange, extending a minimum of 50 mm onto the pipe barrel. Ensure that each additional section overlaps the previous by 55% to ensure a double thickness of tape. Finish each side with a circumferential wrap around the pipe to lock in the ends of the tape sections applied longitudinally and continue until 100 mm onto the factory applied coating.
- d) At flanges adjacent to concrete structures, the protective coating system shall be extended from the joint being coated to the wall of the structure.
- e) Finish each side with a circumferential wrap around the pipe to lock in the ends of the tape sections applied longitudinally and continue until 100 mm onto the factory applied coating or pipe barrel.

### 28.4 Inspection

- a) Thoroughly inspect the finished coating to ensure that all overlaps are sealed to prevent moisture and foreign material from working in under the coating.

## 29.0 Pipe Welding

### 29.1 Steel Pipe General

- a) Carry out site fabrication and welding in accordance with **AS/NZS1554.1 Pipework Class 2P**, the welding Procedures and the Subclauses below.
- b) Slip-in joints are to be welded externally. A complete external weld shall in addition to the circumferential fillet weld include a run on the ground-off weld of the 'bell', the whole comprising a 'joint'.
- c) Ball and socket joint pipes are to be fillet welded both internally and externally. They shall be laid with the test hole in the joint at the top. After completion of internal and external welding of the ball and socket joint pipes, air at a pressure of 200 kPa shall be applied through the test hole and soap solution applied to both internal and external welds to check for leaks. All leaks shall be repaired to the satisfaction of the Superintendent and the test hole filled with weld metal.
- d) Butt joints with Collars are to be welded externally. The two complete external welds, together with the two horizontal jointing runs in the case of split collars shall comprise a 'collar joint'. Where pipes that are cut on-site have FBP coating, the coating shall be cut with a sharp knife to make a neat edge 50 mm clear of the welded joint before removing the coating prior to welding.

### 29.2 Welding Procedures

#### 29.2.1 Qualification of Welding Procedures

- a) Welding procedures for all fillet welds, butt welds and combination of each shall be proven qualified by the welding service provider. A schedule of qualified procedures shall be made available by the welding service provider for approval no less than ten (10) working days prior to the intended commencement date of the welding work on which the procedures will be applied.
- b) A welding procedure(s) shall be re-qualified when essential variables (as per the specified standard/ code) are changed.
- c) Where several welding procedures are similar, a qualified procedure is required for each, where the essential variables (as per the specified standard/ code) alter between procedures.

#### 29.2.2 Welding Procedure Sheet

- a) Each welding procedure submitted for approval shall include a welding procedure sheet containing at least the following information:
  - i) sketch of the joint design;
  - ii) material(s) grade-type;
  - iii) material thickness – all parts;
  - iv) method of material(s) preparation;
  - v) welding process(es) to be used;
  - vi) voltage and amperage;
  - vii) number and sequence of runs;
  - viii) classification of electrode/ wire;
  - ix) diameter of electrode/ wire;
  - x) shielding gas/ gas mixture/ fluxtype/ classification;
  - xi) temperature of preheat, inter run heat and post heat applications if applicable;
  - xii) welding standard/ code and classification (ie. **AS1554-1 GP** or **SP**, **AS4041 Class 1, 2 or 3**);
  - xiii) unless otherwise notified, the latest edition of the relevant standard/ code shall apply and is deemed the minimum standard applicable.

### 29.3 Welding Operators Steel Pipe

#### 29.3.1 Qualification, Certification, Background Experience

- a) Before welding operators commence welding work the following information shall be provided for each operator:
  - i) documentary evidence of qualification/ certification currently held;
  - ii) trade training background;
  - iii) duration of employment with current employer;
  - iv) nature of current employment duties.

## 29.3.2 Identification of Welding Operators

- a) Welding service providers shall maintain accountable records clearly identifying welding operators to each completed welded pipe joint and/or fabricated assembly/ unit.
- b) The records are to be made readily available by the welding service provider on request. All weld to be stamped in accordance with the relevant Australian Standard.

## 29.4 Supervision of Steel Pipe Welding Work

- a) All welding work shall be carried out under the supervision of a person who:
  - i) holds current certification to **AS1796 Cert. 10**; or
  - ii) holds current certification to **AS2214**; or
  - iii) holds other current qualification/ certification approved by Gold Coast Water.
- b) Qualification/ certification records of the supervision person(s) are to be made available by the welding service provider on request.

## 29.5 Inspection and Testing of Steel Pipe Welds

### 29.5.1 Inspector

- a) All welding work inspection shall be carried out by a person who:
  - i) complies with the requirements of **Clause 29.4** above; or
  - ii) holds current **Welding Technology Institute of Australia (W.T.I.A.)** welding inspection certification.
- b) Qualification/ records of the inspection person(s) are to be made available by the welding service provider on request.

### 29.5.2 Inspection

- a) The welding service provider shall provide an inspection and test plan for the intended welding work, ten (10) working days prior to commencement of the work.
- b) The test plan shall contain the necessary elements to assure the completed welding work complies with the standards/ codes stated in the work drawings and specifications.

### 29.5.3 Testing of Welds

- a) Testing of welds shall be carried out by the welding service provider as follows:
  - i) for all joints welded externally and internally in accordance with the pneumatic procedure as set out below;
  - ii) 10% of internal and external welds by Magnetic Particle or Penetration methods in accordance with **AS4037**, **AS1171** and **AS2062**.

### 29.5.4 Testing Records

- a) The welding service provider shall maintain accountable testing records for all weld testing and provide the records upon request.

## 29.6 Welding Processes Steel Pipe

- a) Where the welding service provider intends to use a welding process(es) other than those listed below in a welding procedure, the Superintendent is to be notified of the intent prior to the development of welding procedure(s) for approval:
  - i) M.M.A.W. – Manual Metal Arc Welding;
  - ii) F.C.A.W. – Flux Cored Arc Welding;
  - iii) G.M.A.W. – Gas Metal Arc Welding;
  - iv) G.T.A.W. – Gas Tungsten Arc Welding;
  - v) O.F.G.W. – Oxygen Fuel Gas Welding;
  - vi) S.A.W. – Submerged Arc Welding.

## 29.7 Welding Consumables Steel Pipe

All welding consumables used in welding procedures shall comply with the standards/ codes listed below unless otherwise authorized by the Council:

- i) Manual Metal Arc Welding: **AS/NZS4854**, **AS/NZS4855**;
- ii) welding electrodes for G.M.A.W.: **AS2717 Parts 1, 2 and 3**;
- iii) flux cored electrodes for Flux Cored Arc Welding ferritic steel: **AS/NZS ISO 17632**, **AS/NZS ISO 17634**, **AS/NZS ISO 18276**;
- iv) electrodes and fluxes for Submerged Arc Welding: **AS1858 Parts 1 and 2**;
- v) welding consumables for build up and wear resistance: **AS2576**.

## 29.8 Pneumatic Testing Steel Pipe

- a) After completion of internal and external welding of the joint, air at a pressure of 200 kPa shall be applied through the test hole and soap solution applied to both internal and external welds to check for leaks. All leaks shall be repaired and the test hole filled with weld metal. Pipes shall be laid with the test hole at the top of the joint except for vertically deflected bends as shown on the drawings.

## 29.9 External Coating of Welded Steel Pipe Joints

### 29.9.1 Heat Shrink Sleeves

- a) Welded joints shall be externally coated using heat shrink sleeves. The Contractor shall use only fully trained and experienced personnel for installation of heat shrink sleeves.
- b) Only sleeves recommended by the pipe manufacturer shall be used.
- c) Application procedure shall be as follows:
  - i) bevel the edges of the FBMDPE coating so that there is a tapered transition of at least 10 mm between the full coating thickness and the exposed steel;
  - ii) remove any corrosion products on the steel and abrade the steel surface (if necessary) to produce a clean, non-corroded, roughened surface. Suitable abrasives are emery paper or a steel file;
  - iii) clean the area to be repaired (to be free from dirt, dust and other contaminants) in accordance with the recommendations of the shrink sleeve manufacturer;
  - iv) slightly roughen the FBMDPE coating around the repair for a minimum distance of 100 mm from the edge. Solvent wipe the FBMDPE coating with a clean cloth (acetone is a suitable solvent for cleaning);
  - v) apply the shrink sleeve in accordance with the application procedures of the manufacturer with the exception that the sleeve shall overlap the PBMDPE coating for a length of 100 mm on either side of the coating. Note that the specified preheat and postheat is necessary to ensure satisfactory bonding of the sleeve. A roller should be used to eliminate voids from under the sleeve;
  - vi) after application the repair area should be tested with a high voltage detector at 15 kV in accordance with **AS3894.1**;
  - vii) the repair should be visually inspected to ensure that it is in intimate contact with the pipe and that a bead of mastic has exuded from each end of the sleeve for the full pipe circumference. (If this is not in evidence additional heating is required).

### 29.9.2 Tape Wrap Coating

- a) The Contractor may ask approval from the Superintendent to use a tape wrap coating as an alternative to the heat shrink sleeve.
- b) Approval will be given if the Contractor can demonstrate that his staffs are skilled in the application of the tap wrap system.
- c) The Contractor shall use a tap wrap system recommended by the pipe manufacturer.
- d) Application procedure shall be as follows:
  - i) the steel and coating area shall be clean and dry before application of the primer;
  - ii) using a brush, apply a thin even coat of primer onto the steel and overlapping the parent material by 100 mm;
  - iii) allow the primer to tack dry (10-20 mins);
  - iv) spirally apply the tape to the repair area ensuring a 100 mm overlap of the parent metal. The overlap of layers should not be less than 55% of tape width;
  - v) spirally apply the outerwrap to completely cover the first layer tape coating. The overlap of layers should not be less than 10% of the tape width;
  - vi) some tension should be applied when applying the tapes to ensure that air voids, wrinkles, etc. are not present after wrapping;
  - vii) continuity test with a high voltage detector at 15 kV in accordance with **AS3894.1**.

## 29.10 Welding of Above Ground Steel Pipes

- a) Where welded joint pipes are to be laid above ground, no pipe-laying shall be done until end thrust blocks are 14 days old. The pipe shall then be laid and the operations timed so that the closure joint shall be welded up at pipe wall temperature of approximately 21°C.
- b) Should the Contractor elect to weld at night to comply with temperature requirements he must supply sufficient lighting which in the opinion of the Superintendent is necessary for efficient working.
- c) The Contractor will not be permitted to start these sections unless, in the opinion of the Superintendent, he has assembled sufficient plant to enable compliance with this Specification.

## 29.11 Internal Pointing of Steel Pipes

- a) All welded pipe joints shall be closed internally and the bore made uniform by internal pointing after the welding has been completed.
- b) Mortar for pointing shall be premixed and supplied by the pipe manufacturer.
- c) The internal surface to be pointed must be free of grease, oil, paint and loose or flaking material.
- d) Wet the adjacent cement mortar one hour prior to repair.
- e) The mortar shall only be applied when the ambient and mortar temperatures are below 30°C.
- f) Wipe any excess water from the area, but leave the surfaces damp.
- g) Apply an acrylic modifier approved by the manufacturer as a primer to the steel and adjacent cement mortar immediately prior to applying the mortar. This priming coat can be wet or dry when the mortar is placed.
- h) The mortar is added in the normal manner, being worked into place and compacted. The mortar is built up to the level of the existing cement mortar.
- i) As the ambient temperature increases the pot life of the mortar is reduced as defined in the manufacturer's instructions. If the mortar is left to stand a skin will develop on the mortar surface. This skin should be remixed into the mortar before use.
- j) The mortar must be allowed to dry out as recommended by the manufacturer. Note that this is opposite to that normally required for mortar. It must not be subjected to excessive heat, rain or sub-zero temperatures during the first 48 hours. It is recommended that the mortar cures for 7 days prior to service.

## 30.0 Earthing of Pipes During Construction

- a) Where required on the drawings, Cathodic protection systems and/or pipe earthing systems shall be installed along the pipeline in accordance with the Specification for Cathodic Protection and Earthing Systems.

## 31.0 Backfilling

- a) For the purposes of this specification, backfilling material shall consist of:
  - i) all material used in the trench above the Bedding Zone 3 material as specified in **Clause 24.0** herein;
  - ii) all the material as designated for Type 7 Construction in **Clause 25.8** herein.
- b) In addition to the requirements specified herein, no backfill material shall contain rocks larger than 150mm diameter or lumps of material that may prevent the compaction specified herein. Backfill material with rock larger than 150mm shall be screened to exclude material larger than 150mm diameter.
- c) In locations other than under roadways and footpaths (ie. within allotments and parks, etc.) the backfill material shall consist of material complying with **Clause 31.0 a)** and **b)** and either of the following:
  - i) the best of the material (selected and approved by the Superintendent) from trench excavation; or
  - ii) material from 'On-Site' earthworks selected and approved by the Superintendent;
  - iii) imported material.
- d) If, in the Superintendent's opinion, material from **Clause 31.0 c) i)** above is not suitable for backfilling then material from **Clause 31.0 c) ii)** above shall be used by the Contractor. If, in the opinion of the Superintendent, the 'On-Site' material is not suitable for backfilling over pipes and conduits, the Contractor shall import a material acceptable to the Superintendent at the rate nominated in the schedule (material with a soaked CBR not less than 15% will be acceptable).

- e) The backfill material shall be compacted to the standard specified in **Table 7** herein. Any settlement shall be made good by the Contractor, prior to the end of the Defects Liability Period.
- f) Except as specified in **Clause 31.0 h)** herein, under roadways the backfill material shall be as shown on the drawings and nominated in **Clause 31.1** herein. The materials shall be compacted in layers not greater than 200mm thick to the standard specified in **Table 7** herein.
- g) The Contractor shall comply with the nominated HOLD points detailed within the Hold/ Witness Inspection Checklist for Water Reticulation.

**Table 7**

| Area of Work<br>Backfill to Trenches             | Relative Compaction Required |                                    | Min Test Frequency <sup>1, 3</sup>       |
|--------------------------------------------------|------------------------------|------------------------------------|------------------------------------------|
|                                                  | Cohesive Material            | Non-Cohesive Material <sup>2</sup> |                                          |
| Under roads to a depth 0.3m below subgrade level | > 98% Std Density Ratio      | > 80% Density Index                | 1 test per 2 layers per 40 linear metres |
| Commercial development areas                     | > 98% Std Density Ratio      | > 70% Density Index                | 1 test per 2 layers per 40 linear metres |
| Elsewhere including under roads                  | > 95% Std Density Ratio      | > 65% Density Index                | 1 test per 2 layers per 40 linear metres |

**Notes:**

- 1 **Unless directed otherwise by the Superintendent.**
  - 2 **Non-cohesive material shall be defined as material which contains up to 5% by mass of soil particles passing a 75 µm sieve, except that silty sands with non-plastic fines may contain up to 12% passing a 75 µm sieve.**
  - 3 **For non-cohesive material, each compaction test may be replaced by three (3) Perth sand penetrometer tests provided that a correlation between the penetrometer test and the compaction test is established by the NATA accredited testing authority and approved by the Superintendent.**
- h) Under State-controlled roads the provisions of **Clause 25.10** herein shall apply.
  - i) The Contractor shall arrange for compaction control testing of all backfill by a NATA accredited testing authority approved by the Superintendent. Testing shall be carried out in accordance with the appropriate test methods, sourced from either Australian Standard **AS1289** or the **Queensland Department of Main Roads, Materials Testing Manual**. The selection/ application of test methods shall be made on a consistent basis. Inter-related tests shall be performed by methods from the same Standard/ Testing Manual.

**31.1 Flowable Fill**

- a) Where approved by the Superintendent, Flowable Fill may be used as an alternative backfill under roadways.
- b) Flowable Fill shall comply with the following requirements:
  - i) cement shall be Portland cement, Type GP or Type GB and shall conform to **AS3972**;
  - ii) if used, fly ash shall conform to **AS3582.1**;
  - iii) fine aggregates shall conform to **AS2758.1**;
  - iv) if used, chemical admixtures shall conform to **AS1478**. Any chemical admixture must be approved by the Superintendent;
  - v) minimum compressive strength @ 28 days – 0.5 MPa;
  - vi) maximum compressive strength @ 28 days – 1.5 MPa;
  - vii) maximum size aggregate – 4.75 mm;
  - viii) minimum cement/ cementitious content – 5% by weight;
  - ix) the consistency of flowable fill shall suit the job application;
  - x) flowable fill shall have the ability of being placed by concrete pump when required;
  - xi) the mix design of flowable fill shall be such as not to cause segregation while being placed;
  - xii) flowable fill will be required to produce the necessary flowability and self-compaction without the use of immersion vibrators.
- c) Lean mix concrete containing 85 kg cement per cubic metre may be used for backfilling under roadways with the approval of the Superintendent.

## 31.2 Metallic Detection Tape

- a) A 50 mm wide metallic detection tape (blue colour with wording 'Buried Water Line Below') shall be buried at the base of the backfill and generally between 300 and 350 mm below the surface for all pipelines.

## 32.0 Boring and Jacking

### 32.1 General

- a) Where shown on the drawing or directed by the Superintendent, water mains may be constructed by progressively boring and then jacking an approved enveloping pipe underneath the existing ground surface. All such boring and jacking work shall be done without disturbances to the existing surfaces.
- b) Under State-controlled roads the provisions of **Clause 25.10** herein shall apply.
- c) Works near Railway Lines shall be carried out in accordance with the **Railway Authorities Specifications and Codes**.
- d) All boring, jacking and pressure grouting work shall be performed by specialist personnel who are experienced with the equipment and methods proposed to be used.
- e) Alternative methods of boring and jacking may be accepted providing such methods are approved by the Superintendent in writing prior to their use.
- f) The Contractor shall ensure that all pipes, or any wrapping thereon, are not damaged during, or as a result of insertion in the enveloping pipe.
- g) The Contractor shall be responsible for thoroughly assessing ground conditions, determining boring and thrusting conditions, and all design work required.
- h) The enveloping pipe shall be thrust into the hole simultaneously as boring advances, and shall not be withdrawn after the completion of boring and jacking work. The ground shall not be excavated more than 600mm ahead of the lead pipe. The jacks shall be capable of advancing the enveloping pipe up to the face of the excavation at any time, should this be ordered.
- i) Neither oversize boring nor water-assisted, lubricant-assisted or wet boring methods shall be used unless such methods are approved by the Superintendent.
- j) The Contractor shall ensure that the boring and jacking operation is continuous from each starting pit to the next adjacent pit. The Superintendent may direct the Contractor to provide full stand-by capacity for the Contractor's plant and equipment to ensure such continuous operation.
- k) In the event that this is ordered by the Superintendent then all costs associated therewith shall be deemed to be included in the relevant Bill Items (if part of the Contract) and/or the Lump Sum of the Contract generally.
- l) The Contractor shall provide a shield or cutting edge to protect the leading edge of the front pipe, for the purpose of jacking. Such a shield shall not exceed the outer diameter of the pipe by more than 14mm.
- m) Unless otherwise specified, the Contractor shall pressure grout the annular void between the enveloping pipe and the water main, using an approved 5% Portland cement grout (or alternatively Flowable Fill as specified in **Clause 31.1**). The Contractor shall ensure that the Manufacturer's recommended allowable external pressure and maximum external temperature for the type of pipe used is not exceeded and that excessive deflection, distortion or damage of such pipe is prevented during or as a result of pressure grouting.
- n) Floatation control of the pipe during grouting shall be carried out through filling the pipe with water to prevent any deviation from the grade or alignment shown on the drawings shall be approved only on the written approval of the Superintendent.
- o) In the case of the enveloping pipe, the minimum clearance between the water main and the enveloping pipe shall be 75mm and the minimum cover over the enveloping pipe shall be as specified under **Clause 21.0** herein.
- p) Prior to final inspection and acceptance of the bored and jacked pipe, the Contractor shall excavate a pit at each end of the enveloping pipe, to enable line and level of the pipe to be checked. On completion, the Contractor shall take all steps necessary to prevent ingress of foreign materials to the water main and/or the enveloping pipe.

## 33.0 Pipe Jacking

### 33.1 Micro-Tunnelling

- a) Where shown on the drawing or directed by the Superintendent, water mains may be constructed by pipe jacking that shall be undertaken utilising micro-tunnelling techniques.
- b) Micro-tunnelling shall, for the purpose of this document, be defined as a trenchless construction method for installing pipelines which incorporates the following features:
  - i) remote controlled – the micro-tunnelling boring machine (MTBM) shall be operated from a control panel at the surface. The system shall simultaneously install pipe as spoil is excavated and removed. Personnel entry is not required for routine operation;
  - ii) guided – the guidance system shall reference a laser beam projected onto a target in the MTBM, capable of installing water mains or other types of pipelines to the required tolerance for line and grade;
  - iii) pipe jacked – the process of constructing the pipeline shall be by consecutively pushing pipes and the MTBM through the ground using a jacking system for thrust;
  - iv) continuously supported – continuous pressure shall be provided to the face of the excavation to balance groundwater and earth pressures.
- c) The Contractor shall employ personnel who are trained in and have substantial project experience of the type of machine to be used. Details shall be provided to the Superintendent by the Contractor to support its selection of tunnelling equipment and operatives.
- d) Unless otherwise specified by the Superintendent, the Contractor shall install either DICL or SCL water main in accordance with **Clause 5.0** herein.

#### 33.1.1 Micro-Tunnelling Equipment Requirements

- a) A machine that is capable of the following shall carry out excavation:
  - i) excavating mixed face conditions;
  - ii) excavating materials from marine deposits to rock beneath the water table while ensuring face stability at all times.
- b) Equipment and systems shall be designed to provide the forces necessary for the installation of the full pipe string and take into account the pipe manufacture's recommendations on the applicable forces. The Contractor shall be responsible for the design and provision of the following items:
  - i) intermediate jacking stations;
  - ii) use of bentonite to reduce friction;
  - iii) steering system to achieve alignment both horizontally and vertically;
  - iv) control of surface settlement; and
  - v) control of ground water table.
- c) All tunnelling machines shall be robust with adequate safety margins for the anticipated duty, designed and manufactured to comply with all safety standards.
- d) The external diameter of the tunnelling machine shall be designed to produce minimum overbreak and the least necessary clearance for the proper construction of the Works.
- e) The Contractor shall be responsible for the quality of materials used or present within the tunnelling machine and shall ensure that all materials used or present are adequate for the task they are to perform.
- f) The Contractor shall maintain records on-site of the date, time jacking load, distance moved relationship between load and distance moved, line and level measurements.

### 33.2 Grouting Around Pipelines

- a) The Contractor shall grout the annular space between the bored hole and the pipeline with a suitable cement grout. The mix design shall be submitted for approval by the Superintendent prior to grouting.

### 33.3 Thrusts and Reception Pits

- a) Thrust and reception pits and shafts shall be designed and constructed to allow the safe operation of plant, equipment and handling of materials and safely withstand all loading imposed by ground pressure, superimposed loads and the maximum anticipated thrust forces.

- b) The permanent Works shall not be used to transfer jacking force reactions unless the component in question has been specifically designed to resist such forces. Any proposals in this regard shall be referred to the Superintendent for approval prior to implementation.
- c) Proposals shall include calculations and sketches illustrating the proposed arrangement.
- d) Permanent shafts or pits shall have all internal surfaces finished to the details shown in the drawings.

#### 34.0 Markings for Location of Pipes, Hydrants, Flushing Points, Valves, Other Fittings and Pressure Zones

- a) Markings for the location of hydrants, flushing point's valves, fittings, appurtenances and pressure zone designation markings shall be installed at the locations shown on the drawings.
- b) Underground detection/ tracer tape shall be provided for all pipes as shown in the drawings.
- c) Valve and other fitting markings shall be provided on the pavement and on the kerb at the locations shown in the drawings.
- d) Marker posts shall be provided at the locations shown in the drawings.
- e) Metallic tags shall be located as shown on the drawings on each kerb for all water main road crossings.
- f) Rural valve installation shall be where there is no residential allotments or Park Domain allotments. The valve installation shall:
  - i) use an Iron Box with an Iron Lid;
  - ii) surrounding the box and lid shall be a 1000mm x 1000mm square concrete slab that is 100mm thick and contains reinforcement sheet;
  - iii) have the concrete slab grade away from the valve box;
  - iv) have the slab integral cast with the iron box with all cast at ground level;
  - v) where shown on the drawings for verge/ footway installations be provided with a marker post with attached marker plate defining the valve function and contained product; or
  - vi) where shown on the drawings for allotment/ park/ vacant land installations be provided with a Gal Steel street sign post that has a concrete footing and is provided with a marker plate defining the valve function and contained product;
  - vii) for Water mains the box and lid shall be painted the required colour shown in the drawings;
  - viii) where a roadway is adjoining the valve installation the asphalt paving marking shall be as shown the drawings.

#### 35.0 Grouted Stone Pitching

- a) Drains, channels and surfaces of slopes shall be stone pitched, where shown on the drawings or directed by the Superintendent.
- b) All stone pitching shall be of sound, durable rock not less than 150mm thick, properly bedded to a uniform surface on approved loam or sand. The exposed surface of each stone shall be approximately flat and of areas not less than 0.03m<sup>2</sup>.
- c) The stone pitching shall be set in mortar consisting of three (3) parts of clean fine sand and one (1) part of cement by volume. The sand shall be clean, sharp sand complying with **AS2758.1**. The sand must be free of clay and of maximum size not greater than 2.0mm. The mortar shall be thoroughly rammed to the full depth of the stones.

#### 36.0 Crossings

##### 36.1 Bridge Crossings

- a) All bridge crossing pipe work shall be either DICL or SCL in accordance with **Section 5** herein and the **WSAA** drawing **WAT-1312**.
- b) Structural steel supports shall be in accordance with **AS/NZS3679** and any associated saddle clamps, tie rods and cradle supports shall be hot dip galvanised in accordance with **Clause 4.2** herein.
- c) Where shown on the drawings, embedded saddle clamps, tie rods, cradle supports, bolts, nuts and washers shall be Stainless Steel Grade 316.
- d) Rubber support blocks and insert rubber for clamps shall be an EPDM material. The height of the support block shall be such that any pipe socket or barrel is 20mm clear of the beam or support. Insertion rubbers shall be a minimum of 3.0mm thick and 100mm wide and shall fully encircle the pipe.

## 36.2 Aerial Crossings

- a) All aerial crossing pipe work shall be either DICL or SCL in accordance with **Section 5** herein and the **WSAA** drawing **WAT-1310**.
- b) Saddle clamps, tie rods and cradle supports shall be hot dip galvanised in accordance with **Clause 4.2** herein.
- c) Where shown on the drawings, saddle clamps, tie rods, cradle supports, bolts, nuts and washers shall be Stainless Steel Grade 316.
- d) Concrete piers and abutments and pipeline protection grills shall be provided to the details shown in the drawings.
- e) Rubber support blocks and insert rubber for clamps shall be an EPDM material. The height of the support block shall be such that any pipe socket or barrel is 20mm clear of the beam or support. Insertion rubbers shall be a minimum of 3.0mm thick and 100mm wide and shall fully encircle the pipe.

## 36.3 Buried Crossings Under Obstructions

- a) Where shown in the drawings, buried crossing pipe work shall be DICL or SCL in accordance with **Clause 5.0** herein that has been installed under the obstruction by Boring and Jacking, refer **Clause 32.0** herein.
- b) Unless shown otherwise in the drawings, crossing pipe work shall be in accordance with the **WSAA** drawing **WAT-1212** or **WAT-1213**.
- c) Where shown in the drawings, river crossings shall be PE pipe. The pipe shall be Series 1 PE100 SDR11 pipe.

## 37.0 In-Ground Water Supply Pump Stations

- a) In-Ground Water Supply Pumping Stations, including pumps, cradles, fittings and internal pipework shall be constructed to the details shown on the drawings.
- b) Site earthworks shall be to the details shown on the drawings and shall comply with the requirements of Council's **Standard Specification SS4**.
- c) Mechanical Works shall be carried out in accordance with Council's **Standard Specification SS14**.
- d) Electrical Works shall be carried out in accordance with Council's **Standard Specification SS12**.
- e) Access driveways shall be constructed in accordance with the drawings.
- f) Fencing and landscaping shall be as shown on the drawings.
- g) All external surfaces of the Light Weight aluminium covers shall be coated with an anti-slip coating system conforming to **AS/NZS4586 Classification W, Table 2** and **R11** of **Table 5** applied in accordance with manufacturer's recommendations. The covers shall be prepared prior to application of anti slip aluminium chemical etchant and primer.
- h) The anti-slip coating system shall be applied so that the operation/ movement of the cover is not restricted.
- i) The anti-slip coating system shall be either:
  - i) 100% solids moisture curing MDI based polyurethane prepolymer including a crumbed rubber binder, such as Huntsman Daltobond CR2; or
  - ii) a liquid applied acrylic-polyurethane composite coating including a 16/30 crumbed rubber, such as Neoferma Neotop; or
  - iii) a high % by volume of solids content epoxy flooring system suitable for marine and industrial environments, such as Epirez Supatuff AS-550; or
  - iv) a medium % by volume of solids content water base polyurethane flooring system suitable for marine and industrial environments, such as Parchem Tex-Cote Strata Grip.

## 38.0 Mains Swabbing Facilities

- a) Mains swabbing facilities shall be constructed to the details shown on the drawings. Discharge to any stormwater system or natural gully shall be as shown on the drawings or as directed by the Superintendent.

## 39.0 Flushing of Mains

- a) On completion of pipe laying and prior to hydraulic pressure testing and sterilisation of mains, the Contractor shall flush all mains and Property Service pipes. Where directed batching pigs or spheres shall be used in the cleaning of mains before the commencement of scouring with the appropriate water product, ie. potable water for potable mains and Class A + water for Class A + mains. The rate of filling the mains with water shall be such that the water velocity therein shall nowhere exceed 0.05m/s.
- b) Flushing of the entire system shall be done by scouring under pressure through scours, spring hydrants, flushing points and Property Service pipes. Flushing shall be carried out using a high velocity of at least 2m/s or if this is not possible, by a turbulent water change using batching pigs or spheres.
- c) All breaks which occur during or after testing shall be repaired. The Contractor shall then again flush the section of main or Property Service pipe. Where directed swabbing pigs shall be used to clean such sections of main in conjunction with flushing operations. The Contractor shall ensure that when pigs are in use the pipeline is effectively secured so as to prevent damage through vibration.
- d) The Contractor shall take whatever steps are necessary to ensure that:
  - i) water used in the flushing process does not enter the distribution system;
  - ii) during the process specified in **Clause 39.0** herein, all measures are taken to protect the environment.

## 40.0 Hydraulic Pressure Testing

- a) Pressure testing shall be undertaken as soon as possible after the concrete thrust blocks have developed their design strength and prior to pavement sealing of any roadway over the main.
- b) Testing shall include the water main and fittings and any water service pipes with the length of test section of main normally to be between 500m and 1000m. It is strongly recommended that under no circumstances shall test lengths exceed 1600m. All tests shall be carried out in a manner approved by the Superintendent.
- c) Hydraulic pressure testing of the pipeline shall be carried out at the lowest point of the line or lines being tested.
- d) Care shall be taken to remove all air from mains under test when filling with test water. The rate of filling of the test section with water shall be such that the water velocity within the test section shall nowhere exceed 0.05m/s.
- e) The test head for water mains shall be 1350kPa. Test gauges shall be Certified by a NATA registered testing laboratory with the gauges Certification being no more than 6 months old.
- f) Within the ITP, the testing of the water main is a Hold point for the Superintendent.
- g) The test pressure shall be maintained for one (1) hour minimum without any drop in the gauge reading and during this period the whole line shall be inspected for leakage or movement. Any defects shall be repaired and the main re-tested until the gauge pressure remains steady for one (1) hour minimum.
- h) The length of main or mains under hydraulic pressure test shall be deemed to have passed the test provided the pressure gauge remained steady for one (1) hour minimum and there is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component and there is no visible leakage.
- i) It is recommended that the testing of PE mains be carried out separately to the testing of PVC-DI mains due to the different material properties of these mains and the effects of these different properties during the testing process.
- j) Guidance on the testing of PE mains can be obtained from the PE pipe and fitting manufacturer or from the **WSAA Polyethylene Pipeline Code WSA 01**.

## 41.0 Sterilisation

- a) Following satisfactory hydraulic pressure testing as specified in **Clause 40.0** herein, all potable water mains and all Class A + recycled water mains shall be sterilised by adding a sterilising agent to water drawn from Council's distribution system.
- b) During the sterilisation process all valves, hydrants, water meter box ball valves (where fitted) and other fittings shall be operated to ensure disinfection.
- c) The sterilisation process shall ensure complete sterilisation of the mains and fittings to meet the requirements of **Clause 42.0** herein.

## 41.1 Flushing of Sterilisation Water

- a) The chlorinated water used in the sterilisation process shall be flushed from the mains and any Property Service pipes at the completion of the sterilisation process.
- b) Flushing of the mains shall be continued until the chlorine concentration does not exceed 1.0mg/ L.
- c) The main shall be left full of water and ready for the process specified in **Clause 42.0** herein.
- d) The Contractor shall take whatever steps are necessary to ensure that:
  - i) water used in the sterilisation and flushing process does not enter the distribution system;
  - ii) during the process specified in **Clause 41.1 a)** herein all measures are taken to protect the environment.

## 42.0 Water Quality Testing

- a) At the completion of the flushing of the sterilisation water specified in **Clause 41.1** herein the system shall be sampled and tested by a NATA registered laboratory accredited for the sample collection and testing of the water to the parameters nominated in **Table 8** herein.
- b) Tests shall be considered satisfactory when they fall within the water quality limits specified in **Table 8** herein.

**Table 8**

| Analysis                   | Unit      | Required Result Range |
|----------------------------|-----------|-----------------------|
| pH (not cement lined main) |           | 6.5 – 8.5             |
| (cement lined main)        |           | 6.5 – 9.2             |
| Chlorine (free)            | mg/ L     | < 1.5                 |
| Total Coliform count       | cfu/100mL | <1                    |
| E.Coli count               | cfu/100mL | <1                    |
| Heterotrophic Plate count  | cfu/mL    | <500                  |

- c) Should any sample analysed not comply with the water quality limits shown in **Table 8** herein, the corresponding section of new main shall be re-sterilised, re-flushed and re-tested until the test results are satisfactory.
- d) Notwithstanding the water quality limits set out in **Table 8** herein, test results of new sections of mains may be deemed satisfactory when the following conditions apply:
  - i) water quality in the new sections of mains is no worse than in a sample of influent existing mains water; and
  - ii) the sample referred to in **Clause 42.0 d) i)** above was collected by the NATA registered laboratory referred to in **Clause 42.0 a)** herein at the same time as it sampled water from the new sections of mains.

## 43.0 Restoration Works

- a) Restoration of existing developed areas shall be carried out to such a standard that the finished Works shall be as near as practicable to standard of the Site prior to commencement of Works. Photographic evidence of the original state of the existing developed area shall be provided by the Contractor to validate the restoration standard provided.
- b) The Contractor shall be responsible for all restoration works including, but not restricted to, concrete work, footpath and pavement repairs, gardens, edging, trees, shrubs and grass.
- c) The restoration works shall be completed within forty-eight (48) hours of the initial work being undertaken on a particular property unless agreed otherwise by the Superintendent.
- d) Any excess material which has resulted from work under the Contract shall be removed from the Site at the Contractor's expense.
- e) Should the Contractor fail to complete restoration to a satisfactory standard, within the specified time, then the Superintendent shall arrange to have the restoration work completed by others at the Contractor's expense.

- f) The Contractor shall be responsible for all restoration works including, but not restricted to fences, concrete work, footpath and pavement repairs, gardens, edging, trees, shrubs and lawn to a condition equivalent to that prior to the commencement of work. In the case of grassed areas which are not lawn, restoration shall consist of the placement of 100 mm of topsoil and the spreading of a mixture of grass seed and fertiliser at the following minimum rates:
  - i) Green Couch (*Cynodon dactylon*) 20 kg/ hectare;
  - ii) Carpet Grass (*Axonopus affinis*) 20 kg/ hectare;
  - iii) fertiliser 350 kg/ hectare.
- g) The restoration of grassed areas will not be considered as complete until 80% of the disturbed area has an established grass cover.

#### 44.0 Live Connection, Disconnection, Commissioning and Decommissioning

- a) After all the requirements of this specification have been satisfied, the Contractor shall arrange for Gold Coast Water to carry out the live connection and the commissioning of the Works or any necessary decommissioning.
- b) The Contractor shall allow sufficient time for Gold Coast Water to quote for the connection works, order any materials required and program in the Works.
- c) Where Gold Coast Water requires the live connections to existing infrastructure to be undertaken by the Contractor, the Contractor shall make connection to existing water mains only under Gold Coast Water supervision and Gold Coast Water will provide assistance to the Contractor for filling of the water main.
- d) Prior approval by Gold Coast Water of the Contractor's proposed procedure for connection to existing infrastructure is required to be issued by the Superintendent.
- e) Where connections to existing infrastructure are to be undertaken by the Contractor, the Contractor shall submit to the Superintendent a detailed method statement of how each connection is proposed to be undertaken, including times of connection, materials and equipment to be used in undertaking the connection, and details of service interruptions anticipated to arise during the period of the connection.
- f) In all cases, the method statement for the connection is to endeavour to minimise any disruption to existing customers and/or users of the affected infrastructure. The method statement is to be received by the Superintendent not less than fourteen (14) days prior to the date scheduled for the connection works.
- g) The Contractor shall further confirm the final arrangements with the Superintendent not less than 48 hours before the proposed commencement of the connection works.
- h) The Superintendent shall within seven (7) days of receipt of the method statement either approve the method statement or return it to the Contractor requesting further consideration of issues raised.
- i) Should resubmission of the method statement be required, the Superintendent's approval to the revised method statement will still be required prior to proceeding with the connection works. In all cases, the proposed date to undertake the connection works shall be not less than seven (7) days after receipt of written approval from the Superintendent to the proposed method statement. No additional cost will be applicable arising from delays in obtaining the Superintendent's approval to the connection method statement.
- j) If in the opinion of the Superintendent the Contractor does not have the necessary equipment and/or resources available to successfully complete the connections, the connection activities will be postponed to another day. No cost for this delay will be granted.
- k) Connections to existing infrastructure are also to be undertaken outside normal working hours and not during peak periods Monday through to Sunday to minimise disruption to customers. The Contractor shall therefore be required to undertake live connections during such off-peak hours.
- l) Council may postpone live connections during Major events, ie. holidays, Indy, Surf Carnival weekend's, etc. If the Contractor can ensure no such functions are affected, the Superintendent will advise whether the live connection can take place.
- m) Where the Contractor can ensure disruption to customers is minimal, the Superintendent may authorise connection during the above periods.
- n) All costs associated with the connections to the existing water supply system shall be included in the lump sum.

## 45.0 Construction Tolerance

- a) Where levels are nominated, the Contractor shall construct the Works within the following tolerances:
- |      |                             |        |
|------|-----------------------------|--------|
| i)   | Horizontal                  | + 75mm |
| ii)  | Vertical                    |        |
|      | Surface Level               | + 50mm |
|      | Design Level                | + 30mm |
| iii) | Pipeline Cover <sup>1</sup> |        |

**Note 1:** *Minimum cover shall be maintained.*

## 46.0 Measurement and Payment

- a) Quantities in the Bill of Quantities have been computed on the following basis:
- water main – per plan linear metre, including: excavate, supply, lay, joint, bed and backfill; including tees (other than hydrant tees), thrust blocks, caps and bends;
  - other items have been measured in the units indicated in the text of the items in the Bill and based on the dimensions shown on the drawings or specified elsewhere.
- b) The cost of all work required by this specification including testing, supply of all materials, plant, tools, labour and all expenses necessary for the satisfactory completion of the Works, shall be deemed to be included in the relevant Bill Items (if part of the Contract) and/or the Lump Sum of the Contract generally.

## 47.0 'As-Constructed' Submission

### 47.1 'As-Constructed' Criteria

- a) 'As constructed' information shall be prepared by the Contractor and shall meet the following minimum criteria:
- be endorsed by a Licensed Consulting Surveyor with an appropriate QA standard;
  - be submitted to the Superintendent prior to acceptance of the Works on Practical Completion. Should any amendments be required by the Superintendent to the submitted 'as constructed' information, such amendments shall be made and resubmitted by the Contractor prior to acceptance of the Works on Practical Completion;
  - for Linier assets, such as pipes and fittings, be submitted in the format specified in Council's current '**Standard Electronic Format for As Constructed Data**';
  - for Non-Linier assets, such as pumping stations, be submitted in accordance with the requirements of **Standard Specifications SS12 and SS14**;
  - show all significant variations from the Contract Drawings (including tolerances outside those specified below);
  - where variations occur the Design Drawings are to be amended and submitted to Council for approval.

### 47.2 Water Mains – Council's Records Tolerance

- a) Deviations from approved design shall not exceed:
- |     |              |                       |
|-----|--------------|-----------------------|
| i)  | Fittings     |                       |
|     | 1) Locations | ± 100 mm <sup>1</sup> |
|     | 2) Levels    | ± 50 mm <sup>2</sup>  |
| ii) | Lines        |                       |
|     | 1) Alignment | ± 100 mm <sup>1</sup> |
|     | 2) Levels    | ± 50 mm <sup>2</sup>  |

#### Notes:

- 1** *Deviation should not result in conflict or interference with any other service or structure. All services should remain within the approved service corridors.*
- 2** *Levels should be adequate for installation of fittings. Tolerances are only critical if design levels are nominated.*

## 48.0 Standards and Codes

a) This specification makes reference to the following Australian Standards:

|                          |                                                                                              |
|--------------------------|----------------------------------------------------------------------------------------------|
| <b>AS1074</b>            | Steel tubes and tubulars for ordinary service                                                |
| <b>AS1111</b>            | ISO metric hexagon commercial bolts and screws                                               |
| <b>AS1111.1</b>          | ISO metric hexagon bolts and screws – Product grade C – Bolts                                |
| <b>AS1111.2</b>          | ISO metric hexagon bolts and screws – Product grade C – Screws                               |
| <b>AS1112</b>            | ISO metric hexagon nuts, including thin nuts, slotted nuts and castle nuts                   |
| <b>AS1112.3</b>          | ISO metric hexagon nuts – Product grade C                                                    |
| <b>AS1141</b>            | Methods for sampling and testing aggregates                                                  |
| <b>AS1159</b>            | Polyethylene pipes for pressure applications                                                 |
| <b>AS1281</b>            | Cement mortar lining of steel pipes and fittings                                             |
| <b>AS1289</b>            | Methods of testing soils for engineering purposes                                            |
| <b>AS1302</b>            | Steel reinforcing bars for concrete BL                                                       |
| <b>AS1304</b>            | Welded wire reinforcing fabric for concrete                                                  |
| <b>AS1379</b>            | The specification and manufacture of concrete                                                |
| <b>AS1397</b>            | Steel sheet and strip – hot-dipped zinc-coated or aluminium/ zinc-coated                     |
| <b>AS1449</b>            | Wrought alloy steels – stainless and heat resisting steel plate, sheet and strip             |
| <b>AS/NZS1477</b>        | Unplasticized PVC (UPVC) pipes and fittings for pressure applications                        |
| <b>AS1478</b>            | Chemical admixtures for concrete                                                             |
| <b>AS1565</b>            | Copper and copper alloys – ingots and castings                                               |
| <b>AS1567</b>            | Copper and copper alloys – wrought rods, bars and sections                                   |
| <b>AS1568</b>            | Copper and copper alloys – forging stock and forgings                                        |
| <b>AS1579</b>            | Arc welded steel pipes and fittings for water and wastewater                                 |
| <b>AS1627.4</b>          | Metal finishing – preparation and pre-treatment of surfaces-abrasive blast cleaning of steel |
| <b>AS1646</b>            | Elastomeric seals for waterworks purposes                                                    |
| <b>AS1650</b>            | Hot-dipped galvanised coatings on ferrous articles                                           |
| <b>AS1720.1</b>          | Timber Structures – Design Methods                                                           |
| <b>AS1722.1</b>          | Pipe threads of Whitworth form – sealing pipe threads                                        |
| <b>AS1830</b>            | Iron castings – grey cast iron                                                               |
| <b>AS1831</b>            | Ductile cast iron                                                                            |
| <b>AS1837</b>            | Code of practice for application of ergonomics to factory and office work                    |
| <b>AS/NZS2032</b>        | Installation of PVC pipe systems                                                             |
| <b>AS2053</b>            | Conduits and fittings for electrical installations                                           |
| <b>AS2129</b>            | Flanges for pipes, valves and fittings                                                       |
| <b>AS2187</b>            | Explosives – Storage, transport and use (known as the <b>SAA Explosives Code</b> )           |
| <b>AS2200</b>            | Design charts for water supply and sewerage                                                  |
| <b>AS/NZS2280</b>        | Ductile iron pressure pipes and fittings                                                     |
| <b>AS2345</b>            | Dezincification resistance of copper alloys                                                  |
| <b>AS2544</b>            | Grey iron pressure fittings                                                                  |
| <b>AS/NZS2566.1</b>      | Buried flexible pipelines – Structural design                                                |
| <b>AS2638.1</b>          | Gate valves for waterworks purposes – Metal seated                                           |
| <b>AS2638.2</b>          | Gate valves for waterworks purposes – Resilient seated                                       |
| <b>AS/NZS2648.1</b>      | Underground marking tape – Non-detectable tape                                               |
| <b>AS2700S-1996(P23)</b> | Colour Standards for general purposes – Lilac                                                |

|                     |                                                                                                                                   |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| <b>AS2758.1</b>     | Aggregates and rock for engineering purposes – Concrete aggregates                                                                |
| <b>AS2837</b>       | Wrought alloy steels – stainless steel bars and semi-finished products                                                            |
| <b>AS2865</b>       | Safe working in a confined space                                                                                                  |
| <b>AS3000</b>       | Electrical installations – buildings, structures and premises (known as the <b>SAA Wiring Rules</b> )                             |
| <b>AS/NZS3518</b>   | Acrylonitrile Butadiene Styrene (ABS) compounds, pipes and fittings for pressure applications                                     |
| <b>AS3571</b>       | Glass filament Reinforced thermosetting Plastics (GRP) pipes – Polyester based – water supply, sewerage and drainage applications |
| <b>AS3582.1</b>     | Supplementary cementitious materials for use with Portland and blended cement – Fly ash                                           |
| <b>AS3600</b>       | Concrete structures                                                                                                               |
| <b>AS3610</b>       | Formwork for concrete                                                                                                             |
| <b>AS3678</b>       | Structural steel – hot-rolled plates, floor-plates and slabs                                                                      |
| <b>AS/NZS3679</b>   | Structural steel – hot-rolled                                                                                                     |
| <b>AS3680</b>       | Polyethylene sleeving for ductile iron pipelines                                                                                  |
| <b>AS3681</b>       | Guidelines for the application of polyethylene sleeving to ductile iron pipeworks and fittings                                    |
| <b>AS3688</b>       | Water supply – metallic fittings and end connectors                                                                               |
| <b>AS3706</b>       | Geotextiles – methods of test                                                                                                     |
| <b>AS3894.1</b>     | Non-conductive coatings – continuity testing – high voltage (brush) method                                                        |
| <b>AS3952</b>       | Water supply – DN80 spring hydrant valve for general purposes                                                                     |
| <b>AS3972</b>       | Portland and blended cements                                                                                                      |
| <b>AS/NZS4020</b>   | Testing of products for use in contact with drinking water                                                                        |
| <b>AS4041</b>       | Pressure piping                                                                                                                   |
| <b>AS4087</b>       | Metallic flanges for waterworks purposes                                                                                          |
| <b>AS4097</b>       | Information processing – SGML support facilities – registration procedures for public text owner identifiers                      |
| <b>AS/NZS4129</b>   | Fittings for polyethylene (PE) pipes for pressure applications                                                                    |
| <b>AS/NZS4130</b>   | Polyethylene (PE) pipes for pressure applications                                                                                 |
| <b>AS/NZ4158</b>    | Thermal-bonded polymeric coatings on valves and fittings for water industry purposes                                              |
| <b>AS4181</b>       | Stainless steel clamps for waterworks purposes                                                                                    |
| <b>AS4198</b>       | Pre-cast concrete access chambers for sewerage applications                                                                       |
| <b>AS4321</b>       | Fusion bonded medium density polyethylene coating and lining for pipes and fittings                                               |
| <b>AS4441(Int.)</b> | Oriented PVC (PVC-O) pipes for pressure applications                                                                              |
| <b>AS/NZS4586</b>   | Slip resistance classification of new pedestrian surface materials                                                                |
| <b>AS/NZS4671</b>   | Steel reinforcing materials                                                                                                       |
| <b>AS/NZ4680</b>    | Hot-dip galvanized (zinc) coatings on fabricated ferrous articles                                                                 |
| <b>AS/NZS4765</b>   | Modified PVC (PVC-M) pipes for pressure applications                                                                              |
| <b>AS4794</b>       | Non-return valves – Swing check and tilting disc                                                                                  |
| <b>AS4795</b>       | Butterfly valves for waterworks purposes                                                                                          |

- b) In this specification Australian Standards are referred to only by their allocated AS number. The latest available edition (including interim editions) at the date of close of Tenders shall be deemed to apply.

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## Policy 11: Land Development Guidelines

### SS2

#### Appendices

|             |                                                                                                         |
|-------------|---------------------------------------------------------------------------------------------------------|
| <b>C</b>    | <b>Consulting Engineer's Certificate and As Constructed Certification</b>                               |
| <b>C2-A</b> | <b>Typical Hold/ Witness Point Inspection Checklist Traditional Potable Water Reticulation</b>          |
| <b>C2-B</b> | <b>Traditional Potable Water Completed Works Matrix</b>                                                 |
| <b>C3-A</b> | <b>Typical Hold/ Witness Point Inspection Checklist Dual Water System (Recycled Water Reticulation)</b> |
| <b>C3-B</b> | <b>Dual Water System (Recycled Water) Completed Works Matrix</b>                                        |
| <b>C4-A</b> | <b>Typical Hold/ Witness Point Inspection Checklist Dual Water System (Potable Water Reticulation)</b>  |
| <b>C4-B</b> | <b>Dual Water System (Potable Water) Completed Works Matrix</b>                                         |
| <b>C5</b>   | <b>Dual Water System Rectification Summary List</b>                                                     |
| <b>C6</b>   | <b>Site Inspection Summary List</b>                                                                     |
| <b>C7</b>   | <b>Water Standard Drawings</b>                                                                          |

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 SN:  
 SS:  
 BN:  
 RN:

# Appendix C

# Consulting Engineer's Certificate and As Constructed Certification

Development Name: ..... Stage No: .....

Council File No: .....

Works to which Certification relates: .....

**PROPERTY DETAILS**

Real Property Description: .....

Area of Land: .....

Address: .....

**CONSULTANT**

a) Company Name: .....

b) Address: .....

c) Phone No: ..... Fax No: .....

I, ..... being a Registered Professional Engineer registered under the provision of the **Professional Engineers Act 2002** (as amended) and a duly authorised representative of ..... do hereby certify that we have exercised reasonable skill, care and diligence to ascertain that the Works described above have been executed in accordance with:

1. The approved Engineering Drawings, Specifications, Development Guidelines and relevant Australian Standard Code of Practice.
2. Good engineering practice and to a satisfactory standard of workmanship.
3. Council's By-Laws.

We further certify that the 'As Constructed' information submitted herewith (including survey information prepared by others) indicates to the best of our knowledge and belief that the completed Works represent a true and accurate record of what has been constructed within the specified tolerances required by Council.

We further certify that all significant variations from the approved Engineering Drawings (outside the specified tolerances) have been submitted to Council for approval and are incorporated in the 'As Constructed' information.

Signature: ..... RPEQ No: ..... Date ..... / ..... / .....

Consulting Engineer for and on behalf of (Company): .....

## Appendix C2-A Typical Hold/ Witness Point Inspection Checklist Traditional Potable Water Reticulation

| Development Name:                                |                                                                                    | Key:                     |                          |                          |                                                        |                                                                            |  |
|--------------------------------------------------|------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------------------------------------|----------------------------------------------------------------------------|--|
| Stage No:                                        | File No:                                                                           | No<br>H<br>W             | C/R                      | E/R                      | Coun                                                   | Contractor Representative<br>Engineer/ Consultant Rep<br>Council Inspector |  |
| Contractor:                                      |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| No. H/W                                          | Inspection Activity                                                                | C/R                      | E/R                      | Coun                     | Record/ Results or Other Supporting Documentation      |                                                                            |  |
| <b>Preparation</b>                               |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| 1W                                               | Existing services located and marked clearly (if applicable).                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 2W                                               | Existing water main exposed and level confirmed.                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 3W                                               | Approved material supplier.                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| <b>Material Handling and Storage</b>             |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| 4W                                               | All pipe materials delivered as ordered without damage.                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 5W                                               | All fittings delivered as ordered without damage.                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 6W                                               | All bedding material to Council standard and stored on-site without contamination. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| <b>Trench Excavation</b>                         |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| 7W                                               | Width and depth to Council standards.                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 8W                                               | If ground water is present, diversion drains as required.                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 9W                                               | Pipes laid to level and grade, within tolerance.                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Certification of 80% compliance prior to plan sealing. |                                                                            |  |
| 10W                                              | Pipe embedment, bedding depth to specification.                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| <b>Dual Reticulation Only – Common Trenching</b> |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| 11W                                              | Minimum 200mm pipe separation. Correct of-take crossover and thrust block formats. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| 12H                                              | No snaking of PE pipe.                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| <b>Backfilling</b>                               |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| 13W                                              | Backfill trench compaction.                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |
| <b>Thrust Restraints</b>                         |                                                                                    |                          |                          |                          |                                                        |                                                                            |  |
| 14H                                              | Adequate restraint provided on all uPVC/ DI fittings and all valves.               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                        |                                                                            |  |

| No. HW | Inspection Activity                                                                          | C/R                      | E/R                      | Coun                     | Record/ Results or Other Supporting Documentation |
|--------|----------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------------------------------------------------|
|        | <b>Conduits</b>                                                                              |                          |                          |                          |                                                   |
| 15W    | For all Property Service road crossings.                                                     | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |
| 16W    | Property service lines and water meter box installed.                                        | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |
|        | <b>Markings</b>                                                                              |                          |                          |                          |                                                   |
| 17H    | All valves and hydrants clearly marked.                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |
| 18H    | All conduits have brass discs in place.                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |
|        | <b>Main Terminations and Council Connections</b>                                             |                          |                          |                          |                                                   |
| 19H    | Permanent - Mains ended with hydrant. Future extension - thrust restraint and hydrant.       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |
| 20H    | Connection - New main laid at grade and level to match existing. Temporary hydrant provided. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |
|        | <b>Testing</b>                                                                               |                          |                          |                          |                                                   |
| 21W    | Dual Reticulation only - Cross connection valve closed.                                      | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |
| 22W    | Hydrants and/or Flushing points provided at main evacuation points.                          | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |
| 23H    | Water quality and pressure tests passed.                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |
|        | <b>Survey/ As Constructed</b>                                                                |                          |                          |                          |                                                   |
| 24H    | Detailed Survey.                                                                             | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |

**Notes:**

- 1 This Inspection Checklist does not cover environmental or safety items.
- 2 For additional items such as Jacked pipes, Valve chambers and Pump Stations develop specific Checklist points for the Works.

## Appendix C2-B Traditional Potable Water Completed Works Matrix

| No. H/W | Road Names               |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|---------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|         |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
| 7       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| No. H/W | Road Names               |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|---------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|         |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
| 7       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 12      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 13      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 14      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 15      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 16      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 17      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 18      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 19      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 20      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Appendix C3-A Typical Hold/ Witness Point Inspection Checklist Dual Water System (Recycled Water Reticulation)

| Development Name:                                |          | Inspection Activity                                                                       |                          | Key:                                 |                          |                                                                      |
|--------------------------------------------------|----------|-------------------------------------------------------------------------------------------|--------------------------|--------------------------------------|--------------------------|----------------------------------------------------------------------|
| Stage No:                                        | File No: | No H/W                                                                                    | C/R                      | E/R                                  | Coun                     | Contractor Representative Engineer/ Consultant Rep Council Inspector |
| Contractor:                                      |          | Inspection Activity                                                                       |                          | Item Number Hold Point Witness Point | Coun                     | Record/ Results or Other Supporting Documentation                    |
| <b>Class A+ Recycled Water Pipe Installation</b> |          |                                                                                           |                          |                                      |                          |                                                                      |
| 25H                                              |          | Mains - Purple coloured uPVC, purple sleeving to DI. DN63 PE is purple. No scars on pipe. | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 26W                                              |          | DN100 and larger valves with restraint system.                                            | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 27W                                              |          | Flange Bolts SS316 ('A4' marked on head of bolt).                                         | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| <b>Tees and Bends</b>                            |          |                                                                                           |                          |                                      |                          |                                                                      |
| 28W                                              |          | Ductile iron – fusion bonded coated and sleeved in purple.                                | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| <b>Flushing Point Valves - End of Line</b>       |          |                                                                                           |                          |                                      |                          |                                                                      |
| 29W                                              |          | Riser vertical (+/- 5 degrees) with Ball valve and Camlock fitting.                       | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 30W                                              |          | Between 75mm and 150mm from top of dust cap to top of box.                                | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 31W                                              |          | Function of ball valve handle in box.                                                     | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| <b>Hydrants</b>                                  |          |                                                                                           |                          |                                      |                          |                                                                      |
| 32W                                              |          | Vertical (+/- 5 degrees).                                                                 | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 33W                                              |          | Between 75mm and 150mm from top of Claws to top of box. Claw colour.                      | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 34W                                              |          | Correct round hydrant box coloured purple.                                                | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| <b>Property Service Lines</b>                    |          |                                                                                           |                          |                                      |                          |                                                                      |
| 35H                                              |          | 75mm of sand bedding required for all service lines and around tapping.                   | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 36W                                              |          | Tapping fitting angle (0-45 degrees to horizontal).                                       | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 37W                                              |          | Purple service pipe – Twin at DN32.                                                       | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 38W                                              |          | Electrofusion bends and tees.                                                             | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 39W                                              |          | Maintap ball valve open.                                                                  | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 40W                                              |          | Brass plugs fitted to unused Readytap service connections.                                | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 41W                                              |          | Service lines to be provided to side of driveway.                                         | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 42W                                              |          | Watermeter box installation and meter application.                                        | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 43W                                              |          | Cross connection valve MH box and lid and marking.                                        | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |
| 44W                                              |          | Cul-de-sac ends – PVC/ DI to PE Transition fitting                                        | <input type="checkbox"/> | <input type="checkbox"/>             | <input type="checkbox"/> |                                                                      |

## Appendix C3-B Dual Water System (Recycled Water) Completed Works Matrix

| No.<br>H/W | Road Names               |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|            |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
| 25         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 26         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 27         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 28         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 29         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 30         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 31         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 32         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 33         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 34         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 35         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 36         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 37         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 38         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 39         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 40         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 41         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 42         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 43         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 44         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Appendix C4-A Typical Hold/ Witness Point Inspection Checklist Dual Water System (Potable Water Reticulation)

| Development Name:                                         |                                                                                               | Key:                     |                          |                          |                                                   |      |      |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------------------------------------------------|------|------|
| Stage No:                                                 | File No:                                                                                      | No                       | Item Number              | C/R                      | Contractor Representative                         |      |      |
| Contractor:                                               |                                                                                               | H                        | Hold Point               | E/R                      | Engineer/ Consultant Rep                          |      |      |
|                                                           |                                                                                               | W                        | Witness Point            | Coun                     | Coun                                              | Coun | Coun |
| No. H/W                                                   | Inspection Activity                                                                           | C/R                      | E/R                      | Coun                     | Record/ Results or Other Supporting Documentation |      |      |
| <b>Potable Water Pipe Installation</b>                    |                                                                                               |                          |                          |                          |                                                   |      |      |
| 45W                                                       | Mains – Blue coloured uPVC, Blue sleeving to DI. DN63 and DN110 PE is Blue. No scars on pipe. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |      |      |
| 46W                                                       | DN63 and DN110 valves with restraint system.                                                  |                          |                          |                          |                                                   |      |      |
| 47W                                                       | DN150 and larger valves with restraint system.                                                |                          |                          |                          |                                                   |      |      |
| 48W                                                       | Flange Bolts SS316 ('A4' marked on head of bolt).                                             | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| <b>Tees and Bends</b>                                     |                                                                                               |                          |                          |                          |                                                   |      |      |
| 49W                                                       | PE – Electrofusion. Ductile iron – fusion bonded coated and sleeved in blue.                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |      |      |
| <b>Flushing Point Valves – Health Water Access Points</b> |                                                                                               |                          |                          |                          |                                                   |      |      |
| 50W                                                       | Riser vertical (+/- 5 degrees) with Gate valve and Storz fitting.                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |      |      |
| 51W                                                       | Between 75mm and 150mm from top of dust cap to top of box.                                    |                          |                          |                          |                                                   |      |      |
| 52W                                                       | Function of Gate valve handle in box.                                                         | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 53H                                                       | Hydrants are not permitted on Potable in Dual Reticulation System.                            | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 54W                                                       | Flushing Point – Correct square box coloured yellow.                                          | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| <b>Property Service Lines</b>                             |                                                                                               |                          |                          |                          |                                                   |      |      |
| 55H                                                       | 75mm of sand bedding required for all service lines and around tapping.                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |      |      |
| 56W                                                       | Tapping fitting angle (0-45 degrees to horizontal).                                           | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 57W                                                       | Black with blue stripe service pipe – Twin at DN32.                                           | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 58W                                                       | Electrofusion bends and tees.                                                                 |                          |                          |                          |                                                   |      |      |
| 59W                                                       | Tapping saddle valve or Maintap ball valve open.                                              | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 60W                                                       | Brass plugs fitted to unused Readytap service connections.                                    | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 61W                                                       | Service lines to be provided to side of driveway.                                             |                          |                          |                          |                                                   |      |      |
| 62W                                                       | Watermeter box installation and meter application.                                            | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 63W                                                       | Cross connection valve MH box and lid and marking.                                            | <input type="checkbox"/> | <input type="checkbox"/> |                          |                                                   |      |      |
| 64W                                                       | PVC/DI to PE Transition fitting.                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                                                   |      |      |

## Appendix C4-B Dual Water System (Potable Water) Completed Works Matrix

| No.<br>H/W | Road Names               |                          |                          |                          |                          |                          |                          |                          |                          |                          |
|------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|            |                          |                          |                          |                          |                          |                          |                          |                          |                          |                          |
| 45         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 46         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 47         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 48         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 49         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 50         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 51         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 52         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 53         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 54         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 55         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 56         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 57         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 58         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 59         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 60         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 61         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 62         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 63         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 64         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

## Appendix C5 Dual Water System Rectification Summary List

| No. H/W | Defect Details | Date | (GCCC) Approved          | Verification                                                                                                                                                                         |
|---------|----------------|------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         |                |      | <input type="checkbox"/> | I certify that the Works have been constructed in accordance with Gold Coast City Council Land Development Guidelines and Specifications.<br><br>Contractor Representative:<br>Date: |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |
|         |                |      | <input type="checkbox"/> |                                                                                                                                                                                      |

Contractor Representative

Consultant Representative

Subdivision Inspector

