1 GENERAL

1.1 RESPONSIBILITIES

Objectives
General: Provide water supply transfer, distribution and reticulation works in the location, to the lines, levels, grades and using the materials as documented.

Precedence
Precedence: The technical requirements of, or any standard drawing provided by, the Water Authority, used in conjunction with and in conflict with this worksection, take precedence.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- 0136 General requirements (Construction).
- 0152 Schedule of rates – supply projects.
- 0161 Quality (Construction).
- 0167 Integrated management.
- 0257 Landscape – roadways and street trees.
- 0319 Minor concrete works.
- 1101 Control of traffic.
- 1102 Control of erosion and sedimentation.
- 1112 Earthworks (Roadways).
- 1152 Road opening and restoration (Utilities).
- 1392 Trenchless conduit installation.

1.3 REFERENCED DOCUMENTS

The following documents are incorporated into this worksection by reference:

Standards
AS 1141 Methods for sampling and testing aggregates
AS 1141.22-2008 Wet/dry strength variation
AS 1141.32-2008 Weak particles (including clay lumps, soft and friable particles) in coarse aggregates
AS 1214-1983 Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS 1281-2001 Cement mortar lining of steel pipes and fittings
AS 1289 Methods for testing soils for engineering purposes
AS 1289.4.3.1-1997 Soil chemical tests - Determination of the pH value of a soil - Electrometric method
AS 1289.4.4.1-1997 Soil chemical tests - Determination of the electrical resistivity of a soil - Method for sands and granular materials
AS 1289.5.6.1-1998 Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1-2006 Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation (rapid method)
AS 1432-2004 Copper tubes for plumbing, gas fitting and drainage applications
AS/NZS 1477: 2006 PVC pipes and fittings for pressure applications
AS/NZS 1554 Structural steel welding
AS/NZS 1554.1:2011 Welding of steel structures
AS 1579-2001 Arc-welded steel pipes and fittings for water and waste-water
AS 1627 Metal finishing—Preparation and pre-treatment of surfaces
AS 1627.4-2005 Abrasive blast cleaning of steel
AS 1646-2007 Elastomeric seals for waterworks purposes
AS 1657-1992 Fixed platforms, walkways, stairways and ladders—Design, construction and installation
AS/NZS 2032:2006 Installation of PVC pipe systems
AS/NZS 2033:2008 Installation of polyethylene pipe systems
AS 2129-2000 Flanges for pipes, valves and fittings
AS/NZS 2280:2004 Ductile iron pipes and fittings
AS/NZS 2566 Buried flexible pipelines
AS/NZS 2566.2:2002 Installation
AS/NZS 2638 Gate valves for waterworks purposes
AS/NZS 2638.1:2011 Metal seated
AS/NZS 2638.2:2011 Resilient seated
AS 2832 Cathodic protection of metals
AS 2832.1-2004 Pipes and cables
AS 2832.2-2003 Compact buried structures
AS/NZS 3500 Plumbing and Drainage
AS/NZS 3500.1:2003 Water services
AS/NZS 3518:2004 Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications
AS 3571 Plastics piping systems - Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
AS 3571.2-2009 Pressure and non-pressure water supply (ISO 10639:2004, MOD)
AS 3600-2009 Concrete structures
AS 3681-2008 Application of polyethylene sleeving for ductile iron piping
AS 3688-2005 Water supply - Metallic fittings and end connectors
AS/NZS 3690:2009 Installation of ABS pipe systems
AS 3705-2012 Geotextiles - Identification, marking, and general data
AS/NZS 3750 Paints for steel structures
AS/NZS 3750.4:1994 Bitumen paint
AS/NZS 3750.19:2008 Metal primer - General purpose
AS/NZS 3862:2002 External fusion-bonded epoxy coating for steel pipes
AS/NZS 3879:2011 Solvent cements and priming fluids for use with unplasticised PVC (PVC-U and PVC-M) and ABS and ASA pipes and fittings
AS 3952-2002 Water supply—Spring hydrant valve for waterworks purposes
AS 3996-2006 Access covers and grates
AS/NZS 4020:2005 Testing of products for use in contact with drinking water
AS/NZS 4087:2011 Metallic flanges for waterworks purposes
AS/NZS 4129:2008 Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130:2009 Polyethylene (PE) pipes for pressure applications
AS/NZS 4158:2003 Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS 4321-2001 Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS/NZS 4331 Metallic flanges
AS/NZS 4331.1:1995 Steel flanges
AS/NZS 4441:2008 Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4680:2006 Hot-dipped galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4765:2007 Modified PVC (PVC-M) pipes for pressure applications
AS 4794-2001 Non-return valves—Swing check and tilting disc
AS 4795 Butterfly valves for waterworks purposes
AS 4795.1-2011 Wafer and lugged
AS 4795.2-2011 Double flanged
AS 4796-2001 Water supply - Metal bodied and plastic bodied ball valves for property service connection
AS 4809-2003 Copper pipe and fittings - Installation and commissioning
AS 4956-2008 Air valves for water supply
AS 5081-2008 Hydraulically operated automatic control valves for waterworks purposes
AS 6401-2003 Knife gate valves for waterworks purposes
ASTM A240/A240M:2012 Standard specification for chromium and chromium-nickel stainless steel plate, sheet and strip for pressure vessels and for general applications
BS 3416-1991 Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water

Other publications

Plastics Industry Pipe Association (PIPA)
POP001: 2011 Electrofusion jointing of PE pipe and fittings for pressure applications
POP003: 2011 Butt fusion jointing of PE pipes and fittings - recommended parameters
POP007: 2006 Metal backing flanges for use with polyethylene (PE) pipe flange adaptors
POP102: 2009 Solvent cement jointing of PVC pipe
POP202: 2008 PVC and PE pressure pipe installation on curved alignments

Water Services Association of Australia (WSAA)
WSA 03: 2011 Water Supply Code of Australia version 3.1

1.4 STANDARDS

General
Standard: To WSA 03 Part 2.
PVC installation: To AS/NZS 2032.
PE installation: To AS/NZS 2033.
ABS installation: To AS/NZS 3690.
Copper pipe and fittings installation: To AS 4809.

1.5 INTERPRETATIONS

Abbreviations
General: For the purposes of this worksection the following abbreviations apply:
- ABS: Acrylonitrile Butadiene Styrene.
- DI: Ductile Iron.
- GRP: Glass Reinforced Plastic.
- PE: Polyethylene.
- PVC: Polyvinyl Chloride.

Definitions
General: For the purposes of this worksection the definitions given in WSA 03 and the following apply:
- Commissioning: Running the plant and equipment to make sure there is flow through the reticulation system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions.
- Inadequate foundation material: Material beneath or adjacent to the proposed drainage structures which the Superintendent deems to be of insufficient strength to support the structure and loads on the structure, or material whose characteristics the Superintendent deems would adversely affect the performance or construction of the drainage structure.
- Nominal size (DN): Dimensionless whole number, which is indirectly related to the physical size, in mm of the bore or outside diameter of the end connections.
- Pre-commissioning: Preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation.
- Section: A length of pipeline which can be effectively isolated for testing, e.g. by means of main stop valves.
- Selected material zone: The top part of the upper zone of formation in which material of a specified higher quality is required.
- Water Agency: An authority, board, business, corporation, Council or local government body with the responsibility for planning or defining, design, construction and maintenance requirements for a water supply and/or sewerage systems.

1.6 SUBMISSIONS

Approvals
Submissions: To the Superintendent's approval. Submit the following for approval:
- Calculations: Survey set out of water supply works and quantity calculations.
- Components: Pipes and fittings.
- Work-as-executed drawings: Include water supply system information sheets and works.
- Execution details: Refer to HOLD POINTS.
- Materials: Off-site certificates of components.
- Samples: For conformity testing to relevant standards.
- Technical data: Product information.

### 1.7 HOLD POINTS AND WITNESS POINTS

#### Notice

General: Give notice so that the documented inspection and submissions may be made to the HOLD POINT table and the WITNESS POINT table.

#### HOLD POINTS table

<table>
<thead>
<tr>
<th>Clause title/ Item</th>
<th>Requirement</th>
<th>Notice for inspection</th>
<th>Release by</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Authorised products and materials</strong></td>
<td>Submit for approval alternative products and materials.</td>
<td>2 weeks before ordering</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Recycled materials</strong></td>
<td>Submit for approval proposed recycle material</td>
<td>2 weeks before ordering</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>EXECUTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Establishment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Excavation near underground services</strong> – Public utilities within the excavation for water supply systems</td>
<td>Approval from relevant Authority for the method of excavation.</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Excavation near underground services</strong> – Marking</td>
<td>Locate and mark existing underground services</td>
<td>3 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Excavation near underground services</strong> – Protection of other services</td>
<td>Give notice of any interference to the works caused by an existing service and submit a proposed work method statement.</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Excavation for water supply systems</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>General</strong> – Confirm surrounding soil type with design</td>
<td>Confirm surrounding soil type with design.</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>General</strong> – Excavation across improved surfaces</td>
<td>Approval from the land owner prior to commencing any excavation across improved surfaces</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Support of excavation</strong> - Trench instability</td>
<td>Submit for approval the proposal to provide adequate permanent stability of the ground affected by trenching</td>
<td>1 week before relevant action</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>Bedding for pipes</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Clause title/ Item</td>
<td>Requirement</td>
<td>Notice for inspection</td>
<td>Release by</td>
</tr>
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<td>-------------------------------------------</td>
<td>--------------------------------------------------</td>
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</tr>
<tr>
<td>Trench floor preparation</td>
<td>Test for bearing capacity &gt; 50 kPa</td>
<td>3 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Pipe laying, jointing and connecting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of pipes</td>
<td>Submit method statement for approval</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Existing asbestos cement pipe cutting and disposal</td>
<td>Rectify any damage to sleeving before backfilling trench</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Wrapping of ductile iron pipelines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embedment and backfill</td>
<td>Present the laid and jointed pipes for approval prior to the commencement of trench backfilling</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Pipe embedment and support</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embankment fill</td>
<td>Submit proposal for construction of embankments</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Acceptance testing</td>
<td>Rectify any faults even when results are compliant</td>
<td>1 week</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Connections to existing water mains</td>
<td>Submit a proposal to adjust work to fit the connection to the existing as required.</td>
<td>3 working days</td>
<td>Superintendent</td>
</tr>
<tr>
<td>General - Verify on site measurements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General - Connection and/or charging the new mains</td>
<td>Submit request to charge the new mains</td>
<td>5 working days</td>
<td>Water Agency - Superintendent</td>
</tr>
<tr>
<td>Restoration of surfaces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General - Original condition requirement</td>
<td>Restore progressively and as soon as possible after the section of works is completed</td>
<td>2 working days</td>
<td>Superintendent</td>
</tr>
</tbody>
</table>

**WITNESS POINTS table**

<table>
<thead>
<tr>
<th>Clause title/ Item</th>
<th>Requirement</th>
<th>Notice for inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIALS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance with manufacturers recommendations</td>
<td>Inspect material and products at time of delivery.</td>
<td>2 working days</td>
</tr>
<tr>
<td>Pipes and fittings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General - Certification</td>
<td>Provide product or material certification prior to delivery to the works</td>
<td>3 working days</td>
</tr>
<tr>
<td>Valves and hydrants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General - Certification</td>
<td>Provide product or material certification prior to delivery to</td>
<td>1 week</td>
</tr>
<tr>
<td>Clause title/ Item</td>
<td>Requirement</td>
<td>Notice for inspection</td>
</tr>
<tr>
<td>--------------------</td>
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<td>----------------------</td>
</tr>
<tr>
<td><strong>EXECUTION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Establishment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General – Set out</td>
<td>Confirm the set out locations immediately prior to construction.</td>
<td>3 working days</td>
</tr>
<tr>
<td>General – Crossings authority approvals</td>
<td>Approval from relevant Authority and payment of fees.</td>
<td>2 weeks</td>
</tr>
<tr>
<td><strong>Temporary drainage during construction</strong></td>
<td>Approval from appropriate Authority for any discharge to sewers, stormwater drains or watercourses.</td>
<td>2 weeks</td>
</tr>
<tr>
<td><strong>Excavation for water supply systems</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inadequate foundation material - Notice</td>
<td>Give notice of any area of the foundation that may contain inadequate foundation material</td>
<td>1 week</td>
</tr>
<tr>
<td>Inadequate foundation material - Rock foundation</td>
<td>Excavate for an additional depth. Backfill and compact the additional excavation.</td>
<td>1 week</td>
</tr>
<tr>
<td>Trench excavation – Trench size for pipelines</td>
<td>Conformance with documentation</td>
<td>1 week</td>
</tr>
<tr>
<td>Trench excavation – Trench widths</td>
<td>Method for approval</td>
<td>1 week</td>
</tr>
<tr>
<td><strong>Pipe laying, jointing and connecting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation of pipes</td>
<td>Submit and provide ITP</td>
<td>1 week</td>
</tr>
<tr>
<td>Under pressure cut-in connection to pressure pipes ≥ DN 80</td>
<td>Clean and inspect pipe and give notice if badly corroded or damaged.</td>
<td>3 working days</td>
</tr>
<tr>
<td>Thrust and anchor blocks and restrained joints</td>
<td>Give notice if the allowable bearing pressure of the ground and the design pressure of the pipeline differ from actual pressures on site</td>
<td>1 week</td>
</tr>
<tr>
<td>Welding of steel pipelines</td>
<td>Submit proposal for approval</td>
<td>1 week</td>
</tr>
<tr>
<td><strong>Acceptance testing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General - NATA</td>
<td>Provide NATA certified test results for water mains and structures testing</td>
<td>2 working days progressive</td>
</tr>
<tr>
<td>General - Notice</td>
<td>Give notice for compaction testing, hydrostatic pressure testing, block testing and water quality testing</td>
<td>3 working days progressive</td>
</tr>
<tr>
<td><strong>Visual inspection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirement</td>
<td>Inspect for compliance with the documents</td>
<td>2 working days</td>
</tr>
<tr>
<td><strong>Connections to existing water mains</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General – Acceptance testing</td>
<td>Complete acceptance testing to the satisfaction of the Water Agency</td>
<td>Prior to connection to existing mains</td>
</tr>
<tr>
<td><strong>Restoration of surfaces</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backfill - Disposal of surplus</td>
<td>Submit for approval surplus</td>
<td>2 working days progressive</td>
</tr>
</tbody>
</table>
2 PRE-CONSTRUCTION PLANNING

2.1 SCHEDULING

Program of works
General: Program the works as follows:
- Materials: Arrange the program so that it conforms with the approved products and materials.
- Authorities: Arrange approvals and conform to the local environmental requirements e.g. protection of the environment and heritage areas.
- Control of erosion and sedimentation: Provide a erosion and sediment control plan prior to commencing of works.

3 MATERIALS

3.1 GENERAL

Authorised products and materials
Products and materials: Provide only products and materials authorised by the Water Agency, the drawings and this specification. Submit for approval any alternative products and materials. This is a HOLD POINT.

Unauthorised material: Remove unauthorised or non-conforming materials from the site within 24 hours.

Conformance with manufacturer’s recommendations
Requirement: Handle, transport and store materials in conformance with the manufacturer’s recommendations and in a manner to prevent damage or deterioration or excessive distortion. Inspect all products and materials at the time of delivery and reject products and materials not in conformance with this specification and the manufacturers recommendations. This is a WITNESS POINT.

On site storage: Store in protective crating or packaging until immediately before use, stack piping to avoid ovalisation, support all fittings and pipes off the ground.

Damaged or defective materials: Do not use damaged or defective materials, including coatings and linings, outside the manufacturer’s recommended limits and the following:
- Faded/discoloured plastics, plastic coated pipes, fittings and appurtenances.
- PVC pipes and fittings scored deeper than 10% of wall thickness or more than 1 mm.
- PE pipes and fittings scored deeper than 10% of wall thickness.
- GRP pipes and fittings scored deeper than 1 mm or with impact damage.
- DI and steel pipes and fittings with damage to linings in excess of 20% of the lining thickness.
- Plastics coated pipes, fittings and appurtenances with damage to coating in excess of 20% of the coating thickness.

3.2 PIPES AND FITTINGS

General
Certification: Submit product or material certification before delivery to the works. This is a WITNESS POINT.

Standard: All pipe, joint seals, flange gaskets and lubricant for drinking water supply to AS/NZS 4020.

Products and materials: Conform to the Material properties schedule.

Material properties schedule

<table>
<thead>
<tr>
<th>Material properties</th>
<th>Mat 1</th>
<th>Mat 2</th>
<th>Mat 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal size (DN)</td>
<td></td>
<td></td>
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<tr>
<td>Pipe series</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Material properties</td>
<td>Mat 1</td>
<td>Mat 2</td>
<td>Mat 3</td>
</tr>
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<tr>
<td>Pressure classification (PN)</td>
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</tr>
<tr>
<td>Material classification number (as necessary)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint type</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Length and form of pipes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type, materials and classes of fittings</td>
<td></td>
<td></td>
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<tr>
<td>Internal and external corrosion protection:</td>
<td></td>
<td></td>
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<tr>
<td>- Fittings</td>
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<td></td>
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<tr>
<td>- Pipes</td>
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<tr>
<td>Proof stress tests:</td>
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<tr>
<td>- Fittings</td>
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<tr>
<td>- Pipes</td>
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<td></td>
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<tr>
<td>Classification of flanges</td>
<td></td>
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<tr>
<td>Means of tapping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identification of drinking and non-drinking pipe systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gasket types and tightening sequence</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Type: Centrifugally cast (CC) or filament wound (FW)</td>
<td></td>
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</tr>
</tbody>
</table>

**Ductile iron (DI) water mains**

Standard: To AS/NZS 2280.

DI pipe: Cement mortar lined to AS/NZS 2280.

Epoxy coating: To AS/NZS 3862 (or thermal-bonded polyethylene to AS/NZS 4158).

Elastomeric seals: To AS 1646.

Flanges: To AS/NZS 4087 and AS 2129.

Bolts and nuts for flanged joints: To AS 2129, galvanized to AS 1214 or stainless steel to ASTM A276.

Corrosion protection of fittings: As shown on the drawings and the following:
- Thermal-bonded coated: To AS/NZS 4158, or
- Sleeved: To AS 3681. Do not allow exposure to sunlight for more than 7 days.

Fitting without flanges: Pipelines ≤ Class 35.

**Steel water mains**

Standard: To AS 1579 and the following:
- Steel pipe rated pressure: Hydrostatically tested.
- Fittings rated pressure: May be non-hydrostatically tested.

Pipe and fittings: Cement mortar lined to AS 1281.

Buried steel pipe and fittings: External coat with fusion bonded polyethylene (medium density) to AS 4321.

Pipe jointing: As shown on the drawings and the following options:
- Elastomeric seal: To AS 1646.
- Butt welded, welded spigot and socket, or welded using a welding collar and with the application of a polyethylene heat shrink sleeve over the weld, or wrapped.
- Flanges: To AS/NZS 4087.
- Bolts and nuts for flanged joints: To AS 2129.

**PVC water mains**
PVC pipe: To AS/NZS 1477.
PVC-O pressure pipe: To AS/NZS 4441.
PVC-M pressure pipe: To AS/NZS 4765.
PE pressure pipe: To AS/NZS 4130.
PVC curved alignments: To POP202.
Elastomeric seals: To AS 1646.
Handling and storage: To AS/NZS 2032, record time in storage and type of shelter protection from UV damage.

**Polyethylene (PE) water mains**
Standard: To AS/NZS 4130.
Fittings: To AS/NZS 4129.
Mechanical couplings: Self restraining.
Stub flanges and backing rings: To POP007.
PE curved alignments: To POP202.
Butt fusion jointing: To POP003.
Electrofusion jointing: To POP001.
Flanges: To AS 2129, AS/NZS 4331.1 and AS/NZS 4087.
Property service pipe: PE 100, PN 16, series 1.

**Glass reinforced plastic (GRP)**
Standard: To AS 3571.2.
Surge cycles: Refer to the manufacturer when the water temperatures are likely to exceed 35°C.
GRP fittings: To AS 3571.2.

**Acrylonitrile butadiene styrene (ABS)**
Standard: To AS/NZS 3518.
Joints: Conform to manufacturer’s recommendations using solvent cement to AS/NZS 3879.
Pipe class: Provide for cyclic loading.

**Copper pipe and fittings for property service**
Standard: To AS 1432. Bendable temper pipe in the range of DN 6 to DN 200 for Type A or Type B.
Capillary and compression fittings: Conform to AS 3688 and de-zincification resistant with silver brazed joints or solder insert capillary joints.

### 3.3 VALVES AND HYDRANTS

**General**
Requirement: Provide valves and hydrants in conformance with the drawings, the schedules and the specification.
Certification: Provide product or material certification before delivery to the works. This is a **WITNESS POINT**.
All pipe, joint seals, flange gaskets and lubricant for drinking water supply: To AS/NZS 4020.
Extended spindle: To AS/NZS 2638.1 Test J and AS/NZS 2638.2 Test M and the following:
- Welding: To AS/NZS 1554.1 Category GP. Do not weld cast iron (including grey and ductile iron) components.
- Bitumen coat: To AS/NZS 3750.4.
- Synthetic resin base coat: To AS/NZS 3750.19.
- Thermal bonded polymeric coatings: To AS/NZS 4158.
Valves and hydrants: Conform to the **Valves and hydrants schedule**.
Valves and hydrants schedule

<table>
<thead>
<tr>
<th>Valves and hydrants properties</th>
<th>Val 1</th>
<th>Val 2</th>
<th>Val 3</th>
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<td>Installation requirements</td>
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<td>Identification, colour and marking</td>
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<td>Bypass/Rider/Crossing</td>
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<td>- Fittings</td>
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Flanges: To AS 2129 and AS/NZS 4087.
Socket joint configurations: Elastomeric joint seal to AS 1646.

**Stop valves**
Resilient seated valves: To AS/NZS 2638.2.
Metal seated valves: To AS/NZS 2638.1.
Scour valves: Connect to pipelines with a flanged joint.
Gaskets: 3 mm thick insertion rubber.
Gate valves:
- Anti-clockwise rotation of the input spindle for closure.
- Provide spindle cap.
- Knife gate valve: To AS 6401.
Butterfly valves: To AS 4795.1, AS 4795.2 and the following:
- Do not use in reticulation mains.
- Direction for closing: Anti-clockwise.
- Do not use where throttle of flow is required.
- Installed with trunnions horizontal and gearing operated from the surface.
- Chamber required where gearbox is not sealed.
Resilient seated ball valves for property services: To AS 4796.

**Control valves**
Automatic inlet control valves: To AS 5081 and the following:
- Compatible with the existing system, e.g. electrically or hydraulic actuated, fully modulating or two-state open/closed control.
Air valves: To AS 4956 and the following:
- Small orifice: DN 15, 20 and 25.
- Large orifice: DN 50, 80, 100, 150 and 200.
- Double orifice type with integral isolating valve of minimum size DN 80.

Non-return valves: To AS 4794 and the following:
- Pressure class: PN 16.
- Provide lifting lugs: ≥ DN 250.
- Swing check type of ductile cast iron or steel body, cover and disc or bronze body and disc seat rings.
- Clear swinging leaf to provide an unobstructed waterway.
- Do not use wafer style non-return valves.
- Maintenance: Provide body cover of sufficient size and in a location that allows removal of the valve flap and the seat for inspection without removal of the valve body.
- No flow switch: Provide extended spindle of minimum grade 316 stainless steel to ASTM A240/A240M and fitted with an adjustable counterweight together with a proximity switch to indicate a no-flow condition and with the following features:
  - Eccentric cam operated limit switch type.
  - Minimum rating of 10 amps, 240 V AC, 50 Hz.
  - Oil tight and dust proof to IP 65.
  - Suitable for 25 mm conduit entry.
  - Mounted on rigid adjustable brackets of stainless steel in conformance with ASTM A240/A240M and free of sharp edges and exposed corners.

Maintenance facilities
Scours and pump-out branches: Provide scours and pump out branches for maintenance in conformance with WSA 03 clause 8.6 including the following:
- Size: To WSA 03 Table 8.4.
- Location.
- Swabbing points: Provide adequate drainage facilities for dewatering and flushing operations at proposed swabbing points.

Disinfection facilities: Provide chlorination installation in conformance with WSA 03 clause 8.9 and Appendix I and including the following:
- Fittings as permanent fixtures.
- Identification and appropriate location of hydrants if used for disinfection purposes.
- Fittings for transfer and distribution mains.
- Discharge points.

Hydrants
Spring hydrants: To AS 3952.
Access: Locate the top of spring hydrants between 100 mm and 200 mm below finished surface level. Provide hydrant risers of various heights if required.

Surface fittings
Access covers: To AS 3996, Access covers and frames schedule and the following:
- Coating to AS/NZS 3750.4 or BS 3416 for all cast iron solid-top covers and frames other than recessed parts. Do not apply to sealing and threaded surfaces. Make sure coating is dry to touch when handled.
- Single part round covers ≥ DN 375: 0.3 ± 0.03 mm gap between the edge of the cover and the inside edge of the frame.
- Multi-part covers: ≤ 4 mm between either part and the frame.

Access covers and frames schedule

<table>
<thead>
<tr>
<th>Requirements</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
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### Requirements

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<th>A1</th>
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<td>Cover orientation</td>
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<td>Handling</td>
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</tbody>
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**Jointing components**

Jointing lubricant: To AS/NZS 4020.
Joint seals: To AS 1646.

### 3.4 STEEL AND CONCRETE

**Steelwork**

Structural steelwork, including ladders, brackets, and covers: To AS 1657.
Abrasive blast cleaning: To AS 1627.4 Class 2.5.
Protection: Hot-dip galvanize to AS/NZS 4680.

**Concrete**

Premixed, normal class concrete: To 0319 Minor concrete works.

### 3.5 PROTECTION AGAINST DEGRADATION

**General**

Detail: Protect pipeline system items (e.g. pipes, fittings, appurtenances, elastomeric seals) of pipeline systems including the following:
- Eliminate contact between dissimilar metals to prevent galvanic corrosion.
- Fully seal conduits for plastic pipes and fittings in contaminated ground.
- Fully seal conduits for all elastomeric seal jointed pipes and fittings in contaminated ground.
- Control trench fill and pipe embedment materials.
- Mitigate stray current or telluric effects on buried steel pipelines in conformance with WSA 03 clause 4.8.6.
- Cathodic protection for buried steel pipelines to AS 2832.1 and AS 2832.2 and in conformance with WSA 03 clause 4.8.5.

### 3.6 BEDDING, EMBEDMENT AND FILL MATERIAL

**General**

Bedding and embedment material: To AS/NZS 2566.2, Bedding, embedment and fill material schedule and free of noxious weeds and dangerous chemicals.

**Bedding, embedment and fill material schedule**

<table>
<thead>
<tr>
<th>Material</th>
<th>Mat 1</th>
<th>Mat 2</th>
<th>Mat 3</th>
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<tbody>
<tr>
<td>Grading</td>
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<tr>
<td>Resistivity (AS 1289.4.4.1)</td>
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<tr>
<td>pH (AS 1289.4.3.1)</td>
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<tr>
<td>Wet strength (AS 1141.22)</td>
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<td>Wet strength/dry strength variation (AS 1141.22)</td>
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<td>Weak particles (AS 1141.32)</td>
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<td>Aggregate type</td>
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</table>
### 4 EXECUTION

#### 4.1 PROVISION FOR TRAFFIC

**General**

Requirement: Conform to 1101 Control of traffic.

#### 4.2 ESTABLISHMENT

**General**

Tolerances: Install water mains, in-line structures, property services and meters in conformance with the documentation and the following:

- Water mains horizontal: ± 100 mm lateral displacement from the design alignment.
- Appurtenances and structures horizontal: Lateral displacement ± 100 mm from the design alignment and ± 200 mm along the water main axis.
- Property services horizontal: ± 100 mm displacement along the water main axis.
- Water meters horizontal: ± 100 mm displacement from design position.
- Water mains, property connections and structures vertical: ± 50 mm minimum cover.
- Hydrant risers, access chambers, shrouds and aqueduct verticality: 30 H (mm): 1000 V (mm).
- Structures higher than 5 m verticality: 50 H (mm).

**Set out:** Confirm the locations immediately before construction. This is a WITNESS POINT.

**Space allocations:** Conform to any space allocation agreements, local agreements with road owners or other utility service provider.

**Water mains in easements:** Conform to documented requirements including the following positions of the main within the easement:

- 1/3 of the width into the easement on the side away from any buildings.
- Position centrally if there are buildings on both sides and if the easement runs through narrow walkways.
- Where there is a crossfall, position the main on the low side.

**Protection:** Provide protection from external factors such as external loading, third party intrusion as documented including the following:

- Encasement in conformance with WSA 03 clause 5.4.9.2.
- Precast reinforced concrete removable slabs.
- Concrete encasement.
- Service duct.
- Security fencing.
- Protection barriers.

Overhead power lines and transmission towers: Alignment, electrical protection, corrosion protection, and construction details as documented for the following locations:
- Welded steel pipelines simultaneously run parallel and close to high voltage power lines for more than 1 km parallel and within 500 m of powerlines > 50 kV.
- Metal pipelines are located within 5 m of a transmission tower.
- Metal pipeline access is within 50 m of a transmission tower.

Above ground water mains: Provide above ground water main components as documented including pipeline items, supports, restraints, loading protection, maintenance and access requirements, protection from exposure conditions.

Document: Record details of contact with all affected customers. Resolve questions and complaints promptly.

Road opening permits: Obtain a road opening permit before starting any works within a road or road reserve.

Crossings Authority approvals: If a pipeline crosses a main or state road, creek or involves features shown on the drawings, under the control of any Authority, carry out the work in conformance with the requirements of that Authority including obtaining any approvals and paying any fees as appropriate. This is a WITNESS POINT.

Temporary drainage during construction
General: For each part of the system, complete the erosion and sedimentation control measures before starting the works.

Control of erosion and sedimentation: Conform to 1102 Control of erosion and sedimentation. Make adequate provision for runoff flows at drainage works under construction or surrounding areas/structure. Submit plan to WSA 03 clause 11.5.5.4.

Dams and diversions: Do not dam up or divert existing watercourses (either temporarily or permanently). Submit for approval if required.

Dewatering: Keep all excavations free of water, provide dewatering including any equipment required. Make sure no damage is caused to adjacent structures and services. Obtain approval for any discharge to sewers, stormwater drains or watercourses by the appropriate authority. This is a WITNESS POINT.

Material and equipment: Locate material and equipment clear of watercourses or secure to prevent danger or damage in the event of large runoff flows.

Stabilisation of topsoil areas: Immediately following earthworks where required, stabilise the topsoil with hydroseed to 0257 Landscape – roadways and street trees, Hydroseeding.

Excavation near underground services
Public utilities within the excavation for water supply systems: Obtain approval of the relevant Authority for the method of excavation before commencing excavation. This is a HOLD POINT.

Location: Contact DIAL BEFORE YOU DIG, and the names listed in 0136 General Requirements (Construction), to identify location of underground utility services, pipes and cables.

Marking: Before starting earthworks, locate and mark existing underground services in the areas which will be affected by the earthworks operations including clearing, excavating and trenching. This is a HOLD POINT.

Protection of property and environment: To WSA 03 clause 11.5 and the following:
- Protection of other services: Give notice of any interference to the works caused by an existing service and submit a proposed work method statement. This is a HOLD POINT.
- Disused or redundant water mains: Carry out works as documented and to WSA 03 clause 11.5.2.

4.3 EXCAVATION FOR WATER SUPPLY SYSTEMS

General
Topsoil: Remove topsoil in conformance with 1112 Earthworks (Roadways) before undertaking stormwater drainage excavation.

Excavation level: Excavate trench or foundation for water supply works to the designed level of the bottom of the bedding or foundation. Remove all loose material.
Confirm surrounding soil type with design: Give notice if not consistent with the design. This is a HOLD POINT.

Location: Carry out all excavations for structures and pipelines to the lines, grades and forms shown on the drawings.

Authority requirements: Conform with the requirements of the appropriate Authority including drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners.

Safety fencing: Provide safety fencing along the edges of open excavations to statutory requirements.

Access to properties: Provide fenced walkways and vehicular crossings across trenches to maintain access at all times from the carriageway to individual properties or within individual properties and give notice to all affected occupiers.

Existing services: Locate, protect and repair, as necessary, all services within the extent of the works.

Protection of trees: Conform to WSA 03 clause 13.3 including:
- Approval from the tree owner and council for tree removal or working within allowed distances.
- Do not store materials or products against trees, under tree canopies or over root zones.
- Fence off trees to keep machinery away as required or use boring or hand excavation.
- Protect roots: Conform to the following:
  - Cleanly cut tree roots ≤ 60 mm diameter. Obtain approval for cutting larger roots.
  - Damaged roots: Treat as documented in the environmental management plan or as directed.

Blasting: Not permitted.

Excavation across improved surfaces: To 1152 Road openings and restoration (Utilities) and the following:
- Obtain approval from the land owner before starting any excavation across improved surfaces. This is a HOLD POINT.
- Saw cut neat straight lines ≥ 150 mm beyond the outer limits.

Cover over pipelines
Minimum cover: Provide mains pipelines with the minimum depth of cover as documented and in conformance with WSA 03 Table 7.2, measured vertically from the finished ground level to the top of any socket.

Less than minimum cover: Lesser cover may be provided where special protection of the pipelines is documented.

Greater than minimum cover: Greater cover may be provided where special situations occur, where there is conflict with other services or to meet grading requirements.

Maximum cover: Conform to the following:
For pipe ≤ DN 375: 1.2 m.
For pipe > DN 375 < DN 600: 1.5 m.

Inadequate foundation material
Notice: Give notice of any area of the foundation including the sides of the trenches that may contain material that is inadequate to support the proposed drainage structure. This is a WITNESS POINT.

Confirmation of inadequate foundation material: Remove and dispose of inadequate foundation material to 1112 Earthworks (Roadways).

Replacement of material: To Bedding, embedment and fill material.

Rock foundation: If rock is encountered at the foundation level, excavate for an additional depth.

Backfill and compact the additional excavation with material conforming with the Bedding, embedment and fill material. This is a WITNESS POINT.

Support of excavation
Trench support stabilising: Provide any shoring, sheet piling or other stabilisation of the sides of trench excavations necessary to conform to statutory requirements.

Support: All trenches of depth > 1.5 m or in unstable ground strata.

Trench support system: Do not disturb adjacent structures and services.

Compaction of pipe embedment and trench fill material: Provide below any trench support and against native ground.
Permanent trench support system: Cut off the support system below ground surface.
Trench instability: Submit for approval the proposal to provide adequate permanent stability of the ground affected by trenching. This is a HOLD POINT.

**Excavation requirements for under pressure cut-in connection to pressure pipes ≥ DN 80**

Excavate below and behind the host pipe: ≥ 100 mm.

Host pipe: Support during excavation and drilling.

Excavation: Keep sides of excavation vertical ≥ 150 mm above the pipe. Satisfy minimum cover requirements as documented at all times.

**Trench excavation**

Requirements: Conform to the following requirements for trench excavation:

- Minimum cover requirements as documented.
- Maintain trench excavation in a stable condition.
- Minimise the length of the open trench at any one time.
- Align the trench centreline with the design pipeline centreline.

Trench size for pipelines: Excavate the trench to WSA 03 clause 5.6 and the following:
- Buried flexible pipelines or embankment method in general: To AS/NZS 2566.2.
- PVC: AS/NZS 2032.
- PE: AS/NZS 2033.
- ABS: AS/NZS 3690.

This is a WITNESS POINT.

Minimum trench width: 300mm

Embankment installation condition: To AS/NZS 2566.2. Prior to placement of bedding and laying pipes, place and compact embankment fill to a height above the top of the bed zone of at least 0.7 times the external diameter of the pipe and for a minimum lateral distance outside each trench wall of 2.5 times the external diameter of the pipe. Place earthworks to 1112 Earthworks (Roadways).

Trench installation condition: Complete the embankment to the underside of the selected material zone prior to the commencement of the excavation.
- Trench width: Do not excavate > 500 mm over the minimum trench width. This is a WITNESS POINT.

Bitumen and concrete surfaces: Carefully cut, by sawcutting or other means approved by the Superintendent, a neat straight line free from broken ragged edges.

Widen for fittings: Widen the trench where necessary for the installation of valves and fittings and protective coating systems.

Maximum trench depth: Excavate no more than 50 mm below the invert of the pipe.

Easement: Do not excavate outside the easement.

Clearance for on-site works: Provide clear space ≥ 500 mm in all directions from the workface where works such as welding or corrosion protection are required.

Stockpile: Provide stockpiles as follows:
- Do not stockpile excavated materials against the walls of any building or fence.
- Maintain 600 mm minimum between the edge of any excavation and the inner toe of stockpiles.
- Stockpile excavated topsoil separately reuse for surface restoration after backfilling.
- Remove any surplus excavated material not required for reuse for topsoil or backfill.

**Trenchless technology**

Requirement: If using trenchless technology as an alternative, submit proposal for trenchless installation in conformance with 1392 Trenchless conduit installation.

Existing road crossings: If shown on the drawings, use trenchless methods for the installation of the mains.

Encasement pipe: As shown on the drawings. Extend the encasement pipe 1.0 m behind the back of the kerb on either side of the carriageway.

Support cradles: Position the carrier pipe on support cradles centrally located within the encasement pipe.
Ductile iron cement lined (DICL) carrier pipe: Polyethylene sleeving is not required for any length of DICL carrier enclosed within the encasement pipe.

4.4 BEDDING FOR PIPES

Trench floor preparation
Foundation: Before placing embedment, test the proposed foundation in conformance with WSA 03 clause 13.11, clause 14.1 and Appendix G and the following:
- Bearing capacity > 50 kPa.
- Minimum trench depth: + 0 mm, - 50 mm.

Non-conformance: Where this is not achieved give notice for directions. This is a HOLD POINT.

Refill of excessive excavation: To WSA 03 clause 13.10 and Bedding, embedment and fill material. Compaction: Compact all fill and disturbed areas to the density of the natural ground.
Preparation: Remove all debris and water before placing bedding.

Bedding and pipe support
Pipes other than PVC/PE: Provide non-cohesive granular bedding with minimum thickness of 75 mm below the barrel and socket of the pipe.
PVC pipes: To AS/NZS 2032 Figure 5.1.
PE pipes: To AS/NZS 2033 Figure 5.1.
Concrete support: Do not place bedding material until concrete has obtained its initial set.
Compaction of beddings: Provide compaction of bedding to WSA 03 Table 19.1.
Protect: Do not walk on the centreline of the compacted bedding.

4.5 PIPE LAYING, JOINTING AND CONNECTING

Installation of pipes
Water main: Maintain the cleanliness and dryness inside all items during construction by using exclusion caps, plugs or blank flanges. Remove any dirt and foreign matter if pipes flood at any time.
Dual water supply area: Submit and provide Inspection Test Plan (ITP) to WSA 03 Appendix K. This is a WITNESS POINT.
Examine: Clean and examine all pipeline system items before installation. Inspect each joint seal for fit and flaws. Do not use damaged, dirty or incorrect seals.
Cut pipes: Chamfer where required and provide witness marks on the unmarked length of any cut pipes. Do not score pipes when providing the witness mark. Treat cut pipes in conformance with the manufacturer’s recommendations.
For field cuts of ductile iron or steel: Make sure that working fire fighting equipment is on the site before making field cuts.
Petrol engined pipe cutter: If using a petrol engined pipe cutter in an excavation, make sure that a safe atmosphere is maintained in the excavation at all times.
Witness mark on cut pipes: If pipes are cut in the field, make a clearly identifiable witness mark on the pipe at the length specified by the manufacturer from the end of the pipe, except for butt welded PE pipes.
Butt fusion of PE pipes: To POP001.
Electrofusion of PE pipes: To POP003.
Witness marks on PVC/PE pipes: Do not use PVC/PE pipes with scored witness marks.
Witness marking depth: If the same manufacturer does not make spigots and sockets, refer to the socket manufacturer for the correct marking depth.
Laying: Following the preparation of pipe bedding, lay and join pipes in locations and sizes as documented and to WSA 03 clause 15.1.4.
Laying sequence: Lay pipes on continuously rising grades from scour valve to air release valve, despite any minor irregularities in the ground surface.
Lift and re-lay construction: Supply affected properties with a temporary water service including a ball valve.
Horizontal and vertical separation of crossing pipelines: Maintain minimum separation of crossing pipelines. Fill with embedment material and compact.
Maintenance: Install valves, hydrants and other appurtenances for easy access for maintenance and repair.

Prevent flotation: To WSA 03 clause 15.6.

Existing asbestos cement pipe cutting and disposal: Submit method statement for approval. This is a HOLD POINT.

Horizontal and vertical deflections of pipes

Limits of deflection: To the pipe manufacturer’s recommendations.

Remove temporary pegs and stakes: Do not point load pipes.

Curving of PE/PVC pipe: If documented, bend pipes in conformance with POP202 and with a uniform radius along the length of the pipe in conformance with the manufacturer’s recommendations. Join pipes directly before making the curve. Do not use temporary pegs or stakes to restrain the pipe during curving.

Under pressure cut-in connection to pressure pipes $\geq$ DN 80

Inspection of host pipe: Clean pipe and inspect for corrosion, pitting, scoring, other surface damage. Give notice if pipe is badly corroded or damaged. This is a WITNESS POINT.

Inspect valve: Make sure the wedge can be fully withdrawn into the bonnet of the valve without damage during cut-in operation.

Disinfection of fittings and equipment: Remove surface deposits on all equipment with a pressurised washing system and biodegradable detergent. Spray or flood all connection fittings and equipment with a solution of sodium hypochlorite of concentration > 1% or 80/20 ethanol/water solution.

Installation of off-take clamp and valve and cut-in operation: To WSA 03 clause 15.5.4, 15.5.5 and 15.5.6.

Submission: Record pipe pressure, depth, condition of coating, pipe and lining.

Thrust and anchor blocks and restrained joints

Restraints: Provide thrust or anchor blocks in conformance with the drawings and the following:

- Position thrust and anchor blocks to bear against undisturbed material in the direction of the thrust and over the specified bearing area, allow movement at the joint. Do not encase any part of the joints.
- Provide a membrane between the fitting and the concrete to prevent damage to the coating of the fitting.
- Make sure that thrust and anchor blocks are central to the fitting and do not interfere with any other services.
- For DI pipes follow manufacturer’s recommendations.

Notice: Give notice if the allowable bearing pressure of the ground and the design pressure of the pipeline are different to the actual pressures on site. This is a WITNESS POINT.

Concrete: 20 MPa in conformance with 0319 Minor concrete works.

Cast-in situ concrete structures and slabs: Tolerance $\pm$ 0.5% of specified dimension or 5 mm, which ever is greater.

Concrete thrust, anchor blocks and bulkheads: Tolerance + 5%, - 2% of specified dimension.

Tapping of mains, property services and water mains

Pre-tapped connectors: Install pre-tapped connectors in conformance with the drawings.

Install tapping: To WSA 03 clause 15.8.

Marking

Non-detectable marking tape: Lay tape on top of the pipe embedment material before trench filling.

Detectable marking tape: Lay tape on top of the pipe embedment to form a continuous connection between valves, hydrants. Connect bare wires to a nut or bolt of a valve or hydrant.

Tracer wire: Provide 2 mm diameter 316 stainless steel tracer wire in trenchless installations.

Appurtenance location marking: Provide location marker posts, plates or other as shown on the drawings.

Time: Fix marking as soon as practicable after each valve or hydrant is installed.

Temporary cover: Temporarily cover marking plates for hydrants using marking tape or other approved cover and remove on satisfactory completion of the pressure testing of the pipeline.
Distance: Permanently mark the plate with the distance to the valve or hydrant in metres, to an accuracy of 0.1 m, with legible numbers a minimum 80 mm high.

Wooden posts: If there is evidence, by rotting or termite activity, that the integrity of the posts will be affected, do not use.

Post length: Set sufficient length firmly in place under saturated ground conditions.

Post projection: When installed, in conformance with the following:
- Generally: 1000 mm above the ground.
- If tall grass or crops are likely to obscure the post: 1500 mm above the ground.

Finish: Paint posts with 2 coats of white water based enamel for exterior use.

Pavement markers: Two-way reflective raised pavement markers to the road pavement and kerb.

**Valve chambers for large diameter mains**

Spindle top: $\leq 350$ mm below finished surface level (FSL).

Location: Give notice if location of valve, hydrant, chamber or surface fitting is shown in a roadway, driveway, paved area or any other restricted areas.

Pavement marking: [complete/delete]

Chamber covers and frames: Install covers to AS 3996 and the following:
- No warps or twists in covers and frames.
- No abrupt irregularities to surface.
- Gradual irregularities: No more than 3 mm.
- Uniformed surfaces: Dense, uniform and free from blemishes.
- Exposed edges: Minimum 4 mm radius.
- Road pavements, footpaths and other paved surfaces: Finish flush with the surface.

Tolerance: Conform to the following:
- Cover dimensions: $-3$ mm, $+0$ mm.
- Frame dimensions: $\pm 3$ mm.

Plastic covers: Avoid lateral movement, cracking and subsidence when installing plastic covers and frames.

**Bored pipes under roads, driveways etc**

Joints: Provide a continuous pipe under the road carriageway or limit to a single joint.

Grouting: Provide gravity or pressure grouting commencing from the downhill end of the bore, achieve full penetration and complete filling of the void.

Insulators: Insert plastic slippers between the water main and the bored hole in conformance with manufacturers recommendations.

Unsupported bore: Complete all pipework and grouting within 24 hours.

**Flanged joints**

Support: Fully support matching pipe and valve/fitting during installation.

Sequence: Tighten bolts in the specified sequence using a torque wrench.

PE pipe: Provide a butt welded PE stub flange adaptor with a stainless steel backing ring in conformance with POP007.

**Welding of steel pipelines**

Welding: To AS/NZS 1554.1 Category SP.

Field welding of flanges: Submit proposal in conformance with WSA 03 clause 15.20.2. This is a WITNESS POINT.

**Wrapping of ductile iron pipelines**

Polyethylene sleeving: Enclose a pipeline or a section of pipeline, in layflat polyethylene sleeving and plastic tape adhesive in locations as shown on the drawings and in conformance with manufacturer’s recommendations.

Material: High impact resistance polyethylene sleeving in conformance with the following:
- To AS 3681.
- 50 mm wide plastic adhesive tape.
- Width of the sleeving when flat: To the manufacturer’s recommendations for the size and type of the pipeline being encased.
- Do not exceed 48 hours exposure to direct sunlight.

Protection:

- Protect the sleeve from damage during application and the backfilling of the trench.

Field joints:

- Provide 250 mm minimum overlap of sleeving at each field joint.

Sleeving ends:

- Hold in position with at least three circumferential turns of adhesive tape.

Excess material:

- Neatly draw up loose, excess polyethylene sleeving material around the pipe barrel, fold into an overlap on top of the pipe and hold in place with strips of plastic tape at approximately one-metre intervals.

Bends, tapers and similar fittings:

- Cover with polyethylene sleeving as documented for the pipes.

Valves, hydrants and irregular shaped fittings and joints:

- Hand wrap using flat polyethylene sheets secured with plastic adhesive tape, or other suitable material, to provide an adequate seal.

Damage to sleeving:

- Rectify any damage to the polyethylene sleeving before backfilling of the trench.

This is a HOLD POINT.

Steel bolts and nuts corrosion protection

General:

- Wrap all galvanized steel bolts and nuts, used for below ground installation of flanges, bolted gland joints, mechanical joints, tapping bands in conformance with the manufacturer’s recommendations.

Requirement:

- Make sure steel bolts and nuts are dry, clean and free from rust, immediately before wrapping.

Tape:

- Synthetic fibre open weave cloth impregnated with saturated hydrocarbons approved by the Superintendent.

Joints

General:

- Except where solvent cement joints are needed to make up or install fittings, conform to the following:
  - Location: As shown on the drawings.
  - Elastomeric seal joints:
    - Either roll-on or skid type.
    - Apply only lubricant to manufacturer’s recommendations in making the joint.
  - Mechanical joints: Fixed flange, bolted gland type, or a PE pipe system specific joint type.

Witness mark:

- Make the joint so that the witness mark is no more than 3 mm from the end of the socket.

Solvent cement joints:

- To AS/NZS 3879 and manufacturer’s recommendations.

Jointing pipes of different materials

General:

- If jointing PVC pipes to ductile iron pipes, make joints by inserting a PVC spigot into a ductile iron socket. Do not insert ductile iron spigots into PVC/PE sockets.

Compatibility:

- Confirm the compatibility of the PVC pipe, joint seal and DI socket.

Alternative:

- Multi-fit mechanical couplings or flanged adaptor couplings, but not stainless steel leak/repair clamps, may be used to join pipes of different materials. If jointing PE pipes with mechanical couplings, provide joint restraint.

Appurtenances

Compatibility with pipework:

- Provide proper sealing between the pipe flanges and the valve.

Concrete lining in pipework:

- Do not chip away or reduce to provide clearance from the working parts of valves.

Installation:

- Make sure that valves and hydrants are installed to facilitate maintenance.

4.6 EMBEDMENT AND BACKFILL

Pipe embedment and support

Notification of pipeline laid and jointed: Present the laid and jointed pipes for approval before trench backfilling. This is a HOLD POINT.

Material for embedment: Conform with Bedding, embedment and fill material.
Uniform placement: Place embedment material uniformly along and around the whole length of the pipe barrel, couplings and other appurtenances with no distortion, dislodgement or damage to the water main. Maintain more than 50% of the specified bedding depth under all projections.

Compaction: Compact in layers no more than 150 mm thick for minimum compaction of embedment. Conform to AS/NZS 2566.2 and WSA 03 Table 19.1.

Compaction techniques: Do not use equipment or methods that would produce horizontal or vertical earth pressures that would cause damage or distortion of the water main.

Flooding compaction: Submit proposal for flooding compaction for approval where required and in conformance with WSA 03 clause 16.3.1.

Removal of trench supports: Lift temporary trench support systems progressively above each layer of embedment. Compact layers against undisturbed native soil.

**Concrete embedment and encasement**

Location: Concrete embed and encase pipes in conformance with the drawings including construction joints and reinforcement as detailed.

Encasement: Set pipes to line and level on bags of natural fibre filled with sand and cement mix or on concrete blocks or saddles. Make sure pipes do not move or deform while placing concrete.

Contraction joint: Provide at the junction of encased pipeline and the concrete encased section.

Concrete: 20 MPa in conformance with 0319 Minor concrete works.

Cast-in situ concrete structures and slabs: Tolerance ± 0.5 % or 5 mm, whichever is greater.

Concrete thrust, anchor blocks and bulkheads: Tolerance + 5%, - 2%.

Reinforced concrete: Tolerances to AS 3600.

Drainage: Provide a 75 mm diameter drain hole in the concrete bulkhead above the top of the encasement bedding or foundation. Place crushed gravel or rock in and at the upstream end of the drain hole as follows:

- 10 to 20 mm size within 150 mm in all directions upstream and above the invert of the drain hole.
- 2 to 10 mm size for a further 150 mm surround.

**Trench fill**

Fill: Place and compact trench fill using material to Bedding, embedment and fill material, avoid subsidence over or near the trench and damage to adjacent pavements and structures.

Non trafficable areas: Use excavated material as trench fill as follows:

- Excavated material: Free of organic material, containing no rock or hard clay > 75 mm and able to be compacted in conformance with WSA 03 Table 19.1.
- Cohesionless soil excavated material: Do not use in cohesive soil locations.

Placement: Conform to the following:

- Damage: Make good any damage caused by subsidence.
- Do not impact load water main.
- Do not place fill within 24 hours of placing concrete embedment or encasement.
- Fill voids behind timber ground support in close-timbered tunnels, drives and shafts by pressure grouting.
- Do not displace any valve or hydrant access cover assembly or supports.
- Correct any deficiencies caused by settlement.

Compaction of trench fill: Compact in layers to conform with WSA 03 Table 19.1 and clause 19.3.1.

Mechanical compaction: Do not commence mechanical compaction of fill material directly above the pipe until the total depth of cover above the pipe is adequate to prevent damage to the main.

Prevention of damage to pipes, coating and wrapping: Backfill and compact all materials without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.

**Embankment fill**

Embankments: Submit proposal for construction of embankments in conformance with the drawings, including the method of placement and compaction, any limitations to placement/ compaction over the top of the pipeline. This is a **HOLD POINT**.
4.7 SWABBING AND DISINFECTION

Swabbing
Swab mains: Carry out swabbing to the mains to WSA 03 clause 18 and the following:
- Use new pre-packaged swabs, stored and handled hygienically.
- ≥ 2 swabs for each run.
- Swab size: To WSA 03 Table 18.1.
- Insert swabs during construction into the main at connection points of new mains to existing mains or into previously swabbed new mains or for DN 100 to DN 150 at hydrants.
- Swabbing procedure: To WSA 03 clause 18.3.

Disinfection
Disinfect mains: To WSA 03 clause 20, Appendix I and after satisfactory hydrostatic pressure test.

4.8 ACCEPTANCE TESTING

General
NATA: Provide NATA certified test results for all water mains and structures testing. This is a WITNESS POINT.

Unsatisfactory tests: Detect and rectify any faults that provide unsatisfactory tests until testing provides compliant test results. Rectify any visible leaks, blockage, malfunction or other defect even when results are conforming. This is a HOLD POINT.

Notice: Give notice for compaction testing, hydrostatic pressure testing, block testing and water quality testing. This is a WITNESS POINT.

Visual inspection
Requirement: Inspect all water mains and component markers to make sure in conformance with the documents. This is a WITNESS POINT.

Verify products and materials: Provide purchasing records for products and materials. This is a WITNESS POINT.

Compaction testing
Minimum compaction of embedment, trench fill and embankments: To WSA 03 Table 19.1 tested to AS 1289.5.6.1 for cohesionless materials and AS 1289.5.7.1 for cohesive materials.

Compaction testing requirements: Conform to the following:
- Drives and tunnel fill do not require testing.
- Trafficable areas test zone: 300 m² area with test at the centre, depth from the surface to the native ground or foundation level. Test each 300 mm of depth of fill and each test zone.
- Non-trafficable areas: 1200 m² area with test at the centre, depth from the surface to the native ground or foundation level. Test each 900 mm of depth of fill in each test zone.
- Retesting: Recompact and retest if any result does not conform with WSA 03 Table 19.1.

Hydrostatic pressure testing
Pressure test all drinking and non-drinking water mains: To AS/NZS 2566.2 clause 6.3, WSA 03 clause 19.4 and the following:
- Use calibrated gauges under quality control.
- Use mains water or other disinfected water.
- Trenchless mains: Carry out pressure testing before connection to the existing water main of the new section of water main being installed using open trench construction.
- Test length < 100 m.
- Pressure test each property service.
- Under pressure cut-in connections: Before cutting-in to the host pipe, pressure test the assembly by applying a pressure that is 400 kPa above the operating pressure of the pipeline. Do not exceed 1600 kPa for more than 3 minutes.

Sections: Test pipelines in sections as soon as practicable after each section has been laid, jointed and backfilled. Leave some or all of the pipe joints uncovered until the whole of the section has been successfully pressure tested. Commence testing 7 days after the last placement of concrete thrust or anchor block.

Wet weather: Do not perform pressure testing during wet weather.
Field joints: During pressure testing, make sure all field joints, which have not been backfilled, are clean, dry and accessible for inspection.

Stop valves full test pressure: During the pressure testing of a pipeline, test each stop valve at least for the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.

Filling with water: Before testing a pipeline section, clean it to the satisfaction of the Superintendent and fill it slowly with water, taking care that all air is expelled. Promote purging of air from rising mains by opening air valves.

Stable testing conditions: To allow for absorption, movement of the pipeline and escape of entrapped air, keep the section full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

Test pressure: Do not exceed the manufacturer’s recommended test pressure for the lowest rated component taking into account the components location in the pipeline.

Duration of test: Maintain the specified test pressure for minimum 6 hours.

Compressed air test: Do not test the pipeline using compressed air.

**Block testing dual water supply systems for connectivity**

Connectivity inspection of dual water supply: To WSA 03 clause 19.5 and Appendix K.

**Insulated joint resistance test**

Test: Provide test results for insulated joint resistance test by application of a 500 V DC current to insulated joints to conform with WSA 03 clause 19.6.

**Water quality testing**

Water quality testing: Carry out a bacteriological test on all new mains following satisfactory swabbing/flushing and pressure testing of the main to conform with WSA 03 clause 19.7 and the following:

- Accept water main section where test results are within the acceptable ranges for the following:
  - Drinking water: To WSA 03 Table 19.2.
  - Non-drinking water: To WSA 03 Table 19.3.
- Failure of test: Swab, flush or disinfect the section of the water main and retest.

### 4.9 CONNECTIONS TO EXISTING WATER MAINS

**General**

Acceptance testing: Complete acceptance testing to the satisfaction of the Water Agency before connection to existing water mains. This is a **WITNESS POINT**.

Under pressure connections: To WSA 03 clause 22.2.

Inserted Tee connections: To WSA 03 clause 22.3.

Verify on site measurements: Check all relevant measurements on site and submit a proposal to adjust work to fit the connection to the existing as required. This is a **HOLD POINT**.

Connection and/or charging the new mains: Submit a request to charge the new mains to WSA 03 clause 22.4, including the time that will cause the least interference, isolation of the mains and notification of the affected dwelling occupants. This is a **HOLD POINT**.

Temporary private services: Reconnect all properties supplied by a temporary private service to WSA 03 clause 22.5.

### 4.10 RESTORATION OF SURFACES

**General**

Original condition requirement: Restore carriageway pavements, pathways, lawns and fencing and other improved areas in a continuous manner to a condition equivalent to that existing at the commencement of the works. Restore progressively and as soon as possible after the section of works is completed. This is a **HOLD POINT**.

Maintenance requirement: Maintain all restored surfaces in the restored condition until the expiry of the applicable Defects Liability Period, whether or not any deterioration of the restored surfaces is due to defects which become apparent or arise during the Defects Liability Period.

Restoration of surfaces: Conform to 1152 Road openings and restoration (Utilities) and WSA 03 clause 23.
Property owner advice: Provide notice to affected property owners of any pending works.
Vertical tolerance: Structures and fittings on finished surface levels as follows:
- ± 5 mm in road reserves and trafficable areas.
- + 50 mm, - 20 mm in private property non-trafficable or occasional traffic areas.

**Backfill**
Requirement: In other than roadways, place the backfill sufficiently high to compensate for expected settlement and carry out further backfilling or trim the original backfill at the end of the Defects Liability Period so that the surface of the completed trench conforms to the adjacent surface.

Dry weather conditions: If dry weather conditions have persisted after the original backfilling, including during the Defects Liability Period, consolidate the trench before removing surplus materials from the site.

Disposal of surplus material: Submit for approval a proposal for spreading the surplus material neatly in the vicinity of the trench to avoid future erosion of the backfill and adjacent ground surfaces. This is a WITNESS POINT.

Tunnelling: If tunnelling under paving, kerb and gutter or other improved surfaces instead of trenching, backfill to restore full support to those surfaces.

**Bushland**
Environmental: Carry out bushland restoration works in conformance with the Environmental Regulator.

Promote rapid regrowth: As near as is practicable, restore the works area to the pre-existing condition and leave the site in a condition that will promote rapid re-growth of native bush plant species.

Topsoil: Return stockpiled topsoil to its pre-construction location and place to minimise erosion.

Pre-existing vegetation: Use pre-existing vegetation as a seed source and place branches and/or logs across the slope to intercept runoff.

### 4.11 COMMISSIONING

**General**

Procedure: Test and commission the water reticulation system in conformance with the commissioning procedure, schedules and record sheets in conformance with WSA 03 clause 6.2.3.

Supervision: Provide continuous supervision by personnel experienced in the operation of the equipment and have qualified personnel in attendance to carry out all necessary adjustments and/or remedial work during the commissioning tests.

### 4.12 CONSTRUCTION COMPLIANCE

**Work-as-executed details**

Operation and maintenance: Submit work-as-executed details and operation and maintenance information as follows:

- Work-as-executed drawings in the same format as the design drawings and certified by a Registered Surveyor.
- Showing the actual location and alignment of pipelines. Include the size, type, levels of pipelines, valve and hydrant chamber types and cover details and easement requirements for maintenance.
- Asset register data.

### 4.13 LIMITS AND TOLERANCES

**Application**

Summary: The limits and tolerances applicable to this worksection are summarised in Summary of limits and tolerances table.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATERIALS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valves and hydrants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Double orifice air valves minimum size</td>
<td>DN 80</td>
<td>Control valves</td>
</tr>
<tr>
<td>Activity</td>
<td>Limits/Tolerances</td>
<td>Worksection subclause</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Non-return valves lifting lugs</td>
<td>≥ DN 250.</td>
<td></td>
</tr>
<tr>
<td>No flow switch minimum rating</td>
<td>10 amps, 240 V AC, 50 Hz</td>
<td></td>
</tr>
<tr>
<td>Top of spring hydrants</td>
<td>between 100 mm and 200 mm below finished surface level</td>
<td></td>
</tr>
<tr>
<td>Access covers:</td>
<td></td>
<td>Hydrants</td>
</tr>
<tr>
<td>- Single part round covers</td>
<td>0.3 ± 0.03 mm gap</td>
<td></td>
</tr>
<tr>
<td>- Multi-part covers</td>
<td>Max 4 mm gap</td>
<td></td>
</tr>
</tbody>
</table>

**EXECUTION**

**Establishment**

<table>
<thead>
<tr>
<th>Establishment</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water mains horizontal lateral displacement from the design alignment</td>
<td>± 100 mm</td>
<td>General</td>
</tr>
<tr>
<td>Appurtenances and structures horizontal:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lateral displacement from the design alignment</td>
<td>± 100 mm</td>
<td></td>
</tr>
<tr>
<td>- Lateral displacement along the water main axis</td>
<td>± 200 mm</td>
<td></td>
</tr>
<tr>
<td>Property services horizontal displacement along the water main axis</td>
<td>± 100 mm</td>
<td></td>
</tr>
<tr>
<td>Water meters horizontal displacement from design position.</td>
<td>± 100 mm</td>
<td></td>
</tr>
<tr>
<td>Water mains, property connections and structures vertical cover.</td>
<td>± 50 mm minimum</td>
<td></td>
</tr>
<tr>
<td>Hydrant risers, access chambers, shrouds and aqueduct verticality:</td>
<td>30 H (mm): 1000 V (mm).</td>
<td></td>
</tr>
<tr>
<td>Structures higher than 5m verticality:</td>
<td>50 H (mm)</td>
<td></td>
</tr>
</tbody>
</table>

**Excavation for water supply systems**

<table>
<thead>
<tr>
<th>Excavation across improved surfaces:</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Saw cut neat straight lines</td>
<td>≥ 150 mm beyond the outer limits</td>
<td>General</td>
</tr>
<tr>
<td>Support</td>
<td>All trenches &gt; 1.5 m in depth or in unstable ground strata</td>
<td>Support of excavation</td>
</tr>
<tr>
<td>Trench width</td>
<td>Not more than 500 mm over the minimum trench width</td>
<td>Trench excavation</td>
</tr>
<tr>
<td>Clearance for onsite works</td>
<td>Clear space ≥ 500 mm in all directions from the workface</td>
<td></td>
</tr>
<tr>
<td>Stockpile: Distance between the edge of any excavation and the inner toe of stockpiles.</td>
<td>600 mm minimum</td>
<td></td>
</tr>
</tbody>
</table>

**Bedding for pipes**

<table>
<thead>
<tr>
<th>Foundation:</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Bearing capacity.</td>
<td>&gt; 50 kPa</td>
<td>Trench floor preparation</td>
</tr>
<tr>
<td>- Minimum trench depth</td>
<td>+ 0 mm, - 50 mm</td>
<td></td>
</tr>
</tbody>
</table>
Activity | Limits/Tolerances | Worksection subclause
--- | --- | ---
Pipes other than PVC/PE: Non-cohesive granular bedding below the barrel and socket | 75 mm minimum thickness | Bedding and pipe support

**Pipe laying, jointing and connecting**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast-in situ concrete structures and slabs</td>
<td>± 0.5% or 5 mm which ever is greater</td>
<td>Thrust and anchor blocks and restrained joints</td>
</tr>
<tr>
<td>Concrete thrust, anchor blocks and bulkheads</td>
<td>+ 5%, - 2%.</td>
<td></td>
</tr>
<tr>
<td>Field joints: overlap of sleeving</td>
<td>250 mm minimum</td>
<td>Wrapping of ductile iron pipelines</td>
</tr>
<tr>
<td>Chamber covers and frames: - Gradual irregularities - Exposed edges - Cover - Frame</td>
<td>No more than 3 mm Minimum 4 mm radius. – 3 mm +0 mm – 3 mm +3 mm.</td>
<td>Valve chambers for large diameter mains</td>
</tr>
<tr>
<td>Concrete embedment and encasement - For trenches in other than rock:</td>
<td>150 mm minimum dimension under, on both sides and on top of the pipe barrel.</td>
<td>General</td>
</tr>
<tr>
<td>- For trenches in rock:</td>
<td>75 mm minimum dimension under the pipe barrel, 150 mm on top of the pipe barrel and for the full width of trench excavated.</td>
<td></td>
</tr>
<tr>
<td>Distance: Mark plate with legible numbers</td>
<td>80 mm high minimum</td>
<td>Marking</td>
</tr>
</tbody>
</table>

**Acceptance testing**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time period for specified test pressure</td>
<td>≥ 6 hours</td>
<td>Hydrostatic pressure testing</td>
</tr>
</tbody>
</table>

**Restoration of surfaces**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Limits/Tolerances</th>
<th>Worksection subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical tolerance for structures and fittings on finished surface levels: - In road reserves and trafficable areas. - In private property non-trafﬁcable or occasional traffic areas</td>
<td>± 5 mm + 50 mm, - 20 mm</td>
<td>General</td>
</tr>
</tbody>
</table>