DESIGN STANDARD DS 63

Water Reticulation Standard
Design and Construction Requirements for
Water Reticulation Systems up to DN250

VERSION 3
REVISION 14
SEPTEMBER 2018
FOREWORD

The intent of Design Standards is to specify requirements that assure effective design and delivery of fit for purpose Water Corporation infrastructure assets for best whole-of-life value with least risk to Corporation service standards and safety. Design standards are also intended to promote uniformity of approach by asset designers, drafters and constructors to the design, construction, commissioning and delivery of water infrastructure and to the compatibility of new infrastructure with existing like infrastructure.

Design Standards draw on the asset design, management and field operational experience gained and documented by the Corporation and by the water industry generally over time. They are intended for application by Corporation staff, designers, constructors and land developers to the planning, design, construction and commissioning of Corporation infrastructure including water services provided by land developers for takeover by the Corporation.

Nothing in this Design Standard diminishes the responsibility of designers and constructors for applying the requirements of WA OSH Regulations 1996 (Division 12, Construction Industry – consultation on hazards and safety management) to the delivery of Corporation assets. Information on these statutory requirements may be viewed at the following web site location:


Enquiries relating to the technical content of a Design Standard or to become a registered Design Standard user should be directed to Engineering.StandardsEnquiries@watercorporation.com.au. Future Design Standard changes, if any, will be advised to registered Design Standard users as and when published.

Head of Engineering

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## REVISION STATUS

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INTRODUCTION

1.1 Purpose
The Water Reticulation Standard sets out the guidelines and technical standards that are complementary to the requirements in the WSAA Water Supply Code WSA03-2011 for the design and construction of water reticulation assets for the Corporation. In the event of conflict between the Code and the Standard, the Standard shall take precedence.

Guidelines for all administrative, commercial, and procedural matters for subdivision services work can be accessed at web site: https://www.watercorporation.com.au/home/builders-and-developers

1.2 Intended Audience
The Standard has been prepared to assist Corporation personnel, consulting engineers and water industry contractors, engaged in any or all aspects of planning, design and construction of Corporation’s water reticulation assets.

1.3 Scope
This Standard covers the design and construction of water reticulation for pipe sizes up to DN 250 and including service connections on existing live watermains that are installed or prelaid at the time of watermain installation. Pipes larger than DN 250 are considered to be distribution mains and shall be designed and constructed to the requirements of the Corporation’s Water Distribution Standard.

1.4 Alternative Proposal
Alternative proposals for the design, specification or construction of water reticulation shall be subject to acceptance by the Corporation.

1.5 Design and Construction Responsibilities
Water Reticulation design and construction shall reflect the requirements of all parts of the Standard.

1.6 Reference Material

- WSAA Water Supply Code of Australia (Water Services Association of Australia) WSA03-2011
- Polyethylene Pipeline Code WSA 01 – 1998 (Water Services Association of Australia)
- Utility Providers Code of Practice for Western Australia
- Steel Pipeline System Design Manual (Steel Mains)
- Steel Pipeline System Handling and Installation Reference Manual (Steel Mains)
- Pipe Fittings Standard Drawings (Water Corporation)
- DS80 WCX CAD Standard (Water Corporation)
- Strategic Products Register – Water, Wastewater and Drainage Systems (Water Corporation)

1.7 Glossary of Terms
In this Standard the following words and expressions shall have the following meanings. These meanings do not necessarily comply with the meanings given in the Water Corporation Act and other Water Corporation publications.

The following definitions shall apply:
As Constructed Records – records prepared after construction detailing the infrastructure that has been built, including location, alignment, size, material, pressure rating of the works


Corporation - the Water Corporation, Western Australia.

Deferred Services - services to be installed to lots at a later date by the Corporation.

Drawings - water reticulation project drawings including drawings selected from Section 6 of the Standard.

Drawing Guidelines – Corporation’s WCX CAD Standard.

FTI – Final Takeover Inspection

Lot - a property for which a separate title may be held or issued, and which the water reticulation will service.

Major road – Any road that is not defined as an Access Road or Local Distributor as defined by MRWA


Minor Road – Any road that is an Access Road or Local Distributor as defined by MRWA

Prelaid Services - water service connections installed in conjunction with the construction of new reticulation mains.

Shall - a mandatory requirement, which can be varied only under a specific circumstance by written approval of the Corporation.

Should - a requirement to be adopted unless circumstances justify a variation to achieve the intended results.

Standard - the Water Reticulation Standard as published by the Water Corporation.

Water Reticulation - a water service system including watermains (mains), property connections and appurtenant fittings not exceeding DN 250 that provides a water supply to a defined development area

Zoning Valves - valves that are used to divide water reticulation into zones for purposes other than normal maintenance (as distinct from isolating valves).

1.8 Abbreviations

The abbreviations as listed in the Standard shall have the following meanings:

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<th>Description</th>
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<td>AC</td>
<td>asbestos cement</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>AS</td>
<td>Australian Standard</td>
</tr>
<tr>
<td>A1</td>
<td>594mm x 841mm</td>
</tr>
<tr>
<td>A4</td>
<td>210mm x 297mm</td>
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<tr>
<td>B/END</td>
<td>blank end</td>
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<tr>
<td>BL</td>
<td>building (property) line</td>
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<tr>
<td>BV</td>
<td>butterfly valve</td>
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<tr>
<td>CI</td>
<td>cast iron</td>
</tr>
<tr>
<td>CU</td>
<td>copper</td>
</tr>
<tr>
<td>kPa(g)</td>
<td>Kilopascal (gauge)</td>
</tr>
<tr>
<td>L</td>
<td>litre</td>
</tr>
<tr>
<td>mg</td>
<td>milligram</td>
</tr>
<tr>
<td>m</td>
<td>metre</td>
</tr>
<tr>
<td>GRP</td>
<td>glass reinforced plastic</td>
</tr>
<tr>
<td>mm</td>
<td>millimetre</td>
</tr>
<tr>
<td>MSCL</td>
<td>mild steel cement mortar lined</td>
</tr>
<tr>
<td>NI</td>
<td>not installed</td>
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<tr>
<td>OD</td>
<td>outside (external) diameter in mm.</td>
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<td>PAW</td>
<td>pedestrian access way</td>
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<tr>
<td>DAV</td>
<td>dual orifice double air valve</td>
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<td>DI</td>
<td>cement lined ductile iron</td>
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<td>DN</td>
<td>nominal diameter in mm.</td>
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<td>E&amp;C</td>
<td>expanded &amp; collapsed (slip-in)-steel pipe joint</td>
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<td>existing</td>
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<td>FP</td>
<td>flushing point</td>
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<td>HDD</td>
<td>Horizontal Directional Drilling</td>
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<td>HYD</td>
<td>hydrant</td>
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<td>kg</td>
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<td>kPa</td>
<td>kilopascal</td>
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<tr>
<td>PE</td>
<td>polyethylene pipe</td>
</tr>
<tr>
<td>PN</td>
<td>pressure nominal</td>
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<td>POS</td>
<td>Public Open Space</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride</td>
</tr>
<tr>
<td>RC</td>
<td>reinforced concrete</td>
</tr>
<tr>
<td>ROW</td>
<td>Right of Way</td>
</tr>
<tr>
<td>RRJ</td>
<td>rubber ring joint</td>
</tr>
<tr>
<td>S</td>
<td>Steel</td>
</tr>
<tr>
<td>SC</td>
<td>scour</td>
</tr>
<tr>
<td>SV</td>
<td>sluice valve</td>
</tr>
</tbody>
</table>
2 DESIGN GUIDELINES

2.1 General

2.1.1 Scope

This Section of the Standard sets out the requirements for the design and drafting practices for water reticulation assets of the Corporation. It shall be read in conjunction with Part 1 of the WSA Code. In the event of conflict between the Code and the Standard, the Standard shall take precedence.

2.1.2 Redevelopment of Existing Areas

The condition and adequacy of existing water supply mains in the redevelopment work shall be assessed in consultation with, and must be acceptable to, the Corporation.

2.1.3 Water Reticulation Planning for Subdivisions

Determination of the reticulation layout plan including reticulation main sizes and class, location of distribution main off-takes, zoning valves, and capacities of other elements of the system to ensure the supply to and within the subdivision is integrated with the overall water supply scheme will either be by Water Corporation or, where accepted by Water Corporation, by the designer to the Water Corporation’s satisfaction.

2.1.4 Land Requirements

Fee simple ownership is the Corporation’s preferred land tenure for installations such as pump stations, water tanks, treatment plants, reservoirs and pipelines not in public land.

2.2 Technical Requirements

2.2.1 Design Basis

The design methodology provided in the Code is generally acceptable. However, the design criteria in the Standard shall take precedence over the criteria in the Code.

The hydraulic design, network layout and pipe sizing shall meet the conditions for all planned stages of development.

2.2.1.1 Design Criteria

(a) Reference Ground Level

The reference elevation to meet pressure requirements for an urban property is the ground level found on the front 30 m of the property. Minimum pressures are calculated using the highest contour in the front 30 m of the property. Maximum pressures are calculated using the lowest contour in this same area of the property.

In the case of a “battleaxe” lot, the 30m is considered applicable from the "head" of the lot as shown in Figure 1.1.
The reference elevation for a farmland service is the highest point along the property boundary abutting the pipeline.

Where building envelopes are clearly defined on plans for subdivision, the reference elevations for maximum and minimum head calculations may be restricted to the area of the building envelopes, provided adequate planning controls are available to ensure that variations are not permitted. Any anomalies between supply to the front 30m and a defined building envelope shall be submitted to the Corporation for assessment.

(b) Minimum Head

The minimum head ($H_{\text{min}}$) at the reference ground level of every serviced lot shall be:

- 17 m in the Perth Metropolitan Area.
- 15 m in Country urban areas.
- 15 m in farmland services where flow rate restrictions are employed.
- 5 m in farmland services where flow is discharged into a holding tank or stock trough at the service off-take.

(c) Maximum Head

The maximum head ($H_{\text{max}}$) at the reference ground level of a serviced lot shall be limited to 100m.

(d) Pressure Fluctuations

To limit pressure fluctuations for a serviced lot, the minimum head shall be no less than that given by the formula:

$$H_{\text{min}} = 2.7(H_{\text{max}})^{1/2}$$

The maximum pressure shall be that which occurs under static conditions, unless higher pressure occurs in other situations.

2.2.1.2 Sizing of Mains

Water reticulation mains shall be sized so that the velocity of flow in pipes is kept below 2 m/s and with full consideration of the following:

- The impact of adjoining water supply schemes and high-level supply zone boundaries or operational control zones.
• The impact of staging the water supply to a development area in the event that all of the distribution mains defined in the Scheme design are not in place at the time of initial supply.
• The eventuality of a single distribution main connection being closed;
• The eventuality of any one section of the water reticulation being isolated;
• All aspects of the overall long-term supply situation.
• As many services as hydraulically possible are placed on each main to ensure it remains self-cleansing within the limits of minimum supply heads.

(a) Limits on Reticulation Main Size

The largest pipe size to be used for water reticulation shall be DN 250.

In normal circumstances, e.g. suburban and country residential or higher density development, the minimum pipe size shall be DN 100 except in the following situations:
• DN 63 (PE) or DN 50 (CU), may be used as dead end mains in cul-de-sacs serving up to 10 single residential lots if fire hydrant is not located within the main. Hydraulic design check shall be carried out for each cul-de-sac.
• DN 150 shall be the minimum pipe size for areas within industrial and commercial zones.
• DN 200 shall be the minimum pipe size of for the central business districts of Perth, Fremantle, and Joondalup.

The Corporation may specify minimum acceptable pipe sizes in particular locations to meet the needs of distribution planning and future growth areas in regional centres.

(b) Improvements to Existing Mains

Improvements to the hydraulic capacity of existing mains may be necessary as a result of a proposed development. The nature and extent of the improvements will be determined by the Corporation.

2.2.1.3 Reticulation Layout

The water reticulation shall as far as practicable, form a series of closed loops to minimise dead end mains. Every group of 50 or more properties shall be supplied by more than one pipe route.

Within a subdivision agreement area, mains shall be provided across the full frontage of all lots created except where future extension of the main will not be required. Every lot shall be served by a reticulation main along one of the street frontages of the property, i.e. in gazetted road reserves.

Where agreed to by adjacent landowners, water reticulation may proceed up to 12 metres beyond the last lot. This facilitates future connection without disturbance to previous works and shall be in accordance with Water Corporation’s land development procedures.

Dead end mains are permitted, but not preferred, in cul-de-sacs. Dead end mains may also be used at the fringe of a system but they shall be sized to cater for future extension where this can occur.

2.2.1.4 Mains and Services Location

Mains shall align with the existing or proposed connection points from the distribution system and be located:
• within road reserves on an alignment of 2.1m measured from the property boundary in accordance with the Utility Providers Code of Practice for Western Australia, wherever practicable.
• where road reserves are not presently available, within easements negotiated and provided by the Developer over Crown land or Public Open Space.
where the above routes are not available,
either: within a lot of 3m minimum width provided by the Developer, transferred in fee simple
to the Water Corporation;
or: for farmland water reticulation, in an easement over private property where it is often more
practical to lay the main in cleared farm paddock, (for example, within a fire break) rather than
destroy the vegetation along a country road reserve, where agreed with the Water Corporation
and Landowner.

- to minimise the number of long services (service pipes laid under the road to properties on the
  opposite side of the street). For a 30m or wider road reserve a reticulation main shall be placed
  on both sides of the street and all properties provided with short services.

- on one side of the road reserve. If a road crossing is unavoidable, each main should cross the
  road perpendicular to the road reserve boundary at 2.1m off the lot boundary and in line with
  property truncation point as illustrated in Figure 1.2.

![Figure 1.2](image)

- where street corners have truncations larger than the standard, such as at an intersection that
  incorporates a major roundabout with extensive landscaping, the Corporation may require the
  mains to follow the boundaries on the 2.1m standard alignment.

Where a corner lot is the last lot to be supplied then the reticulation main shall continue across the lot
frontage or the intersecting road to connect to an existing main.

Special attention shall be given to crossing a bridge or a river or structures such as tunnels or culverts.
In these cases a proposal shall be shown in a Method Statement and submitted to the Corporation for
consideration and acceptance. In addition, permission shall be sought from the relevant Authorities
(e.g. Local Authority, Main Roads Western Australia, Department of Biodiversity, Conservation and
Attractions, Department of Water and Environmental Regulation).
2.2.1.5 Appurtenances

(a) Valves

In a reticulation network, valves are required to isolate the reticulation mains for operational and maintenance purposes. These guidelines have been written so that where practicable, the network is able to be supplied through alternative mains if the primary main is isolated, without affecting a large number of lots.

For appropriately locating valves in a reticulation network, the concept of primary/secondary reticulation mains is defined (see fig 1.3):

A primary reticulation main supplies water to a number of secondary reticulation mains. The primary reticulation main is normally a 200mm or 250mm diameter main supplying 150mm and 100mm secondary reticulation mains. Generally the primary reticulation main is:

• the connector to the distribution main, but is not the distribution main
• the spine main on a linear main network configuration
• the ring main on a ring main network configuration

Position isolating valves on reticulation mains so that:

• all secondary reticulation mains supplied from the primary reticulation main have isolation valves at the offtake from the primary main
• it is possible to isolate any section of a primary reticulation main by the closure of no more than 10 isolating valves
• isolating any section of reticulation main interrupts supply to no more than 70 residential lots or 20 non-residential lots
• it is possible to isolate any section of reticulation (but not primary reticulation main) by the closure of no more than five isolating valves
- valves are located at street boundary truncation points. Where there is no truncation, the
  valve shall be located 6m from the street boundary line as shown in Figure 1.4
- at connections to distribution mains as shown in Figure 1.5

Intersecting mains shall be arranged in a configuration as typically shown on the drawings as
Section 6 of the Standard.

The positioning of valves at truncation points, where circumstances such as main deviation
around a non-standard or special truncation arise, shall be governed by the following
requirements:
  • Maintenance of each segment of a deviating main on a standard alignment relative to
    normal and truncation boundaries;
  • A straight pipe length of at least 800mm between each socketed valve and an adjoining
    fitting such as a bend;
  • The use of readily available standard pipeline fittings.

Compliance with these requirements may result in slight displacement of a valve from a
preferred position square off a truncation point but is considered acceptable under these special
circumstances.

(b) Hydrants

Hydrants shall be screw-down hydrant with built-in isolation valve and installed only on
DN100 or larger pipes. Hydrants shall be located:
  • so that the maximum distance between a hydrant and the rear of a building envelope, (or
    in the absence of a building envelope the rear of the lot) shall be 120m;
  • so that spacing (as measured by hose-run) between hydrants in non-residential or mixed
    use areas shall be maximized and no greater than 100m;
  • so that spacing (as measured by hose-run) between hydrants in residential areas with lots
    per dwelling <10,000m² shall be maximized and no greater than 200m;
  • so that spacing between hydrants (as measured by hose-run) in rural residential areas
    where minimum lots per dwelling is >10,000 m² (1ha) shall be maximized and no greater
    than 400m;
  • centrally along the frontage of a lot to avoid being under driveways;
• where appropriate at the truncation of road junctions or intersections so that they can serve more than one street and can be readily located;

• on both sides of the major roads at staggered intervals where there are mains on both sides of the road;

• at major intersections on dual multi-lane roads, where two hydrants are to be sited on diagonally opposite corners;

• hydrants should be located at least 20m from traffic calming devices i.e. median slow points or chokers, chicanes, mini traffic circles, and intersection ‘pop-outs’ to ensure traffic is not impeded;

• in a position not less than 10m from any high voltage main electrical distribution equipment such as transformers and distribution boards, liquefied petroleum gas or other combustible storage

• directly on top of the main using a tee unless proved to be impractical

(c) Air Valves

Air in water reticulation is normally dissipated through sufficient number of connected services in a typical residential development. However in special situations such as reticulation of rural towns where services are likely to be sparsely located and fed by long reticulation mains, the use of air valves or hydrants in the mains may be required to expel entrapped air in the system.

Air valves, where used in reticulation systems, shall be of DN 50 dual orifice installed:

• with a flanged or threaded isolating valve;

• within a lidded concrete pit rated for Class D loading and as agreed with the Corporation;

• to the requirements of the Corporation.

(d) Scour Valves

Scour valves are not normally required in water reticulation for residential areas. In these areas scouring can be carried out through hydrants and flushing points. For long reticulation mains located in undulating terrain, or where installation of flushing points are not practical, scouring assemblies may be required, as required by the Water Corporation.

Where required, scouring assembly shall include a DN 100 flanged sluice valve and installed to the Corporation’s requirements.

(e) Flushing Points

All temporary blank ends and dead ends of mains shall be provided with flushing points as shown in the relevant DS63 drawings.

(f) Pressure Reducing Valves

Pressure reducing valves shall be hydraulically operated and controlled by a Cla-Val CRD pilot control.

Pressure reducing valve installations shall be above ground and housed in a standard lockable vandal-proof metal cabinet. The cabinet shall have lockable doors or removable panels with concealed points of fastenings allowing maintenance access to all valves. The cabinets shall be subject to acceptance by the Corporation. An example of a suitable cabinet is shown on MI06-2-1 Pit type installation is not preferred and should be used in special circumstances agreed to by the Corporation.

2.2.6 Services

No services shall be connected directly to any distribution main in the development area.

The number of long services shall be minimised wherever practicable.
Prelaid and deferred water services shall be arranged in accordance with the requirements in the relevant drawings of the Standard.

2.2.1.7 Connections of Water Reticulation to Distribution Mains

The location and size of a connection of the water reticulation to a distribution main shall be determined in consultation with, and as accepted by, the Corporation. The following shall be the standard requirements:

- In industrial subdivisions, the smallest connection shall be DN 200.
- If more than 250 services are to be supplied from the connection, then the connection shall not be smaller than DN 300.

2.2.2 Drawings

Drawings shall show sufficient detail to clearly indicate the proposal for construction of the reticulation.

Water reticulation layout drawings shall be drawn to a scale of either 1:1000 or 1:2000 and include the following information:

- A legend indicating the symbols and abbreviations used, and the north direction which should be aligned towards the top and parallel to the side of the plan, wherever practical.
- The boundary of the Agreement Area for water reticulation.
- Street names, lot boundaries, lot numbers and the total number of lots served.
- Special land use other than single residential, e.g. duplex, POS, school, multi-residential
- The land required by the Corporation.
- Details of significant level changes, i.e. the extent and level of any cut or fill, road levels where substantially different from the natural surface, retaining walls
- Existing water mains serving all blocks adjacent to the proposed area of water supply and details of proposed connections to the existing mains.
- A notation indicating the pipe material, class and diameter, and length(s) of the pipelines.
- The location and alignment of the pipe including location of valves, hydrants, flushing points, prelaid services and indication of lots to have deferred services.
- The Corporation file numbers and plan number including plan number of all relevant standard drawings and the Planning reference number.
- Lot levels in mAHD (for works involving scheme pressure zoning) A typical proposed water reticulation layout drawing is included in Section 6 of the Standard.

2.2.3 As Constructed Documentation

2.2.3.1 General

As constructed documentation shall be based on:

- Measurement of work prior to backfilling of trenches
- Measurements from installed cadastral survey pegs for the subdivision.
- The MGA94 coordinate system.

2.2.3.2 Format of As Constructed Drawings

As Constructed Drawings shall be prepared in the format provided below:

- A title block and information box as shown on the typical As Constructed Drawing template as in Section 6 of the Standard;
• Data for final pre-calculated plan in digital form (DXF file having a coordinate system based on MGA94 and datum to AHD) in the correct format compatible with the Corporation’s Facilities Mapping System;
• Hard copy (signed) in A4 to A1 sheet according to the extent of subdivision, as directed by the Corporation;
• The digital file layout shall be in accordance with the WCX CAD Standard.

2.2.3.3 As Constructed Drawing Layout
As Constructed drawings shall have the following layout:
• The Local Authority and Suburb name;
• Name of Project;
• Reticulation Plan Reference and Primary Grid reference "Ref plan . . . . . . .";
• Plan and Drawing Number (at bottom right hand corner, in large, bold letters and numbers). (Corporation to provide this information)
• Corporation Reference Information (at top right hand corner):
  Subdivision file number: "Sub File . . . . . . ."
  Planning No: "WAPC. . . . . . . . . ."
  File Reference No: "Main Ext'n File . . . . . . ."
• Mains-laying Information Block (at right hand side):
  Actual total lengths of each type laid and size of main.
  Consultant’s name, signature and date.
  Licensed Surveyor's signature and date.
  Date commenced . . . . . . . . .
  Date completed . . . . . . Date of F.T.I. . . . . . . .
• Notes:
  Note 2. State brand names of valves, fittings and pipe, and pipe manufacture date.
• Legend for all services shall be shown according to the Drawing as shown Section 6 of the Standard.
• Standard abbreviations as in Section 1 of the Standard except that:
  a) for PVC mains use the format 150P12(1.8), where 150 is the diameter in millimeters, 12 is the nominal pressure rating, and (1.8) is the alignment. The alignment label should only be used for pipes laid parallel to the property boundary with alignment other than 2.1m.
  b) for Polyethylene mains use the format 63PE16(1.8), where 63 is the nominal diameter in millimeters, 16 is the nominal pressure rating, and (1.8) is the alignment. The alignment label should only be used for pipes laid parallel to the property boundary with alignment other than 2.1m.

2.2.3.4 Details on As Constructed Drawings
As Constructed Drawings shall be drawn to a scale of either 1:1000 or 1:2000 as appropriate and shall include the following:
• Information on the correct position of all mains and appurtenances accurate to within 0.1m including size, class and types;
• Street names, Reserves, Public Access Ways, Right of Ways, Public Open Spaces, lot numbers and boundaries;

• Running chainages for each continuous length of main relating the positions of all valves, hydrants and fittings to the nearest lot boundary or road reserve boundary;

• Depth to the top of the pipe from the final verge level and the gutter level at intervals of 30 metres (maximum). The depths shall be recorded on the drawing, e.g., V:0.7m, or G:0.5m for gutter;

• The start of each connection to the existing network, or change in either pipe material or pipe size shall be marked as "START 00m". "START 00m" shall have a measurement relating its position to the nearest lot boundary or building line, along the alignment of the main;

• All sluice valves marked with size and chainage (e.g. 150 SV 10.2m);

• All tees marked with chainage (e.g. TEE 10.2m);

• All bends marked by angle and chainage (e.g. 45º BEND 10.2m);

• All bronze gate valves marked with chainage (e.g. SV 10.2m);

• All hydrants marked with chainage (e.g. HYD. 10.2m)

• Flushing points installed on the end of mains shall be marked as "END" with chainage (e.g. END FP 110.2m);

• Intermediate flushing points shall be marked with chainages (e.g. FP. 109.2m);

• All blank ends shall be marked as "END" with chainage. (e.g. END 110.2m);

• The chainage of the lot boundary nearest to each appurtenance listed above shall be marked. A typical Reticulation As Constructed Drawing is included in Section 6 of the Standard.
3 **PRODUCTS AND MATERIALS**

3.1 **General**

3.1.1 **Definitions**

The term “product” shall, for the purposes of this standard, have the same meaning as the term “products and materials” and shall be taken to include manufactured products, discrete product components and component materials. The term “supplier” shall be taken to include the product manufacturer, owner, producer, distributor, retailer, vendor and any agent, contractor or provider of a service related to the product.

3.1.2 **Product Quality Requirements**

Water reticulation product shall be new and shall have mechanical, corrosion resistant and operational characteristics that render it fit-for-purpose in live service. Product shall be packaged, handled and installed so that, when installed in accordance with the recommended installation guidelines, it will operate in pressurized water services within the specified operating parameters for at least 50 years before its major rehabilitation or replacement is required.

3.1.3 **Product Suitability for Contact with Drinking Water**

All elements of water reticulation product in contact with drinking water shall comply with the requirements of AS/NZS 4020. All water reticulation systems shall be handed over to the Corporation in a hygienic and disinfected condition in accordance with Section 4.4.8 of the Standard.

3.1.4 **Nominated Product**

Where a specific proprietary product is nominated, an alternative product that is demonstrated to be equal in quality and function may be substituted, subject to authorization by the Corporation in accordance with Table 3.1: Standard Water Reticulation System Requirements, and subject to its listing in the “Strategic Products Register – Water, Wastewater and Drainage Systems” as a conforming product.

3.2 **Product Compliance**

3.2.1 **Performance Compliance Requirements**

Water reticulation product shall comply with the requirements of Table 3.1. All products used must be listed in the “Strategic Products Register – Water, Wastewater and Drainage Systems” (SPR), unless there is no viable alternative.

3.2.2 **Ancillary Materials Compliance**

Materials ancillary to the construction of water reticulation shall comply with requirements of Table 3-2.
<table>
<thead>
<tr>
<th>No.</th>
<th>PIPELINE FEATURE</th>
<th>POLYVINYLCHLORIDE (PVC)</th>
<th>POLYETHYLENE (PE)</th>
<th>MILD STEEL (MS)</th>
<th>COPPER (CU)</th>
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<tbody>
<tr>
<td>1</td>
<td>Pipe standard &amp; materials</td>
<td>PVC-U: SPS 115</td>
<td>AS/NZS 4130 PE100, fabricated from a resin designated HSCR in PIPA POP 004</td>
<td>SPS 100</td>
<td>Steel grade K1016 to AS1594</td>
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<td>PVC-M: SPS 116. (Note 4)</td>
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<td>AS 1452 Type A</td>
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<td>Axially bolted (Gibault)</td>
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<td></td>
<td>Cu-DHP (UNS C12200) to AS/NZS1279</td>
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<td>2</td>
<td>Pipe diameter series</td>
<td>Series 2 (Cast Iron Outside Diameter)</td>
<td>Black striped blue to WSA-61. Pipes must also be marked as being HSCR, identify the resin manufacturer and also resin grade.</td>
<td>SPS 100</td>
<td>N/A</td>
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<tr>
<td></td>
<td></td>
<td>Series 1 (ISO outside diameter series)</td>
<td></td>
<td></td>
<td>AS 1432 Clause 14.3</td>
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<td>3</td>
<td>Identifying colour</td>
<td>SPS 115/116 Clause 2.3</td>
<td></td>
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<td>4</td>
<td>Nominal diameters:</td>
<td>Preferred</td>
<td>DN100, 150, 200, 250</td>
<td>OD25, 32, 63, 125, 180</td>
<td>DN100, 150, 200, 250</td>
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<td>Conditional (Note 18)</td>
<td>OD250, 315</td>
<td>DN20, 40, 50</td>
<td>DN100, 150</td>
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<td>5</td>
<td>Pressure ratings:</td>
<td>Preferred</td>
<td>PN12, 16</td>
<td>PN20 (refer Note 19)</td>
<td>PN40 approx. (governed by steel plate thickness)</td>
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<td></td>
<td></td>
<td>Conditional (Notes 18)</td>
<td>PN20</td>
<td>PN24, 15, 13 (DN50, 100, 150 respectively)</td>
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<tr>
<td>6</td>
<td>Product age</td>
<td>&lt;12 months; &lt; 6 months if exposed (Note 15)</td>
<td>&lt; 12 months</td>
<td>&lt; 12 months</td>
<td>&lt; 12 months</td>
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### Pipe Fittings

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<tr>
<th>No.</th>
<th>Feature</th>
<th>Description</th>
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<tbody>
<tr>
<td>7</td>
<td>Pipe fittings</td>
<td>Standard &amp; materials SPS 106 For OD25mm-OD63mm AS/NZS 4129 compression jointed; For OD125mm-OD315 Ductile Iron fittings as per SPS106. (Note 8)</td>
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<td></td>
<td>Pressure rating (Note 2)</td>
<td>Rated &gt; PN16 Fabricated to Pipe Fittings Standard Drawings (Note 13) Rated &gt; PN16 (governed by steel thickness)</td>
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<td>Compression fitting</td>
<td>Silver-soldered capillary short fittings to AS 3688 (Note 12) Compression fitting: Viega Propress (Note 20)</td>
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<td>8</td>
<td>Flanged pipe fittings</td>
<td>General requirements SPS 106 For OD25mm-OD63mm AS/NZS 4129 PE stub flange with steel backing ring to AS 4087, galvanized to AS/NZS 4680, wrapped to DS95 (refer Note 8)</td>
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<td></td>
<td>Pressure rating applications &lt; PN12</td>
<td>Rated &gt; PN16 AS 4087 Figures B7 &amp; B8</td>
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<td></td>
<td>Pressure rating applications &gt; PN12</td>
<td>Rated &gt; PN16 Rated &gt; PN16 (governed by steel thickness) Compressed: PN12 Capillary: as relic, pipe</td>
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<td>9</td>
<td>Tapping bands c/w DN20, 25 or 40 RP thread tapping (Notes 6, 12)</td>
<td>WSA 197: DN 100, 150, 200, 250 WSA 107 &amp; AS/NZS 4129: OD 63, 125, 180, 250</td>
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<td>SPS 292 (Note 1)</td>
<td>Pipe Fitting Standard Drawings WSA 107: DN40, 50</td>
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<td>10</td>
<td>Self-cutting tapping bands (Notes 7, 12)</td>
<td>DN 100, 150, 200 OD 63, 125, 180, 250</td>
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### Valves and Hydrants

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<th>No.</th>
<th>Feature</th>
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<td>11</td>
<td>In-line isolating valves DN20-50</td>
<td>Copper alloy gate valves to SPS 255 or ball valves to SPS 232. Ball valves for mains tapping isolation to SPS 251 (Notes 1, 12)</td>
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<td>12</td>
<td>Meter isolating valve DN 20</td>
<td>Copper alloy gate valve to SPS 254 (Notes 1, 12)</td>
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<td>13</td>
<td>Isolating gate or butterfly valves DN80-250</td>
<td>Butterfly valves to (DN100-250) to SPS 261. PN16 rated resilient seat gate valves to SPS 272 up to PN16 and PN35 metal seated to SPS 271 for applications &gt; PN16. (Note 1)</td>
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<td>14</td>
<td>Screw-down hydrants</td>
<td>SPS 292 (Note 1)</td>
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<td>15</td>
<td>Extension Valve Spindles</td>
<td>Drawing AJ71-3-1</td>
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### PIPE COUPLING AND REPAIR FITTINGS

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<thead>
<tr>
<th>No.</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Pipe couplings without axial restraint (Note 9)</td>
<td>Axially bolted (Gibault) WSA 105 long series, rated &gt; PN16 (Note 1) Not permissible WSA 105 long series, rated &gt; PN16 (Note 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Circumferentially bolted 316L/316Ti SS body; 316 SS fasteners &gt; PN16 Not permissible 316L or 316Ti SS body; 316 SS fasteners</td>
</tr>
<tr>
<td>17</td>
<td>Pipe couplings with axial restraint (Note 10)</td>
<td>Conditional (Note 18) Conditional (Note 18) Not applicable Not applicable</td>
</tr>
<tr>
<td>18</td>
<td>Slip-on pipe repair couplings (Note 9)</td>
<td>DN100 moulded GRP coupling Not applicable Not applicable Not applicable</td>
</tr>
<tr>
<td>19</td>
<td>Wrap-around pipe repair clamps (Note 11)</td>
<td>SPS 152 Not permissible Not applicable</td>
</tr>
</tbody>
</table>

### INSPECTION COVERS, FRAMES AND SERVICE CHAMBERS FOR VALVES, HYDRANTS AND METERS (Note 14)

<table>
<thead>
<tr>
<th>No.</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Stop tap cover, frame and service chamber</td>
<td>Drawings AJ71-1-3 and BD64-1-2 (RC chamber) or BD64-3-1 (Timber or Plastics)</td>
</tr>
<tr>
<td>21</td>
<td>Sluice valve cover, frame and surround</td>
<td>Drawings AJ71-1-4 and BD64-2-1 (heavy duty); BD64-2-1 (lightweight)</td>
</tr>
<tr>
<td>22</td>
<td>Section valve cover and frame</td>
<td>Drawings AJ71-1-5</td>
</tr>
<tr>
<td>23</td>
<td>Hydrant inspection cover, frame and service chamber</td>
<td>Drawings AJ71-1-2 and BD64-1-1 (heavy duty); BD64-2-1 (lightweight)</td>
</tr>
<tr>
<td>24</td>
<td>Meter inspection cover, frame and service chamber</td>
<td>Drawings AJ71-1-1, BD64-10-1 (GRP) and BD64-4-1 (Timber or Plastics)</td>
</tr>
<tr>
<td>25</td>
<td>Standup Service Protector</td>
<td>Drawing BD64-9-1</td>
</tr>
</tbody>
</table>

### LIMITATION ON PIPELINE INSTALLATION APPLICATIONS

<table>
<thead>
<tr>
<th>No.</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Above ground or exposed</td>
<td>Not permissible Not permissible Acceptable Acceptable</td>
</tr>
<tr>
<td>27</td>
<td>Buried</td>
<td>Acceptable Acceptable (Note 21) Acceptable Acceptable</td>
</tr>
<tr>
<td>28</td>
<td>In unstable ground conditions</td>
<td>Not permissible Acceptable if welded (Note 13) Acceptable if welded (Note 13) Conditional (Note 18)</td>
</tr>
<tr>
<td>29</td>
<td>In bridge crossings</td>
<td>Not permissible Acceptable if welded (Note 13) Acceptable if welded (Note 13) Conditional (Note 18)</td>
</tr>
<tr>
<td>30</td>
<td>Below creek or waterway beds</td>
<td>Not permissible Acceptable if welded (Note 13) Not permissible</td>
</tr>
<tr>
<td>31</td>
<td>In Perth or Fremantle CBD</td>
<td>Not permissible Acceptable if welded (Note 13) Conditional (Note 18)</td>
</tr>
<tr>
<td>32</td>
<td>In pumping main applications</td>
<td>Conditional (Note 18) Conditional (Note 18) Conditional (Note 18)</td>
</tr>
</tbody>
</table>

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Table 3.1 - Standard Water Reticulation System Requirements

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table 3-1: notes

1 relevant strategic product specifications (SPS ***) and design standards (DS**) may be obtained at Water Corporation’s website [https://www.watercorporation.com.au/home/suppliers/resources/design-standards](https://www.watercorporation.com.au/home/suppliers/resources/design-standards). WSA standards (WSA ***) may be downloaded from the WSAA web site at [www.wsaa.asn.au](http://www.wsaa.asn.au) or by telephoning WSAA on 03 9606 8678.

2 COTD (Cast Iron Outside Diameter) pipes mean the range of pressure pipes of the same DN and same OD e.g. grey/cast iron (CI), ductile iron (DI), asbestos cement (AC) with some exceptions, PVC pipe series 2 and GRP, ISO pipe outside diameters most commonly mean PVC pipe (metric) series 1. Series 1 PVC, PE and steel pipe ODs conform to ISO diameter series that are not diameter compatible across all reticulation sizes.

3 Unbalanced hydrostatic forces at axially unrestrained pipeline joints (e.g. socketed bends, tees, taps, blank ends) shall be counterbalanced by permanent thrust or anchor supports in accordance with the drawings (e.g. BD62-2-3). All components connected to and downstream of a reticulation system having an operating pressure up to PN20 shall, in the absence of an intervening PRV, be rated ≥ PN20. Otherwise pipeline fittings and components shall be rated ≥ PN16.

4 The general use of MPVC pipe shall be limited to reticulation (not pumped) watermain applications.

5 PVC pipeline systems shall be re-rated for exposure to temperature variations and, where used in pumping applications, for exposure to cyclic fatigue effects. Re-rating shall be in accordance with WSAA Technical Note TN4 (available on WSAA web site) or shall be supported by appropriate pipeline temperature, water hammer and cyclic fatigue design analysis.

6 Tapping bands shall be designed for the selected watermain and service pipe materials and shall be tapped to the AS1722.1 RP thread series. A tapping band for use on plastics pipelines shall have an E-type thread. Each plastic tapping outlet boll shall be provided with a Type 316 stainless steel reinforcing ring to prevent leakage in long term service due to creep of the plastics material. Wherever there is a requirement for a DN 50 service pipe, threaded service fittings shall be DN 40 as DN 50 fittings are not supported by the Corporation materials catalogue or stock. Connection to existing (legacy) DN 50 threaded tapping bands and fittings may be by means of DN 50 to DN 40 adaptor fittings. The use of tapping bands for pipe repair in lieu of authorized repair fittings is not permissible.

7 Threads to comply with Clause 4.4.5.2

8 The use of tapping ferrule stop taps (e.g. Drawing BD22-11-1) or tapping bands incorporating self-tapping cutters for under-pressure installation shall be conditional (i.e. permissible only by express written authorization of the Corporation). For acceptance, a nominal DN20 service self-tapping assembly shall have a compression off-take to suit DN25 PE pipe.

9 PE fittings are not permitted other than stub flanges and reducers. PE stubs and reducers must be fabricated from the same resin as the main pipeline. For example, if the pipeline is fabricated from an HSCR grade resin, then the stub flange fitting must be made from the same HSCR grade resin.

10 The use of pipe couplings that provide axial restraint shall be conditional. Where permitted, the use of couplings with axial restraint on PE pipe shall require each PE pipe end to be coupled and to be internally supported by means of a 316L stainless steel ring stiffening insert that is designed for the particular PE pipe ID.

11 Selection and use of pipe repair couplings/fittings and wrap-around repair clamps shall comply with DS 53 and SPS 152 respectively. Mechamically bolted pipe repair clamps shall not be permissible for permanent repair of PE pipelines.

12 Copper alloy pipe fittings shall be dezincification resistant to AS2345. Copper alloy compression fittings shall not be permissible in buried or concealed pressure applications and shall be in accordance with Drawing BD62-8-31. Silver braze alloy for capillary joint work shall be in accordance with AS1167.1. Wherever pressure-tight joints are made on threads, threaded fitting ends shall be R (external) and RP (internal) in accordance with AS ISO 7.1.

13 Tape wrapping systems for the corrosion protection of uncoated welded and bolted pipeline joints shall, as a minimum, comprise a cold applied single primer coat, wrapped with butyl mastic tape and over-wrapped with PVC tape (Denso or approved equivalent system).

14 Tap, valve and hydrant cover and frame assemblies shall be lightweight (no individual component >12 kg weight) with an AS 3996 Class B load classification in urban road verge applications. They shall be heavy duty (usually metallic) with an AS 3996 Class D load classification in trafficable applications. The frame footprint shall be designed to withstand a vertical point load > 20 kN and shall be sized to distribute this load together with the assembly self-weight without exerting any force in excess of 100 kN/m² on the foundation soil.

15 PVC pipe shall be permissible only if less than 12 months old and less than 6 months exposed to direct sunlight. Exceptions will be determined by the Corporation on a project-by-project basis, subject to the quality of supporting documentary evidence provided.

16 All pipeline and service components in contact with drinking water shall comply with AS/NZS4020 for a minimum component surface to water volume ratio (or scaling factor) to be agreed by the Corporation.

17 Any reticulation or service component that is second-hand or has been previously used in live service shall not be acceptable for new reticulation assets.

18 "Conditional" shall mean a requirement to submit justified materials selection, design and installation methodology proposal to the Corporation (Engineering Branch) for determination of acceptability.

19 Where used as a service connection north of Latitude 26°S, must be installed within a continuous DN50 PN12 PVC sleeve, from mains connection to meter.

20 Viega compression fittings must be installed using a calibrated Viega compression tool by installed that has satisfactorily completed the associated training course (currently administered by Reece). Compression fittings are not permitted under roads, driveways or other similar surfaces that are difficult to access in the future.

21 PE pipes are acceptable for:

- Single and dual service connections;
- cul-de-sac installations (refer BD62-7 drawings);
- major road crossing;
- rail crossings, when installed within a sleeve; and
- horizontally directional drilled components only.

The use of PE pipes for any other application is not acceptable.
## Table 3.2 - Ancillary Materials Standards and Requirements

<table>
<thead>
<tr>
<th>No.</th>
<th>ANCILLARY MATERIAL</th>
<th>STANDARD SPECIFICATION</th>
<th>OTHER REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete thrust supports, inspection pits and chambers</td>
<td>To AS 1379 grade N25</td>
<td>Cement Type GP AS 3972. Work to AS 3600 and AS 3610</td>
</tr>
<tr>
<td>2</td>
<td>Precast concrete components</td>
<td>To AS 1379 grade N40</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Reinforcing steel bars; fabric</td>
<td>To AS/NZS 4671 grade 400Y; grade 450F</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Timber/Plastics components</td>
<td>F8 unseasoned jarrah to Table 2.4 of AS 1720.1. Plastics product of proven equivalent strength.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Steel bars/flats</td>
<td>To AS/NZS 3679.1 grade 350</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Steel plate/sections/flats</td>
<td>To AS/NZS 3678 grade 400</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stainless steel: Bolts to AS 1111.1 &amp; ISO 3506.1 property class 70; nuts to AS 1112.3 &amp; ISO 3506.2 property class 70; washers to AS 1237.1 &amp; ISO 7089.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Fasteners for structural connection work (steel/steel &amp; steel/concrete connection)</td>
<td>Carbon steel: Fasteners AS 1252 &amp; AS 4291 property class 8.8. Washers must have Vickers hardness between 320 and 390</td>
<td>Galvanizing as for flange fasteners.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stainless steel: Type 316 (A4), mechanical property class 80 - bolts to AS 1111.1 &amp; ISO 3506.1, nuts to AS 1112.1 &amp; ISO 3506.2 and washers to AS 1237.1 &amp; ISO 7089.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>General fastener installation</td>
<td>Washers required under bolt heads and nuts. Stainless steel structures to comply with AS/NZS 4673. Stainless steel fastener threads to be coated with molybdenum based or other anti-galling lubricant of approved formulation. Fastener anchorage into concrete to be by means of approved non-expansive adhesive resins.</td>
<td>Spring washers required wherever fastened connections subject to dynamic loads, vibration or relative movement.</td>
</tr>
<tr>
<td>10</td>
<td>Flange gasket material</td>
<td>Single ply EPDM or NBR, 3mm thick; mechanical properties to Table 3.1 of AS 1646.2 for IRHD 55 to 75.</td>
<td>Gaskets &lt; DN150 full faced. Otherwise narrow faced.</td>
</tr>
<tr>
<td>11</td>
<td>Steel nails</td>
<td>To AS 2334</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Pipeline bedding and side support material</td>
<td>Natural or imported embedment zone material as defined in AS/NZS 2566.2 and graded in accordance with Table G1 of AS/NZS 2566.2 (Appendix G).</td>
<td>10mm crushed rock graded in accordance with Table G3 (Conditional).</td>
</tr>
<tr>
<td>13</td>
<td>Trench &amp; embankment fill material</td>
<td><strong>Trafficable areas</strong> – Well graded cohesionless material with 100% passing a 75mm sieve but with no more than 10% passing an 0.075mm sieve, free of organic matter as determined in accordance with AS 1289.4.1.1.</td>
<td>Subject to road owner and local authority requirements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Non-trafficable areas</strong> - Natural or imported cohesionless material with 100% passing a 150mm sieve but with no more than 15% passing an 0.075mm sieve.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Bedding &amp; fill testing</td>
<td>Material particle size distribution/grading to be tested in accordance with AS 1289.3.6.1 for soil or AS 1411.11 for aggregate.</td>
<td></td>
</tr>
</tbody>
</table>
4 CONSTRUCTION REQUIREMENTS

4.1 General

4.1.1 Construction Responsibilities

Water reticulation shall be constructed to the requirements of the Corporation as required by Section 1.6 of the Standard. Where expressly stated in the Standard the requirements of the Code shall apply.

4.1.2 Impact on Existing Infrastructure

Construction activities that may interfere with, or impact directly or indirectly on existing Corporation infrastructure including existing water reticulation are not permissible except with the agreement of the Corporation.

4.1.3 Accreditation Requirements

Water reticulation construction personnel shall be accredited in accordance with the following accreditation programs, appropriate to the pipeline materials of each project:

- Steel pipeline construction - Construct and Install Water Distribution Assets (Sintakote Quality Pipeline Installation Program) by Steel Mains.
- PVC pipeline construction - PVC Pipelaying course conducted by South Metropolitan TAFE and/or Civil Contractors Federation (WA)
- PE pipeline welding work - Water Corporation Plastic Welding Panel Member.

4.2 Prevention of Contamination

During the construction of water reticulation, all materials, components and installation shall be configured so as to prevent any contamination of system water. A high standard of hygiene shall be maintained with respect to the personnel engaged and all materials, tools and equipment used in the construction of the work. In particular materials, tools or equipment used previously on live sewerage work shall not be permissible on water reticulation work.

All pipelines and all PE pipes must be capped at both ends to prevent ingress of dust, vermin and other contaminants.
4.3 Materials

The specification of materials for construction of water reticulation shall be in accordance with Sections 3 and 4 of the Standard and as defined in the Drawings.

4.4 Construction

4.4.1 Survey and Setting Out

4.4.1.1 General

Water reticulation shall be set out in accordance with the Drawings. Any deviation from the accepted drawings shall be subject to acceptance by the Corporation.

4.4.1.2 Survey Pegs

When finished levels are achieved on lot boundaries after the completion of road reserve clearing and road earthworks:

• sufficient cadastral survey pegs and temporary pegs along curved lot boundaries shall be installed to enable the proper construction of the water reticulation. All pegs shall be uniquely marked so as to be clearly identifiable in relation to individual lots.

• cadastral survey pegs installed for the water reticulation work shall remain uncovered and undisturbed and shall be available for the Joint Final Inspection. Any disturbed cadastral survey pegs shall be re-established by a Licensed Surveyor.

4.4.2 Handling of Pipes and Fittings

All pipes and fittings shall be handled and installed in accordance with the Standard and manufacturer’s recommendations in a manner that will prevent physical or structural damage to pipes, coatings, linings and elastomeric seals. The matter shall be referred to the Corporation for direction where these requirements conflict.

Pipeline components including coatings and linings that are damaged, including scored pipe surfaces, and cement lining cracks larger than 0.1mm shall be rejected.

Pipes and fittings that have coatings or linings of polymeric or plastic materials shall not be exposed to the external environment for more than 12 months prior to use.

4.4.3 Pipe Alignment and Depth

4.4.3.1 Alignment

Pipelaying shall not commence until the cadastral survey pegs required to determine the pipe alignment are in position. The following requirements shall apply unless otherwise shown on Drawings:

• Pipe alignments shall generally be in accordance with the Utility Providers Code of Practice, being 2.1m for pipe in a single pipe trench (1.8m is acceptable for a pipe in a common trench with other utility services), measured at the pipe joints from the pipe centre line to the road reserve boundary.

• In a common trench, the water reticulation main shall be laid with other services in accordance with the alignments and depths shown on the Drawings.

• In Public Access Ways, Public Open Space and other reserves, the main shall be laid parallel to and on an alignment of 2.1m from the nearer side boundary.

Mains shall be laid true to line within 100mm from their correct alignment, except where obstacles prevent access to the alignment. In such instances, a proposal that is acceptable to all utilities shall be submitted to the Corporation for acceptance. All agreed alignment variations shall be documented on the As Constructed Drawings.
4.4.3.2 Pipeline Depth (Cover)

Pipes shall be laid at the depths stated in Table 4.1 and to the details shown on the Drawings except as agreed by the Corporation.

Table 4.1 – Allowable Pipeline Cover

<table>
<thead>
<tr>
<th>Installation Method</th>
<th>Pipe location</th>
<th>Pipe Size (mm)</th>
<th>Allowable Cover (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>min</td>
</tr>
<tr>
<td>Open Cut</td>
<td>Verge</td>
<td>All</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>Minor Road</td>
<td>All</td>
<td></td>
</tr>
<tr>
<td>HDD</td>
<td>Verge</td>
<td>≤125</td>
<td>750</td>
</tr>
<tr>
<td></td>
<td></td>
<td>180</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minor Road</td>
<td>≤125</td>
<td>750</td>
</tr>
<tr>
<td></td>
<td></td>
<td>180</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major Road*</td>
<td>All</td>
<td>1500</td>
</tr>
</tbody>
</table>

*Pipes under Major Roads have additional requirements beyond those stated in this Design Standard and must be reviewed in each case by Water Corporation Engineering Branch for acceptance. They must also comply with the road owner’s cover requirements.

The following additional requirements shall be complied with:

- Generally pipes shall be laid as straight as practicable and in compliance with manufacturer’s recommendations while maintaining the appropriate minimum cover. Change of grade shall be effected by means of a smooth transition over a number of pipes to avoid exceeding the maximum allowable deflection and possible entrapment of air;
- A minimum horizontal clearance of 250mm shall be maintained between the main and any other existing or proposed services;
- Concrete encasement or protective cover slabs are not permissible as alternatives to maintaining minimum pipe cover.

4.4.3.3 Crossing of Other Services

Where the main crosses other services, a minimum clearance of 150mm (measured wall-to-wall) must be maintained unless the other utility owner has greater clearance requirements, in which case the greater of the two clearance requirements shall be met. Flanges and other appurtenances of greater diameter than the pipe small not be located at pipe crossings.

4.4.4 Excavation and Bedding

4.4.4.1 General

Prior to excavation:

- mains, pipes, cables, other services and equipment belonging to the Corporation and other Utilities that are adjacent to a proposed water reticulation system shall be located and potholed;
- all temporary work required to support and protect exposed or buried mains, pipes and cables, to the requirements of the relevant Public Utilities shall be carried out to ensure that the operation of the services is not interrupted in any way.

4.4.4.2 Excavation Work

(a) Open Trench Excavation
Where open trench excavation is proposed, pipe trenches shall be excavated to alignments, depths and widths required by the Drawings to provide the required pipe cover and clearances. The following requirements shall also apply:

- Trenches shall be dewatered where necessary until each section of main has been completed and tested. Groundwater shall not be allowed to enter pipes;
- Over excavation shall be filled with compacted bedding material.

(b) Trenchless Excavation

Where open trench excavation is not practicable, such as across major roads, freeways and railways, under major obstructions, and wherever shown on the Drawings, the pipeline shall be installed by trenchless technology methods. The methods shall be to the requirements of the controlling authority and acceptable to the Corporation. The Drawings shall detail all such requirements.

4.4.4.3 Bedding

Trench bedding shall be constructed in accordance with the Drawings and to meet the following requirements:

- For trenches in sand or gravel the natural soil at the trench bottom shall be compacted;
- For trenches in other soil types the trench shall be over-excavated by at least 150mm in depth, refilled with imported bedding material and compacted as for trenches in granular soils;
- In all cases the trench bottom shall be hand trimmed immediately before placing the pipe to provide even support to the whole pipe barrel, with additional trimming required to accommodate components with greater diameter than the pipe, such as pipe sockets.

4.4.5 Pipe Laying and Jointing

4.4.5.1 Preparation of Pipes

Immediately prior to laying of the pipes:

- the pipes, particularly the pipe ends shall be examined for cracks, scoring, gouges or other defects that may affect the pipeline integrity. Defective pipes shall be rejected;
- all sand and other foreign materials shall be removed from the pipe bore before lowering each pipe into the trench.
- the mating pipe spigots, socket surfaces and joint elastomeric rings shall be cleaned immediately before jointing to prevent damage to joint seals or leakage of jointed pipes.

4.4.5.2 Jointing

a. PVC to PVC Pipes and Fittings

Joints between PVC pipes and fittings shall be made with elastomeric seals in accordance with the manufacturer's instruction, ensuring that:

- the pipes are in a straight line prior to making the joint;
- only jointing lubricant specified by the pipe manufacturer is used;
- joint sockets are adequately restrained to prevent movement during the jointing process;
- joint spigots are “pushed home” in a manner recommended by the pipe manufacturer until the witness mark is just visible;
- the pipes are not damaged during the process.

Where a PVC pipe is cut on site, the cut end shall be chamfered and witness marked in accordance with the manufacturer's instructions without damaging the pipe.

b. PVC to DI Pipes and Fittings
PVC socket ends shall be jointed with only matching PVC spigot ends in order to achieve a watertight joint. No metallic pipe or pipe fitting spigots shall be jointed to PVC socket ends, however it is permissible for PVC spigots to be jointed to DI sockets;

Where a PVC pipe is cut on site, the cut end shall be chamfered and witness marked in accordance with the manufacturer’s instructions without damaging the pipe.

c. DI Fittings

- Ductile iron fittings shall be jointed with elastomeric joint seals in accordance with the manufacturer’s instructions, ensuring that:
  - each seal is retained in the socket groove of the previously laid pipe without any twist or buckle;
  - the spigot end of the joining pipe to be laid is centred within the elastomeric seal and supported until the jointing process is completed;
  - the pipe is “pushed home” firmly and straight in the socket and is restrained from springing back.

d. Jointing of Steel Pipes and Fittings

Elastomeric seal jointed steel pipes shall be installed in compliance with the manufacturer’s instructions. Fittings shall be welded as for weld-jointed steel pipes.

Where steel pipes are weld-jointed, installation shall be in accordance with the Steel Pipeline System Handling and Installation Manual and the following requirements:

- All pipe welding shall be in accordance with AS 4041 Pipework Class 2P, Corporation Welding Specification WS-1 and the Drawings;
- Pipe flanges for valve connections shall be welded to pipes in accordance with the Drawing AY58-15-1 of the Pipe Fittings Standard Drawings;
- Welding procedures and qualification of each welder and welding operator shall be in accordance with AS4041 and the requirements of Corporation Welding Specification WS-1;
- Where the cement mortar lining of a pipe or fitting cannot be readily reinstated at the welded joint, a convex band shall be welded over the joint in accordance with Drawing AY58-13-2 and AY58-19-1. When the band has cooled, it shall be fully injected with cement grout through a hole in the top after making due allowance for air release, which is then sealed with a welded cap once the grout has set;
- All cut ends and welded areas shall be protected as required by sub-clause “Protection of Steel Pipes from Corrosion” under in Section 4.4.5.2.

Welded joints are subject to visual examination by the Corporation for acceptance of welding work.

e. PE to PE Pipes and Fittings

PE pipes and pipe fittings and their jointing shall comply with the requirements of, and including limitations in Table 3.1.

Pipes shall be prepared for welding in accordance with pipe manufacturer’s recommendation.

f. PE to RRJ Pipes and Fittings

PE pipes connecting to RRJ components must feature an anchor block in accordance with Clause 4.4.5.6 and feature provision means for isolation to allow for the pressure test to be conducted.

g. Protection of Steel Pipes from Corrosion
Damaged pipe coating shall be repaired using Canusa heat shrink repair patches in accordance with the manufacturer’s recommendations.

All welded joints, bands, bends, tees, flanges, flange and valve body assembly bolts shall be primed and wrapped with a butyl mastic tape and PVC overwrap system (Denso or approved equivalent) in accordance with the manufacturer’s application specification and Water Corporation DS95.

For pipes emerging from below ground, the tape wrapping shall extend to 100mm above the finished ground level.

Where a protective coating system is used, pipeline and valve surfaces shall be prepared so that rust and any other deleterious materials are removed in accordance with the coating manufacturer’s requirements.

In all circumstances, the minimum surface preparation requirements shall be degreasing and mechanical wire brushing to obtain a Class 2 cleanliness in accordance with AS 1627 Part 2.

h. Threaded Couplings

Pipe and fitting connections using threaded couplings must comply with the following:

Male threads to be AS ISO 7.1, type R. Parallel male threaded fittings are not permitted.

Female threads to be to AS ISO 7.1, type RC (tapered); or AS 1722.2 Type G (parallel).

No more than 3 wraps of thread tape are permitted.

Parallel thread connection c/w sealing gasket is accepted for water meter connections.

4.4.5.3 Laying of Pipes

(a) General

Pipes shall be laid to the following general requirements. At the end of each day’s work or at any time when pipe laying is suspended, every open end of each incomplete pipeline shall be plugged with a tapered stopper or an acceptable end cap matching the pipe. No tools or any construction materials shall remain in the pipes.

b) PVC pipeline system

- PVC pipelines shall be laid in accordance with manufacturer’s instructions and in accordance with the practices recommended in the PVC pipelaying accreditation course.

c) PE pipeline system

- PE pipelines shall be laid in accordance with manufacturer’s instructions and practices recommended in the PE butt welding accreditation course.

- Allowance shall be made for the likely pipe movement due to temperature changes during installation and commissioning. A final service temperature of 20°C±5°C may be assumed unless otherwise specified in the Drawings. Pipe lengths and bend locations shall be adjusted for changes in length that will occur when the temperature stabilises at the final service temperature.

- The trenches shall not be backfilled unless the ambient temperature is within ±5°C of the final service temperature.

- PE pipes within the trench may “snake” if the final “snaked” alignment at the final stabilised service temperature is within 100mm of the correct alignment.

d) Road crossings

Pipelines under the road pavement shall not contain:

- an electrofusion or mechanical joint;
• an elastomeric seal (in the case of major roads only); • a butt-welded joint in the case of an OD125 PE pipe.

Elastomeric seal joints shall be minimized under minor roads.

Mild steel weld-jointed pipes shall have external fusion bonded polyethylene coating and internal cement lining and shall be in the longest practicable lengths, to minimise the number of welded joints under the road pavement.

e) Freeway and railway crossing
• The pipe crossing shall not have elastomeric seal, electrofusion or mechanical joints and shall be in conduit or sleeve only if required by the relevant authorities.
• Minimum clearance between pipe and pipe sleeve shall be 100 mm. Larger clearances may be required by the Corporation in certain circumstances.
• The pipeline shall be supported within the pipe sleeve on non-corrosive saddles or supports acceptable to the Corporation.

f) Bridge, tunnel and river crossings
Each crossing proposal shall detail the construction methodology together with the approval of relevant authorities and shall be submitted to the Corporation for consideration and acceptance.

g) Horizontal Directional Drilling
HDD installations shall limit the installation reamer size to the following sizes.

<table>
<thead>
<tr>
<th>Pipe OD (mm)</th>
<th>Maximum Allowable Reamer Diameter (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>170</td>
</tr>
<tr>
<td>180</td>
<td>255</td>
</tr>
<tr>
<td>250</td>
<td>310</td>
</tr>
</tbody>
</table>

(b) Pipeline Bends and Curves

a) Deflecting Pipes on a Curve
A pipeline required to follow a long curve may be laid and jointed with deflections at the joints. The maximum angular deflection at a pipe joint shall not exceed the pipe manufacturer’s recommendations. Bending of pipes to achieve a curve or for any other purpose is prohibited, except for PE and CU pipes.

PE pipes may be laid in a curve of radius that is not less than the manufacturer’s recommendations.

An acceptable pipe-bending tool shall be used to bend CU pipe. Crimped or distorted pipes shall be rejected.

b) Bends
• Where the required angle change exceeds the permissible joint deflection, standard bend fittings shall be used.
• Bends shall be installed opposite cadastral survey pegs unless otherwise shown on the Drawings or accepted by the Corporation.
• Where a bend is required on a truncation at which a valve is also required, the bend and the valve shall be separated by an 800mm minimum length of straight pipe, with the bend located on the truncation point.
4.4.5.4 Installation of Fittings and Valves

Flanges must be installed in accordance with DS38-02.

The mating flanges of all flanged joints where dissimilar metal contact may occur shall be electrically isolated by means of acceptable flange insulation kits.

The inside of all valves, hydrants and fittings and the mating surfaces of the spigot ends, collars, flanges and rubber rings shall be cleaned immediately prior to installation and before jointing.

Pipes shall be cut to ensure installation of fittings in the correct location. The minimum pipe length between adjacent elastomeric seal jointed fittings shall be 1000mm without anchorage and 800mm with anchorage.

(a) Hydrant Risers

A double flanged hydrant riser pipe of the appropriate length shall be installed on a hydrant tee to suit the final verge level above the tee. The hydrant installation shall then be completed in accordance with the Drawings.

(b) Flushing Points

Flushing points on all permanent and temporary blank ends shall be installed in accordance with and in the locations designated on the Drawings.

(c) Valves

If a sluice valve and a bend are both required at a truncation, the valve may, subject to agreement, be displaced from the truncation point by 800mm. The valve shall be positioned in the location least likely to be paved.

(d) Covers, Frames and Surrounds

Covers, frames and service chamber assemblies for sluice valves, gate valves, stop valves, hydrants and flushing points shall be installed so that the cover level is flush with the final surface level and to the requirements shown on the Drawings.

(e) Temporary Blank Ends

Temporary blank end caps shall be installed on new pipelines to be connected to existing water mains. The end caps shall be installed approximately 4m from the existing water main and shall be clear of any pavement.

Temporary blank ends shall be adequately anchored to withstand test pressure.

4.4.5.5 Connection to Existing Water Mains

Work on or connection of new pipelines to existing water mains is not permissible unless:

- written acceptance has been obtained from the Corporation;
- all required pressure testing of the new water reticulation has been successfully conducted and accepted;
- the new water reticulation has been disinfected in accordance with Clause 4.4.8 of this Part of the Standard.
- A drawing outlining the connection detail has been submitted and accepted by the Corporation, and demonstrates the ability to isolate the new connection as well as sufficient thrust restraint to mitigate the risk of failure of either the new or existing main.
- The potential for exposure to asbestos containing material has been evaluated, noting that in addition to old asbestos cement pipes, asbestos has also historically been a component of old steel pipe wrappings. If asbestos is assessed to be potentially present, a risk assessment must be prepared addressing handling and disposal issues and submitted to the Corporation for acceptance.
New mains shall be laid at the specified depths and alignments after ascertaining by manual excavation methods the positions of other existing services in the vicinity.

Interference with, or operation of any existing main or valve or fitting is not permitted unless accepted by the Corporation in each case.

Connections to existing water mains must be located sufficiently offset from any valves that are under pressure (from either side) in order to avoid the risk of the valve blow-off, in accordance with table 4.2.

<table>
<thead>
<tr>
<th>Pipe Diameter (mm)</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of buried pipe required to nearest valve for systems at 50m head (m)*</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Length of buried pipe required to nearest valve for systems at 100m head (m)*</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

*Assumes unsaturated soils and flat topography, length needs to be increased accordingly in the case of waterlogged soil conditions or steep slopes.

4.4.5.6 Thrust Supports and Anchors

(a) Thrust Supports

Thrust blocks are required on all bends, tee and ends of pipelines with unrestrained jointing (e.g. RRJ).

Thrust supports for permanent installation shall be of concrete. For temporary installation, repairs and where concreting work is impracticable, backing boards may be used in accordance with the relevant Standard Drawings. Thrust supports for multiple or compound bend arrangements shall be of concrete only.

Flange bolts shall be installed with the washers and nuts furthest from any concrete thrust support. Bolt heads must not be encased by the concrete. Corrosion protection of the flange bolts shall be carried out prior to construction of concrete thrust supports.

Thrust supports shall not extend more than 300mm from the nominated alignments except where otherwise accepted by the Corporation. Thrust supports shall be installed and the trench backfilled and compacted prior to commencement of pressure testing.

Thrust blocks on shall be designed and installed such that any future excavation of any thrust block, appurtenance or bend can be safely achieved, using conventional open trenching methods, without compromising the soil support of any other thrust block or causing other thrust blocks to fall. This applies to all thrust blocks, including vertical thrust block pairs.

(b) Steel Pipe Anchorage

- Buried Steel Pipeline

Where buried steel pipes are used, thrust supports may be replaced by welded pipeline sections installed on both sides of the fittings as indicated in Table 4.3:

<table>
<thead>
<tr>
<th>Table 4.3 - Minimum Length of Welded Pipe (m) Each Side of Bend</th>
</tr>
</thead>
</table>
### Design Standard DS 63

#### Water Reticulation Standard

<table>
<thead>
<tr>
<th>Size DN (mm)</th>
<th>Minimum Length of Welded Pipe (m) Each Side of Bend</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>45° Bend</td>
</tr>
<tr>
<td>100</td>
<td>6</td>
</tr>
<tr>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>200</td>
<td>6</td>
</tr>
<tr>
<td>250</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: The lengths are valid for a maximum hydraulic pressure of 1200 kPa in pipe, and a minimum 600mm of well compacted soil cover over pipes.

- Above Ground Steel Pipeline

  Anchorage for above ground steel pipeline shall be constructed to the Drawing details which shall provide for the maximum combined effects of thermal (including linking-in temperature), hydraulic, pipe jointing and pipeline support conditions.

(c) Polyethylene (PE) Pipe Anchorage

When connecting a PE main into an unrestrained component (e.g. rubber ring joint), an anchor block shall be provided to mitigate thermal expansion and Poisson contraction effects. The anchor block must be cast on a rigid metallic puddle flange arrangement. PE puddle flanges are not permitted.

#### 4.4.6 Backfill

##### 4.4.6.1 Initial Backfill

Initial backfill shall be selected fill material placed and compacted to provide continuous support to the pipe as shown in the Drawings.

Initial backfill at the sides and up to 150mm above the pipe shall be well compacted so that no joints or pipes are disturbed or damaged. All joints other than pipe spigot-socket joints shall be left exposed until the pressure tests have been successfully completed.

##### 4.4.6.2 Final Backfill

Final backfill of pipe trenches shall be carried out to the requirements of the Drawings. Where the excavated soil is not suitable for final backfill, granular material complying with the requirements shall be imported for backfill.

Except where thrust support by backfill is required for pressure testing, final backfill shall not be carried out until:

- the As Constructed measurements have been taken for pipes and fittings in pipe trenches;
- the Official Pressure Test is accepted, and height and position have been complied with for service risers.

Where backfill is required to provide thrust support, for pressure testing, it shall be carried out only after the As Constructed measurements have been taken.

Any backfilling carried out prior to complying with the above requirements will be rejected. The reticulation may be required to undergo a further pressure test.

Compacted final backfill shall be finished as follows:

- In a road verge - levelled to the final verge level;
- Within a pavement area - to the levels meeting the road owner’s requirements for the pavement construction;
• At service tapping points and around service risers – to the agreed final ground level. Sections of water reticulation damaged and repaired during backfilling will require the pipeline to pass another official pressure test after reinstatement.

4.4.6.3 Backfill around Valves, Hydrants, Flushing Points and Service Connections

Granular material shall be used for backfill around all valves, hydrants, flushing points and service connections.

4.4.6.4 Restoration of Road Reserves and Access Ways

After backfill pavements in road reserves or access ways shall be temporarily reinstated and maintained in a safe condition for vehicles and pedestrian traffic. The final surface treatment, including restoration of road pavements, footpaths, landscaping and vegetation shall be to the requirements of the road owner.

4.4.7 Testing of Mains and Service Connections

4.4.7.1 General

Each pipeline and service connection shall be subjected to a successful preliminary pressure test before carrying out the Official Pressure Test. The preliminary pressure test is completed by the installer to satisfy themselves that the pipeline components to be Pressure Tested do not have major leaks or have any open valves. Following the successful completion of the preliminary pressure test, the Official Pressure Tests shall be witnessed by the Construction Engineer and the Corporation’s representative. Details of each Official Pressure Test shall be recorded on a Pressure Test Record Sheet, and example of which is included in this part of the Standard. Each record sheet shall be submitted as part of the FTI.

Water service connections must be pressure tested in combination with reticulation mains. The tappings and all riser joints and fittings shall remain exposed to view during the pressure test. Water service connections isolation valves must be cable-tied in the open position, in order to identify that the valve is open.

The use of sealant or similar products to plug any detected leakage is not permitted.

4.4.7.2 Preparation

Mains shall not be tested until at least 24 hours after concrete thrust supports have been constructed. The following requirements shall be met prior to testing:

• The difference in elevation between any two points on the section of the main under test shall be not greater than 30 metres;

• At least 300mm of suitable fill material shall be placed over the initial backfill for the section of pipeline to be tested, leaving all meter risers, stop tap, water service tappings and hydrant tee flanges exposed to view;

• The pressure test gauge shall be located as close as practicable to the lowest point of the test section;

• All water service tapping points and riser joints included for the pressure test shall be exposed for inspection. All property service stop taps shall be in the open position and have their outlets plugged at the time of testing;

• Where a valve is shut to form one end of a test section, suitable temporary supports shall be installed to prevent the valve moving due to unbalanced hydraulic thrust.

• No pressure testing against valves on live mains shall be conducted prior to approval from the Corporation.
4.4.7.3 Filling Mains For Testing

The section of the main to be tested shall be filled gradually with potable water acceptable to the Corporation. Filling of the main shall be completed at least 24 hours prior to the commencement of the Official Pressure Test. For cement mortar lined pipelines this period shall be 48 hours prior to testing to allow for absorption.

Water for testing purposes may be obtained from the Corporation live mains provided prior approval has been given by, and detail arrangements for the draining of test water have been made with the Corporation at least 15 working days prior to filling.

Air from the test section should be expelled. If necessary, temporary air vents may be provided by the use of appropriate tapping band. Temporary air vents shall be removed upon completion of the test and the tapping point sealed with a threaded brass plug in accordance with Table 3.1.

4.4.7.4 Test Equipment

A main or isolated section of the main shall be pressure tested by means of a pump capable of raising and maintaining the hydraulic pressure for the duration of the test.

A calibrated pressure gauge of minimum diameter 100mm, and maximum 50kPa pressure graduation intervals shall be connected to the pipeline to be tested.

4.4.7.5 Official Pressure Test

Each test section shall be subjected to a hydraulic pressure test of 1200 kPa (120m head of water), as measured at the lowest point of the test section, unless otherwise requested by the Corporation.

(a) Test Procedures – All pipelines other than PE

For all water reticulation systems the test shall be carried out with the test pressure maintained for a minimum of 1 hr.

Mains shall be tested in accordance with the constant pressure method detailed in Section 6 and Appendix M, paragraph M4 of AS/NZS 2566.2.

(b) Test Procedures – PE pipelines

For all water reticulation systems the test shall be carried out with the test pressure maintained for a minimum of 5 hrs.

Mains shall be tested in accordance with the constant pressure method detailed in Section 6 and Appendix M, paragraph M5 of AS/NZS 2566.2. In pipeline systems that comprise of both PE and non-PE sections, separate pressure tests must be conducted on each type of pipe, or alternatively the test procedure for non-PE pipelines outlined in 4.4.7.5(a) can be used.

(d) Test Acceptance Criteria

Subject to all test preparation and procedures being adhered to, a pressure test shall be acceptable if the following are met:

- For all pipelines other than PE, no makeup water was required to maintain the pressure for the specified duration;
- For PE pipelines, the quantity of make-up water does not exceed the maximum allowable quantity as defined in AS/NZS 2566.2
- There is no visible leak or evidence of leakage detected from the sections/mains being tested;
- There is no failure of any pipeline component or appurtenance; and
- There is no visible leak or evidence of leakage from all water service tapping point or riser joint during testing.

(e) Re-Testing
If a test section fails the pressure test, the cause of failure shall be determined and rectified. The section shall be re-tested until an acceptable test result has been achieved.

(f) After-Test Requirements

After successful pressure test and before backfilling of a pipe trench, the stop tap in the service connection shall be turned off. The stop tap shall then be fitted with a fabricated “stand-up service protector” in accordance with drawing BD64-9-1, and the stop tap outlet fitted with a security plug in accordance with drawing BD64-9-2.

4.4.8 Disinfection of Water Reticulation

4.4.8.1 General

The water reticulation shall be disinfected and shall not proceed until a Disinfection Plan has been submitted to and accepted by the Corporation. Each Disinfection Plan shall provide the following details:

• Disinfectant and dilution water quantities proposed for each disinfection batch or operation;
• The progressive stages of disinfection operations as defined by the valving sequence proposed;
• The disinfection dilution and injection equipment proposed;
• The timing of each disinfection operation;
• The methodology proposed for flushing of disinfectant waste and the disposal arrangements acceptable to the local and environmental authorities.

At any stage during the filling and testing of mains, the Corporation may request that all mains to be tested be flushed until the water is clear of all foreign material.

During filling, disinfectant shall be added to the main in accordance with the requirements in Clause 4.4.8.2, ensuring that the disinfectant is thoroughly mixed with the filling water and evenly distributed.

The disinfectant shall be progressively introduced until the reticulation has been fully disinfected.

The diluted disinfectant shall be retained in the water reticulation for as long as practicable which shall not be less than 24 hours. The main shall then be drained and flushed with potable water. All waste and flushed disinfectant shall be disposed of in an environmentally acceptable manner in accordance with the requirements of the local and the environmental authorities.

4.4.8.2 Disinfectant

Disinfectant shall be calcium hypochlorite powder rated to yield 65% available chlorine, or sodium hypochlorite liquid rated to yield 12% available chlorine. The disinfectant shall be diluted with water for injection into the water reticulation to be disinfected so that the effective strength of the diluted product provides a dosing rate of 20mg/L measured as free chlorine.

The disinfectant dilution guidelines in Table 4.4 may be used to calculate the appropriate disinfectant and dilution water quantities in each case.
Table 4.4 – Disinfectant Dilution Guidelines

<table>
<thead>
<tr>
<th>Nominal Pipe Diameter (mm)</th>
<th>Nominal Volume in Pipe</th>
<th>Calcium Hypochlorite Powder (65% Cl₂)</th>
<th>Sodium Hypochlorite Liquid (12% C1₂)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kL of Water per 1000m of Pipe</td>
<td>kg used for 1000m of Pipe</td>
<td>Litres used for 1000m of Pipe</td>
</tr>
<tr>
<td>50</td>
<td>2</td>
<td>0.06</td>
<td>0.4</td>
</tr>
<tr>
<td>100</td>
<td>7</td>
<td>0.20</td>
<td>1.2</td>
</tr>
<tr>
<td>150</td>
<td>17</td>
<td>0.50</td>
<td>2.8</td>
</tr>
<tr>
<td>200</td>
<td>33</td>
<td>1.00</td>
<td>5.5</td>
</tr>
<tr>
<td>250</td>
<td>49</td>
<td>1.51</td>
<td>8.2</td>
</tr>
<tr>
<td>300</td>
<td>68</td>
<td>2.10</td>
<td>11.3</td>
</tr>
</tbody>
</table>

Note: For a dose rate of 20 mg/L: (a) 10 kg of calcium hypochlorite will treat 325 kL of water; (b) 20 litres of sodium hypochlorite liquid will treat 120 kL of water.

4.4.9 Water Main Status after Pressure Test and Disinfection

After satisfactory completion of the pressure test and disinfection process, the test section shall be left charged with potable water to 600 kPa(g). All sluice valves and section gate valves shall be left fully opened and all hydrants, flushing points and tapping at temporary dead ends shall remain closed.

4.5 Prelaid Water Service Connections

4.5.1 General

Prelaid water service connections in new subdivisions shall be installed in accordance with the Drawings.

Only a qualified trades person shall carry out silver soldering or brazing.

4.5.2 Alignment and Depth

Water services shall be installed where shown on the Drawings in accordance with the typical arrangements shown.

Where it may prove impracticable to comply with the requirements due to concealed obstructions, alternative proposals will need prior acceptance by the Corporation.

A minimum of 100 mm clearance all round shall be provided for all water service pipes relative to other services.

4.5.3 Road Crossings

Road crossings for service connections shall be installed complying with the Drawings before the final road pavement is constructed.

Immediately after installation the ends of the service pipes shall be temporarily sealed with a securely fastened plug and adhesive tape to prevent ingress of unwanted materials.
4.5.4 Tapping Reticulation Mains

Service tapping locations on water reticulation mains shall be located within 100mm of the standard service alignment unless further constrained by the following requirements:

- a minimum of 300mm from a pipe or pipe fitting socket.
- a minimum of 300mm from an adjoining tapping.

When tapping PVC and PE mains, the swarf and coupon shall not be permitted to fall into the main.

The tapping band shall be installed so that the off-take is centrally positioned over the tapping hole in the main and in accordance with the Drawings.

Fittings shall be assembled and jointed in accordance with the manufacturer's recommendations.

Each threaded joint shall be sealed with PTFE thread tape (no more than 3 wraps) or Teflon jointing compound applied in accordance with the manufacturer's recommendations.

Tapping or service pipework which is positioned more than 200mm from the standard or agreed service location in the road reserve or 100mm within a property will be deemed defective and will be rejected by the Corporation.

4.6 Incidental Works

4.6.1 Kerb Marking

Kerb marking shall be provided to the detail shown on the Drawings to indicate the position of valves, permanent flushing points and hydrants. The kerb marking, shall be placed adjacent to the fittings.

4.6.2 Marker Posts

Where there is no kerbing, marker posts shall be provided and installed to the detail shown on the Drawings to indicate the position of valves, flushing points and hydrants.
### PVC AND STEEL PIPELINE PRESSURE TEST RECORD SHEET

**PRESSURE TEST RECORD SHEET -**

<table>
<thead>
<tr>
<th>Project:</th>
<th>____________________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suburb:</td>
<td>____________________________________</td>
</tr>
<tr>
<td>Main Extension File No.:</td>
<td>WAPC:</td>
</tr>
<tr>
<td>WCFB:</td>
<td>Sheet No.:</td>
</tr>
<tr>
<td>Project Manager:</td>
<td></td>
</tr>
<tr>
<td>Contractor:</td>
<td></td>
</tr>
</tbody>
</table>

#### 1. Pipeline Tested

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Material</th>
<th>Horizontal Distance</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** There are no allowable leakage rates for any type of pipe. Cement mortar lined pipes shall be filled 48 hours before testing to allow for take up.

#### 2. Date Tested:

____________

#### 3. Pressure at start of test:

____________ kPa(gauge)

#### 4. Pressure at test completion:

____________ kPa(gauge)

#### 5. Duration of Test:

____________ MINUTES

- [ ] PASSED
- [ ] FAILED

#### 6. Signed By:

Signed By: ____________________________________________

Date: __/__/__

*Contractor: ____________________________________________

Project Manager (Optional): ____________________________________________

Witnessed by Water Corporation representative: ____________________________________________
PE PIPELINE PRESSURE TEST RECORD SHEET

REFERENCE INFORMATION

<table>
<thead>
<tr>
<th>INSPECTION DATA</th>
<th>ASSET DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECT NAME:</td>
<td>CHAINAGE FROM:</td>
</tr>
<tr>
<td>LOCATION:</td>
<td>CHAINAGE TO:</td>
</tr>
<tr>
<td>INSPECTION DATE:</td>
<td></td>
</tr>
<tr>
<td>INSPECTOR NAME:</td>
<td></td>
</tr>
<tr>
<td>PROJECT / CONTRACT NO:</td>
<td>WC DRAWING / P&amp;ID NO.:</td>
</tr>
<tr>
<td>PROCESS FLUID:</td>
<td></td>
</tr>
<tr>
<td>TEST FLUID:</td>
<td></td>
</tr>
</tbody>
</table>

Calculation Table

Complete the following calculations prior to attending site

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Formula</th>
<th>Result</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design pressure</td>
<td>P&lt;sub&gt;design&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>kPa</td>
</tr>
<tr>
<td>Pipeline pressure rating</td>
<td>P&lt;sub&gt;pipe&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>kPa</td>
</tr>
<tr>
<td>Test pressure at lowest point</td>
<td>P&lt;sub&gt;test&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>kPa</td>
</tr>
<tr>
<td>Pipe diameter</td>
<td>D</td>
<td></td>
<td></td>
<td>m</td>
</tr>
<tr>
<td>Length of pipe being tested</td>
<td>L</td>
<td></td>
<td></td>
<td>km</td>
</tr>
<tr>
<td>Volume of pipe being tested (should not exceed 4000m&lt;sup&gt;3&lt;/sup&gt;)</td>
<td>V</td>
<td>V=π x D&lt;sup&gt;2&lt;/sup&gt;/4 x L x 1000</td>
<td></td>
<td>m&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Fill rate</td>
<td>Q&lt;sub&gt;fmax&lt;/sub&gt;</td>
<td>Recommended Q&lt;sub&gt;fmax&lt;/sub&gt; = 39.27D&lt;sup&gt;2&lt;/sup&gt;</td>
<td></td>
<td>L/s</td>
</tr>
<tr>
<td>Design temperature</td>
<td>T&lt;sub&gt;design&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Volume Added</td>
<td>V&lt;sub&gt;1&lt;/sub&gt;</td>
<td>*measured</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Volume Added</td>
<td>V&lt;sub&gt;2&lt;/sub&gt;</td>
<td>*measured</td>
<td></td>
<td>L</td>
</tr>
<tr>
<td>Maximum allowable make-up water</td>
<td>V&lt;sub&gt;2max&lt;/sub&gt;</td>
<td>V&lt;sub&gt;2max&lt;/sub&gt; = 0.55V&lt;sub&gt;1&lt;/sub&gt; + 0.14LDH</td>
<td></td>
<td>L</td>
</tr>
</tbody>
</table>

Is V<sub>2max</sub> larger than V<sub>2</sub>? If the answer is “yes”, test has passed. If the answer is “no”, test has failed.

☑ PASSED ☐ FAILED
5 GUIDELINES FOR UNDER PRESSURE CUT-IN WORK

5.1 Scope

These guidelines for under pressure cut-in work cover work involved to make large (> DN50) service connections to live (under pressure) Corporation water mains up to DN300 without the need to isolate or shut off the associated water supply to customers.

They also define the minimum requirements for under pressure drilling equipment, associated pipeline fittings, valves and contract personnel accreditation.

5.2 Purpose of Guidelines

5.2.1 Purpose

The purpose of these Guidelines is to provide consistent instruction to operations and maintenance personnel throughout the State for the selection and use of pipeline fittings and for under pressure cut-in connection work.

5.2.2 Objectives

The objectives of the guidelines include:

- allocation of minimum manpower and time resources to connection operations;
- minimal disruption of customers’ water supply;
- least risk to water main integrity by definition of cut-in materials and methods.

5.3 General Requirements

5.3.1 Documented Submission

Each under pressure cut-in proposal will require a prior documented submission. A favourable appraisal and acceptance of the submission shall be prerequisite to the provision of any under pressure cut-in connection service to a Corporation water main.

5.3.2 Methodology

Each submission shall detail the method proposed and should include:

- the location of proposed cut-in, including relative location of roads, properties and other utility services, supported by a dimensioned plan.
- size and material of the live water main including description of its coating, lining and structural condition.
- size of cut-in off-take branch and of tapping hole to be drilled in live water main;
- description of live water main fitting and off-take branch valve proposed;
- Evidence that the manufacturer’s offtake fitting is rated to carry the rated pressure of the host main without any reliance on a structural contribution from the host main.
- Sufficient clear spacing of the offtake fitting from existing fittings or pipe ends
- Tapping to comply with SPS152 Stainless Steel Repair Clamps for Waterworks Pipes unless approved otherwise by Water Corporation Engineering Branch.

5.4 Constraints

5.4.1 Cut-In Work

Under pressure connection work is not permissible:

- where the maximum operating pressure of the host water main exceeds 120m;
• where the live water main is not in a sound condition, determined by visual inspection or by other means, as determined by the Corporation. Unsound water mains include metallic pipelines having significant levels of corrosion and asbestos cement pipelines that are cracked or soft;

• Where a conventional non-pressurized cut-in is feasible

5.5 Authorisation of Under Pressure Cut-In Work

5.5.1 Application
Constructors including external contractors shall submit the following information in support of any application to provide under pressure cut-in connection services for the Corporation:

• Documented procedures for the selection and use of cut-in systems, materials and equipment for under pressure connection services;

• Details of the installation contractor or sub-contractors management system including any third party certification relevant to cut-in service operations;

• Summary of current operational personnel including details of training undertaken in and experience gained on water industry cut-in services;

• The mechanical and hydraulic arrangement of cut-in equipment, so that backflow of any contaminated material from the equipment into Corporation water mains is positively prevented.

• Detailed sketches outlining the arrangement and works involved, including pipe sizes/materials/lining, weld details, and surface treatments.

5.5.2 Acceptable Systems
Under pressure cut-in connection systems currently acceptable to the Corporation include:

• Wangaratta Industries Pty Ltd double-segment flanged off-take clamp system in type 316 stainless steel in accordance with AS4181 and as installed by Complete Tapping Services.

• Fully welded steel connections.

5.6 Responsibility for Under Pressure Cut-In Work

5.6.1 Responsibility
Each under pressure cut-in connection project (or series of projects, if included in a single construction or contract package) shall be the responsibility of a single prime construction or contracting entity. That entity and its legal obligations shall be clearly identified and documented by the project proponent, prior to any cut-in service operation.

5.6.2 Acceptance in Writing
Each quotation or tender for under pressure cut-in connection work shall be subject to acceptance in writing by the Corporation in accordance with corporate procurement policies.

5.6.3 Requirements
The appointed constructor or contractor shall in each case:

• ensure that all work associated with the cut-in service is fit for purpose and is carried out in a competent and hygienic manner in accordance with the procedures documented in the accepted submission for authorisation;

• limit personnel employed in the service delivery to those whose skills, knowledge and experience have, prior to the commencement of the work, been assessed as appropriate;
• prevent any contamination of service equipment or materials in contact with Corporation water mains or contents. Where the extent of contamination is in dispute, such dispute shall be resolved by reference to the provisions of AS/NZS 4020, as appropriate;
• ensure a high standard of hygiene with respect to personnel employed in the service delivery;
• ensure public safety at all times;
• ensure compliance with the requirements of the Corporation’s Occupational Safety and Health Procedure titled “Health Safety and Environment (HSE) handbook for Contractors”
• notify the Corporation (Tel. 131375) of any water main leakage or breakage or of any complaint by a member of the public in the course of service delivery as early as practicable;
• provide all materials, equipment and personnel required to deliver the service, except as arranged to be provided by the Corporation.
• acquire all approvals, licences, permits and any other authorisations required under Environmental Laws.

5.6.4 Materials
All fittings and materials incorporated in permanent Corporation infrastructure shall comply with the requirements of Table 3.1.

5.6.5 Alignment
Each cut-in connection off take branch shall be installed with the branch axis on a horizontal plane. The cut-in must be located centrally to the spigot offtake.

5.6.6 Thrust Supports
Each cut-in connection valve and off-take tee shall be installed and permanently supported to resist movement due to any thrust in accordance with the Standard Drawings.

5.6.7 Disinfection
All drilling equipment, associated fittings and materials that will be in contact with the water main contents shall be cleaned and disinfected prior to each cut-in operation. Disinfection shall be by immersion in or spraying with a 10% solution of sodium hypochlorite for 10 minutes followed by rinsing with fresh potable water.

5.6.8 Coupon Retention
The section of water main removed as part of the cut-in service operation (coupon) shall in each case be retained and shall be supplied to the Water Corporation.

5.6.9 Reinstatement
External pipeline coatings and sleeving shall be reinstated, wherever damaged or removed by cut-in service operations, in accordance with the Corporation’s requirements for such reinstatement including compliance with DS95.

5.6.10 Valve Requirements
The standard requirement for off-take branch valving shall be by means of a sluice valve that complies with SPS 272 (branch size no larger than DN 250). Where flange connections involve coupling of dissimilar metallic components (e.g. stainless steel to cast iron), the isolation flange kits must be used to mitigate galvanic corrosion.
### 6 STANDARD DRAWINGS

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