

***COFFS HARBOUR CITY COUNCIL***



**DEVELOPMENT SPECIFICATION  
DESIGN**

***1341 Water - reticulation and pump stations  
(Construction)***

***Version 1      01 January 2009***

**1341 WATER – RETICULATION AND PUMP STATIONS (CONSTRUCTION)**

---

**1 SCOPE AND GENERAL**

---

**1.1 SCOPE**

The is to be constructed under this worksection consists of the construction of Mains up to DN 600 nominal size and small pump stations.

This worksection excludes the construction activities for:

- Reservoirs, including repainting of reservoirs.
- Treatment plants.
- Dams.
- Headworks, including bores and weirs.
- Dosing plant.
- Larger pump stations.

This is a construction Specification suitable for use in a Sequential Design and Construction (not Design/Construct) delivery of work method, with separate contracts for Design, then Construction, where:

- A development subdivision is likely to be certified.
- State Government subsidises a small town water supply scheme where the Project Director elects not to use performance based contracts for the Service Providers where the work is likely to be supervised by a designated person appointed by the Principal with defined authority.
- Where the augmentation is small and relates to a component or sub-component of a larger facility where the work is likely to be supervised by a designated person appointed by the Principal with defined authority.

AUS-SPEC appreciates the role of the Water Directorate in comprehensively updating the design and construction specifications for water and sewer works.

**1.2 COMPLIANCE WITH STANDARDS**

The Contractor shall carry out the work, and supply materials meeting the requirements of the reference documents, and, in particular, in accordance with the requirements of the Water Supply Code of Australia except as otherwise specified herein.

Water Supply Code of Australia drawings shall be used in preference to PWS Standard Drawings (WSAA 03 Part 4) held by NSW Department of Commerce

**1.3 PRECEDENCE**

Where any standard drawing used in conjunction with this worksection includes technical requirements that conflict with this worksection, the requirements of this worksection shall take precedence.

**1.4 QUALITY**

Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are given in 0161 *Quality (Construction)*.

**1.5 REFERENCED DOCUMENTS**

References to the *Water Supply Code of Australia* are made where there are parallel sections or equivalent clauses to those in this worksection. Where not called up as part of this worksection, these references are identified by part and section numbers and enclosed in brackets thus (WSAA Part, Section).

The following documents referred to in this worksection shall be deemed as the latest edition of the Australian Standards, including amendments and supplements.

**Worksections**

0161 Quality (Construction)

0310 Minor concrete works

1101 Control of traffic

1102 Control of erosion and sedimentation

**Standards**

AS 1111	ISO metric hexagon bolts and screws—Product grade C
AS 1111.1	Bolts
AS 1111.2	Screws
AS 1112	ISO metric hexagon nuts – Style 1 – Product grades A + B
AS 1152	Specification for test sieves
AS 1272	Unsintered PTFE tape for thread sealing applications
AS 1289	Methods for testing soils for engineering purposes
AS 1289.5.4.1	Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	Soil compaction and density tests—Compaction control test—Hilf density ratio and Hilf moisture variation (rapid method)
AS 1349	Bourdon tube pressure and vacuum gauges
AS 1432	Copper tubes for plumbing, gasfitting and drainage applications
AS 1444	Wrought alloy steels—Standard, hardenability (H) series and hardened and tempered to designated mechanical properties
AS 1565	Copper and copper alloys—Ingots and castings
AS 1579	Arc-welded steel pipes and fittings for water and waste-water
AS 1627	Metal finishing—Preparation and pre-treatment of surfaces
AS 1627.4	Abrasive blast cleaning
AS 1646	Elastomeric seals for waterworks purposes
AS 1657	Fixed platforms, walkways, stairways and ladders—Design, construction and installation
AS 1830	Grey cast iron
AS/NZS 2032	Code of practice for installation of UPVC pipe systems
AS 2033	Installation of polyethylene pipe systems
AS 2129	Flanges for pipes, valves and fittings
AS 2419	Fire hydrant installations
AS 2419.2	Fire hydrant valves
AS 2528	Bolts, studbolts and nuts for flanges and other high and low temperature applications
AS 2638	Gate valves for waterworks purposes
AS 2837	Wrought alloy steels—Stainless steel bars and semi-finished products (Withdrawn)
AS 3571	Glass filament reinforced thermosetting plastics (GRP) pipes—Polyester based – Water supply, sewerage and drainage applications
AS 3578	Cast iron non-return valves for general purposes (Withdrawn)
AS 3681	Guidelines for the application of polyethylene sleeving to ductile iron pipelines and fittings
AS 3690	Installation of ABS pipe systems
AS 3952	Water supply—Spring hydrant valve for waterworks purposes
AS 3996	Access covers and grates
AS 4087	Metallic flanges for waterworks purposes
AS 4321	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings
AS 4441(Int)	Oriented PVC (PVC-O) pipes for pressure applications

AS 4794	Non-return valves—Swing check and tilting disc
AS/NZS 1477	PVC pipes and fittings for pressure applications
AS/NZS 1594	Hot-rolled steel flat products
AS/NZS 2280	Ductile iron pipes and fittings
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2566.1	Structural Design
AS/NZS 2566.2	Structural Installation
AS/NZS 3000	Wiring rules
AS/NZS 3008	Electrical installations—selection of cables
AS/NZS 3008.1.1	Cables for alternating voltages up to and including 0.6/1 kV—Typical Australian installation conditions
AS/NZS 3439	Low voltage switchgear and controlgear assemblies
AS/NZS 3518	Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications
AS/NZS 3862	External fusion-bonded epoxy coating for steel pipes
AS/NZS 3879	Solvent cements and priming fluids for use with unplasticized PVC (PVC-U and PVC-M) and ABS pipes and fittings
AS/NZS 4129	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS 4130	Polyethylene (PE) pipes for pressure applications
AS/NZS 4158	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4680	Hot-dipped galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS4765(Int)	Modified PVC (PVC-M) pipes for pressure applications
AS 60529	Degrees of protection provided by enclosures (IP Code)
BS410	Test sieves. Technical requirements and testing
BS410 - 1	Test sieves of metal wire cloth
BS410 - 2	Test sieves of perforated metal plate

**Other publications**

*Institute of Public Works Engineering Australia (IPWEA)*

Streets Opening Conference Information Bulletin on Codes and Practices (Sections 3 and 4 detailing locations and depths of other services and preferred location for water reticulation pipes)

*NSW Department of Commerce*

MEW E101 Electrical Services Minimum Requirements

WS-SPEC Technical Requirements (TRs) and Strategic products Specifications

*Water Services Association of Australia (WSAA)*

WSAA 03 Water Supply Code of Australia

WSAA 01 Polyethylene Pipeline Code Standard Drawings

---

## **2 MATERIALS**

### **2.1 COMPLIANCE WITH MANUFACTURER'S RECOMMENDATIONS**

The Contractor shall comply with the requirements of the manufacturer's recommendations regarding the handling, transport and storage of materials and as further specified in this worksection.

The Contractor shall not use damaged or defective materials, including coatings and linings, outside the manufacturer's recommended limits.

## 2.2 PVC PIPES AND FITTINGS

### Standard

PVC pipes and fittings for mains and suction pipes shall comply with AS/NZS 1477, AS 4441(Int) or AS/NZS 4765, shall be suitable for use with elastomeric seals complying with AS 1646 and shall be of the class and size as shown on the Drawings. (WSAA 03 Part 3, Section 12.1)

### Installation

PVC pipes and fittings for mains and suction pipes shall be installed in accordance with AS/NZS 2032, AS/NZS 2566.1 and WSAA 03.

### Protection

Pipes and fittings shall be handled and stored in accordance with WSAA or AS/NZS 2032.

Where storage beyond the times specified in WSA 03 and AS/NZS 2032 are required, the Contractor shall provide protection for the pipes and fittings from ultra violet light and damage as recommended in the standards for the pipes and fittings.

The Contractor shall take account of the time for storage and type of shelter.

## 2.3 ACRYLONITRILE BUTADIENE STYRENE (ABS)

### Standard

ABS pipes and fittings shall comply with AS/NZS 3518 to the class, size, use, shape and colour as shown on the Drawings and installed in accordance with AS/NZS 2566.1 and AS 3690.

Where storage beyond the times specified in WSA 03 is required, the Contractor shall provide protection for the pipes and fittings from ultra violet light and damage.

### Jointing

ABS pipes and fittings shall be joined in accordance with the manufacturer's instructions using solvent cement to AS/NZS 3897

## 2.4 GLASS REINFORCED PLASTIC (GRP)

### Standard

Glass filament reinforced thermosetting plastics (GRP) pipes shall comply with AS 3571 and shall be of the class and size as shown on the Drawings and installed in accordance with AS/NZS 2566.1 and AS/NZS 2566.2 (WSA 03 Part 3, Section 12.1.).

### Protection

Where storage beyond the times specified in WSA 03 is required, the Contractor shall provide protection for the pipes and fittings from ultra violet light and damage.

## 2.5 DUCTILE IRON (DI) PIPE AND FITTINGS

### Standard

Ductile iron (DI) pipes and fittings shall comply with AS/NZS 2280 and shall be of the class, size and lining, as shown on the Drawings, and installed in accordance with AS/NZS 2566.1 and AS/NZS 2566.2.

Jointing shall be with elastomeric seals complying with AS 1646 series, to the class and type as shown on the Drawings.

### Flanges

Flanges shall be to the table shown on the Drawings. Bolts and nuts for flanged joints shall be galvanised, or stainless steel as for the pumps specified herein, unless shown otherwise on the Drawings.

### Corrosion protection

All pipework, unless specified otherwise, shall be coated and lined. All pipework shall be sleeved externally with polyethylene sleeving in accordance with the requirements of AS 3681.

All fittings shall be fusion-bonded coated, in accordance with AS 4158 or sleeved in accordance with AS 3681.

If it is not possible, or desirable, to protect all joints using the above methods, the Contractor shall wrap all unprotected joints in the trench with a petrolatum tape system approved by the Superintendent.

## 2.6 STEEL PIPELINE AND FITTINGS

### Standard

Steel pipelines and fittings shall comply with AS 1579 and shall be of the class, size, lining and coating as shown on the Drawings. (WSA 03 Part 3, section 12.1.)

### Corrosion protection

The Contractor shall protect all unprotected joints in the trench with a suitable corrosion protection system (e.g., petrolatum tape system or alternative) approved by the Superintendent.

### Joints

The jointing system shall be elastomeric seal joint with seals complying with AS 1646 series or butt-welded, unless shown otherwise on the Drawings.

### High voltage powerlines

The Contractor shall comply with WSA 03 where continuously welded steel pipelines run parallel to, when in close proximity, high voltage power lines.

## 2.7 COPPER PIPE AND FITTINGS

### Standard

Copper tube and fittings shall comply with AS 1432 and shall be of the size and type as shown on the Drawings.

### Insulated

The Contractor shall install copper tube, capillary and compression fittings, insulated from ferrous mains, as shown on the Drawings. (WSAA 03 Part 3, section 12.1.)

## 2.8 POLYETHYLENE (PE)

### Standard

Polyethylene pipe shall comply with AS/NZS 4130 and shall be of the class and size as shown on the Drawings and installed in accordance with AS 2033. (WSAA 03 Part 3, section 12.1.)

### Jointing

Jointing shall be by butt thermal fusion or by electrofusion couplings, or with mechanical fittings.

### Fittings

Fittings shall comply with AS/NZS 4129.

### Internal diameter and wall thickness

The Contractor shall provide pipe and fittings with minimum wall thickness and minimum internal diameter as shown on the Drawings.

## 2.9 STEELWORK

Structural steelwork, including ladders, brackets, and covers, complying with AS 1657, shall be abrasive blast cleaned to AS 1627.4 Class 2.5 and hot dip galvanised to AS/NZS 4680. (WSAA 03 Part 3, section 12.1.)

## 3 VALVES AND HYDRANTS

---

### 3.1 GENERAL

#### Compatibility with pipework

The Contractor shall ensure that the valves and hydrants supplied are compatible with the pipework such that proper sealing is provided between the pipe flanges and the valve.

The concrete lining in pipework shall not be chipped away or reduced to provide clearance from the working parts of valves.

#### Installation

The Contractor shall ensure that the valves and hydrants are installed so as to facilitate maintenance.

The Contractor shall take into account the manufacturer's recommendations, the requirements shown on the Drawings, the type of connection, lubrication of connecting bolts, and the location of valves within valve chambers or type of backfill material. (WSAA 03 Part 3, Section 15.11.1.)

### **Corrosion protection**

The type of external corrosion protection of buried valves and hydrants shall be fusion-bonded medium density polyethylene coating to AS 3862 and AS 4321 or thermal-bonded polymeric coating to AS/NZS 4158.

### **Flanges**

Flanges shall comply with AS 2129 and AS 4087 and shall be of the class and size shown on the Drawings.

## **3.2 STOP VALVES**

### **Sluice valves**

Sluice valves shall be resilient seated valves manufactured in accordance with AS 2638 series.

The valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings.

### **Ball valves**

Ball valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings.

### **Butterfly valves**

Butterfly valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings

### **Knife gate valves**

Knife gate valves shall be flanged where permitted by the Water Authority unless shown otherwise on the Drawings

### **Scour valves**

Scour valves shall connect to pipelines with a flanged joint. Scour valve assemblies shall be as shown on the Drawings.

### **Operation**

Valves shall be operated by a removable key.

The Contractor shall size 'Tee Key' valve operators and hand wheels to operate the valves under all operating conditions throughout their full range with no greater than 180 Newtons applied to the ends of the key bar or the rim of the wheel.

### **Hand wheel arrow**

Hand wheels, where specified, shall display an embossed or engraved arrow, together with 'open' and/or 'close' corresponding to the valve operation.

### **Gaskets for valves**

Gasket for the valves shall be fabricated from 3mm thick insertion rubber.

## **3.3 AIR VALVES**

### **Standard**

Air valves shall be of the double orifice type with integral isolating valve of minimum size DN 80, and shall be installed as shown in the Drawings.

### **Isolation**

Air valves shall be installed such that they can be maintained without affecting supply.

### **Alternate type**

The Contractor shall obtain the consent of the Water Authority for the use of other types of air valves.

## **3.4 NON-RETURN VALVES**

### **Standard**

Non return valves shall be of the swing check type to AS 3578 or AS 4794 of cast iron or steel body, cover and disc or with bronze body and disc seat rings.

The leaf shall swing clear and provide an unobstructed waterway. Wafer style non-return valves shall not be used.

### **Maintenance**

The body cover shall be located and sized to allow the valve flap to be removed and the seat to be inspected without removing the valve body.

### **No flow switch**

Where shown on the Drawings, non-return valves shall have an extended spindle, minimum grade 316 stainless steel complying with AS 1449, fitted with an adjustable counterweight, together with a proximity switch to indicate a no-flow condition.

### **Switch features**

No flow switches shall have the following features:

- Be of the eccentric cam operated limit switch type.
- Have a minimum rating of 10 amps, 240 V AC, 50 Hz.
- Be oil tight and dust proof to IP 65.
- Be suitable for 25 mm conduit entry.
- Be mounted on rigid stainless steel complying with AS 1449 adjustable brackets. The brackets shall be free of sharp edges and exposed corners.

## **3.5 SPRING HYDRANTS**

### **Standard**

Spring hydrant bodies shall be manufactured in accordance with AS 3952 and installed in accordance with AS 2419.2 except as varied below.

### **Access**

The top of spring hydrants shall be between 100 mm and 200 mm below finished surface level as detailed in WSAA 03 Part 4, WAT-1104.

If necessary, this shall be achieved by the use of hydrant risers of various heights.

## **3.6 PRESSURE REDUCING VALVES**

Pressure reducing valves shall be of the type as shown on the Drawings.

Pressure reducing valves shall be installed with isolating valves to facilitate maintenance.

## **4 PIPELINE CONSTRUCTION**

---

### **4.1 ACCREDITATION**

The Contractor, employees, or subcontractors, engaged in excavations, including tunnelling, shall be accredited for the work.

Proof of accreditation constitutes a HOLD POINT.

The approval of the Superintendent, to the supplied documentation, shall be required prior to the release of the hold point.

### **4.2 ALIGNMENT CHANGES**

The Contractor shall not change the pipeline alignment without prior concurrence of the Water Authority.

The Contractor shall provide full details, of any proposed changes to the pipeline alignment, to the Superintendent for submission to the Water Authority.

This action constitutes a HOLD POINT.

The Superintendent shall obtain the decision of the Water Authority prior to the release of the hold point.

### **4.3 LOCATION**

The location of the mains and pump stations, sizes of mains, types of chambers and covers and the classes of pipes shall be as shown on the Drawings.

The pipelines shall be laid to grades and locations shown on the Drawings and to tolerances in the WATER SUPPLY CODE unless directed otherwise by the Superintendent (WSAA 03 Part 3, section 21).

The Contractor shall confirm the locations immediately prior to construction. (WSAA 03 Part 3, Section 11).



#### 4.4 COVER OVER PIPELINES

##### Minimum cover

The minimum depth of cover to be provided for mains, measured vertically from the finished ground level to the top of any socket, shall be as follows (WSAA 03 Part 3, Sections 13, 17, 21, WAT-1201):

- 750 mm in embankments
- 600 mm in roadways and commercial areas
- 450 mm elsewhere

##### Special protection

Lesser cover may be provided where special protection of the pipelines has been shown on the Drawings or directed by the Superintendent.

##### Special needs

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

##### Maximum cover

The maximum cover shall be 1000 mm, unless otherwise directed.

#### 4.5 CROSSINGS

##### Authority approvals for road and creek crossings and other features

Where a pipeline crosses a Main or State road, creek or involves features shown on the Drawings, under the control of any Authority, the Contractor shall carry out the work in accordance with the requirements of that Authority.

The Contractor shall provide written notification to the Authority of the intention to carry out the work, and pay the appropriate fees (WSAA 03 Part 3, Section 1.6 Affected Party Notifications).

The Contractor shall obtain the written approval from the Authority prior to commencement of work. Such written approval shall be supplied to the Superintendent if requested.

This action constitutes a WITNESS POINT.

The Superintendent shall advise at the time of notification by the Contractor whether the option to request the written approval is to be exercised.

##### Existing road crossings

Where shown on the Drawings, the Contractor shall use trenchless methods for the installation of the mains.

The installation of the main by open trenching shall not be permitted over the lengths designated for trenchless installation. (WSAA 03 Part 3, Section 15.13.)

##### Trenchless installation methodology

The Contractor shall address, in its Method Statement for trenchless conduit installation, the following:

- General description of method and sequence of operation.
- Size, depth and position of temporary pits required.
- Use of specialist subcontractors.
- Specialist equipment to be used.
- Grout type and method of injection.

##### Encasement pipe

The encasement pipe shall be as detailed on the Drawings.

The encasement pipe shall extend 1.0 m behind the back of the kerb on either side of the carriageway.

##### Support cradles

The carrier pipe shall be positioned on support cradles and the carrier pipe shall be centrally located within the encasement pipe.

##### Grouting

After installation and pressure testing of the carrier pipe, the Contractor shall fill the annular space between the carrier pipe and the encasement pipe with suitable grout or cementitious grout filler.

Where the carrier pipe is ductile iron cement lined (DICL), any length of pipe which is enclosed within the encasement pipe need not be wrapped in polyethylene sleeving.

## 4.6 EARTHWORKS

### Location

The Contractor shall carry out all excavations for structures and pipelines to the lines, grades and forms shown on the Drawings or as directed by the Superintendent within the specified tolerances.

The Contractor shall comply with all requirements of the appropriate Authority including having regard for drainage, dewatering, silt control, noise abatement, proximity to existing buildings and generally for the amenity of adjacent owners. (WSAA 03 Part 3, Section 13).

### Excavated material

The Contractor shall leave a clear space of 600 mm minimum between the edge of any excavation and the inner toe of stockpiles.

No excavated materials shall be stockpiled against the walls of any building or fence without the written permission of the owner of such building or fence.

Topsoil from excavations shall be stockpiled separately and utilised to restore the surface after backfilling.

### Public safety

At the completion of work each day, the Contractor shall install safety fencing to Statutory requirements along the edges of open excavations to isolate them from the public.

All installations shall be of adequate size and strength and shall be illuminated to prevent accidents.

### Access to properties

The Contractor shall provide fenced walkways and vehicular crossings across trenches to maintain access at all times from carriageway to individual properties or within individual properties and advise all affected residents beforehand.

All installations shall be of adequate size and strength and shall be illuminated to prevent accidents.

### Existing services

The Contractor shall locate, protect and repair, as necessary, all services affected by the Works at the Contractor's expense.

### Erosion control

The Contractor shall carry out erosion and sedimentation control at all construction sites in accordance with 1102 Control of erosion and sedimentation.

### Limiting excavations

The Contractor shall take account of safety issues and possible wet weather effects to limit the extent of excavation left open. (WSAA 03 Part 3, Section 13.2.)

## 4.7 MINIMUM TRENCH WIDTH FOR PIPELINES

### Timbering or sheet piling

The minimum clear width of trench (inside internal faces of timbering or sheet piling, if used) to a height of 150 mm above the top of the pipe shall be as shown in Table 4.1.

**Table 4.1 Minimum trench widths**

Nominal size of pipe (DN)	Minimum clear width of trench (mm) (inside timbering or sheet piling, if any)	
	Pipe other than PVC/PE	PVC/PE pipe
100	400	350
150	450	400
200	500	450
225	550	500
250	550	500
300	600	550
375	700	650
400	700	650
450	750	700
500	850	800
525	850	800

600	950	900
-----	-----	-----

**Minimum disturbances**

Where the Drawings provide for a trench to be excavated across a paved surface, the width of the trench shall be kept to a minimum.

Bitumen and concrete surfaces shall be carefully cut, by sawcutting or other means approved by the Superintendent, so as to provide a neat straight line free from broken ragged edges.

**Widen for fittings**

The Contractor shall widen the trench where necessary for the installation of valves and fittings and protective coating systems.

**4.8 EXCAVATION DEPTH**

**75 mm below**

For rock foundations, the Contractor shall excavate trenches to 75 mm below the underside of the pipe barrel and socket or coupling, or as otherwise shown on the Drawings.

**Pipe support**

The excavation shall be carried out such as to ensure solid and uniform support for each pipe over the whole length of barrel with chases provided for joints and wrapping.

**4.9 SUPPORT OF EXCAVATION**

**Precautions against slips or falls**

The Contractor shall adequately support all excavations as the Works proceed.

When withdrawing supports, the Contractor shall exercise every precaution against slips or falls (WSAA 03 Part 3, Section 13.6).

**Timber left in place**

The Contractor shall ensure that timber is left in place where its removal may endanger structures in the vicinity of the excavation.

**4.10 PIPE BEDDING**

**Approval to bedding installation**

When excavation of the trench has been completed the Contractor shall obtain the Superintendent's approval prior to commencing pipe laying, jointing and bedding.

This action constitutes a HOLD POINT.

The Superintendent's approval of the excavated trench is required prior to the release of the hold point.

**Crusher screenings**

Crusher screenings shall only be used for pipe bedding where sand or other non-cohesive material is not readily available locally or where the Contractor can demonstrate that its use will not impede repair operations. (WSAA 03 Part 3, Section 14.)

**Pipes other than PVC/PE**

Pipes may be laid directly on other than rock foundation.

Where rock or other hard material occurs in the bottom of the trench, the Contractor shall provide non-cohesive granular bedding, having a minimum thickness of 75 mm below the barrel and socket of the pipe.

The bedding material shall conform to the sands classification described in WSAA 03 Part 4 WAT-1200 Soil Classification Guidelines, either loose clean sand and/or medium dense clean sand.

**PVC/PE pipes**

For PVC/PE pipes, irrespective of foundation, the material to be used for pipe bedding as shown in Figure 4.1 in AS 2032 shall be in sand or other non-cohesive granular material, either crushed, natural or blended, and its grading shall fall within the limits in Grading of Bedding Material for PVC and PE Pipes table.

Where the materials cannot be reasonably sourced from within the vicinity, the Contractor may use materials satisfying the classification in Pipe Bedding provided also that the material meets the requirements for passing sieve sizes 9.5 mm and 6.7 mm shown in Table 4.2.

Underlay a minimum of 75 mm below the underside of the pipe barrel and socket, side support and overlay to a depth of 150 mm above the top of the pipe.

**Grades greater than 50%**

All mains laid on grades steeper than 50 per cent shall be encased in concrete as detailed on the Drawings.

**Table 4.2 Grading of bedding material for pvc and pe pipes**

Sieve size aperture width (AS 1152)	Equivalent BS sieve size (BS 410)	Percentage passing
9.5 mm	3/8 inch	100
6.7 mm	1/4 inch	90–100
425 µm	No. 36	40–90
150 µm	No. 100	0–10

**4.11 LAYING AND JOINTING OF PIPES**

**Installation**

Unless detailed otherwise in this worksection, the Contractor shall install pipes in accordance with AS/NZS 2032, AS 2033, AS/NZS 2566.1, AS/NZS 2566.2 or AS 3690, as appropriate (WSAA 03 Part 3 Section 15, WAT-1102 to 1105).

**Examination**

Before being laid, all pipes, fittings, valves, and materials to be used shall be cleaned and examined by the Contractor and, if required by the Superintendent, the Contractor shall suspend each one in a sling to enable the Superintendent to inspect it.

If directed by the Superintendent, the Contractor shall oil valves and repack valve glands.

**Cleaning**

The Contractor shall ensure that the interior of the pipeline is clean and free from obstructions. Plugs shall be used to prevent foreign matter entering sections of pipeline which are left uncompleted overnight.

**Flotation**

The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing.

Any temporary supports shall be removed prior to completion of backfilling.

**Joints**

Except where solvent cement joints are needed to make up or install fittings, joints in pipelines shall be elastomeric seal joints, either roll-on or skid type or, where shown on the Drawings, mechanical joints shall be, fixed flange, bolted gland type, or a PE pipe system specific joint type.

For pipes with rubber ring (elastomeric) joints, only the lubricant specified in writing by the manufacturer shall be applied in making the joint.

The Contractor shall make the joint such that the witness mark shall, at no point, be more than 3 mm from the end of the socket.

**Cut pipes**

Pipes may be cut as needed or directed by the Superintendent to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting.

Field cuts shall be undertaken in accordance with WSAA 03.

For field cuts of ductile iron or steel, the Contractor shall ensure that fire fighting equipment, in working order, is on the site prior to the field cuts being made.

If the Contractor proposes to use a petrol engined pipe cutter in an excavation, the Contractor shall ensure that a safe atmosphere is maintained in the excavation at all times.

The Contractor shall prepare the ends of any pipes cut in the field to the manufacturer’s written instructions, or as directed by the Superintendent.

**Witness mark on cut pipes**

Except for PE pipes to be butt welded, where pipes are cut in the field, the Contractor shall make a clearly identifiable witness mark on the pipe at the length specified by the manufacturer from the end of the pipe.

The Contractor shall not use PVC/PE pipes with scored witness marks.

Where the same manufacturer does not make spigots and sockets, the Contractor shall refer to the socket manufacturer for the correct marking depth.

#### **Different joints**

Where PVC/PE pipes are to be joined to ductile iron pipes, the joints shall be made by inserting a PVC/PE spigot into a ductile iron socket.

(Note: the compatibility of the PVC/PE pipe, joint seal and DI socket should be confirmed)

Ductile iron spigots shall not be inserted to PVC/PE sockets.

Alternatively, multi-fit mechanical couplings or flanged adaptor couplings, but not stainless steel leak/repair clamps, may be used to join pipes of different materials. Where PE pipes are being joined with mechanical couplings, joint restraint shall be provided.

#### **Existing AC pipe**

The Contractor shall conform with the relevant Statutory and OHS requirements when cutting and disposing of asbestos cement pipes.

#### **Joint deflection**

Flexibly jointed pipelines with gradual changes in alignment or grade shall be laid with the joint being deflected after it has been made.

The Contractor shall comply with the manufacturer's written recommendations in respect of maximum deflection for each joint provided that no joint shall be deflected to such an extent as to impair its effectiveness.

#### **Limit of joint deflection**

The maximum angle of deflection between adjacent pipes shall comply with manufacturers recommendations.

#### **Grade**

Unless otherwise directed by the Superintendent, the Contractor shall lay pipes on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface.

#### **Detectable tape**

Detectable identification tape shall be laid along the line of non-metallic mains within 150 mm of the finished surface. (WSAA 03 Part 3, Section 15.10.)

### **4.12 WRAPPING OF DUCTILE IRON PIPELINES**

#### **Location**

Where shown on the Drawings, the Contractor shall enclose a pipeline or a section thereof, in layflat polyethylene sleeving. (WSAA 03 Part 3, Section 15.9.)

#### **Material**

The materials to be used shall be high impact resistance polyethylene sleeving complying with AS 3681 and 50 mm wide plastic adhesive tape.

#### **Width**

The width of the sleeving when flat shall be in accordance with the manufacturer's written recommendations for the size and type of the pipeline which is to be encased.

Precautions shall be taken so that exposure to direct sunlight does not exceed 48 hours.

#### **Colour**

Where necessary to distinguish pipes within close proximity, pipelines shall be identified by Cream sleeving for Sewer Gravity and Rising mains, Lilac sleeving for Sewer Reuse mains and Blue sleeving for Potable Water mains or an appropriate identification tape approved by the Superintendent.

#### **Application**

Application of the polyethylene sleeving and plastic adhesive tape shall be in accordance with the pipe manufacturer's written instructions or as directed by the Superintendent.

The Contractor shall take due care not to damage the sleeving during its application or during the backfilling of the trench.

Each pipe shall be encased in a length of sleeving overlapped for a minimum of 250 mm at each field joint, and the ends of each length of sleeving shall be held in position with at least three circumferential turns of adhesive tape.

As the polyethylene sleeving material covering the pipe will be loose, excess material shall be neatly drawn up around the pipe barrel, folded into an overlap on top of the pipe and held in place by means of strips of plastic tape at approximately one-metre intervals.

Bends, tapers and similar fittings shall be covered by polyethylene sleeving as specified for the pipes. The Contractor shall hand wrap valves, hydrants and irregular shaped fittings and joints using flat polyethylene sheets secured with plastic adhesive tape, or other suitable material, to provide an adequate seal.

The flat polyethylene sheets may be obtained by splitting suitable lengths of sleeving.

#### **Damage to sleeving**

The Contractor shall rectify any damage done to the polyethylene sleeving before, during or after backfilling of the trench.

### **4.13 CORROSION PROTECTION OF STEEL BOLTS AND NUTS**

The Contractor shall wrap all galvanised steel bolts and nuts, used for installation below ground, of flanges, bolted gland joints, mechanical joints, tapping bands using a tape, approved by the Superintendent, consisting of synthetic fibre open weave cloth impregnated with saturated hydrocarbons applied in accordance with the manufacturer's recommendations or as directed by the Superintendent.

Bolts and nuts shall be dry, clean and free from rust immediately before wrapping.

### **4.14 BACKFILL AND COMPACTION**

#### **Notification of pipeline laid and jointed**

After laying and jointing of a pipeline has been completed the Contractor shall present the laid and jointed pipes for inspection by the Superintendent prior to the commencement of trench backfilling. (WSAA 03 Part 3, Section 17).

This action constitutes a HOLD POINT.

The Superintendent's approval to the laid and jointed pipes is required prior to the release of the hold point.

#### **Approval**

Backfill shall not be placed until the Superintendent has given approval.

#### **Side support and overlay**

Material for the side support and overlay of the pipe shall comply with the requirements for pipe bedding specified in Pipe Bedding.

The material shall be compacted in layers of not more than 150 mm to 95% of the standard maximum dry density of the material used when determined in accordance with AS 1289.5.7.1.

#### **Remainder of trench**

The Contractor shall backfill the remainder of the excavation and compact the backfill in layers of not more than 150 mm thick as follows:

#### **Roadway areas**

- Where the trench is within a roadway, proposed roadway, or footpath area, the remainder of the trench shall be:
  - . Backfilled with a non-cohesive granular material, with a grading falling generally within the limits detailed herein for pipe bedding and compacted to Density Index of 70 when determined in accordance with AS 1289.5.4.1 for cohesionless materials
    - \* Below 0.5 m of the road surface
    - \* In the road reserve, but excluding the road pavement
  - . Backfilled with excavated material, and compacted to 100% of the standard maximum dry density of the material when determined in accordance with AS 1289.5.7.1, when within 0.5 m of the road surface, but excluding the road pavement layers.
  - . Backfilled with road base and sub-base material as per existing or proposed pavement layers and compacted to 100% of the standard maximum dry density of the material when determined in accordance with AS 1289.5.7.1.
- Elsewhere, unless stated otherwise, the remainder of the trench shall be backfilled with ordinary excavated backfill material.

Where suitable material is not available, granular material may be used for the full depth of backfilling. The material shall be compacted to a density Index of 70 when determined in accordance with AS 1289.5.4.1 for cohesionless materials or 98% of the standard maximum dry density of the material when determined in accordance with AS 1289.5.7.1 for cohesive materials.

#### **Prevention of damage to pipes, coating and wrapping**

The Contractor shall carry out backfilling and compaction without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.

#### **Compaction tests**

The contractor shall carry out compaction tests 75 mm to 100 mm below the level being tested.

#### **Flood compaction**

The Contractor may compact backfill by trench flooding only where:

- The ground and backfill material is cohesionless sand;
- Water for flooding has been sourced at the site;
- The process will not create mud which would be moved off site by vehicles or construction plant;
- Additives are not used.

### **4.15 TRENCH STOPS**

#### **Grade 5% to 14%**

Where a pipe is laid on bedding at a grade of 5% to 14%, the Contractor shall construct, as below, trench stops consisting of bags filled with clay, or sand or cement stabilised sand and sealed (WSAA 03 Part 4 WAT-1209 and Part 3, Sections 15.7, 15.8):

- a) At the socket side of the joint nearest to the position of a stop required in accordance with the formula hereinafter, a recess 100 mm deep to suit the width of bag shall be excavated into the bottom of the trench across its full width and into both sidewalls and to a level 300 mm above the top of the pipe.
- b) The bags shall be placed around and above the pipe, as in (a) above, so as to give close contact with the pipe and to fill the entire space between the excavated recess and the pipe. Bags shall not be placed onto sand bedding.

#### **Spacing**

The distance between trench stops shall be determined by the following formula:

$$D=100/G$$

where

D = distance between stops in metres

G = grade of pipe expressed in percentum

### **4.16 CONCRETE BULKHEADS**

Where a pipe is installed at a grade of 15% to 29%, the Contractor shall construct concrete bulkheads.

Where a pipe is installed at a grade 30% to 50%, the Contractor shall construct concrete bulkheads integral with concrete encasement.

Bulkheads shall be of 20 MPa concrete complying with *0310 Minor concrete works*.

150 mm minimum thickness as follows (WSAA 03 Part 4 WAT-1209 and Part 3, Sections 15.7, 15.8):

- Where concrete bedding or encasement to pipe is required, the 150 mm thick bulkhead shall be cast integral with the concrete bedding or encasement across the width of trench and shall be keyed into both sidewalls a minimum of 150 mm.

The bulkhead shall extend to 150 mm below finished surface level or such other level as directed by the Superintendent.

- Where other bedding, or no bedding, is applicable, the bulkhead shall also be keyed into the bottom of the trench 150 mm for the full width of trench.
- A 75 mm nominal diameter drain hole shall be provided in the concrete bulkhead immediately above the top of the encasement bedding or foundation and crushed rock or gravel shall be placed in and at the upstream end of the drain hole to act as a filter.

The gravel shall be 10 to 20 mm in size within 150 mm in all directions upstream and above the

invert of the drain hole beyond which another 150 mm thick surround of gravel 2 to 10 mm in size shall be placed.

### Spacing

The distance between concrete bulkheads shall be determined by the following formula:

Concrete bulkhead

$$D=L/G$$

Concrete encasement (continuous) and concrete bulkhead

$$D=100/G$$

where

$$L = 80 \times \text{Pipe length, m with a 450 m max}$$

if  $L > 100$  m use intermediate trenchstops at spacing  $< 100/G$

$$D = \text{distance between bulkheads in m}$$

$$G = \text{grade of pipe expressed in percentum}$$

## 4.17 VALVE AND HYDRANT CHAMBERS

### Type

The Contractor shall construct around each valve and hydrant a chamber of the type and to the details shown on the Drawings (WSA 03 Part 3, Section 15.11.12).

### Concrete

The concrete shall comply with 0310 Minor concrete work.

### Colour designation

Valve chamber covers shall be painted with white pavement marking paint while hydrant chamber covers shall be painted with yellow pavement marking paint.

## 4.18 CHAMBER COVERS AND FRAMES

Covers and frames shall comply with AS 3996. On-site filling of recessed covers shall comply with AS 3996.

### Finish

Covers and frames shall not be warped or twisted.

Surfaces shall be finished such that there are no abrupt irregularities and gradual irregularities shall not exceed 3 mm.

Unformed surfaces shall be finished to produce a surface that is dense, uniform and free from blemishes. Exposed edges shall have a minimum 4 mm radius.

### Tolerance

Tolerances for the dimensions on the COVER shall be  $-3$  mm  $+NIL$ .

Tolerances for the dimensions on the FRAME shall be  $-3$  mm  $+3$  mm.

### Covers

Frames shall be seated as shown on the Drawings or as directed by the Superintendent.

Covers shall be finished flush with the surface in road pavements, footpaths and other paved surfaces.

Elsewhere, covers shall be finished 25 mm above the surface of the ground, or such other level as directed by the Superintendent, in a manner designed to avoid as far as possible, the entry of surface water.

### Plastic covers

The Contractor shall take care to avoid lateral movement, cracking and subsidence when installing plastic covers and frames.

## 4.19 SERVICE CONNECTIONS

The Contractor shall provide service connections in accordance with the Water reticulation code (WSAA 03 Part 4 WAT-1108 and WAT-1109).



#### 4.20 THRUST AND ANCHOR BLOCKS

##### Location

Thrust and anchor blocks shall be constructed where shown on the Drawings to the dimensions depicted therein or as otherwise directed by the Superintendent.

The blocks shall be provided at valves, flexibly jointed bends, tees, enlargers and reducers or any other point where resultant forces resulting from internal pressures will occur. (WSAA 03 Part 4 WAT–1205 to 1208 and Part 3, Section 15.5).

##### Thrust blocks

The Contractor shall provide permanent thrust blocks of 20 MPa concrete, complying with 0310 Minor concrete work (Minor concrete works) such that the thrust blocks bear against undisturbed material normal to the direction of thrust resulting from internal pressures over the bearing area not less than that directed by the Superintendent.

##### Anchor blocks

The Contractor shall provide permanent anchor blocks of 20 MPa concrete, complying with 0310 *Minor concrete works* of a volume not less than that directed by the Superintendent.

##### Temporary anchorage

The Contractor shall provide temporary anchorages adequate to restrain the pipe when under test.

The cost of providing such anchorages shall be deemed to be included in the rates tendered for laying and jointing rising mains.

##### Restrained joints

The Contractor shall obtain the consent of the Water Authority for the type and use of restrained joints, as an alternative to thrust blocks, in the case of congested service corridors and urgent commissioning.

“Tyton Lok” joint restraint units may be used where shown on the drawings.

#### 4.21 CONCRETE ENCASEMENT

##### Location

Where pipes have less than 450 mm of cover above the top of the pipe barrel, or where directed by the Superintendent, they shall be encased in concrete.

##### Specification

Concrete shall be 20 MPa complying with 0310 Minor concrete work and have the following minimum dimensions (WSAA 03 Part 4 WAT–1203, WAT–1204 and Part 3, Sections 12.5.5.1, 14.4, 16.6):

- For trenches in other than rock—150 mm minimum under, on both sides and on top of the pipe barrel.
- For trenches in rock—75 mm minimum under the pipe barrel, 150 mm on top of the pipe barrel and for the full width of trench excavated.

##### Contraction joint

In trenches of other than rock or fissured rock, a contraction joint consisting of a layer of bituminous felt 12 mm thick shall be formed in the concrete encasement at the face of each socket or at one face of each coupling.

##### Reinforcement

Reinforcement in concrete encasement shall be as shown on the Drawings.

#### 4.22 MARKING PLATES

##### Valve and hydrant

The Contractor shall clearly mark the position of each stop valve, scour valve, air valve and hydrant on completion of backfilling in a manner and position as approved by the Superintendent.

The marking shall be made by one of the following methods but the location of the mark or peg shall be consistent with the method(s) in use by the Water Authority. (WSAA 03 Part 3, Section 15.16.)

##### Plates on posts

Where, in the opinion of the Superintendent, a valve or hydrant is more than 3 metres from any existing wall, fence, kerb face, or post, the Contractor shall provide and set in the ground a post with the relevant marking plate fixed at the top of the post, facing the fitting.

The distance to the valve or hydrant in metres, to an accuracy of 0.1 m, shall be permanently marked on the plate with legible numbers a minimum 80 mm high.

Wooden posts are not to be used where there is evidence, by rotting or termite activity, that the integrity of the posts will be affected.

#### **Posts**

The post shall conform to the following requirements:

- The post shall be of sufficient length to be set firmly in place under saturated ground conditions.
- When installed, the post shall project 1000 mm above the ground, provided that where tall grass or crops are likely to obscure the post, its height above the ground shall be increased to 1500 mm.
- The post shall be painted with 2 coats of white enamel for exterior use.

#### **Fixed after installation**

The Contractor shall fix marking plates as soon as practicable after each valve or hydrant is installed. However, the Contractor shall temporarily cover marking plates for hydrants using masking tape or other approved cover which the Contractor shall remove on satisfactory completion of the pressure testing of the pipeline.

#### **Pavement markers**

In addition to the marking plates, the Contractor shall affix two-way reflective raised pavement markers to the road pavement and kerb, where available, in accordance with the Water reticulation code (WSAA 03 Part 4 WAT-1300, WAT-1106 and WAT-1107).

### **4.23 RESTORATION OF SURFACES**

#### **Original condition**

Carriageway pavements, pathways lawns and other improved areas shall be restored in a continuous manner to a condition equivalent to that existing at the commencement of the Works.

The Contractor shall restore any fencing removed during construction and shall restore lawns with turf cut and set aside from the original surface and with turf imported from a source approved by the Superintendent. (WSAA 03 Part 3, Section 23.)

#### **Maintenance**

The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period.

The Contractor shall maintain pavements with crushed igneous rock, gravel or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement.

#### **Temporary pavement restoration**

The Contractor shall maintain all restored surfaces in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces, notwithstanding that any deterioration of the restored surfaces, and the need for their maintenance may or may not be due to defects which become apparent or arise from events which occur during the Defects Liability Period.

The Contractor shall maintain pavements with crushed igneous rock, gravel, asphaltic concrete or other suitable material allowing for consolidation and shall then restore them to a condition equivalent to that of the original pavement.

Final restoration may include, if required by the Superintendent, the removal of temporary restoration.

#### **Backfill**

In other than roadways, the Contractor shall place the backfill sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the defects liability period in order that the surface of the completed trench may then conform to the adjacent surface.

Surplus material shall be removed and disposed of to areas arranged by the Contractor.

Where dry weather conditions have persisted after the original backfilling, including during the defects liability period, the Contractor shall take all necessary steps to consolidate the trench before removing surplus materials from the site.

#### **Disposal of surplus material**

In locations where, in the opinion of the Superintendent, surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the

vicinity of the trench to the satisfaction of the Superintendent in such a way as to avoid future erosion of the backfill and adjacent ground surfaces.

The Contractor shall maintain the backfill and adjacent ground until the expiry of the Defects Liability Period.

#### **Settlement**

Where, within public or private property, the reasonable convenience of persons will require such, the Contractor shall level trenches at the time of backfilling or otherwise as directed by the Superintendent.

The Contractor shall make good any subsequent settlement, as required by placing additional fill.

#### **Restoration**

The Contractor shall immediately restore any damaged or disturbed private property and services.

#### **Tunnelling**

Should the Contractor elect to tunnel under paving, kerb and gutter or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces, and payment shall be made for the restoration of the surfaces as though they had been removed and replaced.

The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period.

#### **Property owner advice**

The Contractor shall provide notice to affected property owners of any pending works.

---

## **5 PIPELINE TESTING AND COMMISSIONING**

---

### **5.1 PRESSURE TESTING**

#### **Mains**

The Contractor shall pressure test mains to detect leakage and defects in the pipeline including joints, thrust and anchor blocks.

#### **Notification**

The Contractor shall notify the timing of pressure tests to the Superintendent.

This action constitutes a WITNESS POINT.

The Superintendent shall advise at the time of notification by the Contractor whether the option to inspect the testing is required.

Pipelines shall be tested in sections approved by the Superintendent as soon as practicable after each section has been laid, jointed and backfilled, provided that:

If so specified, or if the Contractor so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Superintendent; and

The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast.

#### **Polyethylene and other pipelines**

Testing of Polyethylene pipelines shall be carried out in accordance with WSAA 01.

All other pipelines shall be tested in accordance with Pressure Testing.

#### **Section definition**

For the purpose of this clause, a section shall be defined as a length of pipeline which can be effectively isolated for testing, e.g. by means of main stop valves.

#### **Wet weather**

Pressure testing shall not be carried out during wet weather unless otherwise approved by the Superintendent.

#### **Field joints**

During pressure testing, all field joints, which have not been backfilled, shall be clean, dry and accessible for inspection.

### **Stop valves**

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

### **Filling with water**

Before testing a pipeline section, the Contractor shall clean it to the satisfaction of the Superintendent and fill it slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves.

In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24 hours prior to the commencement of the pressure testing.

### **Test pressure**

The hydrostatic test pressure shall be as shown on the drawings. The test pressure shall not exceed the manufacturer's recommended test pressure for the lowest rated component taking into account the components location in the pipeline.

### **Duration of test**

The Contractor shall maintain the specified test pressure as long as required by the Superintendent while the Contractor examines the whole section. In any case, the specified test pressure shall be maintained for not less than 6 hours.

### **Determining actual leakage losses**

For the purpose of determining the actual leakage losses, the Contractor shall carefully measure and record the quantity of water added in order to maintain the pressure during the period of testing.

The pressure testing of a section shall be considered to be satisfactory if:

- There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
- There is no visible leakage; and
- The measured leakage rate does not exceed the permissible leakage rate as determined by the following formula:

$$Q1 = 0.0105 D.L. (H)^{0.5}$$

where:

Q1 = permissible leakage rate (litres per hour)

D = nominal diameter of pipe (mm)

L = length of section tested (km)

H = average test head (m)

### **Rectification**

Any failure, defect, or visible leakage which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the Contractor at the Contractor's expense, provided that where a thrust block or an anchor block fails, and such thrust block or anchor block has been constructed in accordance with the Drawings, and the failure is not, in the opinion of the Superintendent, the fault of the Contractor, the cost of strengthening or reconstruction of such thrust block or anchor block and the cost of retesting shall be paid as a Variation to the Contract at such rates as are determined in accordance with the provisions of the *General Conditions of Contract*.

### **Compressed air test**

The pipeline shall not be tested using compressed air.

**WARNING:** Air testing stores significant quantities of energy in the form of compressed air, which if released by the failure of a pipe, temporary end plate, joint or block, can cause pipeline components, equipment, temporary blocks and fill materials to travel at high speed and become life threatening hazards.

### **Connection to existing network**

Connections to existing pipes carrying water shall be made at such times as will cause the least interference with the supply.

The Contractor shall make arrangements with the Water Authority or other Authority concerned for the timing of the work including the need to isolate the existing mains and notification of affected dwelling occupants.

The Superintendent shall be given five (5) working days notice of such arrangements (WSAA 03 Part 3, Section 22).

**Disinfection of pipelines**

The Contractor shall disinfect all water mains after satisfactory testing in accordance with this worksection (WSAA 03 Part 3, Section 20).

The Contractor shall adopt procedures for the disinfection of the mains with the concurrence of the Water Authority.

**6 PUMP STATIONS**

**6.1 PUMPS**

**Materials**

Pump construction materials for centrifugal end suction pumps shall comply with Table 6.1.

**Manufacturer’s warranty**

The Contractor shall provide a written warranty from the Manufacturer of the equipment.

This action constitutes a HOLD POINT.

The Superintendent’s approval of the warranty is required prior to the release of the hold point.

The Manufacturer’s warranty shall require the Manufacturer to accept liability for any defect in materials or workmanship which becomes apparent at any time within two (2) years after the date of delivery of any piece of equipment used in Work under the Contract.

**Nuts and bolts**

All nuts and bolts shall be manufactured in accordance with AS 1111 and AS 1112 150 metric series and fitted with washers beneath bolts heads and nuts as follows:

- All bolts, nuts and washers shall be stainless steel to AS 1449 and AS 2837, minimum grade 316. All bolts, nuts and washers are to be of the same grade and supplied passivated.
- All threads shall be rolled.
- All bolt heads and nuts shall be hexagonal.
- All bolts, studs, set screws and nuts for bolting flanges and other pressure containing purposes shall conform to AS 2528.
- All nuts and bolts subjected to vibration shall be fitted with lock washers or lock nuts.
- All concrete anchor bolts, nuts, locking nuts and large series washers required for the bolting down of pump set discharge bends shall be provided. These anchor bolts shall be as recommended by the equipment designer with a minimum diameter of 16 mm.
- Concrete anchor bolts shall be chemical masonry anchor type, set to their full depth, suitable for the required duty.

**Bolts and flanges**

Bolts on all flanges will protrude no more than 10 mm past the nut when tightened.

**Anti-galling, anti-seize**

The Contractor shall apply sufficient anti-seize/anti-galling material to the threads of all stainless steel fasteners. The material shall be Polytetrafluoroethylene (PTFE), either tape to AS 1272, dipped or sprayed, or molybdenum disulphide.

**Table 6.1 Construction materials for pumps**

DESCRIPTION	MATERIAL
<b>PUMP</b>	
Casing and suction bend	Cast iron AS 1830 Gr T200
Wear rings	Cast iron AS 1830 Gr T200
Impeller	316 Stainless steel AS 1449
Impeller nut	Gunmetal AS 1565-905C
Shaft	316 Stainless steel AS 2837
Shaft sleeve	Phosphor bronze AS 1565-9060/316

DESCRIPTION	MATERIAL
Neck bush, lantern ring	Phosphor bronze AS 1565-9060
Gland	Cast Iron AS 1830 Gr T200
Gland studs	316 Stainless steel AS 2837
Gland nuts	316 Stainless steel AS 2837
Fixing nuts and bolts handhole	316 Stainless steel AS 2837
Covers	316 Stainless steel AS 1449
Fitted bolts and nuts, casing and dowels	316 Stainless steel AS 2837
Forcing screws	316 Stainless steel AS 2837
Water thrower and drip tray	316 Stainless steel AS 1449
Pump set base plate	Cast iron AS 1830 Gr T200/Fabricated steel
<b>MOTOR</b>	
Motor frame and end shield	Cast iron/Mild steel
Motor terminal box	Cast iron/Mild steel
Motor fan cover	Mild steel
Motor fan	Metal
HOLDING DOWN BOLTS	316 Stainless steel AS 2837
<b>MECHANICAL SEALS</b>	
Seal faces	Tungsten carbide or equal
Springs	Nickel chrome steel
Secondary seal	Fluoro carbon or nitrile rubber

## 6.2 PRESSURE GAUGES

### Compliance

The Contractor shall install one (1) diaphragm protected, glycerine oil filled, direct mounting, bottom connection pressure gauge complying with AS 1349%rifugal pump installation.

Cases shall be fabricated from stainless steel complying with AS 1449 or bronze.

The protective diaphragm shall be suitable for dismantling for cleaning without affecting the accuracy of the gauge.

### Calibration

The gauge face shall be 100 mm in diameter and calibrated in metres head of water. The gauge shall accurately indicate the pump operating head and the pump no-flow head.

### Inclusions

Each gauge shall be supplied with the nominally sized metric equivalent of three of the following bronze fittings: gate valve, union, nipple and reducing nipple.

### Installation

Gauges and fittings shall be screwed into the pipe wall of ductile iron pipes, or pipe fittings, 150 mm and larger.

In pipework less than 150 mm, gauges and fittings shall be screwed into a tapping band. Where shown on the Drawings, the Contractor shall install a ball valve to allow removal of the gauge.

### Gauge range

The pressure gauge range for single or parallel pumps duty shall be 0 to 1.7 times the closed valve head of the pumps.

### 6.3 ELECTRICAL COMPLIANCE

#### Standards

The Works shall be in accordance with the Electrical Services Minimum Requirements contained in MEW E101 except where this worksection or the Drawings indicate otherwise.

The technical requirements detailed on the Drawings shall take precedence over the requirements of this worksection should clauses be in disagreement.

#### DPWS requirements

MEW E101 covers the general requirements for materials, workmanship, and methods of installation as follows:

- General.
- Reticulation and wiring.
- Switchboards and associated equipment.
- Accessories.
- Luminaries—Supply and installation.
- Electric motors.
- Painting, colour coding and labelling.

#### Compliance

Except where MEW E101 requires a higher standard, Works shall be carried out in accordance with AS/NZS 3000, the Service Rules of the Supply Authority, “Service and Installation Rules of NSW” produced by Department of Water and Energy and all relevant Statutory Authorities.

#### Proof of compliance

The Contractor shall supply proof of compliance with a standard or specified test. Such proof shall comprise a test certificate from an approved independent testing authority.

#### Approval of electrical designs and materials

The Contractor shall submit all designs and material to each Authority having jurisdiction for approval.

The Contractor shall arrange for each Authority having jurisdiction to inspect the Works.

The Superintendent shall be advised a minimum of 7 working days in advance of the date of any inspection by an Authority.

This action constitutes a WITNESS POINT.

The Superintendent shall advise at the time of notification by the Contractor whether the option to attend the inspections is to be exercised.

### 6.4 SWITCHGEAR AND CONTROL GEAR ASSEMBLY (SCA)

#### Approved manufacturer

The Contractor shall supply and install the SCA designed and assembled by a manufacturer approved by the Water Authority. The Water Authority is to be Contacted for the Specifications, Supply and Installation of all SCA..

### 6.5 ELECTRICAL INSTALLATION

#### Liaison

The Contractor shall liaise with the Supply Authority for the electricity supply to the pump station site.

All works are to comply with the Current Versions of

- “Service and Installation Rules of NSW” produced by Department of Water and Energy
- AS/NZ 3000 Wiring Rules, 2007

#### Facilities for revenue metering equipment

The Contractor shall be responsible for all facilities required by the Supply Authority for revenue metering equipment and the payment of all associated connection, inspection fees and capacity charges.

## 6.6 TESTING AND COMMISSIONING OF PUMP STATION

### Materials, equipment, installation and workmanship Compliance

The Contractor shall test and/or inspect all materials, equipment, installation and workmanship to prove compliance with the Specification requirements.

The submission to the Superintendent of satisfactory test results constitutes a HOLD POINT.

The approval of the Superintendent is required prior to the release of the hold point.

### Standards

Tests and inspections shall comply with relevant Australian Standards.

### Testing

Testing shall include pre-commissioning, field testing and performance testing of each part of the whole installation.

### Pre-commissioning

Pre-commissioning is the preparation of plant or equipment so that it is in a safe and proper condition and ready for commissioning and operation. It includes all aspects of plant operation such as safety, electrical, mechanical and instrumentation.

### Sequence

The Contractor shall conduct pre-commissioning in a logical sequence in accordance with the program prepared by the Contractor and approved by the Superintendent.

### Record sheets

The Contractor shall prepare pre-commissioning record sheets for each item of equipment to ensure results of tests are satisfactorily recorded and that all necessary checks or tests have been performed.

### Specific requirements for pre-commissioning

Specific requirements for pre-commissioning shall include, but are not limited to:

- Initial charges of lubricant in addition to any special lubricant requirements for initial flushing or treatment of the system or for 'running in'.
- Physical checks and tests such as completeness of assembly, rotational tests (including checking that the rotation of electrical motors is in the correct direction), alignment checks, balancing and vibration checks, temperature, pressure and flow measurements, clearances, belt alignment and tension, etc, depending on the type of equipment.
- Electrical and instrument installation tests, including motor insulation tests and checking instruments against certified instruments and correcting as necessary.
- Tests of the correct functioning of automatic and manual control and protection equipment, including simulating danger conditions, mal-operations or failures, to check that all instruments and controls function correctly. These tests shall also include adjusting instrument set points and alarm settings and proving correct operation of alarms.
- Equipment and system operating tests. The Contractor shall certify compliance of each item and submit a signed copy to the Superintendent prior to commissioning.

### Testing and recording of test results

The Contractor shall carry out pre-commissioning tests to the satisfaction of the Superintendent and shall record the results of the tests on the appropriate Pre-commissioning Record Sheet.

### Submission to Superintendent

The Contractor shall furnish the Superintendent with one signed copy of each completed Pre-commissioning Record Sheet countersigned by the Superintendent's Representative who witnessed the test.

### Commissioning

Commissioning is the running of the plant and equipment to ensure flow through the pumping system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions.

### Notification of commissioning

The Contractor shall give five (5) working days notice of the Contractor's intention to undertake commissioning and supply to the Superintendent the copies of each of the pre-commissioning record sheets and three copies of the operational and maintenance manuals at the time that notice of commissioning is given.

This action constitutes a WITNESS POINT.



The Superintendent shall advise at the time of notification by the Contractor whether the option to attend the commissioning is to be exercised.

**Approved programme**

The Contractor shall conduct commissioning in a logical sequence in accordance with a program prepared by the Contractor and approved by the Superintendent.

**Responsibility**

Throughout commissioning the Contractor shall be responsible for the test program.

**Supervision**

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

**Documentation**

The Contractor shall prepare, schedules, test record sheets and programs for approval by the Superintendent prior to each stage of the overall commissioning.

**Final testing**

The Contractor shall carry out final testing and commissioning (min. 1 day duration) of the electrical services in conjunction with the mechanical equipment (e.g. pump, etc) including setting and adjustment of equipment in accordance with MEW E101.

**Qualified personnel**

The Contractor shall arrange for all testing, commissioning and any adjustments to be carried out by qualified personnel.

**6.7 PRACTICAL COMPLETION OF PUMP STATION**

The Contractor shall fulfil the following requirements before the Certificate of Practical Completion is issued:

- Receipt by the Superintendent of a certificate of approval from the relevant statutory authorities.
- Pump station is in working order as demonstrated by the testing and commissioning.
- Approval by the Superintendent of Operating and maintenance manuals.
- Receipt by the Superintendent of as-built drawings of the pump station.

**6.8 TELEMETRY**

The Contractor shall make provision for equipment to link the pump station to the existing telemetry network to be provided by the Water Authority at the Contractor's expense.

The pump station shall operate automatically by control signals from the telemetry system. In addition, either one or any combination of pumps may operate at any one time by control signals from the telemetry system.

**6.9 OPERATION AND MAINTENANCE MANUALS**

**Information**

Manuals shall contain the following information:

- Contractor's name, address and telephone number.
- Client's Contract number, job name.
- Pump station general arrangement drawing showing pumps, motors, valves, pipework, switchboard and electrical installation.

**Pump and motor curves**

Manuals shall contain the following test curves:

- Pump witnessed test curves.
- Motor test curves.
- Motor torque/speed/efficiency characteristic curves.

**Pumps**

Manuals for pumps shall contain the following information:

- Manufacture.
- Type and model number.

- Serial number.
- Dimensioned general arrangement drawing of pump and motor.
- Sectional arrangement drawing with parts and list.
- Dimensioned sectional arrangements detailing:
  - . Maximum and minimum shaft/bearing clearance (radial)
  - . Maximum and minimum impeller/bowl clearance (radial)
  - . Maximum and minimum impeller/bowl clearance (axial)
  - . Impeller/bowl wear rings.
  - . Motor/pump coupling—type, make and model number.
  - . Mechanical seals where applicable.

#### **Motors**

Manual for motors shall contain the following information:

- Manufacture.
- Type and model number.
- Serial number.
- Dimensioned general arrangement drawing.
- Sectional arrangement drawing for submersible motor power cabling where applicable.
- Gland sealing arrangement drawing for submersible motor power cabling where applicable.
- Cables where applicable.
- Terminal block arrangement drawing where applicable.

#### **Valves**

Manuals for valves shall contain a dimensioned sectional arrangement drawing with parts and material list for all valves.

#### **Operation and maintenance**

The operating and maintenance manual shall include:

- Safe working procedures: For switching and isolating the supply and distribution system;
- Description of operation;
- Maintenance procedures: Recommended maintenance periods and procedures;
- Tools: Particulars of maintenance equipment and tools provided, with instructions for their use.
- Equipment: A technical description of the equipment supplied, with diagrams and illustrations where appropriate;
- Dismantling: Where necessary, procedures for dismantling and reassembling equipment;
- Spare parts: A list of the spare parts provided.

#### **Trouble shooting**

Trouble shooting instructions shall be included for pumps, motors, valves and SCA.

#### **Replacement procedures**

Step by step procedures for dismantling and reassembly of pumps, motors and valves using any special tools shall be detailed together with step by step procedures for replacement of wearing parts such as bearing, seals, wear rings, etc.

---

## **7 CONSTRUCTION COMPLIANCE**

---

### **7.1 WORK-AS-EXECUTED DETAILS**

The Contractor shall submit to the Superintendent work-as-executed Drawings showing the actual location and alignment of pipelines, and all pump station details together with operating and maintenance manuals (WSAA 03 Part 3, Section 24).

Details shall include the size, type, levels of pipelines, valve and hydrant chamber types and cover details, easement requirements for maintenance, pump details, switchboard equipment details and station structural details.

The Contractor shall ensure that a Registered Surveyor certifies the plans showing location and alignment.

## **7.2 ASSET REGISTER**

The Contractor shall provide records, for the Water Authority's Asset Register, to the Superintendent at the time of practical completion of the Contract.

The records are to be in a form consistent for inputting into the Asset Register as directed by the Superintendent.

## **8 MEASUREMENT AND PAYMENT**

---

### **8.1 MEASUREMENT**

Payment shall be made for all activities associated with completing the work detailed in this worksection in accordance with Pay Items 1341.1 to 1341.11 inclusive.

If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.

Concrete for valve chambers, bulkheads, thrust and anchor blocks, concrete encasement and pump stations is measured and paid in accordance with this worksection and not 0310 Minor concrete work.

Miscellaneous minor concrete work not included in the pay items in this worksection shall be in accordance with pay items described in 0310 Minor concrete work.

### **8.2 PAY ITEMS**

#### **1341.1 Excavation and backfill for water reticulation**

The unit of measurement shall be cubic metre.

The schedule rate for this Pay Item shall be an average rate to cover all types of material encountered during excavation. Separate rates shall not be included for earth and rock.

The rate is deemed to include:

- Setting out and associated survey
- Excavation, including excavation and replacement of unsuitable material.
- Backfilling and compaction, other than selected backfill, of pipes
- Restoration of surface
- Replacement for over-excavation for any reason
- Control of stormwater runoff, temporary drainage and erosion and sedimentation control.

The volumes of excavation for payment shall be computed as follows:

- Trench Width: Minimum width in Table 4.1 + 200 mm.
- Trench Depth: Average actual depth to underside of specified bedding.
- Trench Length: Actual excavation length.

#### **1341.2 Supply and lay pipe and fittings**

The unit of measurement shall be the linear metre measured along the centreline of each particular type of pipe installed.

The schedule rate shall include:

- Supply of pipe and fittings
- Wrapping pipeline
- Survey and setting out
- Bedding
- Bulkheads
- Thrust and anchor blocks
- Jointing (including connections)
- Temporary bracing and strutting of excavation
- Selected backfilling

- Quality compliance

**1341.3 Supply and install valves**

The unit of measurement shall be per 'each' stop, air or scour valve and associated chamber or box installed.

The schedule of rate for supply and install valves shall include for setting out, excavation, formwork, supply and placing concrete, supply and installation of valves, supply and installation of covers and frames, supply and installation of marker plates, backfilling and disposal of spoil off site.

It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

A separate unit rate shall be included in the Schedule of Rates for each type and size of valve.

**1341.4 Supply and install hydrants**

The unit of measurement shall be per 'each' hydrant and associated box installed.

The schedule of rate for supply and install hydrants shall include for setting out, excavation, formwork, supply and placing concrete, supply and installation of hydrants, supply and installation of covers and frames, supply and installation of marker plates, backfilling and disposal of spoil off site.

It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

A separate unit rate shall be included in the Schedule of Rates for each type and size of hydrant.

**1341.5 Connection to existing**

The unit of measurement shall be per 'each' connection to existing pipe.

The schedule rate for connection to existing shall include for all the necessary works to arrange and liaise with the appropriate Authority, cut into or otherwise modify and finish the system as shown on the Drawings.

**1341.6 Trench timbering left in place**

The unit of measurement shall be a lump sum for timber directed to be left in place by the Superintendent.

No extra payment shall be made where the Contractor uses more timber than anticipated or the timber used exceeds the size of timber required as determined by the Superintendent.

**1341.7 Concrete encasement**

The unit of measurement shall be the linear metre measured along the centreline of each particular type of concrete encasement.

The schedule rate shall include for additional excavation, formwork, reinforcement, concrete and contraction joints.

**1341.8 Pump station**

The item shall be a Lump Sum for each pump station.

The Lump Sum shall include for the setting out, excavation, preparation of foundation, formwork, reinforcement, concreting, curing concrete, backfilling, disposal of spoil off site, supply and installation of pipework, valves, fittings, access cover, ladder and cleaning up. It shall also include for temporary stockpiling prior to backfilling, control of stormwater run off and erosion and sedimentation control.

**1341.9 Water pumps**

The item shall be a Lump Sum for each water pump.

The Lump Sum shall include for the supply and installation of the system as specified and as detailed on the Drawings including suction and discharge pipework, valves, fittings, control panel and cabinet, power and control wiring and testing.

**1341.10 Commissioning**

The item shall be a Lump Sum.

The Lump Sum for Commissioning shall include for all labour, test equipment and consumables to undertake and record the full commissioning procedure for all equipment and systems, and to carry out all necessary modifications and adjustments to the system so that it operates in accordance with the Specification requirements.

**1341.11 Manuals**

The item shall be a Lump Sum.

The Lump Sum for Manuals shall include for the preparation and printing of the operating and maintenance manuals in accordance with the Specification. Necessary and appropriate 'work-as-executed' drawings shall be included.