**PINE RIVERS SHIRE COUNCIL**

**DESIGN MANUAL**

**CIVIL INFRASTRUCTURE DESIGN**

# SPECIFICATIONS

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| AusSpec | Asset Owner Specifications (Roadworks & Drainage) |
| AusSpec | Development Construction Specifications (Roadworks & Drainage) |
| PRSC 100 | Roadworks Specifications |
| **PRSC 400** | **Water Supply Specifications** |
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**PINE RIVERS SHIRE COUNCIL**

**SPECIFICATIONS**

# PRSC 400

# WATER SUPPLY SPECIFICATIONS

| | |
|---|---|
| **401** | **Water Main Pressure Pipeline Construction** |
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# PINE RIVERS SHIRE COUNCIL

## PRSC 401 - WATER MAIN PRESSURE PIPELINE CONSTRUCTION

# PRSC 401
# WATER MAIN PRESSURE PIPELINE CONSTRUCTION

## 1.0.0 PURPOSE

**1.1.0** The purpose of this specification is to set down requirements for the construction of pressure pipelines associated with water supply works.

**1.2.0** This specification does not apply to the construction of property services, water services or private fire fighting services.

## 2.0.0 SCOPE

**2.1.0** This specification shall apply to works to be constructed by contract, subcontract or direct labour.

**2.2.0** This specification shall apply to works being constructed directly by the Pine Rivers Shire Council or other authority or for a principal who will hand over the ownership of the constructed works to the Pine Rivers Shire Council or who will retain ownership.

## 3.0.0 REFERENCES

**3.1.0** The following shall apply:-

Sewerage and Water Supply Act 1949-1982 with Amendments

Standard Water Supply Law

Water Resources' Guidelines for Planning and Design of Urban Water Supply Schemes

Workplace Health and Safety Act 1995 and Regulations with Amendments.

The Manual of Uniform Traffic Control Devices

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|---|---|
| AS 1657-1992 | Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and Installation |
| AS 2124-1992 | General Conditions of Contract |
| AS 3900 | Quality Management and Quality Assurance Standards |
| AS 4373-1996 | Pruning of Amenity Trees |
| ISO 9000 | Quality Management and Quality Assurance Standards |

**3.2.0** The following shall apply when the respective materials have been specified or approved for use. Where the editions listed have been superseded or replaced, then any later copy of the standards shall apply in their place:-

| | |
|---|---|
| AS 1281-2001 | Cement Mortar Lining of Steel Pipes and Fittings. |
| AS 1289-2000 | (Set) Methods of Testing Soils for Engineering Purposes. |
| AS/NZS 4671-2001 | Steel Reinforcing Materials |
| AS 1345-1995 | Identification of the Contents of Pipes, Conduits and Ducts. |
| AS 1379-1997 | The Specification and Manufacture of Concrete. |
| AS 1449-1994 | Wrought Alloy Steels - Stainless and Heat Resisting Steel Plate, Sheet and Strip. |
| AS/NZS 1477-1999 | PVC Pipes and Fittings for Pressure Applications. |
| AS/NZS 1516-1994 | The Cement Mortar Lining of Pipelines in Situ. |
| AS/NZS 1554<br>1554.1 – 2004 | Structural Steel Welding<br>Welding of Steel Structures |
| AS 1579-2001 | Arc Welded Steel Pipes for Water and Wastewater. |

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|---|---|
| AS 1627-1997 | Metal Finishing - Preparation and Pre-treatment of Surfaces. |
| 1627.1-2003 | Cleaning Using Liquid Solvents and Alkaline Solutions. |
| 1627.2-2002 | Power Tool Cleaning. |
| 1627.4-2002 | Abrasive Blast Cleaning. |
| 1627.7-1988 | Hand tool Cleaning of metal surfaces. |
| 1627.9-2002 | Pictorial Surface Preparation Standards for Painting Steel Surfaces. |
| AS 1646.1-2000 | Elastomeric Seals for Waterworks Purposes – General Requirements. |
| AS 1726-1993 | Geotechnical Site Investigations. |
| AS 1796-2001 | Certification of Welders and Welding Supervisors |
| AS 1830-2002 | Grey Cast Iron. |
| AS/NZS 1906 | Retroreflective Materials and Devices for Road Traffic Control purposes. |
| 1906.3-1992 | Raised Pavement Markers (Retroreflective and Non-retroreflective). |
| AS 2032-1977 | Code of Practice for Installation of uPVC Pipe Systems. |
| AS 2033-1980 | Installation of Polyethylene Pipe Systems. |
| AS 2187 | Explosive - Storage, Transport and Use. |
| 2187.1-1998 | Storage |
| 2187.2-1993 | Use of Explosives. |
| AS/NZS 2280-2004 | Ductile Iron Pipes and Fittings. |
| AS/NZS 2312-2002 | Guide to the Protection of Iron and Steel against Exterior Atmospheric Corrosion. |
| AS 2518-1992 | Fusion-bonded Low-density Polyethylene Coating for Pipes and Fittings. |
| AS/NZS 2544-1995 | Grey Iron Pressure Fittings. |
| AS/NZS 2566 | Buried Flexible Pipelines |
| AS/NZS 2566.1-1998 | Structural Design |
| AS/NZS 2566.2-2002 | Installation |
| AS 2638.2 - 2002 | Gate Valves for Waterworks Purposes - Resilient Seated |
| AS 2648 | Underground Marking Tape. |
| 2648.1-1995 | Detectable Tape. |
| AS 3571-1989 | Glass Filament Reinforced Thermosetting Plastics (GRP) Pipes - Polyester Based - Water Supply, Sewerage and Drainage Applications. |
| AS 3572-2002 | Plastics - Glass filament reinforced plastics (GRP) - Methods of Test |
| AS 3578-1993 | Cast Iron Non-Return Valves for General Purposes. |

| | |
|---|---|
| AS 3600-2001 | Concrete Structures |
| AS/NZS 3678-1996 | Structural Hot-rolled Steel Plates, Floorplates and Slabs |
| AS 3680-1989 | Polyethylene Sleeving for Ductile Iron Pipelines |
| AS 3681-1989 | Guidelines for the Application of Polyethylene Sleeving to Ductile Iron Pipelines and Fittings |
| AS 3952-2002 | Water Supply Spring Hydrant Valve for Waterworks Purposes |
| AS 3972-1997 | Portland and Blended Cements |
| AS 3996-1992 | Metal Access Covers, Road Grates and Frames |
| AS/NZS 4020 | Testing of Products for Use in Contact With Drinking Water |
| AS 4041-1998 | Pressure Piping |
| AS 4087-2004 | Metallic Flanges for Waterworks Purposes |
| AS/NZS 4130-2003 | Polyethylene (PE) Pipes for Pressure Applications |
| AS 4139-2003 | Fibre-reinforced Concrete Pipes and Fittings |
| AS/NZS 4158-1996 | Thermal-bonded Polymeric Coatings on Valves and Fittings for Water Industry Purposes |
| AS 4373-1996 | Pruning of Amenity Trees |
| AS/NZS 4671-2001 | Steel Reinforcing Materials |
| AS 4680-1989 | Hot-dip Galvanised (Zinc) Coatings on Fabricated Ferrous Articles |

**3.3.0** The document "Installation of Utility Services within the Boundaries of State Controlled Roads" issued by the Department of Main Roads (latest issue) shall apply to work within the boundaries of state controlled roads.

**3.4.0** Where materials, not covered by this specification, are specified or approved for use as part of water supply works, the relevant Pine Rivers Shire Council specifications shall apply. Where no Pine Rivers Shire Council specification is available, a product approved by the Water Services Association of Australia (WSAA) and endorsed for use by the General Manager Pine water shall apply. Alternatively an appropriate Pine Rivers Shire Council approved product or other specification approved by the General Manager Pine Water shall apply.

## 4.0.0 DEFINITIONS

**4.1.0** For the purpose of this specification the following definitions shall apply:-

- **Construction** - any work necessary for the installation, testing and commissioning of a pressure pipeline. The term shall include such operations as establishment, clearing, excavation, bedding, laying, jointing, testing, flushing and sterilisation, backfilling and restoration etc. and other miscellaneous items integral to the pipeline and water supply network.

- **Premises** - any parcel of land improved or unimproved, for which there is a property description.

- **Water Main** - any conduit used for carrying, distribution, or reticulation of Potable water, which is not a property service, water service or private fire service.

- **Property Service** - the pipework (and fittings) laid and maintained by the Pine Rivers Shire Council from the water main to the property, for the purpose of providing a supply to the end user customer.

- **Rigid Pipe** - pipe manufactured from mild steel, ductile iron or cast iron.

- **Flexible Pipe** - pipe manufactured from the family of polyvinyl chloride (PVC), polyethylene (PE), glass filament reinforced thermosetting plastics (GRP), or acrylonitrile butadiene styrene (ABS).

- **PVC Pipe / Fittings** – the family of PVC pipes including PVC-M (Modified PVC), OPVC (Optimised PVC) and uPVC (unplasticised PVC) pipes approved for use in water supply pipelines.

- **Developer** - the company, organisation or person to whom, under the provisions of the Planning Scheme, approval has been given to carry out the works, and who acts as principal for the purpose of works executed by contract.

- **Consulting Engineer** - the registered professional engineering company or registered professional engineer engaged by the principal to carry out the investigation and design of the water supply works to be constructed by the principal. When engaged for the construction phase, the company or engineer shall act as superintendent for the purpose of works carried out by contract.

- **Contract, Contractor, Principal and Superintendent** - as defined in AS 2124.

- **General Manager Pine Water** - The person occupying that position within the Pine Rivers Shire Council, or their nominated representative.

- **Pine Rivers Shire Council Engineer** - The engineer employed by the Pine Rivers Shire Council to approve, supervise or inspect the works, or their nominated representative.

# 5.0.0 SPECIFICATION

## 5.1.0 WORK ON PINE RIVERS SHIRE COUNCIL CONTROLLED PREMISES

5.1.1 Before entering these premises in order to carry out approved work, the contractor shall give the superintendent and / or a Pine Rivers Shire Council engineer at least two working days notice of his or her intention to do so.

5.1.2 The contractor shall exercise due care to prevent interference or damage to improvements existing on the premises or to their satisfactory operation. These improvements may be located above or below ground.

5.1.3 The contractor shall preserve all pegs indicating the real property boundaries of the premises in the path of construction and adjacent to the works site. Should such pegs become dislodged or removed during construction, the contractor shall, at his or her own expense, employ a licensed surveyor to restore the pegs to their original position. The surveyor shall provide a plan of the restored pegs to the Titles Office, with a copy to a Pine Rivers Shire Council engineer.

5.1.4 The works site shall be restored to the satisfaction of a Pine Rivers Shire Council engineer.

## 5.2.0 WORK ON OTHER PREMISES

5.2.1 The designer shall have obtained the written approval of the owner and occupier of the premises on which works are to be carried out. Before entering these premises, the contractor shall notify the owner and occupier of the premises at least two working days in advance of his or her intention to do so.

5.2.2 The contractor and their employees shall not trespass on any premises adjoining the site of the works. A list of owners of vacant land within the site of works will be made available by a Pine Rivers Shire Council engineer at the request of the contractor.

5.2.3 The contractor shall exercise due care to prevent interference or damage to improvements existing on the premises or to their satisfactory operation. These improvements may be located above or below ground.

5.2.4 The contractor shall preserve all pegs indicating the real property boundaries of the premises in the path of construction and adjacent to the works site. Should such pegs become dislodged or removed during construction, the contractor shall, at his or her own expense, employ a licensed surveyor to restore the pegs to their original position. The surveyor shall provide a plan of the restored pegs to the Titles Office, with a copy to the Pine Rivers Shire Council engineer.

5.2.5 The premises shall be restored to the reasonable satisfaction of the owner and / or occupier of the premises. At the completion of construction and prior to the constructed works being declared practically complete, the contractor shall obtain a clearance certificate from the owner of each premise. This certificate shall indicate satisfaction at the standard of restoration.

5.2.6 Notwithstanding such clearance being obtained, the superintendent and / or a Pine Rivers Shire Council engineer may instruct the contractor to carry out further restoration work on the premises if the superintendent and/or a Pine Rivers Shire Council engineer consider that the restoration work has not been completed to a reasonable standard. Further, the contractor shall be required to return to the premises to undertake placing further backfill material or other restoration of trenches which may have settled during the defects liability period.

## 5.3.0 WORKS WITHIN RAILWAY LAND

5.3.1 The consulting engineer shall be responsible for arranging written approval from Queensland Rail to construct works under or adjacent to any railway.

5.3.2 The contractor shall submit drawings and specifications to Queensland Rail to support the application and shall comply with any conditions imposed on the works.

5.3.3 Before constructing any work under or adjacent to any railway, the contractor shall give the required notice in writing to Queensland Rail of his or her intention to commence operations. The contractor shall not commence any such work until he or she has received the written permission of the Queensland Rail, and shall conduct the whole of the works under such conditions and supervision, and with such precautions against interruption or danger to traffic as Queensland Rail may direct.

5.3.4 The contractor shall be solely responsible for any stoppages, delays or accidents arising out of or in any way attributable to his or her operations. Should Queensland Rail consider it advisable, flagmen or other personnel shall be placed on any work to be executed under, over, or near any railway or any railway land for the purpose of seeing that no danger occurs to the traffic or railway property. Such action shall not relieve the contractor of any of the responsibilities.

5.3.5 The contractor shall obtain any necessary permits and pay all fees and charges in connection with the works carried out under this section, including the cost of the flagmen or other personnel referred to above.

5.3.6 The attention of the contractor is drawn to the "Code for the Installation of Other Parties' Services and Pipelines within Railway Boundaries" or similar document issued by the Railways of Australia.

## 5.4.0 WORKS WITHIN ELECTRICITY EASEMENTS

5.4.1 Where construction works are proposed in high voltage electricity easements, the consulting engineer shall be responsible for arranging written approval from the controlling authority.

5.4.2 The consulting engineer or designer or contractor shall submit drawings and specifications to the authority controlling the easement in support of the application.

5.4.3 The contractor shall comply with any conditions imposed upon the works.

## 5.5.0 EXCAVATION UNDER STATE CONTROLLED ROADS

5.5.1 The consulting engineer or designer shall be responsible for arranging written approval from the Department of Main Roads to construct works under or adjacent to any state controlled road.

5.5.2 The contractor shall submit drawings and specifications to the department to support the application and shall comply with any conditions imposed on the works.

5.5.3 Work within the boundaries of state controlled roads shall be carried out in accordance with the current issue of the document "Installation of Utility Services within the Boundaries of State Controlled Roads" or any other documents prepared by the Queensland Department of Main Roads.

5.5.4 The contractor shall be responsible for giving the Department of Main Roads the required notice prior to the commencement of construction.

## 5.6.0 WORKS WITHIN OTHER ROADS

5.6.1 Work under road surfaces carrying vehicular traffic shall be carried out in accordance with the details shown on the Pine Rivers Shire Council standard drawings and to the requirements of a Pine Rivers Shire Council engineer.

5.6.2 The contractor shall be responsible for giving a Pine Rivers Shire Council engineer one weeks notice prior to the commencement of construction.

5.6.3 Where the works are on or beside existing roads, they shall be carried out in such a manner which causes the least interruption to traffic. Access to properties shall be maintained at all times. Where traffic shall cross open trenches, suitable bridging shall be provided.

5.6.4 The sides to trenches through roads and hard surfaced areas, including concrete, asphalt and chip sealed roads, shall be saw cut to provide a clean edge. Should the edges of saw cut surfaces crumble, the surfaces shall be saw cut again clear of the damaged area, prior to restoration.

5.6.5 Existing roads shall not be closed for more than half their width, except for short durations during placement of materials, unless approved by a Pine Rivers Shire Council engineer.

5.6.6 The pipe bedding, approved filling and backfilled material shall be compacted to prevent settlement of road surfaces in accordance with relevant clauses of this specification and the details shown on Pine Rivers Shire Council standard drawings.

## 5.7.0 WORKING HOURS

5.7.1 Construction works shall be limited to between the hours of 7am and 6pm, Monday to Friday and on Saturday between 7am and 12 noon. The contractor shall not be permitted to carry out construction on Sundays and Public Holidays.

5.7.2 Where the contractor wishes to carry out construction works outside of the above hours, they shall seek approval of the superintendent and / or a Pine Rivers Shire Council engineer in writing. The request shall include the following information:-

I. the hours the contractor wishes to work
ii. the duration or period the contractor wishes to work those hours
iii. the reason why the contractor wishes to work outside the normal hours
iv. the measures the contractor intends to put in place in order to minimise any noise or other nuisance

The request shall be considered and may be refused, accepted, or accepted subject to certain conditions.

5.7.3 Notwithstanding Clauses 5.7.1 and 5.7.2 of this specification, the contractor shall comply with the Pine Rivers Shire Council local laws regarding abatement of excessive noise in relation to residential construction sites. The contractor shall also comply with the provisions of the Environmental Protection Act (1994) and relevant Australian Standards relating to noise from a construction site.

5.7.4 Should the contractor elect to carry out work outside of the normal award hours and which, in the opinion of the General Manager Pine Water, requires the presence of a Pine Rivers Shire Council engineer, the Pine Rivers Shire Council reserves the right to recover from the contractor any cost which it incurs in making a Pine Rivers Shire Council engineer available.

## 5.8.0 INFORMATION SUPPLIED TO THE CONTRACTOR

5.8.1 The principal shall supply to the contractor sufficient details by way of drawings, specifications and schedules to allow the contractor to construct the works to the principal's requirements.

5.8.2 Such information will normally be in the form of key or layout plans, detail plans, longitudinal sections of pipelines, standard drawings, results of soil investigations at the works site and any other information which may be considered relevant.

## 5.9.0 SETTING OUT

5.9.1 The principal shall supply to the contractor sufficient information to accurately locate the works.

5.9.2 The principal shall supply the contractor with sufficient information to locate the centreline of each pipeline. The contractor will be supplied with drawings showing the alignment and level of the pipeline, the distance between changes in vertical and horizontal alignment, the positions of various fittings along the pipeline, and the diameter, level and grade of the mains.

5.9.3 In all cases the contractor will be supplied with a level datum related to conveniently placed permanent marks or temporary benchmarks. The stated origins for the level datum shall be preserved from damage or interference by the contractor. The contractor shall be responsible for any costs associated with the reinstatement of any survey mark or survey peg damaged or removed during the progress of the works.

5.9.4 It shall be fundamental to the contract, that the positions of water mains in relation to the boundaries of premises and/or easements and to the improvements thereon shall be maintained unless authorised otherwise by the superintendent and / or a Pine Rivers Shire Council engineer in writing.

## 5.10.0 MATERIALS AND WORK STANDARDS

5.10.1 The contractor shall supply all the materials required to complete the works in accordance with the issued drawings, specifications and schedules. The materials supplied shall comply with the relevant Australian Standards and relevant Pine Rivers Shire Council Specifications and, where necessary, shall be approved for use by the General Manager Pine Water.

5.10.2 All materials used shall be of new and unused material and entirely suitable for use for the purposes intended.

5.10.3 All materials shall be suitable for use and contact with drinking or potable water. Materials which are unsuitable for this use will not be accepted.

5.10.4 Unless the manufacturer has an approved quality system in place, all manufactured items shall be inspected and tested at the place of manufacture by an appropriately accredited inspecting and testing authority.

5.10.5 The contractor shall employ experienced workers and trades persons on all types of work. The standard of work shall be such as to allow the works to be used for their intended purpose over their expected working life. Licensed trades persons shall be employed on those works governed by statutory regulations.

5.10.6 Where supplier / manufacturer accredited courses are offered for use of their materials and components, and these are being used in the works, the contractor shall ensure at least one person so accredited is involved with that element of the works at all times.

5.10.7 Where they exist, construction shall be carried out to relevant Australian Standards.

## 5.11.0 PIPES

5.11.1 The pipe materials and their structural requirements shall be as set out in the specifications and drawings. Pipes shall be provided with flexible joints in accordance with the relevant Australian Standards unless otherwise stated.

5.11.2 For the purpose of establishing construction standards, pipes shall be classified as either rigid or flexible. For details of the classifications of pipes refer to the relevant Pine Rivers Shire Council specification definitions.

## 5.12.0 HANDLING OF PIPES, VALVES AND FITTINGS

5.12.1 In handling pipes and fittings during laying, transporting or during any other process, the greatest care shall be exercised to avoid damage to the pipe or fitting or coating. Under no circumstances shall a pipe be lifted by unprotected slings, levered or moved by implements without protecting pads. Slings shall be of a broad webbing material, selected in accordance safe lifting requirements, and be of a width so as to adequately support the pipe without damaging any protective coatings. Where special lifting devices or methods are recommended by manufacturers, these shall be adhered to. Lifting forks shall not be permitted.

5.12.2 Every care shall be taken during loading, stacking, carting and handling of pipes, fittings or materials. On no account shall pipes or fittings be dropped off trucks or allowed to collide with one another when rolled down skids.

5.12.3 Where pipes are lowered on to the ground they shall rest on padded bolsters, padded ramps or on padded cradles. Mounds of sand or soft earth as supports may be acceptable, subject to approval from the superintendent and / or a Pine Rivers Shire Council engineer. Fittings are to be lowered to ground and shall not to be thrown or dropped.

5.12.4 Any damage occurring to the pipe, fitting or coatings shall be made good by the contractor in a manner satisfactory to the superintendent and / or a Pine Rivers Shire Council engineer.

## 5.13.0 COATING OF VALVES, PIPEWORK, FITTINGS AND FABRICATED ARTICLES

5.13.1 Ductile iron pipes and fittings laid underground require no additional external paint treatment, but shall be wrapped with polythene sleeving applied in accordance with AS 3681.

5.13.2 Pipes, valves, fittings other components to be installed above ground, and in pits or chambers, and which have not been supplied with a thermal bonded polymeric coating shall be painted in accordance with the relevant clauses of this and relevant Pine Rivers Shire Council specifications. An approved DENSO coating system or equivalent may be accepted by a Pine Rivers Shire Council engineer.

5.13.3 All fabricated items not manufactured of all stainless steel, or supplied with a thermally bonded polymeric coating, and which are to be located above ground or in pits or chambers shall be painted, or hot dip galvanised in accordance with the relevant clauses of this and relevant Pine Rivers Shire Council specifications. An approved DENSO coating system or equivalent may be accepted by a Pine Rivers Shire Council engineer.

5.13.4 Hot dip galvanising shall be carried out in accordance with AS 4680, after final fabrication of the component.

5.13.5 Before painting, components shall be treated externally by abrasive blast cleaning followed by painting with an approved system as detailed in AS/NZS 2312, reference LP1-A or LP2-A as appropriate to the installation location.

5.13.6 <u>ABRASIVE BLAST CLEANING</u>

i. The surfaces to be blast cleaned shall be dry abrasive blast cleaned to a metal finish in accordance with AS 1627-Part 4 and AS 1627-Part 9 using one of the following methods:-

- grit blasting using compressed air nozzles
- grit blasting using centrifugal wheels
- sand blasting using compressed air nozzles

ii. The articles shall be cleaned by abrasive blast to a surface standard at least equal to Class 2½ as defined by AS 1627 - Part 4.

iii. Metallic abrasive, where used, shall comprise cast iron, cut wire or grit and shall be hard, sharp and free from dust. The maximum particle size shall be not larger than that passing through 1.18 mm Australian Standard Sieve.

iv. Non-metallic, silica free and silica material shall not be reused in the blasting operation.

v. All free oil and moisture shall be effectively removed from the air supply lines of all blasting equipment using adequate filters and driers.

vi. After blasting, the surface shall be brushed or blown down with clean dry air (using driers and oil mist filters in air lines), or vacuum cleaned to remove all blast products and abrasives from the entire surface including pockets and corners.

vii. Blast cleaning operations shall not be performed on objects which have a surface temperature which is less than $3^0$ C above the dew point of the ambient temperature, or when the humidity is calculated using a hygrometer, the wet bulb temperature differs from the dry bulb temperature by less than seven and a half percent (7½%) of the dry bulb temperature.

viii. The cleaned surfaces shall be kept free of all contamination before painting and shall not be touched by bare hands or other bare parts of the body.

ix. Any areas which become contaminated shall be immediately solvent cleaned in accordance with AS 1627 - Part 1.

x. Any surface which has been abrasive blast cleaned shall be coated within four hours or less of blasting depending on climatic conditions.

xi. All reference to the standard surface preparation shall be to AS 1627 - Part 4 Section 1.4 and AS 1627 - Part 9.

5.13.7 PAINTING

i. Where fabricated articles are not specified or shown on the drawings to be galvanized or hot dip galvanized, they shall be painted.

ii. Proposed paint systems shall be submitted to the superintendent and / or a Pine Rivers Shire Council engineer for approval before use. Full details of the paint manufacturers' specifications, which shall include details of methods of application, dry film thickness, pot life, drying time, recoating time, thinners and compatibility between primer and top coats shall be submitted.

iii. For wetted surfaces, the paint system shall be suitable for continuous immersion and, in the case of potable water, shall be approved by the Government Paint Committee for that purpose. The metalwork shall be painted with an approved system as detailed in AS 2312, reference LP1-A, i.e. primed with an inorganic zinc silicate with a minimum dry film thickness of 65 microns and maximum of 75 microns, followed by two coats of high build catalysed epoxy paint, the two coats being different shades or colours. Total dry film thickness shall be not less than 325 microns. Micaceous iron oxide may be incorporated into the first of the two coats to assist bonding.

iv. For other surfaces, the steelwork shall be painted with an approved system as detailed in AS 2312, reference LP2-A, i.e. primed with an inorganic zinc silicate with a minimum dry film thickness of 65 microns and maximum of 75 microns, followed by two coats of high build catalysed epoxy micaceous iron oxide paint, the two coats being different shades or colours. Total dry film thickness shall be not less than 325 microns.

v. The final external colour of painting on pipework and fittings shall be those called for in AS 1345, according to the use of the pipeline. The paint colour proposed for items other than pipework and fittings shall be submitted to and approved by a Pine Rivers Shire Council engineer before application.

## 5.14.0 CARTAGE

5.14.1 The contractor shall cart all materials to their appropriate position in the pipeline. This cartage shall include all necessary loading and unloading.

5.14.2 In the distribution of any pipes, fittings, valves or other material along streets, roadways or easements, care shall be taken not to cause any blockage or hindrance to drainage or traffic of any sort.

## 5.15.0 PIPE BEDDING

5.15.1 Material used for pipe bedding shall provide adequate support to the bottom and sides of pipes under the conditions reasonably expected to occur during the working life of the pipeline.

5.15.2 The pipe bedding used shall be a non cohesive granular material approved by a Pine Rivers Shire Council engineer and its grading shall comply with the limits in Table 5.0, unless otherwise directed by a Pine Rivers Shire Council engineer.

**Table 5.0**

| Sieve size | Percentage Passing |
|---|---|
| 9.50 mm | 100 |
| 4.75 mm | 95 - 100 |
| 2.36 mm | 75 - 95 |
| 1.18 mm | 30 - 80 |
| 0.60 mm | 10 - 40 |
| 0.425 mm | 5 - 20 |
| 0.30 mm | 2 - 10 |
| 0.15 mm | 0 - 5 |

5.15.3 Sand for pipe bedding shall be coarse grained, shall consist of clean, hard, durable uncoated grains, not more than 20% passing a 425 micron sieve, and shall be suitable for the particular trench conditions. This material would be expected to be suitable for both dry and wet conditions. Sharp, angular material shall not be used to bed flexible pipes.

5.15.4 Materials which occur naturally at the site of the works may be suitable for bedding subject to approval from a Pine Rivers Shire Council engineer. Such material shall consist of a uniformly graded sandy loam or other approved material having all particles passing a 9.50 mm sieve.

5.15.5 Pipe bedding shall be placed over the full width of the trench in layers not exceeding 150 mm compacted thickness and compacted by tamping, rolling or vibration to achieve a minimum Density Index (DI) of 65.

## 5.16.0 APPROVED FILLING

5.16.1 Approved filling is the filling which is placed immediately on the pipe or pipe bedding to a depth of not less than 300 mm above the pipe. The purpose of the approved filling is to provide protection to the installed pipeline against damage from heavy objects which may fall into the trench or be contained in material being replaced in the trench.

5.16.2 Approved filling placed above a full surround of pipe bedding shall therefore be free from particles which may be retained on a 30 mm sieve. It is intended that approved filling shall be obtained from material occurring naturally at the site of the works unless otherwise directed by a Pine Rivers Shire Council engineer.

5.16.3 Approved filling placed against a rigid pipe barrel shall be non-cohesive and free from any particles which may be retained on a 19.5 mm sieve.

The characteristics of a suitable approved fill material shall be that It shall compact free of cavities or voids to the standards given in Clause 5.17.3 of this specification. It shall be free from hard pointy stones and shall contain sufficient fines material, but not be of all fines or silt material. The material shall be generally free from vegetable mater.

5.16.4 A Pine Rivers Shire Council engineer may require that rigid pipes be laid in a pipe bedding surround where he or she is not satisfied with the quality of material proposed to be used as approved filling.

5.16.5 Approved filling shall be placed over the full width of the trench in layers not exceeding 300 mm compacted thickness and compacted by tamping, rolling or vibration to a minimum relative dry density, or minimum density index (DI) as given in the backfill compaction table in Clause 5.17.3 of this specification.

## 5.17.0 BACKFILLING

5.17.1 Backfill of trenches between the top of the approved filling and the surface shall be generally obtained from material occurring naturally at the site of the works unless otherwise directed by a Pine Rivers Shire Council engineer.

5.17.2 The characteristics of a suitable backfill material shall be that it shall compact free of cavities or voids to the standards given below. It shall be free from hard pointy stones and shall contain sufficient fines material, but not be of all fines or silt material. The material shall be generally free from vegetable mater.

5.17.3 Backfill shall be placed over the full width of the trench in layers not exceeding 300 mm compacted thickness and compacted by tamping, rolling or vibration to the standard provided in Table 5.1.

**Table 5.1**

| BACKFILL COMPACTION | | |
|---|---|---|
| Allotments | | |
| - residential | 95 % standard | DI - 65 minimum |
| - commercial | 98 % standard | DI - 70 minimum |
| Verges and pathways | 95 % standard | DI - 65 minimum |
| Roads | | |
| - Base course | 98 % modified | Not applicable |
| - Sub-base | 95 % modified | Not applicable |
| - Blanket course | 95 % modified | Not applicable |
| - Subgrade - Top 300 mm | 100 % standard | DI - 80 minimum |
| - Balance | 95 % standard | DI - 65 minimum |

5.17.4 Unless otherwise approved by a Pine Rivers Shire Council engineer, the frequency of testing to confirm compliance with the requirements of Table 5.1 shall be the greater of:-

i. where only one layer of material is required, one test per 80 m of trench or part thereof; or
ii. one test per 40 m of trench per two layers of compacted backfill (total compacted thickness not exceeding 600 mm); or
iii. pavement material shall be tested at the rate of one test per 40 m of trench per course or layer of pavement material.

## 5.18.0 SAND FILLING OF TRENCHES UNDER ROAD PAVEMENTS

5.18.1 Sand filling shall be used to backfill trenches under existing road pavements or other specific locations as required by a Pine Rivers Shire Council engineer. Refer to the Pine Rivers Shire Council standard drawing and Section 5.41.0 of this specification for construction of trenches under roadways. Samples of the sand proposed to be used by the contractor shall be submitted to the superintendent and / or a Pine Rivers Shire Council engineer for approval. The required characteristic of the sand is that its particle size distribution will allow its consolidation to a minimum density index (DI) of 65 by saturation and vibration.

## 5.19.0 IMPORTED FILLING

5.19.1 Imported filling shall be used where approved filling is specified and is not obtainable from excavation within the works site. It shall possess characteristics similar to those specified for approved filling.

## 5.20.0 CONCRETE

5.20.1 Concrete used for the construction of structures shall be in accordance with the relevant Pine Rivers Shire Council specification.

5.20.2 Concrete used for the construction of thrust blocks and restoration of surfaces shall be Class N25 in accordance with AS 1379.

5.20.3 Concrete used for in Types 2 and 3 constructions and in other situations as directed by the Pine Rivers Shire Council shall be Class N25 in accordance with AS 1379.

5.20.4 Lean mix concrete used for backfilling trenches under existing roads shall be a no slump (20:1 mix) in accordance with AS 1379.

5.20.5 Concrete shall be transported, placed, compacted and cured in accordance with AS 3600.

5.20.6 Forms shall be used for all concrete work where surfaces and edges are visible. Edges shall be straight and true. Surface finish shall be even and regular - refer to the Pine Rivers Shire Council specification 403 for "Plain and Reinforced Concrete Works for Water Supply".

## 5.21.0 CAST IRON COVERS AND FRAMES

5.21.1 Covers and frames for valves, air releases, chambers and other structures shall be grey iron or ductile iron to the details shown on project drawings or the Pine Rivers Shire Council standard drawings unless otherwise approved by a Pine Rivers Shire Council engineer. Multi-part cover systems with removable beams which provide a full opening are permitted.

5.21.2 Cast iron covers used in roadways or other areas subject to vehicular traffic shall be heavy duty covers complying with Class D of AS 3996.

5.21.3 Cast iron covers used in areas not subject to vehicular traffic shall comply with Class B of AS 3996.

5.21.4 Covers shall be set flush with the surface of the pit or chamber, free from any protrusions and shall provide a watertight installation. The lifting rebates shall be plugged with plastic inserts supplied by the manufacturer. Care shall be taken that concrete infill does not spill into lifting rebates, and any concrete which does shall be removed immediately.

## 5.22.0 WATER REQUIRED FOR WORKS

5.22.1 Reticulated water shall not be used for general earthworks.

5.22.2 The contractor shall make the necessary arrangements with the superintendent and / or a Pine Rivers Shire Council engineer to obtain water for testing or filling.

5.22.3 The contractor shall not use a standpipe on a hydrant until such time that an application has been made to the Pine Rivers Shire Council, and a permit issued for the use of a hydrant. Any fees or charges imposed for the use of a standpipe or for the water used shall be paid by the contractor.

5.22.4 The contractor shall abide by any restrictions imposed on the use of water by a Pine Rivers Shire Council engineer. The Pine Rivers Shire Council may impose a charge for water used if the contractor is deemed to be wasting water.

## 5.23.0 TIMBER

5.23.1 All timber used for trench shoring and the restoration of timber structures shall be suitable for the use. The timber shall be thoroughly seasoned, sound, straight and free from sapwood, large loose knots, wanes, shakes, gum veins, cores and other defects.

5.23.2 Timber used for restoration shall be cut, matched and framed in a tradesman like manner. The timber shall be properly chamfered and shall hold to true dimensions when fixed in position.

5.23.3 A Pine Rivers Shire Council engineer may direct that timber used in trench shoring shall remain in place in the trench in order to protect adjoining improvements.

## 5.24.0 NATURE OF GROUND

5.24.1 Where the principal has undertaken a sub-soil testing programme on the site of the works, that information shall be made available to the contractor. It shall be the contractor's responsibility to interpret the information supplied.

5.24.2 In the case of water mains, the testing may be restricted to a limited number of positions which were accessible to the drilling crew. Therefore, it should not be assumed that the available information represents all the sub-soil conditions which may be encountered.

5.24.3 The contractor shall be deemed to have satisfied themself as to the nature of the ground at the time they made the offer to carry out the works including the type of material to be excavated and sub-surface conditions.

## 5.25.0 CLEARING

5.25.1 The contractor shall take not of any permit or approval conditions regarding limitations on the extent and nature of clearing. Permits may contain conditions established by the Pine Rivers Shire Council, and / or State Government department.

5.25.2 Before commencing excavation the contractor shall agree with the superintendent and / or a Pine Rivers Shire Council engineer on any measures to protect or to temporarily remove any improvements which may exist on or adjacent to the pipe centreline.

5.25.3 Prior to commencing clearing, grubbing and stripping operations, all erosion and siltation control measures and devices are to be established in place.

5.25.4 All trees, shrubs, stumps and roots which, in the opinion of the superintendent and / or a Pine Rivers Shire Council engineer, are likely to obstruct or damage the works, shall be removed and disposed of and the ground surface restored. All holes made by clearing shall be filled with sound material in an approved manner.

A Pine Rivers Shire Council engineer may require the works to be constructed so that certain trees or other flora shall be preserved without damage and without interference to their limbs and roots. Trimming of trees and shrubs may be agreed to by a Pine Rivers Shire Council engineer, and shall be carried out by the contractor in a manner which will minimise the permanent damage to the trees or shrubs and in accordance with AS 4373. The superintendent and/or a Pine Rivers Shire Council engineer may direct that hand excavation be carried out adjacent to selected trees in this regard.

5.25.5 Prior to excavation, existing topsoil and turf shall be removed and stockpiled. The stockpiled topsoil shall be replaced over the completed works to the satisfaction of the superintendent and / or a Pine Rivers Shire Council engineer. Where areas are designated for re-seeding the topsoil shall be tined to a depth of 100 to 150 mm.

5.25.6 Areas to be cleared and grubbed shall be limited to the minimum necessary for the completion of the works. The contractor is to ensure that any clearing for the operation of machinery is minimised through the use of the smallest available equipment which will effectively carry out the works. The contractor shall exercise every care and where possible, shall preserve adjacent amenity trees, fruit trees, ornamental trees and shrubs. Where pipelines pass through lawns and elsewhere when directed by the superintendent and/or a Pine Rivers Shire Council engineer to do so, the contractor shall carefully cut and stack turfs which shall be replaced when the work is completed. The stacked turf shall be kept moist and replaced as quickly as possible.

5.25.7 The contractor shall be responsible for claims for loss and damage resulting from the unapproved removal of or damage to trees and other flora.

5.25.8 The contractor shall be responsible for carting and disposal of cleared trees and vegetation removed in accordance with this section. These shall be disposed of by chipping, milling or other approved means or dumped at approved sites in accordance with the Pine Rivers Shire Council local laws and policies. Vegetable mater shall not be disposed of by burning unless it is specified elsewhere that burning shall be permitted.

Disposal of soil and vegetable mater at the Pine Rivers Shire Council refuse facilities may call for the payment of fees, and all fees shall be paid by the contractor.

## 5.26.0 COMMON AND ABUTTING TRENCHES

5.26.1 Water mains shall be laid on the correct alignment indicated for water mains as shown in the Pine Rivers Shire Council standard drawings, or on an alternate alignment as approved by the Pine Rivers Shire Council General Manager Pine Water.

5.26.2 Where water mains are laid in trenches which have been excavated to a width which is sufficient to accommodate other services on their standard alignment in addition to the water main, the water main section of the trench shall be excavated deeper, and the main laid deeper than other services in order to achieve an undisturbed trench wall for the construction of thrust blocks.

5.26.3 A minimum horizontal separation of 200 mm shall be maintained between water mains and all other services except where other services cross the water main transversely. Other services shall not cross water mains at acute angles and extending over long distances.

## 5.27.0 EXCAVATION

5.27.1 Before commencing work on any pipeline, the contractor shall establish the centre of the pipeline, offset any level pegs which may be located on the pipe centreline, and locate any underground services which may be present. The contractor shall make provision for the safe passage of foot and vehicular traffic during construction, and install appropriate signs as required by the superintendent and / or a Pine Rivers Shire Council engineer, or the Manual of Uniform Traffic Control Devices.

5.27.2 Excavation shall be performed in open cut unless otherwise ordered or approved by the superintendent. All excavation shall be made to the lines, grades and levels shown on the approved drawings unless otherwise approved by a Pine Rivers Shire Council engineer. Care shall be taken to ensure that excavation is sufficiently deep at pipe sockets to allow a minimum clearance of 75 mm between collar and bottom of trench.

5.27.3 All trenches, shafts, tunnels and drives shall have vertical sides, except that the superintendent and/or a Pine Rivers Shire Council engineer may approve of open cut trenches in which the sides above a level of 300 mm above the top of the pipe are battered from the vertical and, if sheeted, the clear width between the trench sheeting shall correspond with the dimensions shown for trenches, shafts, tunnels and drives.

5.27.4 Trenches shall not be excavated wider than the standard widths shown on the drawings, except with the written approval of the superintendent and/or a Pine Rivers Shire Council engineer who will take into account the depth of trench, type of pipe bedding, class of pipe and type of backfilling material. If the contractor excavates the trench wider than the approved width (due to collapse of the trench walls or for any other reason), then the contractor shall provide stronger pipes and / or more effective bedding and consolidation as ordered by the superintendent and/or a Pine Rivers Shire Council engineer.

5.27.5 Sharp points of rock or other hard material which project above the general level of the bottom of trenches are to be removed. Any cavities in the bottom of trenches shall be filled with selected material, and compacted properly to grade. Trenches shall be kept free of all water, and rubbish, and maintained in a proper condition for pipe laying.

5.27.6 Where the contractor has excavated a trench deeper than required, he or she shall make good the over-excavation with compacted sand, concrete or such other materials as directed by the superintendent and / or a Pine Rivers Shire Council engineer.

5.27.7 Where the depths shown on the drawings are to the pipe inverts, the contractor shall allow for the additional depth of excavation required for the bedding under pipes.

5.27.8 All surplus spoil shall be removed from the site and stacked or spread as directed, or as specified in the job specification and shall not be disposed of in any other manner. Any material which is removed or falls beyond the limits of the excavation shown shall be removed by the contractor at his or her own expense.

5.27.9 Spoil shall not be placed on any property in Pine Rivers Shire that is external to the site of the works without prior written application and approval from the Pine Rivers Shire Council under the Pine Rivers Shire Council local laws and / or planning scheme requirements.

5.27.10 The contractor shall ensure that the work site is maintained as a safe working area and that the requirements of the Workplace Health and Safety Act and Regulations are complied with at all times.

The contractor shall indemnify the principal and / or the Pine Rivers Shire Council against any costs arising out of any events occurring on the works.

5.27.11 The contractor shall supply all sheeting, waling, props and wedges which are necessary to secure all open trenches or tunnels. The superintendent and / or a Pine Rivers Shire Council engineer may order the contractor to cease excavation should he or she consider that a dangerous situation exists. The trench shoring system shall be certified by a suitably qualified person in accordance with the Workplace Health and Safety Act.

5.27.12 The contractor shall leave a clear space of not less than 600 mm between the edge of the excavation and the inner toe of the spoil bank. Materials shall not be stacked within 1 m of the edge of any excavation. Excavated materials shall not be placed against the walls of any

building or fence without the written permission of the owner of such building or fence.

5.27.13 The contractor shall do all work necessary to divert any water likely to interfere with the progress of the works, to keep the excavations free from water while the works are in progress and prevent any damage to the works by water due to floods or other causes. Any work or material damaged by water shall, if ordered, be taken up and replaced with fresh material by the contractor at his or her own cost.

5.27.14 The contractor shall provide, where considered necessary in the opinion of a Pine Rivers Shire Council engineer, sediment traps on the discharge line of each dewatering pump, to prevent the deposit of sediment in channels and stormwater drains.

5.27.15 Dewatering shall be carried out by methods which cause no damage to the works or to adjacent property.

5.27.16 The contractor shall ensure that their employees do not, by walking on unprotected trench bottoms, cause puddling or other damage to the material of the trench bottom, or in any other way bring about a reduction in the bearing capacity of the material. In the event that such capacity is reduced, the contractor shall without any additional payment therefore, make good the trench bottom to the satisfaction of, and by such means as, the superintendent and / or a Pine Rivers Shire Council engineer may direct. Should the contractor place gravel under Type 1 bedding to satisfy the requirements of this clause, the cost of the gravel and its placement shall be the responsibility of the contractor.

## 5.28.0 TUNNELLING

5.28.1 Where tunnelling is approved, the maximum distance between adjacent shafts shall be determined to the satisfaction of a Pine Rivers Shire Council engineer. Pipes shall not be laid until the tunnel between adjacent shafts has been holed through and finished to the required line, level and grade.

5.28.2 In all underground workings, the contractor shall take precautions prescribed in respect of mines and shall comply with all regulations applicable to such works.

5.28.3 The dimensions of the tunnel and the installation of the tunnel support system shall be as agreed to the satisfaction of a Pine Rivers Shire Council engineer. Adequate working space to bed and lay pipes shall be provided.

## 5.29.0 ROCK

5.29.1 For a schedule of rates contract only, the principal may recognise that rock can be classified separately from other materials and may make an additional payment for its excavation in a trench if included in the schedule of rates.

5.29.2 For this purpose only, rock shall be defined as a material which has a rock strength rating classified as “HIGH” or greater in accordance with the definitions and systems outlined in AS 1726.

5.29.3 The superintendent and / or a Pine Rivers Shire Council engineer are to be present with the contractor when measuring the quantity of rock excavated.

## 5.30.0 BLASTING

5.30.1 Blasting may only be permitted subject to the approval of the superintendent and / or a Pine Rivers Shire Council engineer, who shall have the right to limit the sizes of the charges used and to fix the hours of the day or night within which blasting may be carried out.

5.30.2 Before using any explosives, the contractor shall obtain the necessary permits and instructions from the relevant authorities and issue all appropriate notices. The contractor shall be wholly responsible for any damage to life or property and shall take at his or her sole risk every precaution to carry out such operations. The contractor's public indemnity insurance shall provide for claims for personal injury, death or property damage resulting from blasting.

The contractor shall indemnify the principal and / or the Pine Rivers Shire Council against any action, claim or demand resulting from injuries to, or death of, persons, or damage to property resulting from blasts or explosions.

5.30.3 When using explosives, the contractor's methods and operations shall conform with the:-

(a) Explosive Act 1952 - 1981, including delegated regulations; and
(b) Standards Association of Australia Explosive Codes:-
    i. AS 2187, Part 1 - Storage
    ii. AS 2187, Part 2 - Use of Explosive
(c) conditions of any permits including subsequent endorsements.

5.30.4 The contractor shall employ a licensed and experienced shot firer to handle, load, and set off charges. The contractor shall provide written advice to the superintendent and / or a Pine Rivers Shire Council engineer of the shot firer's name and license number at least one day prior to blasting work commencing.

All blasting operations, including the depth and size of holes and the size and characteristics of charges, shall be subject to review by the superintendent and / or a Pine Rivers Shire Council engineer.

5.30.5 The contractor shall take all necessary precautions to prevent the flight of fragments, to prevent damage to property or injury to persons and to prevent any member of the public on any adjacent land or thoroughfare whether private or public from being exposed to danger.

Explosives shall not be used within 3 m of the boundary of any land unless permission is granted from the superintendent and/or a Pine Rivers Shire Council engineer. Permission may be granted provided that the superintendent and / or a Pine Rivers Shire Council engineer is of the opinion that there is no increase of risk of damage to property or injury to persons, and such permission may be subject to certain conditions.

5.30.6 The contractor shall give sufficient warning to the general public and employees when blasting operations are in progress.

## 5.31.0 SERVICES

5.31.1 The contractor shall note the presence of existing underground or overhead services in public and private premises on the works site. Special care shall be taken in the vicinity of all services.

5.31.2 The locations of some services given on plans are based on the information supplied by the respective authorities where such information is available. It is to be clearly understood that the information regarding these services are tentative only with respect to both details of services shown and the existence of other services not shown. The superintendent and / or a Pine Rivers Shire Council engineer does not warrant the completeness of any information given, and the contractor is required to make enquiries to all relevant authorities regarding the presence of underground services.

5.31.3 The contractor shall verify the position of each underground service with the relevant Authority before he or she commences excavation. The contractor shall pre-locate the services as to depth, alignment and extent or size, so as to ensure such services are not adversely affected. **Hand excavation shall be used in close proximity to such services until the exact location is determined.**

5.31.4 Trenches or excavations containing underground services shall be backfilled so that the subgrade is restored as nearly as possible to its original state of compaction. Where selected backfill has been placed by other utilities and has had to be removed, it shall be replaced by the same type of selected material. All backfill shall be carefully deposited in the trench and around the utility service in layers and adequately compacted by appropriate hand rammers and tampers, or by use of effective mechanical equipment.

5.31.5 Extra care shall be taken by the contractor to re-compact excavations near existing underground pipework so that foundations of that pipework are restored.

5.31.6 The contractor shall be responsible for any damage caused to existing underground services. In case of failure or damage, repairs shall normally be carried out immediately by the contractor. If there is any delay, the superintendent and / or a Pine Rivers Shire Council engineer will arrange for repairs to be carried out and the full cost of such repairs shall be borne by the contractor. If in the opinion of the superintendent and / or a Pine Rivers Shire Council engineer the failure or damage causes an emergency situation, then remedial action will be taken by the superintendent and / or a Pine Rivers Shire Council engineer and the full cost of such action shall be borne by the contractor.

5.31.7 Should the contractor find that any existing services require alteration, the contractor shall bring this to the attention of the superintendent. Any alterations to existing services ordered by the superintendent and / or a Pine Rivers Shire Council engineer shall be carried by the principal at no cost to the contractor.

5.31.8 Claims for payment or extension of time as a result in delays in alterations to services will not be accepted.

## 5.32.0 LAYING AND JOINTING PIPES - GENERAL

5.32.1 All mains shall be laid to such lines, gradients and levels as are shown on the drawings or as may be otherwise directed by the superintendent and / or a Pine Rivers Shire Council engineer. It is the contractor's responsibility to preserve uniform gradients and correct alignment. Abrupt changes of grade, which may result from irregularities of the existing surface, shall be avoided.

5.32.2 Where shown on the drawings, special bends shall be provided for effecting horizontal or vertical changes of direction. Where such bends are not shown on the drawings or required by a Pine Rivers Shire Council engineer, changes of direction shall be effected by angling the

pipe joints.

5.32.3 No joint shall be angled to such an extent as to impair its effectiveness and tightness.

5.32.4 When making a joint, pipes shall always be in line and, if required, deflection made after making the joint. The deflection shall not be greater than the maximum value recommended by the pipe manufacturers.

5.32.5 Pipe joints shall not be made and cast into walls of pits, chambers, or thrust blocks without approval from the superintendent and a Pine Rivers Shire Council engineer, except where shown on the Pine Rivers Shire Council standard drawings.

5.32.6 A ductile iron or cast iron spigot shall not be pushed into a PVC socket.

5.32.7 Pipes shall be cut (by the methods specified herein) where and in such lengths as necessary to conform to the horizontal and vertical alignment shown on the drawings.

5.32.8 Before laying, all pipes and fittings shall be thoroughly cleaned of all dirt on the inside and the greatest care must be exercised to prevent dirt or foreign matter entering the pipes during the operation of laying and jointing.

5.32.9 All open ends shall be protected against the ingress of dirt or foreign matter, by the use of plugs in a manner satisfactory to the superintendent and / or a Pine Rivers Shire Council engineer.

5.32.10 The pipe bedding and backfilling shall be carried out with the relevant construction type as indicated on the Pine Rivers Shire Council standard drawing and as described in relevant sections of this specification.

5.32.11 Unless otherwise indicated on the drawings or ordered by the superintendent and / or a Pine Rivers Shire Council engineer, water mains shall be laid as Type 1 construction.

5.32.12 Where pipe materials have an internal protective lining, any damage to the lining made during cutting etc. is to be repaired and made good in accordance with the manufacturer's specifications before use.

5.32.13 The continuity of any external protective coating shall be tested in accordance with the manufacturer's specifications to ensure its integrity. Where pipe materials have an external protective coating, any damage to the coating shall be repaired and made good in accordance with the manufacturer's specifications.

5.32.14 All ductile iron pipe, and ductile iron or cast iron fittings shall be sleeved with polyethylene sleeving using the procedures given in AS 3681.

5.32.15 PVC pipes and fittings shall be laid in accordance with AS 2032.

## 5.33.0 JOINTING PIPELINES - FLEXIBLE JOINTS

5.33.1 DUCTILE IRON PIPES - SPIGOT AND SOCKET RUBBER RING JOINTS

The contractor shall ensure that:-

i. All pipe jointing is carried out in accordance with manufacturers recommended

procedures.

ii. Before assembling the joint, the spigot and interior of the socket shall be thoroughly cleaned. The gasket shall be wiped clean, flexed in accordance with the manufacturer's instructions, and then placed in the socket with bulb leading. When inserting 750 mm size gaskets, flexing in two places is necessary. The groove in the gasket shall be located on the retaining bead in the socket and the retaining heel of the gasket firmly bedded in its seat so the heel of the gasket is not proud of the mouth of the pipe.

iii. The gasket fits evenly around the whole circumference, removing any bulges which would prevent the proper entry of the spigot end.

iv. Only lubricant supplied by the pipe manufacturer is to be used.

v. A thin film of lubricant is applied to the inside surface of the gasket which will be in contact with the entering spigot. In addition a thin film of lubricant may be applied to the outside surface of the entering spigot for a distance of 50 mm from the spigot end.

vi. The spigot of the pipe being jointed shall be aligned and entered carefully into the adjacent socket until it makes contact with the gasket. Final assembly of the joint is completed from this position.

vii. Joint assembly is completed by forcing the spigot end of the entering pipe past the gasket, which is thus compressed, until the first painted strip on the end of the pipe disappears and the second is approximately flush with the socket face.

viii. If the joint is difficult to assemble, then the spigot should be removed and rotated through $90^0$ before attempting to assemble a second time. If the joint is still difficult to assemble, then the spigot should be removed and the position of the gasket examined.

ix. The actual method of assembly by either "crowbar method", "fork & tool method", "come-along method" or "trench excavator method" shall be carried out in strict accordance with the pipeline and / or fitting manufacturer's directions and installation manual.

x. All cuts in ductile iron pipes shall be made by either power driven abrasive wheel cutter or special wheel cutter made for ductile iron pipe. Pipes shall be cut right through the ductile iron and the lining in order to achieve a smooth unbroken end to the lining. To assist in this, the free end of the pipe shall be supported during cutting. Pipes cut more than 4 m from the spigot end may require grinding to remove the peening pattern on the pipes' outside surface to facilitate jointing, together with reinstatement of the pipe coating. Hydraulic snap cutters used for grey iron pipe shall not be used for cutting ductile iron pipe.

xi. All cut ends shall be chamfered similar to the original spigot.

xii. Using a full pipe length as an example, a witness mark is to be made on the cut end of pipe to indicate the required penetration depth.

xiii. Deflections of the pipeline joints are to be made only after the joint has been successfully made.

5.33.2 PVC PIPES - SPIGOT - SOCKET & SPIGOT - SPIGOT (COLLAR) RUBBER RING JOINTS

The contractor shall ensure that:-

i. All pipe jointing is carried out in accordance with manufacturers recommended procedures.

ii. Before assembling the joint, the spigot and interior of the socket should be thoroughly cleaned. Check that the ring code is correct. The component should then be wiped clean.

iii. A heart shaped fold is formed in the ring to reduce the ring diameter and then the ring placed in the socket groove with the thicker section going furthest into the socket. The ring may be dipped in water to assist in locating the ring correctly.

iv. The spigot, and especially the chamfer of the mating pipe as far as the witness mark, is lubricated using the lubricant supplied with the pipes. With pipes in a straight line introduce the spigot into the socket and push home until the witness mark remains just visible. In this position clearance is automatically provided to allow for expansion and contraction. Jointing may be assisted by the use of a crowbar and wooden block. The socket of the joint being made should be restrained to prevent backward movement which would close up joints already made.

v. If the joint is difficult to assemble, the spigot should be removed and rotated through $90^0$ before attempting to assemble a second time. If the joint is still difficult to assemble, then the spigot should be removed and the position of the gasket examined.

vi. The actual method of assembly shall be carried out in strict accordance with the manufacturer's directions.

vii. When laying in direct sunlight or hot weather, precautions shall be taken to minimise the distortion caused by uneven heat absorption where one side is exposed to the heat and the other is in the shade. The pipes should be shaded where possible, particularly during the jointing process so that an even heat is maintained around the circumference of the pipe. In these conditions the pipe should be free to expand and contract. This effect may be otherwise overcome by rotating alternate pipes $180^0$ immediately prior to jointing. The system shall not be restrained by rigid connections until it reaches ground or service temperature.

viii. All cuts in PVC pipes will be made by using a fine toothed hand saw or an electric circular saw with cut-off wheel. All burrs shall be removed with a file. All cut ends shall be chamfered similar to the original spigot. A witness mark shall then be made using a soft marker, at the required penetration depth.

ix. Deflections of the pipeline joints are to be made only after the joint has been successfully made.

5.33.3 GIBAULT JOINTS

The contractor shall ensure that:-

i. Gibault joints shall be made by compressing the rubber joint rings between the collar and barrel of the gibault.

ii. Ends of pipes or fittings shall be separated by gap typically of between 20 and 40 mm.

iii. Bolts shall be tightened progressively, working opposite one another, sequentially around the collar. Bolts shall be tightened in a manner which compresses the ring ensuring a leak proof seal under operation and test pressures and conditions. The joint shall not be tightened excessively so as to damage the rubber ring.

iv. Collars shall end up approximately parallel.

5.33.4 LOOSE FLANGE COUPLINGS

Loose flange couplings may be used as a dismantling joint where there is insufficient space for installation of a gibault.

The contractor shall ensure that:-

i. Loose flange couplings are not be used where allowances for pipe alignment or deflection are required and shall take care to ensure accurate alignment of pipes for this type of joint.

ii. A gap of not more than 10 mm shall be left between the spigot end of the pipe or fitting and the flanged fitting.

iii. A gasket is used between the spacer flange and the flanged fitting. A rubber sealing ring is placed on the pipe spigot between the spacer flange and the retention flange. Care is to be taken to ensure flanges are placed in the correct order and direction. The sealing ring is to be inserted in the designated area between the spacer and retention flange.

iv. The fitting is assembled with the required number of bolts and nuts correctly positioned according to the manufacturer's design of the fitting. On thrust-type loose flange couplings, the central flange on the fitting shall be secured with a nut against each face of the flange.

v. Bolts shall be tightened progressively, working opposite one another, sequentially around the collar. Bolts shall be tightened in a manner which compresses the ring ensuring a leak proof seal under operation and test pressures and conditions

5.33.5 MILD STEEL PIPES - SPIGOT AND SOCKET RUBBER RING JOINTS

The contractor shall ensure that:-

i. All pipe jointing is carried out in accordance with manufacturers recommended procedures.

ii. Before assembling the joint, the spigot, interior of the socket and the rubber ring shall be cleaned thoroughly. Pipes shall be inspected for damage to the internal and external coatings and flats, dents or distortion of the spigots and sockets shall be corrected before the pipe is used. Damage to the protective coatings of the pipe is to be repaired in an approved manner before the pipe is used.

iii. The rubber ring is inserted in the groove at the invert of the pipe socket and then evenly distributed and compressed into the groove until the last part of the ring snaps into place.

iv. Ensure the correct lubricant is available for use with the rubber ring and external coating of the pipeline. Non-approved lubricants may degrade the rubber ring or protective coating to the pipe.

v. Lubricant is applied to the internal lip of the socket and exposed surface of the rubber ring. Care should be taken to ensure lubricant does not get behind or under the rubber ring. The spigot end of the pipe to be inserted shall have lubricant applied to the depth of the witness mark.

In cold conditions the lubricant may be warmed to achieve a brushable consistency. In hot conditions care is to be taken the lubricant does not dry before assembly of the joint. Lubricant is to be applied immediately before jointing the pipes.

vi. Pipes are laid with the socket mouths facing the direction of laying. Pipes are to be aligned for assembly with a maximum tolerance of:-

- 0.25 degrees from straight for pipes 750 mm diameter and over
- 0.50 degrees from straight for pipes up to 750 mm diameter

The spigot is to be located in the mouth of the socket, gently touching the rubber ring. Final assembly of the joint is completed from this position.

vii. Carefully push or pull the spigot of the new pipe home into the socket. The depth of penetration is to leave the witness mark visible and in line with the face of the socket. Assembly of joints by slewing of the crane or excavator is permitted provided it does not damage the pipe, or the external or internal linings of the pipe.

viii. Where pipes are to be deflected at the joint, this is to be done after the joint is made. The deflection is to be made with the load remaining on the puller. The load on the puller must not be released until sufficient backfill is placed around the pipe to ensure joint movement does not occur.

Where concave changes in grade or deflection are required, over-deflection is required to permit joint assembly. A padded packer is to be placed under the pipe end and the joint assembled. The packer is then to be removed allowing the pipe to rest back on the bedding. The packer is then transferred to the free end of the pipe just laid and the operation repeated. Two pullers will be needed to ensure the necessary over-deflected joint does not come apart.

ix. The completed joints are to be checked to ensure the witness mark remains visible in line with the face of the socket. The joint gap between the lip of socket and spigot end surface should be uniform all around the pipe and not greater than 1.5 mm. A feeler gauge is to be used to verify the position and tightness of the rubber ring against the spigot, frequently around the circumference of the joint. Where possible, the joint should be inspected from inside to ensure the rubber ring remains properly seated, and that no part of the rubber ring protrudes past the spigot end of the pipe.

x. Joints indicating displacement of the rubber ring or excessive gapping must be pulled apart, cleaned and re-assembled using a new rubber ring.

## 5.34.0 JOINTING PIPELINES - RIGID JOINTS

### 5.34.1 BOLTED FLANGE JOINTS

The contractor shall ensure that:-

i. Flange joints shall be made with a suitable insertion gasket between the two flanges. Gaskets are to be flat-face extending over the full width of the flange including bolt holes.

ii. Flanges shall be bolted using materials specified in the relevant section of this specification. Bolts and studs shall be lubricated with an anti-galling paste before nuts are run on.

iii. Gaskets shall be centralised before bolting together. The contact faces of the flanges shall bear uniformly on the gasket and the gasket compressed during tightening of the bolts.

iv. Bolts and nuts are to be tightened in a sequence working generally opposite the previously tightened bolt and around the flange. Bolts and nuts are to be tightened in four stages with a uniform torque.

v. Bolting shall be engaged so that there is visual evidence of complete threading through the nuts, or where studs are used, through the flange.

vi. Flange joints between PVC fittings with integral flanges include a stainless steel backing plate between the bolt head or nut (and washers) and the fitting's flange.

vii The bolting of flange joints between PVC fittings with integral flanges and ductile or cast iron fittings with raised faces are be made with bolts tightened to the recommended torque by the PVC fitting manufacturer. Care shall be taken that the PVC flange is not distorted effecting the integrity and/or life of the joint.

viii. All joints involving ductile iron fittings are to be sleeved with polyethylene sleeving applied in accordance with AS 3681.

### 5.34.2 MILD STEEL PIPES - FIELD WELDED JOINTS

Welded joints are preferred for use when crossing under roads, railways, creeks, rivers, or in expansive soils where the integrity of the rubber ring joints cannot be guaranteed. Welded joints may also be used where long aerial spans are required.

In constructing field welded joints the contractor shall ensure the following:-

**A. Welding**

i. All welding shall be Type SP carried out in accordance with AS 1554.1.

ii. All welders employed on the works shall be qualified in accordance with AS 1796. Details of the welder's certifications shall be provided to the superintendent and / or a

Pine Rivers Shire Council engineer before commencing any welding.

iii. Test pieces shall be provided by the contractor on request of the superintendent and/or a Pine Rivers Shire Council engineer. Test welds shall be performed in the presence of the superintendent and / or a Pine Rivers Shire Council engineer, and are to be made in restricted conditions similar to those which will exist when welding the pipe joints.

iv. The contractor shall keep a record of welding procedure for each weld, and the welder, and of the testing carried out on any weld.

v. Mating ends of the pipes are to be cleaned with a hand or power operated wire brush to remove surface rust etc. Where pipes are supplied with an external protective coating, or are cut to length, the coating is to be cut radially, and stripped from the pipe for a distance of 50 mm each side of the weld area.

vi. The pipe ends are to be aligned as required. Tack or stitching welds may be used to hold the joint temporarily. These temporary welds are to be ground away before making the final weld passes.

vii. Unless stated otherwise, welds shall be the same size as the pipe plate thickness.

viii. All pipe joints are to be given a complete circumferential external fillet weld. Where pipe diameters are large enough to provide internal access (in accordance with the Workplace Health and Safety Act - typically pipes larger than 610 mm diameter) joints are to be given an additional full circumferential internal fillet weld.

ix. Where joints are welded both internally and externally, a test hole is to be drilled in the outer socket or collar between each of the two weld positions before assembly of the joint. This is to be tapped with a 6 mm gas thread for testing of weld integrity.

x. After welding is completed, each joint shall be dressed to remove all sharp irregularities and slag. Spatters are to be ground off leaving a smooth surface.

xi. All welds shall be visually examined by the superintendent and / or a Pine Rivers Shire Council engineer. The superintendent and/or a Pine Rivers Shire Council engineer may subject up to 5% of the welds by number to magnetic particle, liquid penetrant, ultrasonic or radiographic examinations. Such tests shall at the discretion of the superintendent and / or a Pine Rivers Shire Council engineer. All testing of welds shall be carried out in the presence of the superintendent and / or a Pine Rivers Shire Council engineer.

xii. Ball and socket and welded collar joints carried out in accordance with (viii) above are to be air tested by applying air through the tapped hole. The welds are to be daubed with a soap solution, and the annulus pressurised to 300 kPa. This pressure shall be maintained at for a minimum of five minutes, and the welds inspected for air bubbles.

xiii. Where joints fail any tests, or welds are found to be defective, the defects are to be repaired. Defects shall be assessed in accordance with Section 6.2 of AS 1554.1. Defects are to be removed and repaired in accordance with Section 5.8 of AS 1554.1.

**B. External Protection of Joints**

i. On completion of welding and dressing, each joint shall be protected externally in

accordance with the pipe manufacturers' specifications, and the specifications of the manufacturer of the protection system used.

ii. Generally, the following systems may be used -

a) Heat shrink sleeve coating method
   - Denso WPCP primer with Raychem WPC Type B Sleeve

b) Tape wrap coating method
   - Denso Densolen HT Primer with Denso Rockrap 3000 Tape having a 55% overlap, then Denso MP/HD Tape with a 10% overlap

**C. Internal Protection of Joints - Pointing**

i. Where pipe diameters are large enough to provide internal access (in accordance with the Workplace Health and Safety Act - typically pipes larger than 610 mm diameter) all internal joints are to be closed internally between the factory applied cement lining with internally applied mortar pointing after all welding of the joint has been completed.

ii. Joints shall be cleaned free from all oil, grease, paint, and loose or flaking material by wire brushing.

iii. The mortar shall be made up of a mixture of water, Portland cement to AS 3972 and dry clean sharp sand free of clay. The sand shall be of a grading where not more than 2% is retained on a 2.36 mm sieve, and not more than 5% passes a 150µm sieve. Mortar shall be mixed to a stiff workable consistency using a mass ratio of between 2 and 3:1 sand : cement.

iv. Mortar shall be applied to the joint fresh from mixing. The mortar shall be well packed into the joint with a suitably sized tool to a smooth surface. The new mortar is to be faired evenly with the existing internal surfaces. Mortar which is no longer fresh, has partially set and become hard shall be removed from the site. Additional water shall not be added to a mix which has partially set in order to extend its life.

v. An approved curing compound shall be applied to the surface of the mortared joint.

vi. All dropped material is to be cleaned from the pipeline.

## 5.35.0 TYPE 1 CONSTRUCTION

5.35.1 Details for Type 1 construction are shown on the Pine Rivers Shire Council standard drawing. This type of construction applies to sand and approved naturally occurring bedding material.

5.35.2 The bedding shall be placed in the trench and compacted before any pipes are laid. Sand shall be compacted to a density index of not less than 65 measured in accordance with AS 1289.5.1.1. Naturally occurring material shall be compacted to 95% maximum dry density using standard compaction as determined by AS 1289.5.1.1.

5.35.3 Natural occurring material from the trench excavation shall only be used for pipe bedding where specifically approved by a Pine Rivers Shire Council engineer in writing.

5.35.4 The bedding shall be placed to a level of not less than one quarter of the pipe diameter above invert, and then recessed to accommodate the pipe barrel. Holes shall be dug out for the pipe sockets to relieve the sockets of any load.

5.35.5 Having checked the pipe for soundness, it shall be bedded firmly along its barrel in the bedding material, while ensuring that the collar is not providing any support for the pipe. The pipe shall then be brought to line and grade with the minimum possible disturbance to the bedding material. On no account will the contractor be permitted to build up the bedding under the pipe after the pipe is in position.

5.35.6 When the line has been laid, the additional bedding material shall be added in layers not exceeding 150 mm compacted depth to bring its level midway up the barrel of the pipe for rigid pipes. For flexible pipes, the bedding material shall be added in layers not exceeding 150 mm compacted depth, to bring its level to 75 mm over the crown of the pipe. This bedding shall also be compacted to the required standard set out in Clause 5.35.2 of this specification.

5.35.7 The remainder of the trench shall be filled with approved filling and general backfill in accordance with relevant sections of this specification and as indicated on the Pine Rivers Shire Council standard drawing.

## 5.36.0 TYPE 2 CONSTRUCTION

5.36.1 Details for Type 2 construction are shown on the Pine Rivers Shire Council standard drawing. This construction replaces Type 1 construction and other construction types and is designed to provide added strength to the pipeline and to ensure a long working life in sensitive locations. Type 2 construction shall be used as detailed or as directed by the superintendent and / or a Pine Rivers Shire Council engineer.

5.36.2 Type 2 construction consists of a full surround of Class N25 concrete. The thickness of the surround shall be not less than 100 mm. The concrete under the pipes shall be placed in the trench before any pipes are laid, and the pipes shall then be bedded firmly and brought to line and grade on the fresh concrete. The balance of the concrete surround shall then be placed without delay and without disturbing the pipes.

5.36.3 The contractor shall not be permitted to lay the line on bricks or other material and then place the concrete under the pipes. Flexible joints in the concrete surround shall be provided at intervals not exceeding nine 9 m, and coinciding with a flexible joint in the pipeline. The means of creating the flexible joint shall be approved by the superintendent and / or a Pine Rivers Shire Council engineer.

5.36.4 Where this construction is used with flexible pipes, a 10 to 15 mm thick flexible, compressible material, fully surrounding the pipe shall be used to separate the concrete from the pipe to allow longitudinal pipe movement to occur. The thickness of the strip is to be selected as a proportional function of pipeline diameter.

5.36.5 The remainder of the trench shall be filled with approved filling and general backfill in accordance with relevant sections of this specification and as indicated on the Pine Rivers Shire Council standard drawing.

## 5.37.0 TYPE 3 CONSTRUCTION

5.37.1 Details for Type 3 construction are shown on the Pine Rivers Shire Council standard drawing. This construction shall be used in conjunction with other construction types and is designed to provide support to pipelines constructed at steeper grades than;

- 1 in 6 for 150 mm diameter water mains
- 1 in 10 for 225 mm diameter water mains
- 1 in 15 for 300 mm diameter and larger water mains

5.37.2 Type 3 construction consists of line stops constructed from Class N25 concrete and embedded in the undisturbed sides and bottom of the trench.

5.37.3 The stops shall be placed immediately behind the collars or sockets of the pipes, and the stops shall be spaced so that the maximum distance between them is 6 m.

5.37.4 Where this construction is used with flexible pipes, a 10 to 15 mm thick flexible, compressible material, fully surrounding the pipe shall be used to separate the concrete from the pipe to allow longitudinal pipe movement to occur. The thickness of the strip is to be selected as a proportional function of pipeline diameter.

5.37.5 The balance of pipeline construction shall be as for the type appropriate for a similar pipeline on normal grades.

## 5.38.0 TYPE 4 CONSTRUCTION

5.38.1 Details for Type 4 construction are shown on the Pine Rivers Shire Council standard drawing. This construction replaces Type 1 construction and other construction types. It shall be used where the bottom of the excavated trench is unable when in a dry condition to provide support to allow the compaction of sand or naturally occurring bedding material to the required standard.

5.38.2 Type 4 construction consists of a 300 mm depth of gravel or crushed rock and a 75 mm depth of bedding material below the pipe and further bedding, approved filling and backfill material as for Type 1 construction in accordance with this specification.

5.38.3 The gravel or crushed rock shall consist of particles generally between 19.0 mm and 37.5 mm in size 100% of the material shall pass the 37.5 mm sieve, with not more than 20 percent passing a 19.0 mm sieve and not more than 5 percent passing a 6.7 mm sieve.

5.38.4 The gravel shall be compacted by a single pass of a heavy vibrating plate before the normal bedding is placed and compacted.

5.38.5 The pipe bedding, approved filling and backfill shall be constructed according to Type 1 construction.

## 5.39.0 TYPE 5 CONSTRUCTION

5.39.1 Details for Type 5 construction are shown on the Pine Rivers Shire Council standard drawing. This construction replaces Type 1 construction and other construction types. This construction shall be used where the bottom and sides of the excavated trench are unable to provide support to allow the compaction of sand, naturally occurring material, gravel or crushed rock to the required standard.

5.39.2 Type 5 construction consists of a 100 mm layer of gravel or crushed rock placed and compacted by a single pass of heavy vibrating plate. The grading of the gravel or crushed rock shall be as described in Clause 5.38.3 of this specification.

Pipe bedding / surround consisting of gravel or crushed rock, not less that 200 mm deep

below the underside of the pipe, shall then be placed within a layer of geotextile as indicated on the Pine Rivers Shire Council standard drawing. The purpose of the geotextile fabric is to prevent the migration of the pipe bedding / surround into the adjacent natural material.

5.39.3 Pipe bedding / surround for Type 5 construction shall be non-cohesive granular material, free from particles which may be retained on a 19 mm sieve with not more that 10% passing a 2.36 mm sieve. Angular material which, in the opinion of a Pine Rivers Shire Council engineer, may damage flexible pipes or the protective coating on rigid pipes shall not be used.

Flexible pipelines are to be wrapped with geotextile to assist in preventing damage to the pipeline.

5.39.4 The pipe bedding shall be placed in layers not exceeding 150 mm and compacted by hand tamping or vibration to the satisfaction of a Pine Rivers Shire Council engineer. Well graded material shall achieve a minimum density index (DI) of 65.

5.39.5 The geotextile fabric shall be non-woven, thermally or mechanically bonded, with a mass not less than 150 g/$m^2$, a CBR tensile strength of 2700 N minimum and a puncture resistance measured by the drop cone test producing a hole not greater than 16 mm diameter.

The remainder of the trench shall be filled with approved filling and general backfill in accordance with relevant sections of this specification and as indicated on the Pine Rivers Shire Council standard drawing.

## 5.40.0 TYPE 6 CONSTRUCTION

5.40.1 Details for Type 6 construction are shown on the Pine Rivers Shire Council standard drawing. This construction shall be used where all other construction types are unsuitable.

5.40.2 Type 6 construction consists of a 100 mm layer of gravel or crushed rock, compacted by a single pass of a heavy vibrating plate, upon which a 500 mm deep gabion lined with geotextile fabric and filled with gravel or crushed rock, is placed.

5.40.3 The gabion shall be formed by preparing a cage of PVC coated galvanised wire mesh supported by timber sheeting to limit bending when lifted into the trench. The cage shall be lined with geotextile fabric and filled with gravel or crushed rock of 20 mm to 75 mm nominal size. The geotextile fabric shall be folded and overlapped 500 mm at the top of the cage and the wire mesh joined to complete the cage. The cage shall not exceed 3000 mm in length. The geotextile fabric shall be as specified in Clause 5.39.5 of this specification and the wire mesh shall be of adequate strength to permit the gabion to be handled in the intended manner.

5.40.4 The gabion shall then be lifted into the trench by slings placed around the cage and timber or by wire ropes threaded through the gabion and passing through the timber base.

5.40.5 With the gabion in place on the aggregate base layer, the bedding shall be completed in a similar manner to Type 5 construction.

5.40.6 The remainder of the trench shall be filled with approved filling and general backfill in accordance with relevant sections of this specification and as indicated on the Pine Rivers Shire Council standard drawing.

## 5.41.0 CONSTRUCTION THROUGH ROADWAYS

5.41.1 The backfilling of works under state controlled roads shall be carried out in accordance with Section 5.5.0 of this specification.

5.41.2 The backfilling under new roads and driveways shall be carried out in accordance with Section 5.6.0 of this specification. The backfill material shall be brought up to the underside of pavement. Pavement materials, similar to and of the same depth as the new road pavement material shall then be placed and compacted and brought up to the underside of the surfacing material. The pavement material shall be compacted as per relevant sections of this specification.

5.41.3 Where construction of pipelines of 375 mm diameter and greater are proposed for lengths of more than 100 m under existing roads, the preferred construction method shall be as for new roads. The placement, compaction and testing of road pavement material shall be in accordance with relevant sections of this specification.

5.41.4 In all cases other than those meeting the criteria of Clause 5.41.3 of this specification, backfill under existing roads shall consist of a 600 mm minimum depth of no slump lean mix (20:1 mix) concrete placed on top of the compacted pipe bedding, and brought up to the underside of the surfacing material. The lean mix concrete shall be compacted in four layers with each receiving two passes of a heavy vibrating plate or similar compaction equipment.

## 5.42.0 MARKER TAPES

5.42.1 Water main marking tape is to be placed in all water main trenches. Marker tapes are to be of the detectable type containing a conductive trace wire, in accordance with AS/NZS 2648. Tapes are to be positioned centrally above the water main pipeline within the trench.

5.42.2 Where one layer of backfill or approved fill is required to be placed, the marker tape is to be laid at:-

- the top of the sand bed/surround where flexible pipes are used; or
- not more than 200 mm above the water main.

Where more than one layer of backfill or approved fill is required, the marker tape is to be positioned between layers, not more than 500 mm or less than 200 mm above the water main.

## 5.43.0 FITTINGS, VALVES, AIR RELEASES, SCOUR VALVES, ETC.

5.43.1 The contractor shall fix in position all valves, bends, tees, angle branches, crosses, dead ends, reducers and other fittings which may be necessary for the completion of the mains into a continuous whole.

5.43.2 Unless otherwise specified, sluice valves, bends, tees, angle branches, reducers, crosses and scour tees shall be supplied with two socket ends. Valves, bends, tees, wyes, reducers, and crosses shall be located in fixed positions, thereby necessitating the cutting to correct length of pipe, with the off-cut being used on the other side of the valve or fitting.

5.43.3 Air valve, hydrant and scour valve tees may be joined into the pipeline between full pipe lengths.

In the case of air valves, the pipeline shall be graded so as the air valve is at the highest point.

In the case of scour valves, the pipeline shall be graded so as the scour valve is at the lowest point where practical.

5.43.4 Sluice valves, hydrants, air releases etc. shall be carefully fixed in position so as to be plumb and at the correct distance from the surface.

5.43.5 The backfilling around the bodies of buried sluice valves shall be sand or gravel thoroughly compacted. Such sand/or gravel shall fill the full width of the trench and shall extend along the trench for a length of at least four times the valve diameter on both sides of the valve.

5.43.6 The contractor shall take such steps with valves and air releases to fully protect them during laying, backfilling and compaction, and on completion shall see that all glands are well-screwed down and all valves operate freely.

## 5.44.0 INSTALLATION OF BUTTERFLY VALVES

5.44.1 Butterfly valves shall not be buried in service. All butterfly valves shall be installed within pits or chambers.

5.44.2 Butterfly valves are to be installed to the manufacturer's specifications, however generally the following shall apply:-

i. The pipework is to provide a sufficient clear opening between flanges to allow free entry of the valve.

ii. The valve is to be manipulated so as the disc is in the partially open position. The disc is not to protrude beyond the body of the valve.

iii. The valve is to be aligned correctly between flanges and bolts or studs tightened sufficiently to hold the valve in place.

iv. The valve is to be operated so as the disc is in the fully open position. Should the disc not open fully, alignment of the valve is to be checked. If there is interference between the disc and the pipework, the valve is to be withdrawn from position and approved stainless steel spacers inserted between the valve and the pipe flanges to provide the necessary clearances.

v. All bolts are to be tightened to final torque evenly.

## 5.45.0 PROPERTY SERVICE CONNECTIONS

5.45.1 Where water mains are laid for the purpose of conveying bulk supply (trunk mains), or interconnecting ring mains, property service connections may not be required.

5.45.2 The contractor will not be required to provide property service connections on mains greater than 150 mm diameter unless included in the project documents.

5.45.3 On all other mains than those described in 5.45.1 or 5.45.2 of this specification, property service connections shall generally be required for supply to individual allotments.

5.45.4 Property service connections for 100 mm and 150 mm diameter mains shall be made by pre-

tapped connection fittings.

5.45.5 The pre-tapped fittings, together with nipple, insulator and ball valve shall be laid by the contractor as an integral component of the main. Where necessary, lengths of pipe shall be cut to length to ensure the pre-tapped fitting is located opposite the property boundary. Pre-tapped fittings are to be laid with the tapping offtakes deflected in an upward direction.

5.45.6 Pre-tapped water service fittings installed integrally with the pipeline are to have their service valve positions marked by bringing a tape attached to the service valve above the trench surface.

5.45.7 Pre-tapped property service fittings shall be installed in accordance with the Pine Rivers Shire Council standard drawings.

## 5.46.0 PROPERTY SERVICE CONDUITS

5.46.1 Where service conduits are called up by the principal as part of the contract, these shall be placed and laid in accordance with Pine Rivers Shire Council standard drawings.

## 5.47.0 FASTENERS AND MISCELLANEOUS ITEMS

5.47.1 All fasteners used in the work shall be stainless steel of Grades 316 or 304 to either AS 1449, or AISI 316 or 304 (American Iron and Steel Institute) or UNS S31600 or S30400. This includes bolts, nuts, washers, studs, screws, masonry anchors and threaded items used for joining flanges, mounting equipment, or in the assembly of valve bodies and other components.

5.47.2 All stainless steel bolts, nuts, studs, masonry anchors and washers shall be marked in accordance with either the ISO 3506 or the AISI marking standards as appropriate. Products not marked in accordance with either of these standards shall be accompanied with a manufacturer's certificate indicating the grade and strength, and general authenticity of the products compliance with the requirements of this section.

5.47.3 All bolts, nuts, studs and masonry anchors up to and including 24 mm dia. shall be Class 70, having a minimum tensile strength of 700 MPa. Fasteners greater than 24 mm dia. may be Class 50, with a strength of 500 MPa.

5.47.4 Threads shall generally be cut in accordance with DIN 933 or DIN 931.

5.47.5 Bolts shall be metric series, hexagonal head. Studs shall be either hexagonal head, or where used in the assembly of components, may be socket head type. Bolts and studs shall be manufactured from Grade 316 stainless steel.

5.47.6 Nuts shall be metric series normal type, hexagonal nuts. Nuts shall be manufactured from Grade 304 stainless steel.

5.47.7 Washers shall be normal series washers manufactured from Grade 316 stainless steel.

5.47.8 Bolt and stud lengths shall be chosen and supplied such that when used to assemble materials supplied in accordance with Pine Rivers Shire Council Specifications, there shall be a minimum of 10 mm thread remaining under the washer when the articles are assembled, and a minimum bolt projection of 10 mm clear beyond the external face of the nut.

5.47.9 Bolts for use with gibaults shall be selected for length and threaded length so as:-

i. there is a minimum bolt projection equivalent to 1½ times the nut depth clear beyond the external faces of the assembly when loosely assembled prior to tightening

ii. when gibaults are assembled and installed in accordance with accepted industry practice, there shall be a minimum of 10 mm thread remaining under the washer

Alternatively, lengths of threaded rod with an additional nut and washer may be used in place of bolts. The above minimum overall length of rod shall apply. The rod shall be of a strength grade equivalent to bolts.

5.47.10 The contractor shall provide washers under all nuts, studs or bolts where rotation can occur during tightening of the fastener. Loctite 222 or 567 or other approved nickel based anti-galling paste shall be used on all threads and between stainless steel mating surfaces as an anti-galling lubricant.

5.47.11 Hole sizes shall be drilled only sufficiently large enough to accommodate the fastener and isolator chosen. Oversized holes shall not be accepted.

5.47.12 Unless otherwise shown on the drawings or specified in the job specification, chemical anchors shall comply with the requirements of Table 5.2.

**Table 5.2**

| SIZE (min.) | LENGTH (min.) | EMBEDMENT | DISTANCE TO EDGE (min.) |
|---|---|---|---|
| M 10 | 130 | 90 | 45 |
| M 12 | 160 | 110 | 55 |
| M 16 | 190 | 125 | 65 |

5.47.13 Unless otherwise shown on the drawing or specified in the job specification, mechanical anchors shall comply with the requirements of Table 5.3.

**Table 5.3**

| SIZE (min.) | LENGTH (min.) | EMBEDMENT | DISTANCE TO EDGE (min.) |
|---|---|---|---|
| M 10 | 90 | 60 | 60 |
| M 12 | 110 | 80 | 80 |
| M 16 | 145 | 100 | 100 |

## 5.48.0 THRUST BLOCKS

5.48.1 The contractor shall construct thrust blocks of Class N25 concrete in accordance with AS 1379, at all bends, horizontal and vertical tees, angle branches, crosses, dead ends, reducers and other locations where there will be an unbalanced hydraulic load.

5.48.2 Every block shall be cast at least three days prior to the testing of any section of the main which may create hydraulic forces at the block. The contractor shall place the concrete against excavated ground which shall be undisturbed and free of loose or deleterious matter. Notwithstanding that detail of thrust blocks have been shown on the standard drawings, the contractor shall be responsible for assessing the ground and should refer any instability to the superintendent and / or a Pine Rivers Shire Council engineer for advice.

5.48.3 Thrust blocks shall not encase joints in pipelines, but shall be formed against the body of the fitting. In special circumstances where changes of direction exceeding 90° are made in the pipeline, thrust blocks may be formed against a pipeline joint. In this case, the thrust block shall not encase the joint by more than one half the circumference of the pipeline. On occasions where inclusion of the joint into the thrust block is required, the contractor shall seek permission from the superintendent and a Pine Rivers Shire Council engineer before constructing the thrust block.

5.48.4 The bearing area of the thrust block shall be such that the ground will amply support the unbalanced hydraulic load. The hydraulic load shall be calculated from the test pressure detailed in this specification.

5.48.5 Notwithstanding the above provisions, the contractor shall be solely responsible for the performance of the thrust blocks.

## 5.49.0 TESTING OF PIPELINES

5.49.1 Unless specified otherwise, the whole of the mains laid by the contractor shall be tested under hydraulic pressure to a pressure test of 1.2 MPa.

5.49.2 Where the levels of different portions of the pipeline or the portion under test vary, the point at which the test pressure shall be held to be measured shall be the lowest point in the profile of that section.

5.49.3 The contractor shall provide all labour together with all plant including pumps, engines, pipes, temporary valves, plugs and flanges as may be necessary for testing of the pipeline. The equipment shall include a gauge capable of being read to 0.01 MPa and shall be accompanied by a recent calibration certificate from a registered testing laboratory. Such plant etc. shall be maintained by the contractor.

5.49.4 All tests shall be carried out by an accredited testing agent or under the supervision and in the presence of the superintendent and / or a Pine Rivers Shire Council engineer.

5.49.5 On reticulation mains servicing properties, test sections shall coincide with the length of main along each road section.

On trunk mains or where the length of reticulation main along any street exceeds 500 m, the length of test sections shall normally be between 500 m and 1000 m. Under no circumstances shall test lengths exceed 1500 m.

5.49.6 The contractor shall make his or her own arrangements to procure at his or her own expense the water necessary for carrying out these tests. Tests shall be carried out as soon as possible after the completion of any section of the main.

5.49.7 If water should be available from the Pine Rivers Shire Council water mains and the contractor desires to use it, the contractor shall give seven days notice to a Pine Rivers Shire Council

engineer of his or her need for water. The Pine Rivers Shire Council shall make a charge for water supplied to the contractor, such charge to be the subject of agreement between the contractor and the Pine Rivers Shire Council.

5.49.8 The Pine Rivers Shire Council, in making this water available, shall not thereby absolve the contractor from any responsibility attaching to him or her under this contract.

5.49.9 During filling, the contractor shall release air from all air valves, air releases, and hydrants.

5.49.10 All tests shall be conducted against temporary blank flanges and not against closed valves.

5.49.11 Mains constructed using concrete lined pipes shall be filled and allowed to settle for a 12 hour period, and water loss made up. After settling, and for all other pipe types, the main shall now be filled with water, and the test section shall stand for a period of approximately 24 hours under a static pressure of the intended working pressure in the section. A pressure gauge and data recorder capable of recording or displaying the pressures in the pipeline over the 24 hour period shall be attached for the duration of this test procedure.

Should a failure occur and some or all of the water is lost, the procedure of filling and of raising the pressure shall be repeated after remedial work has been carried out. The standing period shall commence from the time at which the pressure has been last successfully reached. The test section shall be visibly inspected after the further standing period of about 24 hours.

5.49.12 If neither appreciable movement of the pipeline nor any leakage has been found, the section shall be subjected to the pressure test proper. While the pressure is being raised, care shall be taken to permit the release of further quantities of air. The duration of the test at full pressure shall be not less than three hours for each test. Should pressure drop during the test, additional quantities of water shall be pumped into the test section to restore the required test pressure. Restoration of the test pressure shall be carried out at half-hourly intervals.

5.49.13 The quantity of water added each time, referred to later as makeup water, shall be measured, recorded and totalled up at the end of the test.

5.49.14 During the three hour test, the amount of water added to maintain the specified test pressure shall not exceed the quantity given by the following formula for rubber ring jointed pipelines:-

$Q = 60\ DL$ where:-

Q = permissible make up quantity over three hours (litres)
D = nominal diameter of pipe (m)
L = length of pipe under test (km)

nor must any defects in the contractor's work become apparent.

For fully welded pipelines no makeup water shall be permitted.

5.49.15 Where a Pine Rivers Shire Council engineer is not present for the test, the superintendent shall supply a Test Certificate which shall include all information detailing times, pressures, makeup water added etc. and any failures during the test.

## 5.50.0 BACKFILLING OF EXCAVATION

5.50.1 Trenches shall not be backfilled until the lines have been visually inspected by the superintendent and/or a Pine Rivers Shire Council engineer, construction details recorded and permission given by him or her for filling to commence. With approval from the superintendent and / or a Pine Rivers Shire Council engineer, the contractor may be permitted to backfill the trenches.

5.50.2 Approved filling shall be selected and placed to a level 300 mm above the crown of the pipe for rigid pipe or the bedding for flexible pipe, and the remaining backfill shall be placed by methods which will ensure maximum compaction without damage to the pipes in accordance with relevant sections of this specification. Should the material excavated in a particular area be unsuitable for refilling then the contractor shall backfill using suitable material excavated from other areas within the works site or imported to the site.

5.50.3 Where trench shoring has been used during excavation the contractor shall exercise particular care in its removal during the backfilling operation. The contractor shall not remove the shoring in such a way that the sides of the trench are permitted to fall or voids are left in the backfilled material.

5.50.4 Where the excavation is in tunnel, the refilling shall be with sand filling compacted by flooding with water, immersion vibration or other method approved by a Pine Rivers Shire Council engineer.

5.50.5 The backfilling of excavation under railway lines shall be carried out in accordance with Section 5.3.0 of this specification.

5.50.6 The backfilling of excavations through roadways are to be carried out in accordance with Section 5.41.0 of this specification.

## 5.51.0 RESTORATION OF SURFACES

5.51.1 All backfilling shall be fully completed as soon as practicable after the completion of testing. Areas affected shall be cleared up, the surfaces made good and all surplus materials carted away.

5.51.2 Restoration of surfaces shall follow on immediately after completion of backfilling.

5.51.3 All restoration works shall be to the satisfaction of the superintendent and / or a Pine Rivers Shire Council engineer. Initial cleaning up shall be carried out as soon as backfilling is completed, and restoration in private premises shall be completed within seven days after backfilling. Beyond this time the superintendent and/or a Pine Rivers Shire Council engineer may arrange to have the work carried out at the contractor's expense.

5.51.4 All surfaces shall be restored in such a manner that they conform generally to the levels, grades and types of surface material existing before the work was commenced. Restored surfaces shall be maintained in such a way as to avoid any hazards or inconvenience. In private properties, routes of normal access shall be restored to a safe and trafficable condition by the close of work each day.

5.51.5 In grassed areas, the top 150 mm of the backfilling shall be carried out with material approved by the superintendent and / or a Pine Rivers Shire Council engineer as equivalent to that removed. Where turfs have been removed, they shall be replaced on this material and top dressed.

5.51.6 All improvements on or to premises which have been damaged by the contractor shall be made good or replaced so as to be the equal of those existing before the contractor's operations.

5.51.7 In bitumen, asphalt or concrete surfaces the edges of the excavation shall be saw-cut in straight lines before any surface restoration is attempted. Some preliminary cutting before excavation commences may assist in limiting the width of surface damaged.

5.51.8 Bitumen seal coats shall be restored using a prime coat and two seal coats in accordance with the Pine Rivers Shire Council current specifications.

5.51.9 If directed by the superintendent and / or a Pine Rivers Shire Council engineer, or specified in the project drawings or specifications, hot mixed asphalt shall be used in lieu of the bitumen seal coats.

Asphalt surfaces shall be restored using hot mixed asphalt in accordance with Pine Rivers Shire Council specifications. The thickness of asphalt shall be not less than 50 mm.

5.51.10 Concrete surfaces shall be restored with Class N25 concrete with a surface texture matching the original surface as closely as possible. The depth of concrete shall be not less that of the existing concrete. In reinforced concrete surfaces, either dowel bars shall be used to join new with existing works, or the reinforcement in the original surface shall be exposed and bonded with reinforcement placed in the surface to be repaired. External edges of concrete surfaces shall be poured against secure formwork to restore the true edge shape of the original concrete.

5.51.11 Any survey permanent marks, property pegs, or other survey marks which were noted to be retained, and which are disturbed or removed during construction are to be replaced by a licensed surveyor.

5.51.12 The contractor shall, from time to time, as required, provide and place any pavement material, topsoil or other material that may be necessary to make good any subsidence and shall ensure that the restored surfaces are maintained throughout the duration of the contract in conformity with the level of the adjoining surfaces to allow the safe and convenient passage of traffic and pedestrians.

5.51.13 The superintendent and / or a Pine Rivers Shire Council engineer may require that designated areas receive special restoration using any one of a number of special techniques which are available. These may include re-seeding, turfing, hydraulic seeding and mulching and may include provision for the protection of newly restored surfaces using fibre matting.

5.51.14 For areas nominated by the superintendent and / or a Pine Rivers Shire Council engineer to be re-seeded, the contractor shall tine the top 100 to 150 mm of soil. On completion of backfilling, the material removed in accordance with the preceding operation shall be spread uniformly over the disturbed area and covered with a light cover of topsoil to minimise wind erosion and leaching out. The whole of the disturbed area shall then be seeded with an approved mixture of grass seeds and fertilizer including trace elements. One mixture which has been successfully used is as provided in Table 5.4.

**Table 5.4**

| 1 kg Husked Couch Seed (Cynodon Dactylon) | |
|---|---|
| SUMMER MIX<br>1 kg Japanese Millet | WINTER MIX<br>1 kg Winter Rye |
| 10 kg Q5 with copper, Zinc and Molybdenum | |
| 10 kg Nitran | |

The approved mixture shall be spread at the rate of not less than 2.9 kg per 100 $m^2$. The mixture shall be lightly raked in and the whole area immediately hand watered. Watering in compliance with the Pine Rivers Shire Council regulations shall then be carried out as necessary until the grass is well established.

5.51.15 For areas nominated by the superintendent and / or a Pine Rivers Shire Council engineer to be turfed, the surface of the backfilled trench and adjoining area shall be raked smooth at a depth of 50 mm below the required finished surface level. The turfs shall be of Cynodon Dactylon (green couch). The grass shall be of good quality free from paspalums, nut grass, oxalis and other weeds. Turfs shall be cut 300 mm wide x 3 m length approximately, and 50 mm - 60 mm thick.

Turfs shall be cut and delivered to the site so as to minimise time between deliveries and laying. If necessary, the turfs shall be rolled with the grass facing inwards. A sample of $2m^2$ of turf shall be submitted to the superintendent and / or a Pine Rivers Shire Council engineer at least one week prior to the commencement of laying of turfs. If approved, all turfs shall be of at least equal quality. If rejected, further samples from different sources shall be submitted, until an approved source is found.

5.51.16 For areas nominated by the superintendent and / or a Pine Rivers Shire Council engineer, the contractor shall use hydraulic seeding and mulching (referred to as hydromulching). Only qualified personnel with a proven ability to apply hydromulching treatment shall be employed by the contractor to perform this work. The contractor shall submit to the superintendent and / or a Pine Rivers Shire Council engineer documentary evidence listing similar projects satisfactorily completed together with a statement of the qualifications and / or experience of the personnel to be employed on the works.

The contractor shall cover the area to be treated with topsoil to a depth of 75 mm. The topsoiled area shall first be watered with a fine water spray to thoroughly moisten the soil to a depth of at least 25 mm without inducing any erosion.

Seed, fertiliser, wood-fibre mulch, water and binder shall be thoroughly mixed together to provide a slurry. Spraying of the slurry shall be carried out as soon as possible, but not later than two weeks after topsoiling. Spraying of the slurry shall take place while the topsoil is still moist. The slurry shall then be applied under pressure on to the area to be treated by means of hydromulching equipment specifically designed for this purpose. Application rates shall be as listed in the Table 5.5. The contractor may submit alternative mixes to the superintendent and / or a Pine Rivers Shire Council engineer for approval. After the slurry has been sprayed, further watering shall be applied, as ordered by the superintendent and / or a Pine Rivers Shire Council engineer.

**Table 5.5**

| MATERIALS FOR HYDROMULCHING | | |
|---|---|---|
| **MATERIAL** | **RATE OF APPLICATION** | |
| (A) Wood-fibre<br>Defibrated pinus radiata dyed green | 2.5 tonnes / hectare | |
| (B) Binder<br>Anionic bitumen emulsion<br>50/50 bitumen/water | 1000 - 2000 litres / hectare | |
| or Polymer binder | Maximum 250 litres / hectare | |
| (C) Certified seed | | |
| **PRIMARY CEREAL COVER** | **SUMMER MIX** | **WINTER MIX** |
| Japanese Millet | 25 kg / ha | - |
| Perennial rye grass | - | 40g / ha |
| **SECONDARY GRASS COVER** | **SUMMER MIX** | **WINTER MIX** |
| Green couch | 15 kg / ha | 25 kg / ha |
| Rhodes grass | 15 kg / ha | 15 kg / ha |
| (D) Fertiliser Type to be approved by superintendent and/or a Pine Rivers Shire Council engineer | 250 - 400 kg/ha | |

5.51.17 Areas to be protected against erosion during the establishment of the grass cover shall be covered with a heavy duty fibremat. The heavy duty fibrematting (Enviromat or similar approved by the superintendent and / or a Pine Rivers Shire Council engineer) shall be supplied and laid to the manufacturer's recommendations.

5.51.18 Summer shall be defined as from October to March inclusive. Winter shall be defined as from April to September inclusive.

## 5.52.0 FLUSHING AND STERILISATION OF PIPELINES

5.52.1 Flushing and sterilisation is to be carried out to clean water mains.

5.52.2 PRELIMINARY FLUSHING

i. The main shall be flushed so as a velocity of 0.75 m/s is obtained in the main to remove any debris remaining in the pipeline from construction. Section valves and/or scour valves shall be used for flushing.

ii. Where the flow of water from flushing is likely to cause erosion or nuisance, the contractor shall pipe the flushed water from the outlet to a location where a nuisance will not be caused.

iii. Table 5.6 gives the required orifice diameters to flush pipelines with 250 kPa pressure at the orifice.

**Table 5.6**

| Pipe Size (mm) | 0.75 m/s Flushing Velocity | |
|---|---|---|
| | Flow (l/sec) | Orifice Diameter (mm) |
| 100 | 5.5 | 22 |
| 150 | 12.6 | 34 |
| 200 | 22.5 | 45 |
| 225 | 28.2 | 51 |
| 250 | 35 | 56 |
| 300 | 51 | 68 |
| 375 | 78 | 84 |
| 450 | 110 | 100 |
| 525 | 151 | 117 |
| 600 | 195 | 134 |
| 675 | 250 | 151 |
| 750 | 306 | 167 |

5.52.3 STERILISATION (CHLORINATING)

i. A water mixture of Sodium hypo-chlorite with a 10% available chlorine concentration shall be used for chlorination. Other chlorine bearing agents may be used with approval from the superintendent and/or a Pine Rivers Shire Council engineer.

ii. The sodium hypo-chlorite shall be diluted to approximately 1 percent solution (10,000 mg/l) prepared by adding 1 kg of sodium hypo-chlorite to 10 litres of water.

iii. The chlorine dosage shall be at least 20 mg/litre.

iv. The main is to be completely filled with chlorinated water for a contact period of 24 hours. While the pipeline is filled with the chlorine agent, valves shall be manipulated so as the chlorine solution is thoroughly and evenly distributed throughout the pipeline and all fittings.

v. The chlorine bearing water shall be added to the pipeline at the beginning of the extension, or at any valved section of the line. The required dose is to be added as each section of the main is filled.

vi. Table 5.7 gives chlorine requirements per 100 m of pipe which may achieve the required sterilisation test results.

vii. Any cross connection, temporary or otherwise, to the live system while sterilising is to be fitted with backflow prevention in accordance with AS 3500.

**Table 5.7**

| Pipe Size (mm) | Volume per 100 m length of pipeline (kl) | Chlorine required for 20 mg/l concentration using a 1% Chlorine/Water solution (l) |
|---|---|---|
| 100 | 0.7 | 1.4 |
| 150 | 1.7 | 3.4 |
| 200 | 3.0 | 6.0 |
| 225 | 3.8 | 7.6 |
| 250 | 4.7 | 9.4 |
| 300 | 6.8 | 13.6 |
| 375 | 10.4 | 20.8 |
| 450 | 14.7 | 29.4 |
| 525 | 20.1 | 40.2 |
| 600 | 26.0 | 52.0 |
| 675 | 33.3 | 66.6 |
| 750 | 40.8 | 81.6 |

5.52.4 FINAL FLUSHING

i. Following chlorination all chlorine treated water shall be thoroughly flushed from the pipeline at its extremities. Discharge of the chlorine bearing water from the main shall be done in a manner such that the discharge will not cause any harmful effects to or degradation of the flora, fauna and streams or waterways. A Pine Rivers Shire Council engineer may direct the contractor in the manner which the water shall be discharged, including the need for any neutralisation or dilution of the water.

ii. Where the flow of water from flushing is likely to cause erosion or nuisance, the contractor shall pipe the flushed water from the outlet to a location where a nuisance will not be caused.

5.52.5 TESTING FOR STERILISATION

i. After final flushing, the main shall be charged with water. After a contact time of not less than 30 minutes, a quantity of water for testing shall then be drawn off from the lowest convenient off-take point of each section of the main as tested. This sample shall be tested against the acceptance criteria in Table 5.8 to determine the adequacy of sterilisation.

**Table 5.8**

| | | |
|---|---|---|
| pH | 6.5 to 8.5 | See Note 2 |
| Free Chlorine | 0.2 to 0.5 mg/litre | See Note 2 |
| Total Chlorine | > 0.5 mg/litre | See Note 2 |
| Colour | < 15 PtCoU | See Note 3 |
| Turbidity | < 5 NTU | See Note 3 |
| Total Coliforms | < 1 org/100 ml | See Note 1 |
| Faecal Coliforms | < 1 org/100 ml | See Note 1 |
| E. Coli | < 1 org/100 ml | See Note 1 |
| HPC | <100 CFU/ml | See Note 2 |

Notes:-

(1) The status of these results shall represent absolute pass or failure of the test.

(2) These recommended concentrations given above shall be a secondary assessment of the water quality. The superintendent may pass or fail the test on the basis of these results. Excessively high or low results are to be referred to a Pine Rivers Shire Council engineer.

(3) These figures are based on aesthetic guidelines. Results outside the results given above may be considered and passed by a Pine Rivers Shire Council engineer on written request from the contractor or superintendent.

ii. All tests on water shall be performed by an appropriately accredited testing laboratory.

iii. Should the above test results not be achieved, the main shall be re-sterilised and the test procedure re-commenced.

## 5.53.0 INSTALLATION OF HYDRANT AND VALVE INSPECTION BOXES, MARGIN SETTS AND MARKERS

5.53.1 The contractor shall fix an inspection box and margin sett over all hydrants and valves (not including valves in concrete pits or chambers). At all hydrants and valves, gravel and sand shall be filled into the trench and compacted to form a support for bricks upon which the cover boxes are to be placed.

5.53.2 Inspection boxes shall be set on bricks. The bricks shall be of good quality, well burnt and of uniform standard size. Samples shall be submitted and no bricks may be used which have not been approved by the superintendent and / or a Pine Rivers Shire Council engineer.

5.53.3 Margin setts shall be carefully placed around the inspection boxes, on selected filling and maintained so that their tops are 6 mm higher that the tops of the inspection boxes.

5.53.4 The locations of hydrants, sluice valves and air valves shall be marked in accordance with the

Pine Rivers Shire Council standard drawings.

5.53.5 Raised retro-reflectorised pavement markers shall be used to indicate the positions of hydrants and all valves where water mains are constructed adjacent to roadways in accordance with the Pine Rivers Shire Council standard drawings.

5.53.6 Marker stakes for valves and hydrants shall be of hardwood, straight, sound and free from imperfections. Letters and distances shall be painted on plates as shown on the drawings. The lettering and numbering shall be done in a first class manner by an experienced signwriter.

5.53.7 Where water mains are constructed in other than road reserves, or in reserves along un-formed roads, main markers shall be placed to identify the location of each bend, reducer, tee or other similar fitting (other than valves or hydrants) along the main. The position of main markers relative to the position of the main and other things is to be approved by a Pine Rivers Shire Council engineer.

5.53.8 Installation details for valve boxes, margin setts, marker stakes and main markers shall be in accordance with the Pine Rivers Shire Council standard drawings.

## 5.54.0 CONNECTIONS TO EXISTING MAINS

5.54.1 Interconnections of new water mains with existing mains may be carried out by the Pine Rivers Shire Council, or by an approved contractor in accordance with the Pine Rivers Shire Council Private Works Policy.

5.54.2 Unless noted otherwise, the principal shall submit the Private Works Application to the General Manager Pine Water, together with all plans and specifications required.

5.54.3 Unless noted otherwise, all notified fees and charges due for supervision and bond and/or construction works by the Pine Rivers Shire Council, shall be paid by the applicant making the application.

5.54.4 The contractor shall comply with all conditions imposed by the General Manager Pine Water when carrying out interconnection works.

5.54.5 The contractor shall not operate any valves or close down or open any existing water mains or sections of mains.

5.54.6 The time of making the connection to existing mains shall be at the discretion of the General Manager Pine Water.

5.54.7 Connections to the existing water supply system shall not be permitted until such time as the water main has passed the pressure testing and sterilisation testing and the works have been accepted “on maintenance”.

Where, in the opinion of a Pine Rivers Shire Council engineer, minor items not directly affecting water supply matters are causing a delay in acceptance of the works “on maintenance”, connection of the new main to the existing system may be permitted by a Pine Rivers Shire Council engineer.

## 5.55.0 TIDYING OF SITE

5.55.1 The contractor on completion of the works specified herein, shall tidy up the whole of the site of the works including the construction area and the area used for his or her plant, stores and amenities. This shall include the removal of all rubbish, waste and excess materials.

## 5.56.0 PAYMENT UNDER A SCHEDULE OF RATES CONTRACT

5.56.1 This section of the specification is intended primarily for Pine Rivers Shire Council projects. It may also be applied to other projects as described in the job specification and schedules.

5.56.2 This section of the specification identifies the obligations of the contractor and the items in the schedule of rates under which it is expected that a competent contractor would make a cost allowance to meet these obligations. The contractor shall not be entitled to any additional payment in meeting obligations set out in this specification or to be implied from the description of works to be carried out but not specifically referred to in this section. The clause numbers listed in the clauses below are as found in this specification.

5.56.3 The contractor's obligations under Section 5.11.0, 5.12.0 and 5.14.0 shall be allowed for in the rates for items relating to supply of pipes, fittings and valves where their supply is included in the works. Where supply of materials is not part of the works, the cost of these items shall be allowed for in the rates for items relating to the various construction types as detailed in Clause 5.56.6.

5.56.4 The contractor's obligations under Section 5.13.0 shall be allowed for in the rate for items relating to painting or coating of pipework and fittings etc.

5.56.5 The contractor's obligations under Section 5.1.0 to 5.10.0 inclusive, and 5.16.0, 5.17.0, 5.18.0, 5.23.0 to 5.27.0 inclusive, 5.30.0, 5.31.0, 5.41.0, 5.42.0, 5.50.0, 5.51.0 (Clauses 5.51.1 to 5.51.6 and 5.51.11) shall be allowed for in the rates for items relating to excavation and backfilling.

5.56.6 The contractor's obligations under Sections 5.35.0 to 5.40.0 inclusive shall be allowed for in the rates for items relating to the various construction types. The rates for Type 2 to 6 inclusive shall be in addition to the quoted rate for Type 1 construction.

5.56.7 The payment for construction types shall be based on a linear measurement except for Type 3 construction which is based on actual number. The linear measurement shall be taken from the length of trench.

5.56.8 The contractor's obligations under Clauses 5.51.7 shall be allowed for in the rates for items relating to saw cutting.

5.56.9 The contractor's obligations under Clauses 5.51.8 and 5.51.9 shall be allowed for in the rates for items relating to resurfacing with bituminous surfaces.

5.56.10 The contractor's obligations under Clauses 5.51.10 shall be allowed for in the rates for items relating to reinstatement of concrete surfaces.

5.56.11 The contractor's obligations under Sections 5.19.0, 5.20.0, 5.21.0, 5.28.0, 5.45.0, 5.46.0, and 5.51.0 (Clauses 5.51.12 to 5.51.18 inclusive) shall be allowed for in the rates for items specifically included for these works in the schedule.

5.56.12 The contractor's obligations under Section 5.15.0 shall be allowed for in the rates for items relating to pipe bedding and surround.

5.56.13 The contractor's obligations under Sections 5.22.0, 5.32.0, 5.33.0, 5.34.0, 5.43.0, 5.44.0, 5.47.0, and 5.48.0 shall be allowed for in the rates for items relating to laying and jointing of pipes.

5.56.14 The contractor's obligations under Section 5.49.0 shall be allowed for in the rates for items relating to testing of pipelines.

5.56.15 The contractor's obligations under Section 5.52.0 shall be allowed for in the rates for items relating to flushing and sterilisation of pipelines.

5.56.16 The contractor's obligations under Section 5.53.0 shall be allowed for in the rates for items relating to installation of valve boxes, margin setts and markers.

5.56.17 The contractor's obligations under Section 5.54.0 shall be allowed for in the rates for items relating to connections to existing mains.

5.56.18 The contractor's obligations under Section 5.55.0 shall be allowed for in the rates for items relating to establishment and final clean up.

5.56.19 The payment for excavation and backfilling shall be based on the linear measurement of the trench.

5.56.20 The payment for excavation of rock, Clause 5.29.0, shall be based on the volume of rock removed. This shall be calculated from the standard trench width, the length over which it occurred and the actual depth to a maximum of 75 mm below the barrel of the pipe. In the case of rock excavation at a pit or structure it shall be calculated from the outside dimension of the pit or structure multiplied by the depth over which it occurred.

5.56.21 The payment for supply, lay and joint shall be based on a linear measurement of the length actually laid.

5.56.22 Payment for special backfilling materials for use under railways, state controlled roads, roads or other specified locations shall by volume based on a standard trench width unless otherwise agreed with the superintendent and / or a Pine Rivers Shire Council engineer.

5.56.23 In general, payment will be made only in respect of lines which have been completed structure to structure, backfilled, tested and the surface restored.

5.56.24 Payment for restoration of surfaces shall be based on area calculated from the linear measurement along the pipeline multiplied by the standard trench width.