

Specification
For
**Non-Pressure
Pipeline
Construction**

Pr9875



Unitywater

Pr9875 - Specification for Non-Pressure Pipeline Construction

Documents Details

This document is only valid on the day it was printed.

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Pr9875 - Specification for Non-Pressure Pipeline Construction

Pr9875 - Specification for Non-Pressure Pipeline Construction

Contents

1. Purpose	7
2. Scope	7
3. References	7
3.1 General.....	7
3.2 Applicable Legislation and Regulation	8
3.3 Codes of Practice (ratified by Legislation).....	8
3.4 Quality and Standards	8
3.5 International and Australian Standards	9
4. Definitions/Abbreviations	11
5. General Requirements	12
5.1 Information to be supplied by the Manufacturer	12
5.2 Information Supplied to the Contractor.....	13
5.3 Setting Out.....	13
5.4 Traffic Control and Road Signage.....	13
5.5 Real Property Survey Pegs.....	13
5.6 Care for and Relocation of Existing Fences	14
5.7 Work within Private Property.....	14
5.8 Work within Road Reserves.....	14
5.9 Notification of Impact on Adjacent Properties.....	15
5.10 Impact on Unitywater Network	15
5.11 Overhead and Underground Services	15
5.12 Alterations to Public Utility Services	16
5.13 Materials and Workmanship	16
5.14 Pipes	16
5.15 Pipeline Components.....	17
5.16 Branding of Mark Number	17
5.17 Materials Transport and Handling	17
5.18 Delivery and Storage	17
5.19 Concrete	17
5.20 Manhole Covers and Frames.....	17
5.21 Water Required for Works	18
5.22 Timber	18

Pr9875 - Specification for Non-Pressure Pipeline Construction

5.23	Nature of Ground.....	18
5.24	Unidentified Existing Pipelines.....	18
5.25	Disused Existing Pipelines.....	19
5.26	Handling Asbestos Cement Pipe and Fitting.....	19
6.	Clearing and Grubbing.....	20
6.1	General.....	20
6.2	Erosion and Sediment Control.....	20
7.	Pipeline Trench Excavation.....	20
7.1	General Requirements.....	20
7.2	Limits of Excavation.....	21
7.3	On-Site Stockpiles.....	21
7.4	Cover Requirements.....	22
7.5	Excavation Across Improved Surfaces.....	22
7.6	Vacuum Excavation.....	22
7.7	Excavation in Root Zones.....	24
7.8	Support of Excavations.....	24
7.9	Adjacent Structures and Services.....	24
7.10	Drainage and Dewatering.....	24
7.11	Disposal of Surplus Excavated Material and Unsuitable.....	25
7.12	Trenching in Non-Rippable Rock.....	25
7.13	Trench Floor Preparation and Unsuitable Foundation Material.....	25
7.14	Tunnelling.....	26
7.15	Excavation under Railway Lines.....	26
7.16	Excavation Under Controlled Roads.....	27
7.17	Excavation Under Other Roads.....	27
7.18	Boring/Jacking of Enveloper Conduits.....	27
8.	Laying and Jointing Pipes.....	28
8.1	General.....	28
8.2	Handling FBP Coated Pipes.....	29
8.3	Testing of FBP Coating.....	29
8.4	Laying of Rubber Ring Joint Pipes.....	29
8.5	Jointing PE Pipes and Fittings.....	30
8.6	Concrete Bulkhead and Trenchstop Construction.....	34
9.	Painted Coatings.....	34

Pr9875 - Specification for Non-Pressure Pipeline Construction

10. Wrapping of Fittings	34
11. Embedment	34
11.1 General.....	34
12. Trench Fill	34
13. Construction Finishes	35
13.1 Grouted Stone Pitching.....	35
13.2 Maintenance Structures	35
13.3 House Connection Branches	36
13.4 House Drains.....	36
14. Acceptance Testing for Non Pressure Infrastructure	36
14.1 General.....	36
14.2 Air Pressure and Vacuum Testing of Sewers.....	36
14.3 Testing PE pipeline welds.....	37
14.4 Compaction Acceptance Testing	37
14.5 Pressure Testing Inverted Siphons	37
14.6 Pressure Testing Knife Gate Valves	37
14.7 Cleaning General.....	38
14.8 CCTV Inspection.....	38
14.9 As constructed Asset Information	38
15. Restoration and Finishing Works	38
15.1 Backfilling of Excavation	38
15.2 Restoration and Revegetation of Surfaces.....	39

List of Tables

Table 1 - Materials for Hydromulching.....	41
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Pr9875 - Specification for Non-Pressure Pipeline Construction

1. Purpose

- 1.0.1 The purpose of this Specification is to define Unitywater's requirements for the construction of non-pressure pipelines, manholes and house drains within Unitywater's sewerage network.
- 1.0.2 These requirements shall also apply to non-pressure and low pressure pipelines associated with the transport of stormwater, sewage and sludge under gravity typically found at Unitywater's sewage treatment facilities.
- 1.0.3 This Specification does not apply to the construction of pressure pipelines other than gravity flow pipelines where the water pressure head does not exceed 10 metres.

2. Scope

- 2.0.1 This Specification shall apply to works being constructed directly for Unitywater or other authority or for an owner who will hand over the ownership of the constructed works to a local government or who will retain ownership.
- 2.0.2 The Specification applies to non-pressure and low pressure pipelines of ductile iron cement lined (DACL), poly-vinyl chloride (PVC), glass filament reinforced thermosetting plastic (GRP), mild steel cement lined (MSCL), Acrylonitrile Butadiene Styrene (ABS), polyethylene (PE), polypropylene (PP) and concrete.

3. References

3.1 General

- 3.1.1 All work carried out under this specification shall comply in all aspects (i.e. in design, construction, testing and performance) in accordance with the;
 - South East Queensland Water Supply and Sewerage Design and Construction Code (SEQ WS&S D&C Code) including:
 - SEQ WSA 01 – Polyethylene Pipeline Code;
 - SEQ WSA 02 – Sewerage Code of Australia;
 - SEQ WSA 04 – Sewage Pumping Station Code of Australia;
 - SEQ IPAM List (SEQ approved Infrastructure Products and Materials List);
 - SEQ Asset Information Specification;
 - Unitywater's Technical Specifications;
 - Pr9903 Specification for Building and Structural Works;
 - Pr9787 Specification for Microtunneling/Pipejacking Construction;
 - Pr9788 Specification for Horizontal Directional Drilling;
 - Pr9789 Specification for Auger Boring;
 - Pr9790 Specification for Pipe Ramming;
 - Pr9825 Specification for Shafts;
 - Pr9693 Specification for Mechanical Installations;
 - Pr9086 Pressure Testing of Sewer Mains Work Instruction;

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Pr8871 - Specification for Commissioning of Network Project Assets;
 - F8940 - Check Sheet Template Overflow and Emergency Storage;
 - F8917 - Worksheet – Overflow and Emergency Storage;
 - The latest relevant Australian (AS), British (BS) and IEC Standards;
 - The Plastics Industry Pipe Association of Australia (PIPA); and
 - Standards in the following sections.
- 3.1.2 Reference to specific clauses of the various codes is intended to highlight those points and shall not be taken to imply a lesser importance for all other applicable clauses.
- 3.1.3 All the works shall conform to the Rules and Regulations of the Statutory Authorities having jurisdiction over the Site.
- 3.1.4 If the requirements of this Specification do not articulate with the minimum requirements of the statutory regulations and standards, the regulatory requirements are taken to apply. If the requirements of this Specification are more exacting than the minimum requirements of the statutory regulations and standards, the former shall apply.
- 3.1.5 All Materials, fittings, accessories and equipment supplied by the Contractor shall be new and the best obtainable of their kind and shall comply in all respects with the requirements of the relevant Standards Australia specifications.

3.2 Applicable Legislation and Regulation

- 3.2.1 At least the following legislation and related regulation shall apply:
- a. *Work Health and Safety Act 2011* (Qld);
 - b. *Work Health and Safety Regulation 2011* (Qld);
 - c. *Water Supply (Safety and Reliability) Act 2008* (Qld);
 - d. *Environmental Protection Act 1994* (Qld);
 - e. *Queensland Building Services Authority Act 1991*.

3.3 Codes of Practice (ratified by Legislation)

SEQ Water Supply and Sewerage Design and Construction Code

The SEQ Water Supply and Sewerage Design and Construction Code (SEQ WS & S D & C Code) is available via the SEQCODE website: www.seqcode.com.au.

3.4 Quality and Standards

- 3.4.1 Unless otherwise specified, the equipment covered by this Specification shall be designed, manufactured, installed and tested in accordance with the following, listed in order of precedence:
- The Project Contract documents;
 - Requirements of the Statutory Authorities having jurisdiction over all or part of the manufacture, installation or operation of the plant;
 - The SEQ WS & S D & C Code;
 - All relevant Australian and governing Queensland standards where applicable;
 - Water Services Australia (WSAA) National Codes;

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Water Services Australia (WSAA) Guidelines:
 - Dechlorination of Drinking Water to Discharged Waterways, National Guidance for the Urban Water Industry 2019; and
 - Water Quality Australia Guidelines:
 - Acid Sulfate Soil (ASS) National Management Guideline.
- 3.4.2 In the absence of relevant SEQ WS&S D&C Code, WSAA or Australian codes or standards, relevant industry, international (ISO), European or British standards shall be followed. International standards shall take precedence over European or British standards. The Contractor shall obtain approval from the Superintendent prior to using any non-Australian standards not nominated in the equipment specifications, schedules, datasheets or associated drawings.
- 3.4.3 Where local or international standards do not exist, the manufacture and installation of equipment shall be in full compliance with the manufacturer's own recognised standards. Manufacturer's standards, where used, shall be submitted to the Superintendent by the Contractor for review and acceptance shall be obtained by the Contractor from the Superintendent prior to commencement of manufacture.
- 3.4.4 All equipment shall comply with relevant Federal and State Acts, Regulations and Codes including, but not necessarily limited to, the following:
- *Work Health and Safety Act 2011* (Qld);
 - *Work Health and Safety Regulation 2008* (Qld);
 - Work Health and Safety Queensland Codes of Practice.
- 3.4.5 The version of any applicable standard or regulation shall be the revision in place at the date of invitation of contract packages.
- 3.4.6 The Contractor shall have in place a dedicated quality system that conforms to ISO 9001.
- 3.4.7 Quality control procedures for management, inspection, review and evaluation of all materials, manufacture, workmanship and testing of all products shall be planned and implemented by appropriately skilled and qualified persons to ensure that requirements of the quality procedures are met and that high quality is maintained.
- 3.4.8 The Contractor shall ensure that all equipment supplied/installed under this Specification is the product of a manufacturer who is fully experienced, reputable, qualified and regularly engaged for at least five years in the manufacture of the equipment to be supplied/installed.

3.5 International and Australian Standards

Standard	Title
Quality Systems	
AS 2990	Quality Systems for Engineering and Construction Projects
AS 3901	Quality Systems for Design/Development, Production, Installation and Servicing
AS 3902	Quality Systems for Production and Installation
AS 3903	Quality Systems for Final Inspection and Test
Materials and Workmanship	
AS 1074	Steel tubes and tubulars for ordinary service

Pr9875 - Specification for Non-Pressure Pipeline Construction

Standard	Title
AS 1260	PVC Pipes and Fittings for Drain Waste and Vent Applications
AS 1579	Arc Welded Steel Pipes and Fittings for Water and Waste Water
AS 1631	Cast Grey Iron and Ductile Non-Pressure Pipes and Fittings
AS 1646	Elastomeric Seals for Waterworks Purposes
AS 1650	Hot-dipped galvanised coatings on ferrous articles
AS 1741	Vitrified Clay Pipes and Fittings with Flexible Joints – Sewer Quality
AS 1830	Iron castings – Grey cast iron
AS 2032	Code of Practice for Installation of uPVC Pipe Systems
AS 2033	Installation of Polyethylene Pipe Systems
AS 2566.1	Buried flexible pipelines – Structural design
AS 2566.2	Buried flexible pipelines - Installation
AS 2887	Plastics Waste Fittings
AS 3500	Plumbing Code of Australia
AS 3571	Glass Filament Reinforced Thermosetting Plastics (GRP) Pipes
AS 3679	Structural steel – Hot-rolled bars and sections
AS 3680	Polyethylene Sleeving for Ductile Iron Pipelines
AS 3681	Guidelines for the Application of Polyethylene Sleeving to Ductile Iron Pipelines and Fittings
AS 3690	Installation of ABS Pipe Systems
AS 3706	Geotextiles – Methods of test
AS 3725	Loads on buried concrete pipes
AS 3894.1	Non-Conductive Coatings – Continuity Testing – High Voltage (Brush) Method
AS 4058	Precast concrete pipes (pressure and non-pressure)
AS 4139	Fibre-reinforced concrete pipes and fittings
AS 4321	Fusion Bonded Medium Density Polyethylene Coating and Lining for Pipes and Fittings
AS 4373	Pruning of Amenity Trees
AS 4799	Installation of underground utility services and pipelines within railway boundaries
AS 6401	Knife gate valves for waterworks purposes
DIN 8077	Polypropylene (PP) pipes – dimensions
DIN 8078	Types 1, 2 and 3 polypropylene (PP) pipes – General quality requirements and testing

Pr9875 - Specification for Non-Pressure Pipeline Construction

4. Definitions/Abbreviations

Term	Meaning
ABS	Acrylonitrile Butadiene Styrene
AS	Australian Standard
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BS	British Standard
BSPT	British Standard Pipe Thread
CPVC	Chlorinated Polyvinyl Chloride
CSPP	Carbon Steel Polypropylene
DFT	Dry Film Thickness
DICL	Ductile Iron Cement Lined
DIN	Deutsches Institut für Normung
DN	Nominal Diameter (Number) (mm)
DRG	Drawing
ECTFE	Ethylene chlorotrifluoroethylene
EPDM	Ethylene Propylene Diene Monomer
ERW	Electric Resistance Weld
FBE	Fusion Bonded Epoxy
FBP	Fusion Bonded Polyethylene
GR	Grade
GRP	Glass Reinforced Plastic
HDPE	High Density Polyethylene
ID	Inside Diameter
ISO	International Organisation for Standardisation
MPVC	Modified Polyvinyl Chloride
OD	Outside Diameter
PE	Polyethylene
PN	Nominal Pressure (Number) (bar)
PP	Polypropylene
PTFE	Polytetrafluoroethylene
PVC	Polyvinyl Chloride
PVDF	Polyvinylidene fluoride
Sch	Schedule
SI	International System of Units

Pr9875 - Specification for Non-Pressure Pipeline Construction

Term	Meaning
SS	Stainless Steel
UHMWPE	Ultra High Molecular Weight Polyethylene
UNO	Unless Noted Otherwise
UPVC	Unplasticised Polyvinyl Chloride
WPS	Weld Procedure Specification
WPQ	Weld Procedure Qualification
WQ	Weld Qualification
WSAA	Water Services Association of Australia
House Connection Branch (HCB)	The connection point of the lateral house drain to the sewer.
House drain	Any pipe (including fittings) normally laid underground, situated within any premises and provided to convey to a HCB the discharge of soil and waste pipes from such premises.
Sewer	Any conduit for the carrying off of sewage from any premises which is not a house drain, soil or waste pipe.
Construction	Any work necessary for the installation, testing and commissioning of a pipeline, manhole or house drain. The term shall include such operations as taking care of existing assets, clearing, excavation, erosion control, bedding, laying, jointing, backfilling, restoration, forming, concrete placing, vibrating and stripping, pressure testing and quality testing.
Superintendent	As defined in the General Conditions of Contract called up in the Contract document (such as AS2124-1992 or AS4000)
Vacuum excavation	Excavation using equipment designed to use water or air pressure to loosen soil and other materials and a vacuum to remove it.
Materials	Any raw or manufactured materials or goods. This includes all machinery, equipment and components.

5. General Requirements

5.1 Information to be supplied by the Manufacturer

- 5.1.1 Where a pipe, fitting or other items are to be manufactured, whose dimensions and tolerances are not detailed in this Specification or the references given in Section 3 of this Specification, the manufacturer shall submit for approval a complete description of the proposed item. The description shall include drawings showing general detail, overall dimensions and detailed dimensions of component parts including fits and tolerances. The composition of the materials to be used in the manufacture of the component parts shall also be submitted.
- 5.1.2 If a manufacturer proposes to use any material not specifically mentioned herein or any material with composition or properties differing from those covered in this specification, or to apply any special treatment or process to any material in order thereby to provide any extra strength, durability, or any other desirable quality, he shall supply a complete specification of such material, treatment or process and shall obtain the approval of the Superintendent before utilisation of the material, treatment or process.

Pr9875 - Specification for Non-Pressure Pipeline Construction

5.2 Information Supplied to the Contractor

- 5.2.1 The Superintendent undertakes to supply to the Contractor sufficient details by way of drawings and specifications to allow the Contractor to construct the works to the Superintendent's requirements.
- 5.2.2 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.
- 5.2.3 In the case of house drain construction the Contractor shall be supplied with a house connection plan for each premises.

5.3 Setting Out

- 5.3.1 The Superintendent shall supply to the Contractor sufficient information to accurately locate the works.
- 5.3.2 In the case of sewers and manholes the Superintendent will supply the Contractor with sufficient information to locate centreline of each manhole. The Contractor will be supplied with drawings showing the level of the top of any peg indicating the location of a manhole, the distance between consecutive manhole positions and the diameter, level and grade of the connecting sewers.
- 5.3.3 In the case of other works the Superintendent will establish datum lines from which the Contractor can locate structures and interconnecting pipework. The Contractor will be supplied with layout plans, structure details and the diameter, level, length and grade of the pipelines.
- 5.3.4 In both cases the Contractor will be supplied with a level datum related to conveniently placed permanent survey marks or temporary benchmarks.
- 5.3.5 The stated origins for the level datum shall be preserved from damage or interference by the Contractor.
- 5.3.6 The Contractor shall be responsible for any costs associated with the reinstatement of any Permanent Mark damaged or removed during the progress of the works.
- 5.3.7 It shall be fundamental to the Contract that the positions of sewers in relation to the boundaries of premises and to the improvements thereon, shall be maintained unless authorised otherwise by the Superintendent in writing.
- 5.3.8 The Contractor shall establish offset pegs clear of the immediate working area.

5.4 Traffic Control and Road Signage

- 5.4.1 All traffic control and road signage shall be in accordance with the Manual of Uniform Traffic Control Devices Part 3 published by the Queensland Department of Transport and Main Roads.
- 5.4.2 Traffic control shall ensure at all times the safe passage of vehicles and pedestrians through and around the site and physical separation of traffic and pedestrians from construction activities.

5.5 Real Property Survey Pegs

- 5.5.1 The Contractor shall mark all real property survey pegs, including easement pegs, by a 600 mm high painted stake before work commences on the adjacent pipeline. The Contractor shall take full responsibility for the maintenance of such pegs once he commences work on

Pr9875 - Specification for Non-Pressure Pipeline Construction

the contract and if any are disturbed he shall arrange replacement by a licensed surveyor at his own expense.

5.6 Care for and Relocation of Existing Fences

- 5.6.1 Fences, other than those specifically noted for removal, shall be maintained at all times with special care taken to prevent straying of stock if grazing is carried out on adjoining lands.
- 5.6.2 If fences are required to be cut or moved, the Contractor shall erect temporary fences for stock containment as agreed with the property owner or as directed by the Superintendent.
- 5.6.3 Where fences are to be cut for access, wire shall be drawn tight to end posts, suitably struted and suitable gates provided, if directed, for closure after working hours or when no work is in hand on the site.
- 5.6.4 Any fence cut or removed during the execution of work shall be replaced and reinstated to its original alignment unless otherwise directed by the Superintendent. It is the Contractor's responsibility to ensure that the fence is located correctly.
- 5.6.5 Any fence, or part thereof, damaged by the Contractor's works shall be repaired immediately with appropriate materials in consultation with the owner and Superintendent.
- 5.6.6 Re-erected fencing shall be true to line and posts installed vertically.
- 5.6.7 No relocated fencing shall be erected to a standard below that which existed prior to relocation.

5.7 Work within Private Property

- 5.7.1 The Contractor shall confine all work within private property to minimise disturbance. Disturbance within the property shall not extend beyond a 6.0 metre wide construction swathe and shall be wholly within the pipeline easement unless agreed otherwise with the Superintendent. If directed by the Superintendent, the Contractor shall erect a temporary barrier fence or marker to define the limits of the construction swathe. Activities outside the limits of the construction swathe shall not be permitted without the expressed permission of the Superintendent.
- 5.7.2 It is the Contractor's responsibility to give prior notice to private property owners of any construction activities that may affect them or their property. General notification is to occur two weeks prior to commencing these activities and specific notification at least forty-eight (48) hours prior to clearing or excavation work. Notwithstanding the above, notification periods and formats shall comply with current legislation.

5.8 Work within Road Reserves

- 5.8.1 All work within road reserves shall be in accordance with the road authority conditions of approval and comply with the following:
- Work shall proceed without interruption to traffic and any steps necessary for the protection of the public during construction shall be taken;
 - Warning signs, flashing lights and other traffic control devices shall be erected in accordance with the relevant road authorities' requirements;
 - Work which is likely to reduce traffic flow shall be carried out between 9.00 a.m. and 3.00 p.m. only (unless otherwise specified or agreed with the Superintendent) and shall be organised so as to cause minimum disruption to pedestrians and access to adjacent properties; one lane of traffic under 'STOP-GO' control must remain open at all times along all roads;

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Trenches shall not be left open overnight;
- Work shall be carried so as not to detrimentally affect the existing drainage provisions of the roadway.

5.9 Notification of Impact on Adjacent Properties

- 5.9.1 It is the Contractor's responsibility to give prior notice to private property owners of any construction activities that may affect them or their property. General notification is to occur two weeks prior to commencing these activities and specific notification forty-eight (48) hours prior to work commencing.
- 5.9.2 Notification shall be in a form approved by the Superintendent and include the nature and expected duration of impact and both business hours and after hours telephone numbers for the Contractor in the event of difficulties arising.

5.10 Impact on Unitywater Network

- 5.10.1 It is the Contractors responsibility to advise Unitywater of any impacts that the works will have on Unitywater's infrastructure network.
- 5.10.2 The Contractor shall submit to Unitywater applications for Permit to Work (PTW) and/or Planned Network Intervention (PNI) to enable work to be assessed and approved.

5.11 Overhead and Underground Services

- 5.11.1 The Contractor shall note the presence of overhead and underground services on the works site. Special care shall be taken in the vicinity of electricity services.
- 5.11.2 The locations of some underground services are indicated on the drawings and are based on information supplied by the respective Authorities where such information is available.
- 5.11.3 It is emphasised that information supplied regarding these services is tentative only with respect to both details of services shown and the existence of other services not shown.
- 5.11.4 The Superintendent does not warrant the completeness or accuracy of the information given and the Contractor is required to make enquiries into the presence and location of underground services with the relevant Authorities.
- 5.11.5 The attention of the Contractor is drawn to the fact that private underground and overhead services and individual services to premises from public utilities are not shown on the drawings.
- 5.11.6 The Contractor shall verify the position of each underground service before commencement of 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 may be necessary to close proximity to services until the exact location is determined.
- 5.11.7 Trenches 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 proper hand rammers and tampers or by use of effective mechanical equipment.
- 5.11.8 Extra care shall be taken by the Contractor to recompact excavations near existing underground pipework, so that foundations of that pipework are restored, and more especially when recompacting in the vicinity of low flexibility pipework.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 5.11.9 The Contractor shall be held responsible for any damage caused to existing overhead or underground services. In case of failure or damage, the Contractor shall immediately notify the service provider and arrange for repairs to be undertaken. If there is any delay, the Superintendent will arrange for repairs to be carried out by the Superintendent or others and the full cost of such repairs shall be borne by the Contractor. If in the opinion of the Superintendent the failure or damage causes an emergency situation, then remedial action will be taken by the Superintendent and the full cost of such action shall be borne by the Contractor.
- 5.11.10 Only those persons qualified to undertake repairs on the relevant services shall be permitted to perform the work with the prior approval of the service authority.

5.12 Alterations to Public Utility Services

- 5.12.1 Where it is necessary to carry out alterations to existing overhead or underground services, this work will be arranged by the Contractor unless otherwise specified.
- 5.12.2 The Contractor shall allow to co-ordinate and work around service authorities where relocations are necessary during the Contract.
- 5.12.3 The Contractor shall promptly advise the Superintendent of any services affecting the works which were not shown on drawings so that appropriate action can be taken.

5.13 Materials and Workmanship

- 5.13.1 The Contractor shall supply all the materials required to complete the Contract in accordance with the issued drawings and specifications unless stated otherwise elsewhere in this Contract. The materials supplied shall comply with the relevant Australian Standard. All materials and equipment supplied shall be new and of the best industrial quality and manufacture.
- 5.13.2 All materials in contact with drinking water shall comply with the requirements of AS/NZS 4020.
- 5.13.3 Unless the manufacturer has an approved Quality System in place, all manufactured items shall be inspected and tested at the place of manufacture by the nominated inspecting and testing authority.
- 5.13.4 The Contractor shall employ experienced workers and tradespersons on all types of work required by the Contract. 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 tradespersons shall be employed on those works governed by statutory regulations.

5.14 Pipes

- 5.14.1 The pipe materials and their structural requirements shall be as set out in this Specification, SEQ WS&S D&C IPAM list and all applicable drawings. Pipes shall be provided with flexible joints in accordance with the relevant Australian Standard unless otherwise stated.
- 5.14.2 The Superintendent may carry out tests on the soils and groundwater in which the pipes are to be located. These tests may be used in the selection of pipe materials, their structural requirements and any external protection. The results of any such tests will be made available to the Contractor.
- 5.14.3 Pipes to be used in non-pressure applications shall be certified by the Manufacturer as being suitable for the intended installation and performance requirements.
- 5.14.4 DICL pipes shall be wrapped with sufficient polyethylene sleeving and sealing tape in accordance with AS 3680.

Pr9875 - Specification for Non-Pressure Pipeline Construction

5.15 Pipeline Components

- 5.15.1 Pipeline fittings and couplings shall comply with the SEQ WS&S D&C IPAM List.

5.16 Branding of Mark Number

- 5.16.1 Where the documents provide a mark number for the fittings and pipes, then they shall be branded with the mark number by the contractor.

5.17 Materials Transport and Handling

- 5.17.1 The Contractor shall cart all materials to their appropriate position in the pipeline. This cartage shall include all necessary loading and unloading.
- 5.17.2 The Contractor shall comply with the manufacturer's instructions for handling and storage of pipes and fittings. Every care must be taken during loading, stacking, carting and handling of pipes, fittings or pipeline components. On no account shall pipes, fittings or pipeline components be dropped off trucks or allowed to collide one with another when rolled down skids. The use of chain or wire rope slings or fastenings will not be permitted on pipes unless properly protected with rubber belting. Damage to any coatings shall be made good in a manner satisfactory to the Superintendent.
- 5.17.3 When distributing pipes, fittings or other material along streets, roadways or easements, care must be taken to not cause any blockage or hindrance of any sort to drainage or traffic (including pedestrians). Safety barriers, warning signs and flashing lights shall be provided as appropriate.

5.18 Delivery and Storage

- 5.18.1 The Contractor shall comply with the manufacturer's instructions for handling and storage of pipes and fittings. Delivery shall be into stockpiles as close as is practicable to the pipeline route unless specified otherwise. The pipes, fittings and valves shall be securely stacked clear of the ground in a safe, stable and secure location to restrict public access. The Contractor shall provide all craneage, labour and materials necessary to unload and stack in the stockpiles. All damage done to the coating in transit or during unloading and stacking shall be satisfactorily repaired by the Contractor at his own expense to the manufacturer's requirements.
- 5.18.2 The pipes shall be delivered in such quantities and at such times as shall be directed by the Superintendent. The Contractor shall remain responsible for the stockpiles of pipes and fittings until such time as they have been inspected and accepted in writing by the Superintendent.
- 5.18.3 During construction, when pipes may be located outside the secured area for welding and/or laying purposes, they shall be located in a safe and stable location, secured from movement via wedges and capped to stop any vermin or Public access internally into the pipes.

5.19 Concrete

- 5.19.1 Concrete work shall comply with the requirements of the Job Specification and Unitywater's *Specification for Building and Structural Works* (Pr9903).
- 5.19.2 Concrete used for the restoration of concrete surfaces shall be Class S32 (min.).

5.20 Manhole Covers and Frames

- 5.20.1 Manhole covers and frames shall be of grey iron or ductile as detailed on the SEQ WS&S D&C IPAM list.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 5.20.2 Class 'D' iron cover shall be used in roads and on premises where the manhole may be subjected to heavy vehicular traffic or where directed by the Superintendent.
- 5.20.3 Concrete filled covers shall not be used due to excessive lifting weight of the lid that concrete imparts.
- 5.20.4 A bolt down cover shall be used where the manhole is located in an area subject to surcharge, flooding or where directed by the Superintendent.

5.21 Water Required for Works

- 5.21.1 The Contractor shall not use a standpipe on a hydrant until such time as an application has been made to the Superintendent and a permit issued for the use of a hydrant. Any fees which the Superintendent may impose for the use of the standpipe shall be paid by the Contractor and shall be included in his Schedule of Rates or Contract Sum as applicable for carrying out the work.
- 5.21.2 The Contractor shall abide by any restrictions imposed on the use of water by the Superintendent. The Superintendent may impose a charge for water used if the Contractor is deemed to be wasting water.
- 5.21.3 Where water is required for pressure testing purposes, the Superintendent may accept the use of recycled water in lieu of potable water sources for sewer pipeline testing. The Contractor shall make all necessary pumping and transportation provisions to obtain the required volumes of recycled water. Test water will be disposed with the approval of the Superintendent

5.22 Timber

- 5.22.1 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, waness, shakes, gum veins, cores and other defects.
- 5.22.2 Timber used for restoration shall be cut, matched and framed in a tradesman like manner. The timber shall be properly arised and shall hold to true dimensions when fixed in position.
- 5.22.3 The Superintendent may direct that timber used in trench shoring shall remain in place in the trench in order to protect adjoining improvements.

5.23 Nature of Ground

- 5.23.1 Where the Superintendent has undertaken a sub-soil testing program on the site of the works, this information shall be made available to the Contractor. It shall be the Contractor's responsibility to interpret the information supplied.
- 5.23.2 The Superintendent does not purport that the available information represents all the sub-soil conditions which may be encountered.
- 5.23.3 The Contractor shall be deemed to have satisfied himself as to the nature of the ground at the time he made the offer to carry out the works.

5.24 Unidentified Existing Pipelines

- 5.24.1 Upon identification of a connected unidentified pipe to the network, the contractor shall immediately report the finding to the superintendent. It shall be the Contractor's responsibility to confirm if the unidentified pipe is live or disused and redundant.
- 5.24.2 The Contractor shall take all practical tests to try and prove if the pipe is live. These tests shall include dye flush tests from local buildings or from any other logical source.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 5.24.3 If the dye tests do not identify the source, the contractor shall undertake a 24hr bucket capture test from the pipeline discharge to confirm if it is in service.
- 5.24.4 The contractor shall have the captured fluid tested to confirm if the captured liquid is sewage.
- 5.24.5 The pipe cannot be disconnected until all tests are completed and results have been given to the superintendent for a direction.
- 5.24.6 The location, extents and levels of the unidentified existing pipelines shall be recorded on the as-constructed information.

5.25 Disused Existing Pipelines

- 5.25.1 The Contractor shall be responsible for the decommissioning of disused or redundant pipelines.
- 5.25.2 Where applicable, the disused pipeline shall be flushed and scoured with recycle water with the wastewater to be discharged to an approved collection point within the Unitywater network.
- 5.25.3 The disused or redundant pipeline shall be capped or plugged with an appropriate material to be confirmed by the Superintendent. The pipeline is then to be completely grout filled unless otherwise directed in writing by the Superintendent.
- 5.25.4 All surface infrastructure (i.e. maintenance structures, etc.) shall be removed and correctly disposed.
- 5.25.5 Pipeline markers or references shall also be removed.
- 5.25.6 The location and extent of disused pipelines shall be recorded on the as-constructed information.

5.26 Handling Asbestos Cement Pipe and Fitting

- 5.25.1 Asbestos fibres, if inhaled or ingested, can lead to diseases such as asbestosis and various cancers. It is recognised that exposure to all forms of asbestos dust must be avoided to safeguard the health of those persons working with asbestos-containing products.
- 5.25.2 Where possible the Contractor shall open pipe joints and remove whole lengths of AC pipe rather than cutting.
- 5.25.3 Where asbestos material is encountered, the Contractor shall be responsible for:
- Full compliance with relevant guidelines and legislation.
 - The supply and maintaining in good order of the appropriate tools and safety equipment.
 - The instruction of all operators and their assistants in the proper use of such tools and/or equipment.
 - The necessary supervision and monitoring to ensure that the prescribed safe working practices are adhered to.
 - Necessary medical examination or treatment of employees in contact with the asbestos material.
 - Safe Disposal of asbestos material in accordance with relevant legislation.

Pr9875 - Specification for Non-Pressure Pipeline Construction

6. Clearing and Grubbing

6.1 General

6.1.1 Clearing and grubbing requirements shall conform with the requirements of the Job Specification and Unitywater's *Specification for Civil and Earth Works* (Pr9902).

6.1.2 All trees, shrubs, stumps and roots which, in the opinion of the Superintendent, 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 and compacted with sound material in a manner approved by the Superintendent.

The Superintendent may require the Contractor to construct the works 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 the Superintendent and carried out by the Contractor in a proper manner to minimise the permanent damage to the trees or shrubs.

6.1.3 Except where otherwise specified, or where express instructions are issued to the Contractor, the areas to be cleared and grubbed shall be those within a horizontal distance of 600 mm of the centre of each pipeline. The Contractor shall exercise every care and where possible, shall preserve fruit trees, ornamental trees, shrubs and vegetables.

Where pipelines pass through lawns and elsewhere when directed by the Superintendent 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.

6.1.4 The Superintendent shall be responsible for claims for compensation arising from the loss of trees and other flora which the Contractor removes with the consent of or by the direction of the Superintendent within the limits defined in the previous clause. The Contractor shall be responsible for claims for loss and damage resulting from the removal of or damage to trees and other flora outside the limits set out in the previous clause.

6.2 Erosion and Sediment Control

6.2.1 Erosion and sediment control requirements shall conform to the requirements of the Job Specification and the SEQ WS&S D&C Code.

7. Pipeline Trench Excavation

7.1 General Requirements

7.1.1 Excavation requirements shall conform to the requirements of the Job Specification and the SEQ WS&S D&C Code.

7.1.2 Dial Before You Dig (DBYD) shall be undertaken prior to commencement of excavations or any activities which may disturb the ground; DBYD information shall be available on site and be current and up to date. (note: DBYD information is provided by DBYD members only)

7.1.3 For works within land under the control of Queensland Department of Transport and Main Roads or Queensland Rail, asset information must be obtained separately from the DBYD process prior to the commencement of excavations.

7.1.4 The Contractor shall not commence, without the consent of the Superintendent, the work of excavating trenches in any section or sections of the work and shall not at any time during the progress of the work have more than 40 metres of trench opened up ahead of pipe laying in

Pr9875 - Specification for Non-Pressure Pipeline Construction

any section of the work unless agreed by the Superintendent. In all cases, trenches shall be backfilled and made safe prior to the completion of each day's work.

- 7.1.5 Before commencing work on any pipeline the Contractor shall establish the centre of the pipeline, locate any underground services which may be present, make provision for the safe passage of foot and vehicular traffic during construction and offset any level pegs which may be located on the pipe centreline.
- 7.1.6 Trenching shall be carried out in such a manner as will cause the least interruption to traffic. Access to properties must be maintained at all times. Where traffic must cross open trenches, suitable bridging must be provided at street crossings and driveways.
- 7.1.7 The Contractor shall take such precautions as are necessary to ensure that all excavation is made in a careful manner, and that it is rendered secure and safe by sheeting and/or other means. Throughout the whole of the work, the Contractor shall take all precautions against accidents, etc. whether arising from insufficient strength of sheeting, bad workmanship, breakage of machinery or plant, inadequate caulking or packing, floods or any other cause whatsoever.

7.2 Limits of Excavation

- 7.2.1 The Contractor shall keep the extent of excavation to the minimum possible to allow efficient construction of the Works while meeting the minimum requirements shown on the Drawings and the relevant Standard Drawings. The Contractor shall keep pipe trench widths within the maximum widths shown within the Contract drawings. Widening of the trench beyond the maximum specified in will increase the load carried by the pipe and will require a review of the pipe class and trench compaction method.
- 7.2.2 If the maximum width limits cannot be met, the Contractor shall seek advice from the Designer and Superintendent.
- 7.2.3 The maximum length of trench open at any one time is 150 m. An open trench is defined as any excavation that is below natural surface level. At the end of the shift the trench shall be made safe and barricaded off.
- 7.2.4 Where not otherwise shown on the drawings, the minimum width of trenches, under stable ground conditions shall be as shown in:
- AS 2566.2 for flexible pipes (includes DICL and MSCL);
 - AS 3725 for rigid pipe (concrete).

7.3 On-Site Stockpiles

- 7.3.1 Only sufficient materials shall be stored on site as are necessary to allow timely and efficient progress of the work. Stockpiles of excavated or imported material shall be located where they cause no interference to the public, drainage routes or vehicular or pedestrian traffic.
- 7.3.2 Clear lines of sight for drivers must not be obstructed. Materials shall not be stacked against structures, fences, trees or other property improvements. A clear path at least 600 mm wide shall be left between the edge of any excavation and the inner toe of any stockpile or spoil banks. The load due to stockpile of materials in the vicinity of any excavation shall be taken into account in the design of excavation.
- 7.3.3 All excavated materials that are to be re-used should be protected from excessive drying or wetting during storage. Additionally, these materials should be excavated, stored, handled and laid so as to avoid contamination and loss of fines.
- 7.3.4 Where stockpiling of topsoil is required, establish stockpiles in approved locations, to heights not exceeding 1.5 m. The Contractor shall:

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Provide adequate drainage and erosion protection;
- Not burn off to remove plant growth that may occur during storage;
- Not allow traffic on stockpiles;
- Sow stockpile(s) of topsoil with temporary grass, if a stockpile of topsoil is to remain unused for more than four weeks.

7.4 Cover Requirements

- 7.4.1 The Contractor shall ensure that the minimum cover requirements are satisfied following any earthworks which may occur in the area of the pipelines. Minimum cover for pipelines shall be in accordance with the SEQ WS&S D&C Code.
- 7.4.2 Pipe floatation of empty pipe in full submergence shall be considered with regard to depth of pipe cover.
- 7.4.3 Minimum cover for pipelines, unless nominated otherwise on drawings, from finished surface level to pipe obvert, is stated in the SEQ WS&S D&C Code. The Contractor shall protect pipes from damage during construction activities where cover may be less than the minimum specified or subject to heavy or unusual loading.
- 7.4.4 The Contractor shall seek guidance from the Designer and Superintendent where the minimum cover requirements cannot be met and the proposed solution is not detailed on the Contract Drawings.

7.5 Excavation Across Improved Surfaces

- 7.5.1 The Contractor shall use tunnelling or boring techniques where possible in at least the following situations:
- Where excavation is required under improved surfaces such as pavements, driveways and kerb and gutter;
 - Where the surfaces cannot be satisfactorily reproduced;
 - Under existing concrete footway areas and concrete driveways.
- 7.5.2 If open excavations are used in improved surfaces, the excavation width shall be kept to the minimum allowed.
- 7.5.3 The Contractor shall provide all necessary traffic control to manage excavation across roads and shall minimise the time required to complete the works. The Contractor shall provide alternative public vehicle and pedestrian access around all excavations in the roadway.
- 7.5.4 Before excavating trenches, the Contractor shall saw cut existing concrete and bituminous surfaces to provide a straight even joint during the work. All works across road carriageways are to be in accordance with the road authority conditions of approval.
- 7.5.5 Excavation along carriageways should wherever possible be located such that the edge of the opening is at least one (1) m from the edge of the carriageway.
- 7.5.6 The Contract shall ensure that unity paving is lifted by hand, cleaned and set aside in suitable location for later reinstatement.

7.6 Vacuum Excavation

- 7.6.1 Vacuum excavation is an efficient, safe and effective alternative to hand digging within designated tolerance zones when used appropriately. Use of equipment must follow all Government statutory laws and regulations.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 7.6.2 Excavators must also comply with the requirements of current Environmental Legislation, Work Health and Safety Regulations and WorkCover Guides and Codes of Practice.
- 7.6.3 The safe exposure of underground services within tolerance zones is essential for damage prevention. Site conditions may make the use of hand tools to expose underground facilities difficult or even impractical. Vacuum excavation is often an appropriate alternative.
- 7.6.4 Unless specifically allowed by law, approval must be obtained from the underground service owner prior to the commencement of any vacuum excavation work. Underground service owners may have specific criteria for safe excavation/exposure practices around their facilities. Some underground service owners accept vacuum excavation as equivalent to hand excavation for exposing their facilities and others have restrictions on its use.
- 7.6.5 Vacuum excavation must not be used where asbestos containing material is known or suspected to be present.
- 7.6.6 Vacuum excavation is an appropriate method of excavating safely around underground services provided that:
- a. The pressure and vacuum excavation equipment has been specifically designed and engineered by a excavating equipment manufacturer for non-destructive, close excavation around buried infrastructure;
 - b. The equipment is operated in accordance with the manufacturer's operating instructions;
 - c. The pressure and vacuum excavation equipment is operated in accordance with practices that provide appropriate levels of worker and public safety and prevent damage to buried facilities;
 - d. Use of all equipment complies with Government statutory laws and regulations and the underground service owner requirements and restrictions;
 - e. Documented vacuum excavation safe work practices and procedures are in place and available for review upon request by a representative of a service owner;
 - f. Use of the equipment follows the documented safe work methods and procedures;
 - g. The documented safe work practices and job procedures meet service owner guidelines;
 - h. Only suitably experienced, competent and qualified workers operate the equipment;
 - i. The tools used (dig wand/vacuum tube) have been specifically designed for excavating around buried services (e.g. rubberised coating on dig wand and rubberised sleeve attached to the end of the vacuum tube).
- 7.6.7 The following procedures shall be followed when vacuum excavation technology is used:
- a. A minimum distance of 200mm must be maintained from the tip of the pressure wand to the service; the nozzle shall never be inserted into the ground while excavating within the 'underground service zone'.
 - b. When pressurised wands are used, the maximum water pressure with a straight tip nozzle to be used at any time during excavation in public roads and easements shall be 135 bar.
 - Below a ground depth of 500mm, the water pressure to be used at any time shall be reduced to a max. 100bar.
 - When a straight tip nozzle is used, pressure measurements are to be monitored using a pressure gauge mounted on the pressure machine.
 - c. The max. pressure to be used at any time with a spinning nozzle during excavation shall be 200bar;

Pr9875 - Specification for Non-Pressure Pipeline Construction

- When a spinning nozzle is used, pressure measurements are to be monitored using a pressure gage mounted on the excavation machine;
- d. The pressurized air or water wands shall never remain motionless during excavation. Aiming directly at the underground facilities shall be avoided at all times.
- e. A device capable of stopping the excavation on demand, such as an Emergency Shut-off Device, shall be immediately available at the point of excavation.
- f. If damage to underground facilities and/or coatings on these facilities occurs while using vacuum-excavation technology or any other method of excavation, the excavator shall contact the facility owner/operator.

7.7 Excavation in Root Zones

- 7.7.1 The Contractor shall ensure that no undue damage is caused to existing tree root systems as a result of excavation works. Tree roots larger than 25 mm in diameter shall not be cut without the approval of the Superintendent.
- 7.7.2 Where necessary, the Contractor shall ensure roots are pruned using a handsaw or secateurs, making a clean cut and making as small a wound as possible.

7.8 Support of Excavations

- 7.8.1 The sides of excavations for pipework shall be kept vertical to at least 150 mm above the pipe. Except where described in, or permitted in the Contract, the sides of excavations shall be supported at all times and shall not be battered.
- 7.8.2 When removing, raising or withdrawing supports, the Contractor shall ensure that no damage, disturbance or displacement occurs to adjacent structures along with the pipes, fittings, geotextile filter fabric, pipe embedment and trench fill already installed. The Contractor shall ensure that compaction of pipe embedment and trench fill material occurs below such trench support and against native ground.
- 7.8.3 If the trench support system is to be left in place as permanent support, the support system shall be cut off at a depth below ground surface that will satisfy the structural requirements of the site.

7.9 Adjacent Structures and Services

- 7.9.1 The Contractor is responsible for locating, identifying and contacting the owner of any service within close proximity of the trench excavation.
- 7.9.2 The Contractor shall provide a condition assessment report on any adjacent structures and services identified by the Superintendent.
- 7.9.3 The Contractor shall ensure that adjacent structures and services are not subject to disturbance by the excavation or by any trench support system
- 7.9.4 The Contractor shall ensure that adjacent services and services which cross the excavation are adequately supported and protected during trenching. The Contractor shall liaise with the owner of the services to coordinate trenching operations and any temporary isolation of the service which may be required.

7.10 Drainage and Dewatering

- 7.10.1 The Contractor shall:
- Keep all excavations free of water;

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Provide, maintain and operate intercepting works to prevent surface water from entering the excavations and all equipment necessary for dewatering the excavations and keeping the Works free from water;
 - Lower the water table by well points or other external dewatering methods only if no damage is likely to be caused to adjacent structures and services.
- 7.10.2 The Contractor shall ensure that all downstream works that are under construction, completed or in use are protected at all times against the effects of any drainage which is discharged or likely to be discharged from the Works.
- 7.10.3 The Contractor shall ensure that:
- Watercourses and other surface water drainages, including land and/or road drainage, within the Site are maintained in an effective working condition at all times;
 - All practicable measures are taken to prevent the deposition of silt or other material and pollution or damage arising from construction operations and acts of vandalism, to any existing watercourse, canal, lake, reservoir, borehole, aquifer or catchment area.
- 7.10.4 The Contractor shall obtain approval for all temporary liquid discharges, crossings or diversions to watercourses from the relevant statutory authority and comply with approval requirements.

7.11 Disposal of Surplus Excavated Material and Unsuitable

- 7.11.1 The Contractor shall promptly remove and lawfully dispose of excavated material that is unsuitable for (re)use on-site at a suitable off-site location. No unsuitable material may be disposed of on-site without permission from the Superintendent.
- 7.11.2 Suitable surplus material that is not required for reuse in the works is the property of the controlling authority or owner of the excavation site. The Contractor shall seek approval from the Superintendent on the location for disposal of surplus material. If directed by the Superintendent the Contractor shall dispose of surplus material off site.

7.12 Trenching in Non-Rippable Rock

- 7.12.1 Non - rippable Material is defined as rock that would experience hard digging with a CAT245 excavator or similar.
- 7.12.2 Encountering rock shall be a hold point, the Contractor shall obtain agreement from the Superintendent on the extent of excavation.
- 7.12.3 Rock shall be excavated to reach the design trench levels as detailed on the Drawings. The Contractor shall avoid forming pockets of shattered material below the level of the excavation.
- 7.12.4 The Contractor shall remove all loose material. Any over-excavation below the design level of the trench shall be filled to formation level with embedment material approved by the Superintendent, free from perishable materials and resistant to washing. The Contractor shall compact all material in accordance with requirements for embedment material.
- 7.12.5 The Contractor shall trim the excavation to shed water.
- 7.12.6 Blasting of rock shall not be permitted.

7.13 Trench Floor Preparation and Unsuitable Foundation Material

- 7.13.1 The time for which the trench floor is exposed shall be minimised to prevent deterioration.
- 7.13.2 Prior to placing embedment, check that the proposed foundation is able to provide a firm foundation with a minimum bearing capacity of 50kPa at the required level.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 7.13.3 Where a minimum bearing capacity of 50 kPa cannot be achieved a rock mattress, as detailed on design drawings, shall be installed at the base of the trench. The depth of the rock mattress shall be agreed with the superintendent.
- 7.13.4 In locations where the installation of a rock mattress is not considered practical or suitable, unsuitable foundation material shall be removed and replaced. The Contractor shall obtain agreement from the Superintendent on the extent of unsuitable removal prior to starting work.
- 7.13.5 The Contractor shall excavate any localised unsuitable ground, soft spots or damaged surfaces below the formation level and then fill to formation level with approved embedment material, free from perishable materials and resistant to washing.
- 7.13.6 The Contractor shall compact all material in accordance with requirements for embedment material.

7.14 Tunnelling

- 7.14.1 The Contractor shall not undertake excavation in tunnel unless shown on the Contract drawings or instructed or permitted by the Superintendent in writing to do so.
- 7.14.2 Where tunnelling is used, the maximum distance between adjacent shafts shall be determined by the Contractor and approved by the Superintendent. No pipes shall be laid until the tunnel between adjacent shafts has been holed through and finished to the required line, level and grade.
- 7.14.3 No excavation shall be deemed to be in tunnel unless it is shown on the drawings or express instructions are issued by the Superintendent in writing that specific lengths of pipeline shall be so constructed.
- 7.14.4 In all underground workings, the Contractor shall take precautions prescribed in respect of mines, and shall comply with all regulations applicable to such works.
- 7.14.5 The dimensions of the tunnel and the installation of the tunnel support system shall be as agreed with the Superintendent. Adequate working space to bed and lay pipes shall be provided.

7.15 Excavation under Railway Lines

- 7.15.1 The Contractor shall conform to AS 4799 Installation of underground utility services and pipelines within railway boundaries.
- 7.15.2 Before constructing any work under or adjacent to any railway, the Contractor shall give notice in writing to the relevant Rail Authority, of his intention to commence operations.
- 7.15.3 The Contractor shall not commence any such work until he has received the written permission of the Rail Authority and shall conduct the whole of the works under such conditions and supervision and with such precautions against interruption or danger to traffic as the Rail Authority directs.
- 7.15.4 The Contractor shall be solely responsible for any stoppages, delays or accidents arising out of or in any way attributable to his operations. Should the Rail Authority consider it advisable, flagmen or other men 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 permanent way. Such action shall not relieve the Contractor of any of the responsibilities under the Contract.
- 7.15.5 The Contractor shall obtain any necessary permits and pay all fees and charges in connection with the works carried out under this clause, including the cost of the flagmen or other men referred to above.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 7.15.6 All pipe crossings of railways shall be laid in box culverts, enveloping pipes or concrete surround, as specified.

7.16 Excavation Under Controlled Roads

- 7.16.1 Work within the boundaries of State controlled roads shall be carried out in accordance with the current condition of approval from the Road Authority.
- 7.16.2 The Contractor shall be responsible for giving the local State Road Authority Manager the required period of notice prior to the commencement of construction.

7.17 Excavation Under Other Roads

- 7.17.1 Work under road surfaces carrying vehicular traffic shall be carried out in accordance with the current condition of approval from the Road Authority.
- 7.17.2 The Contractor shall be responsible for giving the Road Authority the required period of notice prior to the commencement of construction.
- 7.17.3 Unless otherwise specified the approved filling and backfilled material shall be compacted to prevent settlement of road surfaces.

7.18 Boring/Jacking of Enveloper Conduits

- 7.18.1 Trenchless construction by Boring/Jacking of conduits shall conform to the requirements of the Job Specification and Pr9787 *Specification for Microtunneling and Pipejacking Construction*.
- 7.18.2 The Contractor shall carry out all work necessary for the installation of the pipeline. The Contractor shall construct temporary access, benches, standing areas, haul roads and any other facilities necessary for the installation and completion of the pipelines and associated works. Upon completion of the pipeline, the Contractor shall reinstate those areas affected by such work to their original geometry, function and condition.
- 7.18.3 The pipeline shall be constructed by progressively boring/jacking an approved enveloping pipe. The enveloper pipe installed shall be in accordance with the specifications of the relevant authority. All such boring/jacking shall be done without disturbance to existing road, structures, works or services. The Contractor shall be responsible for thoroughly assessing ground conditions, determining boring and thrusting conditions and all design work required.
- 7.18.4 The pipeline shall be installed in the enveloping conduit. The Contractor shall use a method of installation that does not damage the pipeline.
- 7.18.5 The void between the pipeline and the enveloping pipe shall be pressure grouted using an approved flowable Portland cement grout. The Contractor shall ensure that the manufacturer's recommended allowable external pressure for the pipe is not exceeded and that the pipeline does not suffer any deflection, distortion or damage as a result of the pressure grouting.
- 7.18.6 The pipeline shall also be managed to flotation and thermal reversion during the grouting procedure
- 7.18.7 All boring, jacking and pressure grouting work shall be performed by specialist personnel who are experienced with the equipment and construction method.

Pr9875 - Specification for Non-Pressure Pipeline Construction

8. Laying and Jointing Pipes

8.1 General

- 8.1.1 All pipe laying shall be supervised by persons having at least 2 years' experience in laying the relevant pipe material. Alternatively, pipe layers with 2 years' experience in other pipe materials and who have successfully completed the Pipe Laying Program for the relevant pipe material, within the previous 3 months, may supervise the laying of pipe.
- 8.1.2 An accredited pipe layer shall be on site while pipes are being laid and bedded. Records of experience (including references) and/or training qualifications for all site staff shall be provided to the Superintendent prior to the commencement of work.
- 8.1.3 Flexible pipelines (including DICL and MSCL) shall be installed in accordance with the requirements of AS 2566 Part 2, unless otherwise noted in this specification.
- 8.1.4 All pipelines shall be laid to such lines, gradients and levels as are shown on the drawings or as may be otherwise directed by the Superintendent.
- 8.1.5 It is the Contractor's responsibility to preserve uniform gradients and correct alignment.
- Abrupt changes of grade such as might result from minor irregularities of surface or otherwise must be avoided. The maximum tolerance in horizontal alignment shall be ± 75 mm. The Superintendent will carry out compliance checks at times nominated by the Superintendent.
- If any audit check finds the pipe incorrect in size, level or grade, the Contractor shall, at his own cost, recheck the pipes laid between the previous correct audit and the incorrect audit pipe and remove and relay all pipes found incorrect.
- Any pipes damaged during the course of such removal shall also be replaced at the Contractor's cost.
- 8.1.6 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.
- 8.1.7 Before laying, all pipes and fittings must 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. Particular attention shall be paid to cleaning the jointing faces.
- 8.1.8 All open ends must be protected against the ingress of dirt or foreign matter by the use of plugs in a manner satisfactory to the Superintendent.
- 8.1.9 Unless otherwise specifically approved in writing by the Superintendent, pipelines shall be laid, jointed and checked in complete lengths from manhole to manhole or structure to structure prior to commencement of backfilling.
- 8.1.10 The Superintendent will, in exceptional circumstances such as crossing of important roads, works adjacent to buildings and extreme weather conditions, give consideration to any request from the Contractor for approval to commence backfilling at an earlier stage, but will not approve any such request unless such action is, in the Superintendent's opinion, necessary in the circumstances. The Contractor shall adopt measures to control the line and level of the pipeline.
- 8.1.11 The Contractor shall ensure that pipes to be embedded in the walls of structures are laid and retained in correct position and level. Where such pipes are at or near floor level of the structure, they shall be fixed by bedding the pipes on the concrete manhole bottom placed in conjunction with laying and jointing of pipes or by other approved methods.
- 8.1.12 Seals for future inspection and maintenance purposes and temporary seals shall be made with an approved factory-made sealing plug and flexible watertight joint.

Pr9875 - Specification for Non-Pressure Pipeline Construction

The plug shall be restrained from movement by an approved metal clip suitably protected against corrosion by hot dip galvanising and wrapping.

A square of polythene sheeting shall be used to cover the plug so as to prevent entry of sand, soil, etc. into the joint.

All seals shall be watertight under the specified test heads applied either internally or externally. Other approved seals may be used.

- 8.1.13 Joints in pipelines shall be of the flexible types using rubber jointing rings supplied with the pipes for that purpose. Lubricants shall be used where specified by the manufacturer.

Spigot and socket joints shall be marked with gauge lines so that the pipe layer can judge the penetration achieved at the joint. The joints shall be cleaned before mating.

To avoid damaging the end of the pipe during jointing, a suitable timber spacer shall be used between the pipe and the lever. Extreme care shall be exercised to avoid damage to any external coating of the pipe when the joint is pulled together.

8.2 Handling FBP Coated Pipes

- 8.2.1 When handling FBP coated steel pipes, the greatest care shall be exercised to avoid damage to the pipe or coating. Under no circumstances shall a pipe be lifted by unprotected slings or levered or moved by implements without protecting pads.

- 8.2.2 Lifting slings shall not be less than 300 mm wide. Where pipes are lowered onto the ground they shall rest on padded bolsters or on padded ramps or on padded cradles. Heaps of sand or soft earth as supports will be acceptable. Pipes with uncoated ends may be lowered onto the ground with chocks placed only under the ends left uncoated. Any damage to the pipe coating occurring after delivery shall be made good by the contractor at his own expense.

8.3 Testing of FBP Coating

- 8.3.1 Before the FBP coated steel pipe is placed onto its bedding the pipe shall be tested for defects in the external coating by means of a high voltage holiday testing apparatus capable of testing at 15,000 volts. Testing shall be in accordance with AS3894.1. Safety procedures must be strictly followed. The earth should be on the current mortar lining. At any place where the apparatus gives a spark or discharge through the coating to the steel pipe it will be taken that a defect in the coating exists and all such defects shall be repaired at the contractor's own expense and retested to the satisfaction of the Superintendent.

- 8.3.2 Repairs to the FBP coating shall be in accordance with AS4321. The contractor shall provide a skilled workman to do this work and in the first instance he shall arrange for the manufacturer to have one of their repairers to be on the job to supervise and train the contractor's repairer in this work. All expenses in this regard will be at the contractor's cost.

8.4 Laying of Rubber Ring Joint Pipes

- 8.4.1 The contractor shall obtain a copy of the pipe manufacturer's recommended laying practice for rubber ring jointed pipe. The pipes shall be laid in accordance with the instructions in this pipe laying manual except as modified by this specification.
- 8.4.2 Where the grade of the pipeline is steeper than 10% then the pipe laying shall proceed in an uphill direction as shown in the pipe laying manual. Where necessary, the contractor shall cut and weld in a split collar joint so that the socket end of the pipes will face uphill.
- 8.4.3 Extreme care shall be exercised to avoid damage to any external coating of the pipe when the joint is pulled together.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 8.4.4 The jacking system used shall have a capacity of not less than 30 kN where the wall thickness of the pipe is 8 mm or less and 50 kN for pipes with 10 mm wall thickness or greater and shall provide an even pull over the whole of the circumference of the joint. A digging bucket shall not be used to push the FBP pipes home.
- 8.4.5 All spigot ends for rubber ring jointed pipes will be supplied with witness marks applied in the factory. The joint shall not be considered fully made unless the distance between the witness mark and the adjoining socket end is within the tolerance nominated by the pipe manufacturer.
- 8.4.6 Where a deflection in the joint is required by the drawings or directed by the Superintendent this deflection shall be made after the joint has been fully entered and the pressure is still applied to the joint.
- 8.4.7 After the completion of the joint a feeler gauge shall be used to probe the gap between spigot and socket to locate the rubber ring and the probing shall progress continuously around the joint so that the rubber ring is touched at intervals of not more than 12 mm. If there is any indication that the rubber ring has been displaced from its groove the joint shall be pulled apart and remade.

8.5 Jointing PE Pipes and Fittings

- 8.5.1 PE pipes and fittings shall be jointed in accordance with AS 2033, SEQ WS&S D&C Code, WSA01 Polyethylene Pipeline Code and PIPA Technical Guidelines.
- 8.5.2 Pipe shall be Series 1 and coloured both internal and external in accordance with the SEQ WS&S D&C IPAM List
- 8.5.3 Butt Fusion and Electrofusion joints shall only be performed by suitable trained and experienced operators with current welding certification. Certificates of qualification and trained operators previous work history and references, shall be provided to Unitywater prior to work commencing. Operators shall be experienced with the equipment and pipe sizes relevant to the work being undertaken and must produce evidence of such experience to the satisfaction of Unitywater.
- For Butt weld jointing, all welding operators shall be qualified to PMBWELD301B – Butt weld Polyethylene Plastic Pipelines.
 - For Electrofusion jointing, all welding operators shall be qualified to PMBWELD302B – Electrofusion weld Polyethylene pipelines.
- 8.5.4 Fabricated fittings shall only be used where permitted in the Project Specification.
- 8.5.5 Preferred PE pipe and fitting jointing types:
- Butt fusion jointing is Unitywater's preferred method for joining PE pipes.
 - Electrofusion jointing shall be engineered out where possible to limit their use. The use of Electrofusion joints must be approved by Unitywater.
 - Gripper type joints for connection non-pressure PE pipe is not approved by Unitywater.
 - Flange joints for connecting non-pressure PE pipe lengths is not approved by Unitywater.
- 8.5.6 The Contractor shall submit full details of the proposed jointing methodology to Unitywater for approval, prior to undertaking the work.
- 8.5.7 Weld Procedure Specification (WPS) shall be submitted for each model fusion machine. WPS shall be relevant to the machines capabilities and any pipe size not relevant shall not be included. WPS shall cover every pipe size and SDR relevant to the project. Attention should

Pr9875 - Specification for Non-Pressure Pipeline Construction

be noted to display cooling times and time before rough handling. See PIPA POP003 appendix for guidance.

- 8.5.8 Weld Procedure Qualification (WPQ) shall be submitted for each individual model butt fusion and electrofusion machine. Each individual pipe size and SDR on the WPS must have a relevant test coupon completed if it is to be qualified. WPQ shall consist of:
- Weld Procedure Specification;
 - Compliant visual inspection check sheet per coupon;
 - Destructive test results from a NATA accredited laboratory for each relevant pipe size to be qualified compliant as per section 8.5.11 and 8.5.11.
- 8.5.9 Welder Qualification (WQ) shall be submitted for each individual to be eligible to perform any PE jointing on an associated fusion machine. If multiple machine models or manufacturers are to be used on the project, the welder shall be qualified to the corresponding WPS associated with each machine. WQ shall consist of:
- Cover page for welder details including:
 - i. RTO course qualification details;
 - ii. Unique welder I.D;
 - iii. Weld Procedure Specifications qualified to with relevant pipe size and SDR;
 - Weld Procedure Specification;
 - Daily weld sheet traceable to the test coupon;
 - Visual inspection check sheet;
 - Compliant destructive test results from a NATA accredited laboratory for each relevant pipe size to be qualified compliant as per section 8.5.11 and 8.5.12.
- 8.5.10 The associated test results and inspection sheets for acceptable test coupons may be used to approve both the WPQ and WQ simultaneously. No PE pipe production joints shall be carried out unless formally approved by Unitywater.
- 8.5.11 Acceptance criteria for butt fusion shall pass visual inspection as per PIPA POP014 Table 1, Table 2 and destructive tensile test results by a NATA accredited Laboratory. Destructive tensile testing shall be performed in accordance with per ISO 13953 (2001) exhibiting ductile failure, no contamination in the weld plane and minimum tensile strength of 90% parent pipe.
- 8.5.12 Acceptance criteria for electrofusion shall pass visual inspection as per PIPA POP014 Table 4 and a peel decohesion test. The peel decohesion test shall display >66.7% ductile mode of separation in accordance with ISO 13954 (1997).
- 8.5.13 Once qualified every welder shall have one in the first ten (10) welds destructively tested for a butt fusion and electrofusion joint chosen at random by the Contractor. Following this, if compliant a minimum of one weld in twenty (20) shall be chosen at random. Relaxation of testing may be applied for by the Contractor for non-critical sections such as exposed pipework and short trenched sections. Approved relaxing on testing shall be replaced by bead testing as per PIPA POP014 section 2.1.1
- 8.5.14 A Non-compliant destructive test result for butt fusions or electrofusion exhibiting brittle failure shall be investigated and trigger the following process.
- The welder who performed the joint shall be removed from production and investigation carried out to determine the root cause. Should it be deemed to not be an issue with the fusion machine, the previous two joints shall be cut out and destructively tested as per section 8.5.11 and 8.5.12.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- If either destructive test results exhibit a non-compliant result, the pipeline shall be quarantined between the last acceptable test result and current failure location.
 - Proceeding activities shall be decided upon by Unitywater with the possibility of cut outs until acceptable destructive test results are obtained or complete replacement of the pipe. It is advised that measures are taken to ensure that the failure is not due to equipment.
 - Butt fusion machines with 2 or more brittle failures shall be either replaced or returned for maintenance.
 - Prior to a fusion machine being allowed back into production welding it is required to produce a compliant test coupon to the destructive test acceptance criteria.
- 8.5.15 No repairing of PE pipe is allowed. Sections damaged greater than 10% of the wall thickness shall be removed.
- 8.5.16 Welding machines to have current servicing and calibration certificates valid for 1 year.
- 8.5.17 Generator used for welding shall match welding machines minimum power requirements.
- 8.5.18 Quality records including ITP's and Checklists of all welds, including location/number and all destructive test results shall be provided to Unitywater.
- 8.5.19 Threaded joints shall only be used if permitted by the Job Specification.
- 8.5.20 Butt fusion welding minimum requirements in addition to WSA 01;
- No butt fusion welding shall be undertaken within the pipe trench. This condition can only be relaxed under special approval by Unitywater;
 - Only pipe supplier approved, well maintained automatic welding machines of suitable size including clamp frame, clamp shells shall be used;
 - All welding is conducted in a welding tent to reduce contamination by dust and/or moisture;
 - Welding parameters for the machine and pipe are confirmed and correct. Heater plate temperature to be confirmed with thermometer prior to jointing;
 - Generator is adequately sized and has enough fuel for the welding work to be completed;
 - Pipe is located on support rollers;
 - Pipe clamps are the correct size and clean to ensure correct alignment;
 - Only clean, dry lint free cloth or paper towel is to be used in the pipe surface;
 - Pipes of different SDR (wall thickness) must not be butt welded;
 - Toe-in at pipe ends is to be removed by trimming pipe back to ensure pipe dimension comply with the requirements of AS/NZS 4130;
 - Joint is cooled in accordance with standard before removal from the machine;
 - Bead gauge is used to check that bead width meets specification;
 - Quality records of each completed butt weld connection shall be provided to Unitywater in addition to the "Equipment Servicing and Calibration Sheet".
 - One butt weld shall be removed for destructive testing by the Contractor at the start of each days welding session.
- 8.7.2 Electrofusion welding minimum requirements (including EF Branch saddles) in addition to WSA 01;

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Only approved, well maintained automatic electrofusion welding machines of suitable size including clamp frame, clamp shells shall be used;
- All welding is conducted in a welding tent to reduce contamination by dust and/or moisture;
- Welding parameters for the machine and pipe fitting are confirmed and correct;
- Generator is adequately sized and has enough fuel for the welding work to be completed;
- Pipe and fitting is supported and fixed in position prior to welding;
- Pipe clamps are the correct size and clean to ensure correct alignment;
- Manufacturer approved re-rounding tool to be used;
- Only clean, dry lint free cloth or paper towel is to be used;
- Toe-in at pipe ends is to be removed by trimming pipe back to ensure pipe dimension comply with the requirements of AS/NZS 4130;
- Only approved rotational mechanical peeling tool equipment are to be used (hand scraping of the pipe surface both rotational or longitudinal is NOT an approved method of peeling)
- Peeled pipe surface or the bore of the electrofusion fitting is not to be touched or allowed to get damp.
- Only unused approved alcohol wipes are to be used;
- Do not under any circumstances use methylated spirits, acetone, methyl ethyl ketone (MEK) or other solvents to clean the fusion area. Rags of any kind with or without any alcohol solvent are not to be used to clean the fusion area given the possibility of introducing dye, dirt, detergent, fabric conditioner or other contaminants into the fusion zone;
- Final gap between pipe and fitting is checked and conforms to accepted tolerance;
- Pipe shall be shaded from the Sun by the use of a thermal blanket or a shade structure to ensure pipe and fittings are at an even ambient temperature prior to welding;
- Couplings shall remain in sealed bags until the point and time of installation;
- Fusion indicator pins must have risen, with no melted material or wire seen to have exuded from the fitting and that pipe shows no sign of movement in the fitting. Any fitting failing these checks shall be cut out and another fitting used;
- Allow the weld to cool for the time stated on the fitting before removing pipe clamps;
- Re-cooked (second weld) EF welds will not be accepted;
- For electrofusion welding of pipes and fittings \geq DN315, the contractor shall provide third party certification that EF welding has been completed in accordance with Unitywater specifications, manufacturers requirements and industry guidelines;
- All Electrofusion Branch Saddles must pass pressure test before hole cutting into the pipe.
- Quality records of each completed electrofusion joint connection shall be provided to Unitywater in accordance with POP001 "Appendix 'A' Sample Weld Record Sheet" in addition to the "Equipment Servicing and Calibration Sheet".

Pr9875 - Specification for Non-Pressure Pipeline Construction

8.6 Concrete Bulkhead and Trenchstop Construction

8.6.1 Details for concrete bulkhead and trenchstop construction are shown on SEQ WS&S D&C Standard Drawing SEQ-SEW-1206.

8.6.2 The bulkheads shall be placed immediately behind the collars of the pipes.

9. Painted Coatings

9.1.1 Painted coatings to be in accordance with SEQ WS&S D&C Code and Unitywater specification Pr9693 *Specification for Mechanical Installations*.

10. Wrapping of Fittings

10.1 General

10.1.1 All materials and procedures shall be by a recognised manufacturer of corrosion protection systems and shall be acceptable to the pipe manufacturer.

10.1.2 The Contractor shall use only fully trained and experienced personnel for the wrapping of fittings.

10.2 Couplings

10.2.1 Wrapping shall not be used on stainless steel couplings.

10.3 Inspection

10.3.1 The finished wrapping must be thoroughly inspected to ensure that all overlaps are sufficiently sealed to prevent moisture and foreign material from working in under the tape.

11. Embedment

11.1 General

11.1.1 Pipeline embedment shall conform to the requirements of this Specification and the SEQ WS&S D&C Code.

12. Trench Fill

12.1.1 Requirements for trench fill shall conform to the Job Specification and the Pr9904 *Pressure Pipeline Construction Specification*.

12.1.2 For the purposes of this Specification, trench fill is defined as the refilling of trenches/excavations from the top of the pipe overlay (embedment) to ground level in non-trafficable areas and sub-grade level in trafficable areas.

12.1.3 Trench fill shall be in accordance with the SEQ WS&S D&C Code.

12.1.4 The Contractor shall ensure all exposed surfaces of trenches/excavations are uniform and free of excessive gouging, overhangs and cavities to enable uniform compaction of backfill.

12.1.5 The Contractor shall use appropriate methods of compaction to achieve the compaction requirements of the Drawings and the Specification.

Pr9875 - Specification for Non-Pressure Pipeline Construction

13. Construction Finishes

13.1 Grouted Stone Pitching

- 13.1.1 Stone pitching requirements shall conform to the requirements of the Job Specification and the *Specification for Civil and Earth Works* (Pr9902).

13.2 Maintenance Structures

- 13.2.1 Maintenance structures shall be constructed in accordance with SEQ WS&S D&C Standard Drawings SEW-1300 series. Where pegs have been placed at maintenance structures, the attention of the Contractor is directed to the fact that the pegs at junction maintenance structures are on the point of intersection of the centre of the sewer pipelines and not necessarily the centre of Maintenance Structures.
- 13.2.2 Maintenance structures constructed from precast segments are permitted unless specifically approved by the superintendent as cast in-situ for a particular location.
- 13.2.3 Precast segments and joints shall be designed and installed in accordance with the product manufacturers requirements.
- 13.2.4 All sections of precast maintenance structures shall be constructed of high quality, dense, hard, sulphate-resisting concrete with interior and exterior surfaces smooth and impervious. Cement, aggregates and reinforcing steel shall comply with the requirements of the *Specification for Plain, Reinforced and Prestressed Concrete*.
- Unless otherwise specified, precast maintenance structures segments shall not be coated with cement wash or any other preparation.
- The ends of wall sections shall be square with the walls to within 5 mm. The minimum clear cover to reinforcement in precast segments shall be 25 mm.
- 13.2.5 Joints between segments shall have a minimum safe working pressure of 100 kPa. All internal joints in maintenance structures walls shall be caulked as directed by the Superintendent to provide a flush surface.
- 13.2.6 No cutting or breaking out of pieces from precast segments shall be permitted. Maintenance structures with external drop junctions shall have block outs for pipe openings cast into the wall segment.
- 13.2.7 Maintenance structure top slabs shall be adequately bonded to the wall of the manhole with steel dowels. Coping rings shall be similarly bonded to the top slab and shall contain a cover and frame in accordance with the drawings.
- 13.2.8 Maintenance structures constructed of precast segments shall not be allowed for depths greater than three (3) metres or in water charged ground, in areas subject to flooding or where bolt down covers are required.
- 13.2.9 All benches and channels shall be rendered with a 2:1 fine sand and Portland cement mortar and finished with a steel trowel true to the shape and dimensions shown.
- 13.2.10 Maintenance structure covers and concrete rings shall be finished accurately to the levels shown or directed by the Superintendent and shall wherever appropriate be sloped to conform to the required slope of road pavements or shoulders, footpaths or other areas.
- All covers shall sit evenly on the seatings without rocking and shall give as near as possible a watertight joint. Sealing shall be provided by use of an approved section of polyurethane foam impregnated with asphaltic bitumen or by other means approved by the Superintendent.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 13.2.11 The Contractor shall supply one (1) set of approved maintenance structure lifting hooks for any particular type. Under no circumstances shall any cover be lifted other than by these hooks and all gangs of men who may have to lift covers shall be provided with sets of lifting hooks. The Contractor shall supply lifting hooks for the Superintendent's representative. The cost of supply of lifting hooks shall be included in the schedule rates for supply and fixing covers.

13.3 House Connection Branches

- 13.3.1 House connection branches shall be constructed in accordance with SEQ WS&S D&C Standard Drawings SEW-1100 series. House connection branches shall be constructed in sewers in the positions shown on the plans or as directed by the Superintendent.
- 13.3.2 Concrete used in the construction of house connection branches shall be Class N20.
- 13.3.3 The depth of the house connection branch shall be sufficient to permit the servicing of the whole of the area within building lines with a house drain gradient of 1 in 40.

13.4 House Drains

- 13.4.1 Each house drain shall be constructed in accordance with Job Specification drawings. An inspection opening shall be provided at the end of each section of pipeline to facilitate testing of both upstream and downstream sections of the pipeline.
- 13.4.2 The Contractor shall set out each house drain to the lines shown on the plan and shall grade each pipeline to maintain minimum cover to the pipes at all places and shall ensure that the ends of each pipeline are at such depths as will allow the proposed extension to be carried out in accordance with these requirements.
- 13.4.3 Every care is to be taken to prevent the entry of soil, bedding sand and other matter into house drains. The Contractor shall wash out house drains to allow inspection by mirroring prior to carrying out the hydrostatic test.
- 13.4.4 All junctions in house drains shall be made obliquely and Class N20 concrete shall be placed under and around the junction pipe.

14. Acceptance Testing for Non Pressure Infrastructure

14.1 General

- 14.1.1 Acceptance testing of non-pressure infrastructure shall be undertaken in accordance with the relevant SEQ WS&S D&C Code to ensure all parts of the non-pressure infrastructure including material manufacture, design and installation have been carried out in accordance with codes and specifications. The Contractor shall provide signed quality documentation to Unitywater to ensure that the appropriate inspections and testing are carried out for all aspects of the project.

14.2 Air Pressure and Vacuum Testing of Sewers

- 14.2.1 Testing the integrity of non-pressure pipelines, maintenance structures and house drains shall be conducted in accordance with SEQ WS&S D&C WSA02, Section 22.4.
- 14.2.2 Vacuum testing shall be undertaken unless another method is specified and approved by the Superintendent.
- 14.2.3 Risks associated with other test methods must be identified and managed appropriately.
- 14.2.4 The following shall be recorded during the test:

Pr9875 - Specification for Non-Pressure Pipeline Construction

- Test pipe section information (length, diameter, material, class);
- Test manhole information (diameter, depth, construction type [precast or cast in situ]);
- Maximum negative pressure (or positive pressure for low pressure air testing);
- Test duration (minutes);
- Drop in vacuum over test period (or drop in positive pressure for low pressure air testing);
- Rectifications undertaken for any failed tests; and
- Subsequent test results until a passing test for the section is achieved.

14.2.5 A pressure test certificate shall be produced on completion of the pressure test and submitted to the Superintendent.

14.2.6 Testing shall be undertaken by a NATA accredited organisation that holds a current listing for the relevant test.

14.3 Testing PE pipeline welds

14.3.1 Compliant destructive test results from a NATA accredited laboratory for each relevant pipe size to be qualified compliant as per section 8.5.11 and 8.5.12

14.4 Compaction Acceptance Testing

14.4.1 Compaction acceptance testing shall be in accordance with the relevant SEQ WS&S D&C Code.

14.4.2 The Contractor shall conduct compaction trials, in the presence of the Superintendent, to demonstrate that the proposed compaction methodology meets the requirements of this Specification. These trials shall cover each diameter of pipe on the project and shall be performed to the Superintendents satisfaction prior to pipe laying.

14.4.3 The Contractor shall undertake compaction trials where the material does not conform to the embedment or fill specification or where changes occur in the compaction procedure or the material supply.

14.4.4 The Contractor shall use direct methods of measurement to control compaction, except where indirect methods enable appropriate correlations with the soil moduli are permitted.

14.4.5 The Contractor shall engage an approved body accredited by NATA for the particular tests to be undertaken.

14.4.6 Indirect compaction control measures include the dynamic cone penetrometer, Perth sand penetrometer and Clegg impact soil tester. Indirect methods of measurement may be considered where access is difficult or unsafe.

14.5 Pressure Testing Inverted Siphons

14.5.1 Pressure testing of inverted siphons shall be carried out in accordance with SEQ WS&S D&C WSA02, Section 22.9

14.6 Pressure Testing Knife Gate Valves

14.6.1 Hydrostatic pressure testing of knife gate valves shall be carried out in accordance with the requirements of AS3735 and shall be filled to 500 mm above system overflow level and in accordance with SEQ WS&S D&C Code.

Pr9875 - Specification for Non-Pressure Pipeline Construction

14.7 Cleaning General

- 14.7.1 Before any pipelines are taken over by the Superintendent, the Contractor shall clear them by flushing with clear water and pulling an appropriate device through the pipeline to remove any material deposited there during construction.
- 14.7.2 The Contractor shall remove flushing water from the pipe system in accordance with WSAA Guideline: Dechlorination of Drinking Water to Discharged Waterways, National Guidance for the Urban Water Industry 2019.
- 14.7.3 The Contractor shall inspect the pipelines after cleaning to ensure they present a clear barrel free from any obstruction.
- 14.7.4 Pipelines will not be placed 'on maintenance' until the Superintendent or his representative has carried out an audit inspection. All pipelines will be inspected after cleaning and will not be taken over until they present a clear barrel free from any obstruction.

14.8 CCTV Inspection

- 14.8.1 CCTV inspection will be carried out on all sewers and maintenance structures in accordance with SEQ WS&S D&C WSA02, Section 22.7
- 14.8.2 All sewers and maintenance structures shall be cleaned prior to CCTV inspection.
- 14.8.3 All sewers and maintenance structures shall be inspected by CCTV after all backfilling operations have been completed and all junctions installed.

14.9 As constructed Asset Information

- 14.9.1 As constructed asset information shall be provided in accordance with the Job Specification and the SEQ WS&S D&C Asset Information Specification.

15. Restoration and Finishing Works

15.1 Backfilling of Excavation

- 15.1.1 No trenches shall be backfilled until the pipelines have been visually inspected, construction details recorded, the Superintendent or his representative has carried out his audit inspections and permission given by him for filling to commence.
- 15.1.2 Backfilling of pipe trenches shall be undertaken in accordance with the specification and the SEQ WS&S D&C Code.
- 15.1.3 Excavated material which is surplus to the requirement for filling shall be removed from the site and disposed of at an approved waste disposal facility.
- 15.1.4 Should suitable backfill material be unavailable from the material excavated from the site of the works, the Contractor shall, following the approval of the Superintendent in writing, use imported filling.
- 15.1.5 The material used for backfilling shall be carefully replaced in such a manner as to leave no cavities or voids. Particular care must be taken not to allow any large pointed stones or other hard and unyielding material to be placed immediately above the pipe surround. The finest material must be used for 300 mm above the sand.
- 15.1.6 Care shall be taken when backfilling that the surface shall be left in such a condition that it will not erode as the result of surface water passing over it.
- 15.1.7 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

Pr9875 - Specification for Non-Pressure Pipeline Construction

the shoring in such a way that the sides of the trench are permitted to fall or voids are left in the backfilled material.

- 15.1.8 The Contractor shall take adequate measures to prevent flotation of the pipeline due to groundwater or inundation before completion of the backfilling. Any length of pipeline, where flotation has occurred, shall be removed from the trench, carefully inspected for damage and re-laid.
- 15.1.9 Where excavation is in tunnel the refilling shall be with bedding material compacted by flooding with water or immersion vibration.
- 15.1.10 The backfilling of excavation under railway lines shall be carried out in accordance with the conditions set down for the construction of such lines.
- 15.1.11 The backfilling of excavation under main roads or important Council roads where special treatment is required shall be carried out in accordance with the relevant road Authorities current standard.

15.2 Restoration and Revegetation of Surfaces

- 15.2.1 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.
- 15.2.2 Restored surfaces shall be maintained in such a way as to avoid any hazard 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.
- 15.2.3 Garden soil shall be replaced to a maximum depth of 300 mm during backfilling with material approved by the Superintendent as equivalent to that removed.
- 15.2.4 In grassed areas, the top 150 mm of the backfilling shall be carried out with material approved by the Superintendent as equivalent to that removed. Where turfs have been removed, they shall be replaced on this material and top dressed.
- 15.2.5 Areas affected shall be cleared up, the surfaces made good and all surplus materials carted away.
- 15.2.6 All improvements on premises which have been damaged by the Contractor shall be replaced so as to be the equal or better of those existing before the Contractor's operations. Where infrastructure on private premises cannot be restored within two (2) days, it shall be re-erected to the satisfaction of the Superintendent in a temporary location until such time as permanent restoration can be carried out unless agreed otherwise with the occupier.
- 15.2.7 All restoration work shall be to the satisfaction of the Superintendent. Initial cleaning up shall be carried out as soon as backfilling is completed, and restoration in private premises shall be completed within seven (7) days after backfilling. Beyond this time the Superintendent may arrange to have the work carried out at the Contractor's expense.
- 15.2.8 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.
- 15.2.9 The Principal 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.
- 15.2.10 The choice of restoration technique must be made prior to completion of clearing and stripping activities, taking into consideration:

Pr9875 - Specification for Non-Pressure Pipeline Construction

- The pre- construction and post-construction landform of both the immediate construction area and that adjacent to the construction site – on steep slopes hydromulching or turf application is the preferred approach and the restoration area must, after its establishment period blend seamlessly into the surrounding area;
 - The type of pre-clearing and pre-stripping vegetation in both the immediate construction area and that adjacent to the construction site – wherever possible vegetation is to be restored in keeping with the pre-construction landscape;
 - A preference for hydromulching on steep slopes, large land areas, areas where laying or maintaining turf represents a challenge (e.g. 'disconnected' areas along a construction corridor, access by watering truck difficult/restricted);
 - A preference to use turf in areas where there is a need for quick, well established grass cover such as within residential developments, along footpaths, parks with (uncontrolled) public access and other public access areas with a high trip risk and in high erosion risk areas;
 - Where turf has been used in the restoration, ensure there is a well prepared and scarified sub-grade (i.e. sandy loam topsoil) and where necessary, roll the laid turf to enable adequate contact with the subgrade. The turf should be even with the ground and with no undulations. The edge of the turf patch should be made flush with the surrounding 'non-turfed' areas and 'feathered out'. Topsoil and an approved seed mix may need to be used where top dressing is required, particularly on the edges of the turf patch and/or where gaps between the turf strips are visible;
 - Where hydromulch or turf has been used in the restoration, necessary implementation of a watering regime that ensures watering occurs as necessary (having due regard to local weather conditions) and consistently to attain established root structures and uniform ground cover for a period of no less than 12 weeks;
 - Where hydromulching or seeding is to be used in the restoration, seasonal and weather conditions are to be considered in making the choice of seed mix and time of application (so as to provide greatest success of establishment), additional binders required on steeper slopes and use of Australian native seed mix in areas within and adjacent to areas of regional ecosystem significance.
- 15.2.11 For areas nominated by the Principal to be re-seeded, the Contractor shall remove the top 100 to 150 mm of sand and/or soil including vegetable matter and stockpiled for later re-use.
- 15.2.12 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 slight cover of topsoil to minimise wind erosion and leaching out.
- 15.2.13 The whole of the disturbed area shall then be seeded with an approved mixture of grass seeds and fertilizer including trace elements suitable for the locality.
- 15.2.14 The approved mixture shall be spread at the rate of not less than 2.9 kg per 100 m².
- 15.2.15 The mixture shall be lightly raked in and the whole area immediately hand watered. Watering in compliance with the local government regulations shall then be carried out until the grass is well established.
- 15.2.16 For areas nominated by the Superintendent, the Contractor shall use hydraulic seeding and mulching (referred to as hydromulching).
- 15.2.17 Only qualified personnel with a proven ability to apply hydromulching treatment shall be employed by the Contractor to perform this work.

Pr9875 - Specification for Non-Pressure Pipeline Construction

- 15.2.18 Seed, fertiliser, wood-fibre mulch, water and binder shall be thoroughly mixed together to provide a slurry and shall then be applied under pressure on to the area to be treated by means of hydromulching equipment specifically designed for this purpose.
- 15.2.19 Prior to spraying the slurry, the Contractor shall cover the area to be treated with topsoil to a depth of 75 mm. Spraying of the slurry shall be carried out as soon as possible after topsoiling, but not later than 2 weeks.
- 15.2.20 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. Spraying of the slurry shall then take place while the topsoil is still moist.
- 15.2.21 After the slurry has been sprayed any further watering as ordered by the Superintendent will be paid for at the tendered rate per kilolitre. Application rates for south-east Queensland shall be as listed in the following table. The Contractor shall submit alternative mixes to the Superintendent for approval for areas with different climatic conditions.

Table 1 - Materials for Hydromulching

Material	Rate of Application	
A. Wood-fibre Defibrated pinus radiata dyed green	2.5 tonne/ha	
B. Binder Anionic bitumen emulsion 50/50 bitumen/water or Polymer Binder	1000-2000 L/ha Max.250 L/ha	
C. Certified seed	Summer Mix	Winter Mix
<u>Primary Cereal Cover</u> Japanese millet Perennial rye grass	25 kg/ha 40 kg/ha	
<u>Secondary Grass Cover</u> Green couch Rhodes grass	15 kg/ha 15 kg/ha	25kg/ha 15 kg/ha
D. Fertiliser Type to be approved by the Superintendent	250-400 kg/ha	

- 15.2.22 Summer shall be defined as from October to March inclusive. Winter shall be defined as from April to September inclusive.
- 15.2.23 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 erosion control blankets (such as Enviromat, coir/jute mator similar approved by the Superintendent) shall be supplied and laid to the manufacturer's recommendations.