



FNQROC DEVELOPMENT MANUAL

SPECIFICATION

S6

SEWERAGE RETICULATION

Issue Date – 11/19

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GENERAL

S6.01 SCOPE

1. This specification details all matters pertaining to the minimum requirements for Sewerage Reticulation Construction.
2. Where there is any conflict determined between the requirements specified herein and the requirements of any referenced Australian Standard, Statutory Authority Standards or otherwise, the requirements specified herein shall apply.
3. The planning, design and construction of infrastructure is to be carried out in accordance with this Manual and the following Water Services Association of Australia publications:
 - a. CTM Alliance Water Service Design and Construction Code Version 0.2 May 2015
 - b. WSA 02-2014 Sewerage Code of Australia
 - c. WSA 04-2005 Sewerage Pumping Station Code of Australia
4. Aspects of modification or clarification of the codes are detailed in Appendix A and B of Design Manual – D7
5. The requirements of this Manual will take precedence over the CTM Water Alliance Design and Construction Code and Water Services Association of Australia Codes
6. Aspects of modification or clarification of the codes Standard Drawings are detailed in Appendix A and B of this document.
7. Smart Sewers are to be designed and constructed in accordance with SEQ Water Supply and Sewerage Design and Construction Code.

S6.02 REFERENCE DOCUMENTS

Note: Where Acts or reference documents are updated, reference should be made to the current version.

Australian Standards

- AS/NZS 1260 PVC-U pipes and fittings for drain, waste and vent applications
- AS 1289 Methods of Testing Soils for Engineering Purposes
- AS 1463 Polyethylene Pipe Extrusion Compounds
- AS/NZS 1477 Unplasticised PVC (uPVC) pipes and fittings for pressure applications
- AS 1646 Elastomeric Seals for Waterworks Purposes
- AS 2032 Installation of uPVC pipe systems.
- AS 2129 Flanges for pipes, valves and fittings
- AS 2280 Ductile Iron Pressure Pipes and Fittings
- AS 3996 Access covers and grates
- AS 4198 Precast concrete access chambers for sewerage applications
- AS/NZS 4765 Modified PVC (PVC-M) pipe for pressure applications

- AS 5488 Classification of Subsurface Utility Information

Cairns Regional Council

- Design Guideline Switchboards
- Design Guideline Sewage Pumping Station

CTM Water Alliance Design and Construction Code Version Version 1.0 August 2019

QLD Government Legislation

- Water Act 2000
- Water Supply (Safety and Reliability) Act 2008
- Queensland Plumbing and Wastewater Code

Water Services Association of Australia

- WSA 02-2014 Gravity Sewerage Code of Australia
- WSA 04-2005 Sewerage Pumping Station Code of Australia
- WSA 06-2008 Vacuum Sewerage Code of Australia
- WSA 07-2007 Pressure Sewerage Code of Australia
- WSA 05-2013 Conduit Inspection Reporting code of Australia

SEQ Water Supply and Sewerage Design and Construction Code.

MATERIALS

S6.03 PIPES GENERAL CRC, DSC

1. All pipes used for sewer reticulation shall be constructed from the following materials:
 - (i) Polyvinylchloride (PVC)
 - (ii) Ductile Iron
 - (iii) Polyethylene
 - (iv) Polypropylene

S6.04 UNPLASTICISED PVC (PVC-U)

1. Unplasticised PVC (PVC-U) pipes and fittings for gravity systems shall be manufactured in accordance with AS1260 suitable for rubber ring joints. Pipe classes shall be in accordance with the manufacturers recommendation and shall be as shown on the approved Project Drawings. The minimum pipe class shall be SN8.
2. Unplasticised PVC (PVC-U) pipes and fittings for pressure (rising) mains and suction pipes shall be manufactured in accordance with AS/NZS 1477 minimum Class 12 suitable for rubber ring joints with a cream coloured pigment.
3. Modified PVC (PVC-M) pipes manufactured in accordance with AS/NZS 4765 minimum Class 12 by an Australian Standards quality endorsed company may be used as an alternative to uPVC with a cream coloured pigment.
4. Oriented PVC (PVC-O) pipes manufactured in accordance with AS 4441 minimum Class 12 by an Australian Standards quality endorsed company may be used as an alternative to PVC-U with a cream coloured pigment.
5. Rubber Rings shall be manufactured and tested in accordance with AS 1646. They shall be of natural rubber and only those impregnated with a Root Inhibitor shall be used.

S6.05 DUCTILE IRON

1. Ductile Iron pipes shall be manufactured and cement lined in accordance with AS 2280 by an Australian Standards quality endorsed company. Pipes shall be lined with calcium aluminate cement for sewerage applications. For sections of rising mains that are permanently wet, DI pipes with normal cement lining may be used subject to Council approval. Sections of rising mains subject to alternate wetting and drying shall have calcium aluminate lining. Where calcium aluminate lining is not available, fusion bonded epoxy lining should be used.
2. Socketed Pipes to be Class PN35 suitable for the patented "Tyton" type rubber ring joint. Flanged Pipes to be Class PN45.
3. Flanges shall comply with AS 2129 Table C. Bolts and nuts for flanged joints shall be in accordance with AS 2129.
4. All pipes and fittings shall be wrapped in a cream coloured loose polyethylene sleeving 0.25mm thick. Wrapping and taping shall be carried out in accordance with the pipe manufactures recommendations.
5. All bends for mains of 100mm diameter or larger and all other associated fittings shall be constructed in accordance with AS2280, and have flange or spigot and socket type joints as specified on the approved Project Drawings. Where flanges are used, bolts shall be matched sets and conform to the following criteria:

- a. In above ground uses, bolts shall be Hot Dipped Galvanised
- b. In below ground uses, bolts shall be Grade 316 Stainless Steel with nuts and washers Grade 304 stainless steel.

S6.06 BEDDING MATERIALS

General

1. The bedding material shall be selected commensurate with the trench conditions prevailing and in accordance with Standard Drawing S3015.

Type 1 Bedding

2. Type 1 Bedding shall consist of a clean course sand or recycled glass free from organic matter, clay, shells and deleterious material with 100% passing the 6.7mm AS sieve and not more than 5% passing a 0.150 mm AS sieve.
3. In wet conditions and where the trench bottom is firm, a 12 -16mm Aggregate may be used for the bedding material.

Type 2 Bedding

4. Type 2 Bedding shall be used in wet conditions particularly where the trench bottom requires stabilising and consist of a "Crushed Rock Foundation" with a geotextile surround.
5. The crushed rock is to have a maximum size of 37.5mm and there shall be not more than 20% passing the 19mm sieve and not more than 5% passing the 4.76mm sieve.
6. The geotextile surround shall be as stated on the approved Project Drawings or as specified by a registered Geotechnical Engineer.
7. The bedding of the pipes shall then be as specified for Type 1 above.

Type 3 Bedding

8. Type 3 Bedding construction is adopted where there is wet ground with insufficient supporting capabilities for other methods of bedding.
9. Piles shall be in accordance with the approved Project Drawings with 150 x 50 hardwood sleepers and planks placed prior to pouring the concrete cradle as depicted in Standard Drawing S3015. Concrete shall be N15 grade.

S6.07 CONCRETE

1. The concrete and reinforcement used in the construction of cast insitu manholes shall comply with Specification S7 CONCRETE WORKS.

S6.08 PRECAST MANHOLES

1. Precast manhole components shall comply with AS 4198.

S6.09 MANHOLE COVERS ^{TRC}

1. Manhole covers and frames shall be supplied for all sewer manholes and shall be Cast Iron sealed (gastight) covers manufactured in accordance with AS 3996.
2. All openings shall conform to the details on Standard Drawing S3000.
3. All covers shall have a raised stud pattern with the letters SEWER (65mm high) cast into the centre of the lid and "gatic" type lifting holes.
4. Unless noted otherwise on the approved Project Drawings the minimum class of manhole covers shall be as follows:
 - Within Private Properties - Class B
 - All Other Areas (Parks, verges, etc) - Class C
 - Roads, Carparks etc - Class D

CONSTRUCTION

S6.10 SETOUT

1. The alignment and grade of sewer lines and position of manholes shall be stated on the approved Project Drawings.
2. The position of the centre of each manhole shall be pegged on the ground by a Registered Surveyor prior to the commencement of work.
3. Offset pegs shall be established prior to commencing construction of any line, at a convenient distance to remain clear of all works and remain intact for the duration of the work.
4. The levels of the sewers shall be maintained in strict accordance with bench marks and only approved and tested equipment shall be used to establish and maintain these levels in accordance with the design documents.

S6.11 CLEARING AND GRUBBING

1. All clearing and grubbing works shall be in accordance with Specification S1 EARTHWORKS.
2. Where sewer lines pass through allotments any trees or obstructions not on the line of the pipes shall be preserved.

S6.12 TRENCHING

1. All trenching and foundation works necessary for the installation of the pipeline or thrust blocks, shall be in accordance with Specification S1 EARTHWORKS.
2. The width of trenching excavation shall be in accordance with the Standard Drawing S3015 at the trench base and comply with all regulations of Workplace Health and Safety Act.
3. In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.
4. Where public utilities exist in the vicinity of sewer reticulation works the Contractor shall obtain the approval of the relevant authority / corporation to the method of excavation before commencing excavation.
5. In the event of any trenching being left open for longer than one week, the Contractor shall provide erosion control measures to ensure minimal soil disturbance and material loss off the site. Some or all of these measures shall be provided immediately upon the onset of rain with an open trench.
6. The Contractor shall leave a clear space of 600mm minimum between the edge of any excavation and the inner toe of spoil banks. No excavated materials shall be stacked against the walls of any building or fence without the written permission of the owner of such building or fence. Topsoil from excavations shall be kept separate and utilised to make good the surface after backfilling.

S6.13 CROSSINGS

1. Where a sewer main crosses a State Controlled Road, Railway line or creek, the affected work shall be carried out in accordance with the requirements of the relevant Authority / Corporation. It shall be the Contractor's responsibility to complete written notification to the Authority / Corporation of the intention to carry out the work.
2. Where a sewer main crosses an existing road, the affected work shall be carried out in accordance with the requirements of Council. It shall be the Contractor's responsibility to notify Council of the intention to carry out the work.

S6.14 BEDDING

1. Bedding types shall be as detailed on Standard Drawing S3015 with the bedding materials complying with the "Bedding Material" section of this Specification.

Type 1 Bedding

2. The bedding material shall be as specified and shall be placed and compacted for the full width of the trench to the level of the underside of the pipe.
3. An area of bedding adjacent to the position of the pipe collar should be removed to provide a minimum 20mm clearance to the collar while the remainder of the pipe is bedded evenly on the bedding material.
4. The remainder of the bedding material is then placed and carefully tamped to avoid disturbing the position of the pipe thus ensuring that the surface of every pipe is in full and even contact with the bedding material.
5. All bell holes shall be rammed prior to completion of the bedding operation. The bedding material shall be uniformly compacted so as to achieve the following standards:
 - a. Minimum dry density ratio 95% Standard (cohesive soils).
 - b. Minimum density index 65% (cohesionless soils)

Compaction requirements are with reference to the relevant Test Methods contained in AS1289.

6. In wet conditions, where the ground below the invert of the pipe is firm and stable, the pipe surround, for 100mm below the pipe and 300mm above shall be crushed rock (20mm size).

Type 2 Bedding

7. Used in wet conditions particularly where the trench bottom requires stabilising the trench invert shall be over excavated to accommodate a "Crushed Rock Foundation" with a geotextile surround.
8. Water is to be removed from the excavation as work proceeds to allow for placement of the geotextile and crushed rock layer. The crushed rock layer shall be laid in 100mm layers and compacted as required.
9. The crushed rock is to be placed, compacted and tested until it supports a load of 3 tonnes on a 300mm square steel plate with less than 12mm settlement in 12 hours.
10. The geotextile shall surround the crushed rock layer and be overlapped minimum of 450mm.
11. The pipe bedding material shall be placed and compacted over the crushed rock foundation as specified for Bedding Type 1.

Type 3 Bedding

12. Type 3 bedding incorporating designed piles that are driven by air or electric hammer on a heavy dolly.
13. Piles shall be driven to give a set in accordance with the design requirements and spaced accordingly as stated on the approved Project Drawings.
14. A 200 x 400 hardwood sleeper is placed on top of the pile with 150 x 50 hardwood planks spanning the sleepers.
15. A concrete cradle as detailed on the approved Project Drawings shall then be poured on the planks to support the pipes.

S6.15 LAYING AND JOINTING OF PIPES

1. All contractors shall have undertaken a manufacturers pipe laying accreditation course.
2. All pipelines shall be constructed of pipes of such sizes and laid true to such levels and grades as shown on the approved Project Drawings.
3. The lines, levels and grades of all lines shall be checked and all pipes found incorrect shall be removed and re-laid.
4. Trenches shall be kept free of water during pipe laying, and until completion of backfill.
5. Jointing of pipes, valves and fittings is to be carried out to the manufactures recommendations and in accordance with Australian Standards where applicable.
6. When the joint is made, the witness mark shall at no point be more than 1mm from the end of the socket.
7. Before being laid, all pipes, fittings, valves, etc shall be cleaned and examined by the Contractor.
8. Approved plugs shall be used to prevent foreign matter entering sections of pipeline, which are left uncompleted overnight.
9. The Contractor shall take all necessary precautions to prevent flotation of pipes during laying, backfilling and initial testing. Any temporary supports shall be removed prior to completion of backfilling.
10. Pipes may be cut as needed to suit closing lengths, to remove damaged pipe or fittings or to remove sockets if necessary when jointing a socketed fitting.
11. For field cuts, only an approved mechanical pipe cutter shall be used, except that uPVC pipes may be cut using a power saw or a fine toothed hand saw and mitre box.
12. Any pipes cut in the field shall have their ends prepared in accordance with the manufacturer's written instructions.
13. Where pipes are cut in the field, a witness mark shall be made on the pipe at the length specified by the manufacturer from the end of the pipe. Scoring of uPVC pipes shall not be permitted.
14. Gravity lines shall be constructed to the tolerances specified hereafter:
 - a. The maximum horizontal deviations to either side from the design axis of a pipeline shall be 100mm for all sizes of pipes.
 - b. The maximum vertical deviations from the design grade of pipelines of any diameter and grade, shall be ± 10 mm.

S6.16 CONNECTIONS TO MANHOLES

1. Pipelines shall be connected to manholes, structures or embedded concrete by means of 600mm long pipes such that two flexible joints are provided, the first joint being at or within 150mm of the face of the structure.
2. The position of the access chamber shall be as shown on the approved Project Drawings. The Contractor shall check the alignment prior to commencing construction and advise the design engineer of any obstructions (Structure, Flora, Services etc)
3. Allowable lateral deviations from the final design position of access chambers shall be in accordance with the tolerances for horizontal deviations of pipelines as specified. Longitudinal deviations from that position shall not exceed 300mm.

S6.17 CONNECTION TO EXISTING

1. Connection to existing live sewer mains and manholes shall be carried out in accordance with the requirements of Council. It shall be the Contractor's responsibility to notify Council of the intention to carry out and arrange for the timing of such works.
2. The upstream side of the existing manhole is to be plugged until all new sewer mains have been approved, tested and cleaned.
3. The proposed date of any sewerage connection work is to be submitted to and agreed with Council as early as possible (minimum 1 month notice). The scheduled date of the connection work is to then be confirmed by the Contractor 1 month prior to the date. Any change to the date within two weeks of the scheduled date will result in the contractor being responsible for any additional costs incurred by Council to change to the new date.

S6.18 ANCHOR BLOCKS

1. Concrete anchor blocks shall be provided in accordance with Standard Drawing S3015 for 150 dia. lines laid at a grade of 1 in 6 or steeper and 225 dia. lines laid at 1 in 10 or steeper.
2. Concrete works shall comply with Specification S7 CONCRETE WORKS.

S6.19 PROPERTY CONNECTION BRANCHES

1. Property Connection Branches (PCB) to all properties shall be constructed in accordance with Standard Drawing S3005 and to the types, locations, levels and dimensions stated on the approved Project Drawings.
2. Concrete surrounds shall be provided to all PCB's. All concrete works shall comply with Specification S7 CONCRETE WORKS.
3. Backfill around risers shall be sand compacted to the top of the socket or coupling, for the full width of trench and for a minimum distance of 500mm upstream and downstream of the riser.
4. The position of each riser, junction or end of a sideline shall be clearly marked by the Contractor on completion of backfilling, with an approved metallic marker tape or wire loosely tied to the end of PCB and held in a vertical position during backfilling. The top end of the tape or wire shall be left flush with ground level.

S6.20 RISING MAINS

1. All works necessary for the installation of the rising (pressure) mains including installation of thrust block and anchor blocks, shall be in accordance with Specification S5 WATER RETICULATION.
2. Line valves, air release valves and scour valves shall be installed where shown on the approved Project Drawings.
3. Unless otherwise noted on the approved Project Drawings, pipes for pressure (rising) mains shall be laid on continuously rising grades from scour valve to air release valve, notwithstanding any minor irregularities in the ground surface.
4. Marking plates bearing the letters "AV" for air valves, "SV" for scour valves and "RM" at changes of direction and at such chainages that the location of the main is marked at least once each 200 metres, shall be provided as shown on Standard Drawing S2011.
5. Sewer rising (pressure) main connection to discharge manholes are to be constructed in accordance with standard Drawing S3000 CRC Pressure Main Receiving Manhole.

S6.21 MANHOLES^{TRC, CRC, DSC}

1. All concrete work associated with the construction of manholes shall comply with Specification S7 CONCRETE WORKS.
2. Manholes shall be constructed in accordance with Standard Drawing S3000 and to the types, locations, levels and dimensions stated on the approved Project Drawings.
3. Rendering of this invert and benching shall be in accordance with the Standard Drawing S3000.
4. In areas not subject to water charged ground, precast manholes are an acceptable alternative with precast base units for Inlet Type A manholes in accordance with Standard Drawing S3000 and their use has been certified by an RPEQ.
5. In areas not subject to water charged ground, precast manhole risers are acceptable for use with cast insitu manhole bases and their use has been certified by an RPEQ.
6. Precast riser units shall be jointed in accordance with the manufacturers specifications utilising the recommended method and materials. Inlets into precast units shall be constructed in accordance with the details illustrated on Standard Drawing S3000.
7. The installation of all precast manhole components shall be in accordance with the manufacturers' recommended procedures and requirements.

S6.22 COVERS AND SURROUNDS

1. Manhole covers shall be finished flush with the surface in roadways, footpaths and paved surfaces. Elsewhere, unless noted otherwise on the approved Project Drawings, covers shall be finished 50mm above the surface of the ground, in a manner designed to avoid as far as possible, the entry of surface water.
2. Manhole covers are to be gas tight.
3. Manhole covers are to be located such that the position of the access opening is directly over the outlet pipe.
4. The installation of all precast manhole covers shall be in accordance with the manufacturers' recommended procedures and requirements.

S6.23 PUMP STATIONS DSC, CRC, MSC

1. All concrete work associated with the construction of pump stations shall comply with Specification S7 CONCRETE WORKS.
2. Except where modified by Council specific requirements, pump stations shall be constructed in accordance with Standard Drawings S3020, S3025, S3030, and S3035 and to the types, locations, levels and dimensions stated on the approved Project Drawings.
3. Concrete pump stations are to have an council approved hydrogen sulphide resistant. high build, water proof coating applied to the internal walls in accordance with the manufactures specifications.
4. Use of the pump station is not permitted until Works Acceptance, unless otherwise approved by Council.

S6.24 BACKFILL AND COMPACTION

1. Material for the side support and overlay of the pipe shall comply with the pipe bedding material specification. The material shall be compacted in layers of not more than 150mm thick to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289 Flooding of non-cohesive material shall be considered as an acceptable method of compacting bedding material.
2. The remainder of the excavation shall be backfilled with excavated material. The backfill shall be compacted in layers of not more than 150mm thick to 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289. Flooding of cohesive material shall not be permitted as a means of compacting backfill.
3. Backfilling and compaction shall be carried out without damaging the pipe or its external coating or wrapping or producing any movement of the pipe.
4. Where trenches are under constructed pavements or in other situations where required, the material used for backfilling shall be approved excavated material with linear shrinkage of the fines passing a 2.36mm sieve of not greater than 6 per cent. The Contractor may elect to use imported, select fill or sand for this purpose. The backfill shall be spread in layers not exceeding 300mm in loose depth at or near optimum moisture content and compacted using mechanical vibration equipment.
5. Backfill material down to a depth of 300mm below the underside of the pavement material shall be compacted to 98 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289, and backfill material below such depth shall be compacted to not less than 95 per cent of the standard maximum dry density of the material used when determined in accordance with AS1289.

6. In cases other than those covered by the above clause backfilling above the level of 300mm above the top of the pipes in open trenches may be carried out by dumping from mechanical plant into the trench providing that no rock is placed in the trench until the pipes are covered by at least 300mm of soil backfill.
7. Compaction testing shall be carried out at a rate of 1 test for each 150 metres of trench backfilled or in the cast where trenches are constructed under road pavements and road shoulders, 1 test for each 25 metres of trench backfilled.

S6.25 CLEANING SEWERS

1. Before the sewers, manholes and house drains are accepted they shall be cleaned to remove all clay, sand and other materials.
2. All water plus materials used in the flushing of the reticulation system shall under no circumstances be discharged into existing sewers downstream of construction. All lines shall be inspected after flushing and will not be accepted until they present a clear barrel, free from any obstruction.
3. The contractor/owner accepts all responsibility for costs associated with pumping out from a manhole.
4. Prior to commencement of use, the manholes and sewers upstream must be flushed to the satisfaction of Council.
5. The Contractor must submit a work method statement for approval by Council for pumping out from a manhole and flushing the sewers.

S6.26 TESTING OF MANHOLES

1. All manholes shall be subjected to hydrostatic or vacuum tests to prove their water tightness unless directed otherwise by the Local Authority.
2. For vacuum test, the maximum allowable loss of vacuum is 3.5 KPa after achieving a vacuum of 33.5 KPa in the time shown in Table S6.1.

Table S6.1 Acceptance times for 3.5Kpa Vacuum Drop

Manhole Depth	Manhole Diameter	
	1050 mm	1200 mm
<2400	17 sec	20 sec
3000	21 sec	25 sec
4000	28 sec	33 sec
5000	35 sec	41 sec
6000	42 sec	49 sec
7000	49 sec	57 sec

3. For hydrostatic tests, all pipe openings out of the manhole shall be plugged and the manhole filled with water to the lowest point on the top of the manhole cover surround. The plugs shall be positioned in the pipes as near as practicable to the internal face of the access chamber. After allowing an interval for absorption, the manhole shall be refilled.

4. The test on the manhole will be considered satisfactory provided the level does not drop more than 25mm in twenty four (24) hours. The plug of the outlet shall be fitted with a suitable release for emptying the manhole on satisfactory completion of the test.
5. Manholes failing the test shall be repaired and the test repeated. The process of testing, repair of defects and retesting shall continue until a satisfactory test is obtained.
6. Where the ground water level is high, an infiltration test may also be required. This shall not take place until ten (10) days after the placing of concrete.

S6.27 TESTING OF LINES

1. All gravity lines shall be subject to air testing to prove their water tightness unless directed otherwise by the Local Authority.
2. Testing may be done progressively, a minimum of 24 hours notice shall be provided to Council before commencement of testing. Ensure that pipes are clean before any test is performed.
3. If any of the tests proved to be unsatisfactory, the contractor shall be required to detect and repair the fault and then re-test. The contractor shall continue to repair and re-test until a satisfactory test is obtained. Even if testing produces satisfactory test results, the contractor shall repair any pipeline or conduit in which there is a visible or detectable leak or blockage.
4. The contractor shall carry out a visual inspection to ensure that all sewer lines present a full clean bore.

Air Testing General

5. Air testing shall be either pressure testing or vacuum testing, as directed by the Local Authority. The tests shall include the Property connection branches and inspection tee.
6. Air Testing (Pressure) - The sewer line to be tested shall be pressurised to the “Initial Pressure” shown in the Table S6.2 for a minimum of 3 minutes to stabilise the temperature.

Table S6.2 Pressure Air Testing – Initial Pressures

	Sewer Depth Range (metres)				
	0 - 1.5	1.5 - 3.0	3.0 - 4.5	4.5 - 6.0	Over 6.0
Initial Pressure (kPa)	30	35	40	45	50
Test Start Pressure (kPa)	25	30	35	40	45

7. After the 3 minute stabilisation period the pressure shall be dropped to the “Test Start Pressure” shown in the above table and the pressure gauge monitored for 5 minutes.
8. The sewer line under test shall be considered to have passed the test when the pressure does not fall by more than 5 kPa during the 5 minute period.
9. Air testing (Vacuum) - The sewer to be tested shall be drawn to a vacuum of 28 KPa and the vacuum gauge monitored for 5 minutes. The sewer under test shall be considered to have passed the test when the vacuum does not fall by more then 5 KPa during the 5 minute period.

Ovality Testing

10. All gravity sewer pipes shall be tested to determine any excessive pipe deflection (Ovality) by using a proving tool.
11. Testing for ovality shall be carried out no sooner than 14 days after all backfilling operations have been completed. Testing shall be by pulling a proving tool, for the nominal size pipe in the table below through each section of pipe by hand winching to demonstrate that the maximum allowable deflection is not exceeded.
12. The proving tool shall be:
 - (a) Fabricated from steel or aluminium alloy with pulling rings at each end and marked to indicate the nominal pipe size and the provers' outside diameter.
 - (b) Rigid, non-adjustable, have an odd-number of legs (min 9) and an effective length of not less than its nominal diameter + 75mm. The minimum diameter at any point along the length shall be as shown in Table S6.3.
 - (c) The shape of the proving tool must be approved. An alternate tool to that described in (a) and (b) may be approved by Council.

Table S6.3 Minimum Prover Diameter (mm)

Nominal Pipe Size (DN)	uPVC Pipes (SN 8)*
150	141.9
225	221.1
300	280.8
375	357.2

(Note: Where SN 10 is required as a result of the trench condition (equivalent to PVC pressure pipe PN12) or there is an unusual delay in the ovality testing (>3 months after backfilling of trench) alternate Prover Diameter may be considered by Council provided it is supported by calculations done under AS/NZS 2566.2.)

13. Sewer pipes that fail the maximum allowable deflection as shown above, shall be replaced and the re-laid section retested for ovality.

S6.28 TESTING OF RISING (PRESSURE) MAINS

1. Hydrostatic pressure testing of all sewer rising (pressure) mains shall be carried out prior to the acceptance of the works.
2. The contractor shall have carried out a successful test prior to arranging a Council witness test.
3. Pressure testing shall not be carried out during wet weather unless otherwise approved by Council.
4. Before testing a pipeline section, it shall be cleaned and filled slowly with water, taking care that all air is expelled. Purging of air from rising (pressure) mains shall be promoted by opening air valves.
5. The hydrostatic test pressure which shall be applied to each section of the pipeline shall be such that at each point of the section the test head shall be equal to or greater than the design head specified or shown on the approved Project Drawings, but shall not exceed same by more than 20 per cent.

6. The pressure testing of a section shall be considered to be satisfactory if:
 - (a) There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component;
 - (b) There is no visible leakage; and
 - (c) There is no loss of pressure in the 15 minute test period
7. The specified test pressure shall be maintained as long as required, while the whole section is examined, and in any case not less than 15 minutes.
8. Any failure, defect, and / or visible leakage, which is detected during the pressure testing of the pipeline or during the Defects Liability Period shall be made good by the contractor.

S6.29 CCTV INSPECTION OF SEWERS

1. All reticulation sewers including private sewers that discharge into the Council reticulation system are to be inspected by closed circuit television (CCTV) at a maximum 14 days before Works Acceptance Inspection but after all backfilling operations have been satisfactorily completed and all junctions are installed. This inspection is required to ensure that the pipe is without any construction defects, the pipe has no internal flow obstructions and all approved junctions are in the correct location. Further the inspection will verify the information provided with the 'As Constructed' drawings
2. Inspection surveys are to be carried out by qualified and experienced CCTV operators with appropriate equipment being able to give accurate chainage and pipe grade and allowing site locations and condition comments to be recorded. All CCTV work is to be carried out under the supervision of the Consulting Engineer.
3. CCTV inspections shall comply with the following requirements:
 - a. Appendix F of the latest version of the WSAA Conduit Inspection Reporting Code of Australia WSA 05-. This includes all requirements outlined in Section 2 of the Code in relation to CCTV operator qualification, CCTV camera equipment and accuracy, camera operation, data display on recorded images and the inspection report.
 - b. The sewer shall be cleaned prior to the CCTV inspection
 - c. Two sets of digital video files (MPEG 1 or MPEG 2 format), digital photographs (JPEG format) or certain defects as state in Appendix F of WSA 05- 2013 and a digital file with the coding information (WinCan format or other digital formats stated in future editions of the WSA 05 standard) on CD or DVD medium shall be provided.
4. Viewing and assessing of the DVD recording is to be undertaken by the Consulting Engineer and a report is to be prepared and submitted to Council confirming the inspection verifies the following:
 - a. Chainage of Property connection branches to be checked against the as constructed survey information and drawings.
 - b. Pipe grades to be checked against the as constructed survey information and drawings
 - c. Absolutely no ponding
 - d. All joins have been pushed fully home and no ring protrusions to be evident
 - e. No discernible diversion from a straight line in both the vertical and horizontal
 - f. No infiltration
5. One copy of the DVD recording is to be retained by the Consulting Engineer as part of the project records and a copy is to be submitted to Council with the 'As Constructed' submission.

S6.30 RESTORATION OF SURFACES

1. Pavements, lawns and other improved areas shall be cleaned and left in the same order as they were at the commencement of the works. Lawns shall be restored with turf cut and set aside from the original surface and / or with imported turf.
2. All restored surfaces shall be maintained in the condition to which they are restored until the expiry of the Defects Liability Period applicable to those surfaces. Pavements shall be maintained with crushed metal, gravel or other suitable material allowing for consolidation and shall then be restored to a condition equivalent to that of the original pavement.
3. Immediately the backfilling of a trench excavated through a pavement has been completed, the pavement shall be temporarily restored. Where the trench crosses bitumen or concrete pavement, a pre-mixed asphaltic material shall be used for such temporary restoration. Temporary restoration works shall be maintained by the Contractor until final restoration is carried out.
4. Final restoration of the pavement shall be carried out to restore the pavement and its sub-base to no less than the original condition. Unless noted otherwise on the approved Project Drawings all trenches excavated through bitumen or concrete pavement shall be sawcut each side to facilitate a neat finish to the final restoration. Final restoration may include, if required, the removal of temporary restoration.
5. Backfill shall be placed sufficiently high to compensate for expected settlement and further backfilling shall be carried out or the original backfill trimmed at the end of the Defects Liability Period in order that the surface of the completed trench may then conform to the adjacent surface. Surplus material shall be removed and disposed of to areas arranged by the Contractor.
6. In locations where surplus material left in the vicinity of the trench would not be objectionable, the surplus material may be disposed by spreading neatly in the vicinity of the trench in such a way as to minimise future erosion of the backfill and adjacent ground surfaces. The Contractor shall maintain the backfill and adjacent ground until the end of the Defects Liability Period.
7. Where, within public or private property, the reasonable convenience of persons will require such, trenches are to be levelled off at the time of backfilling. Any subsequent settlement shall be made good by the Contractor, as required on a regular basis by placing additional fill.
8. Where shown on the approved Project Drawings or where the Contractor elects to tunnel under paving, kerb and channel or other improved surfaces in lieu of trenching, backfilling shall be so carried out as to restore full support to those surfaces. The Contractor shall remain responsible for the repair of the improved surfaces, if subsequently damaged due to subsidence of the backfill, until the end of the Defects Liability Period.

S6.31 TOLERANCES

Tolerances for the construction of sewer reticulation works shall comply with:

1. Horizontal tolerances:

Sewers and on-line structure:	
Sewers	+ 100mm lateral displacement from the design sewer alignment
Structures	± 100mm lateral displacement from the design sewer alignment; and ± 200mm displacement (from the design position) along the sewer axis
Junction	± 100mm displacement (from the design position) along the sewer axis
Property connection sewers:	
Property connection sewers	± 100mm displacement (from design position) along sewer axis
Property connection risers, inspection opening and surface fittings	<u>Same lateral displacement as for the sewer junctions and 100mm displacement along the property connection sewer axis.</u>

2. Vertical Tolerances:

Category	Design grade	Minimum acceptable grade
Sewer Grade Tolerances:		
Flat Grades	$\leq 1.0\%$ (less than or equal to 1 in 100)	10% flatter, 10% steeper
Flat to moderate grades	$>1.0\% \leq 5.0\%$ (greater than 1 in 100 and less than or equal to 1 in 20)	15% flatter, 15% steeper
Moderate to steep grades	$>5.0\%$ (greater than 1 in 20)	20% flatter, 20% steeper
Property Connection Sewer Grade Tolerances:		
DN 100	1.65% (1 in 60)	15% flatter, 15% steeper
DN 150	1.2% (1 in 83)	15% flatter, 15% steeper

APPENDIX A

CTM Water Alliance Design and Construction Code

Version 1.0 August 2019

**APPENDIX A – CTM Water Alliance Design and Construction Code Version 1.0
August 2019 - Amendments to Standard Drawings**

CTM Drawings (Additional to SEQ)	Status
CTM-SEW-001 Typical Site and Locality Plan	Do not use

SEQ Drawing Reference	Status
GEN-1100-1 Water Supply, Sewerage, Vacuum Sewerage & Pressure Sewerage Legend	Do not use
SEW-1100-1 Design Layout Nusewers Typical Locality & Site Plan	Do not use
SEW-1100-2 Design Layout Rigss Typical Locality & Site plan	Do not use
SEW-1101-1 Design Layout Pe Nusewers Typical Longitudinal Sections	Do not use
SEW-1101-2 Design Layout Rigss Typical Longitudinal Sections	Do not use
SEW-1101-3 Sewerage Reticulation Typical Estate Details And Notes	Do not use
SEW-1102-1 Design Layouts Connection To Existing Sewer Typical Schedule Of Works	Do not use
SEW-1103-1 Rigss Pipelaying Typical Arrangements	Do not use
SEW-1103-2 Nusewer Pipelaying Typical Arrangements	Do not use
SEW-1104-1 Sewerage House Connection Typical Construction Details Rigss-Sheet1	Replace with S3005
SEW-1105-1 Sewerage House Connection Typical Construction Details Rigss-Sheet2	Replace with S3005
SEW-1106-1 PE Nusewers Property Connections Typical Layout	Replace with S3005
SEW-1106-2 PE Nusewers Typical Property Connection Type A1, A2 Standard & Extended	Replace with S3005
SEW-1106-3 PE Nusewers Typical Property Connection Type A3, A4 Standard & Extended	Replace with S3005
SEW-1106-4 PE Nusewers Typical Property Connection Type B1 to B4 Sloped Connections	Replace with S3005
SEW-1106-5 PE Nusewers Typical Property Connection Type C1 to C4 Vertical Riser	Replace with S3005
SEW-1106-6 PE Nusewers Typical Twin Property Connection Type C1 to C4 Vertical Riser	Replace with S3005
SEW-1106-7 PE Nusewers Typical Twin & Single Property Connections	Replace with S3005
SEW-1200-1 Soil Classification Guidelines And Allowable Bearing Pressures For Anchors And Thrust Blocks	Replace with S3015
SEW-1200-2 Embedment & Trench fill Typical Arrangement	Replace with S3015
SEW-1201-1 Typical Standard Embedment Flexible & Rigid Pipes	Replace with S3015
SEW-1202-1 Typical Special Embedment Inadequate Foundations Requiring Over Excavation & Replacement	Replace with S3015
SEW-1203-1 Typical Special Embedment Concrete And Stabilised Supports	Replace with S3015
SEW-1204-1 Typical Special Embedment Support Utilising Piles	Replace with S3015
SEW-1205-1 Typical Trench And Bedding Details Within Existing Roads Type 14 To 17	Replace with S3015
SEW-1206-1 Typical Bulkheads & Trench Stops	Do not use
SEW-1207-1 Trench Drainage Typical Systems	Do not use
SEW-1207-2 Typical Drainage Of Sewer Trenches And Diversion Drains	Do not use
SEW-1300-1 Maintenance Holes < Dn300 Sewer Types P1, P2 & P3 Typical Pre-Cast	Replace with S3000
SEW-1301-1 Cast in-Situ Maintenance Hole Typical Coping & Anchor Bracket Details	Replace with S3000
SEW-1301-2 "G"Type-Pe NuSewers Typical Maintenance Hole Details	Replace with S3000
SEW-1301-3 "G"Type- Pe NuSewers Typical Maintenance Hole And Slab Details	Replace with S3000
SEW-1301-4 "F"Type- Pe NuSewers Typical Maintenance Hole Details	Replace with S3000
SEW-1301-5 "F"Type Pe NuSewer Typical Maintenance Hole And Slab Details	Replace with S3000
SEW-1301-6 "X"Type Deep Maintenance Hole Typical Arrangement Sewer<01200	Replace with S3000
SEW-1301-7 "X"Type Deep Maintenance Hole Typical Arrangement Sewer>01200	Replace with S3000
SEW-1301-8 "X"Type Deep Maintenance Hole Typical Arrangement Sewer<0600 With Drop Pipe	Replace with S3000
SEW-1301-9 "X"Type Deep Maintenance Hole Typical Arrangement Sewer 0675 To 0900 With Drop Pipe And Safety Chain Details	Replace with S3000
SEW-1301-10 "X"Type Deep Maintenance Hole Typical Junction Details	Replace with S3000
SEW-1301-11 "X"Type Deep Maintenance Hole Typical Top Slab Details	Replace with S3000

SEWERAGE RETICULATION

SEW-1301-12 Typical M.S. And S.S. Ladder And Associated Fittings	Replace with S3000
SEW-1302-1 Maintenance Holes Cast In-Situ & Precast Typical Pipe Connection Details	Replace with S3000
SEW-1303-1 Maintenance Holes Sewers < Dn300 Typical Changes In Level Details	Replace with S3000
SEW-1303-2 Iron Inspection Bends For Typical Internal Drop Pipes In Sewerage Manholes	Replace with S3000
SEW-1303-4 Typical Stainless Steel Bracket For Dn100 And Dn150 Upvc Drop Pipes	Replace with S3000
SEW-1304-1 Maintenance Holes Sewers <DN300 Typical Channel Arrangements	Replace with S3000
SEW-1305-1 Maintenance Holes Typical Channel Details	Replace with S3000
SEW-1306-1 Maintenance Holes Typical Alternative Drop Connections	Replace with S3000
SEW-1307-1 DN1000 to DN1500 Cast In-Situ Maintenance Holes Typical Details	Do not use
SEW-1307-2 Sulphide Control Sewer Maintenance Hole-Relined General Arrangement	Do not use
SEW-1307-3 Sulphide Control Sewer Maintenance Hole-Relined Details	Do not use
SEW-1307-4 Sulphide Control Sewer Maintenance Hole-Relined Cut-Ins	Do not use
SEW-1308-1 Typical Maintenance Hole Cover & Surround Detail	Do not use
SEW-1308-2 Maintenance Hole Cover Sewer-Class b-Concrete In Fill Typical Frame Details	Do not use
SEW-1308-3 Maintenance Hole Cover Sewer-Class b-Concrete In Fill Typical Cover Details	Do not use
SEW-1308-4 Maintenance Hole Cover Sewer-Class b-Concrete In Fill Typical Lifting Hole Details	Do not use
SEW-1308-5 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Frame Details	Do not use
SEW-1308-6 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Cover Details	Do not use
SEW-1308-7 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Cover Details	Do not use
SEW-1308-8 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Base Frame Details	Do not use
SEW-1308-9 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Riser Ring Details	Do not use
SEW-1308-10 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Cover Details	Do not use
SEW-1308-11 Maintenance Hole Cover Sewer-Class b-Bolt Down Typical Cover Details	Do not use
SEW-1309-1 "Y" Type Maintenance Hole Sewers DN600 & DN750 Typical Arrangement	Do not use
SEW-1310-1 "Z1" Type Non-Trafficable Typical Grip MH Option Dn1200 And Larger Sewers	Do not use
SEW-1311-1 "Z2" Type Typical Tunnel Jacking Shaft-Caisson Option	Do not use
SEW-1312-1 "Z3" Type Typical Tunnel Receival Shaft Manhole Option	Do not use
SEW-1313 -1 Maintenance Hole Sewer Connection Details All Pipe Materials	Replace with S3000
SEW-1314-1 Maintenance Structures For Dn225 And Smaller Rigss Typical Arrangement Details	Do not use
SEW-1314-2 Maintenance Shafts Ms And Variable Bend For Rigss Typical Arrangement Details	Do not use
SEW-1314-3 Gravity Sewers Rigss Typical In-Line Bend Details	Do not use
SEW-1315-1 Pe NuSewers Typical Maintenance Shaft And Terminal Entry Point	Do not use
SEW-1316-1 Pe NuSewers Typical Maintenance Structure Cover Frame And Support Details	Do not use
SEW-1400-1 Buried Crossings Typical Siphon Arrangement	Do not use
SEW-1401-1 Typical Buried Crossings Railways	Do not use
SEW-1402-1 Typical Buried Crossings Major Roadways	Approved
SEW-1403-1 Typical Buried Crossings Bored And Jacked Encasing Pipe Details	Approved
SEW-1404-1 Typical Aerial Crossings Aqueduct	Approved
SEW-1405-1 Typical Aerial Crossings Aqueduct Protection Grille	Do not use
SEW-1406-1 Aerial Crossings Typical Bridge Crossing Concepts	Approved
SEW-1407-1 Typical Ventilation Systems Induct Vent	Do not use
SEW-1408-1 Water seal Arrangements Typical Mains Type	Do not use
SEW-1408-2 Water seal Arrangements Typical Maintenance Hole System	Do not use
SEW-1409-1 Standard Overflow Flap Valve Chamber-Type1 Typical Chamber Details	Do not use
SEW-1409-2 Standard Overflow Flap Valve Chamber-Type1 Typical Top Slab And Flap Details	Do not use

SEWERAGE RETICULATION

SEW-1410-1 Standard Overflow Flap Valve Chamber-Type2 Typical Chamber Details	Do not use
SEW-1410-2 Standard Overflow Flap Valve Chamber-Type2 Typical Top Slab And Flap Details	Do not use
SEW-1411-1 Standard Overflow Flap Valve Chamber-Type3 Typical Chamber Details	Do not use
SEW-1411-2 Standard Overflow Flap Valve Chamber-Type3 Typical Top Slab And Flap Details	Do not use
SEW-1412-1 Typical Overflow Details From Pump Well Or Manhole Shielded Outlet	Replace with S3035
SEW-1412-2 Typical Overflow Shield Shielded Outlet	Replace with S3035
SEW-1413-1 Sewerage Overflow Arrangement Typical Overflow with Screened Outlet	Replace with S3035
SEW-1500-1 Insertions And Repair Systems Typical Pipe cut-In methods	Do not use
SEW-1501-1 Insertions And Repair Systems Typical Insertion Of Junctions	Do not use
SEW-1502-1 Insertions And Repair Systems Typical Maintenance Structures	Do not use

APPENDIX B

SEWERAGE PUMPING STATION CODE OF AUSTRALIA

WSA 04-2014

Amendments to Standard Drawings

APPENDIX B – Sewerage Pumping Station – WSA 04-2014 - Amendments to Standard Drawings

Drawing	Amendments
SPS - 1100	Do not use
SPS - 1101	Do not use
SPS - 1102	Do not use
SPS - 1103	Do not use
SPS - 1104	Do not use
SPS - 1200	Do not use
SPS - 1201	Do not use
SPS - 1202	Do not use
SPS - 1203	Do not use
SPS - 1204	Do not use
SPS - 1205	Do not use
SPS - 1300	Do not use
SPS - 1301	Do not use
SPS - 1302	Do not use
SPS - 1303	Do not use
SPS - 1304	Do not use
SPS - 1305	Do not use
SPS - 1306	Do not use
SPS - 1307	Do not use
SPS - 1308	Do not use
SPS - 1309	Do not use
SPS - 1310	Do not use
	Replace with S3020 and S3025
SPS - 1400	Do not use
SPS - 1401	Do not use
SPS - 1402	Do not use
SPS - 1403	Do not use
SPS - 1404	Do not use -
SPS - 1405	Do not use
	Replace with S3035
SPS - 1500	Do not use
SPS - 1501	Do not use
SPS - 1502	Do not use
SPS - 1503	Do not use
SPS - 1504	Do not use
SPS - 1505	Do not use
SPS - 1506	Do not use
SPS - 1507	Do not use
SPS - 1508	Do not use
SPS - 1600	Do not use
SPS - 1601	Do not use
SPS - 1602	Do not use
SPS - 1603	Do not use
SPS - 1604	Do not use
SPS - 1605	Do not use
SPS - 1606	Do not use

NB: Drawings above may be subject to council specific requirements. Please refer to body text and D7 – Sewerage System Design Manual for further information.