

Policy 11: Land Development Guidelines

SS1

Specification for Construction of Sewerage Mains and Associated Works

Table of Contents

Specification for Construction of Sewerage Mains and Associated Works.....	1
1.0 General	5
2.0 Acts, Regulations and Local Laws	5
3.0 Existing Services.....	5
4.0 Materials.....	6
4.1 General	6
4.2 Concrete Structures, Reinforcing, Timber, Formwork	6
4.3 Plastic Access Structures.....	6
4.4 Certification of Concrete and Warranty for Protective Coating of Wet Wells.....	6
5.0 Non-Pressure Pipes	6
5.1 Sewer Reticulation and House Connections	6
5.2 Trunk Sewers	7
5.3 Unplasticized Polyvinyl Chloride (uPVC)	7
5.4 Glass Reinforced Plastic (GRP).....	7
5.5 Vitrified Clay Pipe (VC)	7
5.6 Polyethylene (PE)	7
5.7 Reinforced Concrete	8
5.8 Polypropylene (PP)	8
5.9 Polycrete	8
5.10 Pipe Joints.....	8
5.11 Pipe and Fitting Colour.....	8
5.12 Pipe Bends In-Line.....	8
6.0 Pressure Pipes.....	8
6.1 Reticulation Sewer	8
6.2 Trunk Sewer.....	9
6.3 Polyvinyl Chloride Pipes (PVC).....	9
6.4 Ductile Iron (DI).....	9
6.5 DI Flanged Pipe	10
6.6 Glass Reinforced Plastic (GRP).....	10
6.7 Polyethylene Pipes (PE)	10
6.8 Steel	10
6.9 Steel Flanged Pipe.....	11
6.10 Pipe Colour	11
7.0 Pipe Fittings	11
7.1 Gravity Pipe Fittings	11
7.2 Pressure Pipe Fittings	11
7.2.1 DI Socket Fittings.....	11
7.2.2 DI Flanged Fittings.....	12
7.2.3 Puddle Flanges	12
7.2.4 Steel Fittings	12
7.2.5 Non-Metallic Fittings	12
7.2.6 Pressure Pipe Fitting Colour	12

8.0	Polyethylene Pipe Sleeving and Marker Tape	12
8.1	Australian Standard Pipe	12
8.2	ISO Standard Pipe	13
9.0	Jointing Systems	13
9.1	Pipe Mechanical Joints	13
9.1.1	Gibault Joints	13
9.1.2	Dismantling Joints	13
9.1.3	Flanged Assembly Joints	13
9.1.4	Flexible Couplings/ Clamps	13
9.2	Pipe Joint Seals	14
9.2.1	Rubber Rings	14
9.2.2	Flange Gaskets	14
9.3	Concrete Joint Seals	14
9.3.1	Hydrophilic Waterstops	14
9.3.2	PVC Waterstops	14
10.0	Jointing Bolts	15
11.0	Valves.....	15
11.1	Sluice and Scour Valves	15
11.2	Gas Release Valves.....	15
11.3	Wafer Butterfly Valve	16
11.4	Check Valves	16
11.5	Knife Gate Valves (DN600 and larger)	16
11.6	Valve Spindles, Actuators and Gearboxes	16
11.7	Valve Installation	17
11.7.1	Valve Boxes	17
11.7.2	Valve Pits	17
11.7.3	Valve Thrust Restraint	17
12.0	Protective Coating.....	17
12.1.1	Thermal Bonded Polymeric Coatings	17
12.1.2	Epoxy Painted Coatings.....	17
13.0	Step Irons.....	18
14.0	Geotextile	18
15.0	Setting Out Work.....	18
16.0	Care of Real Property Survey Pegs.....	18
17.0	Care of Existing Fences.....	18
18.0	Work Within Private Property.....	18
19.0	Work Within Road Reserves	19
20.0	Clearing and Grubbing.....	19
21.0	Cover Over Pipes and Depths of Pipework	19
21.1	Non Pressure (Gravity) Pipe	19
21.1.1	Permissible Depths for Non-Pressure (Gravity) Pipe	19
21.2	Pressure Mains	19
22.0	Erosion and Sediment Control	20
23.0	Excavation.....	20
24.0	Bedding Material	22
25.0	Trench Construction.....	22
25.1	General	22
25.2	Type 1 Construction.....	22
25.2.1	Bedding Zone 1.....	23
25.2.2	Bedding Zone 2.....	23

25.2.3	Bedding Zone 3.....	23
25.3	Type 2 Construction.....	23
25.4	Type 3 Construction.....	23
25.5	Type 4 Construction.....	23
25.6	Type 5 Construction.....	23
25.7	Type 6 Construction.....	24
25.8	Type 7 Construction.....	24
25.9	State-Controlled Roads.....	24
26.0	Laying and Jointing of Pipes.....	24
26.1	Definition of Terms.....	24
26.2	Approval of Pipe Layers.....	25
26.3	Laying of Gravity Pipework.....	25
26.4	Laying of Pressure Pipework.....	26
26.5	Laying of Pressure Pipe Fittings.....	26
26.6	Wrapping of Flanges and Mechanical Joints.....	26
26.6.1	Flanges.....	27
26.6.2	Mechanical Joints.....	27
26.6.3	Inspection.....	27
26.7	Additional Requirements for Laying and Jointing of Steel Pipes.....	27
26.7.1	Handling FBMDPE Coated Pipes.....	27
26.7.2	Testing of Coating.....	27
26.7.3	Laying of Rubber Ring Joint Pipes.....	28
27.0	Pipe Welding.....	28
27.1	Welding Procedures Steel Pipe.....	28
27.1.1	Qualification of Welding Procedures.....	28
27.1.2	Welding Procedure Sheet.....	29
27.2	Welding Operators Steel Pipe.....	29
27.2.1	Qualification, Certification, Background Experience.....	29
27.2.2	Identification of Welding Operators.....	29
27.3	Supervision of Steel Pipe Welding Work.....	29
27.4	Inspection and Testing of Steel Pipe Welds.....	29
27.4.1	Inspector.....	29
27.4.2	Inspection.....	30
27.4.3	Testing of Welds.....	30
27.4.4	Testing Records.....	30
27.5	Welding Processes Steel Pipe.....	30
27.6	Welding Consumables Steel Pipe.....	30
27.7	Pneumatic Testing Steel Pipe.....	30
27.8	External Coating of Welded Steel Pipe Joints.....	31
27.8.1	Heat Shrink Sleeves.....	31
27.8.2	Tape Wrap Coating.....	31
27.9	Welding of Above Ground Steel Pipes.....	31
27.10	Internal Pointing of Steel Pipes.....	32
27.11	Jointing of PE Pipes and Fittings.....	32
27.11.1	General.....	32
27.11.2	Butt Welding.....	32
27.11.3	Electrofusion Couplings.....	32
27.11.4	PE Stub Flanges.....	33
28.0	Earthing of Pipes During Construction.....	33
29.0	Marking for Location of Pipes, Valves, Manholes and Other Fittings.....	33

30.0	Backfilling	34
30.1	General	34
30.2	Flowable Fill	35
31.0	Boring and Jacking	35
31.1	General	35
31.2	Pipe Jacking	36
31.2.1	Micro-Tunnelling	36
31.2.2	Micro-Tunnelling Equipment Requirements	36
31.2.3	Grouting Around Pipelines	37
31.2.4	Thrusts and Reception Pits	37
32.0	Manholes – Standard Cast <i>In Situ</i> and Receiving Manholes	37
33.0	Manholes – Pre-Cast	38
34.0	Maintenance Shafts and Rodding Points	39
35.0	Discharge Manholes Protective Coating System	40
36.0	Manhole Covers and Frames	40
37.0	Manhole Drops	40
38.0	Sewerage Lift Stations and Pump Stations	41
39.0	Protective Coating of Wet Wells	43
40.0	Testing of Gravity Sewers and Maintenance Shafts	44
40.1	Air Testing General	44
40.2	Air Testing – Pressure	44
40.3	Air Testing – Vacuum	45
40.4	Ovality Testing	45
40.5	Closed Circuit Colour TV Inspection (CCCTV)	46
41.0	Testing of Pressure Mains	46
42.0	Manhole and Wet Well Testing	46
43.0	Cleaning of Sewerage Reticulation System	47
44.0	Restoration Works	47
45.0	Live Connection, Disconnection, Commissioning and Decommissioning	48
46.0	‘As-Constructed’ Submission	49
46.1	‘As-Constructed’ Criteria	49
47.0	Construction Tolerance	49
47.1	Sewer Reticulation	49
47.2	Trunk Sewers	49
48.0	Measurement and Payment	49
49.0	Standards and Codes	50
	Appendices	53
	Appendix C Consulting Engineer’s Certificate and As Constructed Certification	55
	Appendix C1-A Typical Hold/ Witness Point Inspection Checklist Sewer Reticulation	56
	Appendix C1-B Rectification Summary List	59
	Appendix C1-C Sewerage Completed Works Matrix	60
	Appendix C1-D Site Inspection Summary List	62

1.0 General

This specification covers the construction of:

- a) Sewerage Reticulation and Associated Works:
 - i) DN100 to DN300 sewers, manholes, maintenance shafts, sewerage pumping stations, house connections and associated appurtenances;
 - ii) DN100 to DN300 pressure mains and associated appurtenances where the maximum working pressure is not more than 900 kPa.
- b) Major Sewerage Mains and Associated Works:
 - i) DN300 to DN1200 sewers, manholes, sewerage pumping stations and associated appurtenances;
 - ii) DN300 to DN600 pressure mains and associated appurtenances where the maximum working pressure is not more than 900 kPa.
- c) This specification covers reticulation and trunk sewerage requirements and where needed, separately specifies requirements for reticulation and trunk sewerage.
- d) The construction of mechanical installations, electrical installations and treatment plants is not covered by this specification.

2.0 Acts, Regulations and Local Laws

- a) The Contractor shall comply with all Acts, Local Laws and Regulations having jurisdiction over work under the Contract and shall be fully responsible for any breaches thereof.
- b) Notwithstanding the requirements of this specification the whole of the work under the Contract shall be executed in conformity with the relevant sections of the **Water Act 2000** (as amended), the **Environmental Protection Act**, the **Environmental Protection Regulation**, the **Workplace Health and Safety Act** and any **Construction Safety Plans** required by this Act and all other **Queensland** and **Australian Acts** and **Regulations**.
- c) The Contractor is advised that Council has **Occupational Health and Safety Guidelines** that shall be reviewed and used as appropriate. These Guidelines are available for viewing at Council's Nerang and Evandale Administration centres.

3.0 Existing Services

- a) It shall be the Contractor's responsibility to contact all public utility authorities to ascertain the location of services prior to commencing the Work under the Contract. In carrying out the Works, the Contractor shall be responsible for all damage caused to any public utility whatever.
- b) Before undertaking any work, which may interfere with any public utility, railway, road, watercourse or tidal waters or with any structure, the Contractor shall give the required notice in writing to the Department or Authority concerned. The Contractor shall not commence the work until it has received the necessary permits and it shall carry out the work in accordance with the conditions set out in these permits.
- c) If the Contractor damages any existing services it shall arrange for the relevant service authority to make good such damage and the cost thereof shall be borne by the Contractor.
- d) Where the design of the Works requires alterations to existing services and such alterations are to be organised by the Contractor then the Contractor shall liaise and arrange with the relevant Department or Authority to effect such alterations and the Contractor shall pay all costs, fees, and charges of the Department or Authority.
- e) All of the Contractor's costs in performing this function shall be deemed to be included in the relevant Bill Item (if part of the Contract) and the Lump Sum of the Contract generally.
- f) Prior to commencing the Works on site, the Contractor shall physically locate and expose all services in the vicinity of the Works using non destructive vacuum excavation methods, unless approved otherwise, and assess if there is interference with the construction of the Works as designed.
- g) Where existing services interfere with the Works as designed the Contractor shall notify the Superintendent of the interference immediately. The Superintendent will then instruct the Contractor on how to proceed.
- h) Where the design of the Works is altered to overcome the existing services interference the Contractor shall undertake the work instructed.
- i) Actual additional construction costs associated with the alteration of the Works or services to overcome the existing services interference will be met by the Principal. No delay and disruption costs will be considered as the additional works will be instructed in response to notification by the Contractor prior to works commencing on site.

4.0 Materials

4.1 General

- a) All materials used in the Works shall be handled, transported and stored in accordance with the relevant Australian Standard and the manufacturer's recommendations.

4.2 Concrete Structures, Reinforcing, Timber, Formwork

- a) The grade of concrete to be used in the Works shall be as shown on the drawings. The manufacture, supply, handling and placing of concrete shall comply with the requirements of **AS1379** and **AS3600**.
- b) Portland and blended cements shall comply with the requirements of **AS3972**.
- c) Steel reinforcing bars and welded wire reinforcing fabric shall comply with the requirements of **AS/NZS4671**.
- d) Structural steel shall comply with the requirement of **AS/NZS3678**, **AS/NZS3679** and **AS/NZS1554.5**.
- e) Galvanising shall comply with the requirements of **AS/NZS4680**.
- f) All structured timber shall comply with the requirements of **AS1720.1** and timber species shall conform to unseasoned stress Grade F17.
- g) Formwork shall comply with the requirements of **AS3610**.

4.3 Plastic Access Structures

- a) PVC maintenance shafts shall comply with **AS/NZS4999**.
- b) PE maintenance shafts shall comply with **AS/NZS4798 (Int)**.
- c) Polypropylene maintenance shafts shall generally comply with **AS/NZS4999** or **AS/NZS4798(Int)** as appropriate.

4.4 Certification of Concrete and Warranty for Protective Coating of Wet Wells

- a) The Defects Liability Period for the Contract shall not commence and furthermore the Superintendent will not be required to issue a Certificate of Practical Completion until all of the following conditions have been met:
- i) pursuant to the requirements of **Clause 38.0 d)** herein the Contractor has furnished the Superintendent with the originals of certification (in a format approved by the Superintendent) relating to:
 - ii) concrete test cylinder results (from a NATA registered laboratory approved by the Superintendent) and the suppliers certification that the requirements of **Clause 38.0 c)** herein have been met.
- b) Pursuant to the requirements of **Clause 39.0 I)** herein that the Contractor has furnished the Superintendent with the certifications and warranties required.

5.0 Non-Pressure Pipes

5.1 Sewer Reticulation and House Connections

- a) Subject to the following conditions the only types and classes of pipes to be used in the Works shall be as specified in **Table 1** herein:
- i) the fittings are compatible with the type and class of pipe being used;
 - ii) the pipes and fittings conform with the relevant Australian Standard.
- b) For each diameter of pipe, the same type of the pipe and fittings must be used throughout the whole of the Works unless specifically stated otherwise in the Contract.

Table 1

Nominal Diameter Size (DN)	Use	Type of Pipe	Class
100	House Connection Branches	Unplasticized PVC	SN6
150, 225 & 300	Sewers & House Connection Branches	Unplasticized PVC	SN8
		Vitrified Clay	160
		Glass Reinforced Plastic	SN 10000

5.2 Trunk Sewers

- a) Subject to the following conditions the only types and classes of pipes and fittings to be used in the Works shall be as specified in **Table 2** herein:
 - i) The fittings are compatible with the type and class of pipe being used.
 - ii) The pipes and fittings conform with the relevant Australian Standard.
- b) For each diameter of pipe, the same type of the pipe and fittings must be used throughout the whole of the Works unless specifically stated otherwise in the Contract.

Table 2

Type of Pipe	Class	Nominal Diameter DN								
		300	375	450	525	600	750	900	1000	1200
Unplasticised PVC	SN8	✓	✓							
Vitrified Clay	160	✓	✓	✓	✓	✓	✓	✓	✓	✓
Glass Reinforced Plastic	SN 10000	✓	✓	✓	✓	✓	✓	✓	✓	✓
Polyethylene	SN 10000		✓	✓		✓				
Reinforced Concrete	4	✓	✓	✓	✓	✓	✓	✓		
Polycrete						✓	✓	✓	✓	✓
Polypropylene	SN 10000		✓	✓		✓				

5.3 Unplasticized Polyvinyl Chloride (uPVC)

- a) uPVC pipes and fittings shall comply with **AS/NZS1260**.
- b) uPVC moulded fittings shall be class SN6 minimum with fibreglass reinforcement in accordance with **Clause 7.1** and to the details shown in Council's Standard drawing.
- c) Handling and storage of uPVC pipes and fittings shall comply with the requirements of **AS2032**. If there is any discrepancy in the requirement of this specification and **AS/NZ2032** then the requirements of this specification shall take precedence.

5.4 Glass Reinforced Plastic (GRP)

- a) GRP pipes and fittings shall comply with either **AS3571** or **ISO10467**.
- b) The class of GRP pipes shall be as shown in **Clause 5.0** herein. The pipes shall be lined with a suitable resin liner and be capable of withstanding exposure to sewage and aggressive ground water.
- c) Where GRP non-pressure pipes are joined to poured concrete, the MH short coupling shall be treated by the manufacturer to ensure that a watertight joint is attained.
- d) All pipe ends of either factory provided or field cut pipe shall be sealed across the end face and feathered onto the internal and external linings of the pipe prior to installation with an approved epoxy material at 1.0mm thick on the pipe end face that does not affect the assembly of the joint.

5.5 Vitrified Clay Pipe (VC)

- a) VC pipes and fittings shall comply with EN295. The class of VC pipe and fittings shall be as shown in **Clause 5.0** herein. Pipe and fitting joint systems shall be a minimum of System 'C' in accordance with **EN295**.

5.6 Polyethylene (PE)

- a) PE pipes and fittings shall be manufactured from PE 80 or PE 100 compounds in accordance with **AS/NZS4131**.
- b) Structured wall PE pipes and fittings shall conform with the requirements of **AS/NZS5065** and be suitably lighter coloured for the internal pipe face. Solid wall PE pressure pipe may be used where the pipe equals a minimum of SN 10,000 and the internal pipe face shall be lighter coloured.
- c) Where PE non-pressure pipes are joined to poured concrete, the MH short coupling shall be treated by the manufacturer to ensure that a watertight joint is attained.

5.7 Reinforced Concrete

- a) Concrete pipes and fittings shall be manufactured from steel reinforced concrete and shall comply with **AS/NZS4058** and shall be continuously Plastiline coated to the internal faces excluding the invert for 1 degree.
- b) The class of reinforced concrete pipe shall be as shown in **Clause 5.0** herein.

5.8 Polypropylene (PP)

- a) Polypropylene pipes and fittings shall be manufactured in accordance with **AS/NZS5065**.
- b) Polypropylene pipes and fittings shall be suitably lighter coloured for the internal pipe face.
- c) Where Polypropylene non-pressure pipes are joined to poured concrete, all MH couplings shall be treated by the manufacturer and as shown in the drawings to ensure that a watertight joint is attained.

5.9 Polycrete

- a) Polycrete pipes and fittings shall be manufactured in accordance with **ASTM D 6783** or **DIN 54815-1** and **DIN 54815-2**.

5.10 Pipe Joints

- a) All sewer pipes specified in **Clause 5.0** herein shall be rubber ring jointed. The rubber rings shall comply with **Clause 9.2** herein.
- b) All house connection branch pipes specified in **Clause 5.0** herein shall be rubber ring jointed with the rubber rings complying with **Clause 9.2** herein.
- c) Solvent Welded Joint (SWJ) PVC pipe joints are only permitted in accordance with **Clause 7.1** herein.
- d) At Manholes, the MH coupling shall be treated by the manufacturer and as shown in the drawings to ensure that a watertight joint is attained.

5.11 Pipe and Fitting Colour

- a) All gravity sewer pipes and fittings specified in **Clause 5.0** herein, except VC pipe, shall preferably be externally coloured grey or black. The colour grey shall be not lighter than Pearl Grey N11 and not darker than Cloud Grey N22 and the colour black shall generally be Black N61 as defined by **AS2700**.
- b) Where a sewer pipe or fitting that is not externally grey or black coloured is installed less than 2000mm from pipe invert to finished surface then pipe sleeving as specified in **Clause 8.0** herein shall be provided over the non grey or non black pipe, VC pipe is exempt from the requirement to be sleeved.
- c) All black pipes and fittings shall be provided with a suitably lighter coloured internal pipe face. Suitable lighter colours are between white and yellow as defined by **AS2700**.

5.12 Pipe Bends In-Line

- a) In-line PVC bends shall be factory formed pieces of Solid Wall or Sandwich Wall uPVC pipe complying with **AS/NZS1260** that are manufactured to ensure uniformity of pipe diameters, pipe socket and spigot and pipe ovalities. Bends shall be Aymroo Vario ® bends, A & L Industries bends (or equal approved product). In-line bends shall be 3000mm radius as shown within the drawings and 635mm radius for the integral rodding end bend as shown within the drawings.
- b) GRP bends shall be fabricated from GRP pipe complying with either **AS3571** or **ISO10467** where the maximum deflection of individual segments of the bend is 15 degrees.
- c) PE bends at 30 and 45 degrees shall be as shown in the drawings.

6.0 Pressure Pipes

6.1 Reticulation Sewer

- a) Subject to the following conditions the only types and class of pipes to be used in the Works shall be as specified in **Table 3** herein.
 - i) the fittings are compatible with the type and class of pipe being used;
 - ii) the pipes and fittings conform with the relevant Australian Standard.
- b) For road crossings, DI pipes shall be provided from back of kerb plus 1.0 metre to back of kerb plus 1.0 metre.

- c) Except at road crossings, for each diameter of pipe, the same type of the pipe and fittings must be used throughout the whole of the Works unless specifically stated otherwise in the Contract.

Table 3

Nominal Diameter (DN)	Type of Pipe	Class of Pipe
100, 150, 200, 250, 300	PVC	Series 2 PN16
	Ductile Iron	PN20, PN35 and Flange Class

6.2 Trunk Sewer

- a) Subject to the following conditions the only types and class of pipes to be used in the Works shall be as specified in **Table 4** herein.
- i) the fittings are compatible with the type and class of pipe being used;
 - ii) the pipes and fittings conform with the relevant Australian Standard.
- b) For road crossings, DI or steel pipes shall be provided from back of kerb plus 1.0 metre to back of kerb plus 1.0 metre.
- c) Except at road crossings, for each diameter of pipe, the same type of the pipe and fittings must be used throughout the whole of the Works unless specifically stated otherwise in the Contract.
- d) Steel pipes shall not be used for pipelines with internal diameter less than 600 mm.

Table 4

Type of Pipe	Class	Nominal Diameter (DN)							
		300	375	450	500/525	600	750	800	960
PVC	Series 2 PN 16	✓	✓	✓					
Ductile Iron	PN20, PN35 and Flange Class	✓	✓	✓	✓	✓			
Glass Reinforced Plastic	SN 10000 PN 16	✓	✓	✓	✓	✓			
Polyethylene	Series 1 PN 16	✓	✓	✓	✓	✓			
Steel	Rated Pressure 1.4 Mpa					✓			

6.3 Polyvinyl Chloride Pipes (PVC)

- a) PVC Pipes shall comply with **AS/NZS1477**.
- b) PVC-M pipes shall comply with **AS/NZS4765**.
- c) PVC-O pipes shall comply with **AS4441 (Int.)**.
- d) PVC-O pipes shall not be used for Pumped Mains in locations where bad ground conditions exist and pipe support is poor due to low to very low soil modulus. PVC-O pipes may be used where calculations in accordance with **AS2566** show that pipe buckling due to external loads, depth of cover, water table level and traffic live loads, etc. is not an issue.
- e) Handling and storage of PVC pipes and fittings shall comply with the requirements of **AS2032**. If there is any discrepancy in the requirement of this specification and **AS/NZ2032** then the requirements of this specification shall take precedence.
- f) No PVC pipe socket of any approved material shall be joined to a Ductile Iron Spigot.
- g) Joint seals shall be as specified in **Clause 9.2** herein.

6.4 Ductile Iron (DI)

- a) DI pipes shall comply with **AS/NZS2280** or **EN545** compliant DI pipes can be used with appropriate marking as **ISO Pipe** as specified in **Clause 8.0** herein.
- b) DI pipes shall be internally lined with cement mortar in accordance with **AS/NZS2280**. DI pipes shall be bitumen coated externally in accordance with **AS/NZS2280** and sleeved as specified in **Clause 8.0** herein.

- c) DI pipes at gas release valves and at the discharge point and/or within 5.0m head of the HGL at static shall be provided with a Calcium Aluminate cement mortar lining such as the TytonXtreme product or equal.
- d) Joint Seals shall be as specified in **Clause 9.2** herein.

6.5 DI Flanged Pipe

- a) External to the pump wet well, all flanged pipework shall be manufactured in accordance with **AS/NZS2280** – Flange Class wall thickness ductile iron pipe, to which has been fitted threaded boss flanges in accordance with **AS4087**. **EN545** compliant DI pipes can be used with appropriate marking as **ISO Pipe** as specified in **Clause 8.0** herein.
- b) Pipes may be of flange/ flange, flange/ socket or flange/ spigot configuration as specified. All flange faces shall be machined at right angles to and concentric with the axis of the internal diameter of the pipe. For all new work, flanges shall be drilled in accordance with **AS4087 Figure B7** unless connecting on to existing mains where the connecting flange shall match existing. All pipes shall be cement mortar lined and coated with a bituminous compound in accordance with **AS/NZS2280** and sleeved as specified in **Clause 8.0** herein.
- c) Within the pump wet well, flange/ flange DI Flange Class pipes shall be utilised conforming to **Clause 6.5 a)** herein except that they shall have applied to the external surfaces of the pipe and flanges, a factory applied high build, epoxy protective coating system similar to Jotacote 412 or Devtar 5A or a coating system that complies with the **Australian Paint Approval Scheme Specification No. 0213 – Coatings for Steel Used in Sewage Works**.
- d) The pipes nominated in **Clause 6.5 c)** herein shall be supplied with two (2) coats of the protective coating system that has been applied over a compatible primer following the pipes abrasive blast cleaning in accordance with **AS1627.4** at Class 2.5. The two applied coats shall have a combined dry film thickness of 300 microns minimum with the dry coatings to be continuity tested, by wet sponge in accordance with **AS3894.2** with any defects to be repaired in accordance with the manufacturer's instructions.
- e) Joint Seals shall be as specified in **Clause 9.2** herein.

6.6 Glass Reinforced Plastic (GRP)

- a) GRP pipes, fittings and couplings shall comply with either **AS3571** or **ISO10467**.
- b) GRP pipes and fittings shall be joined with GRP couplings with full width rubber membranes. The rubber membranes shall comply with the requirements for rubber rings as specified in **Clause 9.2** herein.
- c) GRP couplings shall not be jointed to ductile iron spigot.

6.7 Polyethylene Pipes (PE)

- a) PE pipes and fittings shall be manufactured from PE 80B or PE 100 compound in accordance with **AS/NZS4131**. The compound shall be selected by the designer taking into account the required stiffness and the service condition. PE pipe dimensions shall be in accordance with **AS/NZS4130** for Series 1. The class of pipe shall be as specified in **Clause 6.0** herein.
- b) PE pipes and fittings shall be joined using the butt welding method or by the use of electrofusion couplings for the smaller pipe sizes.
- c) Joint Seals for flanges shall be as specified in **Clause 9.2** herein.

6.8 Steel

- a) Steel pipes shall comply with **AS1579**.
- b) The minimum wall thickness shall be 5 mm.
- c) The pipes shall be cement lined in accordance with **AS1281**. The pipes at gas release valves and at the discharge point and/or within 5.0m head of the HGL at static shall be provided with a Calcium Aluminate cement mortar lining such as the DI TytonXtreme mortar lining product or equal.
- d) The pipes shall be externally coated with a fusion bonded medium density polyethylene (FBMDPE) coating in accordance with **AS4321**.
- e) Pipe joints shall be either welded slip-in, welded butt, welded ball and socket, welded collar, flanged or elastomeric ring as specified. Joint Seals shall be as specified in **Clause 9.2** herein.
- f) When cathodic protection is required on elastomeric ring jointed pipelines, cable attachment lugs shall be provided on all pipe ends approximately 125 mm from the end of the coating.

6.9 Steel Flanged Pipe

- a) Steel flanged pipework shall be manufactured from **AS1579** pipe to which has been fitted plate flanges in accordance with **AS4087 Figure B7** as raised face flanges.
- b) Pipes may be of flange/ flange, flange/ socket or flange/ spigot configuration as specified. All flange faces shall be machined at right angles to and concentric with the axis of the internal diameter of the pipe. For all new work flanges shall be drilled in accordance with **AS4087 Figure B7** unless connecting on to existing mains where the connecting flange shall match existing.
- c) All pipes shall be cement mortar lined and coated as specified in **Clause 6.8 d)** herein and Joint Seals shall be as specified in **Clause 9.2** herein.
- d) Prior to welding the flange to the pipe, the FBMDPE coating shall be cut back to a neat edge 50mm clear of the weld. After the completion of welding and inspection, the pipe barrel and exposed parts of the flange shall be coated with an epoxy painted coating as specified in **Clause 12.0** herein.
- e) The epoxy painted coating between the original FBMDPE coatings shall be covered using a U.V. stabilised heat shrink sleeve.

6.10 Pipe Colour

- a) All pressure sewer pipes specified in **Clause 6.0** herein shall preferably be externally coloured cream. The colour cream shall be not lighter than RAL 080 90 20 and not darker than RAL 075 80 20 as defined by the **RAL DESIGN System**.
- b) Where a pressure sewer pipe that is not externally cream coloured is installed then pipe sleeving as specified in **Clause 8.0** herein shall be provided over the non-cream pipe.

7.0 Pipe Fittings

7.1 Gravity Pipe Fittings

- a) All sewer pipe and all sewer pipe fittings for pipe materials nominated in **Clause 5.0** herein shall be rubber ring jointed. The rubber rings shall comply with **Clause 9.2.1** herein.
- b) All house connection pipe and all house connection branch fittings for pipe materials nominated in **Clause 5.0** herein shall be rubber ring jointed with the rubber rings complying with **Clause 9.2.1** herein.
- c) All PVC house connection branch fittings and bends shall be moulded rubber ring jointed fittings or factory assembled, certified and stamped fittings assembled from moulded solvent weld jointed (SWJ) fittings and moulded rubber ring joint socket fittings.
- d) All moulded PVC fittings and all factory assembled PVC fittings shall be fibreglass wrapped in accordance with **AS/NZS1260** and in accordance with Council's drawings. Site assembled (SWJ) fitting are not acceptable.
- e) All PVC Type D Junction fittings shall be provided with a slip coupling in accordance with the drawings.

7.2 Pressure Pipe Fittings

7.2.1 DI Socket Fittings

- a) DI socket fittings shall comply with **AS/NZS2280** and shall be PN16 (min) and shall be rubber ring jointed as specified in **Clause 9.2.1** herein. **EN545** compliant DI socket fittings can be used with appropriate marking of the **ISO Pipe** as specified in **Clause 8.0** herein.
- b) DI reticulation fittings and pipe shorts shall be internally and externally coated as specified in **Clause 12.1.1** herein. Pipe or fittings with this coating system shall not be cut.
- c) Sockets shall be of a design which provides an effective sealing length. At assembly of the socketed fittings joints, care shall be taken when cutting pipes that the pipe ends are cut square and evenly, not excessively bevelled and that the end is fully inserted into the socket by use of the witness mark.
- d) DI trunk fittings shall be either internally lined with cement mortar and externally bitumen coated in accordance with **AS/NZS2280** or coated as nominated in **Clause 12.1.1** herein DI fittings shall be rubber ring jointed as specified in **Clause 9.2.1** herein.
- e) Only bitumen coated cement mortar lined pipe and fittings in accordance with **AS/NZS2280** may be cut.

7.2.2 DI Flanged Fittings

- a) Flanged pipe fittings shall be manufactured in accordance with **AS/NZS2280. EN545** compliant DI flanged pipe fittings can be used with appropriate marking of the **ISO** Pipe as specified in **Clause 8.0** herein. All flanged pipe fittings shall be in accordance with **AS4087 Figure B7** unless connecting onto existing mains, where the connecting flange shall match existing. DI reticulation fittings and pipe shorts shall be internally and externally coated as specified in **Clause 12.1.1** herein. Trunk fittings shall be either coated as nominated in **Clause 12.1.1** herein or internally lined with cement mortar and externally bitumen coated in accordance with **AS/NZS2280**.
- b) Flanges shall be raised face as detailed in **Appendix C** of **AS4087**. Joint Seals shall be as specified in **Clause 9.2** herein.
- c) Fittings, where specified, shall be epoxy painted as specified in **Clause 12.1.2** herein.

7.2.3 Puddle Flanges

- a) Puddle flanges shall comply to **AS/NZS2280** except that all nuts, bolts and washers used in the assembly of puddle flanges shall be of Grade 316 stainless steel.
- b) Puddle flanges shall be attached to Flange Class pipe by a machined groove complying with **AS/NZS2280**.

7.2.4 Steel Fittings

- a) Steel fittings shall comply with **AS1579** with a rated pressure of 1.4 MPa.
- b) Fittings shall be manufactured from sections of pipe which have been cement lined in accordance with **AS1281** and coated or lined and coated with fusion bonded medium density polyethylene in accordance with **AS4321**.
- c) Fittings shall have square plain spigot ends for collar jointing.
- d) Fittings shall generally comply with the suggested configurations and dimensions shown in **Appendix G** of **AS1579**.
- e) Fittings such as wyes, tees, angle branches, etc. shall be reinforced in accordance with the provisions of **American Water Works Association Manual M11, Clause 13.3**.
- f) At all welds, the FBMDPE coating shall be cut back to a neat edge 50mm clear of the weld. After the completion of welding and inspection, the exposed surface shall be coated with a spray application of the FBP coating material. Any gap in the cement mortar lining shall be packed with cement mortar.

7.2.5 Non-Metallic Fittings

- a) Non-metallic GRP and PE fittings for pressure pipes may be approved by the Director, Gold Coast Water for specific applications, subject to suitability for the service conditions.
- b) Fittings shall comply with the requirements of **AS/NZS4129** or **ISO10467** as appropriate.
- c) PE fittings shall be fully moulded. Larger PE pipe fittings formed from pipe may be used subject to a derating of 0.8.

7.2.6 Pressure Pipe Fitting Colour

- a) Fittings for pressure pipes and other appurtenances do not need to be coloured cream.
- b) Where a pressure pipe fitting or other appurtenances is not coloured cream then pipe sleeving as specified in **Clause 8.0** herein shall be provided over the non-cream fitting or appurtenance.
- c) The colour cream shall be not lighter than RAL 080 90 20 and not darker than RAL 075 80 20 as defined by the **RAL DESIGN System**.

8.0 Polyethylene Pipe Sleeving and Marker Tape

8.1 Australian Standard Pipe

- a) For Gravity mains, polyethylene sleeving shall be grey coloured and be manufactured to satisfy the requirements of **AS3680**.
- b) Gravity main polyethylene sleeving shall be installed on all non-grey and non-black coloured gravity pipes and fittings installed less than 2000mm from invert to finished surface to satisfy the requirements of **AS3681** and shall state Sewer, VC pipes are exempt from the requirement for sleeving.
- c) The colour grey shall be not lighter than Pearl Grey N11 and not darker than Cloud Grey N22.

- d) For Pressure mains, polyethylene sleeving shall be cream coloured and be manufactured to satisfy the requirements of **AS3680**. Pressure mains \geq DN375 shall be provided with two (2) applications of polyethylene sleeving along the pipes.
- e) Pressure main polyethylene sleeving shall be installed on all non-cream coloured pressure pipes and fittings to satisfy the requirements of **AS3681** and shall state Sewer.
- f) The colour cream shall be not lighter than RAL 080 90 20 and not darker than RAL 075 80 20 as defined by the **RAL DESIGN System**.
- g) All pipelines shall be marked by the use of underground detectable warning tape. For Pressure mains the cream coloured tape shall be located at a depth of 300 mm below finished surface and within the trench vertically above the pipeline being marked. For Gravity mains the grey coloured tape shall be provided above the bedding zone 3 material and below the backfilling material directly above the pipeline being marked.
- h) Underground detection/ tracer tape shall conform to **AS2648.1**.
- i) The tape shall be coloured polyethylene as noted above with a continuous metal core. The tape shall feature sub-surface graphics incorporating a warning 'Caution Buried Sewer Line'. The graphics shall be continuous along the tape.

8.2 ISO Standard Pipe

- a) **ISO** Standard pipe systems and fittings in addition to the requirements of **Clause 8.1** herein shall be clearly marked as an ISO pipe system.
- b) Marking shall be through the use of either **AS3681** compliant sleeving that additionally states that the pipe system is to an ISO Standard or the pipe system shall be marked over the standard sleeving with a spirally wound detection/ tracer tape that states that the pipe system is to an ISO Standard. The spirally wound tape shall be at 1.0 metre spaces circumferentially along the pipe.

9.0 Jointing Systems

9.1 Pipe Mechanical Joints

9.1.1 Gibault Joints

- a) Only elongated gibault joints complying with WSA 105 shall be used in the Works. They shall be approved by the Superintendent and shall be on Council's list of approved products.
- b) Gibault joints shall be tolerant of pipe axial deflection at the joint pipe and axial movement and forces applied perpendicular to the pipe axis.
- c) Joint Seals shall be as specified in **Clause 9.2.1** herein.

9.1.2 Dismantling Joints

- a) Dismantling joints shall be PN16 minimum, either thrust type or non-thrust type depending on the pipeline arrangement.
- b) They shall be manufactured from ductile iron in conformance with **AS/NZS2280** and drilled to **Figure B7** of **AS4087** and be provided with natural rubber seals and flange gaskets in accordance with **Clause 9.2** herein. Bolts shall comply with **Clause 10.0** herein.
- c) The ductile iron components shall be provided with a thermal bonded polymeric corrosion protective coating as specified in **Clause 12.0** herein.

9.1.3 Flanged Assembly Joints

- a) Flanged Assembly Joints (UniFlange and the like) shall be DI fittings manufactured in conformance with **AS/NZS2280** and drilled to Figure B5 of **AS4087**. Jointing bolts shall be in accordance with **Clause 10.0** herein. Set screws shall be stainless steel Grade 431 that have been heat treated following manufacture.
- b) Joint Seals shall be as specified in **Clause 9.2.1** herein and coatings shall be as specified in **Clause 12.0**.
- c) The pressure rating shall be nominated by the manufacturer and shall be equal to the test pressure for the pipeline.
- d) Flanged Assembly Joints shall only be used on DI Flange Class pipe.

9.1.4 Flexible Couplings/ Clamps

- a) Flexible couplings shall be suitable for jointing the type of pipe used in the work.

- b) Couplings such as the Straub Flex range shall be manufactured from Grade 316 stainless steel, with Grade 316 stainless steel fasteners and EPDM sealing sleeves. Alternatively the body and retaining rings may be made of ferrous metals and coated as specified in **Clause 12.1.1** herein. Washers shall be provided under all bolt head and nuts where rotation may occur to prevent damage to the coatings.
- c) Couplings shall be suitable for in ground installation on pipelines laid in soils which may be subject to ground movement. The couplings shall be tolerant of pipe axial deflection at the joint pipe and axial movement and forces applied perpendicular to the pipe axis. For axial restraint of metal pipes, the Straub Metal-Grip range are acceptable.

9.2 Pipe Joint Seals

9.2.1 Rubber Rings

- a) Rubber rings shall comply with the requirements of **AS1646**, and may be either natural rubber, a Nitrile (NBR) compound or an Ethylene Propylene Diene Terpolymer (EPDM) material.
- b) Rubber rings used for non-pressure sewers and house drains are not required to contain root inhibitor. Root inhibitor is identified by the letters RI in accordance with **AS1646**.
- c) Rubber rings used for pressure pipes shall not contain root inhibitor.

9.2.2 Flange Gaskets

- a) Flange Gaskets shall comply with the requirements of **Figure B7** and **Appendix D** of **AS4087**.
- b) Gaskets shall be manufactured from an elastomer complying with **AS1646** and may contain a reinforcement material. The minimum working pressure for gaskets shall be 1600 kPa at 3.0mm thick.
- c) Flange gaskets for DN600 and larger mains shall comply with the manufacturer's requirements.

9.3 Concrete Joint Seals

9.3.1 Hydrophilic Waterstops

- a) Swellable waterstops (Hydrophilic) are used to provide integral sealing for pipe fitting joints in concrete manholes and as well for concrete construction joints where conventional centrally placed PVC waterstops are impractical to use because of limited access. The Hydrophilic material is a high performance synthetic elastomer strip or a curing 'gun' applied paste that swells when placed in contact with water. The expansion of the waterstop creates a positive seal. For pipes encased in concrete, Council's preference is for an elastomer strip waterstop seal attached as a ring to the pipe.
- b) Swellable waterstops where shown on the drawings, shall be Fosroc® Supercast SW20 and Supercast SWX (or equals such as the Hydrotite range). It shall be fixed and used in accordance with the manufacturer's instructions.
- c) Swellable waterstop, shall be made from a preformed elastomeric strip or curing elastomeric paste that is free from rubber, bentonite or other inclusions. The waterstop shall have an unrestrained volumetric expansion of not less than 170% and preformed elastomeric strips must be able to withstand a hydrostatic head of 50 metres.
- d) Swellable waterstop shall not be installed with less than 70mm concrete cover or 50mm of Megapoxy P1® cover to ensure that the pressure arising from the swelling action is accommodated.
- e) Swellable waterstop shall be installed where shown on the drawings.

9.3.2 PVC Waterstops

- a) PVC Waterstops provide an integral sealing system for construction joints within cast *in situ* concrete structures.
- b) PVC waterstops shall be made from an extruded plasticised PCV compound. The compound used shall meet the **US Corps of Engineers Specification CRD-C 572-74**. The compound shall have a tensile strength in excess of 14MN/m², an elongation at break in excess of 300% and shall be able to withstand a hydrostatic head of 50 metres.
- c) During construction, PVC waterstops are centrally positioned within the wall of the concrete structure and as a result are supported by concrete on both sides. During installation the waterstop may require restraint and support. For installation guidance refer to the manufacturer's installation instructions.
- d) PVC waterstops where shown on the drawings shall be Fosroc® Supercast PVC 150mm Hydrofoil Waterstops (or equals).
- e) PVC waterstop shall be installed where shown on the drawings.

10.0 Jointing Bolts

- a) All nuts, bolts and washers (including assembly nuts, bolts and washers) shall be stainless steel Grade 316, with an anti-seizing paste used in assembly.
- b) All stainless steel bolts and nuts other than bolts which form an integral part of an article shall comply with the metric standards **AS111**, **AS111.2** and **AS1112.3**.
- c) Bolt length shall be equal to the sum of the thickness of the flanges, gaskets, nut and washers and nut, and rounded up to the nearest standard size.
- d) Bolts shall exhibit a clean cut thread with no burrs or torn peaks on the thread. Nuts must turn freely on the threads without binding.
- e) Torque used to tighten bolts with clean flat lubricated surfaces shall comply with the pipe manufacturer's recommendations or the bolt suppliers recommendations.
- f) Flange gaskets shall comply with **Clause 9.2.2** herein.

11.0 Valves

11.1 Sluice and Scour Valves

- a) Sluice and Scour valves shall be PN 16 resilient seated with double 'O' ring stem seals and shall comply with **AS2638.2**. In addition to the Standard Type Tests, each valve shall be tested in accordance with **Section 5.2** of **AS2638.2**.
- b) All nuts and bolts used in the assembly of valves shall be of Grade 316 stainless steel. Fasteners other than stainless steel shall be of high grade steel and shall be isolated from the external environment.
- c) Valves shall be treated as specified in **Clause 12.1.1** herein. Wedges shall be fully encapsulated in an approved sewage resistant synthetic rubber in accordance with **AS1646**.
- d) Valves shall have anti-clockwise spindles for closing. Spindles shall be turned out of high tensile brass or stainless steel.
- e) End configurations shall be either flanged or double socket or double spigot or combinations. Sockets shall incorporate an elastomeric sealing ring as specified in **Clause 9.2** herein.
- f) Valves shall be supplied with a standard square spindle cap or where specified shall be supplied with a triangular spindle cap that attaches to the standard square spindle cap. Triangular spindle caps supplied by Tyco or equal are acceptable.

11.2 Gas Release Valves

- a) Gas release valve assemblies shall be installed onto the main with a suitable sized hydrant tee.
- b) The location, size and type of gas release valve together with an adequately sized valve chamber shall be as shown on the drawings.
- c) Unless approved otherwise, gas release valves shall:
 - i) be manufactured from Fibreglass Reinforced Nylon or an approved alternative non-corrosive material. When components of the valve are manufactured from a corrosive material then these components shall be coated in accordance with **AS4158** thermal-bonded polymeric coatings on valves and fittings for water industry purposes or other approved protective coating;
 - ii) seal the gas bleed hole by a mechanism made of non-corrosive flexible material sealing against a non-flexible seat which seals on the same place at all times;
 - iii) have a maximum rated working pressure of at least 1200kPa and be of a design which guarantees that there is an air gap between the liquid and the sealing system within the valve which prevents the liquid from coming into contact with the sealing mechanism;
 - iv) have a flanged fitting drilled to **Figure B7** in accordance with **AS4087**. All gas release valves shall be installed atop a 100 long (min) flanged hydrant riser together with a suitable isolating Wafer Butterfly valve, refer **Clause 11.3**, to allow the removal of the gas release valve for maintenance purposes;
 - v) attached to the Wafer Butterfly valve shall be a 90 degree actuator (gearbox) with extension system (spindle) brought to under side of lid, refer **Clause 11.6** for detail;
 - vi) be installed on the major or minor high points of all pressure mains and where the main is buried, incorporated within a suitably sized concrete pit with the cover marked accordingly, ie. AV as shown on the drawings.

11.3 Wafer Butterfly Valve

- a) The location, size and type of gas release valve Wafer Butterfly valve together with an Actuator (gearbox) shall be as shown on the drawings.
- b) Unless approved otherwise, gas release Wafer Butterfly valves shall:
 - i) be manufactured from Cast or Ductile iron or an approved alternative material. When components of the valve are manufactured from a corrosive material then these components shall be coated in accordance with **AS4158** thermal-bonded polymeric coatings on valves and fittings for water industry purposes or other approved protective coating;
 - ii) be of a wafer or lugged format incorporating integral o-rings that cover the flange faces and is suitable for installation between flanged fittings drilled in accordance with **AS4087 Figure B7**. Where a non-lugged wafer butterfly valve is used then a flanged hydrant riser short shall be used above the butterfly valve as shown in the drawings;
 - iii) be compatible to attach a 90 degree actuator (gearbox) with extension spindle brought to under side of pit cover. Refer **Clause 11.6** herein for actuator details;
 - iv) have a resilient valve seat of nitrile materials conforming to the requirements of **AS1646** and be pressure rated in full vacuum to 1200 kPa and have a minimum temperature rating of minus 10° C to plus 90° C;
 - v) Wafer Butterfly valves shall be a Keystone AR1/ AR2 wafer type or equal.

11.4 Check Valves

- a) Check valves for pressure mains shall comply with the requirements of **AS4794** – Swing check non-return and shall incorporate a counterweight and extended spindle with flanges in accordance with **AS4087 Figure B7**.
- b) The counterweight lever shall control the valve disc for opening and closing. AVK valves or Dobbie Dico Valves or equal are acceptable. Val-matic Swing-Flex check valves or equal are acceptable where a check valve by-pass valve and by-pass pipeline arrangement is provided that will allow the main to be drained.
- c) Check valves shall be coated internally and externally with an approved thermal bonded coating in accordance with **Clause 12.0** herein.
- d) Valves shall be suitable to operate within the pressure ranges of the system within which they are being installed and shall be located as shown on the drawings.
- e) The type and pressure rating of the check valve shall be as shown on the drawings.

11.5 Knife Gate Valves (DN600 and larger)

- a) Knife gate valves, where shown on the drawings for use within the gravity system shall be uni-directional threaded lug or drilled flanged style rising spindle valves complying with **AS6401**. Valve operational direction shall be permanently marked on the valve. Watergates SP KGVF1 Knifegate Valves or equal are acceptable.
- b) Knife gate valves shall be manufactured from Stainless Steel Grade 316 or equal for the body, gate and spindle and do not require a bonnet. The gate shall be polished so that surface roughness does not exceed 1.6um to **ISO4288** and the gate has a bevelled edge.
- c) The gate seal and top seal shall be a retained resilient perimeter seal manufactured from an approved synthetic rubber material.
- d) Knife gate valves when in the closed position shall be rated for a maximum static pressure on the up stream side of the valve of 1000 kPa with 0 kPa on the down stream side of the valve. The gate, when tested as described shall not deflect more than 1/500 of the span of the gate.
- e) Spindles shall be supported every 1800mm with 316SS triangular brackets with integral bearings and shall be extended through the manhole convertor slab to be terminated with an approved slab mounted pedestal with 6:1 gearbox, handwheel and spindle cover. The pedestal shall be fixed to the slab with 4 x M20 316SS chemset anchors set 200mm into the convertor slab.
- f) The above ground pedestal and handwheel shall be enclosed in a GCCC Security fence or within an approved cabinet as shown in the drawings.

11.6 Valve Spindles, Actuators and Gearboxes

- a) Extension spindles for direct vertical attachment to sluice valves shall comply with **AS2638**. Spindle caps and keys shall be manufactured from Ductile iron and the extension shaft shall be solid alloy steel with the assembly of these components to be by the use of stainless steel spring pins. Welded joints on the extension spindle are not permitted.

- b) Extension spindles for off-set vertical attachment to sluice valves shall generally comply with **AS2638** and **Clause 11.6 a)** herein. The extension spindle shall be supported every 1800mm with 316SS triangular brackets with integral bearings and shall be extended into the pit top slab to be terminated with an approved spindle cap and surface box lid. Universal joints shall be attached where shown on the drawings and shall be provided by the Valve supplier and installed to the manufacturer's recommendations.
- c) Where shown on the drawings, sluice valves shall be provided with Spur Gear gearboxes that will allow the valve to be opened and closed against an unbalanced head of 100m (1,000kPa) by a person using a T key on the spindle cap and applying a torque no greater than 160 NM. Gearboxes shall be in the Rotork IS Range of multi turn Spur gear products or equal.
- d) Unless approved otherwise, gas release wafer butterfly valve actuators (gearboxes) shall:
 - i) be manufactured from Cast or Ductile iron or an approved alternative material for the housing and cover. When components of the actuator system are manufactured from a corrosive material then these components shall be coated in accordance with **AS4158** thermal-bonded polymeric coatings on valves and fittings for water industry purposes or other approved protective coating;
 - ii) the Actuator input shafts, extension system (spindle) and triangular brackets with integral bearings shall be made of a non-corrosive material such as 316 stainless steel;
 - iii) the Actuator shall have a minimum of 6 turns to close/ open the valve by worm and segment gear or bevel gear operation;
 - iv) the Actuator shall be a 90 degree actuator (gearbox) with extension system (spindle) brought to under side of cover;
 - v) the Actuator shall be a Keystone F427 BAF gearbox type or similar and shall be provided with a non-corrosive handwheel.

11.7 Valve Installation

11.7.1 Valve Boxes

- a) All buried sluice valves shall be provided with a valve box and surround that enables personnel on ground access to the valve spindle cap or extension spindle cap. Valve boxes and lids shall be in accordance with the requirements of Council's **Standard Specification SS2** and **Standard Drawing No. 08-06-124** and **08-06-125**.
- b) Marking of valve boxes and lids shall comply with the requirements of **Clause 27.0** herein.

11.7.2 Valve Pits

- a) Valves for sewerage pumping station valve chambers shall be installed in accordance with the drawings.
- b) Thrust restraining reinforced concrete valve pits shall be constructed for 600mm and larger sluice valves or where shown on the drawings. The valve pit shall be in accordance with Council **Standard Drawing No. 08-06-116**.
- c) Marking of valve chambers and pits shall comply with the requirements of **Clause 27.0** herein.

11.7.3 Valve Thrust Restraint

- a) Valve installations shall provide thrust restraint for the valve in accordance with Council's **Standard Drawing No. 08.07.104**, **08-07-105** or **08-06-116** as appropriate or as shown on the job specific drawings.

12.0 Protective Coating

12.1.1 Thermal Bonded Polymeric Coatings

- a) Valves, fittings and pipe fittings shall be treated internally and externally with a factory applied thermal bonded polymeric corrosion protective coating that shall comply with the requirements of **AS/NZS4158** and be applied by the fluidized bed technique.

12.1.2 Epoxy Painted Coatings

- a) Where specified that ferrous fittings are to be painted with an epoxy painted coating, the surface shall be abrasive blast cleaned to **AS1627.4** Class 2½ and painted with a 2 coat system of two pack high build, solvent free cycloaliphatic amine cured epoxy coating such as Jotacote 410 or equal to a dry film thickness of 500 microns. All applications shall be strictly in accordance with the manufacturer's specification.

13.0 Step Irons

- a) Step irons are **not** permitted for use in the Works.

14.0 Geotextile

- a) Geotextile shall be used where shown on the drawings or as directed by the Superintendent.
- b) The geotextile shall have the following minimum properties that shall be marked on the roll in accordance with **AS3705**:
 - i) Nominal weight 180g/m² (as per **AS3706**)
 - ii) Load 750N (as per **ASTM 1682**)
 - iii) Mean Trapezoidal Tear Strength 350N (as per **ASTMD 1117**)
 - iv) Mean CBR. Puncture Resistance 2500N
 - v) Percolation Rate 340 L/m²/ sec (as per **AS3706**)
- c) The geotextile shall be a non-woven fabric made from continuous filament, synthetic fibres.
- d) Minimum lap shall be 300mm.
- e) Installation shall be as shown in the drawings to the manufacturer's recommendations.

15.0 Setting Out Work

- a) The Contractor shall be responsible for setting out the centre line of the main in accordance with the survey data supplied on the drawings prior to the commencement of work. Where survey stations are installed along the Works, the Contractor shall protect these stations.

16.0 Care of Real Property Survey Pegs

- a) The Contractor shall locate and mark with a white painted stake all real property survey pegs within the area likely to be disturbed by the Works. The Contractor shall take care not to distribute any real property survey pegs.
- b) Any existing real property survey pegs beyond the limits of earthworks or excavations under this contract, which are disturbed by the Contractor, will be replaced by the Principal's Surveyors at the Contractor's expense.

17.0 Care of Existing Fences

- a) 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.
- b) If fences are required to be adjusted, relocated or removed, the Contractor shall erect temporary fences, if necessary, for stock containment as directed by the Superintendent.
- c) 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.
- d) Any fence adjusted, relocated or removed during this 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.

18.0 Work Within Private Property

- a) The Contractor shall confine all work within private property to a 6.0 metre wide construction swathe 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.
- b) It is the Contractor's responsibility to inform private property owners of any construction activities that may affect them or their property. Notification is to occur prior to commencing these activities.

19.0 Work Within Road Reserves

All work within road reserves shall comply with the following:

- a) Work shall proceed with minimum interruption to traffic and any steps necessary for the protection of the public during construction shall be taken.
- b) Warning signs, flashing lights and other traffic control devices shall be erected in accordance with the Traffic Management Plan.
- c) Work which is likely to reduce traffic flow shall be carried out between 9.00 a.m. and 3.00 p.m. only 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 across all roads.
- d) Open trenches shall be constructed to the details shown on the drawings. Trenches shall not be left open overnight.
- e) Work shall be carried so as not to detrimentally affect the existing drainage provisions of the roadway.

20.0 Clearing and Grubbing

- a) Clearing and grubbing shall be carried out in accordance with the requirements of Council's **Standard Specification SS3** and the approved **Vegetation Management Plan**.
- b) The Contractor shall take all necessary steps to preserve vegetation along the route of the main. These steps shall include:
 - i) Limiting the construction disturbance area to a minimum. As a general rule, the disturbance area shall be no greater than 6.0m wide for pipes less than or equal to DN600 and 10 m wide for mains larger than DN450. Job specific limitations may be imposed within the project specification as an environmental consideration.
 - ii) The Contractor is advised that adherence to Council's **Planning Scheme Specific Development Code 36 – Vegetation Management** is required when undertaking the Works. It is the Contractor's responsibility to make all necessary enquires with the relevant Council department.
 - iii) Superintendent approval is required prior to clearing any tree with a diameter greater than 300 mm.
 - iv) All vegetation cleared in the course of constructing the Works shall be disposed of in accordance with the approvals. Any material that cannot be disposed of in the approved manner due to its excessive size shall be removed to an approved dump site at the Contractor's expense.

21.0 Cover Over Pipes and Depths of Pipework

21.1 Non Pressure (Gravity) Pipe

- a) Unless otherwise approved by the Superintendent the minimum cover over any pipe specified in **Clause 5.0** shall be:
 - i) Allotments 450mm to top of DN100 to DN225 pipe
 - ii) Allotments 600mm to top of DN300 pipe
 - iii) Allotments 900mm to top of \geq DN375 pipe
 - iv) Footpaths 600mm to top of DN100 to DN300 pipe
 - v) Footpaths 900mm to top of \geq DN375 pipe
 - vi) Roadways 900mm to top of pipe

21.1.1 Permissible Depths for Non-Pressure (Gravity) Pipe

- a) The maximum permissible depths for reticulation pipes specified in **Clause 5.0** shall be as shown on the drawings and will not exceed 5.0 metres unless specifically approved.
- b) The maximum permissible depths for trunk pipes specified in **Clause 5.0** shall be as shown on the drawings.

21.2 Pressure Mains

- a) For all pressure mains, the hierarchy of main crossings shall be the Potable water main above the Recycled water main that shall be above any Sewage pressure main based on the following minimum covers.

- b) For DI pressure pipes, the minimum cover from finished ground level to the obvert of the main shall be:
 - i) for footpath verge allocations 450mm for DN100 to DN300 pipes
 - ii) for footpath verge allocations 600mm for \geq DN375 to \leq DN525 pipes
 - iii) for roadways 600mm for DN100 to DN300 pipes
 - iv) for roadways as shown on the drawings for \geq DN375 pipes
- c) For DI pressure pipes, the maximum cover from finished ground level to obvert of the main shall be 1200mm.
- d) For other pressure pipe material types, the minimum cover from finished ground level to the obvert of the main for footpath verge allocations shall be 600mm for DN100 to DN300 pipes and as shown on the drawings for \geq DN375 pipes.
- e) For other pressure pipe material types, the maximum cover from finished ground level to obvert of the main shall be 1200mm.
- f) For mains of \geq DN525 in any allocation, the minimum and maximum cover shall be by design and as shown on the drawings.
- g) In the event that the cover specified in **Clause 21.2** herein cannot be achieved in a particular location for any reason the Contractor shall seek written instructions from the Superintendent prior to proceeding with construction of the pressure pipe at that location.

22.0 Erosion and Sediment Control

- a) The following erosion and sediment control measures shall be taken to ensure that sediment is contained within the perimeter of the disturbed area in accordance with the approved **Erosion and Sediment Control Plan**.
 - b) The area of disturbance shall be kept to an absolute minimum.
 - c) Topsoil shall be retained for rehabilitation purposes.
- Note:** *Stockpiles should not exceed 2 metres height, as this decreases the seed viability.*
- d) Runoff both external to the site and within the disturbed area shall be controlled. Clean water shall be redirected away from the disturbed area and into a stabilised overland flow path.
 - e) The site shall be rehabilitated quickly, ie. stabilise/ vegetate within fourteen (14) days of completion of works. Rehabilitation shall proceed as each stage is completed. The disturbed area shall be seeded and landscaped in line with Council's landscaping guidelines.
 - f) Sediment fences shall be installed as directed by the Superintendent and shall be inspected after each rainfall event, repaired if necessary and all trapped sediment removed to a designated stockpile.
 - g) Stockpiled material spoiled from trenching operations shall be placed on the upslope side, away from any drainage lines. These stockpiles are to have erosion and sediment control devices in place, ie. sediment fences placed around the base, and if left for an extended period, an erosion proof blanket should be used.
 - h) Where the path of the pipe crosses minor drainage lines extra sediment fences shall be installed or small detention basins shall be constructed.

23.0 Excavation

- a) Excavation for sewerage pipe laying shall be completed to the lines, levels and profiles shown on the drawings.
- b) When (in the Superintendent's opinion) weather, soil conditions, or any contingency exists that may be detrimental to pipe laying the Superintendent may limit the length of trench opening in advance of pipe laying.
- c) In any event, unless approved otherwise by the Superintendent, the length of trench opening ahead of pipe laying shall not exceed 40 metres.
- d) Where the Contractor over-excavates, it shall make good the over-excavation at its expense. The over excavation shall be made good with bedding material which satisfies the requirements of **Clause 24.0** herein and which is the material immediately below Zone 1 for the Type 2 construction shown on the drawings.
- e) The Contractor shall at its own expense do all things necessary to divert any water interfering with the progress of the Works, keep the excavations and trenches free from water while the Works are in progress and prevent any damage to the Works by water due to floods or other causes. The Contractor shall have approved pumping gear for keeping the excavation or trenches constantly dewatered during the times the Works are in progress. Any work or material damaged by water shall be made good by the Contractor.

- f) Where directed by the Superintendent the bottom of trenches or excavations shall be compacted prior to the placing of any bedding or concrete materials. Should (in the opinion of the Superintendent) the foundation material be incapable of effective compaction, the material shall be removed and replaced with bedding material as specified in **Clause 24.0** herein.
- g) If approved by the Superintendent excavated material may be used for backfill over pipes. This material shall remain the property of the Principal and any excess shall be spoiled or used as filling within the Site as directed by the Superintendent.
- h) All excavated material which is classified by the Superintendent as unsuitable shall be removed from the Site. The cost of this work shall be deemed to be included in the relevant Bill Items (if part of the Contract) and the Lump Sum of the Contract generally.
- i) The Contractor shall be solely responsible for the maintenance of excavations and is liable for any damage which may be caused to any public utility, conduit, etc. through the collapse of the excavation.
- j) Any excess spoil and all unsuitable material shall be disposed of at a location where directed by the Superintendent within a 10 km radius of the site.
- k) Unless a separate item is included in any applicable Bill of Quantities for rock excavation, the items entered in the Priced Bill of Quantities and the Lump Sum of the Contract generally shall be deemed to include full compensation for excavation of material of all types and subsequent backfill and compaction of the trench or excavation with approved material.
- l) Excavation volumes shall be calculated using the relevant trench shown on the drawings.
- m) **Extra over for Rock Excavation:** Where a Bill of Quantities is part of the Contract and this Bill contains a separate item for excavation in rock (as defined herein), extra payment will be made for the Bill Item for all rock removed within the limits of the excavation as defined or as ordered by the Superintendent. The quantity for payment shall be the net quantity in place within the limits of the excavation shown on the drawings. No claim for excavation in rock will be entertained unless the method of measurement is agreed in writing with the Superintendent prior to material being excavated. Rock shall be defined as material which cannot be excavated at the rate of 15m³/ hour by a hydraulic tracked excavator with engine gross power output of 148 kW at maximum RPM and a rated breakout force on the bucket of 148 kN with standard bucket. It shall be the responsibility of the Contractor to provide the excavator and bucket for this purpose at its cost. The Superintendent shall have the right to nominate an operator for the machine. In the event of disagreement with any decision made by the Superintendent in accordance with the above definition, rock shall be defined as material geologically in place of a hardness when first exposed of three or greater in the Mohr scale of material hardness. Testing of material to determine classification as rock (by the Mohr scale) shall be carried out by an approved laboratory at the expense of the Contractor.
- n) **Use of Explosives:** Where approved, rock may be carefully excavated by blasting procedures. Prior to commencing any blasting operation the Contractor shall, pursuant to **Clause 2.0** herein, obtain any blasting permit required. The depth, spacing, location, type of explosive and method of firing shall comply with any permit issued for blasting operations. In the handling, storage and use of explosives, the Contractor shall comply with all State and local authority laws and by-laws, and with **AS2187, SAA Explosives Code**. The Contractor shall in particular comply with **Section 11.2** of the **Code**. Where directed the Contractor shall provide measurements from a vibograph or similar instrument. If these measurements indicate that the requirements specified herein are not being complied with the Contractor shall reduce the amount of charge used or take such other action as will ensure compliance with the **Code**. The Contractor may be required to carry out trial blasting in order that the Superintendent may determine the peak vibration effects caused by the trial charges and so limit the maximum charge to be employed. The Contractor shall be responsible for all costs associated with the supply, operation and reporting of the vibograph or similar instrument. The Contractor shall give the Superintendent at least three (3) days notice of any intention to excavate by blasting and shall furnish full details of the location thereof and the methods it proposes to adopt. Subject to approval by the Superintendent for blasting at any location, such blasting shall be carried out only at times approved by the Superintendent. The Contractor shall provide screens, barriers, mats and/or other protective devices as directed by the Superintendent to limit the effects of blasting. Notwithstanding the provision of such protective devices, the Contractor shall be responsible for any loss, damage or injury sustained by the public, workmen, the Works and for damage to property or public utilities of any description whatsoever caused directly or indirectly by such blasting. Secure storage places shall be provided for explosives and all such places shall be clearly marked with warning signs. Only persons trained and experienced in the handling of explosives shall be allowed to use them on the work under the Contract. No shot shall be fired

until a warning has been sounded and all persons within the radius of danger removed. The warning device shall give an audible warning clearly different from any other sound normally heard on the Site. In the event that the vicinity of work under the Contract is accessible to the general public, the Contractor shall, before any shots are fired, post personnel about the Works in various directions to warn all persons of the danger existing and to prevent them approaching closer than safety will permit. Where blasting is likely to endanger life or property, the Superintendent shall have the power to prohibit the use of explosives or prescribe and enforce such rules and regulations as it may deem necessary but the prescribing or failure to prescribe such rules and regulations shall not relieve the Contractor from any responsibility under the Contract. No explosives shall be left in holes overnight. Where explosives are used in rock excavation, the charges shall be so proportioned and placed that they will not loosen the rock outside of the excavation lines shown on the drawings or as provided for in the Contract. If the rock below the line or slopes designated should be loosened by blasting to such an extent as to render it (in the Superintendent's opinion) liable to slide, fall or have a detrimental effect to the Works such loosened rock shall be removed by the Contractor. The removed material shall be made good with material acceptable to and in a manner approved by the Superintendent. All work associated with the use of explosives shall be deemed to be included in the relevant Bill Item (if part of the Contract) and/or the lump sum of the Contract generally.

24.0 Bedding Material

- a) Bedding shall be crushed rock material complying with **AS2758.1** and **AS1141** and of the nominal sizes shown in **Table 6** herein.

Table 6

Percentage Passing By Weight			
AS Sieve (mm)	Crushed Rock Nom Size 5 – 7mm	Crushed Rock Nom Size 10mm	Crushed Rock Nom Size 30mm (Additional Bedding)
37.5			100
26.5			80 – 100
19.0			25 – 60
13.2		100	5 – 20
9.5	100	85 – 100	0 – 5
6.7	85 – 100	30 – 50	
4.75	30 – 85	5 – 30	
2.36	0 – 30	0 – 5	
1.18	0 – 5		

25.0 Trench Construction

25.1 General

- a) Construction types are detailed on the drawings. Bedding material shall comply with the requirements of **Clause 24.0** herein.
- b) Excavated material shall not be used as bedding material.
- c) Where crushed rock material nominal size 5-7mm cannot be sourced, then crushed rock nominal size 10mm is to be used and either a full trench width geotextile covering shall be placed above Bedding Zone 3 as shown in the drawings as Type 2 Construction for dry trenches, or a full geotextile wrapping shall be placed around Bedding Zones 1, 2 and 3 as shown in the drawings as Type 3 Construction for wet trenches.

25.2 Type 1 Construction

- a) The Bedding Zones 1, 2 and 3 shall consist of crushed rock material (nominal size 5-7mm) specified in **Clause 24.0** herein and shall be constructed to the details shown on the drawings.

25.2.1 Bedding Zone 1

- a) This material shall be placed in the trench to the depths shown on the drawings and compacted for the full width of the trench by two passes of a vibrating plate.

25.2.2 Bedding Zone 2

- a) Hand holes shall be made in Bedding Zone 1 material as detailed on the drawings. The pipe shall be laid on the compacted bed and the bedding material carefully added to fill the hand hole. Bedding Zone 2 material shall then be placed in 150mm (maximum) layers and compacted for the full trench width for each layer using hand tampers and ensuring that the Bedding Zone 2 material is in full and even contact with the pipe and pipe joints. Hand tamping shall be carried out to ensure that no damage occurs to the pipe or to the pipe sleeving where provided.

25.2.3 Bedding Zone 3

- a) Bedding Zone 3 material shall be 150mm deep for sand backfill and 300mm deep for all other backfill materials. Bedding Zone 3 material shall be placed in layers of 150mm (maximum) depth and compacted for the full width of the trench for each layer using two passes of a small vibrating plate. The trench shall then be backfilled in accordance with **Clause 30.0** herein.
- b) Where the backfill material is classified by the Superintendent as sand, a layer of geotextile (complying with the requirements of **Clause 14.0** herein) shall be placed as shown on the drawings.
- c) Where a 10mm bedding material is used instead of a 5/7 material, then the Bedding Zones 1, 2 and 3 shall be geotextile covered or wrapped as detailed in **Clause 25.1** herein.
- d) Selected backfill shall be the best of the excavated material, as directed by the Superintendent, in accordance with the general requirements of **Clause 30.0** herein.

25.3 Type 2 Construction

- a) Type 2 Construction shall be used where, in the opinion of the Superintendent, the trench bottom is too soft or too wet to provide sufficient support for the pipe. In these circumstances additional bedding (nominal size 30mm) complying with the requirements of **Clause 24.0** herein shall be placed and compacted immediately below the Bedding Zone 1 material for the full width of the trench.
- b) The depth of additional bedding shall be as directed by the Superintendent but not less than 150mm. In all other respects Type 2 Construction shall be as for Type 1 Construction.

25.4 Type 3 Construction

- a) Type 3 Construction shall be used in locations where the Superintendent directs that Bedding Zones 1, 2 and 3 and the additional bedding are to be wrapped with geotextile as shown on the drawings.
- b) The geotextile wrapping shall comply with the requirements of **Clause 14.0** herein.
- c) In all other respects, Type 3 Construction shall be as for Type 2 Construction.

25.5 Type 4 Construction

- a) Type 4 Construction shall be to the details shown on the drawings. Un-reinforced concrete shall be Grade N20. Pipe floatation and heat reversion of the pipe shall be managed by the pipe layer so that the pipe installation is not damaged.
- b) The minimum width of the concrete embedment shall be as shown on the drawings.
- c) Backfill material shall be placed between the trench wall and the concrete embedment and compacted in accordance with the requirements of **Clause 30.0** herein.

25.6 Type 5 Construction

- a) Type 5 Construction shall be used where shown in the drawings or at locations designated by the Superintendent where trench construction crosses a roadway.
- b) Type 5 Construction shall be to the details shown on the drawings. Bedding Zones 1, 2 and 3 shall be constructed as specified in **Clause 25.2** herein.
- c) Where additional bedding for Type 5 Construction is directed by the Superintendent the requirements of **Clause 25.3** herein shall apply. Where directed by the Superintendent that geotextile wrapping to the Bedding Zones 1, 2 and 3 and the additional bedding is to be installed the provisions of **Clause 25.4** herein shall apply.
- d) Where shown on the drawings, bulkheads shall be installed on each side of the roadway crossing, at a location within the verge, to prevent the migration of embedment and backfill material.

25.7 Type 6 Construction

- a) Type 6 Construction shall be used where shown in the drawings or at locations designated by the Superintendent where trench construction is along unsealed road shoulders.
- b) Type 6 Construction shall be to the details shown on the drawings. Bedding Zones 1, 2 and 3 shall be constructed as specified in **Clause 25.2** herein.
- c) Where additional bedding for Type 6 Construction is directed by the Superintendent the requirements of **Clause 25.3** herein shall apply. Where directed by the Superintendent that geotextile wrapping to the Bedding Zones 1, 2 and 3 and the additional bedding is to be installed the provisions of **Clause 25.4** herein shall apply.

25.8 Type 7 Construction

- a) Type 7 Construction shall be used at the location designated by the Superintendent where trench construction is along sealed roads.
- b) Type 7 Construction shall be to the details shown on the drawings. Bedding Zones 1, 2 and 3 shall be constructed as specified in **Clause 25.2** herein.
- c) Where additional bedding for Type 7 Construction is directed by the Superintendent the requirements of **Clause 25.3** herein shall apply. Where directed by the Superintendent that geotextile wrapping to the Bedding Zones 1, 2 and 3 and the additional bedding is to be installed the provisions of **Clause 25.4** herein shall apply.

25.9 State-Controlled Roads

- a) Where pursuant to the **Transport Infrastructure Act 1994** roads are declared as State-controlled roads, bedding shall comply with this specification. Backfill, pavement and boring and jacking (where required) shall comply with the requirements of **Queensland Department of Main Roads**.

26.0 Laying and Jointing of Pipes

26.1 Definition of Terms

The following definitions shall apply to terms used in this specification:

- a) Reticulation Sewer: consists of sewer pipes and fittings which extend from manhole to manhole or maintenance shaft to maintenance shaft or extend between various combinations of access structures and provide junction House connection points for allotments to drain their on-site sewage wastes to.
- b) Trunk Sewer: consists of sewer pipes and fittings which extend from manhole to manhole.
- c) Pressure Mains: consists of pressure pipes and fittings which extend from the pumpwell to the discharge point shown on the drawings.
- d) House Connection: Type A consists of a 45° reinforced oblique junction branch (OB) of 100mm or 150mm diameter located in the reticulation sewer at the point where the house drainage discharges to the sewer via the house connection pipe at the location shown on the drawings. Connected to this OB shall be a house connection inspection tee as shown in the drawings and laid at the grades as shown in the drawings. Type 'A' house connections are not permitted at depths greater than 2500mm. Type 'A' house connections may connect to an access structure.
- e) House Connection: Type B consists of a 45° reinforced oblique junction branch (OB) of 100mm or 150mm diameter located in the reticulation sewer at the point where the house drainage discharges via the house connection pipe. Connected to this OB shall be a graded 45° reinforced bend with a 100mm or 150mm diameter graded pipe of appropriate length together with a 45° reinforced bend and a house connection inspection tee as shown in the drawings and laid at the grades and located as shown in the drawings. Type 'B' house connections are not permitted at depths greater than 2500mm. Type 'B' house connections may connect to an access structure.
- f) House Connection: Type D consists of a 45° reinforced oblique junction branch (OB) of 100mm or 150mm diameter that is assembled with a 45° bend and slip coupling as shown in the drawings and located in the reticulation sewer at the point where the house drainage discharges via the house connection pipe. Connected to this slip coupling shall be a vertical riser pipe that has a 45° reinforced junction or junctions and associated reinforced 45° bend or bends with a 100mm or 150mm diameter graded pipe or pipes of appropriate length together with a house connection inspection tee or tees as shown in the drawings and laid at the grades and located as shown in the drawings. Type 'D' house connections are only permitted at depths greater than 2500mm.

- g) House Connection Inspection Tee: Consists of a moulded tee of 100mm or 150mm diameter with two (2) removable sealed caps on the upstream side as shown in the drawings. House connection inspection tees are only permitted to be at depths between 600mm and 1500mm and shall be located within the allotment as shown in the drawings at the point where the future private house drain will connect to the sewerage system.

26.2 Approval of Pipe Layers

- a) All pipe laying shall be carried out by competent and accredited pipe-layers under the supervision of the Contractor's accredited personnel. All personnel's accreditations in the type of pipe being laid are to be approved by the Superintendent before pipe laying commences.
- b) If, in the opinion of the Superintendent, pipe-layers are performing unsatisfactorily the Superintendent may reject the work under the Contract and furthermore may instruct that the pipe-layers be removed from Site. All cost of rectification associated therewith shall be borne by the Contractor. Any other costs associated therewith by the Principal may be treated as a debt due from the Contractor as the Principal under the Contract and deducted by the Superintendent from any Progress Certificate issued by the Superintendent.

26.3 Laying of Gravity Pipework

- a) All pipelines shall be constructed of pipes of types and sizes specified in the drawings and laid in accordance with the construction tolerances prescribed below and in **Clause 47.0**.
- b) Bends, pipes and fittings shall be sorted and matched prior to laying. Handling of pipes and fittings by chains, ropes or slings shall be in accordance with the manufacturer's recommendations and any pipes and fittings damaged shall be rejected.
- c) Pipes and fittings shall be laid so that the inverts are continuous and true to line and grade and no part of the pipeline shall be more than 6mm from its true position with respect to line. Spigots and sockets shall be cleaned and the interior of pipes shall be free from obstructions or any contaminate.
- d) Water shall not be allowed to lie in the trenches while the pipes are being laid and the trench shall be kept free from all water until after the completed pipeline has been inspected and backfilling commenced.
- e) Where, in the opinion of the Superintendent, the trench will be continuously wet then trench drainage shall be placed as shown on the drawings.
- f) Except as provided elsewhere in this specification, all joints shall be approved flexible joints, incorporating synthetic or natural rubber rings as specified in **Clause 9.2.1** herein. In jointing pipes with rubber ring joints, the pipes shall be cleaned before jointing and care shall be taken to ensure that the rubber ring is maintained in a plane at right angles to the axis of the pipe. Each pipe shall be jointed as recommended by the manufacturer and each joint checked with a feeler gauge to ensure that the ring is in place.
- g) GRP pipe ends of either factory provided or field cut pipe shall be sealed as required in **Clause 5.4** herein prior to installation. For GRP pipes, following the assembly of each pipe joint, the joint shall be internally pointed with an approved flexible urethane sealant such as Sikaflex – Pro or equal that fills the gaps between the pipe faces and provides a smooth transition between the two joined pipes. The pipe faces shall be cleaned to the requirements of the manufacturer's recommendations prior to the application of the urethane sealant.
- h) All non-grey or non-black coloured gravity pipes and fittings, regardless of the type of pipe system, shall be sleeved in grey coloured polyethylene sleeving in compliance with **Clause 8.0** herein. The sleeving shall be continuous along the pipeline including gibault joints, bends, oblique junctions and other fittings except for those fittings coated as specified in **Clause 12.0** herein.
- i) All house connections shall be constructed to the details shown on the drawings and as specified herein. In constructing oblique junctions (OB) and adjoining bends, care shall be taken to support the pipes firmly in position and to protect the pipes from damage or movement during the processes.
- j) All reticulation main In-Line bends shall be constructed to the details shown on the drawings and as specified herein.
- k) No junction shall be located within any bend.
- l) As detailed within the drawings, only two reticulation sewer In-Line bends shall be installed between access structures. Sewer lines with In-Line bends shall generally increase in grade, through each of the two permitted bends, towards the down stream end.
- m) All house connection inspection tees shall be marked through the use of a buried HW stake at the upstream cap of the tee with orange coloured PVC tubing securely attached to the stake and terminating 500mm above finished surface to the details shown on the drawing.

26.4 Laying of Pressure Pipework

- a) The laying of pressure mains shall comply with **Clause 26.3** herein as appropriate for pressure mains and the following.
- b) Pipes for reticulation main road crossings shall be DI pipes that extend 1.0 metre past the back of the kerb and utilize spigot-socket joints.
- c) Pipes for trunk main road crossings shall be DI or steel pipes that extend a minimum of 1.0 metre past the back of the kerb and utilize spigot-socket joints.
- d) Construction tolerances shall be:
 - i) Invert (vertical) \pm 25mm
 - ii) Alignment (horizontal) \pm 100mm
- e) Where shown on the drawings, bends shall be used to effect horizontal or vertical changes of direction. Where bends are not shown on the drawings (and with the permission of the Superintendent) changes of direction may be effected by angling the joints, by means of short lengths of pipes, or by means of cutting pipes and using thimbles or collars to join them. All such changes of direction shall be effected in curves of uniform radius.
- f) No joint shall be angled to such an extent as to impair its effectiveness or tightness. Pipes shall be jointed in a straight line and the deflection effected after the joint has been made. The maximum deflection for any type of pipe approved for use shall not under any circumstance exceed the recommendation of the manufacturer.
- g) No PVC pipe socket shall be joined to any DI pipe spigot.
- h) All non-cream coloured pressure pipes and fittings and any Iron pipe and fittings, regardless of the type of pipe system, shall be sleeved in cream coloured polyethylene sleeving in compliance with **Clause 8.0** herein. The sleeving shall be continuous along the pipeline including gibault joints, bends, tees and other fittings except for those fittings coated as specified in **Clause 12.0** herein.
- i) ISO pipe systems shall be provided with ISO identification polyethylene sleeving or standard sleeving with spirally wound ISO identification market tape in compliance with **Clause 8.0** herein.

26.5 Laying of Pressure Pipe Fittings

- a) The laying and jointing of mains shall include the fixing in position of all valves, concrete anchor blocks, thrust blocks and all other fittings including the supply and installation of concrete pits, concrete or brick supports, bedding and surface fitting boxes and surrounds as specified or shown on the drawings.
- b) The distance marked on the drawings and the position indicated thereon of pipes, valves and other fittings may be adjusted at the discretion of the Superintendent. If necessary, pipes shall be cut in order to secure the fixing of valves and other fittings in the positions required and all costs associated therewith shall be deemed to be included in the relevant Bill Item and the Lump sum of the Contract generally.
- c) All fittings shall be placed in position so as to be plumb and correct distance from the surface. Risers shall be installed where necessary at valves and, if required, trenches shall be deepened and graded in the vicinity in order to achieve the correct depth below the surface.
- d) At valves and scour valves the bedding cover shall be increased locally to provide support to the base plate, brickwork or concrete surround on which the box is found so as to minimise the transference of weight or shock to the pipe to the details shown on the drawings.
- e) At gas release valves the assembly shall be provided within a concrete pit to the details shown on the drawings. The tee for the gas release valve shall not be deepened in the trench to allow the gas release valve to be installed within the pit.
- f) Except where the drawings show that concrete pits are required, surface fitting boxes shall be fixed over all valves and scour valves. Cover boxes shall be in accordance with the drawings.

26.6 Wrapping of Flanges and Mechanical Joints

- a) All external areas of DI flanges and mechanical joints for mains of DN375 and larger and all steel main flanges and mechanical joints shall have an approved corrosion protection system applied. Systems such as the Denso Petrolatum or the Enviropeel Sprayable polymeric thermoplastic coating system or equal are suitable.
- b) All materials and procedures shall be by a recognised manufacturer of corrosion protection systems and shall be acceptable to the pipe manufacturer.
- c) The Contractor shall use only fully trained and accredited personnel for the wrapping of flanges and mechanical couplings.

26.6.1 Flanges

- a) Wire brush loose dirt and loose rust and clean all oil, grease and other impurities from the flange and 100 mm onto the adjacent pipe.
- b) The Enviropeel system shall be applied by a purposefully designed applicator unit with a computer controlled heating and pumping unit. Gauze mesh shall be applied to flanges to minimize the migration of the coating into the flange gap. Two layers of the coating shall be applied.
- c) For Petrolatum systems apply primer to all metal surfaces. Mould butyl mastic between individual bolts and nuts and over the heads of bolts, nuts and screw threads, with a minimum coverage of 5 mm. Taper onto flange face to provide a suitable contour for tape wrapping. Apply section of flexible tape longitudinally over the flange, extending a minimum of 50 mm onto the pipe barrel. Ensure that each additional section overlaps the previous by 55% to ensure a double thickness of tape. Finish each side with a circumferential wrap around the pipe to lock in the ends of the tape sections applied longitudinally and continue until 100 mm onto the factory applied coating.
- d) At flanges adjacent to concrete structures, the protective coating system shall be extended from the joint being coated to the wall of the structure.
- e) Finish each side with a circumferential wrap around the pipe to lock in the ends of the tape sections applied longitudinally and continue until 100 mm onto the factory applied coating or pipe barrel.

26.6.2 Mechanical Joints

- a) Wire brush loose dirt and loose rust and clean all oil, grease and other impurities from the joint and 100mm onto the adjacent pipe.
- b) The Enviropeel system shall be applied by a purposefully designed applicator unit with a computer controlled heating and pumping unit. Gauze mesh shall be applied to flanges to minimize the migration of the coating into the flange gap. Two layers of the coating shall be applied.
- c) For Petrolatum systems apply primer to all metal surfaces. Fill between bolts and sleeve, and around bolts to top of the retaining rings with butyl mastic. Cover bolt heads, nuts and any protruding thread with butyl mastic. Commencing 100 mm clear of the butyl mastic and a minimum of 50 mm onto the factory applied coating apply flexible tape spirally with a 55% overlap and complete 100 mm past the butyl mastic on the other side or a minimum of 50 mm onto the factory applied coating.

26.6.3 Inspection

- a) Thoroughly inspect the finished coating to ensure that all overlaps are sealed to prevent moisture and foreign material from working in under the coating.

26.7 Additional Requirements for Laying and Jointing of Steel Pipes

26.7.1 Handling FBMDPE Coated Pipes

- a) When handling FBMDPE 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.
- b) Lifting slings shall not be less than the width recommended by the pipe manufacturer. 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.

26.7.2 Testing of Coating

- a) Before the pipe is placed onto Bedding Zone 1, 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.

- b) Repairs to the FBMDPE 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.

26.7.3 Laying of Rubber Ring Joint Pipes

- a) 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.
- b) 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.
- c) Extreme care shall be exercised to avoid damage to any external coating of the pipe when the joint is pulled together.
- d) The jacking system used for RRJ steel pipes 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. Jacking systems for other pipe materials shall be in accordance with the manufacturer's recommendation. A digging bucket shall not be used to push any pipe home.
- e) 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.
- f) 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.
- g) 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.

27.0 Pipe Welding

27.1 Welding Procedures Steel Pipe

- a) Carry out site fabrication and welding in accordance with **AS/NZS1554.1 Pipework Class 2P**, the welding Procedures and the Subclauses below.
- b) Slip-in joints are to be welded externally. A complete external weld shall in addition to the circumferential fillet weld include a run on the ground-off weld of the 'bell', the whole comprising a 'joint'.
- c) Ball and socket joint pipes are to be fillet welded both internally and externally. They shall be laid with the test hole in the joint at the top. After completion of internal and external welding of the ball and socket joint pipes, air at a pressure of 200 kPa shall be applied through the test hole and soap solution applied to both internal and external welds to check for leaks. All leaks shall be repaired to the satisfaction of the Superintendent and the test hole filled with weld metal.
- d) Butt joints with Collars are to be welded externally. The two complete external welds, together with the two horizontal jointing runs in the case of split collars shall comprise a 'collar joint'. Where pipes that are cut on site have FBP coating, the coating shall be cut with a sharp knife to make a neat edge 50 mm clear of the welded joint before removing the coating prior to welding.

27.1.1 Qualification of Welding Procedures

- a) Welding procedures for all fillet welds, butt welds and combinations of each shall be proven qualified by the welding service provider. A schedule of qualified procedures shall be made available by the welding service provider for approval no less than ten (10) working days prior to the intended commencement date of the welding work on which the procedures will be applied.
- b) A welding procedure(s) shall be re-qualified when essential variables (as per the specified standard/ code) are changed.
- c) Where several welding procedures are similar, a qualified procedure is required for each, where the essential variables (as per the specified standard/ code) alter between procedures.

27.1.2 Welding Procedure Sheet

- a) Each welding procedure submitted for approval shall include a welding procedure sheet containing at least the following information:
- i) sketch of the joint design;
 - ii) material(s) grade-type;
 - iii) material thickness – all parts;
 - iv) method of material(s) preparation;
 - v) welding process(es) to be used;
 - vi) voltage and amperage;
 - vii) number and sequence of runs;
 - viii) classification of electrode/ wire;
 - ix) diameter of electrode/ wire;
 - x) shielding gas/ gas mixture/ fluxtype/ classification;
 - xi) temperature of preheat, inter run heat and post heat applications if applicable;
 - xii) welding standard/ code and classification (ie. **AS1554-1 GP** or **SP, AS4041 Class 1, 2 or 3**);
 - xiii) unless otherwise notified, the latest edition of the relevant standard/ code shall apply and is deemed the minimum standard applicable.

27.2 Welding Operators Steel Pipe

27.2.1 Qualification, Certification, Background Experience

- a) Before welding operators commence welding work the following information shall be provided for each operator:
- i) documentary evidence of qualification/ certification currently held;
 - ii) trade training background;
 - iii) duration of employment with current employer;
 - iv) nature of current employment duties.

27.2.2 Identification of Welding Operators

- a) Welding service providers shall maintain accountable records clearly identifying welding operators to each completed welded pipe joint and/or fabricated assembly/ unit.
- b) The records are to be made readily available by the welding service provider on request. All weld to be stamped in accordance with the relevant Australian Standard.

27.3 Supervision of Steel Pipe Welding Work

- a) All welding work shall be carried out under the supervision of a person who:
- i) holds current certification to **AS1796 Cert. 10**; or
 - ii) holds current certification to **AS2214**; or
 - iii) holds other current qualification/ certification approved by Gold Coast Water.
- b) Qualification/ certification records of the supervision person(s) are to be made available by the welding service provider on request.

27.4 Inspection and Testing of Steel Pipe Welds

27.4.1 Inspector

- a) All welding work inspection shall be carried out by a person who:
- i) complies with the requirements of **Clause 27.3** above; or
 - ii) holds current **Welding Technology Institute of Australia (W.T.I.A.)** welding inspection certification.
- b) Qualification/ records of the inspection person(s) are to be made available by the welding service provider on request.

27.4.2 Inspection

- a) The welding service provider shall provide an inspection and test plan for the intended welding work, ten (10) working days prior to commencement of the work.
- b) The test plan shall contain the necessary elements to assure the completed welding work complies with the standards/ codes stated in the work drawings and specifications.

27.4.3 Testing of Welds

- a) Testing of welds shall be carried out by the welding service provider as follows:
 - i) for all joints welded externally and internally in accordance with the pneumatic procedure as set out below;
 - ii) 10% of internal and external welds by Magnetic Particle or Penetration methods in accordance with **AS4037**, **AS1171** and **AS2062**.

27.4.4 Testing Records

- a) The welding service provider shall maintain accountable testing records for all weld testing and provide the records upon request.

27.5 Welding Processes Steel Pipe

- a) Where the welding service provider intends to use a welding process(es) other than those listed below in a welding procedure, the Superintendent is to be notified of the intent prior to the development of welding procedure(s) for approval:
 - i) M.M.A.W. – Manual Metal Arc Welding;
 - ii) F.C.A.W. – Flux Cored Arc Welding;
 - iii) G.M.A.W. – Gas Metal Arc Welding;
 - iv) G.T.A.W. – Gas Tungston Arc Welding;
 - v) O.F.G.W. – Oxygen Fuel Gas Welding;
 - vi) S.A.W. – Submerged Arc Welding.

27.6 Welding Consumables Steel Pipe

- a) All welding consumables used in welding procedures shall comply with the standards/ codes listed below unless otherwise authorized by Gold Coast Water:
 - i) Manual Metal Arc Welding: **AS/NZS4854**, **AS/NZS4855**;
 - ii) welding electrodes for G.M.A.W.: **AS2717 Parts 1, 2 and 3**;
 - iii) flux cored electrodes for Flux Cored Arc Welding ferritic steel: **AS/NZS ISO 17632**, **AS/NZS ISO 17634**, **AS/NZS ISO 18276**;
 - iv) electrodes and fluxes for Submerged Arc Welding: **AS1858 Parts 1 and 2**;
 - v) welding consumables for build up and wear resistance: **AS2576**.

27.7 Pneumatic Testing Steel Pipe

- a) After completion of internal and external welding of the joint, air at a pressure of 200 kPa shall be applied through the test hole and soap solution applied to both internal and external welds to check for leaks. All leaks shall be repaired and the test hole filled with weld metal. Pipes shall be laid with the test hole at the top of the joint except for vertically deflected bends as shown on the drawings.

27.8 External Coating of Welded Steel Pipe Joints

27.8.1 Heat Shrink Sleeves

- a) Welded joints shall be externally coated using heat shrink sleeves. The Contractor shall use only fully trained and experienced personnel for installation of heat shrink sleeves.
- b) Only sleeves recommended by the pipe manufacturer shall be used.
- c) Application procedure shall be as follows:
 - i) bevel the edges of the FBMDPE coating so that there is a tapered transition of at least 10 mm between the full coating thickness and the exposed steel;
 - ii) remove any corrosion products on the steel and abrade the steel surface (if necessary) to produce a clean, non-corroded, roughened surface. Suitable abrasives are emery paper or a steel file;
 - iii) clean the area to be repaired (to be free from dirt, dust and other contaminants) in accordance with the recommendations of the shrink sleeve manufacturer;
 - iv) slightly roughen the FBMDPE coating around the repair for a minimum distance of 100 mm from the edge. Solvent wipe the FBMDPE coating with a clean cloth (acetone is a suitable solvent for cleaning);
 - v) apply the shrink sleeve in accordance with the application procedures of the manufacturer with the exception that the sleeve shall overlap the PBMDPE coating for a length of 100 mm on either side of the coating. Note that the specified preheat and postheat is necessary to ensure satisfactory bonding of the sleeve. A roller should be used to eliminate voids from under the sleeve;
 - vi) after application the repair area should be tested with a high voltage detector at 15 kV in accordance with **AS3894.1**;
 - vii) the repair should be visually inspected to ensure that it is in intimate contact with the pipe and that a bead of mastic has exuded from each end of the sleeve for the full pipe circumference. (If this is not in evidence additional heating is required).

27.8.2 Tape Wrap Coating

- a) The Contractor may ask approval from the Superintendent to use a tape wrap coating as an alternative to the heat shrink sleeve.
- b) Approval will be given if the Contractor can demonstrate that his staffs are skilled in the application of the tap wrap system.
- c) The Contractor shall use a tap wrap system recommended by the pipe manufacturer.
- d) Application procedure shall be as follows:
 - i) the steel and coating area shall be clean and dry before application of the primer;
 - ii) using a brush, apply a thin even coat of primer onto the steel and overlapping the parent material by 100 mm;
 - iii) allow the primer to tack dry (10-20 mins);
 - iv) spirally apply the tape to the repair area ensuring a 100 mm overlap of the parent metal. The overlap of layers should not be less than 55% of tape width;
 - v) spirally apply the outerwrap to completely cover the first layer tape coating. The overlap of layers should not be less than 10% of the tape width;
 - vi) some tension should be applied when applying the tapes to ensure that air voids, wrinkles, etc. are not present after wrapping;
 - vii) continuity test with a high voltage detector at 15 kV in accordance with **AS3894.1**.

27.9 Welding of Above Ground Steel Pipes

- a) Where welded joint pipes are to be laid above ground, no pipe-laying shall be done until end thrust blocks are 14 days old. The pipe shall then be laid and the operations timed so that the closure joint shall be welded up at pipe wall temperature of approximately 21°C.
- b) Should the Contractor elect to weld at night to comply with temperature requirements he must supply sufficient lighting which in the opinion of the Superintendent is necessary for efficient working.
- c) The Contractor will not be permitted to start these sections unless, in the opinion of the Superintendent, he has assembled sufficient plant to enable compliance with this Specification.

27.10 Internal Pointing of Steel Pipes

- a) All welded pipe joints shall be closed internally and the bore made uniform by internal pointing after the welding has been completed.
- b) Mortar for pointing shall be premixed and supplied by the pipe manufacturer.
- c) The internal surface to be pointed must be free of grease, oil, paint and loose or flaking material.
- d) Wet the adjacent cement mortar one hour prior to repair.
- e) The mortar shall only be applied when the ambient and mortar temperatures are below 30°C.
- f) Wipe any excess water from the area, but leave the surfaces damp.
- g) Apply an acrylic modifier approved by the manufacturer as a primer to the steel and adjacent cement mortar immediately prior to applying the mortar. This priming coat can be wet or dry when the mortar is placed.
- h) The mortar is added in the normal manner, being worked into place and compacted. The mortar is built up to the level of the existing cement mortar.
- i) As the ambient temperature increases the pot life of the mortar is reduced as defined in the manufacturer's instructions. If the mortar is left to stand a skin will develop on the mortar surface. This skin should be remixed into the mortar before use.
- j) The mortar must be allowed to dry out as recommended by the manufacturer. It must not be subjected to excessive heat, rain or sub-zero temperatures during the first 48 hours. It is recommended that the mortar cures for 7 days prior to service.

27.11 Jointing of PE Pipes and Fittings

27.11.1 General

- a) PE pipes and fittings shall be jointed using one of the following:
 - i) butt welding;
 - ii) electrofusion couplings;
 - iii) PE stub flanges welded to the pipe or fitting with stainless steel flange plates and bolts.

27.11.2 Butt Welding

- a) Only trained and certified welders shall perform the weld jointing of PE pipelines.
- b) Butt welding may be used for all pipe sizes.
- c) Welding pre-qualification shall be provided. The welder shall submit the proposed procedures to the Superintendent for approval prior to commencing work.
- d) A proposed welding procedure shall be submitted for each pipe diameter wall thickness and material type and shall contain:
 - i) the welding parameters to be used;
 - ii) the welding equipment to be used;
 - iii) the name of the certified welder;
 - iv) a pilot weld for each welding machine, pipe diameter, wall thickness and material type with a record of the parameter values for each weld;
 - v) test results confirming the specification strength requirements;
 - vi) all welding to conform to the procedure;
 - vii) a test sampling plan to demonstrate ongoing quality;
 - viii) retention of QA records for each weld, numbered and located on a plan.

27.11.3 Electrofusion Couplings

- a) Only trained and certified welders shall perform the weld jointing of PE pipelines.
- b) For PE pipe systems, only approved electrofusion fittings complying with **Clause 6.5** shall be used.
- c) In jointing the pipe with the fitting, the pipes square cut face shall be lightly bevelled and the external joint end of the pipe thoroughly scraped and cleaned to remove all Oxidised material before jointing. It is recommended that the pipe and fitting be restrained during the fusion process. The manufacturer's recommendations for fusion jointing shall be followed and care shall be taken to ensure that the fusion process is not carried out while the pipe and fitting are above the recommended ambient air temperature for effective joint fusion. The recommended cooling time shall be allowed to occur before the joint restraints are removed and pipe laying continues. Each pipe joint shall be checked to ensure correct assembly and records of each electrofusion joint shall be kept.

- d) Welding pre-qualification shall be provided. The welder shall submit the proposed procedures to the Superintendent for approval prior to commencing work.
- e) A proposed procedure shall be submitted for each pipe diameter, wall thickness and material type and shall contain:
 - i) the welding parameters to be used:
 - 1) standard fusion time;
 - 2) standard cooling time;
 - 3) welding equipment to be used;
 - 4) control box details.
 - ii) the welding equipment to be used;
 - iii) the name of the certified welder;
 - iv) a pilot weld for each welding machine, pipe diameter, wall thickness and material type with a record of the parameter value for each weld;
 - v) test results confirming the specification strength requirements;
 - vi) all welding to conform to the above procedure;
 - vii) a test sampling plan to demonstrate ongoing quality;
 - viii) retention of QA records for each weld, numbered and located on a plan.

27.11.4 PE Stub Flanges

- a) Where PE pipe is connected to other pipe materials or to valves or is required to be dismantled, a flanged PE stub end and Grade 316 stainless steel back up plate drilled to **AS4087 Figure B7** shall be used. Jointing bolts shall comply with the requirements of **Clause 10.0**.
- b) The PE stub shall be welded to the PE pipe with a butt weld complying with **Clause 27.11.2** herein.
- c) Flange sealing gaskets shall comply with the requirements of **AS1646**.

28.0 Earthing of Pipes During Construction

- a) Where required on the drawings, Cathodic protection systems and/or pipe earthing systems shall be installed along the pipeline in accordance with the Specification for Cathodic Protection and Earthing Systems.

29.0 Marking for Location of Pipes, Valves, Manholes and Other Fittings

- a) Markings for the location of valves, fittings and appurtenances shall be installed at the locations shown on the drawings.
- b) Underground detection/ tracer tape shall be provided for all pipes as shown in the drawings.
- c) Valve and other fitting markings shall be provided on the pavement and on the kerb at the locations shown in the drawings.
- d) Marker posts shall be provided at the locations shown in the drawings.
- e) Metallic tags shall be located as shown on the drawings on each kerb for all pressure main road crossings.
- f) Rural valve installation shall be where there is no residential allotments or Park Domain allotments. The valve installation shall:
 - i) use an Iron Box with an Iron Lid;
 - ii) surrounding the box and lid shall be a 1000mm x 1000mm square concrete slab that is 100mm thick and contains reinforcement sheet;
 - iii) have the concrete slab grade away from the valve box;
 - iv) have the slab integral cast with the iron box with all cast at ground level;
 - v) where shown on the drawings for verge/ footway installations be provided with a marker post with attached marker plate defining the valve function and contained product; or
 - vi) where shown on the drawings for allotment/ park/ vacant land installations be provided with a Gal Steel street sign post that has a concrete footing and is provided with a marker plate defining the valve function and contained product;
 - vii) for Sewage Rising mains the box and lid shall be painted black;
 - viii) where a roadway is adjoining the valve installation the asphalt paving marking shall be as shown in 08-07-124 with a white background with a black V for Sewer Rising Mains.

30.0 Backfilling

30.1 General

- a) For the purposes of this specification, backfilling material shall consist of:
 - i) all material used in the trench above the Bedding Zone 3 material as specified in **Clause 25.2** herein;
 - ii) all the material as designated for Type 4 Construction in **Clause 25.5** herein.
- b) In addition to the requirements specified herein no backfill material shall contain rocks larger than 150mm diameter or lumps of material that may prevent the compaction specified herein. Backfill material with rock larger than 150mm shall be screened to exclude material larger than 150mm diameter.
- c) In locations other than under roadways and footpaths (ie. within allotments and parks, etc.) the backfill material shall consist of material complying with **Clause 30.1 a)** and **b)** and either of the following:
 - i) the best of the material (selected and approved by the Superintendent) from trench excavation; or
 - ii) material from 'On-Site' earthworks selected and approved by the Superintendent;
 - iii) imported material.
- d) If, in the Superintendent's opinion, material from **Clause 30.1 c) i)** above is not suitable for backfilling then material from **Clause 30.1 c) ii)** above shall be used by the Contractor. If, in the opinion of the Superintendent, the 'On-Site' material is not suitable for backfilling over pipes and conduits, the Contractor shall import a material acceptable to the Superintendent at the rate nominated in the schedule (material with a soaked CBR not less than 15% will be acceptable).
- e) The backfill material shall be compacted to the standard specified in **Table 7** herein. Any settlement shall be made good by the Contractor, prior to the end of the Defects Liability Period.
- f) Except as specified in **Clause 30.1 h)** herein, under roadways the backfill material shall be as shown on the drawings and nominated in **Clause 30.2** herein. The materials shall be compacted in layers not greater than 200mm thick to the standard specified in **Table 7** herein.
- g) The Contractor shall arrange for compaction control testing of all backfill by a NATA accredited testing authority approved by the Superintendent. Testing shall be carried out in accordance with the appropriate test methods, sourced from either Australian Standard **AS1289** or the **Queensland Department of Main Roads, Materials Testing Manual**. The selection/application of test methods shall be made on a consistent basis. Inter-related tests shall be performed by methods from the same Standard/ Testing Manual.
- h) Under State-controlled roads the provisions of **Clause 25.9** herein shall comply.

Table 7

Area of Work Backfill to Trenches	Relative Compaction Required		Min Test Frequency ^{1, 3}
	Cohesive Material	Non-Cohesive Material ²	
Under roads to a depth 0.3m below subgrade level	> 98% Std Density Ratio	> 80% Density Index	1 test per 2 layers per 40 linear metres
Commercial development areas	> 98% Std Density Ratio	> 70% Density Index	1 test per 2 layers per 40 linear metres
Elsewhere including under roads	> 95% Std Density Ratio	> 65% Density Index	1 test per 2 layers per 40 linear metres

Notes:

- 1** *Unless directed otherwise by the Superintendent.*
- 2** *Non-cohesive material shall be defined as material which contains up to 5% by mass of soil particles passing a 75 µm sieve, except that silty sands with non-plastic fines may contain up to 12% passing a 75 µm sieve.*
- 3** *For non-cohesive material, each compaction test may be replaced by three (3) Perth sand penetrometer tests provided that a correlation between the penetrometer test and the compaction test is established by the NATA accredited testing authority and approved by the Superintendent.*

30.2 Flowable Fill

- a) Where approved by the Superintendent, Flowable Fill may be used as an alternative backfill under roadways.
- b) Flowable Fill shall comply with the following requirements:
 - i) cement shall be Portland cement, Type GP or Type GB and shall conform to **AS3972**;
 - ii) if used, fly ash shall conform to **AS3582.1**;
 - iii) fine aggregates shall conform to **AS2758.1**;
 - iv) if used, chemical admixtures shall conform to **AS1478**. Any chemical admixture must be approved by the Superintendent;
 - v) minimum compressive strength @ 28 days – 0.5 MPa;
 - vi) maximum compressive strength @ 28 days – 1.5 MPa;
 - vii) maximum size aggregate – 4.75 mm;
 - viii) minimum cement/ cementitious content – 5% by weight;
 - ix) the consistency of flowable fill shall suit the job application;
 - x) flowable fill shall have the ability of being placed by concrete pump when required;
 - xi) the mix design of flowable fill shall be such as not to cause segregation while being placed;
 - xii) flowable fill will be required to produce the necessary flowability and self-compaction without the use of immersion vibrators.
- c) Lean mix concrete containing 85 kg cement per cubic metre may be used for backfilling under roadways with the approval of the Superintendent.

31.0 Boring and Jacking

31.1 General

- a) Where shown on the drawing or directed by the Superintendent sewer pipes may be constructed by progressively boring and then jacking an approved enveloping pipe underneath the existing ground surface. All such boring and jacking work shall be done without disturbances to the existing surfaces.
- b) Under State-controlled roads the provisions of **Clause 25.9** herein shall comply.
- c) Works near Railway Lines shall be carried out in accordance with the **Railway Authorities Specifications and Codes**.
- d) All boring, jacking and pressure grouting work shall be performed by specialist personnel who are experienced with the equipment and methods proposed to be used.
- e) Alternative methods of boring and jacking may be accepted providing such methods are approved by the Superintendent in writing prior to their use.
- f) The Contractor shall ensure that all pipes, or any wrapping thereon, are not damaged during, or as a result of insertion in the enveloping pipe.
- g) The Contractor shall be responsible for thoroughly assessing ground conditions, determining boring and thrusting conditions, and all design work required.
- h) The enveloping pipe shall be thrust into the hole simultaneously as boring advances, and shall not be withdrawn after the completion of boring and jacking work. The ground shall not be excavated more than 600mm ahead of the lead pipe. The jacks shall be capable of advancing the enveloping pipe up to the face of the excavation at any time, should this be ordered.
- i) Neither oversize boring nor water-assisted, lubricant-assisted or wet boring methods shall be used unless such methods are approved by the Superintendent.
- j) The Contractor shall ensure that the boring and jacking operation is continuous from each starting pit to the next adjacent pit. The Superintendent may direct the Contractor to provide full stand-by capacity for the Contractor's plant and equipment to ensure such continuous operation.
- k) In the event that this is ordered by the Superintendent then all costs associated therewith shall be deemed to be included in the relevant Bill Items (if part of the Contract) and/or the Lump Sum of the Contract generally.
- l) The Contractor shall provide a shield or cutting edge to protect the leading edge of the front pipe, for the purpose of jacking. Such a shield shall not exceed the outer diameter of the pipe by more than 14mm.

- m) Unless otherwise specified, the Contractor shall pressure grout the annular void between the enveloping pipe and the sewer pipe, using an approved 5% Portland cement grout (or alternatively Flowable Fill as specified in **Clause 30.2**). The Contractor shall ensure that the Manufacturer's recommended allowable external pressure and maximum external temperature for the type of pipe used is not exceeded and that excessive deflection, distortion or damage of such pipe is prevented during or as a result of pressure grouting.
- n) Floatation control of the pipe during grouting shall be carried out through filling the pipe with water to prevent any deviation from the grade or alignment shown on the drawings.
- o) In the case of the enveloping pipe, the minimum clearance between the sewer pipe and the enveloping pipe shall be 75mm and the minimum cover over the enveloping pipe shall be as specified under **Clause 21.0** herein.
- p) Prior to final inspection and acceptance of the bored and jacked pipe, the Contractor shall excavate a pit at each end of the enveloping pipe, to enable line and level of the pipe to be checked. On completion, the Contractor shall take all steps necessary to prevent ingress of foreign materials to the sewer pipe and/or the enveloping pipe.

31.2 Pipe Jacking

31.2.1 Micro-Tunnelling

- a) Where shown on the drawing or directed by the Superintendent sewer pipes may be constructed by pipe jacking that shall be undertaken utilising micro-tunnelling techniques.
- b) Micro-tunnelling shall, for the purpose of this document, be defined as a trenchless construction method for installing pipelines which incorporates the following features:
 - i) remote controlled – the micro-tunnelling boring machine (MTBM) shall be operated from a control panel at the surface. The system shall simultaneously install pipe as spoil as excavated and removed. Personnel entry is not required for routine operation;
 - ii) guided – the guidance system shall reference a laser beam projected onto a target in the MTBM, capable of installing gravity sewers or other types of pipelines to the required tolerance for line and grade;
 - iii) pipe jacked – the process of constructing the pipeline shall be by consecutively pushing pipes and the MTBM through the ground using a jacking system for thrust;
 - iv) continuously supported – continuous pressure shall be provided to the face of the excavation to balance groundwater and earth pressures.
- c) The Contractor shall employ personnel who are trained in and have substantial project experience of the type of machine to be used. Details shall be provided to the Superintendent by the Contractor to support its selection of tunnelling equipment and operatives.

31.2.2 Micro-Tunnelling Equipment Requirements

- a) A machine that is capable of the following shall carry out excavation:
 - i) excavating mixed face conditions;
 - ii) excavating materials from marine deposits to rock beneath the water table while ensuring face stability at all times.
- b) Equipment and systems shall be designed to provide the forces necessary for the installation of the full pipe string and take into account the pipe manufacture's recommendations on the applicable forces. The Contractor shall be responsible for the design and provision of the following items:
 - i) intermediate jacking stations;
 - ii) use of bentonite to reduce friction;
 - iii) steering system to achieve alignment both horizontally and vertically;
 - iv) control of surface settlement; and
 - v) control of ground water table.
- c) All tunnelling machines shall be robust with adequate safety margins for the anticipated duty, designed and manufactured to comply with all safety standards.
- d) The external diameter of the tunnelling machine shall be designed to produce minimum overbreak and the least necessary clearance for the proper construction of the Works.
- e) The Contractor shall be responsible for the quality of materials used or present within the tunnelling machine and shall ensure that all materials used or present are adequate for the task they are to perform.
- f) The Contractor shall maintain records on site of the date, time jacking load, distance moved relationship between load and distance moved, line and level measurements.

31.2.3 Grouting Around Pipelines

- a) The Contractor shall grout the annular space between the bored hole and the pipeline with a suitable cement grout. The mix design shall be submitted for approval by the Superintendent prior to grouting.

31.2.4 Thrusts and Reception Pits

- a) Thrust and reception pits and shafts shall be designed and constructed to allow the safe operation of plant, equipment and handling of materials and safely withstand all loading imposed by ground pressure, superimposed loads and the maximum anticipated thrust forces.
- b) The permanent Works shall not be used to transfer jacking force reactions unless the component in question has been specifically designed to resist such forces. Any proposals in this regard shall be referred to the Superintendent for approval prior to implementation.
- c) Proposals shall include calculations and sketches illustrating the proposed arrangement.
- d) Permanent shafts, pits or manholes shall have all internal surfaces (excluding the benching) coated with a material complying with **Clause 39.0** herein.

32.0 Manholes – Standard Cast *In Situ* and Receiving Manholes

- a) Cast *in situ* manholes shall be constructed in accordance with the drawings and all concrete for cast *in situ* manholes (including benching but excluding the render) shall be ready-mix concrete manufactured and placed in accordance with **AS1379** and **AS3600**. It shall be grade N32.
- b) The use of pre-cast manhole sections is not permitted.
- c) Concrete for manholes shall not be placed where the formwork is retaining water or adverse weather conditions prevail.
- d) Where the ground is solid to very firm, the Superintendent may permit that back forms need not be used in the construction of manholes, the concrete being poured against the ground. Where this is done, the thickness of the wall shall be increased by a minimum of 50mm greater than the dimension shown on the drawings. All costs associated with this increase in wall thickness shall be deemed to be included in the relevant Bill Item (if part of the Contract) and the Lump Sum of the Contract generally.
- e) The thickness of the walls of manholes shown on the drawings shall be the minimum adopted when back forms are used. Benching and rendering shall be as shown on the drawings.
- f) Prior to the placing of manhole base slabs, the Superintendent may require that by-pass drains be installed at manholes in accordance with the drawings.
- g) Manhole pipe couplings with Hydrophilic Waterstop seals shall be placed within the base in the positions shown on the drawings and to the details shown on **Standard Drawing 08-07-111**.
- h) The coupling shall be placed so that it is true to line and the external socket of the rubber ring joint is kept clear of concrete.
- i) The Hydrophilic Waterstop seal provided around the outside of the coupling shall be maintained in place while the concrete is poured and compacted around the coupling.
- j) The concrete surrounding spillway pipes and external drops at cast *in situ* manholes shall be monolithic with the manhole wall concrete.
- k) Benching and rendering shall be as shown on the drawings.
- l) All benches and channels shall be cement rendered. The rendering shall consist of mortar comprised of one part cement to two parts of approved fine sand and shall be laid on in two layers and when completed, shall not be less than 15mm thick and finished with a steel trowel true to shape and dimensions.
- m) Traditional construction methods may be used for the creation of benches and channels or systems such as the Hi-Tech Sewer Channel system or equal may be used.
- n) Unless otherwise approved by the Superintendent, bench and channel rendering shall be applied while the concrete is green. When directed the concrete surface shall be scabbled to provide efficient bond for the first render coat. Dry concrete surfaces shall be wetted before rendering is applied. The surface of the first coat shall be scored and the second coat applied before the first has set hard.
- o) All construction joints shall be provided with a joint sealing system such as a PVC Waterstop or a Hydrophilic Waterstop that is installed to the manufacturer's requirements. All Waterstops shall be to the requirements of **Clause 9.3.2** herein.
- p) Prior to commencement of the next wall section pour, the concrete shall be well scabbled to remove all laitance and primed with a jointing agent such as Bondcrete™ or equal. The installed Waterstop shall not be damaged or dislodged during this process.

- q) During the final upper wall segment pour, 10 steel reinforcing starter bars shall be placed within the wall to the details shown in the drawings.
- r) Pre-cast manhole convertor slabs are not permitted for cast *in situ* manholes.
- s) Within the convertor slab, in addition to the standard reinforcing steel for the slab, 4 steel reinforcing bars shall be placed within the convertor slab to the details shown on the drawings. The 2 hoop bars for the concrete surround shall be attached to these 4 reinforcing bars.
- t) The manhole convertor slab of the cast *in situ* manholes shall be poured *in situ* with the joint between the wall and convertor slab recessed, scabbled of all laitance and primed with a jointing agent such as Bondcrete™ or equal to ensure a watertight junction. Waterstops are not required at this joint.
- u) Prior to placing the concrete surround to the cast iron cover and frame, the surface of the convertor slab shall be thoroughly cleaned and scabbled of all laitance and primed with a jointing agent such as Bondcrete™ or equal to ensure a watertight junction. Waterstops are not required at this joint.
- v) In pavements the concrete surround shall be varied in thickness, while retaining the minimums shown in the drawings, so as to match accurately the levels and falls of the pavement or other finished surface. The level of the concrete surround shall be as shown on the design drawings.
- w) When not in paved areas, the concrete surrounds shall be set so as not to be in depressions but proud of the surrounding level, as nominated in the drawings, to enable drainage away from the concrete surround. The surrounding area shall then be filled or graded over 1 metre minimum distance up to concrete surround.
- x) Where bolt down covers are to be installed, reinforcement shall extend from the wall of the manhole into the convertor slab as shown on the drawings. The concrete surround shall be keyed to the convertor slab using 4 reinforcing bars as shown on the drawings.
- y) Cast *in situ* manholes for sewers 300mm diameter or larger and cast *in situ* manholes over 4.0 meters deep shall be internally coated with a material conforming to **Clause 35.0** herein.
- z) Receiving manholes for sewers less than 600mm shall comply with the requirements of **Clause 32.0** herein and shall be provided with a SS316 M20 Eye Bolt directly opposite the down stream outlet and chemically set 100mm into the manhole wall as shown in the drawings. Where a sewer line is directly opposite the down stream outlet, the Eye Bolt shall be fixed 300mm above the pipe soffit.
- aa) Receiving manholes for sewers 600mm and larger shall comply with the requirements of **Clause 32.0** herein and shall be provided with a Knife Gate Valve complying with **Clause 11.5** herein that is fixed to the down stream outlet as shown in the drawings.

33.0 Manholes – Pre-Cast

- a) Pre-cast manholes shall be constructed in accordance with the drawings. Pre-cast manholes shall not be used in areas subject to flooding or where bolt down covers are required.
- b) All pre-cast manholes shall have a pre-cast base that includes factory provided benching and rubber compression seals for the pipe coupling attachment. All components for the pre-cast manhole system shall be installed to the manufacturer's recommendations.
- c) Prior to the placement of the manhole pre-cast base, the Superintendent may require that by-pass drains be installed at manholes in accordance with the drawings.
- d) Where shown on the drawings, mass concrete to the specified grade shall be placed under and around the pre-cast base to provide support or prevent floatation. The concrete shall not be placed where the formwork is containing water or adverse weather conditions prevail.
- e) The only pre-cast manholes to be used in the Works are those on Council's list of approved products.
- f) When installing the pre-cast base, the down stream 500mm manhole short pipe shall be installed into the compression seal and connected onto the downstream sewer pipe prior to the final placement of the base. Following the installation of the remaining 500mm manhole short pipes, the compression seals shall be tightened where required and within the manhole the internal gap between the manhole short pipe and the manhole benching shall be mortar or epoxy filled to provide a smooth entry from the benching into the pipe. The pipe soffits within the base shall be rounded or bevelled and shall not exhibit any sharp edges.
- g) Pre-cast manhole wall segments shall be jointed with either a rubber ring seal or a mastic seal installed to and complying with the requirements of the manufacturer.
- h) Any hole to be provided within a pre-cast manhole wall segment shall be cored or drilled.

- i) The joint between the last circular wall segment and the Cone or Taper shaft segment shall be assembled as detailed above together with the external application to the joint of 4 equally spaced 100mm long beads of 'Megapoxy P1' or equal as shown on the drawings to ensure a watertight restrained segment joint.
- j) Pre-cast surrounds shall be installed onto the Cone or Taper shaft segment as shown on the drawings and shall be fixed to the scabbled upper shaft section joint face with a continuous bead of 'Megapoxy P1' or equal as shown on the drawings to ensure a fixed watertight joint.
- k) Where shown on the drawings or where directed by the Superintendent, cast *in situ* surrounds shall be provided.
- l) The top of the pre-cast wall segment shall be well scabbled as shown on the drawings to allow for the fixing of cast *in situ* concrete surrounds, refer **Clause 32 u)** herein.
- m) The requirements to match finished height difference and grades of the finished ground surface to the cover and surround shall be as specified in **Clauses 32 v)** and **32 w)** herein.

34.0 Maintenance Shafts and Rodding Points

- a) Plastic maintenance shafts and rodding ends shall be constructed in accordance with the drawings or the manufacturer's recommendations.
- b) Pre-cast concrete maintenance shafts shall be constructed in accordance with **Clause 33.0** herein and the drawings or to the manufacturer's recommendations.
- c) All PVC fittings and bends and all PP fittings used to connect the maintenance shaft or the rodding end to the sewer main or the base to the vertical shaft shall comply with **Clause 5.0** herein.
- d) All sewer mains shall connect to the assembled maintenance shaft or rodding end with a rubber ring joint complying with **Clause 9.2** herein.
- e) Priming fluids and solvent cements used to assemble sections of the maintenance shaft shall comply with **AS3879** with the assembly carried out by suitably qualified persons.
- f) For PVC and PP maintenance shafts, the concrete base support shall be N20 at 100mm or 150mm thick under the base, subject to bedding Zone 1 thickness, with all shaft and pipe joints to be kept clear of concrete. Where required by the Superintendent, by-pass drainage shall be installed in accordance with the drawings prior to pouring the base support.
- g) Backfilling and compaction shall be carried out as shown on the drawings once the shaft and cap are in place. All backfilling material for maintenance shafts shall be bedding material complying with **Clause 24.0** herein and shall extend from the shaft base up to the surround.
- h) Where shown on the drawings, high level Type 'Z' drop junctions shall be attached to the vertical shaft. The junction and remainder of the vertical riser pipe shall be supported while backfilling and compaction continue as defined above.
- i) Maintenance shafts and rodding ends shall be provided with a either 600mm diameter DI covers and frames located within a pre-cast concrete surround or with an approved PE Smartstream Top Hat or Webforge Ductile Iron 430 diameter maintenance shaft surface fitting system. The pre-cast surround or approved surface fitting shall be placed upon compacted bedding material or bricks as shown within the drawings with the PVC shaft cap set 150mm below the top of cover level.
- j) Where in the opinion of the Superintendent the natural ground or backfill is too soft or wet to provide sufficient support for the surround, and then bricks shall be placed on the ground to provide support for the pre-cast surround or surface fitting.
- k) Maintenance shaft bases may be installed at + 10% or – 10% of the nominated design base grade to facilitate alignment of the base and the sewer main. The vertical shaft section of maintenance shafts and rodding ends shall be installed at + 5% or – 5% of vertical with this being achieved through the use of a PVC Kicker Bend or deflection of the PP coupling.
- l) The PVC shaft cap shall be a minimum of 50mm clear of the bedding material within the pre-cast surround or surface fitting. The provision of the concrete surround shall include the use of a shroud pipe as shown on the drawings. The requirements to match the cover and surround with the grades of the finished ground surface shall be as specified in **Clauses 32 v)** and **32 w)** herein.
- m) All maintenance shaft and rodding end caps shall be provided with a 20 – 25mm Rubber Bung within the cap lid as shown on the drawings. The drilling of the cap with a 20mm hole for the placement of the rubber bung shall occur following successful pressure testing and prior to the On Maintenance of the system.

35.0 Discharge Manholes Protective Coating System

- a) Discharge manholes shall have all internal surfaces coated with a protective coating system as detailed below. The DI cover and frame does not require coating.
 - i) all internal surfaces shall be coated with a two part solvent free 100% solids epoxy protective coating system at 2.0mm thick and suitable for application to damp concrete and to the requirements of **Clause 39.0** herein;
 - ii) the protective coating system shall be installed to the manufacturer's requirements and the application shall be carried out by an accredited applicator approved by the manufacturer and the Superintendent;
 - iii) the provided coating system shall comply with the certification requirements of **Clause 39.0** herein.
- b) Vent poles shall be installed to the details and where shown on the drawings.

36.0 Manhole Covers and Frames

- a) Manhole covers and frames shall comply with **AS3996** – with the class of cover as shown on the drawings.
- b) Manhole covers shall be ductile iron grade 600/3 in accordance with **AS1831**.
- c) Manhole frames and risers shall be ductile iron grade 600/3 in accordance with **AS1831**.
- d) Maintenance shaft and rodding end covers and frames shall be unsealed DI solid top Type 'A' in accordance with **Clause 1.5.3.1** of **AS3996** or approved Class 'B' PE covers and frames complying with **AS3996**.
- e) Manhole covers and frames for all types of concrete manholes and concrete maintenance shafts shall be sealed, watertight DI solid top Type 'D' in accordance with **Clause 1.5.3.1** of **AS3996**.
- f) Manhole covers and frames shall be Class D for roadway installations and Class B for all other applications.
- g) For DI covers as shown in the drawings, the manhole frame shall be cast in a concrete surround, the frame being set in the mould and the concrete poured around it. All forms used for casting concrete surrounds shall be of metal, well braced and capable of being stripped without damaging the concrete.
- h) All covers shall sit evenly on the frame seating without rocking and shall give a watertight joint for all concrete manholes.
- i) Before the commencement of the Defects Liability Period, the Contractor shall check the condition of the seal between the lip of the frame and the cover and install all bolts in the bolt down covers.

37.0 Manhole Drops

- a) Manhole and maintenance shaft drops shall be as shown on the drawings.
- b) External drops shall not be used with pre-cast manholes.
- c) For 100mm to 225mm sewers and HC Branches, internal drops (Type X) entering through the manhole wall may be used. Where the grade of the incoming sewer or house connection is steeper than 5%, then an approved 3.0 meter Long Radius Bend at the appropriate grade angle shall be provided between the 500 short pipe and the sewer or HCB.
- d) Where more than one internal drop is used the manhole shall be a minimum of 1200mm diameter.
- e) Holes in walls of pre-cast manholes shall be cored by drilling a series of 30mm diameter holes at approximately 60mm centres around the circumference of the hole required and any exposed steel cut back to the surface of the concrete. Impact methods to make holes shall not be used.
- f) Type 'X' DI drop fitting shall be provided with a Hydrophilic Waterstop seal around the outside of the coupling that shall be maintained centrally in place while a continuous mass of 'Megapoxy P1' is used to complete the watertight joint within the pre-cast manholes wall in accordance with the drawings.
- g) The PVC drop pipe as shown on the drawings shall be rubber ring pipe and fittings complying with the requirements of **Clause 5.3** herein. The drop pipe shall be fixed in place at 500mm centres with SS316 clips with two SS316 M10 chemical anchor bolts set into the MH wall.

38.0 Sewerage Lift Stations and Pump Stations

- a) Sewerage Lift Stations and Pump Stations shall be constructed to the details shown on the drawings.
- b) Site earthworks shall be to the details shown on the drawings and shall comply with the requirements of Council's **Standard Specification SS4**.
- c) Formwork shall be designed and constructed to produce concrete that conforms within the specified tolerances to the shapes, lines, levels and dimensions shown in the drawings. Internal wet well and valve chamber concrete surfaces shall be provided with a Formwork Class 3 finish with a 5 Colour Tone range in accordance with the Standard.
- d) Void formers or blockouts shall be of sufficient strength and placement/ fixing method to prevent deformation of the former or blockout under the load of wet cement so as to produce the required void within the tolerances specified.
- e) Formwork release agents may be used where the release agent does not affect the concrete surface and the application of the wet wells protective coating, refer **Clause 39.0** herein.
- f) All concrete (including benching) for Sewerage Lift Stations and Pump Stations shall be ready-mix concrete manufactured, supplied and placed in accordance with **AS1379** and **AS3600**. It shall be grade S40 with:
 - i) a minimum fly ash/ Type GP Portland cement ratio of 0.25 and a maximum fly ash/ Type GP cement ratio of 0.30;
 - ii) a nominal aggregate size of 20mm.
- g) The Contractor's attention is drawn to the requirements of **Clause 4.4** herein regarding concrete certification.
- h) Construction joints shall be:
 - i) made in the positions shown on the drawings or as directed by the Superintendent;
 - ii) formed in an approved manner to incorporate either a centrally placed 140mm wide (minimum) PVC centre bulb waterstop similar to Fosroc PVC Supercast Waterstops or approved equivalent or a material such as Hydrotite CJ-0725-3K or equal as shown on the drawings;
 - iii) unless otherwise detailed or directed, be horizontal or vertical.
- i) At construction joints, before any new concrete is placed, the surfaces of the set concrete shall be scabbled or blast cleaned so as to remove any laitance, loose or porous material and have a clean, rough, hard concrete surface which shall be dampened immediately prior to placing new concrete. Care shall be exercised to ensure that waterstops or conduits are not damaged during this operation.
- j) Core holes, embedded conduits, anchor bolts, eye bolts and U bolts shall be provided as shown on the drawings.
- k) The surface finish for the cover slab shall be a steel trowelled non-slip finish.
- l) Concrete cracks less than 0.1mm wide may be sealed with a low viscosity epoxy. Cracks between 0.1mm and 1.0mm wide shall be sealed with a low viscosity epoxy. Cracks greater than 1.0mm shall be grooved out and cleaned and sealed with an approved bentonite/ cement grout.
- m) The protection of the internal concrete surfaces of the wet well shall be in accordance with the requirements of **Clause 39.0** herein.
- n) Mechanical works shall be carried out in accordance with Council's **Standard Specification SS14**.
- o) Electrical works shall be carried out in accordance with Council's **Standard Specification SS12**.
- p) The Contractor shall provide a metered property service, RPZ device with hose cock and associated plumbing works in accordance with the drawings to all Lift Stations and Pump Stations. The Contractor shall apply to Council for the service installation from the main up to and including the meter.
- q) Property service and plumbing components shall comply with **Clause 7.0** of **Standard Specification SS2** and the drawings.
- r) Vent poles shall be installed to the details shown on the drawings. Odour control facilities shall be provided to the details shown on the drawings. The electrical requirements of the odour control facilities shall generally comply with Council's **Standard Specification SS12** and the specification for the facility.
- s) Access driveways shall be constructed in accordance with the drawings.

- t) Fencing and landscaping shall be constructed in accordance with the drawings.
- u) Drop structures shall be provided at the wet well inlet pipe as shown in the drawings.
- v) Two SS316 M20 Eye Bolts shall be chemically set into the wet well wall adjoining the sewer inlet as shown in the drawings.
- w) Round guide rails shall be continuous lengths of 50 mm or 65 mm ID x 3.6 mm (medium) wall thickness black pipe to **AS1074**. Guide rails shall be galvanized in accordance with **AS/NZS4680**.
- x) Square guide rails shall be continuous lengths of 50 x 50 x 2.5 mm or 75 x 75 x 3.5 mm wall thickness black SHS steel tube to **AS1163**. Guide rails shall be galvanized in accordance with **AS/NZS4680**.
- y) DuraGal ® coated material shall not be used.
- z) Guide rail lengths longer than standard tube lengths shall be welded together according to **AS/NZS1554**. The welded area and galvanising shall be repaired and fully reinstated according to **AS/NZS4680 Appendix E**. Guide rail brackets shall be SS316L and fixed to the wall and guide rail to the pump manufacturer's recommendations so that pump installation and removal is not impeded.
- aa) Lifting chains shall comply with **AS2321**. Eyebolts shall comply with **AS2317**. Shackles shall comply with **AS2741**. Lifting eyes shall comply with **AS3776**.
- bb) Pump lifting chains shall comprise a main lifting chain and two 500mm long chains branching from it. All three chains are linked together with shackles at each chain end.
- cc) Each 500mm chain is attached by two consecutive shackle links to a lifting eye on the pump.
- dd) The main lifting chain shall be attached by a shackle set 500mm from the free end to a stainless steel hook located within the top slab opening. The free end of the lifting chain shall comprise a shackle connecting with the lifting eye.
- ee) Lifting chains and shackles shall have a minimum working load limit of 1000kg. Pairs of eyebolts shall have a minimum safe working load of 1000kg. Lifting eyes shall have a minimum safe working load of 3200kg.
- ff) Each lifting chain and fitting shall have a minimum design factor of 5 for the total weight of lift and shall be as a minimum Grade L chain of 10mm nominal chain size or greater subject to the weight of lift. Lifting chain segments shall be terminated or jointed with shackles or a series of shackles. The shackle size shall be selected to suit the chain size.
- gg) For 10mm chain, shackles shall be 10 x 11mm yellow pin anchor bow shackles and lifting eyes shall be Pewag A18 – 8W or similar oblong Grade 80 alloy master links at 18mm thick with an ID of 135 x 75mm.
- hh) All lifting equipment except the shackles, yellow pin and the lifting eye shall be galvanized, by the manufacture, in accordance with the requirements of **AS/NZS4680**. Lifting eyes shall be coated with Pewacoat ® (8 microns thick) or equivalent.
- ii) One (1) finishing coat of an epoxy protective coating system complying with **Clause 6.5 c)** herein shall be applied to the installed pipe and to the flanges of flanged fittings within the pump wet well including the associated stainless steel bolts, nuts and washers.
- jj) All external surfaces of the lightweight aluminium covers and the RPZ box shall be coated with an anti-slip coating system. The anti-slip coating system shall comply with **AS/NZS4586** including slip resistance classifications Class W of **Table 2** and Classification R11 of **Table 5**. The anti-slip system shall be applied according to the manufacturer's recommendations over a suitable aluminium chemical etchant and primer.
- kk) The anti-slip coating system shall not, in any way, restrict the articulation of the covers. The anti-slip coating system shall be either:
 - i) a 100% solids moisture curing MDI based polyurethane prepolymer including a crumbed rubber binder, such as Huntsman Daltobond CR2; or
 - ii) a liquid applied acrylic-polyurethane composite coating including a 16/30 crumbed rubber, such as Neoferma Neotop; or
 - iii) a high solid content (>90% vol) epoxy flooring system suitable for marine and industrial environments, such as Epirez Supatuff AS-550; or
 - iv) a medium solids content (>50% vol to <80%vol) water base polyurethane flooring system suitable for marine and industrial environments, such as Parbury Tex-Cote Strata Grip.

- ll) Wet well and valve chamber openings shall be provided with a personnel safety netting system. The safety net shall be made from black polyethylene rope complying with **AS4142.1** at 10 mm dia for the net mesh and 16 mm diameter for the border rope. The border rope may be white.
- mm) The safety net shall be constructed to the requirements **NSW Workcover – Safety Nets** and fixed with 150 mm long by 12 mm diameter Grade 316 stainless steel twisted 'J-Hooks'.
- nn) The safety net hooks shall be centrally fixed into the wet well and valve chamber top slab openings with Reid Swiftchem 3+3 EA or similar at a maximum spacing of 1200 mm and at a minimum insertion depth of 110 mm with a minimum of two hooks per opening side. The hooks shall be placed so that they do not interfere with the pump removal and are in accordance with the standard drawings.
- oo) The diversion pumping camlock fitting within the valve chamber shall be installed to the details shown in the drawings.

39.0 Protective Coating of Wet Wells

- a) All internal vertical, soffit and cover opening wet well surfaces of Sewerage Lift Stations and Pump Stations and discharge chamber surfaces of Sewerage Lift Stations shall be coated with a protective coating system as detailed below. Benching shall not be coated.
 - i) either a two part solvent free 100% solids epoxy protective coating system suitable for application to damp concrete and to the requirements of **Clauses 39.0 c) – 39.0 g)** herein; or
 - ii) a Coating System that complies with the Australian Paint Approval Scheme Specification No. 0214 – Coatings for Concrete Used in Sewage Works, applied to the requirements of **Clauses 39.0 c) – 39.0 g)** herein; or
 - iii) a HDPE, PE or uPVC plastic lining protective coating system to the requirements of **Clauses 39.0 h) – 39.0 j)** herein.
- b) The protective coating system shall be installed to the manufacturer's requirements and the application shall be carried out by an accredited applicator approved by the manufacturer and the Superintendent.
- c) The two part solvent free epoxy protective coating system suitable for sewerage works shall consist of a chemical resistant two part epoxy primer/ sealer (if specified by the manufacturer) with a minimum single coat dry film thickness of 30 microns together with a high build two part solvent free 100% solids epoxy coating resistant to Sulfuric Acid and abrasion with a minimum dry film thickness of 2000 microns for wet wells of 2400mm diameter or less and a minimum dry film thickness of 3000 microns for wet wells of greater than 2400mm diameter.
- d) The pot life of the mixed coating shall be a minimum of 40 minutes with a colour when dry of either light grey, white or off white.
- e) The protective coating system may include Quartzite aggregates and where used the minimum dry film thickness shall be 4000 microns.
- f) Prior to the application of the coating system the new concrete surface shall be pressure blasted or scabbled so as to remove any laitance, loose or porous material leaving a clean, rough, hard concrete surface.
- g) The cleaned concrete surface shall be dried prior to all holes and shallows being filled with an approved filler such as Fosroc Nitomortar EL ® or equal with a minimum compressive strength at 7 days of 70 MPa. Following recommended curing of the filler the protective coating system shall be applied to the manufacturer's requirements.
- h) The plastic lining protective coating system shall be a minimum of 2mm thick and either a High Density Polyethylene, Polyethylene or uPVC material cast onto the structure or grouted in place either during or following construction of the structure.
- i) The plastic lining protective coating system shall be installed by an accredited applicator approved by the manufacturer and the Superintendent to the manufacturer's requirements.
- j) The plastic lining protective coating system shall be fully joined and sealed by welding or proprietary product locking seams to provide a continuously sealed surface coloured either light grey, white or off white.
- k) The protective coating system shall be finished to the details shown on the drawings.

- l) The Contractor shall:
 - i) certify to the Superintendent (in a manner approved by the Superintendent) that:
 - 1) the protective coating has been applied in accordance with the manufacturer's recommendation;
 - 2) the protective coating has been applied by an accredited applicator and that the tests required by the manufacturer have:
 - 1. been carried out; and
 - 2. met the manufacturer's requirements; and
 - 3. passed the test requirements of **Clauses 42.0 h)** and **42.0 i)** herein.
 - ii) provide to the Superintendent a joint manufacturer's and applicators written warranty (in Council's name) covering the protective coating for a minimum period of 10 years.
- m) The Contractor's attention is drawn to the requirements of **Clause 4.4** herein regarding certification and warranty.

40.0 Testing of Gravity Sewers and Maintenance Shafts

- a) Guidance on the acceptance testing of sewers and maintenance shafts is available within the **Sewerage Code of Australia WSA 02-2002, Clause 22.4**.
- b) For sewers and maintenance shafts the following requirements shall apply:
 - i) the Contractor shall provide all labour, materials and appliances required for use in connection with acceptance testing;
 - ii) all rectification work required shall be at the cost of the Contractor;
 - iii) it is recommended that pipes and maintenance shafts and each length of pipe between manholes be tested on a daily basis.

40.1 Air Testing General

- a) Manholes shall be tested to the requirements of **Clause 42.0** herein.
- b) Air testing shall be either pressure testing or vacuum testing. Prior to testing commencing, the Contractor shall nominate either vacuum or pressure testing as the method of acceptance testing. The Contractor shall not be permitted to change from one method to the other.
- c) The test shall include manhole drops, house connection branches (including inspection tee) maintenance shafts, rodding ends and any in line bends.
- d) Test gauges shall be Certified by a NATA registered testing laboratory with the gauges Certification being no more than 6 months old.
- e) Within the ITP, the testing of the sewer is a Hold point for the Superintendent.

40.2 Air Testing – Pressure

- a) The sewer, maintenance shaft or rodding end to be tested shall be pressurised to the 'Initial Pressure' shown in **Table 8** herein for a minimum of 3 minutes to stabilise the temperature.

Table 8

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

- b) After the 3 minute stabilisation period the pressure shall be dropped to the 'Test Start Pressure' shown in **Table 8** herein and the test timing for the particular sewer diameter shall then commence.
- c) The sewer line, maintenance shaft or rodding end under test shall be considered to have passed the test when the 'Time to Drop by 5 kPa' exceeds the time shown in **Table 9** herein for the sewer diameter nominated.

Table 9

Nominal Pipe Size DN Maximum test length (m)	DN150 150m	DN225 150m	DN300 150m	DN375 200m	DN450 200m	DN525 200m	DN600 250m
Minimum Time to Drop 5 kPa	3 min	8 min	14 min	29 min	41 min	56 min	92 min

- d) For sewers larger or longer than those shown above in **Table 9** up to DN1050, the testing lengths, times and required pressures shown within **Table 22.4** of the **Sewerage Code of Australia WSA 02-2002** at **Clause 22.0** shall be used to define that the sewer has passed or failed the test.
- e) For sewers larger than DN1050, including the manholes and shafts, the acceptance test at a minimum of 21 days after the sewers installation, shall be that the sewer has no visibly flowing leaks occurring but the pipe may exhibit damp patches and that the measured infiltration, at the lowest end of the pipeline under test, over a 24 hour period is less than 5 L/mm diameter/km/day.

40.3 Air Testing – Vacuum

- a) From the sewer, maintenance shaft or rodding end to be tested, a vacuum of 27 kPa shall be drawn and the vacuum gauge monitored for a 3 minute stabilization period. The test shall commence where the sewer under test is at a vacuum between 23.6 kPa to 27 kPa after the stabilization period. The start pressure shall be recorded.
- b) The sewer and/or maintenance shaft under test for the maximum test lengths shown in **Table 9** above shall be considered to have passed the test when the vacuum does not fall by more than 5 kPa from the pressure recorded at the start of the test and during the nominated time period in **Table 9**.
- c) For sewers larger or longer than those shown above in **Table 9**, the testing lengths, times and required pressures shown within **Table 22.4** of the **Sewerage Code of Australia WSA 02-2002** at **Clause 22.0** shall be used to define that the sewer has either passed or failed the test.

40.4 Ovality Testing

- a) All flexible pipe materials such as PVC, PE, PP and GRP gravity sewer pipes shall be tested to determine any excessive pipe deflection (ovality) by using a proving tool.
- b) 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 **Table 10** herein, through each section of pipe by hand winching to demonstrate that the maximum allowable deflection is not exceeded.
- c) Where DN150 to DN300 bends are used within the sewer system then ovality testing shall only be carried out with a rigid, non-adjustable circular ball.
- d) Except for as stated above, the proving tool shall be fabricated from steel with pulling rings at each end and marked to indicate the nominal pipe size and the provers' outside diameter and shall be rigid and non-adjustable and shall have an odd-number of legs (min 9) and an effective length of not less than its nominal diameter. The minimum diameter (at any point along the length) shall be as shown in **Table 10** herein.

Table 10

Minimum Prover Diameter (mm)							
Nominal Pipe Size DN	PVC Solid Wall	PVC Ultra Rib	GRP Pipes	Nominal Pipe Size DN	PVC Solid Wall	PE and PP Pipes	GRP Pipes
100	95	-		375		351	
150	140	142		450		424	465
225	220	211		525			538
300	278	283	310	600		567	613
375	362		390				

- e) For flexible sewers not shown in **Table 10** or larger than DN600, the prover tools diameter shall be as shown within the **Sewerage Code of Australia WSA 02-2002, Clause 22.6.2 – Ovality** proving tools, based on the tool size being relative to the percentage of maximum deflection nominated at 14 days. The base pipe Internal Diameter for the calculation shall be the nominated diameter within the Australian or Manufacturer's Standard for the particular pipe material.
- f) Sewer pipes that exhibit excessive ovality (by failing the maximum allowable deflection shown in **Table 10** herein) shall be replaced and the re-laid section retested for ovality.

40.5 Closed Circuit Colour TV Inspection (CCCTV)

- a) The Contractor shall have a CCCTV inspection of 100% of sewer pipes carried out in accordance with the guidelines of the **WSA 05-2006 Conduit Inspection Reporting Code of Australia** and **Sewrat Data Capture Software**.
- b) The following requirements shall apply to the CCCTV inspection:
 - i) only CCCTV operators certified with the **Australian Water and Wastewater Association (AWWA)** or the **Water Services Association of Australia (WSAA)** are approved to conduct the inspections;
 - ii) the CCCTV inspection record shall be of such quality that an accurate assessment of the internal condition of the sewer can be made;
 - iii) the following items shall be provided to the Superintendent:
 - 1) one set of digital survey data from either **Sewrat Data Capture Software** on 3½” disk/ CD or as detailed within the **WSAA Sewer Inspection Reporting Code**. The disk/ CD shall be clearly labelled as such;
 - 2) one hardcopy printout of survey data from **Sewrat Data Capture Software** or as detailed within the **WSAA Sewer Inspection Reporting Code**.
- c) The cost of providing the CCCTV inspection shall be offset against the relevant PC item in the Bill of Quantities.

41.0 Testing of Pressure Mains

- a) Pressure testing shall be undertaken as soon as possible after the concrete thrust blocks have developed their design strength, all backfilling operations have been completed and prior to pavement sealing of any roadway over the main.
- b) Testing shall include all pipes and fittings with the length of test section of main normally to be between 500m and 1000m.
- c) Hydraulic pressure testing of the pipeline shall be carried out at the lowest point of the line or lines being tested.
- d) Care shall be taken to remove all air from mains under test when filling with test water. The rate of filling of the test section with water shall be such that the water velocity within the test section shall nowhere exceed 0.05m/s.
- e) The test head for the pipeline shall be 900kPa. Test gauges shall be Certified by a NATA registered testing laboratory with the gauges Certification being no more than 6 months old.
- f) Within the ITP, the testing of the pressure main is a Hold point for the Superintendent.
- g) The test pressure shall be maintained for one (1) hour minimum without any drop in the gauge reading and during this period the whole line shall be inspected for leakage or movement. Any defects shall be repaired and the main re-tested until the gauge pressure remains steady for one (1) hour minimum.
- h) The length of pipeline under hydraulic pressure test shall be deemed to have passed the test provided the pressure gauge remained steady for one (1) hour minimum and there is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component and there is no visible leakage.

42.0 Manhole and Wet Well Testing

- a) After all manholes have been constructed (including benching and fitting of convertor slab surround frame and cover) they shall all be tested.
- b) Backfill operations shall be completed before testing of all manholes commences.
- c) The minimum number of manholes to be tested shall be as shown in **Table 11** herein.

Table 11

Number of Sewer Manholes in Contract	Percentage Tested Initially
≤ 5	100%
6 to 10	50%
11 to 20	33%
>20	25%

Note: *If 20% or more of the sample manholes fail the initial test – all manholes shall be tested.*

- d) The vacuum test head shall be placed in the top of the manhole and the seal inflated.
- e) Draw a vacuum of 33.5 kPa on the manhole then close the valve on the vacuum line and turn the pump off.
- f) The manhole shall have passed the vacuum test if the time taken for the reading to drop to 30.0 kPa meets or exceeds the time shown in **Table 12** herein.

Table 12

Manhole Depth	Manhole Diameter (mm)		
	1050	1200	1500
	Time in Seconds		
< 2400	17	20	25
3000	21	25	30
4000	28	33	40
5000	35	41	50
6000	42	49	60
7000	49	57	70

- g) For manholes larger or deeper than those shown above in **Table 12**, the testing requirements shown within **Tables 22.5** and **22.6** of the **Sewerage Code of Australia WSA 02-2002** at **Clause 22.0** shall be used to define that the manholes have passed or failed the test.
- h) All wet wells and manholes with a protective coating system in accordance with **Clause 35.0** and **Clause 39.0** herein shall have the continuity of the Protective Coating spark tested in accordance with **Clause 7** of **AS3894.1** at a minimum of 12,000 volts. Any discontinuity of the coating shall be repaired in accordance with the coating manufacturer's recommendations.
- i) In addition to the above, Cast in place sheet plastic Protective Coating systems shall be tested in accordance with **Clause 22.8.3** of the **Sewerage Code of Australia WSA 02-2002** to define that the coating has passed or failed the required Locking Key pull out test.

43.0 Cleaning of Sewerage Reticulation System

- a) Prior to the commissioning and live connection referred to in **Clause 45.0** herein the Contractor shall flush all sewers, manholes, house connections and pressure mains with clean water so that all lines present a clean and clear barrel that is free of obstructions.
- b) Cleaning of GRP pipe shall be carried out with the equipment recommended by the manufacturer.
- c) The Contractor shall ensure that the cleaning water does not pass into the live sewer. The cleaning water shall pass through a silt trap before being allowed to enter a stormwater drain or a natural water course in accordance with the environmental approvals.

44.0 Restoration Works

- a) Restoration of existing developed areas shall be carried out to such a standard that the finished Works shall be as near as practicable to standard of the site prior to commencement of Works. Photographic evidence of the original state of the existing developed area shall be provided by the Contractor to validate the restoration standard provided.
- b) The Contractor shall be responsible for all restoration works including, but not restricted to, concrete work, footpath and pavement repairs, gardens, edging, trees, shrubs, and grass.
- c) The restoration works shall be completed within forty-eight (48) hours of the initial work being undertaken on a particular property unless agreed otherwise by the Superintendent.
- d) The Contractor shall be responsible for all restoration works including, but not restricted to fences, concrete work, footpath and pavement repairs, gardens, edging, trees, shrubs and lawn to a condition equivalent to that prior to the commencement of work. In the case of grassed areas which are not lawn, restoration shall consist of the placement of 100 mm of topsoil and the spreading of a mixture of grass seed and fertiliser at the following minimum rates:
 - i) Green Couch (*Cynodon dactylon*) 20 kg/ hectare;
 - ii) Carpet Grass (*Axonopus affinis*) 20 kg/ hectare;
 - iii) fertiliser 350 kg/ hectare.

- e) The restoration of grassed areas will not be considered as complete until 80% of the disturbed area has an established grass cover.
- f) The restoration works shall be completed within forty-eight (48) hours of the initial work being undertaken on a particular property unless agreed otherwise by the Superintendent.
- g) Any excess material which has resulted from work under the Contract shall be removed from the Site at the Contractor's expense.
- h) Should the Contractor fail to complete restoration to a satisfactory standard, ie. to a standard comparable to that prior to commencement of work under the Contract within the specified time, then the Superintendent shall arrange to have the restoration work completed by others at the Contractor's expense.

45.0 Live Connection, Disconnection, Commissioning and Decommissioning

- a) After all the requirements of this specification have been satisfied, the Contractor shall arrange for Gold Coast Water to carry out the live connection and the commissioning of the Works or any necessary decommissioning.
- b) The Contractor shall allow sufficient time for Council to quote for the connection works, order any materials required and program in the Works.
- c) Where Gold Coast Water requires the live connections to existing infrastructure to be undertaken by the Contractor, the Contractor shall make connection to existing sewer mains only under Gold Coast Water supervision and Gold Coast Water will provide assistance to the Contractor for his diversion pumping or tankering of any required flows.
- d) Prior approval by Gold Coast Water of the Contractor's proposed procedure for connection to existing infrastructure is required to be issued by the Superintendent.
- e) Where connections to existing infrastructure are to be undertaken by the Contractor, the Contractor shall submit to the Superintendent a detailed method statement of how each connection is proposed to be undertaken, including times of connection, materials and equipment to be used in undertaking the connection, and details of service interruptions anticipated to arise during the period of the connection.
- f) In all cases, the method statement for the connection is to endeavour to minimise any disruption to existing customers and/or users of the affected infrastructure. The method statement is to be received by the Superintendent not less than fourteen (14) days prior to the date scheduled for the connection works.
- g) The Contractor shall further confirm the final arrangements with the Superintendent not less than 48 hours before the proposed commencement of the connection works.
- h) The Superintendent shall within seven (7) days of receipt of the method statement either approve the method statement or return it to the Contractor requesting further consideration of issues raised.
- i) Should resubmission of the method statement be required, the Superintendent's approval to the revised method statement will still be required prior to proceeding with the connection works. In all cases, the proposed date to undertake the connection works shall be not less than seven (7) days after receipt of written approval from the Superintendent to the proposed method statement. No additional cost will be applicable arising from delays in obtaining the Superintendent's approval to the connection method statement.
- j) If in the opinion of the Superintendent the Contractor does not have the necessary equipment and/or resources available to successfully complete the connections, the connection activities will be postponed to another day. No cost for this delay will be granted.
- k) Connections to existing infrastructure are also to be undertaken outside normal working hours and not during peak periods Monday through to Sunday to minimise disruption to customers. The Contractor shall therefore be required to undertake live connections during such off-peak hours.
- l) Council may postpone live connections during Major events, ie. holidays, Indy, Surf Carnival weekend's, etc. If the Contractor can ensure no such functions are affected, the Superintendent will advise whether the live connection can take place.
- m) Where the Contractor can ensure disruption to customers is minimal, the Superintendent may authorise connection during the above periods.
- n) All costs associated with the connections to the existing sewerage system shall be included in the lump sum.

46.0 'As-Constructed' Submission

46.1 'As-Constructed' Criteria

- a) 'As constructed' information shall be prepared by the Contractor and shall meet the following minimum criteria:
- i) be endorsed by a Licensed Consulting Surveyor with an appropriate QA standard;
 - ii) be submitted to the Superintendent prior to acceptance of the Works on Practical Completion. Should any amendments be required by the Superintendent to the submitted 'as constructed' information, such amendments shall be made and resubmitted by the Contractor prior to acceptance of the Works on Practical Completion;
 - iii) for Linier assets, such as pipes, fittings and manholes, be submitted in the format specified in Council's current '**Standard Electronic Format for As Constructed Data**';
 - iv) for Non-Linier assets, such as pumping stations, be submitted in accordance with the requirements of **Standard Specifications SS12 and SS14**;
 - v) show all significant variations from the Contract Drawings (including tolerances outside those specified below).

47.0 Construction Tolerance

47.1 Sewer Reticulation

- a) The Contractor shall construct the Works within the following tolerances:
- i) Horizontal + 75mm
 - ii) Vertical
 - Surface Level + 30mm¹
 - Invert Level + 30mm²
 - iii) Grade³

Notes:

- 1 Structures.**
- 2 Manholes.**
- 3 Minimum design grade shall be maintained.**

47.2 Trunk Sewers

- a) Deviations from approved design shall not exceed:
- i) Manholes
 - 1) Locations ± 100 mm¹
+ 100 mm²
 - 2) Surface Levels 25 mm
 - ii) Lines
 - 1) Invert ± 25 mm³
 - 2) Alignment ±100 mm¹
 - 3) Grade³

Notes:

- 1 Deviation should not result in conflict with any other service or structure. All services should remain within the approved service corridors.**
- 2 Should match the adjacent finished surface.**
- 3 Not less than minimum and not more than maximum grade. Council's design criteria shall be achieved.**

48.0 Measurement and Payment

- a) Quantities in the Bill of Quantities have been computed on the following basis:
- i) Sewer lines – per plan linear metre, including: excavate, supply, lay, joint, bed and backfill pipes and fittings, junctions, manholes, maintenance shafts, pumping stations, including pressure pipes and valves, fittings and thrust blocks;
 - ii) other items have been measured in the units indicated in the text of the items in the Bill and based on the dimensions shown on the drawings or specified elsewhere.
- b) The cost of all work required by this specification including testing, supply of all materials, plant, tools, labour and all expenses necessary for the satisfactory completion of the Works, shall be deemed to be included in the relevant Bill Items (if part of the Contract) and/or the Lump Sum of the Contract generally.

49.0 Standards and Codes

a) This specification makes reference to the following Australian Standards:

AS1074	Steel tubes and tubulars for ordinary service
AS1111.1	ISO metric hexagon bolts and screws – Product grade C – Bolts
AS1111.2	ISO metric hexagon bolts and screws – Product grade C – Screws
AS1112.3	ISO metric hexagon nuts – Product grade C
AS1141	Methods for sampling and testing aggregates
AS1163	Structural steel hollow sections
AS1171	Non-destructive testing – Magnetic particle testing of ferromagnetic products, components and structures
AS/NZS1260	PVC-U pipes and fittings for drain, waste and vent application
AS1281	Cement mortar lining of steel pipes and fittings
AS1289	Methods of testing soils for engineering purposes
AS1302	Steel reinforcing bars for concrete
AS1304	Welded wire reinforcing fabric for concrete
AS1379	The specification and manufacture of concrete
AS1397	Steel sheet and strip – Hot-dipped zinc-coated or aluminium/ zinc-coated
AS/NZS1477	Unplasticized PVC (UPVC) pipes and fittings for pressure applications
AS1478	Chemical admixtures for concrete
AS/NZS1554.1	Structural steel welding – Welding of steel structures
AS1579	Arc welded steel pipes and fittings for water and wastewater
AS1627.4	Metal finishing – preparation and pre-treatment of surfaces-abrasive blast cleaning of steel
AS1646	Elastomeric seals for waterworks purposes
AS1650	Hot-dipped galvanised coatings on ferrous articles
AS1720.1	Timber Structures- Design Methods
AS1741	Vitrified clay pipes and fittings with flexible joints – Sewer quality
AS1831	Ductile cast iron
AS/NZS2032	Installation of PVC pipe systems
AS2053	Conduits and fittings for electrical installations
AS2062	Non-destructive testing – Penetrant testing of products and components
AS2187	Explosives – Storage, transport and use (known as the SAA Explosives Code)
AS/NZS2280	Ductile iron pressure pipes and fittings
AS2317	Collared eyebolts
AS2321	Short-link chain for lifting purposes
AS2544	Grey iron pressure fittings
AS2638.1	Gate valves for waterworks purposes – Metal seated
AS2638.2	Gate valves for waterworks purposes – Resilient seated
AS/NZS2648.1	Underground marking tape – Non-detectable tape
AS2741	Shackles
AS2758.1	Aggregates and rock for engineering purposes – Concrete aggregates
AS2837	Wrought alloy steels – Stainless steel bars and semi-finished products
AS2865	Safe working in a confined space
AS/NZS3000	Electrical installations – Buildings, structures and premises (known as the SAA Wiring Rules)

AS3571	Glass filament reinforced thermosetting plastics (GRP) pipes – Polyester based – Water supply, sewerage and drainage applications
AS3582.1	Supplementary cementitious materials for use with Portland and blended cement – Fly ash
AS3600	Concrete structures
AS3610	Formwork for concrete
AS3678	Structural steel – Hot-rolled plates, floor-plates and slabs
AS/NZS3679	Structural steel – Hot-rolled
AS3680	Polyethylene sleeving for ductile iron pipelines
AS3681	Guidelines for the application of polyethylene sleeving to ductile iron pipeworks and fittings
AS3706	Geotextiles – Methods of test
AS3776	Lifting components for Grade T chain slings
AS/NZS3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS pipes and fittings
AS3894.1	Non-conductive coatings – continuity testing – high voltage (brush) method
AS3894.2	Site testing of protective coatings – Non-conductive coatings – Continuity testing – Wet sponge method
AS3972	Portland and blended cements
AS3996	Metal access covers, road grates and frames
AS4037	Pressure equipment – Examination and testing
AS4041	Pressure piping
AS4087	Metallic flanges for waterworks purposes
AS/NZS4129	Fittings for polyethylene (PE) pipes for pressure applications
AS/NZS4130	Polyethylene (PE) pipes for pressure applications
AS/NZS4131	Polyethylene (PE) compounds for pressure pipes and fittings
AS4142.1	Fibre ropes – Care and safe usage
AS/NZ4158	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS4321	Fusion bonded medium density polyethylene coating and lining for pipes and fittings
AS/NZS4586	Slip resistance classification of new pedestrian surface materials
AS/NZS4671	Steel reinforcing materials
AS/NZ4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS4794	Non-return valves – Swing check and tilting disc
AS/NZS4854	Welding consumables – Covered electrodes for manual metal arc welding of stainless and heat-resisting steels – Classification
AS/NZS4855	Welding consumables – Covered electrodes for manual metal arc welding of non-alloy and fine grain steels – Classification
AS/NZS5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
AS/NZS ISO 17632	Welding consumables – Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of non-alloy and fine grain steels – Classification (ISO 17632:2004 , MOD)
AS/NZS ISO 17634	Welding consumables – Tubular cored electrodes for gas shielded metal arc welding of creep-resisting steels – Classification (ISO 17634:2004 , MOD)
AS/NZS ISO 18276	Welding consumables – Tubular cored electrodes for gas shielded and non-gas shielded metal arc welding of high-strength steels – Classification (ISO 18276:2005 , MOD)

- b) In this specification Australian Standards are referred to only by their allocated AS number. The latest available edition (including interim editions) at the date of close of Tenders shall be deemed to apply.

This page intentionally left blank.

Policy 11: Land Development Guidelines

SS1

Appendices

C	Consulting Engineer's Certificate and As Constructed Certification
C1-A	Typical Hold/ Witness Point Inspection Checklist Sewer Reticulation
C1-B	Rectification Summary List
C1-C	Sewerage Completed Works Matrix
C1-D	Site Inspection Summary List
C1-E	Sewerage Standard Drawings

This page intentionally left blank.



Gold Coast City Council
 Surfers Paradise Office
 P O Box 5042
 GOLD COAST MAIL CENTRE QLD 9729
 Email: gcccmal@goldcoast.qld.gov.au
 Web: goldcoastcity.com.au

Office Use Only

FN:
 PFN:
 SN:
 SS:
 BN:
 RN:

Appendix C

Consulting Engineer's Certificate and As Constructed Certification

Development Name: Stage No:
 Council File No:
 Works to which Certification relates:

PROPERTY DETAILS

Real Property Description:
 Area of Land:
 Address:

CONSULTANT

a) Company Name:
 b) Address:
 c) Phone No: Fax No:

I, being a Registered Professional Engineer registered under the provision of the **Professional Engineers Act 2002** (as amended) and a duly authorised representative of do hereby certify that we have exercised reasonable skill, care and diligence to ascertain that the Works described above have been executed in accordance with:

1. The approved Engineering Drawings, Specifications, Development Guidelines and relevant Australian Standard Code of Practice.
2. Good engineering practice and to a satisfactory standard of workmanship.
3. Council's By-Laws.

We further certify that the 'As Constructed' information submitted herewith (including survey information prepared by others) indicates to the best of our knowledge and belief that the completed Works represent a true and accurate record of what has been constructed within the specified tolerances required by Council.

We further certify that all significant variations from the approved Engineering Drawings (outside the specified tolerances) have been submitted to Council for approval and are incorporated in the 'As Constructed' information.

Signature: RPEQ No: Date / /

Consulting Engineer for and on behalf of (Company):

Appendix C1-A Typical Hold/ Witness Point Inspection Checklist Sewer Reticulation

Development Name:		Contractor:		Key:			
Stage No:	File No:			No	Item Number	C/R	Contractor Representative
Line No's Inspected:				H	Hold Point	E/R	Engineer/ Consultant Rep
				W	Witness Point	Coun	Council Inspector
No. H/W	Inspection Activity	C/R	E/R	Coun	Record/ Results or Other Supporting Documentation		
Preparation							
1W	Existing services located and marked clearly (if applicable).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
2W	Approved material supplier.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Material Handling and Storage							
3W	All pipe materials delivered as ordered without damage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
4W	All fittings delivered as ordered without damage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
5W	All bedding material to Council standard and stored on-site without contamination.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
6W	All pre-cast manholes components supplied on-site without damage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
7W	Maintenance shafts & rodding end components supplied on-site without damage.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Trench Excavation							
8W	Width and depth to Council standards.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
9W	If Ground water is present, diversion drains as required.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
10W	Pipe laid, level and grade.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		Certification of 80% compliance prior to Survey plan sealing.	
11H	Pipe embedment, bedding depth to specification.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Trench Backfill							
12W	Backfill material in accordance with the drawings and/or Council specifications. Marker tape installed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
13H	Backfill compaction tests meet Council requirements.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Manholes							
14W	Manholes greater than 4 metres deep – approved protective lining.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
Manholes Pre-Cast							
15H	Approved pre-cast base and compression seals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			

No. H/W	Inspection Activity	C/R	E/R	Coun	Record/ Results or Other Supporting Documentation
16W	Megapoxy circumference of concrete surround to Converter slab.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17W	Megapoxy conical shaft (converter shaft) to vertical shaft in 4 x 100mm long locations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18W	If gradient of surround is 1 in 3 or greater, the surround is to be doweled to the converter shaft.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19W	Rubber seal frame to cover.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20W	At type x drops, hydrophilic and Megapoxy incorporated into opening in manhole shaft.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Manholes Cast In Situ					
21H	Hydrophilic seal at all inlet and outlet pipes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
22W	All construction joints (base to wall & wall to wall) to have waterstops.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
23W	Shaft to converter slab to surround to have reinforcement steel and appropriate joint preparation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24W	Concrete has been vibrated appropriately.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Maintenance Shafts					
25H	Approved type and componentry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
26W	Concrete supports installed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
27W	Drainage pipes installed (if applicable).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
28W	Riser is vertical.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
29W	Lock down quick release end caps.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Rodding Ends					
30H	Approved type and componentry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
31W	Concrete supports installed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
32W	Drainage pipes installed (if applicable).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
33W	Riser is vertical.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
34W	Lock down quick release end caps.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

No. H/W	Inspection Activity	C/R	E/R	Coun	Record/ Results or Other Supporting Documentation
Property Connections: Junctions – Type A & B					
35H	Approved type and componentry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
36W	Concrete under supports for PP and PVC.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Property Connections: Junctions – Type D only					
37H	Approved type and componentry.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
38H	Location marker installed & attached to stake – 500mm clear of tee.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
39W	Location markers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Survey/ As Constructed					
40W	Detailed survey.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
41W	All house connection branches GDA Coordinated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
42H	CCTV of Sewer lines.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Council Connections					
43H	New main on grade and level with existing stub.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
44W	End of main clearly marked – location pipe & marker tape raised to surface.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Testing					
45H	Pressure/ Vacuum & Oxality test passed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Notes:

- 1 This Inspection Checklist does not cover environmental or safety items.
- 2 For rising mains, use Water Reticulation Hold/ Witness Point Inspection Checklist and develop specific Checklist points for the Works.
- 3 For additional items such as Jacked pipes, Tunnel shafts and Pump Stations develop specific Checklist points for the Works.

Appendix C1-B Rectification Summary List

No. HW	Defect Details	Date	(GCCC) Approved	Verification
			<input type="checkbox"/>	I certify that the Works have been constructed in accordance with Gold Coast City Council Land Development Guidelines and Specifications. Contractor Representative: Date:
			<input type="checkbox"/>	
			<input type="checkbox"/>	
			<input type="checkbox"/>	
			<input type="checkbox"/>	
			<input type="checkbox"/>	
			<input type="checkbox"/>	
			<input type="checkbox"/>	

Contractor Representative

Consultant Representative

Subdivision Inspector

Appendix C1-C Sewerage Completed Works Matrix

No. H/W Activity	Sewerage Line Numbers									
	1	2	3	4	5	6	7	8	9	10
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

No. H/W Activity	Sewerage Line Numbers									
	1	2	3	4	5	6	7	8	9	10
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
29	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

