# Brisbane City Council

# Reference Specifications for Engineering Work

# S160 Drainage

## Amendment Register

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| --- | --- | --- | --- |
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| 3.2.5 | Steel reinforced concrete pipe section renumbered, extensively modified including requirements for repair of minor defects |
| 3.2.6 | Installation requirement modified to reflect withdrawal of BCC Standard Drawing UMS 302 |
| 3.2.8 | Flexible pipes section added |
| 3.3 | Precast box culverts – modification to supply standard note for large box culverts, formatting change on backfilling requirements. |
| 3.4 | Gullies and manholes – requirements for connections to existing infrastructure modified. |
| 4.0 | 1.3 | Australian Standard reference modified in third paragraph of Section 1.3. | Apr 2014 |
| 1.3, 3.4 | Requirements for the supply of Gully Grates and Frames revised to include assessment criteria for proprietary products. |
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| 3.7 | Precast components requirements modified |
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| 3.2.2and 3.2.3 | New sections for Pipework Layout and Gully To Gully Drainlines/Gully Manholes added to specification |
| 7.0 | 3.4.4 | Manhole design details updated. | Nov 2018 |
| 3.4.6 | Manhole and gully depth and step iron requirements amended. |
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| 1.2 | Reference to Australian Standard corrected. |
| 1.3 | Standard Drawing references added. |
| 3.3 | Proprietary product name removed. |

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## TABLE OF CONTENTS

1.0 GENERAL 1

1.1 Section Content 1

1.2 Standards 1

1.3 References 1

1.4 Definitions 2

2.0 QUALITY 2

2.1 Quality System 2

2.2 Inspection 2

2.3 Contractor’s Submissions 3

3.0 EXECUTION 3

3.1 Existing Services 3

3.2 Stormwater Drains 3

3.2.1 General 3

3.2.2 Pipework Layout 3

3.2.3 Gully to Gully Drainlines/Gully Manholes 3

3.2.4 Tolerances 4

3.2.5 Pipe surround 4

3.2.6 Defects generally 5

3.2.7 Steel reinforced concrete pipes 5

3.2.8 Fibre reinforced concrete pipes 8

3.2.9 uPVC pipes 9

3.2.10 Flexible pipes 9

3.3 Precast Box Culverts 10

3.4 Gullies and Manholes 11

3.4.1 Gully Grates and Frames – Technical Requirements 11

3.4.2 Gully Lintels – Technical Requirements 12

3.4.3 Trench Grates 12

3.4.4 Manholes 12

3.4.5 Manhole Lids and Risers 12

3.4.6 Construction 12

3.5 Inlets and Outlets 12

3.6 Roofwater Pits 12

3.7 Precast Drainage Structures 13

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## GENERAL

### Section Content

This specification covers the construction of piped stormwater drainage and associated elements.

### Standards

|  |  |  |
| --- | --- | --- |
| Australian/New Zealand Standard | AS/NZS1260 | PVC-U pipes and fittings for drain, waste and vent application |
| Australian/New Zealand Standard | AS/NZS1462.22 | Methods of test for plastics pipes and fittings - Method for the determination of pipe stiffness |
| Australian Standard | AS 1646 | Elastomeric seals for waterworks purposes |
| Australian Standard | AS 1657 | Fixed platforms, walkways, stairways and ladders – Design, construction and installation |
| Australian Standard | AS 1830 | Grey cast iron |
| Australian Standard | AS 1831 | Ductile cast iron |
| Australian/New Zealand Standard | AS/NZS2032 | Installation of PVC pipe systems |
| Australian/New Zealand Standard | AS/NZS2566.1 | Buried flexible pipelines – Structural design |
| Australian/New Zealand Standard | AS/NZS2566.2 | Buried flexible pipelines – Installation |
| Australian/New Zealand Standard | AS/NZS3679.1 | Structural steel – Hot-rolled bars and sections |
| Australian/New Zealand Standard | AS/NZS3725 | Design for installation of buried concrete pipes |
| Australian Standard | AS 3996 | Access covers and grates |
| Australian/New Zealand Standard | AS/NZS4058 | Precast concrete pipes (pressure and non-pressure) |
| Australian Standard | AS 4139 | Fibre reinforced concrete pipes and fittings |
| Australian/New Zealand Standard | AS/NZS5065 | Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications |
| Australian Standard | AS 5100.5 | Bridge design – Concrete |
| Australian/New Zealand Standard, International Standards Organization | AS/NZS ISO 9001 | Quality management systems – Requirements |

### References

|  |  |  |  |
| --- | --- | --- | --- |
| Queensland Department of Transport and Main Roads | Technical Specification | MRTS24 | Manufacture of precast concrete culverts |

Refer to the following other Reference Specifications for Engineering Works:

|  |  |
| --- | --- |
| S110 | General Requirements |
| S140 | Earthworks |
| S150 | Roadworks |
| S170 | Stonework |
| S200 | Concrete Work |

Refer to the following Standard Drawings:

|  |  |
| --- | --- |
| BSD-2042 | Trench restoration – Road crossing – Flexible pavements |
| BSD-2043 | Trench restoration – Verges and paths |
| BSD-8001 | Minimum pipe cover – Steel reinforced concrete pipes |
| BSD-8002 | Minimum pipe cover – Fibre reinforced concrete pipes *(Currently withdrawn)* |
| BSD-8003 | Construction loading typical detail |
| BSD-8011 | Bedding methods for rigid and flexible drainage pipes |
| BSD-8021 | Storm water manhole details |
| BSD-8023 | Manhole roof slab 1350 to 1950 diameter |
| BSD-8024 | Manhole roof slabs 1980 diameter extended 600 and 900 |
| BSD-8025 | Reinforced concrete roof slabs for manhole chambers |
| BSD-8031 | Manhole frame roadway and non-roadway 1050 to 1500 diameter |
| BSD-8032 | Riser details roadway |
| BSD-8033 | Manhole cover roadway 1050 to 1500 diameter |
| BSD-8034 | Manhole cover non-roadway 1050 to 1500 diameter |
| BSD-8035 | Manhole cover concrete infill pedestrian traffic |
| BSD-8051 | Type A gully lip in line |
| BSD-8052 | Type A gully kerb in line |
| BSD-8053 | Type A grate |
| BSD-8054 | Type A grate frame |
| BSD-8055 | Type A gully precast concrete lintel (extended kerb inlet) |
| BSD-8071 | Hydraulic capture charts lip in line gully on grade |
| BSD-8082 | Hydraulic capture charts kerb in line gully sag conditions |
| BSD-8101 | Inlets and outlets concrete stormwater drains |
| BSD-8102 | Inlets and outlets stone pitched stormwater drains |
| BSD-8112 | Rood water inspection manholes for low density |

### Definitions

Pipe surround: Pipe bed, haunch, side and overlay zones as applicable and as defined in the relevant Australian Standards.

Half round pipe drains: Surface drains lined with half round pipe including the necessary bedding and jointing.

Grated trench: Precast or cast in situ concrete lined trench with hot-dipped bitumen coated cast iron or galvanised steel grating. A high maintenance device – not acceptable for use on public roads or pathways.

## QUALITY

### Quality System

* The supplier must maintain a Quality Assurance System with third party accreditation to *AS/NZS ISO 9001*.

### Inspection

Witness points

*Refer annexure.* Give sufficient notice so that inspection may be made of the following:

* Excavated surfaces prior to placing pipe bedding material.
* Pipes and other precast concrete components prior to acceptance on site (refer Table 3.4).
* Pipe joints prior to covering.
* Formwork and reinforcement prior to placing cast in situ concrete
* Placing of cast in situ concrete.
* Works ready for specific testing.
* Surfaces prior to application of coatings and applied finishes.
* Concealed and underground work prior to covering, concealing or backfilling.

### Contractor’s Submissions

Submit the following information if requested by the Superintendent.

* Manufacturer’s conformance report for each batch of precast products delivered to the site, confirming that these products comply with the requirements of the nominated Australian Standards.
* Details of the proposed precast manholes, gullies, pits and head walls, and methods for concrete repairs.
* An outline of the sampling and test program by which the manufacturer monitors compliance with this specification.

## EXECUTION

### Existing Services

If an existing service or structure (which is to be retained) crosses the line of a required trench, provide permanent support for the existing service or structure.

### Stormwater Drains

#### General

* Design life: 150 years.
* Changes in direction: All changes in direction to occur at a manhole.
* Anchor blocks: Manholes to be designed as anchor blocks where needed to restrain lateral movement of the pipelines at junctions and changes of grade or direction.
* Encasement: Where encasement is specified, place 20 MPa concrete to not less than 150 mm above and below the pipe and 150 mm each side or the width of the trench, whichever is the greater and 500 mm in either direction from the or defect being bandaged.
* Brisbane City Council standard products to be used and installed.
* Minimum grade to be 1in300.

#### Pipework Layout

Underground stormwater pipework layout should, in most cases, be the conventional herringbone layout.

#### Gully to Gully Drainlines/Gully Manholes

In the gully to gully systems, pipes are connected between gully pits instead of manholes, with both the inlet and outlet pipes connected to the gully pit walls. (Note: The conventional gully pit has only the outlet pipe connection to the main trunk drainage line). Refer to Figure 3.1.

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| Sketch showing desired underground stormwater layout.  The detail contained within this Brisbane City Council Reference specification is of a technical nature and as such is not accessible. For assistance accessing and interpreting this Reference specification please contact Council on 07 3403 8888. |
| Figure 3.1 – Typical Gully Layout |

Gully to gully drainlines are acceptable for pipes 600mm diameter or less, provided that all the following Council requirements are satisfied.

1. Gullies are consistent with Council’s Standard Drawings;
2. Acute angles in connecting pipes are avoided to minimise head losses;
3. Potential interference with other utility services on the footpath is avoided;
4. The major drainage line (spine) of the gully to gully system is constructed on one side of the road only. Any gullies on the opposite side of the road should be connected directly across the road. Under no circumstances are spines of gully to gully systems permitted on both sides of the road;
5. The gully pit is appropriately benched.

Gully manholes in Brisbane City are not permitted without written approval from the Principal Engineer, Strategic Asset Management Planning. The stringent approval process ensures that Council’s performance and maintenance objectives are met to maximise the serviceability of the asset, and to achieve sustainable level of ongoing maintenance and replacement program by using standardised components to the maximum practicable extent.

Gully manholes may be approved subject to compliance with all the following criteria.

1. The inlet and manhole is at the same point, for example: at the sag of the road;
2. It is the only alternative to a multi-grated inlet, for example: in relief drainage works where utility services locations pose major constraints;
3. Written advice from the responsible utility authority is submitted, stating that the existing services will preclude the construction of the conventional herringbone drainage pattern;
4. Council’s standard components such as lintels and grates should be used wherever possible. Hydraulic analysis and structural testing data should accompany any request for approval to use alternative components.

#### Tolerances

Place pipelines in accordance with the Table 3.1. The specified tolerances are conditional on falls to outlets being maintained.

Table 3.1 – Pipeline maximum tolerances

| Alignment | Angular deviation from required alignment | Displacement from required alignment |
| --- | --- | --- |
| Horizontal | 1V in 300H | 15 mm |
| Vertical | 1V in 500H | 5 mm |

#### Pipe surround

Pipe surround/bedding: To *Standard Drawing BSD-8011*. Construct bed, haunch, overlay and side zone using 5 mm or 10 mm screenings, or alternatively bedding sand. Bed drainage pipes in trenches on a continuous underlay of compacted bedding material. Place material in the pipe surround in layers not more than 200 mm loose thickness and compact without damaging or displacing the pipe. Comply with Table 3.2 for screenings grading requirements

Table 3.2 – Screenings particle size distribution limits

| A.S. sieve size | % passing by weight | |
| --- | --- | --- |
| 5 mm nominal size | 10 mm nominal size |
| 13.2 mm |  | 100 |
| 9.50 mm |  | 85 – 100 |
| 6.70 mm | 100 |  |
| 4.75 mm | 85 – 100 | 0 – 20 |
| 2.36 mm | 0 – 40 | 0 – 5 |
| 0.075 mm | 0 – 2 | 0 – 2 |

Bedding sand: The sand must be washed and screened; comprising approved inert materials having clean, hard, strong, durable, uncoated grains, free from dust, clay, soft or flaky particles, organic matter, loam or other deleterious substances. Comply with Table 3.3 for grading requirements.

Table 3.3 – Grading of bedding sand

| A.S. sieve size (mm) | Passing (% by weight) |
| --- | --- |
| 9.5 | 100 |
| 4.75 | 95 – 100 |
| 2.36 | 75 – 90 |
| 1.18 | 15 – 25 |
| 0.60 | 10 – 20 |
| 0.30 | 5 – 10 |
| 0.15 | 0 – 5 |

Support: Do not use rigid sills to support pipes. Partially filled sandbags, containing screenings or bedding sand, may be used to establish bedding levels prior to placing screenings or bedding sand to provide continuous support along the pipe.

#### Defects generally

Structural defects (including spalling to rigid pipes or crushing and creasing of flexible pipes): Repair affected pipes if the defects are isolated to one or two pipe lengths in the entire line. Remove and replace affected pipeline if defects are found for more than two pipe lengths.

Joint defects: Repair displaced or open joints. Replace affected pipes if the defect will allow penetration of material from the embedment zone, or if the defect will affect the structural integrity of the pipeline.

Serviceability defects: Remove silt and debris.

#### Steel reinforced concrete pipes

Standards

Supply: Generally to *AS/NZS 4058*. Provide minimum cover to reinforcement in accordance with the durability provisions of *AS 5100.5* for the appropriate exposure classification and manufacturing process (by spinning or rolling, or by wet casting).

Installation: To *AS/NZS 3725*. Select appropriate compaction plant compatible with the minimum pipe cover in accordance with *Standard Drawing BSD-8001*.

Pipe selection

Pipes 900 mm diameter: Use spigot and socket pipes with rubber ring joints.

Pipes >900 mm diameter: Use flush jointed pipes where the ground conditions are stable and infiltration or exfiltration is insignificant. Use rubber ring jointed spigot and socket pipes where water seal is essential, and some ground movement is expected.

Pipe jacking: Select pipe type and special jacking joint to suit the application.

Laying

General: Trim pipes where necessary to suit manholes, gullies and other structures. Lay pipes with the top, as marked, up. Plug lifting holes with the pipe manufacturer's supplied plugs. Do not make joints under water.

Installation: To *AS/NZS 3725*. Select appropriate compaction plant compatible with the minimum pipe cover in accordance with manufacturer/supplier requirements. Compact backfill in layers using specified design compaction plant. Refer to supplier design aids and *Standard Drawing BSD-8001* for standard compaction plant compaction depths and *Standard Drawing BSD-8003* for typical longitudinal section design requirements to show design compaction equipment.

Spigot and socket pipes: Lay pipes with the socket facing up the grade. After the bedding material has been placed correctly, excavate a hole for the pipe socket carefully by hand so there is uniformity of support along the pipe barrel.

Flush jointed pipes: Abut pipes against one another such that the alignment of the lip at the inside of the joint between the two pipes does not exceed 5 mm, such as for culverts under roads.

Pipe jacking: Use in locations where open trenches would cause major disruption to traffic and existing installations. Excavate jacking pits at intervals along the pipe alignment. Position pipes in the jacking pit. Drive pipes through the ground by hydraulic jacks. Grout the annulus between the pipe and the excavation. Complete packing and banding around the joint.

Rubber ring joints

General: Keep rubber rings clean and free from contaminants. Store rings under cover if pipes are not installed within a few days to prevent ultraviolet degradation.

Installation: Clean and dry spigots, sockets, and rings. Stretch the rubber ring evenly and place ring in the groove at the end of the spigot, free of any twists. Align the pipe carefully so that the rubber ring touches the socket all the way around. Make joint by pushing or pulling the pipe home. Assemble the rolling rubber ring dry without the use of lubricant.

Correct jointing: Rubber is simultaneously rolled and compressed evenly at all points around the joint and there is no skidding or pushing of the concrete pipe past the rubber ring. Immediately after assembly use a feeler gauge around the spigot circumference to check that the rubber ring is in the correct position, and that there is clearance between the spigot and socket.

Flush joints

External elastomeric band: Keep rubber rings clean and free from contaminants. Store rings under cover if pipes are not installed within a few days to prevent ultraviolet degradation. Fit half of the width of the band over the end of the pipe and fold back the remaining half. Excavate bedding material to allow band to be fitted. Line up the other pipe, home the joint, and flip the folded band over the joint.

Internal mortar joint: Fill the internal annular space generously with cement mortar. Extend mortar joint to cover at least the bottom half of the pipe. To minimise movement, apply mortar after the trench has been backfilled. Apply mortar on wet surfaces. Clean and smooth the mating faces. Mortar to consist of one-part cement to three parts clean sharp sand (by volume) and mixed with only sufficient water to obtain the required consistency. The time between mixing and use must not exceed 30 minutes. Do not re-temper. Cure mortar for at least 48 hours. Protect green mortar from water erosion.

Pipes <1050 mm diameter: Make jointing using external elastomeric band.

Pipes ≥1050 mm diameter: Make jointing using both external elastomeric band and internal cement mortar joint.

Inspection and acceptability

Acceptability of pipes with defects upon delivery to site: Inspect each pipe for pipe wall and joint surface defects in accordance with Table 3.4.

Table 3.4 – Acceptability of pipes upon delivery to site

| Defect type | Defect description | Acceptability |
| --- | --- | --- |
| 1 & 2 | Cracks up to 0.10 mm wide (measured at a depth of 3 mm) and not extending through the pipe wall |  |
| Pipes 900 mm diameter | Acceptable after repair |
| Pipes ≥900 mm diameter | Acceptable |
| 3 | Cracks 0.10 mm wide but 0.50 mm wide (measured at a depth of 3 mm) or cracks extending through the pipe wall | Acceptable after repair and passes standard load test |
| Cracks 0.50 mm wide | Not acceptable |
| 4 | Dents, bulges, chips and spalls of depth/height up to 2.5 mm and length up to 50 mm | Acceptable |
| Surface blowholes not exceeding 4 mm depth and 10 mm diameter | Acceptable |

| Defect type | Defect description | Acceptability |
| --- | --- | --- |
| 5 | Dents, bulges, chips and spalls of depth/height up to 5 mm and length up to 50 mm | Acceptable after repair |
| Surface blowholes not exceeding 5 mm depth and 50 mm diameter | Acceptable after repair |
| Bony patches of depth up to 5 mm and extending in any direction for no more than 50 mm | Acceptable after repair |
| Bony patches on socket back walls of depth up to 5 mm | Acceptable after repair |
| Visible inclusions of foreign matter, with a total surface area less than 0.1% of outside pipe surface area (either inside or outside), with no individual inclusion greater than 400 mm2 in area | Acceptable after repair |
| 6 | Dents, bulges, chips and spalls of depth/height greater than 5 mm | Not acceptable |
| Surface blowholes exceeding 5 mm depth | Not acceptable |
| Bony patches exceeding 5 mm depth | Not acceptable |
| Above defects confined to socket joints | Acceptable after repair |
| 7 | Visible inclusions of foreign matter, with a total surface area exceeding 0.1% of outside pipe surface area (either inside or outside), or an individual inclusion exceeding 400 mm2 in area | Not acceptable |
| Above defects confined to socket joints | Acceptable after repair |

Note: Classification of defects by type is generally based on *AS/NZS* *4058*.

Acceptability of installed pipes: Inspect each pipe for pipe wall and joint surface defects in accordance with Table 3.5.

Table 3.5 – Acceptability of installed pipes

|  |  |  |
| --- | --- | --- |
| Defect type | Defect description | Acceptability |
| 1 & 2 | Insignificant cracking ≤0.15 mm wide |  |
| * Circumferential crack | Acceptable |
| * Longitudinal cracks ≤300 mm length | Acceptable |
| * Longitudinal cracks 300 mm length | Use repair method A |
| 3 | Significant cracking 0.15 mm wide | Replace pipe or structural reline (repair method B) |
| Structural damage | Significant damage to collar or ends of pipe during installation, or significant gouging or physical damage sustained through other construction activities eg exposed reinforcement | Replace pipe preferably at the time of installation |

Note: Classification of defects by type is generally based on *AS/NZS 4058*.

Repair materials: Use repair materials that can be demonstrated to be suitable for the intended application and having a tensile or bond strength not less than that of the concrete in the pipe.

Repair Method A (Figure 3.2): Generally appropriate for longitudinal cracks. Apply epoxy resin at a thickness of not less than 1 mm to fill cracks. Extend epoxy repair to cover at least 100 mm past the crack in all directions. Inspect repaired area after the resin compound has adequate time to cure and set. Achieve a smooth repair finish consistent with that of the original pipe surface.

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| Image showing desired repair method for longitudinal cracks in a concrete stormwater pipe.  The detail contained within this Brisbane City Council Reference specification is of a technical nature and as such is not accessible. For assistance accessing and interpreting this Reference specification please contact Council on 07 3403 8888. |
| Figure 3.2 – Repair Method A |

Repair Method B (Figure 3.3): Generally appropriate for circumferential cracks on the internal surface. Apply liner and grout to cover at least 200 mm past the crack in all directions or structural reline pipe between manholes. Maintain the original hydraulic design characteristics after repair.

|  |
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| Image showing desired repair method for circumferential cracks on the internal surface of a concrete stormwater pipe.  The detail contained within this Brisbane City Council Reference specification is of a technical nature and as such is not accessible. For assistance accessing and interpreting this Reference specification please contact Council on 07 3403 8888. |
| Figure 3.3 – Repair Method B |

Repair method C: Generally appropriate for circumferential cracks on the external surface. Install an approved bandage over the cracks.

Alternative repair methods: The manufacturer may submit alternative standard documented repair practices for approval by Council Delegate.

#### Fibre reinforced concrete pipes

Supply: To *AS 4139*. Supply ≤450 mm diameter pipes pre-socketed at one end with a factory fitted ‘Adcol’ coupling. Supply >450 mm diameter pipes with a purpose machined internal spigot and socket system within the pipe wall.

Installation: To *AS/NZS 3725*. Select appropriate compaction plant compatible with the minimum pipe cover in accordance with manufacturer/supplier requirements. Compact backfill in layers using specified design compaction plant. Refer to supplier design aids for standard compaction plant compaction depths and *Standard Drawing BSD-8003* for typical longitudinal section design requirements to show design compaction equipment. *Standard Drawing BSD-8002* has been withdrawn from service; however it is available for reference.

‘Adcol’ joint: Place the V-shaped rubber ring onto the special machined groove near the spigot end of the pipe, with the pointed side of the ring facing outwards. Ensure that the spigot and socket are free from dirt. Apply a generous coating of the manufacturer’s recommended lubricant to the inside of the socket and pipe spigot. Insert the pipe end into the coupling or socketed end of the previously laid pipe. Keep the pipe as close to horizontal as practicable. Push pipe home using leverage tools, such as a crowbar and wooden block, without damaging the pipe or joint.

Deflecting pipes: Make deflection after jointing. Comply with the manufacturer’s recommendations for the limits on joint rotation.

Cutting pipes: Cut pipes where necessary to suit manholes, gullies and other structures. Trim cut ends back about 6 mm to virgin material.

#### uPVC pipes

Scope of application: Generally only suitable for internal roofwater drainage reticulation. Do not use in road reserve.

Supply: To *AS/NZS 1260*.

Installation: To *AS/NZS 2032*. Select appropriate compaction plant compatible with the minimum pipe cover in accordance with manufacturer/supplier requirements. Compact backfill in layers using specified design compaction plant. Refer to supplier design aids for standard compaction plant compaction depths and *Standard Drawing BSD-8003* for typical longitudinal section design requirements to show design compaction equipment.

Laying: Lay and joint pipes in the excavation. Where pipes are jointed at ground level, lower into the excavation without being dropped, or the pipe and joints being strained.

Exposure to sunlight: Minimise distortion caused by uneven heat absorption where one side is exposed to the sun and the other is in the shade.

Jointing: Maintain even heat around the circumference of the pipe during the jointing process. Join uPVC drainpipes by solvent welding or rubber rings. Where uPVC pipes are to be jointed to concrete or fibre cement pipes, the uPVC surface must be prepared by coating with solvent cement and blinding with clean, sharp sand. A mortar joint can then be made. Slotted uPVC pipes must be dry jointed.

Setting of pipes in concrete: Provide a polyethylene membrane around the pipes and fittings to permit movement without scoring the pipe.

#### Flexible pipes

Type B flexible pipe: A polypropylene/polyethylene pipe or fitting with a smooth inside surface and a solid or hollow helical or annular ribbed or corrugated external surface.

Supply: To *AS/NZS 5065*.

Design and installation: To *AS/NZS 2566.1* and *AS/NZS 2566.2*.

Minimum pipe cover: 0.6 m to the underside of a road pavement (subgrade box level), in addition to the requirements of *Reference Specification for Engineering Works S145 Installation and Maintenance of Utility Services* (Table 5.1).

Maximum pipe cover: 5.0 m embankment height.

Stiffness tested in accordance with *AS/NZS 1462.22*: The initial short-term stiffness must not be less than 8000 N/m/m (pipe class SN8). For non-creep affected composite pipes, the minimum long term stiffness must not be less than 2000 N/m/m.

Inspection and acceptability: Where the diametral deflection (ovality) measurement limits are exceeded and/or where the alignment tolerances are exceeded, reinstate trench embedment and relay pipe. Replace sections of pipe that are crushed or creased.

### Precast Box Culverts

Supply

Large box culverts: Generally in accordance with *Queensland Department of Transport and Main Roads Standard Specification MRTS 11.24 Manufacture of Precast Concrete Culverts*. Provide minimum cover to reinforcement in accordance with the durability provisions of *AS 5100.5* for the appropriate exposure classification and manufacturing process.

Small box culverts: Generally in accordance with *Queensland DTMR Department of Transport and Main Roads Standard Specification* *MRTS24 Manufacture of Precast Concrete Culverts*. Maximum nominal size, span 1200 mm by height 1200 mm. Provide minimum cover to reinforcement in accordance with the durability provisions of *AS 5100.5* for the appropriate exposure classification and manufacturing process.

Pipe or box culvert types: Use a pipe or box culvert of class appropriate to the method of bedding, depth of cover and construction equipment in use. Refer annexure.

Installation

General: Construct and install box culverts/culvert components at the locations specified. Install box culvert sections without abrupt changes in alignment or grade.

Minimum grade: 1 in 300.

Lifting: Lift box culverts according to manufacturer’s instructions.

Precast baseplates: Screed and compact bedding material (as specified for pipes) to not less than 75 mm thick after compaction. An extra baseplate must be laid in the line so that each crown is seated half on one baseplate and half on the next.

Unit placement: Place unit legs on a layer of 3:1 (by volume) sand cement mortar of suitable consistency. Lower units carefully into position. Strike off excess mortar. Cure and protect mortar from water erosion for at least 48 hours. Butt units hard together with any offset between the side walls of adjacent units not exceeding 5 mm for units up to 1200 mm wide and 20 mm for larger units. Place adjacent cells 20 mm apart (unless specified elsewhere). Plug the gap between the adjacent cells to a depth of 300 mm at each end using Grade N20 concrete with 10 mm aggregate. Fill the remainder of the gap with 1:12 cement stabilised sand (by volume).

Drain line construction: Trim base plates and inverted “U” units to suit manholes, gullies and other structures.

Lifting loops: Cut off at the concrete surface and seal the cut ends using an approved epoxy compound.

Sealing

Seal the butt joints externally between units by applying a 300 mm wide strip of high-performance moisture and water-resistant rubberised asphalt composite membrane incorporating a puncture and heat-resistant polypropylene reinforcing mesh. For multi-cell culverts, seal the top and legs against the earth.

Geometric tolerances

Alignment: The horizontal and vertical alignments of culverts must not exhibit noticeable irregularities.

Slope: Culverts must have a positive drainage slope along the whole of their length and, where relevant, join neatly to existing structures.

Horizontal tolerance: ±100 mm from the design alignment.

Vertical tolerance: ±10 mm from the design invert levels, provided that the culvert grade does not depart from the specified slope by more than 1% absolute.

Cover thickness: The minimum cover over the culvert must not be less than the specified thickness.

Backfilling

The compactive effort used during trench compaction must be less than the live load capacity of the box culverts at the current cover. The differential backfill height between each side of a culvert must not exceed 200 mm.

### Gullies and Manholes

#### Gully Grates and Frames – Technical Requirements

Standard gully grate and frame

Gully grates and frames to be supplied to *Standard Drawings BSD-8053* and *BSD-8054*.

Steel in gully grates and frames to conform to *AS/NZS 3679*. Testing and compliance certificates for the steel to be supplied upon request.

Proprietary gully grate and frame

Where a proprietary product is proposed to be used, the following assessment criteria are to be fulfilled:

The Australian Standard for gully grates is *AS 3996* and from this Standard all other associated Standards are listed and therefore compliance to those is also required. Steel in gully grates and frames to conform to *AS/NZS 3679.1*. Testing and compliance certificates for the steel to be supplied with any submission.

Hydraulic testing is not covered by any Australian Standard and therefore a proprietary Class ‘D’ Gully Grate manufacturer is to prove their capture results to Council through full scale hydraulic testing by a NATA registered laboratory (or equivalent to be approved by Council if the testing is done overseas).

The assessment of proprietary Class ‘D’ Gully Grates for use in Brisbane shall meet the following technical requirements:

* Full compliance with all relevant current Australian Standards including *AS 3996*;
* Full dimensional compliance with *Standard Drawing BSD-8054* (Type ‘A’ Gully Frame) without exception to ensure interchangeability with existing grates/frames in the field;
* Full dimensional compliance with *Standard Drawing BSD-8053* (Type ‘A’ Gully Grate), variations shall be submitted to Council for approval and ensure interchangeability with existing grates/frames in the field;
* Gully grates must be fully compatible with Council’s gully frame, as per *Standard Drawing BSD-8054*, including the locking of the grate in the open position, ensuring interchangeability with existing grates/frames in the field;
* Cast or fabricated grates other than that identical to *Standard Drawing BSD-8053* shall have equivalent or better hydraulic capture as shown by Council's Standard Hydraulic Capture Curves (refer to *Standard Drawings BSD-8071* to *BSD-8082*);
* If there are any variations to the Council’s grate as per *Standard Drawing BSD-8053*, then hydraulic capture curves and a report from a NATA registered laboratory for the relevant tests (or equivalent to be approved by Council if the testing is done overseas) must be submitted to Council for review and must include the following configurations:
* *Standard Drawing BSD-8051*: Type ‘A’ Gully – Lip-in-Line;
* *Standard Drawing BSD-8052*: Type ‘A’ Gully – Kerb-in-Line;
* All lintel sizes – 2.4 m, 3.6 m and 4.8 m;
* 2.5% and 3.3% cross-falls;
* Grades: 0% (Sag), 0.5%, 1%, 2%, 4%, 8%, 12% & 16%;
* Various approach flows up to 330L/s or more and to include interpolation of curves to 500 Litres per second;
* Derive a suitable blockage factor of the grate due to possible debris, leaves and litter flowing in the channel and apply to capture curves;
* Hydraulic testing to be carried on full size components only, no scaling of gullies, grates and lintels permitted;
* Capture curves shall be presented in same format as Council’s hydraulic capture curves, refer *Standard Drawings BSD-8071* to *BSD-8082*;
* Approved Capture Curves shall be available for public access.

#### Gully Lintels – Technical Requirements

Standard gully lintel (extended kerb inlet)

Gully lintels to be supplied to *Standard Drawings BSD-8055*.

#### Trench Grates

Trench grates or similar systems are not acceptable for use on public roads or pathways. Trench grates may be used on private installations.

#### Manholes

* Manholes (1,050mm to 1,500mm diameter, maximum 3.0m deep) Standard Drawing *BSD-8021*;
* Manholes (1,050mm to 1,500mm diameter, greater than 3.0m deep) to be individually designed and certified by an RPEQ;
* Manhole roof slab 1,350mm to 1,950mm diameter: *Standard Drawing BSD-8023*;
* Manhole roof slabs 1,980mm diameter extended 600mm and 900mm: *Standard Drawing BSD-8024*;
* Reinforced concrete roof slabs for manhole chambers: *Standard Drawing BSD-8025*.

#### Manhole Lids and Risers

Manhole Lids and Risers to be supplied to the following:

* Manhole frames: *Standard Drawing BSD-8031*;
* Manhole risers: *Standard Drawing BSD-8032*;
* Roadway manhole covers: *Standard Drawing* *BSD-8033*;
* Non-roadway manhole covers: *Standard Drawings* *BSD-8034* (cast iron) and *BSD-8035* (concrete infill).

#### Construction

Back forms

If approved, back forms may be omitted and concrete cast against the ground. Increase the concrete cover by 50 mm.

Benching

Bench manholes and chambers to half height of all pipes using solid concrete and render with a sand-cement mortar to a smooth finish. Shape the benching for efficient water flow.

Pipe connections

Existing infrastructure: Where breaking into existing gullies, manholes, chambers or pipes obtain the relevant permits and approvals. Repair the join to ensure the drainline continues to function at a standard equal to that prior to the connection being made.

Future connections: Provide a 100 mm diameter blockout in the uphill sidewall or sidewalls of all gullies for the future connection of side drains.

Step irons and ladders – manholes

Limit depth of standard manholes to 3,000 mm. For manholes between 1,200 mm and 3,000 mm deep, install step irons in accordance with *AS* *1657*.

Install fixed access ladders in manholes deeper than 3,000 mm, in accordance with *AS* *1657.*

Step irons and ladders – gullies

Limit depth of gully to 1,350 mm. For gullies deeper than 1,200 mm, install step irons in accordance with *AS* *1657*.

### Inlets and Outlets

To *Standard Drawing BSD-8101* or *BSD-8102*. If type is unspecified, obtain instructions.

### Roofwater Pits

To *Standard Drawing BSD-8112*. Use a proprietary product with well-sealed lid and surround. Bench pits to half height of all pipes with sand-cement mortar to provide efficient flow.

### Precast Drainage Structures

Approved structure types

The following precast cast concrete drainage components may be used:

* Manhole tops (Aspros);
* Gully lintel (extended kerb inlet) and integrated gully tops/kerb inlet units (all-in-one units comprising apron area, gully grate and frame and gully lintel): and
* Head walls.

Provided:

* They are rated by their manufacturers for the prevailing load and exposure conditions.
* Jointing details provide a watertight seal.
* Head walls are of the required configuration.
* Head walls specified as stone-pitched gravity structures are faced with stone pitching.

Unapproved structure types

The following precast cast concrete drainage components may not be used:

* Manhole shaft and chamber components and units; and
* Gully shaft and chamber components and units.