

Policy 11: Land Development Guidelines

SS5

Specification for Stormwater Drainage Construction

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1.0 General

- 1.1 This specification covers the construction of concrete kerb, kerb and channelling, stormwater drains, inter allotment drainage, manholes, gullies, gully connections, headwalls and other miscellaneous drainage works.

The specification applies to the supply, delivery, laying and jointing of drainage pipes, reinforced concrete box culverts and drainage works components including excavation, bedding and backfilling.

2.0 Acts, Regulations and Local Laws

- 2.1 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.

3.0 Existing Services

- 3.1 It shall be the Contractors 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 gas or water main, Telstra, or electric power cable or conduit or any other public utility.
- 3.2 Before undertaking any work which may interfere with any drain, 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.
- 3.3 If the Contractor damages any existing services it shall arrange for the relevant public utility authority to make good such damage and the cost thereof shall be borne by the Contractor.
- 3.4 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. 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.

4.0 Excavation

- 4.1 Excavation for stormwater drainage construction covered by this specification shall be completed to the lines and levels shown on the drawings.
- 4.2 Where the Contractor over-excavates, it shall make good the over-excavation at its own expense with bedding material as specified in **Table 1** herein or other material approved by the Superintendent.
- 4.3 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 pumping equipment 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.
- 4.4 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 approved material.
- 4.5 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.
- 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.
- 4.6 The Contractor shall be solely responsible for the maintenance of excavations and is liable for any damage, which may be caused, to any water pipe, public utility, conduit, etc., through the collapse of the excavation.

4.7 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.

4.8 **Extra Over for Rock:**

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 nett 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.

4.9 **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, and 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.

5.0 Pipe Bedding

- 5.1 All bedding and haunch material shall be crushed rock material complying with the requirements of **AS2758.1** and **AS1141** and of the nominal sizes shown in **Table 1** herein.
- 5.2 All proposed bedding and haunch material for stormwater drainage shall be subject to approval by the Superintendent.
- 5.3 Standard bedding and haunch material shall be of 10.0mm nominal size.
- 5.4 In wet or unstable ground conditions where the trench bottom requires further stabilizing, additional bedding of 20mm and/or 30mm nominal size (as directed by the Superintendent), shall be placed below the standard bedding to a depth determined by the Superintendent. Where ordered by the Superintendent an approved filter fabric shall be used in conjunction with the additional bedding.
- 5.5 The bed and haunch material shall be compacted for the full width of the trench by two passes of a vibrating plate or hand tamping method to the satisfaction of the Superintendent.

Table 1

AS. Sieve (mm)	Percentage Passing by Weight		
	Crushed Rock Nom Size 10.0mm (Standard Bedding)	Crushed Rock Nom Size 20mm (Additional Bedding)	Crushed Rock Nom Size 30mm (Additional Bedding)
37.5	-	-	100
26.5	-	100	80-100
19.0	100	90-100	70-90
13.2	80-100	50-80	60-80
9.5	30-45	30-40	50-70
6.7	-	0-5	
4.75	15-25		
2.36	2-8		

6.0 Reinforced Concrete Pipes and Box Culverts – Supply and Delivery

- 6.1 Reinforced concrete pipes and box culverts shall conform in all respects to the following Standards:
 - a) For **Precast Concrete Drainage Pipe – AS4058**;
 - b) For **Small Precast Reinforced Concrete Box Culverts – AS1597 Part 1**;
 - c) For **Large Precast Reinforced Concrete Box Culverts – AS1597 Part 2**.
- 6.2 Pipe classes shall be as shown on the drawings. Spigot and socket rubber ring jointed pipe shall be used up to and including 600mm diameter. For larger diameter pipes flush jointed external bandage joint shall be used unless shown otherwise on the drawings.
- 6.3 The outside and inside surface of the pipe shall be smooth, dense and hard and shall not be coated with cement wash or other preparation, unless so approved by the Superintendent.

- 6.4 All finished reinforced concrete pipes and box culverts shall, be subject to inspection and approval by the Superintendent.

Notwithstanding the above, all finished reinforced concrete pipes and box culverts shall be subject to final inspection at the Site and any pipes and box culverts which, independent of any physical tests specified herein, fail to meet the specified requirements will be rejected.

- 6.5 The Contractor shall provide a certificate of compliance from the manufacturer that the pipes supplied meet the requirements of **AS4058**.

7.0 Reinforced Concrete Pipes and Box Culverts – Laying and Jointing

- 7.1 Concrete pipes are to be installed to the requirements of **AS3725**.

- 7.2 Pipes, and precast or cast-in-situ box culvert bases shall be bedded on approved material as specified in **Clause 5.0** herein. The depth and extent of bedding and haunch support shall be as shown on the drawings or as specified. Cast-in-situ box culvert bases shall be constructed to the details shown on the drawings.

- 7.3 Pipe laying shall begin at the down stream end of the line with the socket or grooved ends of the pipe facing upstream. When the pipes are laid, the barrel of each pipe shall be in contact with the bedding material throughout its full length exclusive of the socket. Pipe sockets shall not bear on the bottom of the trench.

- 7.4 When elliptical pipes with circular reinforcement or circular pipes with elliptical reinforcement are used, the pipes shall be laid in such a position that the manufacturer' marks, designating the 'Top' or 'Bottom' of the pipe shall not be more than 5 degrees from a vertical plane through the longitudinal axis of the pipe.

- 7.5 For rubber ring joints the pipe ends shall be thoroughly cleaned before the joint is made. The two pipe sections shall then be tightly joined with their inner surfaces at the manufacturers nominated laying gap.

- 7.6 For flush jointed pipes, external bands shall be installed in accordance with the manufacturers recommendations.

- 7.7 Joints in box culvert segments shall be made using cement mortar to provide as thin a joint as possible. The external faces of the units shall be bandaged with 'Denso Tape 600' or approved equivalent 200 mm wide lapped by at least 100 mm.

Lifting holes in pipes and culverts shall be plugged with mortar, precast tapered plugs mortar or tape surrounded, or other approved means prior to backfill material being placed.

Cutting operations for concrete pipe and box culverts shall provide neat end surfaces. The cut surfaces shall be given two coats of a tar epoxy paint.

- 7.8 Joints shall not be made under water. The trench shall be de-watered to facilitate joint making and inspection. Precautions shall be taken to prevent erosion of joint material by moving currents of water.

- 7.9 Completed cement mortar joints shall be kept damp and protected from the direct rays of the sun until backfilling takes place.

- 7.10 Drainage lines shall be constructed to the tolerances set out in **Clause 12.0** herein.

8.0 uPVC Pipes – Supply and Delivery

- 8.1 uPVC pipes shall conform in all respects with the requirements of **AS1260**. The class of pipes shall be uPVC 'class SNB' designed for solvent weld spigot and socket connection. Prior approval for their use shall be subject to the requirements of the Local Authority.

- 8.2 uPVC pipes shall be supplied with sufficient quantities of solvent for making of the pipe joints.

- 8.3 uPVC pipes shall be transported, handled and stacked in accordance with manufacturer's recommendations.

- 8.4 The Contractor shall provide a Certificate of Compliance from the manufacturer that the pipes supplied meet the requirements of **AS1260**.

9.0 uPVC Pipes – Laying and Jointing

- 9.1 uPVC pipes are to be installed to the requirements of **AS2032**.

- 9.2 Pipe laying shall begin at the downstream end of the line with the socket end of the pipe facing upstream. When the pipes are laid, the barrel of each pipe shall be in contact with the bedding material throughout its full length.

- 9.3 The pipe ends shall be thoroughly cleaned before the joint is made. Jointing shall be in accordance with manufacturer's directions using jointing solvent.
- 9.4 Joints shall not be made under water. The trench shall be de-watered to facilitate joint making and inspection. Precautions shall be taken to prevent erosion of joint material by moving currents of water.
- 9.5 Drainage lines shall be constructed to the tolerances set out in **Clause 12.0** herein.

10.0 FRC Pipes – Supply and Delivery

- 10.1 FRC pipes and fittings shall comply with the requirements of **AS4139**.
- 10.2 The class of pipes shall be as shown on the drawings or in the Bill of Quantities.
- 10.3 Pipe size of 100mm and 150mm shall be normally in 2.0m length and 4.0m length for pipe sizes >150.
- 10.4 The pipes shall carry the manufacturers distinguishing mark, date of manufacture, nominal size and class of pipe.
- 10.5 The pipes shall be transported handled, stacked and protected in accordance with the manufacturers recommendations.
- 10.6 The Contractor shall provide evidence that compliance testing of process and proof load testing verify that the pipes supplied meet the manufacturers product specification.
- 10.7 Bends, junctions and associated couplings shall comply with the same requirements as for pipes.
- 10.8 Unless otherwise specified all pipe joints shall be made using an approved internal rubber ring joint.
- 10.9 The Contractor shall provide a Certificate of Compliance from the manufacture that the pipes supplied meet the requirements of **AS4139**.

11.0 FRC Pipes – Laying and Jointing

- 11.1 FRC pipes are to be installed to the requirements of **AS3725**.
- 11.2 Laying and jointing shall be in accordance with the manufacturers recommendations unless otherwise directed by the Superintendent.
- 11.3 Construction of pipelines on curves shall require the approval of the Superintendent and shall not be carried out at greater deflections than that recommended by the manufacturer. Where approved by the Superintendent, fittings with glued joints shall be concrete surrounded as directed or as shown on the drawings.
- 11.4 Joints shall not be made under water. The trench shall be de-watered to facilitate joint making and inspection.
- 11.5 Drainage lines shall be constructed to the tolerances set out in **Clause 12.0** herein.

12.0 Construction Tolerances

The contractor shall construct the works within the following tolerances:

Pipework:

Horizontal	± 150mm
Vertical	± 50mm
Grade ¹	

Manhole, Field Inlet, Property Pit, I O Structure and GPT:

Horizontal	Lateral	± 50mm
	Longitudinal	± 1000mm
Vertical	Surface Level	± 50mm
	Invert Level	± 50mm

Inlet Gully:

Horizontal	Match Kerb & Channel
Vertical	Match Kerb & Channel

Note 1: Minimum design grade shall be maintained.

13.0 Rubber Rings and Gaskets

13.1 Rubber rings and gaskets shall be manufactured and tested in accordance with **AS1646**.

14.0 Sub-Surface, Mitre Drains and Seepage Drains

14.1 Sub-surface, mitre drains, seepage and diversion drains shall be constructed in accordance with the drawings and where directed by the Superintendent.

14.2 Sub-surface and mitre drain backfill material shall be clean aggregate graded from 10mm to 20mm. Flushing points and sub-surface inlets are to be provided as shown on the drawings, and/or as directed. All sub-surface and mitre drains shall be tested by flushing to the satisfaction of the Superintendent. The cost of this work shall be included in the relevant Bill Item (if part of the Contract) and the Lump Sum of the Contract generally.

15.0 Backfilling

15.1 Under roadways and footpaths the backfill material above the haunch zone shall be compacted in layers not greater than 200mm thick to the standard specified in **Table 2** herein. 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).

15.2 In locations other than under roadways and footpaths (eg. allotments and parks, etc.) the backfill material shall consist of either of the following:

- a) the best of the material (selected and approved by the Superintendent) from trench excavation; or
- b) material from 'on-Site' earthworks selected and approved by the Superintendent.

If, in the Superintendent's opinion, material from item a) above is not suitable for backfilling then material from item b) above shall be used by the Contractor.

The backfill material (in locations other than under roadways and footpaths) shall be compacted to the standard specified in **Table 2** herein. Any settlement shall be made good by the Contractor, prior to the end of the Defects Liability Period.

15.3 Where work is being constructed on private property, the Contractor shall carry out such work with a minimum of inconvenience to the owner or occupier. All items located on such property including lawns, gardens, etc., shall be reinstated and left in the same condition as before the commencement of the work unless the owner or occupier of the property agrees otherwise in writing.

Table 2

Area of Work	Relative Compaction Required		Minimum Test Frequency ^{1,3}
	Cohesive Material	Non-Cohesive Material ²	
Backfill to Trenches Under roads to a depth 0.3m below sub-grade 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.*

15.4 All direct and associated costs regarding protection and reinstatement of public utility and services and the reinstatement of private property shall be deemed to be included in the relevant Bill Item (if part of the Contract) and the Lump Sum of the Contract generally.

15.5 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.

16.0 Gullies, Manholes, Inlets, Outlets and Other Structures

16.1 The grade of concrete to be used in the Works shall be as shown on the drawings. The manufacture, supply, handling, placing and curing of concrete shall comply with the requirements of **AS1379** and **AS3600**.

16.2 Steel reinforcing bars shall comply with the requirements of **AS1302**. Welded wire reinforcing fabric shall comply with **AS1304**.

16.3 Galvanising shall comply with the requirements of **AS1397**.

16.4 Formwork shall comply with the requirements of **AS3610**.

16.5 Reinforcing shall conform to the requirements of **AS1303** and **AS3600**.

16.6 Gullies, manholes, headwalls, and other miscellaneous structures shall be constructed to the forms and dimensions shown on the drawings. Where the ground is solid the Superintendent may permit that back forms need not be used in the construction of manholes and gullies, the concrete being poured against the earth. Where this is done, the thickness of the wall of such gullies or manholes 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.

16.7 The thickness of the walls of gullies and 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 and shall be concrete of minimum strength 15MPa.

16.8 Precast gullies, manholes, manhole lids and headwalls may be used provided the product is an approved product, listed on Gold Coast City Council's current 'Approved Product List for Stormwater Drainage'. The product shall be installed in accordance with the manufacturers recommendations.

16.9 Gully gratings, manhole covers and frames shall be provided as shown on the drawings. Gully grates/frames and manhole covers/frames to be incorporated into the Works, shall be approved products listed on GCCC's current 'Approved Products List for Stormwater Drainage'. The products shall comply with the following criteria:

- i) Be manufactured to meet the requirements of **AS3996 – Metal Access Covers, Road Grates & Frames**. The load requirements shall be:
 - a) Residential Streets – Class C (Std drawing 03-02-001);
 - b) Major Traffic Routes – Class D (Std drawing 03-02-002);
 - c) Rural Residential Street – Class C (Std drawing 03-02-003);
 - d) Industrial and Commercial Streets – Class D (Std drawing 03-02-004);
 - e) Council infrastructure within car parks, group title developments, etc., subject to vehicular traffic – Class C;
 - f) all other public places (including parks) – Class B;
 - g) private property (no vehicle access) – Class A.
- ii) Finished cast and ductile iron products shall be dipped in hot bitumen before leaving the manufacturer's works.
- iii) Finished steel products shall be hot dip galvanised in accordance with **AS1650**.
- iv) Be sized to ensure compatibility with the standard drawings.
- v) In addition to the markings specified in **Clause 1.6 a) – f)** of **AS3996**, the manufacturers product name, mass and reference code are to be permanently marked and be visible from above when the grate is in its installed position.
- vi) Side or end hinged grates may be used, provided the grate can be installed to the dimensions shown in GCCC standard drawings.
- vii) Casting inspection certificates shall be provided by the Contractor for all cast and ductile iron grates covers and frames incorporated in the Works.

17.0 Concrete Kerb, Kerb and Channel, Kerb Crossings

- 17.1 The foundation is to be thoroughly compacted prior to the placing of concrete. Compaction shall be equivalent to that of the adjacent pavement. Should the foundation material be incapable of effective compaction, it shall be removed and replaced with suitable material. The cost of this replacement shall be borne by the Contractor.
- 17.2 Concrete grade shall be as shown on the drawings and shall conform with the requirements of **Clause 16.1** herein.
- 17.3 The whole of the water channel cross-section shall be cast simultaneously ie casting of invert and kerb at different times will not be permitted.
- 17.4 Where kerb or kerb and channel is constructed by an extrusion process, the extrusion machine shall be fitted with a tamper and an automatic control which allows adjustment of the position of the forming mould while the machine is in operation. The horizontal and vertical alignments of kerb, kerb and channel and channel shall be controlled by means of sensor working to a control line. The finished kerb, kerb and channel or channel shall be well compacted and shall have exposed surfaces free from voids.
- 17.5 Prior to the placing of concrete all loose material shall be removed and the surface of the foundation shall be watered to produce a damp surface.
- 17.6 Rendering shall be used only when approved or directed by the Superintendent and shall be mixed in the proportion of one (1) part Portland Cement to two (2) parts fine sand.
Rendering to kerb and invert (when approved) shall be broken at the joints and shall show a neat joint line at right angles to the length of the kerb on top of the kerb and the invert of the channel. Joint lines shall not exceed 6mm in width and depth.
- 17.7 Connection of extruded kerb and channel to gully pits or existing kerb and channel shall be made by hand to give a smooth transition.
- 17.8 Concrete kerb and channel shall be subject to a water test within 24 hours of placing. The test shall consist of placing sufficient water at the high point to make the channel flow over its full length. The criteria for acceptance shall be that not more than 6mm of water ponds in the channel twenty minutes after the flow ceases. All testing shall be carried out in the presence of the Superintendent. A similar test may be required prior to the commencement and the expiration of the Defects Liability Period.
The cost of supplying all plant, tools, material and labour for carrying out the water test shall be deemed to be included in the relevant Bill Item (if part of the Contract) and the Lump Sum of the Contract generally.
- 17.9 The vertical alignments of kerb and kerb and channel shall not vary from that specified by more than $\pm 10\text{mm}$. The horizontal alignment of the kerb and kerb and channel shall not vary from that specified by more than $\pm 25\text{mm}$. Notwithstanding the above tolerances, the alignments of the kerb and kerb and channel shall have smooth lines. Minimum design grade shall be maintained.

18.0 Stone Pitching

- 18.1 Stone pitching shall be laid as shown on the drawings or elsewhere specified, and shall consist of sound igneous, metamorphic or approved sedimentary rock which will not disintegrate in water. Unless larger stones are specified in the Contract, the stones shall be not less than 0.015m^3 , and generally no dimension shall be less than 250mm; but where the face area of the stones is 0.1m^2 or greater the depth may be reduced to 150mm. The stones shall be properly bedded to even planes on approved loam or sand, and wedged together with broken rock.
- 18.2 Mortar for grouted stone pitching shall consist of one (1) part Portland Cement to three (3) parts of fine sand. Mortar shall be used within one (1) hour of mixing.
- 18.3 The mortar shall be applied by means of a trowel, and shall be worked between the stones, so that the interstices are completely filled as far down as practicable, but to a depth of at least 75mm. Exposed stone surfaces shall be cleaned free of any coating of cement mortar. The grouted stone shall be shaded and kept damp for at least 48 hours. After the mortar has set, if any stones are not firmly held in position, the mortar shall be removed around such loose stones and the area re-grouted.

19.0 Rubble Masonry

- 19.1 Rubble masonry shall be laid as shown on the drawings or elsewhere specified, and shall consist of sound igneous, metamorphic or approved sedimentary rock which will not disintegrate in water. Unless larger spalls are specified in the Contract, the spalls shall be not less than 0.015m³, except spalls for wedging.
- 19.2 Spalls shall be placed in cement mortar beds in horizontal layers. All spalls shall be thoroughly wetted before placing. All voids shall be filled with cement mortar and/or smaller size spalls.
- 19.3 Mortar for grouted rubble masonry shall be as for Stone Pitching. Hydrated lime may be incorporated into the cement mortar to the extent of 1 part hydrated lime to 10 parts cement (loose volume).

20.0 Measurement and Payment

- 20.1 Quantities in the Bill of Quantities have been computed on the following basis:
- i) Kerb, kerb and channel – per plan linear metre including vehicle crossings and access ramps (unless itemised separately).
 - ii) Stormwater line – per plan linear metre along the axis of the pipe or culvert between centre line of the manholes and gullies and up to the sealed or open end of the line.
 - iii) Other items of drainage works have been measured in the units indicated in the text of the item in the Bill, and based on the dimensions as shown on the drawings or specified elsewhere.
- 20.2 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.

21.0 Standards and Codes

- 21.1 This specification makes reference to the following Australian Standards:

AS1141	Methods of Sampling and Testing Aggregates
AS1260	PVC Pipes and Fittings for Drain Waste and Vent Applications
AS1289	Method of Testing Soils for Engineering Purposes
AS1303	Steel Reinforcing Bars for Concrete
AS1379	The Specification and Manufacture of Concrete
AS1597 (Part 1)	Small Precast Reinforced Concrete Box Culverts
AS1597 (Part 2)	Large Precast Reinforced Concrete Box Culverts
AS1646	Elastomeric Seals for Waterworks purposes
AS1830	Iron Castings – Grey Cast Iron
AS2032	Installation of uPVC Pipe Systems
AS2187	Explosives – Storage, Transport and Use
AS2758	Aggregates and Rock for Engineering Purposes
AS3600	Concrete Structures
AS3678	Structural Steel – Hot-Rolled Plates, Floor-Plates and Slabs
AS3725	Loads on Buried Concrete Pipes
AS3996	Metal Access Covers, Road Grates and Frames
AS4058	Precast Concrete Pipes
AS4139	Fibre Reinforced Concrete Pipes and Fittings
AS4680	Hot-Dipped Galvanised Coatings on Ferrous Articles

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