



Section 3: Stormwater drainage

Sutherland Shire Public Domain Technical Manual
Part D: Specification

SUTHERLANDSHIRE

**Sutherland Shire Public Domain Technical Manual
Part D: Specification**

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Section 3: Stormwater drainage

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3 Stormwater drainage

3.1 Scope

This section includes the requirements for all stormwater drainage works including the following:

- supply, delivery, transport and installation of pipes, box culverts, subsoil drainage, stormwater pits and lintels;
- materials and construction of inlet grates, frames and pit lids; and

3.2 Standards and guidelines

The following list indicates the Australian Standards and/or RMS Standards applicable to this section. This table is not exhaustive and may not include all standards that may apply to the work to be undertaken. It is the responsibility of the *contractor* to ensure that all relevant standards are met.

| | |
|-----------|----------------------------------------------------------------------------------------------------------------------------|
| AS 1214 | <i>Hot dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)</i> |
| AS 1254 | <i>Unplasticised PVC (uPVC) pipes and fittings for storm or surface water applications</i> |
| AS 1260 | <i>PVC pipes and fittings for drain, waste and vent applications</i> |
| AS 1289 | <i>Methods of testing soils for engineering purposes</i> |
| AS 1302 | <i>Steel reinforcing bars for concrete</i> |
| AS 1303 | <i>Hard drawn steel reinforcing wire for concrete</i> |
| AS 1304 | <i>Welded wire reinforcing fabric for concrete</i> |
| AS 1463 | <i>Polyethylene pipe extrusion compounds</i> |
| AS 1579 | <i>Arc-welded steel pipes and fittings for water and waste-water</i> |
| AS 1597 | <i>Precast reinforced concrete box culverts</i> |
| AS 1646 | <i>Rubber joint rings for water supply, sewerage and drainage purposes</i> |
| AS 1741 | <i>Vitrified clay pipes and fittings with flexible joints – sewer quality</i> |
| AS 1831 | <i>Ductile cast iron</i> |
| AS 2032 | <i>Code of practice for installation of uPVC pipe systems</i> |
| AS 2033 | <i>Installation of polyethylene pipe systems</i> |
| AS 2439 | <i>Perforated plastics drainage and effluent pipe and fittings</i> |
| AS 2566.1 | <i>Buried flexible pipelines – Structural design</i> |
| AS 2701.4 | <i>Methods of sampling and testing mortar for masonry constructions – Method for determination of compressive strength</i> |
| AS 2865 | <i>Safe working in confined space</i> |
| AS 3500 | <i>National plumbing and drainage code – Compendium</i> |
| AS 3500.3 | <i>Stormwater drainage - Plumbing and drainage - Stormwater drainage</i> |

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| | |
|---------|-----------------------------------------------------------------|
| AS 3600 | Concrete structures |
| AS 3680 | Polyethylene sleeving for ductile iron pipelines |
| AS 3705 | Geotextiles – Identification, marking and general data |
| AS 3706 | Geotextiles – Methods of test |
| AS 3725 | Loads on buried concrete pipes |
| AS 3972 | Portland and blended cements |
| AS 3996 | Metal access covers, road grates and frames |
| AS 4041 | Pressure piping |
| AS 4058 | Precast concrete pipes (pressure and non-pressure) |
| AS 4060 | Loads on buried vitrified clay pipes |
| AS 4139 | Fibre reinforced concrete pipes and fittings |
| CPAA | The foreman's guide to laying concrete pipes (Abridged version) |

3.3 Materials

3.3.1 Pipes

General

All pipes shall be of first quality manufacture, free from damage and/or distortion and capable of withstanding the prescribed proof loadings. All fittings shall be of similar manufacture and of suitable quality.

Reinforced concrete pipes (RCP)

Reinforced concrete pipes shall conform to AS 4058 Precast Concrete Drainage Pipes. All concrete pipes shall be spigot and socket type and be fitted with rubber joint rings. The pipes are to be of the class specified in the *approved design drawings*.

Galvanised steel section

Hot dipped galvanised steel rectangular hollow sections shall conform to AS1250. Refer *SSC standard drawings*.

Fibre reinforced concrete (FRC) pipes

FRC drainage pipes shall be manufactured in accordance with AS 4139.

Plastic pipes

Recycled plastic pipes and other plastic pipes may be used as substitutes to RCP where specified in the *approved design drawings* in non-trafficable areas or areas

difficult to access for construction purposes. All plastic roof water pipelines within the road reserve shall be sewer grade UPVC. Plastic pipes shall conform to the applicable standard as follows:

- UPVC Pipe conforming to AS 1260 (sewer quality);
- HDPE Pipe conforming to AS 1463; and
- Polyethylene (PE) pipe conforming to AS 1463.

Other pipe materials

The use of other pipe types will be considered by *Council* provided full test results and specifications are submitted a minimum twenty-eight (28) days prior to placing an order.

One type of pipe only shall be used in constructing or extending any culvert or pipeline section between any two structures.

Prefabricated fittings

Fabricated fittings such as lobster back elbows, slope junctions and pipe bend configurations shall be manufactured to AS 1579, AS 1210 and AS 4041 standards.

Rubber rings

Rubber rings shall conform to AS 1646.

3.3.2 Box culverts

Precast reinforced concrete

Precast reinforced concrete box culverts up to 1200mm x 1200mm shall comply with the requirements of AS1597.1. Each batch of culvert sections shall be subjected to the proof loading test as prescribed in Section 3.2 of AS1597.1.

Large precast reinforced box culverts from 1350mm to 4200mm span and 1200mm height shall comply with the requirements of AS1597.2 and shall be manufactured to conform to *RMS Specification R16*.

Box culvert sections of size equal to or larger than 600mm x 450mm shall be fitted with suitable lifting lugs to facilitate installation.

Cast-in-situ base slabs shall be used unless specified otherwise.

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Culverts shall be manufactured under an approved quality assurance system. Culverts shall only be used if they have the necessary information clearly marked on them to identify the manufacturer, date of manufacture, batch number, culvert dimensions and inspection status.

Cast in-situ concrete

Cast in-situ concrete box culverts to designs certified by a qualified structural engineer shall be permitted in situations where site conditions do not allow the practical installation of precast concrete units. Concrete and reinforcement shall be supplied, formed and placed as per Section 4 Concrete *Works* and as detailed in the *approved design drawings*.

Culvert jointing material

A self-adhesive aluminium tape with a bitumen/rubber adhesive shall be used to positively weatherproof all culvert joints.

3.3.3 Subsoil drainage

Subsoil drainage shall be installed in accordance with the *SSC standard drawings* and shall comply with the requirements of AS 2439.

3.3.4 Stormwater pits

Stormwater pits shall be cast in-situ concrete.

Concrete, reinforcement and formwork for drainage structures shall comply with the requirements of Section 3: Concrete *Works* of this specification and the *SSC standard drawings*.

3.3.5 Lintels

Lintels shall be pre-cast structures which are manufactured, supplied and installed in accordance with the requirements of AS 3600 - *Concrete Structures*.

3.3.6 Inlet grates, frames and covers

Inlet grates, frames and covers shall be in accordance with AS 3996.

3.3.7 Fill, pipe support & backfilling material

Granular material

Material for fill and pipe support including bedding, haunch and side zones, pipe overlay and backfill shall be free draining granular material having a particle size distribution, determined in accordance with AS 1289.

The *contractor* shall obtain a copy of the supplier's grading test results for material representative of the material supplied. A copy of this test certificate shall be provided to the *PCA* for inclusion in the documentary evidence to be submitted in support of certification of the *works*.

Recycled material

Council prefers and encourages the use of recycled products to replace natural products where possible. Crushed recycled building materials may be used as a bedding and pipe support material, provided that it comprises of well graded, angular, hard, durable inert particles and meets the grading limits for fill as detailed above.

The *contractor* shall obtain the grading curves for the material to be used from the supplier and provide them to the *PCA* for inclusion in the documentary evidence to be submitted in support of certification of the *works*.

Refer to:

- Specification for Recycled Crushed Glass as an Engineering material – <http://www.afgc.org.au/doc-library/category/9-packaging-recycling.html?download=716%3Aspecifications-for-recycled-crushed-glass-as-an-engineering-material>; and
- Recycled Glass as Pipe Embedment Material –

<http://www.environment.nsw.gov.au/warr/crushedrecycledglass.htm>.

3.4 Supply and handling of drainage products

3.4.1 Quality

The *contractor* shall obtain a copy of the certification establishing that the drainage products supplied under the contract conform to the appropriate Australian Standard. A copy of this certification shall be provided to the *PCA* for inclusion in the documentary evidence to be submitted in support of certification of the *works*.

3.4.2 Unloading, handling and storage

Where pipes, box culverts and other drainage products are not immediately laid, they are to be placed and stored in a position and in a manner that will safeguard the public against personal or property injury, in the event of which, the *contractor* will be held entirely responsible.

The *contractor* shall employ adequate means in handling the products and shall be responsible for all damage done to these in unloading from delivery vehicles, cartage to the site and laying in position.

All products damaged in these operations will be replaced or repaired, at the *contractor's* expense. No product shall be laid which is cracked, spalled or damaged, and all such products shall be removed by the *contractor* from the site of the *works*.

3.5 Construction

3.5.1 Excavation

Trenches

Before commencing excavation, the *contractor* shall expose all utility services on the centre line of proposed pipelines and confirm that works can proceed as planned. Where utility services prevent works as planned, the *contractor* shall report concerns to the *PDC* who shall arrange the preparation and approval of amended plans.

Trenches for pipelines shall be parallel with the design centre line of the pipe and excavated as necessary to provide the required bedding conditions in accordance with the pipe manufacturer's guidelines and specifications.

Filled ground

If pipes are to be laid in filled ground, the fill shall be compacted to not less than 95% of the maximum dry density as determined by A.S. 1289. The trench shall be excavated into the compacted fill, the pipes laid and the trench backfilled in accordance with the manufacturer's specification.

Rock excavations

Rock excavation for pits shall be neatly excavated to form a bed for the concrete, and shall be thoroughly scraped, cleaned and roughened immediately prior to pouring concrete.

Excavation in earth

Soil foundations shall be excavated neatly from the solid material. All soft or unsound material shall be removed and replaced with sound material compacted to not less than 95% of the maximum dry density as determined by A.S. 1289.

Width of excavation

Trench excavation generally shall comply with the principles prescribed in the following Codes of Practice for the various types of pipe:

- Concrete Pipes *AS3725;*
- Vitrified Clay Pipes *AS4060;*
- UPVC Pipes *AS2032;* and
- Flexible Pipelines *AS2566.*

Trenching for pipes shall suit ground conditions in accordance with the above standards unless otherwise specified.

Trench widths for concrete pipes shall be at least 1.4 times the external pipe diameter or the external pipe diameter plus 600mm whichever is greater.

In trenches where shoring is necessary, increase width sufficiently to maintain clearances specified above between face of shoring and pipes.

Allowance for bedding

Trenches shall be excavated to the pipe design levels shown on the drawings plus the required bedding depth. Allowance shall be made in the depth of the trench for the bedding type specified.

For concrete pipes the depth of bedding shall be a minimum of 100mm for pipes up to and including 1500mm diameter and 150mm for pipes larger than 1500mm diameter.

3.5.2 Pipe laying and backfilling

Pipes shall be laid and backfilled in accordance with the manufacturer's recommendations and the relevant Australian Standards.

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The *contractor* shall inspect pipe joints progressively as pipe sections are laid to confirm that the joints have been driven home correctly and that the rubber rings have not slipped out of the joints.

A CCTV inspection report covering all pipelines must be provided to the *PCA* for inclusion in the documentary evidence to be submitted in support of certification of the *works*. CCTV inspection shall be conducted in accordance with the Conduit Inspection Reporting Code of Australia WSA 05. The inspection shall involve the camera remaining stationary at each pipe joint whilst panning through a full 360deg.in order to ensure that the full length of each pipe joint is clearly visible in the report.

Trenches shall be backfilled promptly after laying of pipelines. Backfilling around pipes shall be placed in layers not exceeding 300 mm loose thickness and compacted to achieve 95% maximum dry density as determined by AS 1289. The degree of compaction shall be determined and certified by a NATA accredited laboratory (or SSC laboratory). The *contractor* shall be responsible for any damage caused to pipes by floating or the like due to delay in backfilling or inadequate protective measures.

Where drainage lines are laid wholly or in part under the kerb and gutter or pavement, the trench shall be backfilled with clean filling sand placed and compacted in layers not exceeding 300 mm up to the Subgrade level of the pavement. The filling sand shall then be flooded with water and compacted by means of a pencil vibrator to achieve a density not less than 95% of the maximum dry density as determined by AS 1289.

Support to pipes and structures

Where an existing utility service pipe or conduit crosses a trench, it shall be supported in accordance with the relevant utility service provider's requirements.

Backfilling around pits

Backfilling around pits shall be placed in layers not exceeding 300 mm loose thickness and compacted to achieve 95% maximum dry density as determined by AS (1289). The degree of compaction shall be determined and certified by a NATA accredited laboratory (or SSC laboratory).

3.5.3 Laying and jointing

General

All pipelines shall be laid and jointed accurately to the alignment, grade and level shown in the approved drawings. Unless shown otherwise in the approved drawings the minimum permissible pipe grade shall be 1.0%.

All pipes shall be laid so that the pipe barrels and box drain bases have solid bearing throughout their length.

All pipes shall be set out and laid so that the centrelines intersect at the centreline of the outlet pipe at the downstream face of the pit.

Pipe laying shall commence at the downstream end and proceed uphill, with the spigot end of the pipe located downstream from the socket end.

Jointing

All pipes shall be fitted with rubber joint rings installed to the manufacturer's recommendations.

Precast concrete box culvert units shall be butt jointed and made watertight using self-adhesive aluminium tape with a bitumen/rubber adhesive.

Lifting holes

All concrete pipes fitted with lifting holes shall be adequately plugged in accordance with the manufacturer's specifications prior to backfilling to prevent the penetration of backfill material.

Box culverts

Box culverts shall be either wholly cast in-situ or precast units with a continuous cast in-situ reinforced concrete base. Precast bases shall not be used unless shown in the approved drawings.

Precast sections of box culverts shall be firmly butted together and the joints sealed in accordance with the manufacturer's recommendation.

The contact areas between the culvert sections and the base slab shall be mortared.

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Unless otherwise specified or shown in the drawing, multi-row box culverts shall be laid with the sections in each row in contact with the sections in the adjacent rows and the longitudinal joint between culverts sealed using self-adhesive aluminium tape with a bitumen/rubber adhesive.

Cast in-situ culverts shall be constructed in accordance with the *approved design drawings*. All concrete shall be constructed in accordance with Section 4 – Concrete Works.

Connections and junctions

All stormwater drainage connections shall be made at drainage pits or by way of factory fabricated special fittings.

Where pipes are cut they are to be cut using concrete saws and the ends shall be finished using a non-shrinkage epoxy grout.

Upstream pipelines connecting to stormwater pits shall be oriented between 90° and 270° to the pit outlet. Connections outside this range are unacceptable.

Where future pipe connections are proposed, the *contractor* shall provide a suitably sized pipe stub capped for future stormwater drainage pipes as shown in the *approved design drawings*.

Holes for subsoil drains shall be 100 mm diameter, unless otherwise specified or shown in the *approved design drawings*.

All pipe to pipe connections shall be factory fabricated. Site fabricated pipe to pipe connections (pipe junctions) shall not be accepted.

Concrete encasement

Drainage pipes shall not be concrete encased. Where standard cover cannot be achieved due to services conflicts or other unforeseen obstructions, the *contractor* shall increase the class of pipe as necessary to provide for the reduced cover.

Concrete bulkheads

Where the grade of a pipeline exceeds 16% or where shown in the *approved design drawings*, bulkheads shall be constructed as detailed in the *SSC standard drawings*.

Spacing of adjacent pipelines

The distance between pipes in multiple pipelines shall be at least one-third the external diameter of the pipe, or 300 mm, whichever is the greater.

3.5.4 Drainage pits

General

Drainage pits shall be constructed in locations indicated in the *approved design drawings*. All pits shall be constructed to finish flush with design surface levels, and shall conform to the details shown in the *SSC standard drawings*.

Concrete

Concrete used in pits shall be placed in the formwork in horizontal layers without segregation of the aggregate and shall be compacted by vibrating.

Formwork

Formwork used for the internal faces of pits shall be unyielding, and retain the concrete to the shape and location shown in the *SSC standard drawings*.

Upon removal of the formwork, all voids, holes and rough surfaces shall be repaired by removing the defective sections and replacing with stiff cement mortar brought to an even surface with a wooden float.

Benching

Mass concrete benching shall be provided in the floor of the pit to half pipe section as shown in the *SSC standard drawings*.

Internal dimensions

Pits shall be constructed in accordance with the *SSC standard drawings*. Where necessary the internal dimensions of pits shall be increased to accommodate pipes larger than 675mm diameter and pipes entering the pit at an angle.

Inlet Frames, Grates and Covers

Frames, grates and covers shall be installed in accordance with the *SSC standard drawings*.

3.5.5 Installation of lintels

Drainage lintels shall be as specified in the *SSC standard drawings* and installed in accordance with the *SSC standard drawings*.

Lintels for sag pits shall be installed centrally to the pit. Lintels for pits on grade shall be offset upstream of the pit.

3.5.6 Subsoil pipes in trench

General

Subsoil drainage shall be provided in locations shown in the *approved design drawings*

The subsoil drain shall be connected into the stormwater drainage system as detailed in the *SSC standard drawings*.

A flushing point is to be provided at the upstream end of all subsoil lines and at maximum intervals of 30 m along each line. Subsoil lines at flushing points are to be brought up to the finished surface level and capped as detailed in the *SSC standard drawings*.

Trenches

The subsoil drain shall be constructed as indicated in the *SSC standard drawings*.

Minimum Grade

The minimum grade of the subsoil line shall be 1%.

Bedding

Refer to the *SSC standard drawings*.

3.5.7 Property downpipe connections

All property downpipe connections shall be connected to the kerb and gutter or directly into *Council's* drainage pits. Property downpipes shall not be discharged onto footways.

All downpipes crossing the footpath reserve shall be laid to a minimum fall of 1%. This may require the installation of the drains at an angle rather than perpendicular to the boundary/kerb.

Connections to kerbs/kerb outlets

Connections to barrier kerb shall be made using solid walled solvent welded PVC pipes. Connection to roll kerb shall be made using 100x150mm galvanised rectangular hollow sections. The kerb connections shall be in accordance with the *SSC standard drawings*.

The down pipe crossings shall take the shortest route to the kerb and shall be generally straight grade with minimal bends. All bends shall be manufactured fittings with a maximum deflection of 45°.

No pressure/pump lines shall be connected to the kerb all connections to the kerb shall be conveyed by gravity only.

Pipelines behind roll kerb

All shallow roof water pipelines within 1.5m of roll kerb shall be hot dip galvanised as detailed in the *SSC standard drawings*.

3.6 Quality management

3.6.1 Tolerances

The *contractor* shall construct the *works* within the following tolerances:

| Item | Activity | Tolerances |
|------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Pipework | <ul style="list-style-type: none"> — Finished horizontal position +/- 15mm from <i>approved design</i>; — Finished vertical position +/- 25mm from design levels; (provided resultant grade not less than 1%); and — Finished grade +/- 0.5% from design grades greater than 3% and +/- 0.2% from design grades less than or equal to 3%. |
| 2. | Manhole, Field Inlet, Property Pit, I O Structure and GPT | <ul style="list-style-type: none"> — Finished horizontal position +/- 50mm laterally and +/- 100mm longitudinally from the <i>approved design drawings</i>; and — Finished vertical position +/- 25mm from both the surface and invert design levels. |
| 3. | Inlet Gully | <ul style="list-style-type: none"> — Finished position of an inlet gully to match the adjacent kerb and gutter both horizontally and vertically. |
| | Open Drain | <ul style="list-style-type: none"> — Depth Plus 75mm, minus Nil (from <i>approved design drawings</i> provided resultant grade not less than 1%); — Width of any part of the cross section plus 100mm, minus Nil |

3.6.2 Schedule of hold points and check points – Stormwater drainage

| Construct Drainage Pipe | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Work Process: | Laying and jointing stormwater pipe |
| <i>Hold point or Check point:</i> | <i>Hold point - PDC</i> |
| <i>Required Notice:</i> | By arrangement with <i>PDC</i> |
| <i>Required Action:</i> | The <i>PDC</i> shall inspect the pipeline, lifting holes, slope of pipe and jointing prior to authorising backfilling. |
| 2. Work Process: | Supply of filling sand for backfill |
| <i>Hold point or Check point:</i> | <i>Check point</i> |
| <i>Required Notice:</i> | NA |
| <i>Required Action:</i> | The <i>contractor</i> shall obtain a copy of the grading curves for a representative sample of the backfill material and shall provide the results of testing to the <i>PCA</i> for incorporation in the documents to be presented to <i>Council</i> in support of certification |
| 3. Work Process: | Compaction of backfill for pipes and pits |
| <i>Hold point or Check point:</i> | <i>Check point</i> |
| <i>Required Notice:</i> | NA |
| <i>Required Action:</i> | The density of pipe backfill shall be tested by a NATA registered (or SSC laboratory) for compliance with the specification and the test results are to be provided to the <i>PCA</i> for incorporation into the documents to be presented to <i>Council</i> in support of certification |
| 4. Work Process: | Completion of pipe laying |
| <i>Hold point or Check point:</i> | <i>Check point</i> |
| <i>Required Notice:</i> | NA |
| <i>Required Action:</i> | A CCTV inspection is to be completed to confirm that all bung holes have been stopped and that all joints have been satisfactorily made. The report is to be provided to the <i>PCA</i> for incorporation into the documents to be presented to <i>Council</i> in support of certification. |

| Construct cast in-situ culvert base | |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. Work Process: | Fix formwork |
| <i>Hold point or Check point:</i> | <i>Hold point - PDC</i> |
| <i>Required Notice:</i> | By arrangement with <i>PDC</i> |
| <i>Required Action:</i> | The <i>PDC</i> shall check the formwork for location and levels using fixed marks or set-out marks. If there are insufficient marks available, a land survey is to be completed. The <i>PDC</i> shall certify the culvert base location and levels before reinforcing steel is fixed. |
| 6. Work Process: | Fix reinforcing steel |
| <i>Hold point or Check point:</i> | <i>Hold point PDC</i> |
| <i>Required Notice:</i> | By arrangement with <i>PDC</i> |
| <i>Required Action:</i> | The <i>PDC</i> shall check the size, location and levels of reinforcing bars for compliance with the approved location and levels relative to the formwork. The <i>PDC</i> shall certify the size, location and levels of reinforcing before authorising the pouring of concrete. |

| Construct Box Culvert | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7. Work Process: | Jointing between culvert Units |
| <i>Hold point or Check point:</i> | <i>Check point</i> |
| <i>Required Notice:</i> | NA |
| <i>Required Action:</i> | Photographs are to be taken from both sides of the culvert and showing all joints to have been jointed using self-adhesive tape. Photographs are to be provided to the <i>PCA</i> for incorporation into the documents to be presented to <i>Council</i> in support of certification. |

| Supply of drainage products | |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8. Work Process: | Supply of drainage products |
| <i>Hold point or Check point:</i> | <i>Check point</i> |
| Required Notice: | NA |
| Required Action: | The <i>contractor</i> shall obtain a copy of the certification establishing that the drainage products supplied under the contract conform to the appropriate Australian Standard. A copy of this certification shall be provided to the <i>PCA</i> for inclusion in the documentary evidence to be submitted in support of certification of the <i>works</i> . |