Standard specification construction and testing of sewerage works

Hawkesbury City Council

This document replaces the standard specification issued December 2003.

No significant changes have been made to this document; however Section 4 Earthworks has been rewritten for the sake of clarity.

This document contains important information.
If you do not understand it, contact the
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1 Extent of Contract

1.1 Work to be done

The work to be done under this Contract includes, the undertaking of all operations with the provision of all materials, plant, tools and services (except those specifically stated or shown on the Contract Documents as to be provided by the Principal) necessary for the construction, testing and maintenance of the works described in the tender documents in accordance with the General Conditions, the Special Conditions, this Specification, Contract Drawings and Standard Drawings as listed in the attached Appendix, with all work being carried out to the satisfaction of the Superintendent.

1.2 Specifications, drawings, etcetera

The Specification and the Contract Drawings or Standard Drawings referred to in the Specification and any other Drawings included in the Contract must be taken to explain each other. Anything contained in the specification or in any of the Drawings shall be binding on the Contractor as if it were contained in all.

Any dimensions written or figured on the Drawings must be taken in preference to measurements by scale. Any ambiguity or defective description will not invalidate the Contract, but must be explained by the Engineer upon request of the Contractor. Such explanations are final and the Contractor shall have no claim for damages on account of such ambiguity or defective description.

The Contractor must completely and thoroughly inform himself of every circumstance connected with or related to the Works, and to the site and of the correctness of any information contained in, or supplied by the Specification or Drawings. He shall have no claim on account of any errors, omissions or inaccuracies that may be found in these documents.

If neither Specification nor Drawings contain any mention of minor parts or works which are reasonably or obviously necessary for the satisfactory completion of the work, such parts must be provided or such works must be executed by the Contractor, at his cost as if they were specially mentioned.

1.3 Works As Executed

Where Council is the Principal the Contractor must submit to the Superintendent or his Representative a Works As Executed ‘package’ consisting of a plan of work as executed, pressure test certificates, hydrostatic test certificates for access chambers, junction location sheets and a CCTV video and report.

Where Council is not a Principal to the Contract the Contractor/Developer responsible for the proposed work must submit the Works As Executed ‘package’ to the appropriate Council Officer (Waste Water and Design Branch).

The Works As Executed must commence when the Contract has reached a stage of Practical Completion. The Contractor must rectify any defects identified in the Works As Executed package prior to issue of the Certificate of Practical Completion.

Where Council is not a Principal to the Contract, the Linen Plan and or any Security held by Council will not be released until the Works As Executed ‘package’ has been assessed and approved by the appropriate Council Officer (Waste Management Branch).

1.3.1 Plan of works as executed

A detailed Works As Executed plan showing all pipe conduits included in the Contract must be prepared and signed by a registered surveyor. The Works As Executed plan must include the following:

a) all works as executed information must be shown in red
b) the location of access chambers with reference to boundaries
c) reduced levels on AHD indicating top of access chamber, upstream and downstream inverts at the access chamber and invert of dead ends
d) measured distance from access chamber to access chamber between the centreline of each constructed access chamber and NOT from centre of lid
e) pipe grades from access chamber to access chamber.

1.3.2 Pressure test certificates

All gravity pipe conduits included in the contract must be pressure tested and certified in accordance with Sec. 7.2 (low pressure air test) of this specification or as directed by the Superintendent or his Representative.

All rising or pressure mains included in the Contract must be tested and certified in accordance with Sec. 7.3 (water loss test) of this specification or as directed by the Superintendent or his Representative.

1.3.3 Hydrostatic test certificates

All access chambers included in the Contract must be hydrostatically tested and certified in accordance with Section 7.1 of this specification or as specified by the Superintendent or his Representative.

1.3.4 Junction sheets

The Contractor must submit on standard forms (provided by the Principal) junction information for every reach of pipe conduit in the Contract. If a reach does not have any junctions the sheet must be completed and clearly labelled "Nil Junctions".

1.3.5 CCTV video and report

The Contractor must submit a colour video on DVD format showing an internal inspection of all pipe conduits included in the contract. In addition, the Contractor must also submit an inspection report with the WSA Conduit Inspection Reporting Code of Australia (current edition). The CCTV survey must be conducted in accordance with Section 7.4 (CCTV survey) of this specification. The CCTV survey is required where the works exceeds 20m in length or if the work exceeds 2m in depth.

Where defects are identified from the CCTV survey, they must be rectified and those reaches (nodes) subjected to an additional CCTV survey prior to applying to the Superintendent for a Certificate of Practical Completion.

1.4 Defects liability period

All work constructed in accordance with this Specification is subject to a Defects Liability Period of not less than 12 months from the date of practical completion or commissioning depending on the nature of the work. Where Council is not a Principal to the Contract, the Contractor / Developer responsible for the proposed work must lodge security equal to 10% of the contract value up to $100,000 plus 2.5% of the balance of the contract value for contracts in excess of $100,000. The Contractor/Developer must enter into an agreement with Council to undertake the repair of any defects that will occur during this period. Minimum security is presently $1,000.

Security is required where the subdivision is eight lots or more or if the sewer works exceeds 2m in depth.

1.5 WorkCover to be notified

Prior to commencement of any works, the Contractor must notify WorkCover Authority, relating details of the Contract as required. In addition, the Contractor must show evidence to the Superintendent or Council's supervising/inspecting Officer that WorkCover Authority has been notified.

2 General

2.1 Centrelines and invert levels

The centrelines and invert levels of sewers to be laid are shown on the Contract Drawings where necessary.

In the event of the Superintendent's Representative assisting the Contractor in setting out the works, by supplying him with a list of depths from pegs (or other marks) to sewer invert, this shall not relieve the Contractor of the sole responsibility for the accuracy of the setting out, as required of him by the relevant Clause of the General Conditions.

The Contractor must provide, at his own expense, approved sight rails, standards, straight edges, boning rods and other appliances for the efficient setting out of the work.

2.2 Contractor to report to Superintendent

After the Contract is signed, and prior to commencement of the work, the Contractor must call on the Superintendent to discuss arrangements for commencement of the work and to be advised regarding the Superintendent's Representative.

2.3 Starting and inspection of the work

Excavation must not be started on any portion of the work without the prior approval of the Superintendent's Representative. Such approval may be withheld if, in the Superintendent's opinion, the quantities of materials, tools and plant, ready for immediate use on the subject portion of the work, are insufficient to permit speedy and uninterrupted construction.

No work must be backfilled or otherwise covered without the prior approval of the Superintendent's Representative.

When the whole or any portion of the work is being inspected prior to being taken into service by the Principal, the Contractor or his Representative must be present and must furnish, at his own cost, any labour required by the Superintendent's Representative in connection with the inspection.

2.4 Delays, stoppages and disputes arising from rejection of materials or plant

No claim must lie against the Principal on account of any delay or stoppage of the works arising from rejection of materials or plant, or from a dispute about the quality or supply of materials or plant. Any damage to the works under this Contract, to adjacent services or buildings or other works, to streets, fences, land or gardens, in consequence of any such delay or stoppage must be the Contractor's responsibility.

2.5 Use of water from Sydney Water's system

The Contractor must not use water direct from Sydney Water's mains for the purpose of this Contract until he has applied for and been issued with an authority to use a standpipe on a Sydney Water's hydrant.

Any standpipe connected to Sydney Water's hydrant must be made conspicuous by the attachment of a red flag (by day) and a lighted lamp (at night), and must be protected in an approved manner against traffic hazards.
The Contractor must not use water from a metered or non-metered private service unless he has furnished the Superintendent's Representative with a statement, signed by the ratepayer concerned, to the effect that the Principal will not be held responsible for the water so used.

2.6 Drainage of works

2.6.1 Temporary drainage

Drainage works required temporarily for construction expediency and for the efficient construction of the sewer.

At his own expense, the Contractor must provide:

a) All materials and labour for the effectual diversion of surface water from the works;

b) Secure and proper fluming for conducting sewage, stormwater and subsoil water across and beyond the works, in an approved manner;

c) Means for the uninterrupted flow at all times of stormwater and drainage along existing gutters, water tables and conduits in the vicinity of the works;

d) Alternative and adequate means for the diversion of the drainage water where the existing drainage is to be interrupted and no such interruption must take place until this diversion is provided. All diversions must be of sufficient capacity to prevent flooding of the works, surrounding country and existing upstream drainage channels and to the satisfaction of the Superintendent's Representative.

e) Operate effective pumping plant for keeping all excavations constantly dewatered whilst construction is in hand. The Contractor must not permit drainage from these excavations to enter the Principal's foul water sewers.

2.6.2 Permanent drainage

Works such as provision of permanent trench or structural drainage works, which are considered necessary by the Superintendent, and which the Superintendent directs the Contractor to construct, and which do not form part of the reticulation lines or other structures shown on the plans, must be provided at the Contractor's expense.

2.7 Shelter sheds and sanitary conveniences

At his own expense, the Contractor must, to the satisfaction of the Superintendent's Representative, erect shelters wherein his workmen may change their clothes and must provide efficient sanitary appliances for their use. Shelter sheds and conveniences must not be used for any purpose other than which they are provided.

Sanitary pans must be provided with close-fitting seats and fly proof hinged flaps of a type approved by WorkCover Authority. The Contractor must apply to Council for the necessary sanitary service and pay all sanitary service fees.

2.8 Safety precautions

Throughout the Contract, the Contractor must obey all Acts of Parliament and all regulations, by-laws and orders made thereunder. The Contractor must also comply with the requirements of Council and other Public Authorities in any way affecting or applicable to the carrying out of the works. See Appendix 2: Relevant Legislation and Council Documents.
The Contractor must do all works required under this Contract in a careful and safe manner. The Contractor must take all proper precautions against accidents, and carry out such safety measures as WorkCover Authority and the Superintendent's Representative may direct from time to time.

The Contractor must, in the performance of the Contract, take all necessary steps and to ensure compliance with the requirements of the Work Health and Safety Act 2011 and the Occupational Health and Safety Act 2011, their amendments and regulations and any other legislation relating to the health, safety and welfare of his employees and other persons.

Specific examples are Confined Space entry requirements, the use of gas detectors, helmets, dust suppression devices, respirators, safety footwear, and earmuffs.

2.9 Access roads

Where necessary, the Contractor must, at his own expense, provide and maintain all access roads to the working site, adequate for the carriage and transport of all materials used in and for the construction of the works.

3 Materials

3.1 Materials to be delivered by the Principal

3.1.1 Delivery

Where applicable, materials to be supplied to the Contractor by the Principal must be delivered generally along the lines of the sewers to sites reasonably accessible by motor lorry. As early as practicable, the Contractor must inform the Superintendent's Representative of:

a) the sites at which he desires deliveries of the various materials to be made
b) the date and amount desired for the first delivery of each type of material
c) the desired rate of delivery of each type of material thereafter.

The Principal must try to arrange for deliveries accordingly, but if the desired Schedule of Deliveries is not realised, the Contractor shall have no claim for damages unless such delay is caused solely by a negligent act or omission of the Principal or the Superintendent.

3.1.2 Contractor's responsibility

The materials supplied by the Principal remain the Principal's property, and attention is drawn to the Contractor's responsibility, as stated in the relevant Clause of the General Conditions.

3.2 Materials to be supplied by Contractor

3.2.1 General requirements

3.2.1.1 Contractor to facilitate inspection

The Contractor must, when required by the Superintendent's Representative, inform him of the sources of manufacture and/or supply of the various materials, and provide the Principal with all necessary facilities for inspection during any stage of manufacture and/or supply.

3.2.1.2 Approved samples

The Contractor must submit for approval, samples of materials to be supplied for use on the works. All deliveries of materials must be in strict accordance with approved samples.

3.2.1.3 Removal of rejected material

Any material, which is rejected by the Superintendent's Representative as unsatisfactory, must, if he so directs, be removed immediately from the site by the Contractor at his own expense.

3.2.1.4 Gauging and weighing equipment

When so directed by the Superintendent's Representative, the Contractor must provide, at his own expense, approved gauges and/or weighing equipment for gauging and/or weighing the materials supplied.

3.2.2 Backfilling materials

3.2.2.1 Granular bedding

The granular material must consist of clean, dry, hard, tough, sound, crushed stone, slag or gravel of uniform quality, free from dust, clay, dirt and other deleterious matter and from excess of flat or laminated pieces. Slag must be crushed from air-cooled blast furnace slag of uniform quality, reasonably free from flat, elongated, vesicular, glassy or other brittle pieces. The bedding material must, in all other aspects, conform to the relevant Specification for aggregates.

Any granular bedding used by the Contractor must be suitable for the type and size of pipe being laid. If granular bedding is to be used, unless otherwise directed by the Superintendent's Representative, the Contractor may nominate and submit samples for approval.

3.2.2.2 Sand

Filling sand must consist of dune or river sand or crushed sandstone, and must be free from any mineral and organic matter, which is, in the opinion of the Superintendent, harmful to steel or ironwork. It must contain not less than 95% by volume of hard grains, and the mass passing through a sieve with an aperture of 150 microns, must not exceed 15%. The sand must never contain soluble salt expressed as sodium chloride in excess of 0.05%.

3.2.3 Concrete and mortar materials

3.2.3.1 Portland cement

All cement used for these works must be government tested Portland cement conforming to the relevant Specification for Portland cement. It must be supplied in unopened bags containing 40kg of cement. Cement must be protected from weather and moisture, and must be used in the order in which it is received. No damaged cement must be used, and no cement, which has been in stock for more than three months, must be used, unless approved by the Superintendent's Representative. A low-heat cement must be used for all purposes of this Contract, unless the Superintendent's Representative directs that Type 1, ordinary cement may be used.

3.2.3.2 Fine aggregate for concrete

Fine aggregate for concrete must consist of washed river sand or dune sand or a mixture of these, with or without an admixture of rock grit. The fine aggregate must be of sound material, free of dust, clay, charcoal, roots, leaves and other deleterious matter. The sand must pass a Tyler Standard Sieve No. 4, and must have a range of sizes down to material passing No. 100 sieve. The rock grit, when added to the sand to improve the grading of the aggregate, must have a range of sizes from about 5mm down. The sand and grit must in all other respects conform to the relevant Specification for Aggregates for Concrete. The sand or combined aggregate must be graded according to the stated requirements for fine aggregate.

3.2.3.3 Coarse aggregate for concrete

Coarse aggregate for concrete must consist of graded river gravel or crushed gravel or igneous rock or quartzite, all of approved quality, of sound, hard particles without flakes, free from dust, clay, charcoal, roots, leaves and other deleterious material. The nominal maximum aggregate size must be as shown on the drawings, or as selected by the Superintendent's Representative.

In all other respects, the aggregate must conform to the relevant Specification for Aggregates for Concrete.

3.2.3.4 Sand for mortars

Sand for mortars must comply with the requirements for sand, as per Clause 3.2.3.2 and must be of approved grading.

3.2.4 Metalwork

3.2.4.1 Steel reinforcement

Steel for reinforcement, if required, must be as shown on the Contract Drawings and be in accordance with the relevant Specification as listed in the attached Appendix. The reinforcement must be of the sizes and must be bent to the shapes required by the Contract Drawings; bending must be done in such a manner as not to damage the bars. Cover, spacing, joins lap and other aspects of placement must be strictly in accordance with the Contract Drawings. Reinforcement must be secured in a manner approved by the Superintendent's Representative, to prevent displacement during concreting. Before the reinforcement is placed, the surface of the bars must be cleaned of all heavy rust, loose mill scale, dirt, grease, mortar or other deleterious material.

3.2.4.2 Steel pins

Pins, if shown on the Contract Drawings or ordered by the Superintendent's Representative, must be plain round bars, deformed bars or square twist bars, and in accordance with the relevant Specification. In general, their length will not exceed 500mm and their function is to tie concrete to the floor, walls or roof of an excavation.

3.2.4.3 Rock bolts

Rock bolts, if shown on the Contract Drawings or ordered by the Superintendent's Representative, must be of a type and manufacture approved by the Superintendent's Representative. They must be placed strictly in accordance with his instructions with regard to length, spacing, pattern, drill hole clearances, tension, etc. "Pullout" tests, if required by the Superintendent's Representative, must be carried out by the Contractor at his own expense.

3.2.4.4 Steel, Galvanised

Steel to be galvanised must be in accordance with the relevant Specification. It must be cut, bent or forged to the shapes and dimensions shown on the Contract Drawings, and must be finished in a workmanlike manner. Just before galvanising, the fabricated unit must be properly degreased, washed, pickled, rinsed and fluxed. It must be galvanised by the "hot dip" process, producing an overall coating with a mass of at least 600gms per square metre of surface area.

3.2.4.5 Steel, Metallised

Steel to be metallised must be in accordance with the relevant Specifications listed in the attached Appendix. It must be cut, bent or forged to the shapes and dimensions shown on the Drawings, and must be finished in a workmanlike manner.

Just prior to metallising, the steel must be thoroughly cleaned to bright metal by blasting with copper slag, ilmenite, aluminium oxide or other material approved by the Superintendent's Representative. The steel must be perfectly dry before commencement of metallising, which must not proceed during damp or dusty conditions. Metal sprays must coat the steel as follows: metal zinc of 0.08mm minimum thickness, then metallic aluminium of 0.08mm minimum thickness.

The coatings must be built up immediately to the specified thickness by two passes of the spraying pistol for each type of metal coating, and not applied as a "two coat" system. During the metallising process, the actual mass of each type of metal wire used may be recorded by an Inspector of the Principal, as a check on the average thickness deposited. As soon as practicable after metallising, and without allowing the surface to become damp, the steel must be given two sealing coats of aluminium paint compounded from 1.25kg of aluminium paste per five litre of phenolic resin spar varnish.

3.2.5 Timber

3.2.5.1 Hardwood

Hardwood must be ironbark, box, grey gum, turpentine or other approved hardwood of at least stress grade F11, in accordance with the relevant Specification.

3.2.5.2 Softwood

Softwood must be Oregon, Canada pine or approved Australian softwoods, of at least stress grade F5, in accordance with the relevant Specification.

3.2.6 Bricks

3.2.6.1 Clay bricks

Bricks must be machine made, new, sound, hard, well burnt bricks, in accordance with the relevant Specification.

3.2.6.2 Cement bricks

Bricks must be 230mm x 76mm x 110mm solid bricks, conforming to the relevant Specification listed in the attached Appendix for Precast Concrete Masonry Units. The cement used must be ordinary Portland cement and the aggregate, sand and natural gravel or crushed stone must conform to the relevant Specification.

3.2.7 Puddle clay

Puddle clay shall consist of a mixture of approved clay and water, mixed to a suitable consistency as directed by the Superintendent's Representative.

4 Earthworks

4.1 Timbering

The Contractor must supply and place such timbering and shall do such caulking and/or battening of runners as may be necessary to prevent material falling, slipping or being shaken from the face, side or roof of the excavation.

Attention is drawn to the requirements of the Excavation Work Code of Practice, 2013 and any amendment thereof. All trenches of 1.5m or more in depth must be benched, battered or shored in accordance with the Code of Practice.

The Superintendent's Representative may, from time to time, order in writing that timbering be placed at stated locations, and may prescribe the minimum standards for this timbering. On receipt of such an order, the Contractor must thereupon place timbering at the stated locations, which must be at least as strong and safe, in the opinion of the Superintendent's Representative, as the minimum standard prescribed. The order will not relieve the Contractor of the responsibilities laid upon him by statute by the relevant Clause of the General Conditions and by Clause 2.8 of this Specification. Thus, he may place timbering at locations additional to those ordered by the Superintendent's Representative and/or he may place timbering stronger than the minimum standard prescribed.

In general, the Contractor must withdraw timbering as the excavations are refilled, and as the ground no longer requires support; but timbering must be left in the ground wherever the Superintendent's Representative so orders.

4.2 Explosives

4.2.1 Use of or limitations on the use of explosives

The Contractor must not use explosives without first requesting permission in writing from the Superintendent's Representative. Such request, giving the firing pattern and the amount of explosives to be used in each hole, must be made at least two weeks before the Contractor intends to use explosives. Blasting must take place between the hours of 9am and 3pm Monday to Saturday, inclusive. If blasting is required outside these hours, then prior written approval of the Superintendent's Representative must be obtained. The Contractor must take all proper precautions and must not use more than the approved amounts of explosives to loosen the materials to be excavated. Regardless of prior approval being given, the Superintendent's Representative may vary the amount of explosives that may be used.

The Contractor must adhere to the limits, times, kinds of explosives, maximum number of charges for exploding simultaneously and any other precautions as directed in writing by the Superintendent's Representative. When explosives are used in shaft sinking, the charges must be fired electrically. The Contractor must employ all necessary means to prevent fragments of material being thrown out of the excavation. He must comply with all the requirements of the Acts, Regulations and Codes of Practice, and any amendments relevant to the safe use, handling, transportation and storage of explosives.

The Principal must strictly supervise the use of explosives.

4.2.2 Prohibition of the use of explosives

Regardless of any prior permission having been given, the Contractor, where so directed in writing by the Superintendent's Representative, must not use explosives on the whole or on stated parts of the works.

4.3 Excavation

4.3.1 Extent of excavation

The ground must be excavated to the various depths, gradients, steps, widths, batters and dimensions as specified herein and/or shown on the Drawings, unless the Superintendent's Representative orders otherwise. In this event, it must be excavated as he may order in writing from time to time. Excavation under a concrete roadway, driveway or gutter, etc., must be carried out by open-cut, under-bore or as directed by the Superintendent's Representative.

All trenches that exceed 1.5m in depth must be double cut (stepped), battered or shored.

Great care must be taken to ensure that the trench widths, as set out in Table 'A' in this Specification for the relevant pipe sizes, must not be exceeded in the execution of the work. If this width is exceeded in practice, the Contractor must notify the Superintendent, who will determine if additional bedding for the pipes is required. Any additional bedding required must be at the Contractor's expense.

Where mechanical equipment is to be used for excavating the trench, care must be exercised to ensure that the equipment chosen can excavate the trench accurately to the specified width.

All spoil must be placed at least 1000mm back from the edge of the trench to avoid caving-in of the trench wall and to permit safe access along the trench.

Where it is preferred to combine open-cut and trench excavations, unless geotechnical information is provided and states otherwise, an angle of repose of 45° must be adopted. The cut must be made by excavating benches or sloping sides down to a horizontal plane not closer than 600mm above the top of the finished pipeline and then excavating the trench as detailed above, for the pipeline. Care must be taken, however, to ensure that the 600mm minimum distance above the top of the pipe is strictly maintained throughout all construction stages. The Contractor must notify the Superintendent if this minimum distance is not maintained during construction so that pipe-bedding details may be revised if necessary. Any additional bedding required must be at the Contractor's expense.

Particular care must be taken to ensure that, as specified on the Standard Drawings, additional excavation under pipe sockets and barrels is taken out wherever the pipe is entrenched in unyielding foundation material. This material includes ground with thin layers of rock, compact rocky or gravelly soil, and other unyielding or incompressible foundation material, including sandstone and most shales.

4.3.2 Extra excavation

Any excavation beyond the specified limits shown in Table 'A' or ordered in writing by the Superintendent's Representative, which:

a) is required to comply with this Specification, and/or
b) the Contractor does for his own convenience, and/or
c) is the consequence of any scouring, siltation, injudicious workings, slips, falls, blasting or any other cause.

Must be at the sole expense of the Contractor, who must, fill the extra excavation with concrete or other approved material, as ordered in writing by the Superintendent's Representative.

4.3.3 Classification of material excavated

For the purpose of this Contract, the various materials excavated must be classified as "soils, clays etc.", "soft rock" or "hard rock", and defined as follows:

"Soils, Clays etc." any material that, in the opinion of the Superintendent's Representative, can be reasonably excavated with a toothed bucket, without the aid of mechanical spades, rippers, etc.

"Soft Rock" any material that, in the opinion of the Superintendent's Representative, requires excavation with the aid of pneumatic spade or ripper (e.g. cemented gravel).

"Hard Rock" any material that, in the opinion of the Superintendent's Representative, requires excavation with the aid of a pneumatic pick (e.g. sand stone). For the purpose of this contract a pneumatic pick does NOT include a pneumatic spade.

When a boulder (i.e. a portion of rock discontinuous with the massive rock from which it was derived) is encountered in an excavation, and extends through at least one side or the bottom of the trench, the material removed from within the trench dimensions must be measured as "rock".

The Superintendent will determine the classification of materials.

Pay widths for the excavation of materials classified, as 'soft' or 'hard' rock will be the dimensions as set out in Table 'A'.

4.4 Trench excavation

4.4.1 Trench dimensions

For the purpose of this Clause, "trench width" must mean the clear width between the sides of an untimbered trench or the clear width inside runners (or other sheathing) in a timbered trench. The trench width must be not less than as shown in Table 'A' following, unless otherwise specified: All trenches that exceed 1.5m in depth must be double cut (stepped), battered or shored.

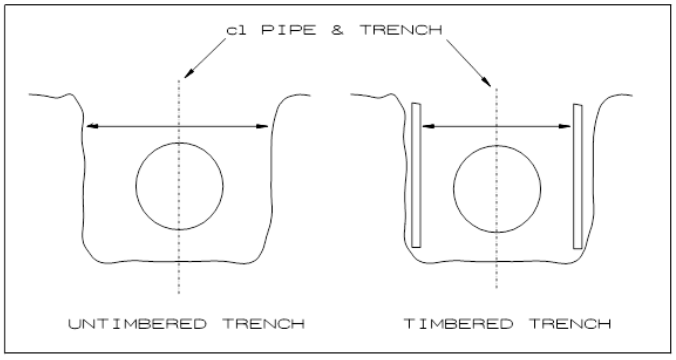


Figure 1: Trench Width

Table A: Trench dimensions

For Pipes with External Joins (mm)			Internal Joins
Nominal Pipe Diameter	Untimbered Trench	Timbered Trench (clear with b/n runner)	
100	530	740	N/A
150	530	740	N/A
225	610	740	N/A
300	690	740	N/A
375	790	790	N/A
400	790	840	N/A
525	970	910	N/A
600	1240	990	N/A

4.4.2 Caulk holes

Caulk holes must be provided as required or directed.

4.5 Excavation by under bore

The under bore must be excavated to the grade and size as specified on the Drawings or as directed by the Superintendent's Representative. If soil types are unsuitable for a clean bore, a mild steel casing must be jacked into place as the bore proceeds. All bores with less than 1.5m of cover must be lined with a mild steel casing, unless otherwise directed by the Superintendent's Representative.

4.6 Access chamber or chamber excavations

4.6.1 Access chamber Dimensions

Excavations for access chambers or chambers must be placed at the locations shown on the Contract Drawings or in the Superintendent's Representative written directive. The minimum dimensions must be as required for safe working conditions in the bottom of the excavation. In the case of timbered excavations, these dimensions must be clear of all timbering.

4.7 Backfilling

4.7.1 Trench Backfill (general)

The trench must be backfilled in accordance with the Standard Drawings, or as ordered by the Superintendent's Representative.

Where spoil from the trench excavation is required for backfilling, the different types of spoil excavation must be kept separate from each other and must be used as the Superintendent's Representative may direct. Where spoil from the trench excavation is not required for backfilling, it must be removed for disposal as directed by the Superintendent's Representative.

When a length of trench has been excavated and approved, the Contractor must proceed without delay, to lay and bed and join the pipes and carry out backfilling of the trench as described below.

Nominated bedding material must be placed around and over the pipe to the specified height. The material must be placed in about 150mm layers and lightly compacted by tamping. Depending on ground conditions or at the discretion of the Superintendent's Representative, the pipe and bedding material may have to be wrapped or covered with a layer of geo-textile.

Backfill material must be placed on the overlay, and care must be taken to ensure that the pipes are not subjected to heavy impact loading, such as from dumping loads of backfill from excessive height.

Where excavation takes place in areas other than those where special backfill has been nominated, the first 300mm of backfill must be select excavated material, placed in the trench in layers not exceeding 150mm in thickness and compacted by tamping.

The remainder of the backfill material must be placed in layers not exceeding 600mm in thickness, well-consolidated and compacted by means appropriate to the location of the trench or excavation, or as directed by the Superintendent's Representative. Subject to provisions of Clause 2.5 and permission given in writing by the Superintendent or his Representative, puddling or water flooding may be used to consolidate the fill. The topsoil shall be replaced at the top of the trench to the depth to which it occurred originally.

Where visual inspection indicates the compaction level may be unsatisfactory, the Superintendent may request submission of compaction certificates from a registered NATA laboratory verifying the level of compaction.

Where shoring has been used and has to be removed, the trench shields must be progressively withdrawn as side fill increases. Any holes or voids must be filled and compacted by tamping to the same level as the rest of the side fill.

If the Superintendent's Representative so directs in writing, the Contractor must backfill over the nominated bedding material or any specified portion thereof, to the top of the trench, with approved sand filling, well compacted.

Care must be taken during the removal of any shoring to minimise risk of disturbance to any adjoining structure. Approved filling only, suitably contained, must be used in the vicinity of any such structure.

All backfilling and compacting must be done without damaging in any way the pipe or any external protection.

Measures must be taken to prevent flotation of the pipes.

4.7.2 Trench backfill in road reserve (footpath)

Where trenches cross footpaths or run parallel along the footpath and the excavated material is suitable as backfill then backfilling must proceed as per Section 4.7.1. Where the excavated material is not suitable as backfill, it must be removed from site and replaced with an approved alternative. The surface layer must match the surrounding surface. Where trenches cross driveways along the foot path, see Clause 4.8.2 Restoration of Driveways.

4.7.3 Trench backfill road reserve (carriageway)

Where trenches cross carriageways or run parallel along the carriage way the excavated material must be removed from site and the backfill material including bedding material is replaced with 14:1 sand/cement. The bedding is placed under around and over the pipe and tamped into place. The remainder of the backfill is compacted in layers not exceeding 600mm in depth to sub-seal. The trench is then sealed with a cold mix patch as a temporary seal. For final restoration see Clause 4.8.3.

Where the carriageway is contained by kerb and gutter the sand/cement backfill must extend a minimum 300mm beyond the kerb and gutter.

Where the carriageway does not have kerb and gutter, the sand/cement backfill must extend a minimum 1000mm beyond the edge of seal.

4.7.4 Trench backfill road reserve (new or proposed road work)

Where trenches are to cross new or proposed road work the sand/cement backfill must be laid to proposed sub-grade the full width of the road reserve.

4.7.5 Trench backfill across driveways, parking areas and other paved surfaces (all types)

Where trenches cross driveways, parking areas and other paved surfaces regardless of the surface treatment the backfill material must be sand or 14:1 sand/cement. The backfill material must be contained within constructed bulkheads on both sides of the driveway, parking area or other paved surface. The bulkhead material and construction method is at the discretion of the Superintendent's Representative.

If the Contractor is given permission to underbore or case bore any or part of these structures; then all voids must be backfilled with high-flow grout.

4.8 Restoration

Generally sewer work can be classified as either private or public works. 'Private Works' is defined as work done by a Contractor for a party other than Hawkesbury City Council. 'Public Works' is defined as work done by Hawkesbury City Council staff or by a Contractor on behalf of Hawkesbury City Council or where Hawkesbury City Council is a Principal to a Contract.

4.8.1 Restoration private or public works (private property)

After backfilling as per Clause 4.7.1, generally the surface treatment of the trench is to match the surrounding surface.

In the case of grassed areas the Contractor must match turf to existing and lay it on a minimum of 200mm of topsoil.

4.8.2 Restoration of driveways (private or public works)

In general the Contractor must backfill the trench in accordance with Clause 4.7.5.

Concrete

In the case of concrete driveways the Contractor must nominate the method of construction by means of open cut or underbore.

If the Contractor chooses open cut, the concrete must be saw cut prior to excavation. If the saw cut is less than 500mm from an expansion joint the slab must be removed to the expansion joint.

To replace the slab, the contractor must epoxy dowels in to the face of the existing slab at an appropriate distance from the slab surface, edge and between each dowel. Dowels must be embedded into the slab a minimum 150mm and a layer of F72 mesh tied to the dowels. The concrete to be poured must have a minimum compressive strength of 30Mpa; dockets of which must be made available on request.

Where the slab is greater than 150mm in thickness then two layers of dowel and F72 mesh is required.
In the case of a stamped concrete driveway, the Contractor may have to remove the entire drive slab if the Contractor cannot maintain continuity or match the stamp pattern.

If the Contractor chooses to underbore the driveway then all restoration work must be done in accordance with Clause 4.7.5.

Bitumen Surface

In the case of a bitumen driveway, the driveway must be backfilled in accordance with Clause 4.7.5 to sub-seal. The surface is replaced with AC10 to match the existing thickness. However, the AC10 replacement layer must not be less than 50mm thick.

Unformed or Gravel Driveways

In the case of unformed or gravel driveways, the driveway must be backfilled in accordance with Clause 4.7.5 to sub-grade and finished with a 200mm layer of approved gravel and compacted.

4.8.3 Restoration of road reserves private works (carriageway and footpath)

Contractors conducting private works within road reserves are no longer allowed to do the final restoration. Instead the Contractor applies for a 'Road Opening Permit' and finishes the work in accordance with Clause 4.7 and its subsequent sub-clauses. The surface area disturbed by the construction is measured by the Council Officer inspecting the works. In accordance with fees and charges set out in Hawkesbury City Council's Revenue Pricing Policy; the Contractor pays a fee in lieu of doing the final restoration. This method also alleviates the Contractor from a Defects Liability period with regard to the restoration.

4.8.4 Restoration of road reserves public works (carriageway and footpath)

Contractors working for Hawkesbury City Council on projects for less then the formal tender limit will not do the final restoration on any work within the road reserve. The Contractors obligation finishes with Clause 4.7 and subsequent sub-clauses.

Contractors working for Hawkesbury City Council that require a formal tender must submit a price for all restoration within the road reserve in accordance with the specification in the tender documents.

4.9 Disposal of surplus spoil

'Surplus spoil' means all material excavated but not required for the purposes of the Contract. Surplus spoil from private property may be left on site with written permission from the owner.

The Contractor must notify the Superintendent of the existence and location of any surplus spoil within the construction area, asking him to state, in writing within 48 hours, whether the Principal requires such surplus spoil.

No surplus spoil is to be left on public or private property without the prior consent in writing of the owner, his agent or lessee. Written evidence of consent must be promptly forwarded to the Superintendent's Representative.

If neither the owner, nor the Principal, requires the surplus spoil, the Contractor must remove and dispose of it without delay, at his own expense.

Where it is proposed to dispose of surplus material on any private development, approval must be sought from the Superintendent and the property owner must obtain Development Consent from Council before depositing any material on the site.

5 Concrete

5.1 General

Concrete must consist of a mixture of Portland cement; fine and coarse aggregate; and clean, fresh, potable water. No additional materials or additives may be incorporated in the mixture without the approval of the Superintendent.

All ready-mixed concrete must comply with the requirements of Tables 'D' and 'E' below.

5.1.1 Inspections

No batching, mixing or placing of concrete is to be carried out without the approval of the Superintendent or his Representative. The Contractor must give at least forty-eight (48) hours' notice of his intention to perform such concreting operations.

The Contractor must keep a copy of the current edition and relevant Australian Standards relating to concrete on site.

Copies of current editions of other codes must also be kept on site if so directed by the Superintendent.

Any other Standard Codes or Specifications mentioned in the body or in the preface to the above Standards must be considered as part of this Specification.

5.1.2 Lighting

All concreting operations must be performed in good daylight or under other approved lighting conditions

5.1.3 Responsibility

It is the Contractor's responsibility to ensure that the concrete work has the properties required by the Specification, notwithstanding the use of approved materials and the stating of requirements and methods in the Drawings and Specifications.

5.1.4 Supervision

All concrete work must be carried out under the direct supervision of a capable foreman experienced in reinforced concrete construction, and in accordance with the appropriate Standards.

5.1.5 Consistency of concrete

The proportion of aggregates to cement for any concrete must be suitable for the method of placement employed, without permitting the materials to segregate or excess free water to collect on the surface. The mix must work readily into corners and angles of forms and around reinforcement.

The concrete mix must be subject to slump tests as directed by the Superintendent's Representative. Unless otherwise directed by the Superintendent's Representative, the slump values must be as follows:

a)	For mass concrete	80mm +/- 15mm
b)	For reinforced concrete and all other concrete	70mm +/- 15mm.

5.2 Classification of concrete

5.2.1 Special-class concrete mixes

These special classes of concrete must be used in aggressive environments and are specified as follows:

a) Type C (low heat) or "high slag" cement is used exclusively
b) a minimum cement content is specified
c) a maximum water-cement ratio is specified
d) a characteristic strength is specified.

Table B: Concrete classification

Concrete Class	Description in Construction notes	Min. Cement Content (kg/m^3)	Max. Water/Cement Ratio	Min. Compressive strength F'c ₸ (Mpa)
SW2	350-50-20	350	0.50	20
SW25	400-45-25	400	0.45	25
SW30	450-40-30	450	0.40	30
SW40	550-35-40	550	0.35	40

₸ F'c refers to the characteristic compressive cylinder strength of concrete at 28 days.

Note: SW30 is the minimum allowable class for water retaining structures.

5.2.2 Normal-class concrete mixes

These classes of concrete are specified on the basis of characteristic strength as set out in AS3600 and the requirements of Table C. These mixes are used in non-aggressive environments and a general purpose (Type A or GP) cement may be used.

Table C: Concrete class requirements

Concrete Class	Description in Construction Notes	Min. Compressive strength F'c (Mpa)
GD15	GD15	15
GD20	GD20	20
GD25	GD25	25

5.2.3 Filling concrete

(Nominal mix 1:10) shall consist of Portland Cement and selected spoil, as approved by the Superintendent's Representative, mixed with water in the proportions needed to produce a concrete containing not less than 170kg of cement per metre cubed.

5.2.4 Blinding concrete

Blinding concrete must be plain weak-mix concrete, not less than 50mm thick. If in ground where injurious or aggressive conditions are encountered, the weak-mix concrete must have a characteristic compressive strength of not less than 20Mpa and where appropriate, sulphate resistant cement must be used in the concrete.

5.2.5 Benching concrete

Concrete benching must have a characteristic compressive strength of 20Mpa, and must be made of the same cement type as that incorporated in the surrounding structure.

5.2.6 Epoxy grouts

Where epoxy grout is to be used, its type must be specified on the Contract Drawings. The Contractor must submit to the Superintendent for his approval, details of the particular brand of epoxy grout to be used, prior to its use.

5.2.7 Mortars (for purposes other than pipe joining and bedding)

Mortars must be proportioned accurately and mixed thoroughly with clean fresh water, as directed by the Superintendent's Representative. For purposes other than pipe joining and bedding, or as otherwise shown on plans, or specified by the Superintendent's Representative, mortars must be mixed in the proportions of 80kg of cement to $0.1m^3$ of dry-rodded measurement of sand. The mortar must be used fresh for all purposes. The cement and sand for use in mortars must be in accordance with Clauses 3.2.3.1 and 3.2.3.4 respectively.

5.3 Concrete supply and ordering

All concrete must be obtained from an approved manufacturer unless permission is obtained from the Superintendent to use site mixed concrete.

When ordering concrete, the four items listed below must be specified as follows:

a) slump up to the maximum shown on the Contract Drawing specified
b) aggregate graded up to the maximum size shown specified
c) portland Cement low heat unless otherwise shown or specified
d) the compressive strength must be that shown on the Contract Drawings or specified, prefixed by the symbol F'c, and these symbols must be given with written or verbal orders (NB: F'c is defined in AS3600).

5.4 Control of concrete

5.4.1 Sampling

Random sampling of the fresh concrete prepared for use in the works, together with the preparation therefrom of compression test specimens 150mm diameter x 300mm long (but increased to 300mm diameter x 600mm long for 75mm nominal maximum aggregate size), must be carried out as required herein. The work will be entirely under the control of the Superintendent or his Representative, who will select the batches of concrete from which the samples will be taken. The sampling must be in accordance with the relevant Australian Standard as listed in Appendix No. 1 of this Specification.

5.4.2 Making and testing specimens

The making and testing of specimens must comply with the requirements of the relevant Australian Standard as listed in Appendix No. 1 of this Specification.

An approved NATA testing laboratory at the Contractor's expense must carry out testing. Test certificates must be supplied to the Superintendent within seven days of testing.

5.4.3 Acceptance criteria

The testing strength of each sample must be assessed in accordance with the current edition of the relevant Standard.

The concrete must be deemed to comply with the compressive strength requirements of this specification if the test strength of every sample is not less than F'c, or if it complies with the current edition of the relevant Standard.

If the Superintendent permits further tests by core drilling of concrete liable to rejection, the acceptance of such concrete must be in accordance with the current edition of the relevant Standard.

5.4.4 Rejection of concrete

Hardened concrete must be liable to rejection if the test strength of the samples is less than F'c or if:

a) it fails to comply with the particular requirements of Clause 5.5.3 of this specification
b) it is porous segregated or honeycombed
c) its placing has been so interrupted that there is a construction or like join not to the Superintendent's satisfaction
d) the reinforcing steel has been displaced
e) construction tolerances have not been met
f) the required surface has not been achieved
g) the concrete can be shown to be otherwise defective.

All hardened concrete that is rejected must be cut out, disposed of and replaced by new concrete conforming to this Specification, at the Contractors expense and to the satisfaction of the Superintendent or his Representative.

5.4.5 Load tests on completed structures

Should any concrete fail to meet the requirements of Clauses 5.5.3 and 5.5.4 below, a load test on the structure, or that part of it represented by the rejected concrete, may be carried out at the discretion of the Superintendent's Representative, in accordance with the relevant Specification as listed in the attached Appendix. In that case, acceptance of the concrete concerned must be determined according to the Code. The whole cost of such a test must be borne by the Contractor.

5.5 Formwork

5.5.1 General

Formwork must conform to the shape, lines, grades and dimensions of the concrete as required by the Contract Drawings, and must be constructed of approved timber or of metal in which all bolts and rivet heads in contact with the concrete are countersunk.

Formwork for walls must be designed and constructed with wall openings to ensure proper placement of concrete without segregation for the full height of the wall. The wall opening must be carefully and effectively closed with formwork to prevent egress of concrete.

Used formwork must have nails withdrawn and must be thoroughly cleaned and repaired before reuse.

5.5.2 Construction

Forms must be smooth, true to line and properly supported, braced and tied together to maintain their position and shape.

Formwork must be so designed and constructed that the whole can be removed without damage to the concrete. The forms must be close-joined to prevent leakage of mortar. Forms must be chamfered for re-entrant angles and filleted for corners. The faces of the bevel in each case, unless otherwise stated, must have a width of 20mm.

5.5.3 Oiling

The internal surface of the formwork must be oiled or greased to prevent adhesion of mortar. Oil or grease must be of non-staining mineral type, applied in a thin film before the reinforcing is placed. Any surplus moisture must be removed from the forms before to placing concrete.

Ends or end-fasteners, which are to be removed from the concrete, must be so greased and arranged that they can be extracted without excessive jarring or hammering and without damage to the concrete surface.

5.5.4 Inspection and approval

No concrete must be placed in any section of the work until the Superintendent has approved the formwork of that section.

5.5.5 Removal of formwork

Forms must be maintained and must remain firmly in place until the concrete has attained the necessary strength to support its own weight and construction loads. In addition, they must remain in place when required to protect the concrete against the effects of low temperature and excessive evaporation. No formwork must be removed without the authority of the Superintendent.

Removal must be effected in a manner that will not damage the concrete or affect the safety of the structure.

For low-heat cement, the following minimum periods must elapse before the forms may be removed:

Table D: Minimum Delay before Stripping (in days)

Member Type	Member	Effective Span (m)	21°C and Over	10°C to 21°C	5°C to 10°C	Under 5°C
vertical unloaded	wall, beam side	N/A	2	3	5	7
vertical load bearing	wall column or structure	N/A under 3	6 10	7 14	8 21	10 28
horizontal slab		3 - 6 over 6 under 3	14 21 14	21 28 21	28 28 28	 28 28
horizontal beam		3 - 6 over 6	21 28	28 28	28 28	28
tunnel	arch	N/A	12 hours	12 hours	16 hours	2

5.5.6 Formwork in the ground

Unless otherwise approved by the Superintendent, the sides of structures cast below ground level must be formed by formwork as specified above, and the formwork must be stripped so that the concrete can be inspected and any defects rectified.

5.5.7 Defective formwork

Concrete work, which is misshapen or defective due to poor formwork, must be removed or replaced or the defect remedied as directed by the Superintendent.

5.6 Reinforcement

5.6.1 Materials

Unless otherwise specified or shown on the Contract Drawings, all reinforcement must be grade 410Y "Tempcore", deformed bars grade 230S or 450, and mesh complying with current relevant Standards. All steel wire reinforcing fabric must be supplied in flat sheets.

5.6.2 Cleaning

Reinforcement must be stored clear of the ground. Immediately before placing the concrete it must be free of loose mill scale, loose rust, oil, paint, grease, dirt or other matter, which may reduce its bond to the concrete.

5.6.3 Forming

All reinforcement must be bent cold and must be accurately formed to the dimensions indicated on the Contract Drawings.

Unless otherwise shown, all hooks and bends must be standard hooks and bends as described in the current edition of the relevant Standard.

5.6.4 Placing

Reinforcement must be accurately placed in position, and supported by approved concrete, plastic or metal chairs, spacers or hangers.

In reinforcement in the form of a mat, each bar must be secured with tie wires at alternate sections, and at other points as required.

5.6.5 Cover to reinforcement

Unless otherwise specified or shown by figured dimensions, the clear cover of concrete over reinforcement (including stirrups and ligatures) must be as near as is practicable to, but not less than, the following:

a) 65mm to all formed surfaces except where indicated otherwise (below)
b) 65mm to faces of base slab
c) 40mm to top surface of suspended slabs
d) 65mm to underside of suspended slabs
e) 50mm to backfilled face of vertical walls
f) 65mm to water face of vertical walls.

5.6.6 Splices

Splices in reinforcement, including shop welds of all descriptions, may be made only if shown on the Contract Drawings or if approved by the Superintendent. Splice details must comply with the current edition of the relevant Standard, with the minimum lap lengths shown on the Contract Drawings.

5.6.7 Inspection and approval

The placing and fixing of reinforcement of each section of the work must be inspected and approved by the Superintendent before any concrete is placed in that section. At least 48 hours' notice must be given to allow time for inspection.

5.7 Concrete Placing

5.7.1 Placing

No concrete must be placed until the Superintendent or his Representative has approved the equipment, reinforcement, formwork and other surfaces against which the concrete is to be placed.

No concrete, which has been partially hardened or has been contaminated by foreign materials, may be placed in the work. Retempered concrete must not be used.

No concrete is to be exposed to rain during mixing, transport or placing or until it has set. During rain and when rain is impending, approved protection measures must be taken.

Prior to and during the placing of concrete, the contact surfaces of all plant and equipment to be used for this work must be thoroughly cleaned of all hardened concrete and foreign matter Formwork must be cleared of debris, and free from water.

Concrete must be conveyed from the mixer to the place of deposit without delay and by methods, which will not cause or permit segregation and/or loss of materials. Troughs, chutes and pipes for conveying concrete may be used only if approved in advance. Such approval may be withdrawn if, in the opinion of the Superintendent or his Representative, their use will adversely affect the quality of the concrete. Their use must then be discontinued immediately.

Concrete must be placed at a rate that will permit proper compaction and must not be placed to a depth greater than 500mm before compaction of the concrete below.

The method of placement must be so as to prevent segregation and/or accumulation of concrete on the forms or reinforcement.

Except at approved construction joins and movement joins, concrete at each section of the work must be placed in a continuous operation so that new concrete is constantly being placed against unset concrete to produce monolithic mass.

Concrete must be placed in various sections of the work in such order and with such time intervals as may be approved or required. All vertical members must be placed and compacted at least three hours before the commencement of the placing of any member (including reinforcement) which they support.

5.7.2 Compaction

During and after placing, the concrete must be thoroughly compacted by means of mechanical vibration, supplemented by tamping, spading and slicing. Care must be taken to fill every part of the work, to work the concrete under and around the reinforcement without displacing it, to work coarse aggregate back from the formed faces and to leave no air bubbles or voids.

Mechanical vibration must be applied internally to the fresh placed concrete, or externally to the formwork, or by a combination of these methods, as specified, approved or directed. Internal vibrators must be used unless otherwise specified or directed.

Approval of the vibrators and associated equipment must be obtained before the mixing of the concrete. Internal vibrators must transmit at least nine thousand (9,000) vibrations (complete cycles) per minute when under load. Formwork and screed vibrators must have a frequency of at least four thousand, five hundred (4,500) vibrations per minute and where two or more vibrators are mounted on the same unit of formwork, their frequencies must be as near as possible.

Sufficient vibrators must be used to ensure they effect compaction of the whole of the concrete and expulsion of the air from it at the same rate as the concrete is deposited in the forms. In addition, at least one vibrator of each type must be provided as a reserve.

Vibrators must be operated in an approved manner. Internal vibrators must be applied in a systematic manner in the area of freshly deposited concrete. They must be applied at uniformly spaced points, not further apart than twice the radius of the visible vibration effect. Vibration must not be allowed to cause segregation or to draw mortar from the surrounding concrete or to damage partially hardened concrete. Vibrators must not bear on the reinforcement.

5.7.3 Construction Joins

Construction joins must be made as and where indicated on the Contract Drawings and/or specified or approved. The whole of any section of the work between construction joins must be cast in one continuous operation. If the Contractor wants to make construction joins other than those specified, he must obtain approval before starting to pour concrete.

If, due to breakdown or other contingency, a construction join becomes necessary at a point not previously approved, concreting must be continued by emergency means to a point designated by the Superintendent or his Representative, and a construction join of an approved type must be formed.

Unless otherwise specified, approved or required construction joins must be either vertical or horizontal

Vertical construction joins must be formed against mortar tight barriers. At horizontal construction joins, the forms must be overfilled, and the concrete compacted, and the top be struck off to the correct level.

Steel reinforcement shown as continuous on the Contract Drawings must not be interrupted at construction joins.

For construction joins not shown on the Contract Drawings or specified, the Contractor must obtain instructions from the Superintendent or his Representative as to keys, steps or other provisions for load transfer.

Immediately before placing new concrete on or against hardened concrete, the surface of the hardened concrete must be cut back to dense, sound, concrete and cleaned with an air-water jet or other approved means.

5.7.4 Movement Joins

Joins, which are designed to accommodate expansion, contraction or settlement, must be located and formed to the details shown on the Contract Drawings

Join fillers for water-retaining structures must be of the resin bonded cork type, as specified on the Contract Drawings, and must meet the requirements as set out in the current relevant Standard regarding expansion joints. The thickness of the filler must be the same as the join width, and extend through the full thickness of the concrete, except at water-stop centre-bulbs and sealed surfaces, as shown on the Contract Drawings. The filler board must be installed with a polyethylene bond breaker tape on the sealant edge.

Joins must be sealed with a polyurethane elastomeric sealant. The specified sealant materials must be used strictly in accordance with the manufacturer's instructions. No sealant must be placed:

a) until a copy of the manufacturer's specification certified by the manufacturer as being applicable to the materials supplied to the site, has been handed to the Superintendent or his Representative
b) unless the Contractor has thermostatically controlled equipment available which will permit the sealant to be heated and poured at the manufacturer's recommended temperatures.

Formwork release agents must be compatible with the specified sealant and its associated primer.

Join fillers and sealing compounds specified on the Contract Drawings must be used strictly in accordance with the manufacturer's written instructions, and installed by a specialist applicator, approved in writing, for the type of work under this Contract by the manufacturer.

Dowel bars must be structural grade, plain, round bars. The free or unbonded end of each dowel must be coated for one half its length in an approved bond breaker such as 60-70-grade bitumen. Where shown, the dipped end must be sheathed with a standard cardboard dowel cap containing a 15mm compressible packer.

All dowels and special reinforcement specified or shown must be accurately placed and rigidly held in position before concrete is deposited. A tolerance of not more than 1 in 100 will be allowed on the alignment of dowels.

5.7.5 Waterstops

Waterstops must be provided to the size, type and positions shown on the Contract Drawings or as specified by the Superintendent or his Representative.

An approved manufacturer must supply all waterstops. Waterstops must have a specific gravity of not less than 1.4, and be extruded from virgin polyvinylchloride. Waterstops must be properly joined in accordance with the manufacturer's written instructions, and must include all necessary moulded or prefabricated intersection pieces. Joins must have at least 80% of the strength of unjoined material.

The waterstops must be installed so that they are securely held in their correct positions during the placing of concrete, which must be fully and correctly compacted around the water stops so that no voids or porous areas remain. Where reinforcement is present, adequate clearances between it and all water stops must be left to permit proper compaction of the concrete. Unless otherwise specified or approved, reinforcement must not be positioned closer than twice the maximum aggregate size to a water stop, and in no case may the clear distance be less than 25mm. No holes may be made through water stops.

5.8 Curing and protection of concrete

Immediately after the initial setting of the concrete, all exposed surfaces must be protected against loss of moisture for a period of 14 days by covering with reinforced waterproof building paper or other approved impervious material. The covering material must be held firmly against the concrete for the full length of all edges and laps, and at frequent intervals in between. There must be no air circulation of the concrete and all surfaces, must be kept wet.

Curing compounds may not be used unless approved by the Superintendent or his Representative

Curing by ponded water will be permitted, but curing by layer of sand will not be permitted.

Freshly placed concrete must be maintained at a temperature not less than 10°C for at least five days after placing.

5.9 Concrete surfaces

All concrete surfaces must be true, free from excessive depressions and/or projections, and must not show 'bony' or porous patches.

All concrete must be inspected and approved after stripping the formwork and before patching or finishing work has commenced.

Should any detectable defect indicate inadequate compaction or other unsatisfactory work, the whole of the concrete work must be removed between such limits as the Superintendent may decide, and replaced with acceptable concrete work.

In unreinforced concrete all holes less than 0.1m^2 and less than 100mm deep must be made good. The surfaces of the holes must be cleaned, saturated with water and all free water must be removed. The holes must then be packed with stiff mortar composed of cement and fine aggregate in the proportions used in the concrete. The mortar must be well rammed so that no voids remain. The mortar must be protected and cured as specified for concrete.

In reinforced concrete all holes less than 0.05m^2 and less than 25mm deep must be filled as above.

All holes larger than those stated above must be filled in a similar manner using concrete instead of stiff mortar.

Where required by clause 5.10, projections and high areas must be removed.

5.10 Surface finishes

Surface irregularities are classified as 'abrupt' or 'gradual'. Offsets caused by misplaced or displaced form sheathing, lining or form sections or by loose knots or otherwise defective form timber, are considered ‘abrupt irregularities’ and will be tested by direct measurements. All other irregularities are considered ‘gradual’ and are to be tested by use of a straight edge or a template for curved surfaces. The length of the straight edge or template must be 1.5m for formed surfaces or 3.0m for unformed surfaces. The contractor must, if required, provide approved templates for use by the Superintendent.

The classes of finishes for formed and unformed surfaces must be as specified on the Contract Drawings. Unless otherwise specified or indicated on the Contract Drawings, the following classes of finish must apply:

Only skilled workers must perform finishing of concrete surfaces. The Contractor must keep the Superintendent advised as to when the finishing of the concrete will be performed. The Superintendent will test concrete surfaces where necessary to determine whether surface irregularities are within the limits specified as below.

5.10.1 Finishes for formed surfaces

The classes of finishes for formed concrete surfaces are designated by the symbols F1, F2, F3, F4, and F5.

5.10.1.1 Finish 'F1'

Finish 'F1' applies to formed surfaces upon or against which fill material or concrete is to be placed, and to concrete surfaces adjacent to excavated rock faces which are not exposed to view after completion of the works. The surfaces require no treatment after form removal except for repair of defective concrete and filling of holes, (e.g. those left by the removal of fasteners from tie rod ends). Depressions, when measured as described above, must not exceed 26mm.

5.10.1.2 Finish 'F2'

Finish 'F2' applies to all formed surfaces not required to receive finishes 'F1', 'F3', 'F4' or 'F5'. Included in this category are formed interior surfaces in access chambers, valve chambers, wells of sewage pump stations, inside surfaces of tunnel portals etc., except those specified to receive other finishes. Surface irregularities measured as described above must not exceed 10mm for gradual irregularities, and 5mm for abrupt irregularities.

5.10.1.3 Finish 'F3'

Finish 'F3' applies to formed surfaces, the appearance of which is considered to be of special importance, such as surfaces of structures exposed to public view.

Surface irregularities measured as described above must not exceed 6mm for gradual irregularities and 3mm for abrupt irregularities.

5.10.1.4 Finish 'F4'

Finish 'F4' applies to formed surfaces for which accurate alignment and evenness of surface are of paramount importance in eliminating the destructive effects of water action. Surfaces to receive an 'F4' finish include surfaces of flumes, spillways, spillway aprons and sea walls. When measured and described as above, gradual irregularities must not exceed 5mm, and abrupt irregularities must not exceed neither 3mm transverse to flow nor 6mm parallel to flow. In addition, abrupt irregularities on formed surfaces subject to high velocity flow (e.g. stilling basins) must be ground smooth and if considered necessary, stoned.

5.10.1.5 Finish 'F5'

Finish 'F5' applies to all formed surfaces on which plaster is to be applied. A coarse textured surface is required for bond, and the concrete must be placed against rough faced form boards. Surface irregularities, measured as described above, must not exceed 5mm for both gradual and abrupt irregularities.

5.10.2 Finishes for unformed surfaces

The classes of finish for unformed concrete surfaces are designated by the symbols 'U1', 'U2' and 'U3'. Interior surfaces must be sloped for drainage where shown on the Contract Drawings or as directed by the Superintendent or his Representative. Surfaces which will be exposed to the weather and which would normally be level must be sloped for drainage. Unless otherwise indicated on the Contract Drawings or directed by the Superintendent or his Representative, narrow surfaces, such as tops of parapets, must be sloped approximately 30mm per metre. Broader surfaces, such as platforms and decks, must be sloped approximately 20mm per metre. Unless otherwise specified or indicated on the Contract Drawings, the following classes of finish will apply:

5.10.2.1 Finish 'U1' (screeded finish)

Finish 'U1' (screeded finish) applies to unformed surfaces that will be covered by fill concrete, terrazzo or other material. Finish 'U1' is also used as the first stage to finishes 'U2' and 'U3'. Finishing operations must consist of sufficient levelling and screeding to produce even, uniform surfaces. Surface irregularities measured as described in Clause 5.10 must not exceed 10mm.

5.10.2.2 Finish 'U2' (floated finish)

Finish 'U2' (floated finish) applies to unformed surfaces not permanently concealed by fill material or concrete or not required to receive finish 'U3'. Floating may be performed by hand or power float equipment. Floating must be started as soon as the screeded surface has stiffened sufficiently, and should produce a surface that is free from screed marks and uniform in texture. If finish 'U3' is to be applied, floating should be continued until a small amount of mortar without excess water is brought to the surface, to permit effective trowelling. Surface irregularities as described in Clause 5.10 must not exceed 5mm.

5.10.2.3 Finish 'U3' (trowelled finish)

Finish 'U3' (trowelled finish) applies to floors. When the floated surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel trowelling must be started. Steel trowelling must be performed with firm pressure, such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface, free from blemishes and trowel marks. Surface irregularities measured as described in Clause 5.10 must not exceed 5mm.

5.11 Core holes, embedment and hold-down bolts

5.11.1 Core holes and embedment

Where core holes and embedment of service lines and fittings are required in the concrete and not shown on the Contract Drawings, details of such core holes and embedment must be submitted to the Superintendent for approval. Unless otherwise specified, embedded service lines must be positioned to a tolerance of +/- 10mm.

Where pipe work block-outs are required and have not been detailed, the Contractor must obtain written approval from the Superintendent for any position he proposes to use. The block out must have a keyed shape and/or water stop as required by the Superintendent. In addition, the block-out must be fully scabbled before infilling, and the pipe must have either a weep flange or be treated with epoxy and sand to ensure water tight bonding of the infill concrete. All infill concrete must be poured using header boxes to apply pressure to the infill, with bleed holes to ensure the escape of trapped air.

Core holes must not be cut in the hardened concrete without the approval of the Superintendent. The Contractor is responsible for co-ordinating the core, block out and embedment requirements of all the trades, and obtaining approval from the Superintendent.

All block-outs and embedment must be inspected and approved by the Superintendent before pouring concrete. 24 hours' notice must be given for this inspection.

Block-outs in the concrete may be formed from pressed metal forms, tapered to ensure clean removal or from polystyrene blocks. Where polystyrene is used, removal must be affected by dissolving-out with petroleum not less than seven days after the pouring of the concrete. Concrete surfaces so exposed must be thoroughly cleaned prior to placing of mortar. It is the responsibility of the Contractor to ensure that all forming materials are removed without damaging the concrete.

5.11.2 Hold-down bolts

The Contractor is responsible for obtaining suitable templates for use in casting in bolts for all items of steelwork and equipment to be supplied and installed by others.

Bolts to be used in a group to anchor a single base-plate must be shop-assembled to form a rigid arrangement by the welding of 10mm reinforcing bars to form a cage. Sleeves of mild steel must be fabricated in accordance with the Contract Drawings.

Unless otherwise specified, the deviation in the positions of bolts must not exceed +/- 3mm. The bolt group must be positioned to the following tolerances:

a)	Surveyed plan position	+/- 6mm
b)	Level	+/- 6mm

5.12 Testing for water tightness

All water-retaining structures must be tested for water tightness by filling with water to overflow level or the test level shown on the Contract Drawings.

Testing must take place before placing backfill around each concrete water-retaining structure, and before placing concrete benching, mortar toppings or tiling. The Contractor is responsible for the supply and installation of temporary support to walls, and footings of structures to be tested as directed by the Superintendent.

Testing must take place not less than 28 days after the final concrete pour, and not less than 14 days after all pipe work and equipment has been embedded in the walls and floors. This is provided the strength of the concrete used for embedment has reached the specified 28 day characteristic strength as determined by standard test specimens.

The Contractor must provide all labour and equipment required for the conduct of the test, and, is responsible, for continuous supervision while the structure is filling, and for the cost of sealing off, where necessary, any pipe openings.

Water filling of each structure must be at a uniform rate of not more than 1.2m per 24 hours.

Any defects observed during the filling must be made good as directed by the Superintendent as soon, as is practicable. The Contractor is responsible for any cost incurred for discharging water from the structure to enable repairs to be made.

Once the structure is filled with water, it is left for a period of seven days. During this time all exposed faces of the structure should show no signs of leakage and remain apparently dry.

If the drop in water level exceeds 10mm during the seven-day test period after allowing for rainfall and deducting an allowance for evaporation and absorption (which must be calculated by the Superintendent), the structure must be accepted as watertight. The Contractor must provide, locate and fill an evaporation-monitoring tank to the Superintendent's approval for use during testing.

If the drop in water exceeds that level, the new level must be recorded and further measurements made, at intervals of 24 hours for seven more days.

Unless otherwise directed by the Superintendent, the Contractor must pump out all tanks and structures on completion of the water tightness test.

5.13 Small concrete structures, ductile iron and precast articles

5.13.1 Access chambers and chambers

A standard access chamber, or chamber of appropriate type as per the Standard Drawings, must be constructed at each of the positions shown on the Contract Drawings. Galvanised mild steel step irons, or step irons approved by the Superintendent’s Representative, will be supplied by the Contractor, and embedded in the concrete during its placement in the positions shown. All benches and channels must be cement-rendered. Low heat concrete must be used to construct insitu access chambers.

All cover surrounds must be join sealed with mastic compound and the join bandaged with 150mm thick run of concrete reinforced with wire mesh.

All access chambers must be fitted with a lockdown gas/water tight GATIC type lid.

5.13.1.1 Precast Access chambers

Precast access chambers may be used in place of cast insitu access chambers, but the following procedures must be strictly adhered to:

a) pour the concrete base slab (30MPa, low heat with 60-80mm slump) into the excavation. Ensure at least 150mm minimum of concrete below the downstream invert of the benching.
b) ensure a minimum 50mm of concrete above the top of the upstream pipe. Work a 350mm or a 525mm section into the concrete and level. Take care not to deform plastic pipes, if used.
c) place concrete on the outside of the base section up to a depth of 200 mm and vibrate this concrete into position. Ensure flexible joins are not covered.
d) leave the base to set before constructing the rest of the access chamber is.
e) all joins that do not accept rubber rings must be sealed with mastic compound.
f) the cover surround must be sealed with mastic compound and the join bandaged with a 150mm thick rim of concrete reinforced with wire mesh.
g) all access chambers must be fitted with a lockdown gas/water tight GATIC type lid.
h) all joins inside the access chamber must be cement rendered.

5.13.2 Ductile iron and precast concrete access chamber frames and covers

All access chambers must be fitted with a lockdown gas/water tight GATIC type lid.
All access chambers must be finished generally 100mm to 150mm above the ground surface or as directed by the Superintendent's Representative.

5.13.3 Lamp holes, verticals and vertical drops

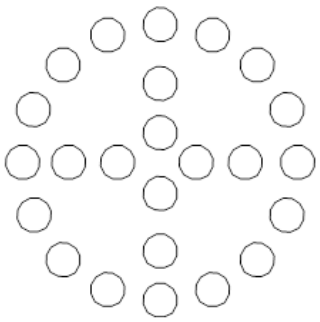
Lamp-holes, verticals and vertical drops must be constructed in the positions shown on the Contract Drawings, or as directed by the Superintendent's Representative.

Where vertical drops have to be cut into existing access chambers, external drops must be constructed if the overall depth of the access chamber is 2500mm or less. Internal drops may be constructed if the overall depth of the access chamber is more than 2500mm.

5.13.3.1 Drop Entry in Precast Access chambers

The approved method of forming a drop entry in a precast access chamber is as follows:

a) Do not cut a drop entry within 150mm of a section join
b) Using a kanga hammer with a 19mm rotary bit, drill a series of holes spaced 12mm apart. The hole pattern should be as follows:



c) Break out the concrete using a kanga hammer with a non-rotating chisel bit. At no time is a hammer to be used to break the remaining concrete. An approved contractor may also core the hole. If in the process of preparing a drop entry the ring cracks out to a join, the entire ring must be removed and replaced. See also Standard Drawing SM1-3 and SM1-5.

5.13.4 Vent shafts

Vent Shafts must be erected in the positions shown on the Drawings or as directed by the Superintendent's Representative in writing.

5.13.5 Bulkheads

Bulkheads, where indicated on the plans or as directed by the Superintendent's Representative, must be minimum 150mm thick concrete or sand cement filled hessian bags constructed from invert level of the main up to sub grade. See standard drawing SM3-1. Backfill material must consist of compacted filling sand or sand cement mix.

6 Pipe Laying and Joining

6.1 Types of pipes and fittings

Pipes and fittings to be supplied by the contractor must be of the following types:

a) vitrified Clay: spigot and socket pipes in effective lengths from 600mm to 1.80m with sockets suitable for:
   (i) Rubber ring joins
   (ii) Polyester rubber ring joins
b) concrete:
   (i) Spigot and socket pipes with sockets suitable for rubber ring joins, pipes of effective lengths of 1.22m to 3.66m.
   (ii) Flush join pipes of effective lengths from 1.22m to 3.66m.
c) ductile Iron: flanged or spigot and socket pipes with sockets suitable for gasket type joins-pipes of effective lengths of 5.49m.
d) ductile iron fittings: these must consist of approved fittings as per Principal's Standard Drawings.
e) PVC pipes and fittings: as specified in the Contract Drawings, all PVC pipes and fittings must comply with the current edition of the relevant Standard.
f) HDPE: as specified on the Contract Drawings.

6.2 Bedding

6.2.1 Bedding to be as ordered

Bedding of pipes must be as ordered from time to time by the Superintendent's Representative, who will select the particular type, as shown on the Standard Drawings or Contract Drawings and described below, to be adopted for each location. The pipes must be laid strictly in accordance with the Drawings and this Specification.

If the specified width of the trench, measured 600mm above the top of the pipe, is exceeded during construction, the Contractor must notify the Superintendent's Representative. If necessary, the Superintendent's Representative will revise the type of bedding to suit this increased width.

Where local patches of very soft strata occur, the Superintendent's Representative may order the Contractor to over excavate and stabilise the bottom of the trench with suitable material.

6.2.2 Type A (sand from elsewhere)

The ground must be excavated to 100mm below the bottom of the pipe barrel (outside) and handholes must be excavated as necessary at joins. The lower portion of the pipe barrel must then be bedded evenly throughout its length in approved sand, obtained from other than the subject trench.

6.2.3 Type B (mortar)

The trench must be excavated to 50mm below the bottom of the pipe barrel (outside), and handholes must be excavated as necessary at joins. 1:4 dry mix must then be dampened as ordered and placed in the bottom of the trench in a triangular shaped keel. The angle formed by the intersection of the two sides of the triangle at the centreline of the pipe must be not less than 90 degrees. The pipes must then be placed on this keel. Effective means must be used by the Contractor to maintain a minimum mortar thickness of 50mm below the barrel (outside) of the pipe, and to maintain the bedding in a satisfactory condition. After the pipes have been laid and uniformly bedded on the barrel, the collar holes and caulk holes in the bottom of the trench must also be filled with 1:4 mortar as above. The cement mortar must be mixed in the proportion of 40kg of Portland Cement to 0.1m^3 of sand (dry rodded measurement).

6.2.4 Type C (concrete)

The trench must be excavated to the required depth below the bottom of the pipe barrel (outside), as shown on the Standard Drawings. The pipes must then be laid and set to line and level, suitably supported on sandbags or, with the approval of the Superintendent's Representative, on precast concrete saddles, equipped with 13mm thick compressible bearing pads.

NO WEDGES, PACKING OR OTHER HARD BEARERS MUST BE USED UNDER THE PIPE.

A 13mm vertical compressible membrane must also be provided at each pipe join as shown on the Standard Drawings.

The lower portion of the pipe barrel must be bedded evenly throughout its length in concrete Class 300.60.15. If the concrete is to be allowed to set before the pipes are laid, the concrete surface must be accurately graded and shaped to suit the outside of the pipe barrel. Any space between the concrete and the barrel must be filled with 1:4 mortar (as specified in Clause 6.2.4) or cement grout, to the satisfaction of the Superintendent's Representative.

6.2.5 Type D (timber under pipes)

The trench must be excavated to the dimensions shown on the relevant Drawings and handholes must be excavated as necessary at joins. Hardwood piles not less than 150mm diameter if round, nor less than 200mm x 100mm if rectangular, must be driven to the depths and in the positions determined by the Superintendent's Representative. Hardwood crossheads for pipes 200mm nominal diameter and over must be not less than 200mm x 100mm, and must be shaped to fit the pipe barrel as shown on the relevant Drawings. Timber must be in accordance with Clause 3.2.5.1. These provisions regarding hardwood piles must also apply to any case of piling under a access chamber or other structure.

6.2.6 Type E (granular: e.g. PC3 graded mix etc.)

The trench must be excavated 100mm below the bottom of the pipe barrel. Additional excavation under sockets, may only be made in trenches in unyielding foundation material. This includes ground with thin layers of rock; compact rocky or gravelly soil or other unyielding or incompressible foundation material; sandstone; and most shales.

The bedding material must be well compacted. If additional bedding material needs to be added or removed from under the pipe, this must be done with minimum disturbance to the already compacted material.

NO WEDGES, PACKING OR OTHER BEARERS MAY BE USED UNDER THE PIPE AS THEIR PRESENCE CAN SERIOUSLY REDUCE THE PIPE'S LOAD BEARING CAPACITY.

Take care to ensure the minimum dimensions specified for the bedding material are achieved, and the minimum thickness of bedding material must be maintained at all points under the barrel of the pipes.

6.2.7 Bedding under pipe joins

Before the backfilling of pipelines, any open spaces under the pipe joins (e.g. the handholes left to permit the joining) must be filled with the bedding material ordered for the pipeline. This additional bedding material must be tamped into place.

6.3 Laying

6.3.1 General

All pipes must be laid in an approved manner, true to line and grade as shown on the Drawings, or as directed by the Superintendent's Representative. The pipes must be laid so that their barrels bear firmly and evenly on the bedding material, the sockets (if any) being entirely free from bearing until after the pipeline has been joined, tested and approved.

Each pipe must be joined to the previous pipe using appropriate joining gear so as to provide gentle pressure and avoid sudden blows that could crack adjacent sockets.

As necessary, additional bedding material must be added to each side of the pipe, up to the specified level and compacted by tamping.

6.3.1.1 Vitrified clay pipes

Vitrified clay pipes must be laid so that no irregularity occurs at the invert of the joins; any unavoidable lips due to variation in the shape or diameter of adjacent pipes must be concentrated, as far as is practicable, at the soffit of the joins.

6.3.1.2 Ductile iron pipes

In the case of ductile iron pipes, each pipe must be cleaned thoroughly when it is about to be laid. The Contractor must suspend each pipe in a sling before lowering it into the trench, or otherwise placing it in its permanent position, so that the Superintendent's Representative can sound and examine it readily to ascertain whether it is cracked. Pipes so passed must be laid one by one in their permanent positions.

6.3.1.3 Concrete pipes

In the case of concrete pipes which are to be embedded in the concrete of access chambers or other structures, any protective coating (bituminous or otherwise) on the outside of the pipes must be removed as directed by the Superintendent's Representative.

6.3.1.4 PVC pipes

In the case of PVC pipes and fittings, blocking must not be used to bring the pipe up to grade. Pipe side support material is to be adequately tamped in layers of not more than 75mm. Pipe overlay material is to be levelled and tamped in layers to a minimum 100mm above the top of the pipe. With PVC pipes and fittings the bedding, side support and overlay materials must be of the same material, unless specified otherwise by the Drawings or the Superintendent's Representative.

6.3.2 Pipes laid through an under-bore

The pipe must be laid inside the mild steel casing to the grade specified on the Contract Drawings or as directed by the Superintendent's Representative. A flexible join must be placed at both ends and clear of the casing; the casing must be backfilled with grout or flooded with sand.

6.3.3 Pipes laid on steep grades

All pipelines laid on grade steeper than 2.5% must incorporate means to prevent scouring of backfill through trench drainage and subsequent trench collapse. This must be in the form of bulkheads such as clay stops, sand/cement-filled bags or concrete. All bulkheads must be keyed into the sidewalls of the trench by 150mm, and constructed from the excavated floor of the trench to 300mm above the pipe barrel. All bulkheads must have pipe drains with filters attached.

The distance between bulkheads is determined by relating the slope of the gravity sewer as follows:

Distance between bulkheads = 30m / % grade

6.4 Service connections, sidelines, branch lines and dead ends

6.4.1 Service connections, general construction

Service connections are to be constructed as indicated on the Drawings or on Specification Drawing SM2-1 or as directed by the Superintendent's Representative. Upon completion of the service connection, plastic tape must be tied to the junction or sideline inlet, and brought to the surface, as the service connection is backfilled. A stake must be placed in the ground over the connection inlet and the tape tied to the stake.

6.4.1.1 Service connections (where main is less than 2m deep)

Where the sewer main is located within the property being served, the service connection must consist of a 45° slope junction, on its side with a plug fitted to the branch. In the case of PVC fittings, the branch must be fitted with a threaded access coupling and screw-on cap.

Where the sewer main is located in an adjacent property to the property being served, the service connection must consist of a 45° slope junction, on its side with a 45° bend fitted to the branch, to bring the connection square to the boundary. The sideline must extend a minimum 1000mm into the property being served and be fitted with a cap or plug. In the case of PVC the end of the sideline must be fitted with a threaded access coupling and a screw-on cap. Sidelines must not exceed 5m in length.

6.4.1.2 Service connections (where main exceeds 2m in depth)

Where the sewer main is more than 2m deep, service connections must be constructed in accordance with Specification Drawing SM2-1, i.e., a 45° slope junction, on its side, with a 90° bend to fit the riser. An 88° junction is to be fitted to the riser at an appropriate depth to serve the property. The branch is then finished as per Clause 6.4.1.1. Both cases apply.

A concrete thrust block must be constructed under the 45° slope junction and 90° bend on the main line to support the riser. The riser must be encased in concrete with a minimum thickness of 100mm around the pipe from the thrust block up to 100mm above the junction pipe or sideline.

6.4.2 Service connection depths

Junction depths must be set at an appropriate depth to serve the entire lot. For the average-sized residential lot, the junction depth is to be 1.5m or as directed by the Superintendent's Representative. Junctions must not be set more than 2.0m deep unless approved by the Superintendent's Representative.

6.4.3 Sidelines (0-5m in length)

Sidelines must not exceed 5m in length.

Extra care must be taken when laying and bedding sidelines to prevent any loading that may damage the sideline during backfilling or due to natural subsidence.

Any proposed sideline in excess of 5m must be treated as a branch line and is dealt with in Clause 6.4.4.

6.4.4 Branch lines (over 5m in length, maximum 50m)

Wherever branch lines over 5m in length are to be connected to an existing riser or junction, the riser or junction may be replaced with a maintenance shaft or access chamber if the mainline is equal to or less than 2m deep. Where the main is in excess of 2m in depth the riser or junction must be replaced with an access chamber constructed insitu or precast see (sec 5.13.1 and 5.13.1.1).

However, only the top half of the existing line is to be removed, using the remainder of the line to form the channel in the base. The terminal end of the branch line must be treated as a dead end and brought to the surface see (sec 6.4.6).

6.4.5 Caps, plugs and discs

The open ends of all pipelines, including dead ends, sidelines, branch lines and junctions must be capped with appropriate fittings.

6.4.6 Dead ends (maximum length, 50m)

All dead ends must be brought to the surface to form a rodding point. The junction and bend out of the main must be encased in concrete against undisturbed ground to form a thrust block. The riser must then be encased in concrete or sand cement to the surface. The riser in capped with a screw-down cover, and this is then to be protected by a lamphole cover with a concrete surround.

6.5 Joining

6.5.1 General

6.5.2 Rubber ring joins

6.5.2.1 Where to be used

Rubber ring joins must be used where pipes and fittings with this type of join are required. The Contractor must supply all joining materials.

6.5.2.2 Joining procedure

a) Vitrified clay and concrete pipes

Before making the join, the Contractor must ensure that both spigot and socket are clean and dry. The rubber ring for vitrified clay pipes must be entered into the groove provided for that purpose in the socket end of the pipes. The rubber ring for concrete pipes must be stretched on to the spigot-end of the pipe, square with the axis, and as near as possible to the end, care being taken that it is not twisted.

In both cases, the spigot end of the pipe must then be pushed up to contact the socket of the pipe with which it is to join, and be concentric and in line with it. The spigot-end must then be entered into the socket of the already-laid pipe, and forced home by means of a bar, lever and chain, or other suitable method.

The join must be tested with a feeler gauge to ensure that the rubber ring has rolled evenly into place.

b) Ductile iron pipes

Any debris that may have entered a pipe or fitting must be removed, and the outside of the spigot and the inside of the socket must be thoroughly cleaned of all foreign matter. The rubber ring must be placed in the groove case in the lip of the socket and the spigot of the entering pipe centred and placed in contact with the rubber ring.

The pipe must be forced home, by an approved method against the back of the socket of the pipe last laid. When the join has been made, it must be tested by inserting a feeler to ensure that the rubber ring is located correctly in the join.

6.5.3 Rubber gasket joins

6.5.3.1 Where to be used

Rubber gasket joins must be used where pipes and fittings with this type of join are indicated in the Drawings.

6.5.3.2 Joining procedure

a) Ductile iron pipes

Any debris that may have entered a pipe or fitting must be removed, and the outside of the spigot and the inside of the socket must be thoroughly cleaned of all foreign matter. In making a join, the rubber gasket must be placed with the socket, as indicated on the Drawing, and the spigot of the pipe to be laid must be centred and brought into contact with the rubber gasket, which must have been properly lubricated with an approved lubricant. The spigot must then be forced home in the socket by means of an approved method. Where the pipe spigot has a depth of entry mark, the socket of the pipe must be brought up to this mark.

b) Concrete pipes

Before making the join, the Contractor must ensure that both spigot and socket are clean and dry. The rubber gasket must be clean and dry. While suitably suspended, the rubber gasket must be fitted to the spigot end of the pipe to be laid, and liberally greased with soft soap on the leading edge. The spigot end of the pipe to be laid, while still suitably suspended, must then be pushed up to contact the socket of the pipe with which it is to join, and be concentric and in line with it. The spigot end must then be entered into the socket of the already-laid pipe, and forced home by means of a puller, lever and chain or other approved method.

6.5.4 Plastic joins

6.5.4.1 Where to be used

Plastic joins must be used where pipes and fittings with these types of joins are indicated on the Drawings.

6.5.4.2 Joining procedure

a) Solvent Weld Joins: Spigots and sockets must be free of damage. Pipes and fittings must be free of sand, dust, grease or any other foreign matter. Before joining, all spigots must be cut square and chamfered, and be free of burrs on both faces of pipe edge.

Both spigot and socket ends of the pipes to be joined must be dry, primed and glued. Upon application of the primer and solvent, the pipes must be joined immediately, and held momentarily for the solvent to form a proper bond. Only recommended primers and solvents may to be used.

b) Rubber Ring Joins: All rubber ring joins must be done in the trench.

Rubber rings must comply with AS1646. Sockets, especially the ring groove, must be free of all foreign matter.

Spigots must be cut square, free of burrs on both faces of pipe edge, and the outside face of pipe edge must be chamfered to 12° - 15°.

Chamfer length must be approximately:

- 17mm for 150mm pipe
- 23mm for 225mm pipe
- 30mm for 300mm pipe.

Where mechanical devices are used for joining pipes, care must be taken to avoid damage to pipe ends and fittings.

6.5.5 Mortar joins

6.5.5.1 Where to be used

Mortar joins must be used only where directed by the Superintendent's Representative. The Contractor must supply all material for mortar joins.

6.5.5.2 Mortar for joins

Mortar for joins must consist of Portland Cement, sand as specified in Clause 3.2.3.4 and water in quantities such that the water/cement ratio by volume does not exceed 1:2. The solid constituents must be mixed thoroughly in a dry state in the proportion of 160kg of cement to 0.1m^3 (dry rodded measurement) of sand. The mixture must then be passed through a plasterer's sieve, and again mixed thoroughly as water is added, to produce a mortar of approved consistency within the water/cement ratio limit already specified. The mortar must be used fresh.

6.5.5.3 Joining procedure

The surface, which will be in contact with the mortar, must be clean and wet when the mortar is packed into each join. The mortar must be packed solidly with approved caulking tools, and must completely fill the joining space. Spigot and sockets joins must be finished with the mortar flush with the end of the socket. For joining concrete pipes 750mm diameter and over, with internal flush type joins, the butting ends of the pipe (excepting those surfaces which will be covered with mortar) must be coated with a bituminous primer, before they are pushed together.
The male-ended pipe must, if ordered, have a length of bituminous plastic joining compound wrapped around the angle of the tongue, so that after the pipes are pushed home, this will fill the outside groove.

The inside groove must be filled with the specified mortar, and finished flush with the inside of the pipe as and when directed by the Superintendent's Representative. Pipelines less than 750mm nominal diameter must be checked with a prover for internal cleanliness after joining; larger pipelines must be inspected internally. In all cases, the interior of pipelines must be pre joined before being laid in their permanent positions. In such cases, the pipes and fittings (if any) must be pre joined in groups and in a manner as may be directed by the Superintendent's Representative. Handling of them must be as directed by the Superintendent's Representative. Any damaged joins must be cut out and re mortared by the Contractor at his expense to the satisfaction of the Superintendent's Representative.

6.5.5.4 Curing

Each join must be kept damp for at least three days after the join is made, or until it is covered by backfilling, whichever comes first. Strips of wet hessian must protect joins, as and wherever directed by the Superintendent's Representative. If ordered by him, joins must be coated with an approved bituminous emulsion soon after the initial set has taken place.

6.5.6 Clay-cement joins

6.5.6.1 Where to be used

Clay-cement joins may be used only where directed by the Superintendent's Representative.

6.5.6.2 Materials for Joining

As directed by the Superintendent's Representative, joining material must consist of either:

a) Powdered Clay and Cement

The Contractor must pass the dry powdered clay through a No. 16 sieve, and mix it thoroughly with Portland Cement, in the proportion of 1:1 by volume.

Sufficient water must then be added, and the mixing continued to secure a joining material of approved consistency.

b) Bentonite, Sand and Cement

The Contractor must dry mix thoroughly one part of Bentonite with four parts of sand, as specified in Clause 3.2.3.4 and five parts of Portland Cement (all by volume). Sufficient water must then be added, and the mixing continued to secure a joining material of approved consistency.

6.5.6.3 Joining Procedures

The joining material must be used fresh. Curing must be as per Clause 6.4.5.4.

6.5.7 Gibault joins

6.5.7.1 Where To Be Used

Gibault joins must be used where shown on the Contract Drawings or as directed by the Superintendent's Representative.

6.5.7.2 Joining Procedure

Place one gibault flange and one rubber ring on the end of each pipe. Place the ductile iron sleeve on the end of one pipe, butt pipes together, leaving about 10mm clearance for expansion, and adjust the sleeve so that it is centrally situated over the ends of pipes. Draw the gibault flanges over the sleeve, insert bolts, and screw up until spanner tight, compressing the rubber ring against the ends of the ductile iron sleeve and making a watertight and slightly flexible join. Long gibault joins must be used in preference to short gibault joins.

6.5.8 Flange joins

6.5.8.1 Where to be used

Flange joins must be used where pipes and fittings with this type of join are indicated in the Drawings.

6.5.8.2 Joining Procedure

The faces of the flanges must be carefully scraped and all rust removed. The join must be made with approved insertion, and the bolts must be screwed up tightly.

6.6 External protection of pipes

6.6.1 Polyethylene sleeving

Where required the Contractor must provide all materials needed for protection of pipes.

The Contractor must place and make continuous the protection over the pipes and fittings in the trench, and is responsible for keeping the protection intact until the mains have been accepted by the Principal, and the trench backfilled.

Where shown on Drawings or directed by the Superintendent's Representative, the pipe must be completely surrounded with 75mm of approved sand, well consolidated.

6.6.2 Electrical bonding

Where electrical bonding is required, the Contractor must supply the fittings. These fittings must be fixed as directed by the Superintendent's Representative and fixing will be at the Contractor's expense.

6.6.3 Concrete encasement

Concrete encasement is required where there is insufficient cover over a main, where a structure may be built over or adjacent to a main, or where the Superintendent’s Representative may order.

In general, the concrete must be mass concrete with a minimum thickness of 150mm around the main, unless otherwise specified. An expansion join must be placed approximately every 4.5m along the encasement.

Where the concrete encasement is to be placed around an existing sewer main, the main must be excavated to a minimum of 0150mm below the pipe barrel, and inspected and repaired if deemed necessary by the Superintendent or his Representative, before concrete encasement.

In the case of concrete or vitrified clay mains, the main must be wrapped in plastic for the length of the encasement plus 1m, before pouring the concrete.

Where a structure is to be built over the main, the structure must not place any load on the main.

6.7 Sandfill disused pipelines

Where shown on the Drawings, disused pipelines must be sand filled, unless otherwise directed by the Superintendent's Representative.

6.8 House service reconnection

Re-connection of existing house services must be made when ordered. This work must be carried out at the Contractor's expense.

6.9 Connection to existing sewer or access chamber

Connections to existing sewer mains or access chambers may be done by the Contractor or by the Principal with the assistance of the Contractor, as directed by the Superintendent's Representative.

This assistance, which will be undertaken at the Contractor’s expense, includes the provision of working plant, labour and materials, as well as incidental excavation, cutting concrete and construction of an external drop as directed by the Superintendent's Representative

If the Contractor fails to do so when ordered, the Principal will do the work and debit the cost to the Contractor.

6.10 Reflux valves

If reflux valves are required, they must be installed in accordance with the current edition of the National Drainage Code.

With regard to location, the reflux valve must be installed on the house service connection, immediately upstream of the boundary inspection riser.

7 Testing

All gravity pipelines of sizes up to and including 600mm nominal diameter must be pressure tested by the Contractor, in the presence of the Superintendent's Representative, or by an independent third party with appropriate training and certification.

Unless otherwise directed by the Superintendent's Representative, the hydrostatic test as described in Clause 7.1 must be done with the pipes and/or fittings exposed. The low-pressure air test described in Clause 7.2 may be conducted at practical completion, unless otherwise directed.

Where mortar or clay-cement joins are used, the pipeline must not be tested until at least 12 hours after the making of the last join. Where PVC pipes with solvent weld joins are used, the waiting period is 24 hours. No such delay is required in the case of other types of joins.

Any joins found to be defective must be removed and replaced, and any faulty pipes or fittings must be replaced, at the Contractor's expense.

After the specified time interval, the repaired pipelines must be retested at the Contractor's expense. This procedure must be repeated if necessary, until the Superintendent's Representative approves the pipeline.

If, in his opinion, the pipeline may have been damaged after a successful test, the Superintendent's Representative may order a retest, at the Contractor's expense.

7.1 The Hydrostatic test

Whenever ordered, must be applied as follows:

7.1.1 Hydrostatic test *(pipe conduits)*

The pipeline must be tested over such lengths as the Superintendent's Representative may approve. Arrangements must be made to supply a head not exceeding 3m of water in the case of vitrified clay and concrete pipelines; higher heads as ordered by the Superintendent's Representative must be applied to ductile iron and plastic pipelines. If so directed by the Superintendent's Representative, the water used for the test must be coloured; for a pipeline to pass this test, no leaks must occur.

The Contractor must supply all equipment and fittings needed, and must do all work required to apply the hydrostatic test.

7.1.2 Hydrostatic test *(access chambers)*

The hydrostatic test must be conducted with all access chamber components in place but prior to cement rendering of the base and all internal joins.

All pipe openings in the access chamber must be plugged. The access chamber is then filled with water to the top of the cover surround. After allowing an interval for absorption, to be determined by the Superintendent or his Representative, the access chamber is refilled and the loss of water during the following 30 minutes is measured.

The test will be considered satisfactory if the water loss is less than 3mm times the depth of the access chamber (3mm x depth = acceptable water loss). The depth of the access chamber is measured from the invert of the outlet to the lip of the cover recess.

7.2 The Low Pressure air test

Wherever ordered, must be applied as follows:

- air must be introduced slowly by suitable means until a specified pressure (50kPa for PVC pipes and fittings or 28kPa for vitrified clay pipes and fittings) is obtained. This pressure must be maintained for at least three minutes
- the air supply should be shut off and, provided that the pressure of the air contained in the pipe under test does not fall below (35kPa for PVC pipes and fittings or 25kPa for vitrified clay pipes and fittings) within 60 seconds, the pipeline will be considered satisfactory
- if, however, the pressure is not maintained within the specified limits, the air must be reintroduced and the pipeline examined for leaks by pouring a concentrated solution of soap and water over the joins and fittings
- the source of the leak shall be ascertained and any defects repaired
- the pipeline must then be retested.

7.3 The Water Loss test

Whenever ordered, must be applied as follows:

The rising main must be tested in an approved manner to a head (nominated by the Superintendent's Representative) above the lowest invert level of the rising main.

The rising main must be tested as soon as practicable after it has been laid and the trenches backfilled. The rising main must not be tested less than seven days after the construction of the last anchor or thrust block on that rising main.

The Contractor must provide suitable approved testing equipment and means for connecting the testing equipment to the rising main. The Contractor must also provide an approved calibrated pressure gauge graduated from zero to 120m head.

Prior to testing, the main must be slowly filled with water, taking care that all air is expelled. Once the main has been filled, it must left for 24 hours to allow for absorption, movement of the main and escape of entrapped air.

The rising main under test must be brought to the specified test head and maintained at that test head for a continuous period of four hours. During this time the quantity of water consumed per hour per metre length of rising main must be less than or equal to an amount specified by the Superintendent's Representative.

Allowable losses will be calculated as follows:

- Ductile Iron pipe - QL = 0.0105*D*L*H 0.5*0.0548
- uPVC pipe - QL = 0.01*D*L*H 0.5*0.0568.

Where:

- QL = allowable loss in litres per hour
- D = nominal diameter in (mm)
- L = length of section being tested in (km)
- H = Test head in (m)

The test head is the sum of maximum surge pressure head and the design operating head for peak wet weather flow taken from the system curve. The maximum surge pressure head is calculated as follows:

- Hp = Vc*V/g

Where:

- Hp = maximum surge pressure head in (m)
- Vc = sonic velocity in (m/s)
- Vc for ductile iron = 1065 m/s
- Vc for uPVC = 305 m/s
- V = design operating head for pwwf in (m/s)
- g = gravitational constant (9.8 m/s)

Where PE100 polyethylene pipe is used as a rising main; the 'water loss' test must be conducted in accordance with the current edition of the Water Services Association of Australia (WSAA) Polyethylene Pipeline Code.

7.4 CCTV survey details

The camera must be fitted with an inclinometer to show any change in grade along the conduit being surveyed. If a camera with an inclinometer cannot be obtained, the survey must be run in an upstream direction, with coloured water flowing through the conduit.

The CCTV operator must be an experienced operator with appropriate certification, a copy of which must be submitted with the CCTV report.

The video must conform to the following:

a) the camera must be fitted with a pan and tilt or a hemispherical head
b) the video must be in focus
c) the video must not have any black or fuzzy centres from a scratched lens or moisture in the lens
d) the video must include a textual display on screen of all potential defects
e) the video must show a careful inspection of all joins, junctions and potential defects

Failure to comply with all of the conditions in Clause 7.4 may lead to rejection of the video, and the survey will have to be redone at the Contractor's / Developer's expense.

8 Building adjacent to or over Council's sewer mains

8.1 General

Council's general policy is to not allow building over sewer mains. However, when circumstances indicate that the economic use of the property may be restricted as a result of sewer location, Developer/Owners may make written application for approval to build adjacent to or over sewer mains.

8.2 Approval

Where an approval is granted, the Developer/Owner must forward to Council an 'Identification Survey'. The survey must show accurate positions of the main and the completed structure built over the main. These measurements must be related to the property boundaries. The 'Identification Survey' must be conducted by a Registered Surveyor.

8.2.1 Indemnity

Where an indemnity applies, it will be recorded on Council's property information files.

With regard to lightweight removable structures, the property owner must indemnify Council against all costs associated with the removal and or subsequent re-erection of the subject structure, and give an undertaking to remove the structure when required to do so by Council.

In case of an emergency, Council may remove the structure to gain access to the sewer and Council shall not be held responsible for damage to the structure. The cost of such removal and subsequent re-erection of the subject structure will be borne by the property owner.

With regard to substantial structures, Council will not be held responsible for any damage to the structure built over or adjacent to a sewer main, in the event the main needs to be repaired.

8.3 Clearances

8.3.1 Horizontal clearance to sewers

For open trench access, regardless of whether or not shoring is required, the face of any footing or pier must be a minimum 600mm clear of the edge of the sewer main. The Superintendent or his representative must approve any variation on the minimum clearance in writing

In the case of deep-shored excavations, minimum clearance may have to be increased to 900mm. Sufficient headroom must be maintained to drive the trench shoring, i.e.; headroom equal to the minimum of depth of trench plus 600mm.

Where access will be by a shored drive or tunnel, the footings are to be designed so that an excavation, minimum width 1.2m (more for larger size pipes) can be carried out. This area need not necessarily be concentric with the centreline of the conduit but no footing should be closer than 600mm to the outside of the conduit (See Standard Drawing SM5-2 and 3).

8.3.2 Vertical clearance over sewers

Where a structure is built over a sewer main, sufficient headroom must be maintained to drive trench shoring or for tunnelling (See Standard Drawing SM5-1 and 3)

8.3.3 Length of tunnelling from open space

This must not exceed 6m, i.e.; a maximum of 12m of the sewer could be built over if access is available from both ends. Where the likelihood of future work is minimal, approval may be granted to increase, in single distance, from six to 7.5m for 225mm dia. mains, and to 10m for 300mm diameter or larger mains.

8.4 Building adjacent to sewers

When building adjacent to Council sewer mains the Contractor must consider the following:

In order to maintain the structural integrity of Council's sewer main, adjacent footings must be designed and constructed so that the footings fall a minimum of 900mm below the zone of influence of the trench which is taken from a point 600mm from the centreline of and at the invert level of the sewer main. The angle of repose shall be assumed to be 1:1 (45°) in undisturbed clay or similar material, and 1:2 (30°) from horizontal in sand or filled ground, whether compacted or not. All supporting piers adjacent to the sewer main must be reinforced for subsequent tying into the strip footing or perimeter beam. Details of the proposed footings system must be submitted for approval prior to commencement of work. The contractor must accurately locate the position of the main prior to commencement of work (See Standard Drawing SM5-2).

When boring holes for footings adjacent to sewer mains, the Contractor/Developer must ensure the drilling equipment has not damaged the sewer main.

8.5 Building over sewers

8.5.1 General restrictions

There are some general restrictions that must be considered when building over a sewer main. They are as follows:

a) building over access chambers, lampholes, vertical shafts or any rodding points will not be permitted at any time
b) building over sewer rising mains (pumping mains) will not be permitted at any time
c) unimpeded access must be maintained to access chambers, inspection shafts, vertical shafts, lampholes or any sewer main rodding points at all times.

8.5.2 Lightweight removable structures / outdoor living areas

Lightweight removable structures may include but are not limited to carports, pergolas, aboveground swimming pools, decking, garden sheds awnings.

The above structures may be built over any reticulation main, subject to the following:

a) general restrictions apply (see clause 8.5.1)
b) where applicable, that portion of the structure, which projects over the sewer main, must be constructed as to be readily detachable from the remainder of the structure.
c) in case of an emergency, Council may remove the structure to gain access to the sewer and Council will not be held responsible for damage to the structure. The cost of such removal and re-erection will be borne by the property owner.
d) indemnity applies (see clause 8.2.1).

8.5.3 Substantial structures

Substantial structures may include but are not limited to in ground swimming pools; residential, commercial, industrial buildings and outbuildings, such as residences, garages, house extensions, home units, commercial buildings, factories.
If approval is granted construction is subject to the following conditions:

a) general restrictions apply (see clause 8.3.1)
b) the structure must be piered and supported in accordance with Council's specifications to maintain structural stability should the sewer main require excavation (see Standard Drawing SM5-1)

c) to minimise the need for future work on the sewer, the main built over must be encased in concrete in accordance with Council's Specification (see Standard Drawing SM5-1 and Clause 6.6.3 in the Standard Specification)
d) indemnities apply (See clause 8.2.1).

8.5.4 Second-story additions

Where the footings of the existing building are to be used, and these were taken below the zone of influence under Council's supervision when the original building was erected, an Engineer's Certificate, stating that the original footings are satisfactory to carry the additional building loads, is to be submitted to Council.

If Council has no record of the original footings, an additional storey may be added only if Council's requirements, such as encasement and underpinning, are observed. Council must be satisfied of the structural adequacy of the building.

Approval will be withheld if the sewer or access to the sewer is not considered satisfactory.

Appendices

Appendix 1: Materials

Unless otherwise specified on the Contract Drawings, Standard Drawings or in this Specification, all materials and workmanship must comply with the current editions of the Australian Standard Specifications, Codes of Practice and Regulations as applicable to:

- bricks
- concrete
- curing compounds
- formwork
- join fillers
- joining procedures
- pipes and fittings
- reinforcement
- safety
- structural steel
- timber.

Appendix 2: Relevant Legislation and Council Documents

The Contractor should have a working knowledge of the relevant sections of the following legislative Acts their amendments and regulations.

Dangerous Goods (Roads & Rail Transport) Act, 2008

Dangerous Goods (Roads & Rail Transport) Regulation, 2008

Local Government (General) Regulation 2005, Part 2(Approvals)

Occupational Health and Safety Act 2011

Occupational Health and Safety Regulation 2011

Protection of Environment Operations Act 1997

Protection of Environment Operations (General) Regulation 2009

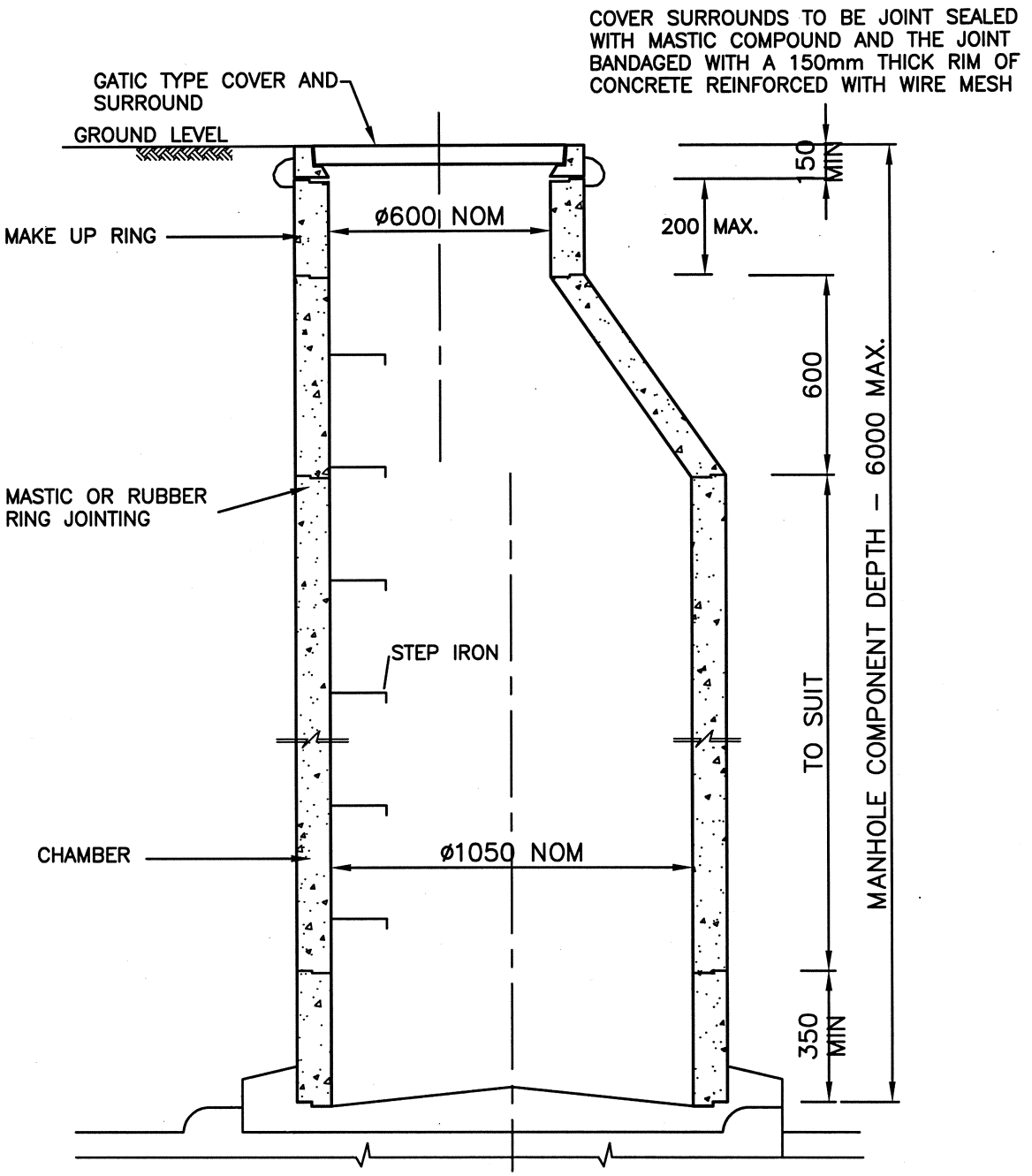
Work Health and Safety Act, 2011

Work Health and Safety Regulation, 2011

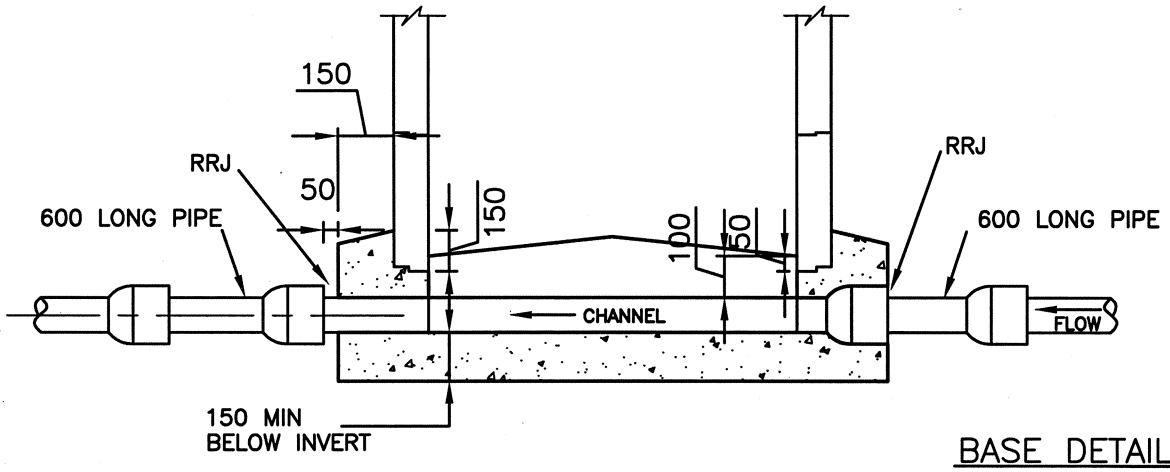
All relevant NSW WHS Codes of Practice (current editions)

Field Guide for Traffic Control at Work Sites, Parts 1 through 6 (current edition)

Appendix 3: Standard Drawings



FOR MANHOLES 1200 TO 6000 COMPONENT DEPTH



BASE DETAILS

H.C.C. STANDARD SPECIFICATION

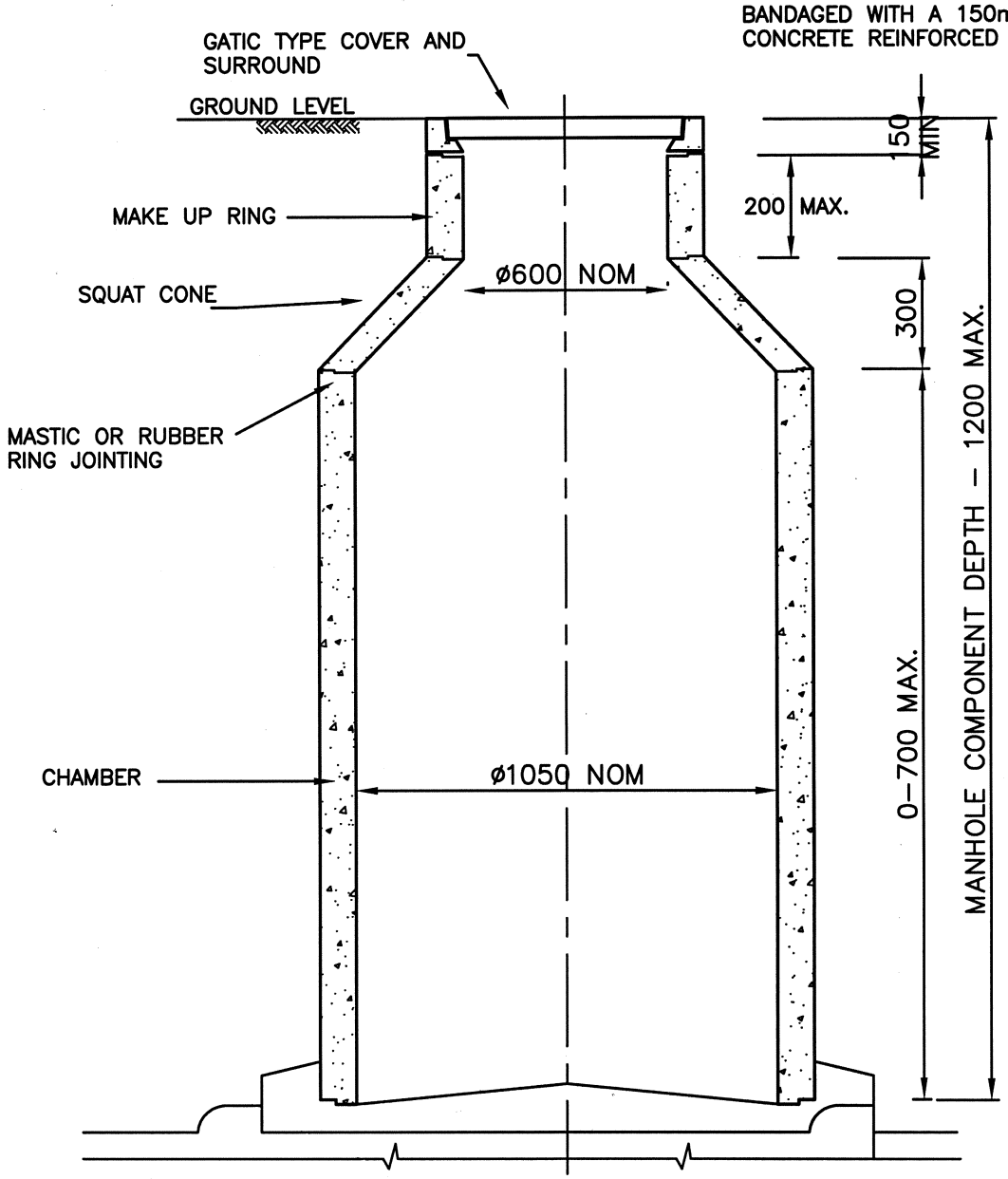
PRECAST CONCRETE MANHOLES
FOR 150,225 AND 300 DIA. SEWERS

Hawkesbury City Council

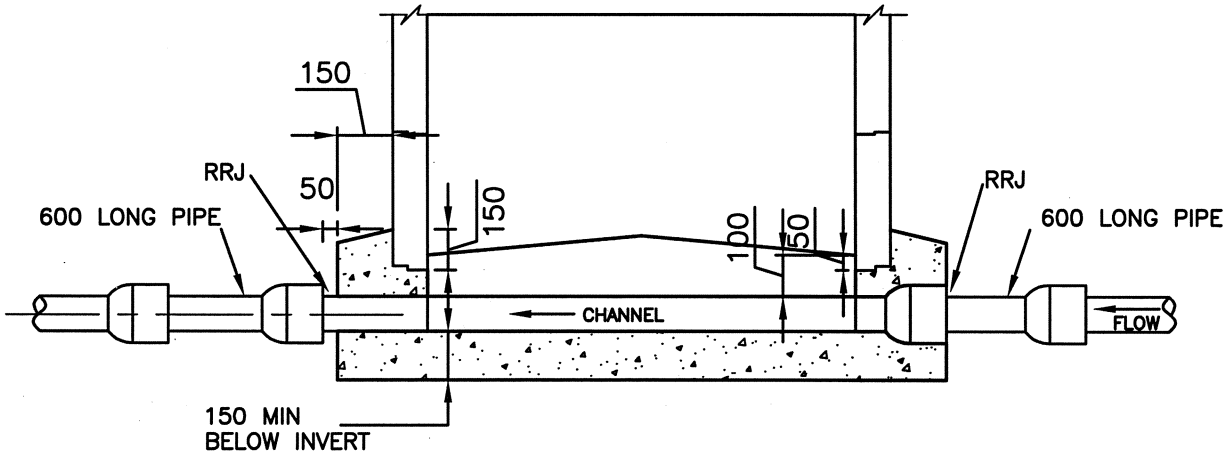
SCALE NTS DRAWN BY: H.G.

PLAN No. SM1–1

COVER SURROUNDS TO BE JOINT SEALED WITH MASTIC COMPOUND AND THE JOINT BANDAGED WITH A 150mm THICK RIM OF CONCRETE REINFORCED WITH WIRE MESH



FOR MANHOLES 450 TO 1200 COMPONENT DEPTH



BASE DETAILS

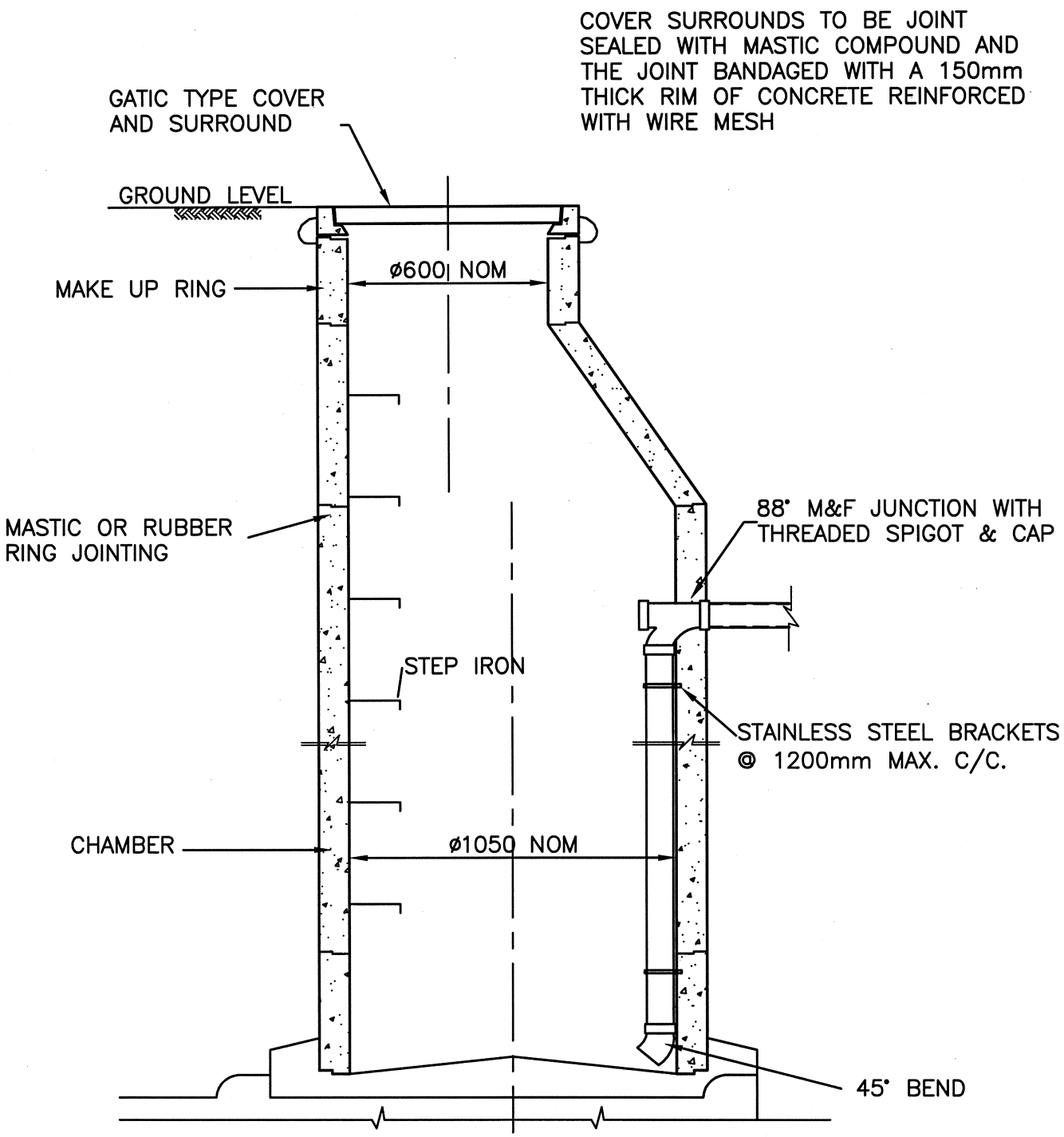
H.C.C. STANDARD SPECIFICATION

PRECAST CONCRETE MANHOLES FOR 150,225 AND 300 DIA. SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM1-2



STANDARD INTERNAL DROP

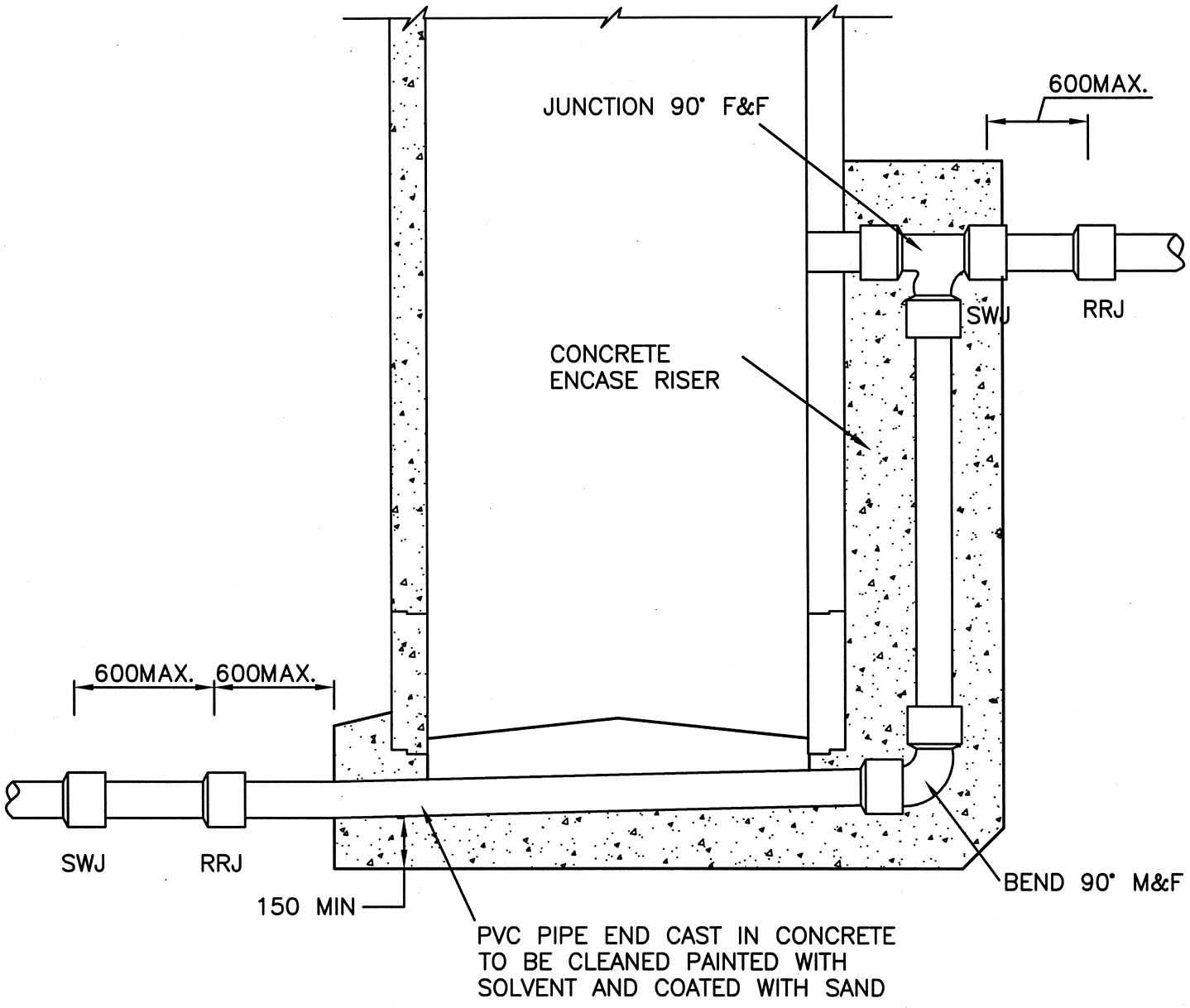
H.C.C. STANDARD SPECIFICATION

PRECAST CONCRETE MANHOLES
FOR 150,225 AND 300 DIA. SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM1–3



EXTERNAL DROP DETAILS

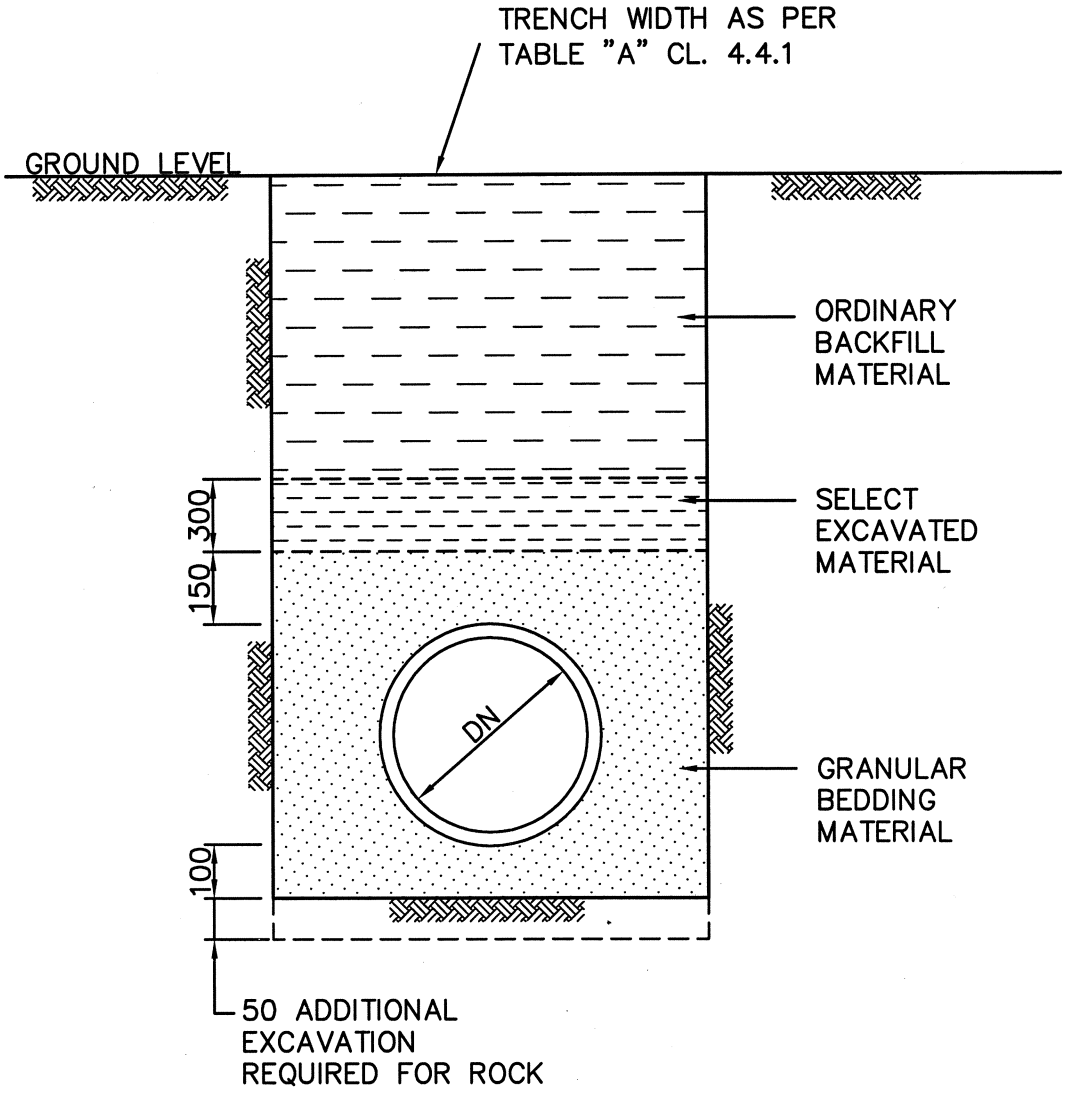
H.C.C. STANDARD SPECIFICATION

PRECAST CONCRETE MANHOLES
FOR 150,225 AND 300 DIA. SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM1–4



GRANULAR BEDDING & SURROUND (VC & UPVC PIPES)

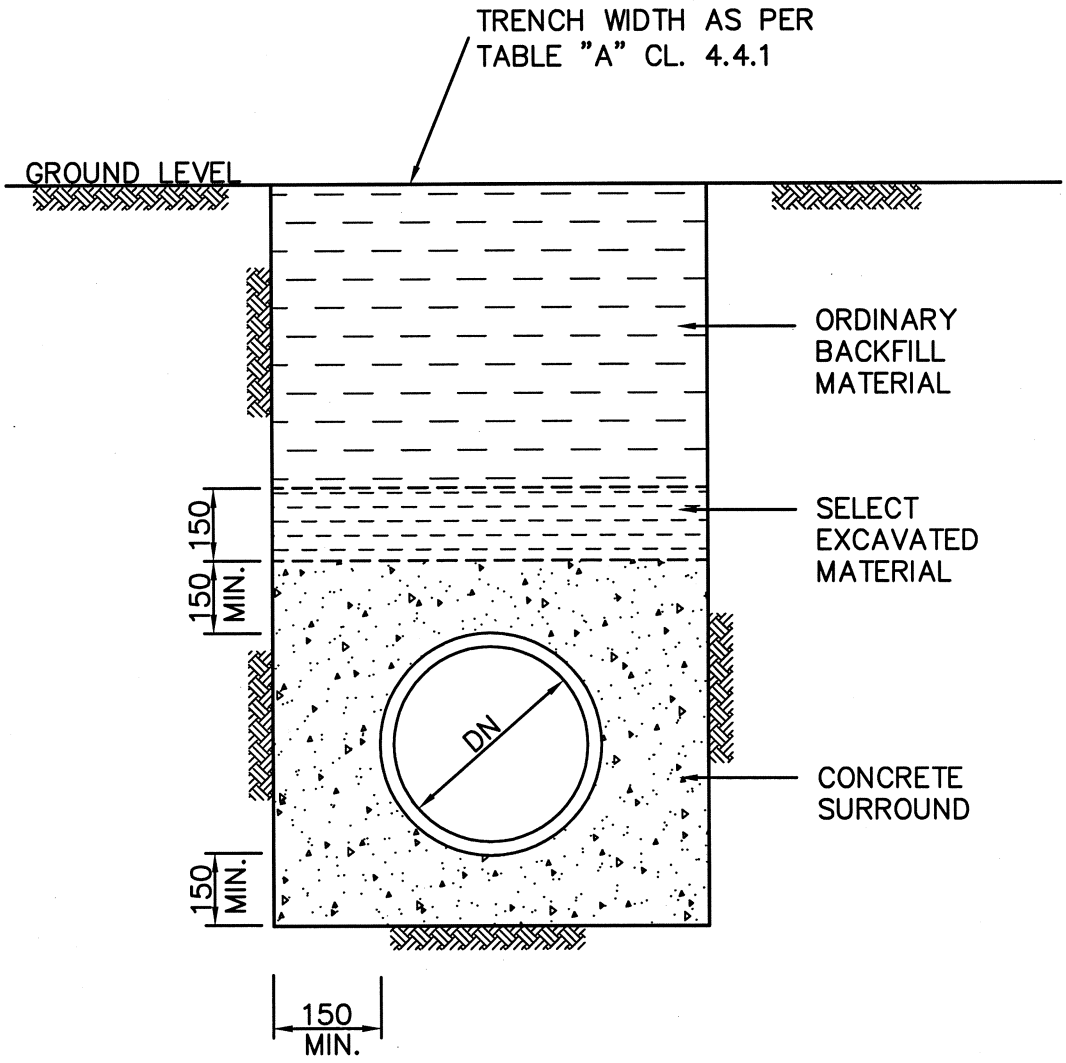
H.C.C. STANDARD SPECIFICATION

BEDDING AND BACKFILLING
FOR 150,225&300 DIA. SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM1–6



PLAIN OR REINFORCED CONCRETE SURROUND
(VC & UPVC PIPES)

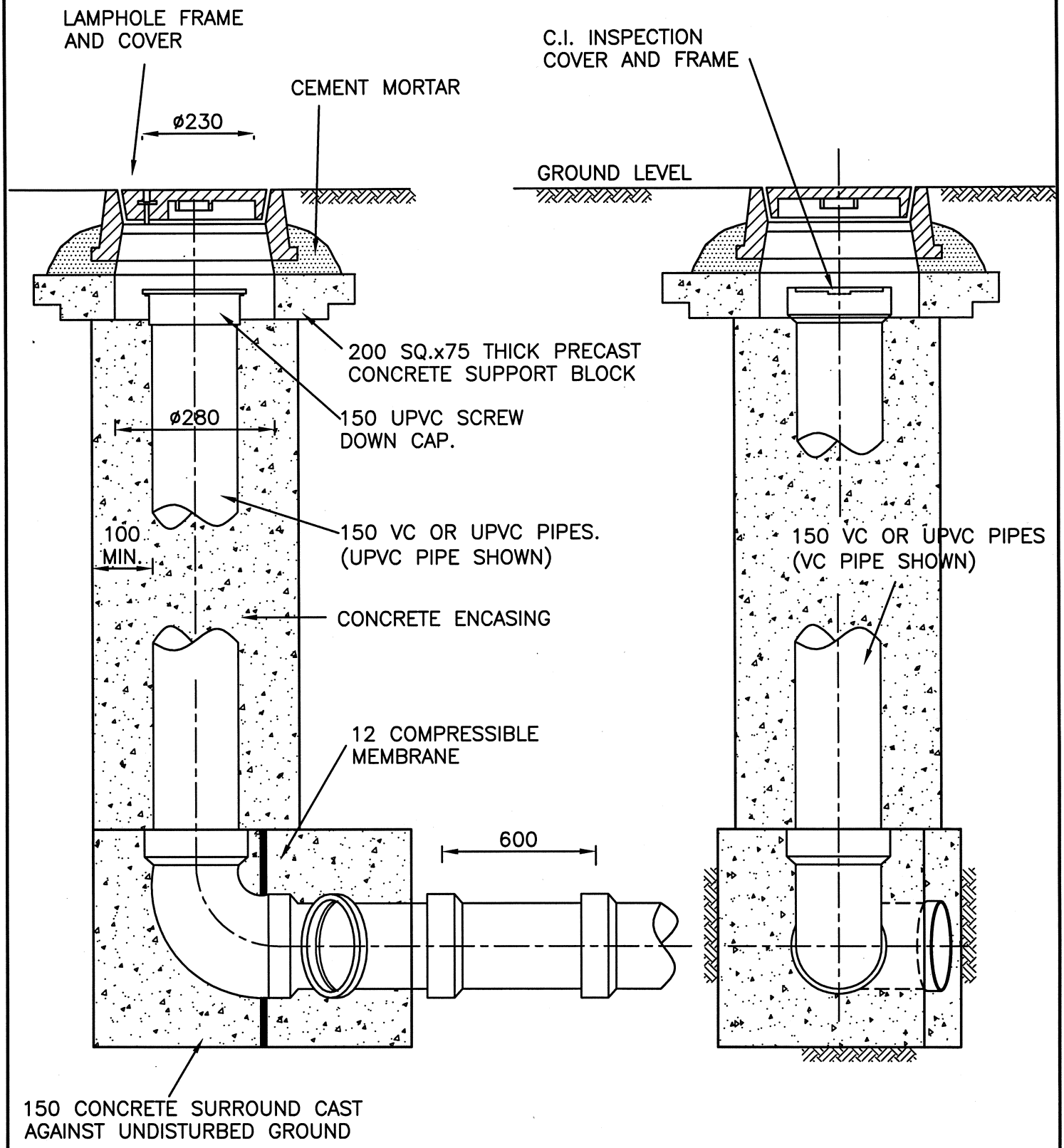
H.C.C. STANDARD SPECIFICATION

BEDDING AND BACKFILLING
FOR 150,225&300 DIA. SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM1–7



SIDE VIEW
(UPVC PIPE SHOWN)

END VIEW
(VC PIPE SHOWN)

H.C.C. STANDARD SPECIFICATION

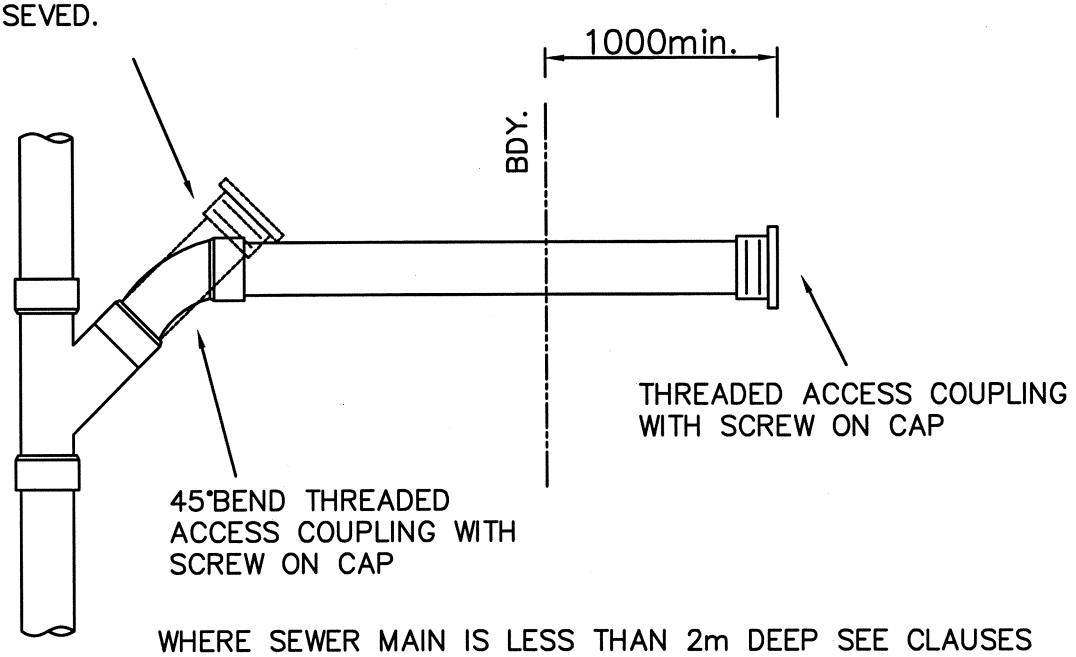
RODDING POINTS AT DEAD END FOR 150 & 225 DIA. SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

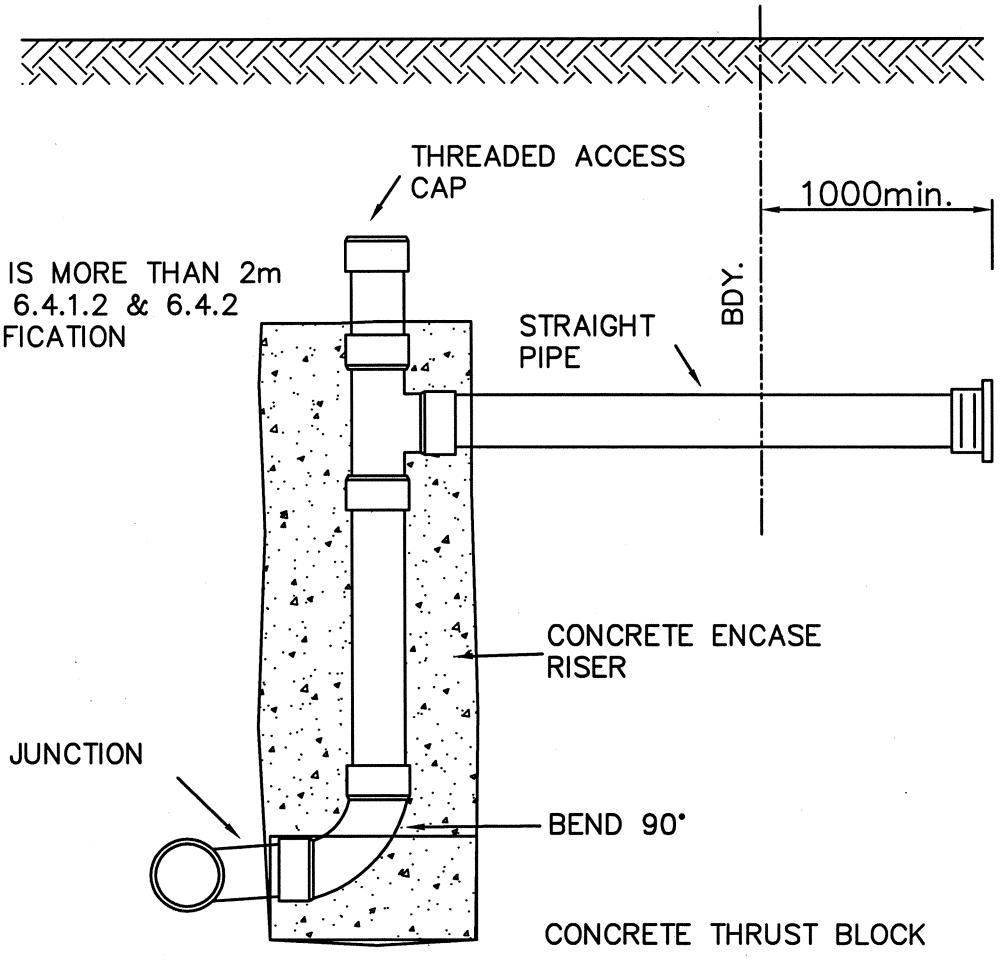
PLAN No. SM1–8

WHERE MAIN IS LOCATED WITHIN PROERTY BEING SEVED.



WHERE SEWER MAIN IS LESS THAN 2m DEEP SEE CLAUSES 6.4.1.1&6.4.2 OF STANDARD SPECIFICATION

WHERE SEWER MAIN IS MORE THAN 2m DEEP, SEE CLAUSES 6.4.1.2 & 6.4.2 OF STANDARD SPECIFICATION



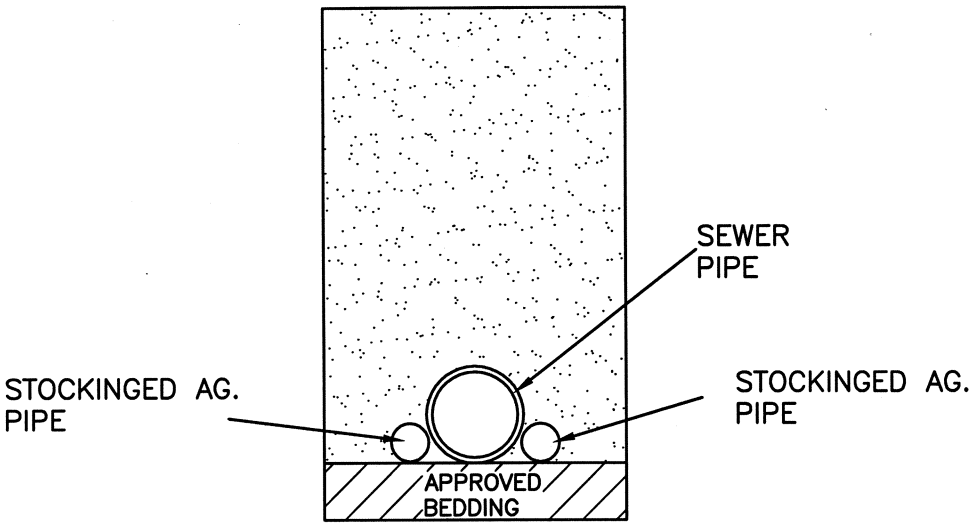
H.C.C. STANDARD SPECIFICATION

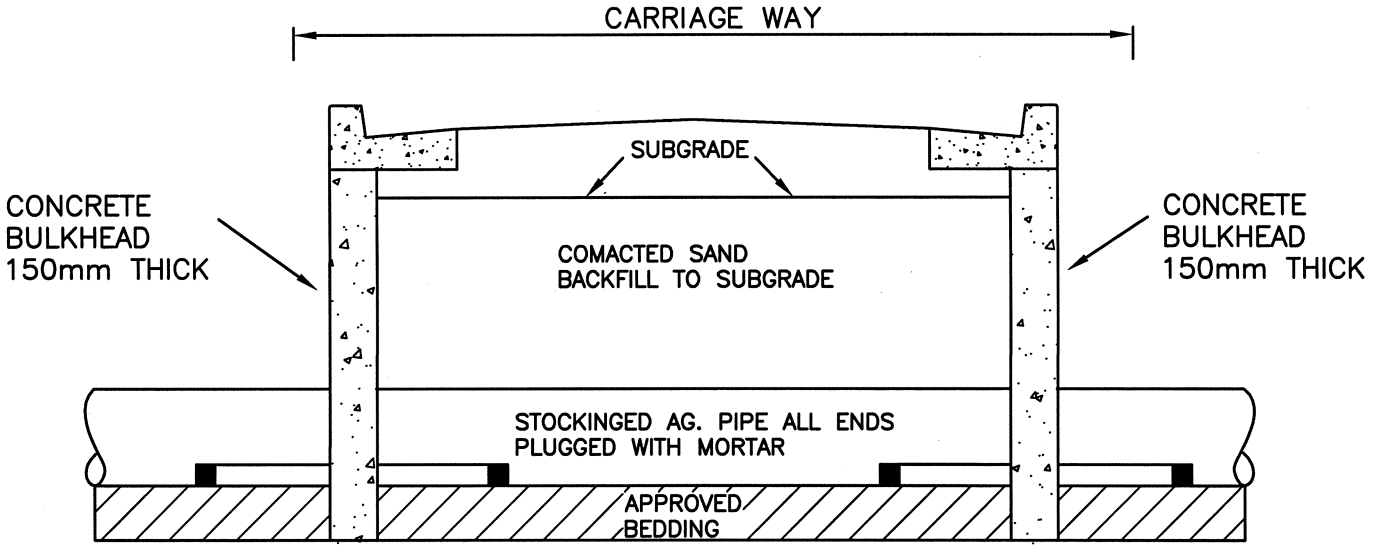
HOUSE SERVICE CONNECTIONS FOR PVC PIPE & FITTINGS

Hawkesbury City Council

SCALE NTS DRAWN BY:H.G.

PLAN No. SM2–1





NOTE:
WHERE PIPE IS TO BE ENCASED IN CONCRETE THE AG. PIPE IS TO BE CONTINUOUS BETWEEN THE BULKHEADS

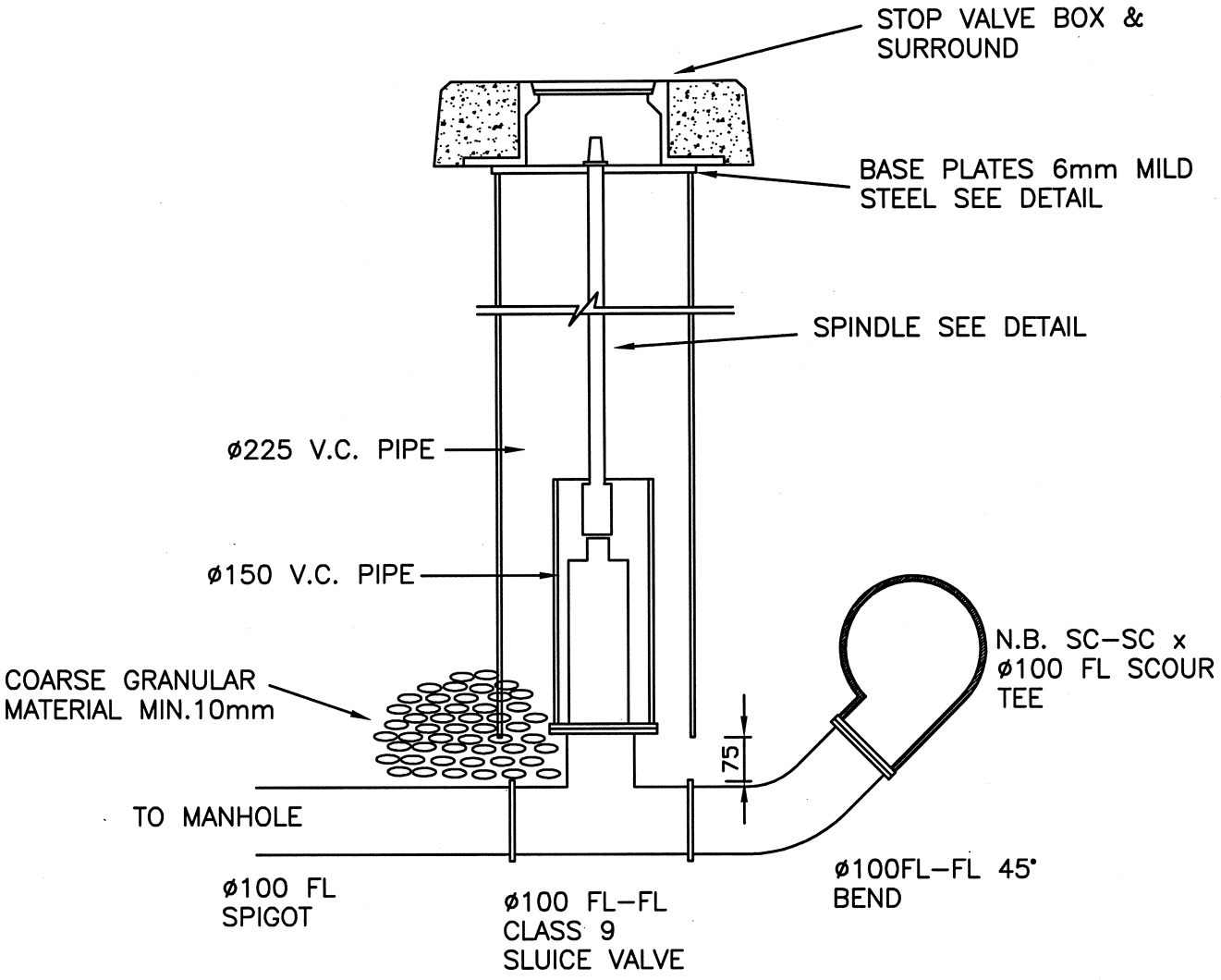
H.C.C. STANDARD SPECIFICATION

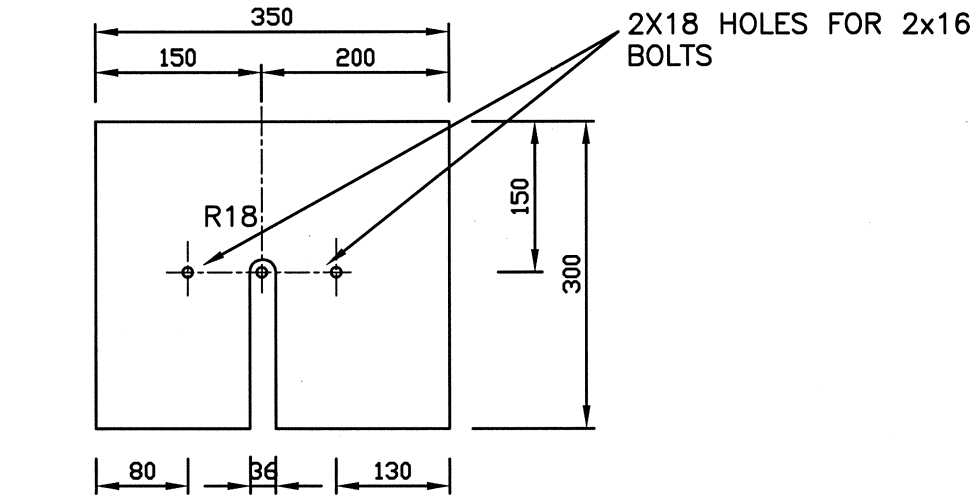
CONSTRUCTION DETAILS
CONCRET BULKHEADS

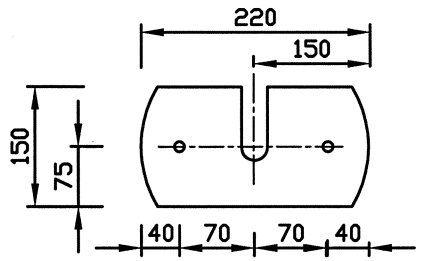
Hawkesbury City Council

SCALE NTS DRAWN BY:H.G.

PLAN No. SM3–1







DETAIL: BASE PLATES FOR STOP VALVE BOX & SURROUND

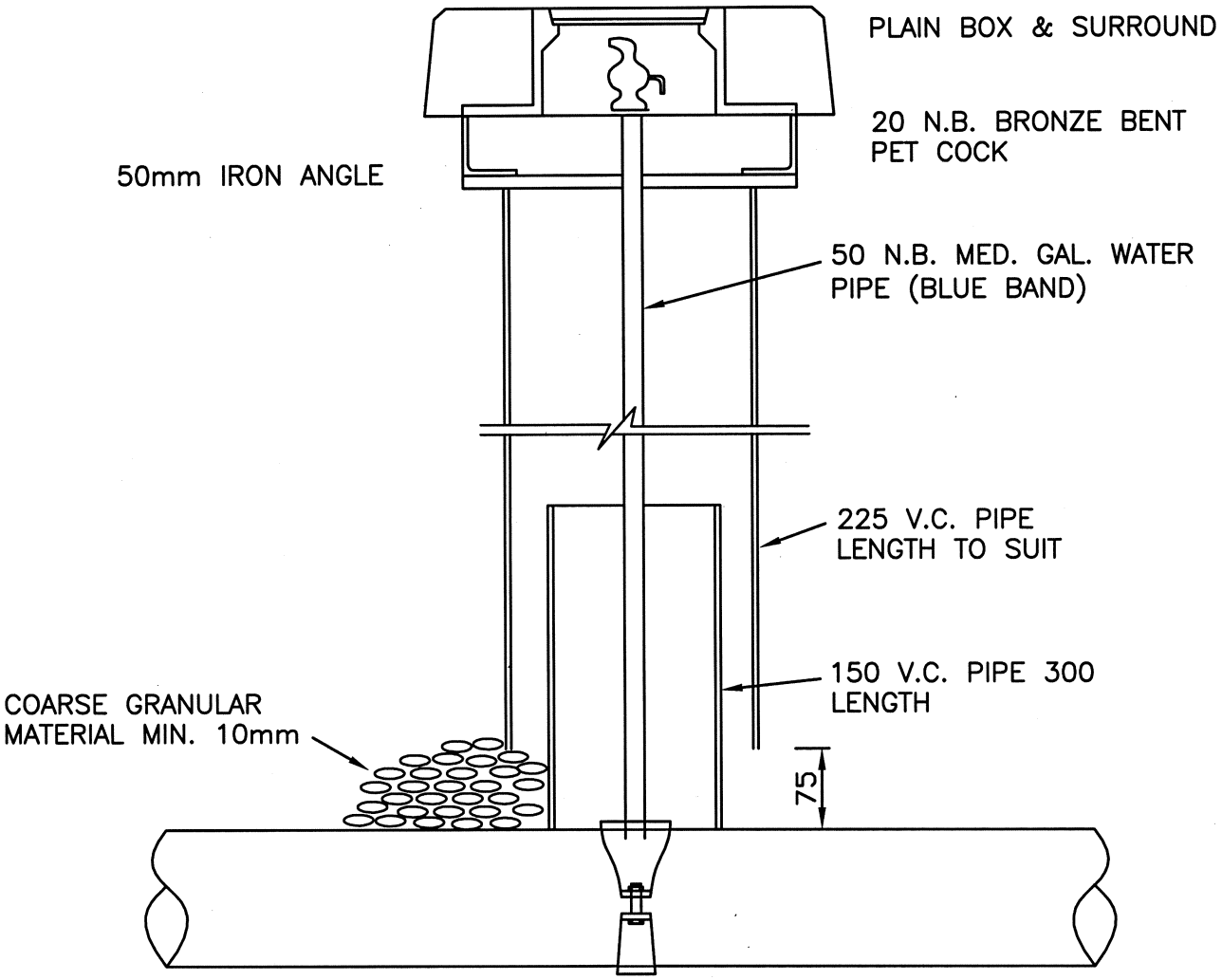
H.C.C. STANDARD SPECIFICATION

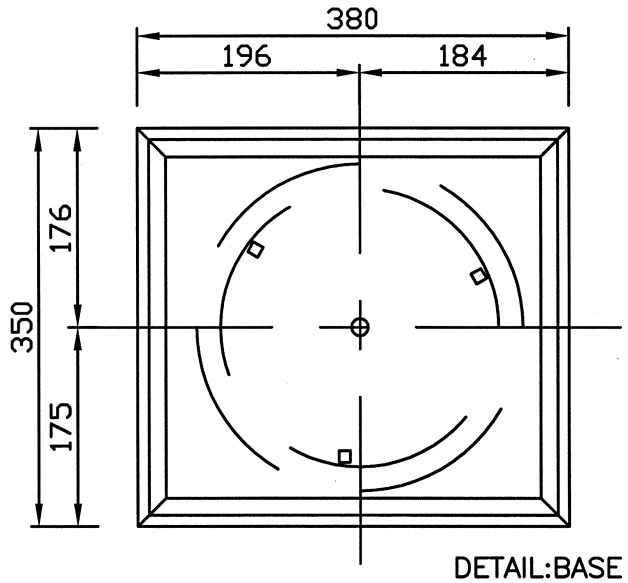
RISING MAIN DETAIL
SCOUR VALVE

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM4-1





DETAIL:BASE PLATE FOR AIR RELEASE VALVE COVER

H.C.C. STANDARD SPECIFICATION

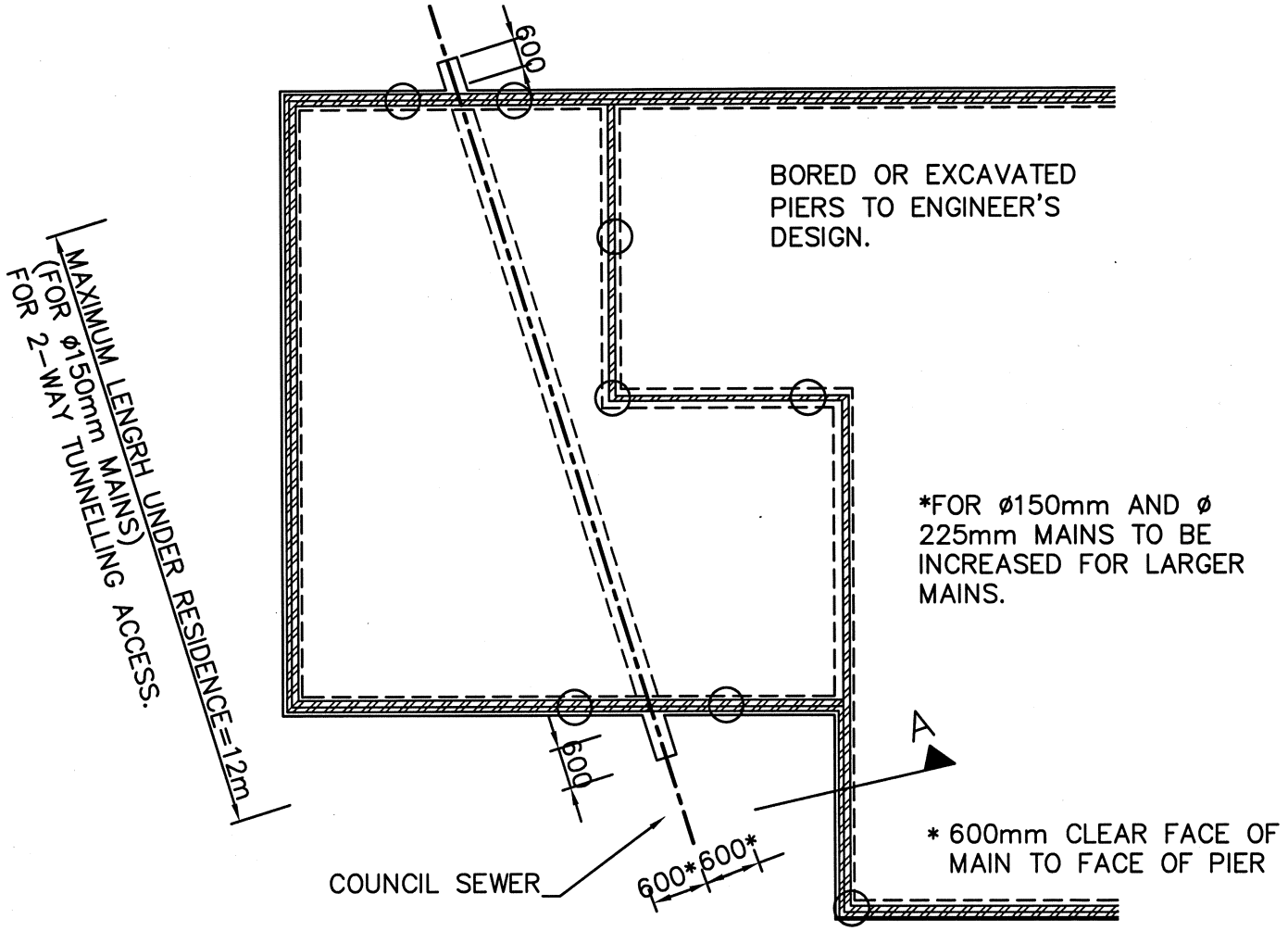
RISING MAIN DETAIL
AIR RELEASE VALVE

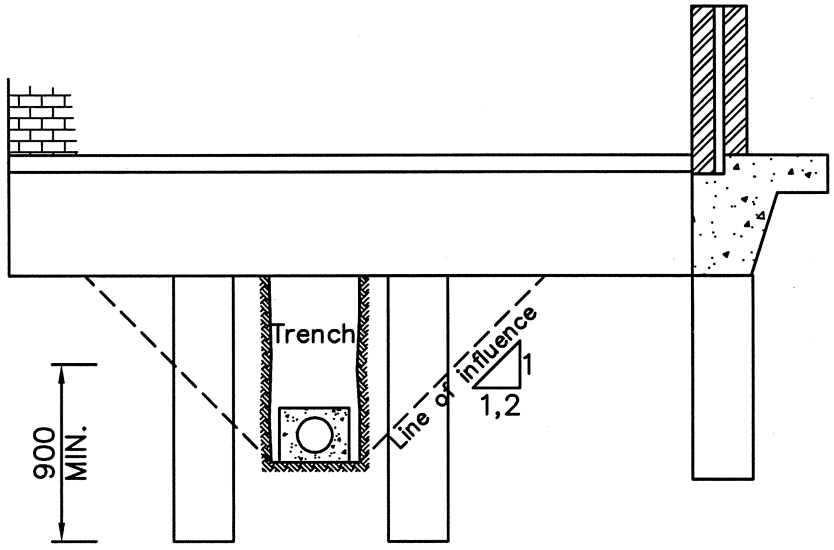
Hawkesbury City Council

SCALE NTS DRAWN BY:H.G.

PLAN No. SM4-2

ALL FOOTING DESIGNS MUST BE IN ACCORDANCE WITH THE STRUCTURAL ENGINEER'S DESIGN OR RELEVANT AUSTRALIAN STANDARDS.





LINE OF INFLUENCE 1:1 SEWER IN CLAY SOIL
2:1 SEWER IN SAND, FILLED GROUND, LOAM
IF ROCK OR HARD SHALE, PIER ONLY TO ROCK OR SHALE

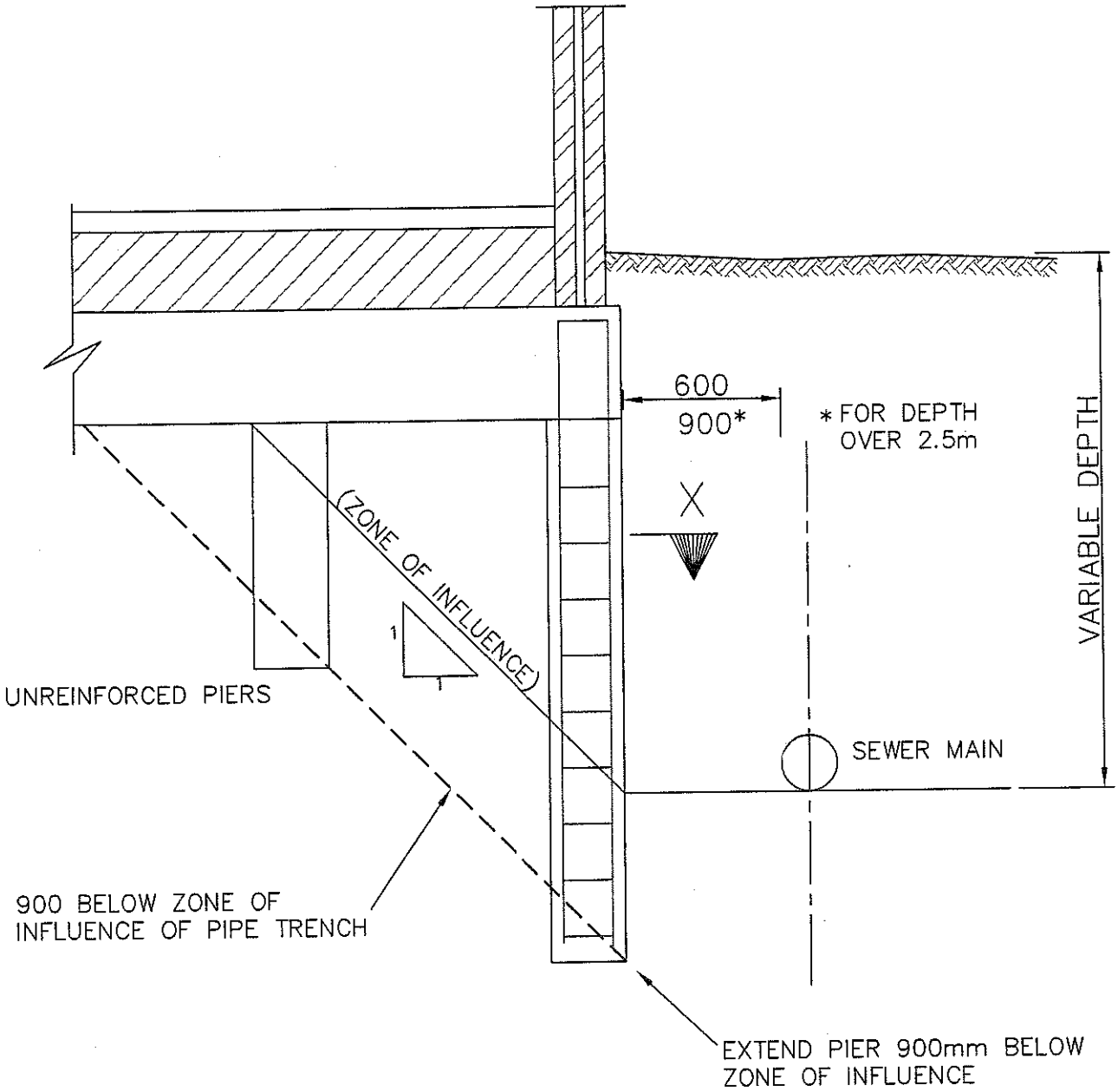
H.C.C. STANDARD SPECIFICATION

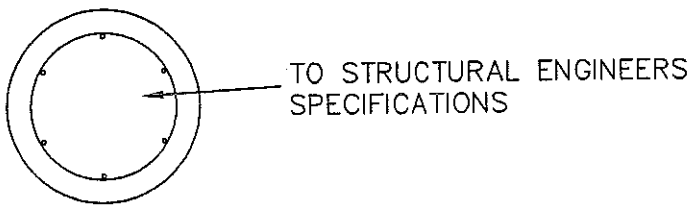
BUILDING OVER COUNCIL'S SEWER
TYPICAL DETAILS FOR V.C. & PLASTIC MAINS.

Hawkesbury City Council

SCALE NTS DRAWN BY:H.G.

PLAN No. SM5-1





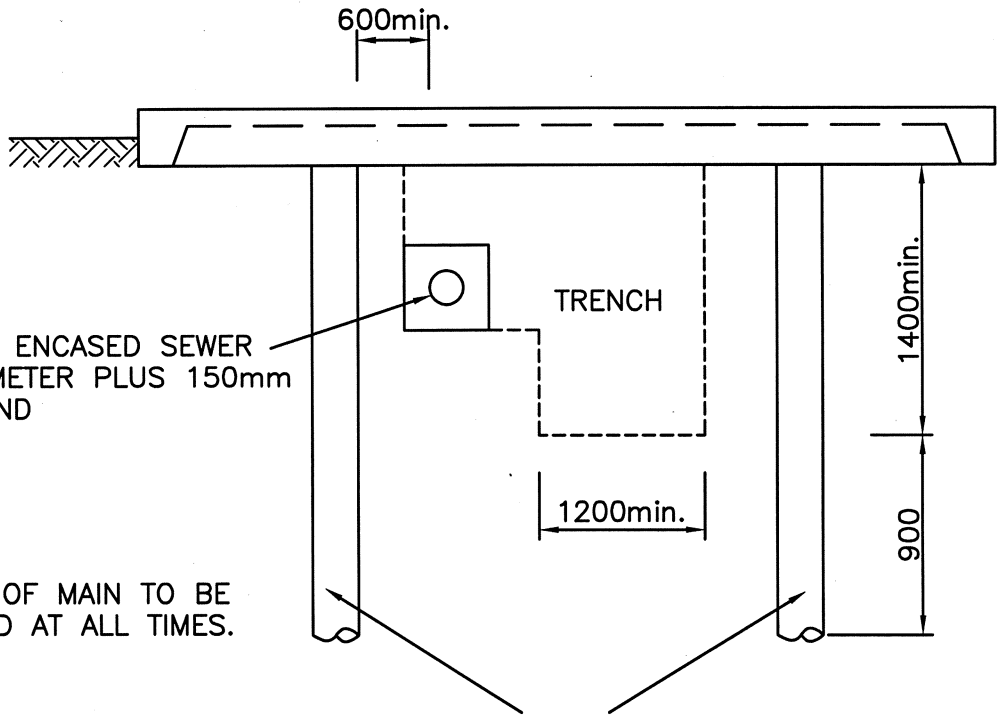
SECTION X–X

H.C.C. STANDARD SPECIFICATION
BUILDING ADJACENT TO COUNCIL SEWERS

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G./I.C. 10/2009

PLAN No. SM5-2



MAIN MUST BE OFFSET FROM CENTRE BETWEEN PIERS TO ALLOW FOR TRENCHING NEXT TO PIPE

FOUNDATION DETAILS FOR SEWER MAINS WITHIN 1400mm OF THE UNDERSIDE OF THE EDGE BEAM.

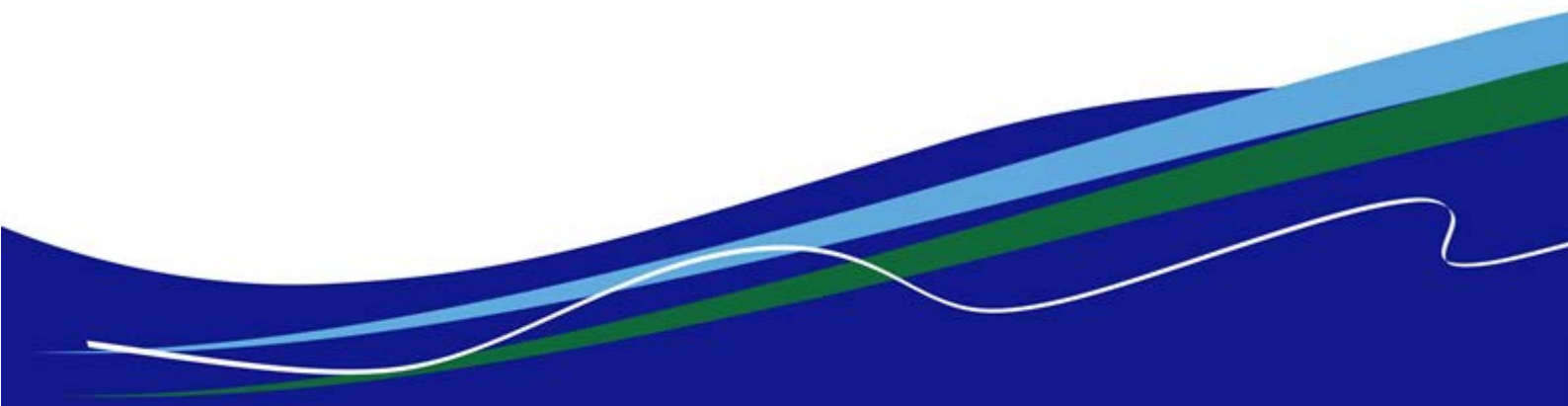
H.C.C. STANDARD SPECIFICATION

BUILDING OVER COUNCIL SEWERS
SEWER MAIN UNDER 1.4m IN DEPTH

Hawkesbury City Council

SCALE NTS DRAWN BY: H.G.

PLAN No. SM5–3



HAWKESBURY CITY COUNCIL
Standard Sewerage Specification