LEICHHARDT PARK

CHILD CARE CENTRE

HYDRAULIC SERVICES SPECIFICATION

PREPARED FOR

LEICHHARDT COUNCIL

MARCH 2013

TENDER ISSUE

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PROJECT NO: 14226 DATE: 30 MARCH 2015

SECTION 1 : PRELIMINARIES

1.1 GENERALLY

This part of the specification shall be read in conjunction with the general conditions of contract, preliminary clauses and technical clauses included in the main specification.

The hydraulic services scope shall include but not be limited to the following works: the coordination, workshop documentation, supply, installation, testing, commissioning, quality assurance, certification, and maintenance during defects liability period as indicated in this specification.

DEFINITIONS

The “Superintendent” herein after referred to, as the SI shall be the person as nominated by the Project Manager or as nominated in the main building contract.

The Client - the Building owner/Developer

The Contractor:-Building Contractor Main Building Contractor; Hydraulics sub-Contractor – Contractor carrying out the hydraulic services installation under this specification.

"Approved" shall mean approved in writing by the SI or his appointed Representative.

"Or equal" shall mean a material, product or component that is equal in all respects to that specified in this specification , shown on the drawings or as nominated by the SI.

1.2 SCOPE OF WORK

The work covered by these documents includes the final design co-ordination, manufacture, supply, installation and testing, commissioning and subsequent maintenance for the stipulated period of the work specified herein and shown on the accompanying drawings.

Provide all manufactured items, materials, labour, cartage, tools, plant, appliances and fixings necessary for the proper execution of the works, together with all minor and incidental works.

The whole of the works shall comply with all the latest relevant Regulations and to all Local Authority requirements. The cost of any materials or equipment required to meet such regulations and requirements shall be included in the Tender whether specially shown or described in the documents or not.

All materials and equipment shall be the best of their respective kinds, complying with the relevant Standards and Local Codes of Practice. All materials and equipment shall be new and shall be delivered to the site with the maker’s label intact.

The extent of the hydraulics work covered in this Specification and as shown on the drawings consists of the following:

Sub-soil drainage
Stormwater drainage
Sanitary plumbing
Roof gutters and downpipes
Domestic cold water
Domestic hot water
Domestic warm water
Gas service
Fire hydrant service
Fire Hose Reel service

Fire Extinguishers

Sanitary fixtures and tapware

The extent of work is as specified, including but not limited to, the following:

Sanitary Plumbing and Drainage

- Provision of a gravity system of drainage from all sanitary fixtures to the point of connection to the existing house drainage system

Domestic Hot and Cold Water

- Provision of mains pressure system of pipework to deliver potable cold water, hot water at 50ºC And warm water at 39ºC.to the various sanitary fixtures as required by the various codes and standards.

- **Stormwater Plumbing and Drainage**

- Provision of in ground system of pipework collecting rainwater from all roof areas and discharging via a first flush device into the rainwater collection and reuse tank a separate piped system collecting surface water and discharging via an On Site Detention tank (OSD) into the existing Council system traversing the site.

Fire Hydrants and Fire Hose Reel

- Provision of external fire hydrant service extending from the existing pump boosted service located on the Eastern side of the internal road at the Mary Street entry point. The scope does not include any amplification of the existing system including water supplies, pumps, backflow prevention devices or Fire Brigade Booster valves etc..

Natural Gas

- Provision of a system of pipework and meter/regulator etc. to supply Natural Gas to the hot water heater and the gas range in the kitchen.

General

- Provision of Work As Constructed Certification for the Stormwater, Rainwater, On Site Detention System, Fire Hydrant and Fire Hose Reel Services.

- Provision of maintenance manuals.
- Provision of Work As Constructed drawings.

1.3 WORK BY OTHER TRADES

Excluded from the hydraulic services part of the work are:

Builder

- Provide all hydraulic ducts and form large hydraulic penetrations as shown on structural drawings only. All other penetrations by Hydraulic Sub-Contractor
- Temporary drainage and water supply for use during construction.
- Temporary electrical supply for use during construction
- Access panels to all ducts and ceilings, inspection openings and fire hose reel/hydrant housings, including fire hydrant booster valve cabinet.
- Cut all holes in finished surfaces, timber, cupboards, false ceilings, vanity units, shelves, etc, as required by the hydraulic Sub-Contractor.
- Bollards and mechanical protection to pipework, stacks and equipment.
- Supply and installation of waterproof membranes in all wet areas.
- Set out of building grids to allow set out of core holes
- Supply and installation of all roof under flashing to external penetrations
- Supply and install all roof/parapet/balcony overflows.

- All in-situ concrete sumps and grated drains (grates to be supplied and installed by Hydraulic Sub-Contractor) that form part of the structural slab.
- Concrete stormwater detention tanks.
- Concrete pump plinths to the dimensions supplied by the Hydraulic Sub-contractor. Note: Metal forms to be supplied and installed by Hydraulic Sub-Contractor.
- Fire hydrant and fire hose reel cupboards and necessary signs.
- The Builder will construct all spoon drains or dish drains and provide these with falls to the outlets provided by the Hydraulics Sub-Contractor.

Electrical Work

Provision of permanent electrical power for various hydraulics components. The Hydraulics Sub-Contractor shall be responsible for contacting the Electrical Sub-Contractor to coordinate the location that the electrical power is required to be run to and for coordinating the time that the electrical power is to be connected to the hydraulics components. The power is required for the following:

- Electrical supply to hot water heaters
- Electrical supply to boiling water units.
- Electrical supply to the Rainwater pressure unit pumps control panel
- Electrical supply to gas hot water unit ignition system.
- Electrical supply to lockable isolating switches or control panel for hot water circulating pumps.
- Temporary electrical power during construction.

Note the hydraulic Sub-Contractor is to supply the connection from the control panel to the equipment where required.

Mechanical Work

- Extension of condensate wastes to inwall tundishes provided by the Hydraulics Sub-Contractor.
- Installation of backflow prevention devices to mechanical services equipment connected to potable water supply.

1.4 CERTIFICATION OF WORKS

At the completion of the works and prior to the submission for final payment the Contractor shall make all necessary applications, pay all fees, obtain and issue to the SI Certificates indicating that the works comply with the current regulations and requirements of the relevant Authority.

Wherever applicable the relevant Authority shall issue the Certificate. Where this is not standard practice the Contractor shall provide a Certificate or Letter of Certification which will guarantee that the works comply with the relevant Authorities regulations, requirements and conditions.

1.5 AUTHORITIES

The whole of the work shall be carried out by or under the full supervision of a fully licensed contractor in accordance with the drawings and specification, and to the satisfaction of the SI and to the Standards and Regulations of any authority having jurisdiction over the works and in particular those listed below: -

Natural Gas Company
Department of Fair Trading
NSW Fire Brigades
Department of Health
Building Code of Australia
Leichhardt Council
Workcover Authority of NSW
Department of Industrial Relations

Pay the relevant authorities all fees and charges legally demandable including:

- Inquiry fees
- Commencement of work fees
- Inspection fees
- Road opening fees
- Service connection fees

The Sub-Contractor shall submit evidence that:

1. Requirements of authorities relating to the work under the contract have been ascertained prior to the commencement of the hydraulic services installation
2. Fees to authorities, if any, have been paid and all types of approvals obtained.
3. Certificates of compliance with regard to the extent of the installation. Such certificates have to be obtained on completion of the installation.
4. All fittings, pipes, accessories and the like used in the works shall bear approval marks where and as required by the regulatory authorities.
5. Test certificates for all essential service fittings. Be provided prior to completion.

1.6 STANDARDS

Materials and workmanship shall conform to Australian Standards and Codes where not in conflict with the provisions of this Specification, including but not limited to the standards and codes listed below: -

AS 1221 Fire Hose Reels
AS 2419 Fire Hydrants
AS 2441 Installation of Fire Hose Reels
AS 2444 Fire Extinguishers
AS 3500 National Plumbing Code
AS 5601 Gas Installation Code
Building Code of Australia
NSW Code of Practice for Plumbing and Drainage

Where some doubts exist as to the appropriate standard, the decision shall be make by the SI before commencement of any work on or off the site. If a doubt exists as to whether a section of the design is able to comply with the relevant authorities regulations the SI shall be notified prior to the commencement of any work. No consideration of claim for redundant work shall be given if the SI is not notified.

1.7 DRAWINGS

Drawings show the approximate route of the various services in setting out; they shall be read in conjunction with all construction drawings for this Project. Make sure allowance for all necessary diversions from the straight line, rise and fall and adjustment and positions of equipment as may be required for the proper execution of the works. No additional money shall be payable to the Contractor for any of these diversions.

It shall be understood that the drawings accompanying this specification are intended to show the general arrangement and the intent of the work to be done and that it is the tenderer's responsibility to provide a complete and fully functioning system complying in all respects to those codes (as amended) and authorities. All materials and items shall be installed in accordance with the manufacturers recommendations unless noted otherwise in this specification or tender drawings.

The Contractor shall be responsible for checking all dimensions and levels indicated against site restrictions and ensure that the proposed layout is practical before commencing work. The hydraulic drawings shall not be used for scaling of dimensions. The Contractor shall refer to the architectural dimensioned drawings for setout of fixtures.

Visits to Site

The Contractor shall be held to have examined the site and to have satisfied themselves as to the existing conditions under which they will be obliged to operate or which will affect their contract in any way prior to submitting their tender. No claims shall be considered for any site conditions that were able to be examined on site and not notified in their tender.

Quality

The Contractor must implement the quality assurance system specified in the Special Conditions of Contract.

Workshop Drawings

Submit workshop drawings for approval prior to the installation showing details of the fabrication and installation of all hydraulic services and equipment, including relationship to building structure and services, service type and size, and marking details.

Co-ordinate works shown diagrammatically in the contract documents and submit dimensioned setout drawings.

Penetrations required through the structure; such drawings shall be dimensioned and shall be submitted and approved prior to the penetrations being made either by cast in forms or drilling.

Drawings submitted by the Sub-Contractor shall have a minimum scale of 1:100 and shall be of the same documentation standard, scale and format as the other trade workshop drawings for co-ordination purposes.

Submit workshop drawings for approval 14 days prior to required approval.

Approval of workshop drawings will not relieve the contractor of his responsibilities for errors and incorrect setting out. Approval of drawings is not intended to service as a check and does not relieve the contractor from furnishing materials and performing work as required by the contract drawings and specification.

Obtain from site all necessary dimensions to enable work to proceed.

Record Drawings

The Contractor shall keep available at all times on site, a copy of design drawings marked up in colour and dated to indicate the extent and chronological order of all work tested and approved by local authorities. The Contractor shall also keep available at all times on site a copy of all local authority test certificates

Work as Executed Drawings

One month prior to practical completion of the works provide a complete and accurate set of CAD drawings showing the installed position of all services, equipment, valves and sundry pipework included in this specification. Drawings shall be prepared by a competent draftsman on approved reproducible material. The minimum size scale shall be at least equivalent to those used on the contract document. The invert depths and location of all pipes and valves shall be accurately plotted and indicated by measurements. Provide one (1) set of CAD drawings on bond paper and one (1) set of computer disks in DXF format.

All changes in between practical completion and the preceding four (4) weeks are to be allowed by the Contractor.

The WAE Drawings shall be prepared by a competent draftsman on approved reproducible material. The minimum size scale shall be at least equivalent to those used on the contract document. **The invert depths and location of all pipes and valves shall be accurately plotted and indicated by measurements that are to be provided by a registered surveyor. A copy of the plans marked up and signed off by a registered surveyor shall be submitted prior to the commencement of the preparation of the work as executed drawings.**

The Consulting Hydraulics Designer at ruling commercial value will furnish a set of the hydraulic design drawings upon request. Such drawings may be used by the Contractor as an aid to drawing production to avoid duplication of effort. It shall be noted that such drawings provided may be as per the tender document and may not incorporate revisions or amendments and as such, the Supplier takes no responsibility for the accuracy.

1.8 OPERATION AND MAINTENANCE MANUALS

FORMAT: The format of all Operation and Maintenance Manuals shall:

(a) Facilitate the rapid detection of the cause of all faults and the recommended course of action for repairs,
(b) Provide a simple and clear system for the safe and efficient operation and maintenance of the system throughout its design life.

The manuals are to contain all necessary information required for the safe and economic operation of the services, and shall include:

(a) System Purpose and Description (with illustrations/diagrams)
(b) Preventive Maintenance Procedures (with illustrations)
(c) Corrective Maintenance Procedures (with illustrations)
(d) Repair Procedures (with illustrations)
(e) Test Procedures
(f) Illustrated Parts List (including a list of recommended spares holding)
(g) Special Tools and Test Equipment
(h) Schedule of Reference Drawings
(i) Statutory Certificates as appropriate
(j) Manufacturers Handbooks, and Data Sheets
(k) Reference Drawings and Commissioning Data.

SYSTEM PURPOSE AND DESCRIPTION:
This section shall consist mainly of a non-technical but functional description of the system and shall state what the system is designed to do and how it does it. Reference shall be made to an appropriate diagram to indicate the system configuration, the system's interface with other services systems and to identify major items described in the following:

ROUTINE MAINTENANCE:
Preventative Maintenance Procedures
Preventive maintenance actions and procedures for carrying them out are to be provided such that the systems can continue operation in economic safe, and energy efficient manner.

Corrective Maintenance Procedures
Instructions are to be provided for all non-obvious removal, repair, adjustment and replacement procedures.

Maintenance Schedule
A specific section of the manual shall be dedicated to a tabulated maintenance schedule on a system by system basis. The schedule shall clearly indicate the routine and preventive maintenance required on a cyclic basis and/or by system indication over the design life of the system, with page references if necessary to detailed sections of the manual.

REPAIR PROCEDURES:

This section will provide information on repair procedures after fault diagnosis.

CC TV – Carry out CC TV inspection of the sewer and stormwater inground drainage systems.
Supply two (2) colour videos and reports in the manual.

TEST PROCEDURES:

This section shall provide a detailed listing and description of all system and equipment tests to which reference is made from other sections of the manual.

OCCUPATIONAL HEALTH, SAFETY AND ENVIRONMENT:

All relevant sections of the manual shall highlight safety and environmental issues (particularly hazards) clearly indicate procedures and/or special precautions necessary to avoid them together with emergency procedures to deal with unfavorable circumstances should they arise.

ILLUSTRATED PARTS LISTS:

Comprehensive and illustrated parts lists shall be included in each manual, including references to suppliers and manufacturers names and contact details. Each part shall be referenced by a unique number within an integrated reference system.

SPECIAL TOOLS AND TEST EQUIPMENT:

Detailed lists of all special tools and/or test equipment required for the repair and/or maintenance of the installation shall be provided.

REFERENCE DRAWINGS:

All necessary reference drawings, including a full set of Work as Executed Drawings shall be included with manuals in A3 and A4 size as appropriate. Where these drawings cannot be reduced in scale, they shall be neatly folded and included in appropriate sections of the manual. Where a significant number of drawings are required, the Drawings may comprise a separate volume. All drawings shall be easily referenced from Text sections of the manuals.

A complete schedule of reference drawings shall be provided in the manual.

BINDERS:

Binders shall be 3 or 4 'D' ring, vinyl clad, sized to accommodate A4 sheets and index tabs. Colour and embossing shall be as nominated by the SI.

IDENTIFICATION:

The front and spine of each binder shall be machine embossed with the following title:

(Job Name)
(Job Address)
HYDRAULIC SERVICES

REPRODUCIBILITY:

Maintenance manuals shall be prepared on computer and be capable of being stored in ASCii file format on 3.5" (minimum Word 97 format) floppy disks.

COPYRIGHT RELEASE:

All information provided in the manuals should be suitable for reproducing for the purposes of the project without breach of copyright or payment of royalties. The Contractor shall provide appropriate written Copyright Releases where necessary.

SUBMISSION:

The preparation of maintenance manuals shall commence progressively as the work is manufactured and installed, but in any case no later than three months prior to the anticipated date for Practical Completion of the Contractor's works. Submission of the final manual, in an agreed format and content, is required prior to Practical Completion, including incorporation of Work As Executed Drawings, Commissioning Manuals and all relevant Statutory Certificates.

Three (3) complete hard copy sets of Operating and Maintenance Instruction Manuals shall be provided together with two (2) full size sets of Work As Executed Drawings in hard copy form including coversheet. One (1) copy of the manual on floppy disk and one (1) set of Work as Executed Drawings in CAD based form 3.5" floppy disk (DXF format) or CD.

1.9 MAINTENANCE

The contract maintenance of the hydraulic services systems shall commence on the date on which all of the equipment and associated pipework, and electrical components are placed in regular service following the satisfactory completion of the tests and final painting.

This date will be agreed upon by the SI and the Contractor but not earlier than practical completion of the works. It should be noted that partial completion is not related to the commencement of the maintenance period.

From the date on which the Hydraulic Services systems are placed in regular service, the Contractor shall fully maintain them (at his cost) in proper working order for a period of twelve (12) calendar months, including routine maintenance.

In the event of the maintenance being delayed or proving unsatisfactory or of the breakage or a serious defect occurring in any part of the equipment, or of the unsatisfactory operation of the Systems SI or Principal shall issue the right to engage the services of an appropriate contractor to undertake the work in question. The cost associated with such shall be directed to the Contractor for payment within the terms of this contract. The maintenance period shall be extended until such time as the Hydraulic Services have operated to the satisfaction of the SI or Principal for a period of one calendar month.

Labour, Materials and Services Covered by Contract Maintenance:

(a) Answering of breakdown calls and supervisory inspections, as specified hereinafter.
(b) The replacement of damaged or defective parts materials or equipment or parts showing signs of undue wear.
(c) The provision of all necessary lubricating oils and greases, cleaning liquids, materials and accessories required for pump and driving unit.
(d) General routine maintenance in accordance with manufacturers' instructions.

Answering of breakdown calls

In the event of a defect occurring at any time (i.e. at any hour of any day or night) during the maintenance period, the Contractor shall, when notified, send a competent tradesman to the site by the quickest means of transport available to restore the System to proper working order with a minimum of delay.

Work to be carried out during final maintenance inspection

During the final supervisory maintenance inspection on Hydraulic Services Systems at the end of the contract maintenance period, the Contractor shall carry out any work as directed to ensure that the whole of the installation and equipment is left in satisfactory working condition and in a clean condition at the end of the maintenance period.

1.10 WARRANTIES

The Contractor shall include all supplied manufacturers warranties in the maintenance manuals.

1.11 CO-ORDINATION

The Contractor shall co-ordinate his work with other trades on the buildings in such a manner as not to interfere with other work being carried out on the building.

In locations where piping and equipment must be installed along with other work being installed under other contracts, the Contractor shall co-operate with the other Contractor's concerned and see that all equipment is installed to the best advantage.

Any cutting etc, required to the building structure as a result of this Contractor's failing to co-ordinate with the program shall be arranged at the Contractor's expense.

1.12 EXISTING SERVICES

The hydraulic sub-contractor shall be completely satisfied that all existing services required to be connected are those to which the documents indicate, and that they are of the size and level shown on the drawings. No additional claims will be accepted for rectifying works that have been incorrectly connected as a result of failing to confirm the documented information at site prior to commencing this work.

All existing services to be connected to, other than Authority Services, shall be cleaned, flushed out and tested to an equivalent standard of all new works, and to the satisfaction of the SI prior to their connection.

The hydraulic sub-contractor shall not close down any existing services without giving at least 48 hours notification to The Proprietor or without written approval to do so. After notification to The Proprietor that the service is redundant, the hydraulic sub-contractor may proceed to cap off, or seal the service off in the correct manner, as is required by the Authorities and the SI.

The hydraulic sub-contractor will be responsible for checking with all Authorities and the SI concerning the location of any existing services on the site.

The hydraulic sub-contractor shall allow to seal off all existing services that may become redundant during the progress of the Project. All such services shall be sealed off at the relevant Authority supply main, and removed where practicable.

1.13 SETTING OUT

The set out of pipework to all groups of fixtures shall be so arranged in conjunction with the SI and other trades concerned. All pipework shall be made and positioned in a neat, workmanlike manner and a first class finish obtained.

1.14 PLACING OF ORDERS

The Contractor shall ensure that orders for materials, sanitary fixtures, pumps, etc., shall be placed with the manufacturer and/or supplier as soon as possible to ensure delivery of the items specified and to obviate any delay or change of specified articles due to this neglect.

1.15 PROVISION OF MATERIALS

Except where otherwise noted, the Contractor shall provide all necessary fixtures and appliances, piping fittings, tools, pumps and all other incidental materials and accessories necessary for the satisfactory installation, testing and completion of the works, all to the satisfaction of the Company.

All materials shall be new and the best of their respective kinds and generally the whole of the work shall be carried out in a tradesmanlike manner and a first class finish obtained.

Allow for building in such other fittings and accessories as required or supplied with the fixtures.

1.16 SPECIFICATION

The intent of this specification is to provide for the work set out and described herein to be completed. Where an item is usual or necessary and is reasonable or properly to be inferred in the type of work generalised in this specification but not specifically mentioned, it shall be deemed to be included in the Scope of Works.

Should there be any discrepancy between the drawings and specification the contract shall be deemed to cover the alternative, which involves the greater cost.

OBVIOUS WORK
The nature and spirit of the Specification and Drawings is to provide for the work herein enumerated and shown on the tender documents to be fully understood that the Hydraulic Sub Contractor, on accepting the contract, agreed to furnish everything necessary for such construction notwithstanding any omission in the Specification and Drawings.

TRADE NAME REFERENCES:
Any reference in this Specification to trade names or to a particular manufactured product should not be interpreted to mean that the particular article or product is the only one to be supplied or used.

The reference is given as an indication of the quality, class, type and finish of the items to be used and an information to Tenderers on the amount to be allowed for the items concerned.

Articles or products of equal type and quality produced by the other manufacturers may be submitted by the Hydraulic Sub-Contractor to the SI for approval at tender. The reference ‘equal to’ shall be taken in all cases to be the same as the reference ‘equal in all respects to”.

SAMPLES:
Samples shall be:

Submitted of all equipment/accessories whose appearance will be visible and any other items as requested.

Approved prior to installation

Be held on site after approval and used as a standard for acceptance or rejection of subsequent production units. Samples will be returned on completion of the project.

Be labelled to identify their intended use.

1.17 TESTING GENERALLY AND STERILISATION OF SYSTEMS

Make all tests as shall be required or ordered by the **authorities having jurisdiction**, using the methods prescribed by them.

Furnish all necessary material, equipment and skilled labour for testing the work. All necessary water for the tests will be from site supply.

The Contractor shall pay for and make good all damage to work and materials resulting from the tests.

All tests shall be make in the presence of the SI and authorities. Give not less than 48 hours notice in writing to these parties before making tests.
Every facility shall be made available to the SI for the inspection of any part of the work or apparatus during the progress of the project and on completion such shall be tested in the Contractor's or Manufacturer's workshop as directed by the SI.

A record of all tests shall be kept on site and the Contractor shall obtain certificates of satisfactory completion of the whole of the installation.

Provide in duplicate to the SI all certificates of tests issued by the authorities.

All piping shall be tested as early as possible after installation of each section of pipework but before any piping joints are concealed, ceilings installed or finishing trades have commenced their work and pipes are grouted in or otherwise concealed.

Pipework systems in which copper tube conforming to AS 1432 is used, must not be subjected to internal water pressure tests which are greater than the following test pressures:

Copper Tube – Type B

Nominal Size (mm)	Water Pressure Test to not greater than;2000kPa
DN15	2100
DN18	2100
DN20	2100
DN25	2100
DN32	2100
DN40	2100
DN50	2100
DN65	1400
DN80	1400
DN90	1400
DN100	1400
DN125	1400
DN150	1400
DN200	1000

Copper Tube – Type D

Nominal Size (mm)	Water Pressure Test to not greater than; 500kPa
DN32	2100
DN40	2100
DN50	1400
DN65	1400
DN80	1400
DN90	1200
DN100	1000
DN125	1000
DN150	1000

PROHIBITED: Air testing of any water pipe during the progress of the works or completion of the works.

Testing may be required at any time during the progress of the works, for the examination of any materials used and inspect the workmanship employed. Any materials and workmanship that are not in accordance with the specification and drawings may be rejected.

Supply all labour, plugs, pressure gauges, measuring gauges, plumbing equipment and necessary materials and equipment etc required for testing. The hydraulic Sub-Contractor is responsible for the disposal of test water.

Precautions shall be taken during testing of pipe services to pressurise to the limits recommended by the manufacturer of the piping materials. Seal off items of equipment not designed to withstand the test pressure.

Pipework fittings, valve and ancillaries damaged, such as annealed copper tube yielding and distorting at joints and other pipework either breaking, cracking, fittings leaking or blown off or apart from pipework, caused by excessive test pressures and procedures shall be replaced at no cost to the Proprietor.

Ensure solvent cement joints have been cured for at least 24 hours before testing.

Underground or enclosed works shall not be covered or concealed from view until it has been inspected, tested and approved by the Authorities concerned.

Carry out progressive testing of the services shown on the drawings and/or nominated in the Section and required by the respective Authorities.

The following types of tests shall be applied to the pipe services:

Sewer Drainage and Stormwater Drainage	-	Water test by gravity to the flood point of each pipe being tested.
Sanitary Plumbing	-	Water test by gravity to the flood point of each pipe section being tested.
Cold Water, Hot Water, Warm Water Services, Fire Hydrant Services & Fire Hose Reel Services	-	Fill pipework with water, remove all air from the pipework and then water pressure test the pipework section.

Before applying water pressure tests check with the manufacturers of each different piping material installed, considering the material of which the pipes and fittings are manufactured, the class pipe (i.e. suitable for certain pressures) and the pipe wall thickness to determine which maximum pressure should apply to the water test to be applied to each particular pipe material and pipe diameter.

On completion the works shall be tested under normal working conditions and as directed and passed by all Authorities having jurisdiction over the works. All defects shall be remedied immediately and the tests re-applied to the satisfaction of the Authorities. Make good at no cost any defects disclosed during tests.

Provide two (2) copies of all Approvals and Test Certificates issued by the Authorities.

All plant and equipment having electrical connections shall be tested for insulation and earth resistance and approved by the Supply Authority. Give seven (7) days written notice of commencement of final tests.

All pipelines shall be flushed clean then charged with disinfectant using 50mg of chlorine per litre of water. The system should remain charged for a period of at least three days, checked and adjusted for free residual chlorine and flushed out thoroughly with clean water before being used. Repeat procedure where necessary.

1.18 FIXING AND SUPPORTING OF PIPES

All service pipes shall be positioned in locations as approved by the SI before installation commences. All pipes shall be adequately supported and secured to adjacent roof trusses Pipework must not come into contact with any other service pipes or part of the building structure unless insulated with 25mm thick sectional mineral wool lagging.

All pipework shall be free to move without causing stresses in the pipework or in the pipe joints.

Support shall be galvanised mild steel "Unistrut" P1000 channel complete with purpose made galvanised spring nuts, framings, fittings and pipe clamps for each pipe. 'U' clamps shall not be used with PVC pipes. Fixings for PVC shall completely circumvent the pipe without distorting the cross sectional profile of the pipe. Alternative methods of fixings may be used provided the proposed method is detailed, discussed and approved by the SI prior to the commencement of any work dependent upon such an approval. Approved fabricated mild steel brackets shall have ground off neat square ends drilled holes.

Mild steel brackets must be hot dipped galvanised after fabrication. Vertical frames where used to support suspended horizontal runs shall allow for complete adjustment of clamp support to suit pipe grading as required. Channels shall be galvanised steel bolt fixed direct or with purpose made clips to walls or underside slab. On completion of work remove all cement droppings, dirt etc. from pipe supports, pipework and fittings.

All copper pipes shall be separated from supports by 4mm thick PVC strip of similar approved material.

Where pipes are insulated, the pipes shall be supported inside the insulation with timber ferrules.

Where the structure is of masonry or concrete, the support shall be fastened either by bolts firmly grouted in or by expanding type bolt device equal to "Loxin".

Explosive power fastening tools shall only be used where specifically approved beforehand by the SI.

Appropriate screws shall be used for fastening supports to timber.

All bolts and screws shall be sized to suit the load but in no case shall the diameter be less than 8 mm for fastening to timber, steel masonry or concrete. Smaller bolt sizes may be approved by the SI.

Sanitary, Vents and Down pipes – Non Pressure Lines

Pipe	**Vertical**	**Horizontal / Graded**
Cast Iron		
Internal	3.0 m	2.0 m
External	2.0 m	2.0 m
Galvanised Steel		
Internal	3.0 m	2.0 m
External	2.0 m	2.0 m
Copper		
Internal	1.8 m	1.8 m
External	1.8 m	1.8 m
UPVC		
Internal	1.8 m	0.9 m
External	1.8 m	0.9 m

Pipe	**Vertical**	**Horizontal / Graded**
Fibre Reinforced Pipe		
Internal	3.0 m	1.5 m
External	2.0 m	1.5 m

In case of rubber ring jointed pipes there shall be a fixing at least at each collar or pipe fitting. Brackets shall be adequate to restrain the effect of the internal forces of piping, including sideways movement.

Pressure lines

Size	**Steel Pipe**	**Stainless Steel or Copper Pipe**	**Plastic Pipe**
15 mm	2.0 m	1.8 m	0.7 m
20 mm	2.0 m	2.0 m	0.7 m
25 mm	2.5 m	2.25 m	1.0 m
32 mm	2.5 m	2.25 m	1.0 m
40 mm	2.5 m	2.5 m	1.5 m
50 mm	3.0 m	2.5 m	1.5 m
65 mm	3.0 m	3.0 m	1.5 m
100 mm	4.0 m	3.5 m	2.0 m
125 mm	4.5 m	4.0 m	2.5 m
150 mm	4.5 m	4.0 m	3.0 m

Copper soil, waste and vent pipes shall be regarded as being fixed at all supports where no provision has been made for axial and/or lateral movement. Provision for movement shall be achieved by the provision at the support of an annular space around the pipe of not less than 8mm clear.

The fire-resisting performance of the building element is not to be impaired by the installation of Hydraulic Services. BCA requirements C3.14 & Spec. C3.15.

Vertical copper soil and waste pipes must be clear to move vertically at least 8mm in both directions through ceilings and roofs, through which they pass. Vertical soil and waste pipes must be restricted against downward vertical movement at their junctions with house drains, at offsets and changes of direction below Ground Floor Level and at branches at all floors.

Pipes shall be supported against sagging or distortion and must be held to line and grade by means of approved clips, saddles or other fixings.

Install ‘Powersorb’ type brackets or approved equal hangers for main riser pipes where vibration or expansion will occur.

Plan hot water pipe routes, on site, to ensure that sufficient offsetting is achieved to compensate for length increases due to expansion of the pipe. Pipe brackets on hot water pipework systems are to be guide type only and are not to restrain the pipe from longitudinal movement.

Ensure that branch pipes are maximum lengths from main pipe circuits before being retrained by entering built in positions, such as passing through walls or concrete floors.

1.19 CHASING AND DRILLING

Provide all the necessary chasing cutting and drilling of brick walls, ceiling, etc to allow the fixing and passage of pipes through the structure.

Chases to be sawcut before breaking-out or be cut with approved mechanical saws.

Set out in ample time all positions required after having established the position of the pipes and obtained approval for same from the SI.

After installation of piping within chases ensure that piping is properly fixed with copper or brass clips (ferrous fixing shall not be used) and chases made good with cement mortar. Ensure that adequate allowance is made for expansion and contraction by piping within chases by lagging with compressible insulation.

Chasing shall be carried out as follows:

- Brickwork shall have been built a minimum of 7 days prior to chasing.
- Chasing shall be carried out using a machine specifically designed for the purpose. Do not use hand tools.
- Chasing shall be on the same side of the wall and vertically above the outlet it serves.
- Minimise horizontal chasing. Obtain approval from SI and structural engineer prior to horizontal chasing. In ensuite bathrooms chasing for services shall be as specified.
- No chase shall be deeper than 35mm nor wider than 80mm or 3 conduit pipes. Pipes shall be installed so they are approximately 5mm below the surface of the bricks. Pipe sizes larger than 25mm shall be provided with block out in walls.
- Where two or more chases are necessary in close proximity they shall be at least 100mm apart.
- No chases on opposite sides of a wall shall be within 150mm of each other.
- No notching or drilling through lintels, wall stiffeners, control joints or the like shall be made without the approval of the SI.
- All voids in chases shall be filled with sand/cement mortar prior to cement rendering. This work is the responsibility of the services Sub-Contractor
- All chases wider than 35mm or serving 2 or 3 pipes shall be done with the approval of the SI.
- No chasing shall be done in walls which are proposed to remain unrendered. These areas can be identified from the schedule of finishes. Where a wall is to remain unrendered, surface mount services to a configuration approved by the SI.
- Do not chase Reinforced Concrete walls without the prior approval of the SI.

Where the above conditions cannot be complied with, immediately notify the SI and await instruction before proceeding.

1.20 BUILDING PENETRATIONS

Set out core holes and sleeves in floors, walls, beams and columns and obtain approval of the set out prior to placing concrete.

Where pipes pass through walls, floors, beams or columns, provide purpose-made metal or plastic sleeves with 12mm clearance all round pipes, packed with gunned silicone rubber joint sealer (self-extinguishing grade).

Pipes passing through walls below ground level shall be provided with a water stop puddle flange.

Penetrations for metal pipes in fire rated walls, ceilings or floors shall incorporate galvanised mild steel sleeves, overall diameter not less than 40mm larger than the penetrating pipe. Seal with a fire stop material/fire prevention, to comply with AS 1530 Part 4.

Approved fire collars shall be provided wherever a fire rated wall, ceiling or floor is penetrated by a UPVC pipe or fitting. The rating of the fire collar is to be the same fire rating of the wall, ceiling or floor penetrated, to comply to AS 1530 Part 4.

Hydraulic Sub-Contractor to provide fire rating certification for all installed hydraulic services, such as fire stop collars, sealants, materials and the like, to maintain the integrity of the fire compartments. Certification shall be provided by an independent party.

Where cold water lines emerge from wall, floor or ceiling surfaces, provide cover plates or non-ferrous metal, finished to match the pipe, or of stainless steel as follows:

Pipe Diameter:	Cover plate diameter (nominal):
Up to 20mm	65mm
Up to 50mm	100mm
Larger than 50mm	50mm larger than pipe

1.21 PROTECTION

The Hydraulic Sub-Contractor shall be entirely responsible for all apparatus, equipment and appurtenances furnished by him or his Sub-Contractors in connection with this work, and special care shall be taken to protect all parts thereof in such a manner as may be necessary or as directed. This protection shall include covers, crating, sheds, stores or other means to protect the apparatus, equipment and materials from the weather and to prevent dirt, grit, plaster or other foreign substances from entering the working parts of machinery or equipment.

Special care shall be taken to keep all open ends of pipes, ducts, flues, etc closed while in storage or during course of installation.

The Hydraulic Sub-Contractor shall protect all parts of the building and the work of other Sub-Contractors from damage which may be caused by the Contractor's workmen or Sub-Contractors. The Hydraulic Sub-Contractor shall be responsible for making good any such damage.

UNDERGROUND METAL PIPING PROTECTION
Provide corrosion protection for underground ferrous piping and underground non-ferrous metal piping in corrosive areas

Select from the following protection methods:

- Impermeable flexible plastic coating
- Sealed polyethylene sleeve
- Continuous wrapping using proprietary petroleum taping material

Provide sacrificial anodes or impressed current for cathodic protection. Incorporate a facility for periodic testing.

Comply with the recommendations of AS 2832.1

PIPING CLEANING, PROTECTION AND INSTALLATION
Before installation, remove loose scale, burrs, fins and obstructions.

During construction, prevent the entry of foreign matter into the piping system by temporarily sealing the open ends of pipes and valves with purpose-made covers of pressed steel or rigid plastic.

After installation all piping to be flushed with clean water at the highest possible velocity and flushed out until all foreign matter is removed.

Install piping in straight lines at uniform grades with no sags. Arrange to prevent air locks. Provide sufficient unions, flanges and isolating valves to allow removal of piping and fittings for maintenance or replacement of plant.

Arrange and support piping so that it remains free from vibrations whilst permitting necessary movements. Minimise the number of joints.

Provide at least 25mm clear between pipes and between pipes and building elements, additional to insulation.

Join dissimilar metals with fittings of electrolytically compatible material.

Provide access and clearance at fittings which require maintenance or servicing, including control valves and joints intended to permit pipe removal. Arrange piping so that it does not interfere with the removal or servicing of associated equipment or valves or block access or ventilation openings.

Sheath or sleeve metal piping chased into masonry or encased in concrete so that expansion or contraction can take place without damage to the pipe or to the material or surface finish of the surrounding element.

1.22 NOISE AND VIBRATION SUPPRESSION

Minimise the transmission of vibration and noise from rotating or reciprocating equipment to other building elements.

Except for external equipment which is not connected to the structure of any building, support rotating or reciprocating equipment on mountings as follows:

For static deflections <15mm: Single or double deflection neoprene in-shear mountings incorporating steel top and base plates and a tapped hole for bolting to equipment.
For static deflections >15mm: spring mountings.

Select mountings to achieve 95% isolation efficiency at the normal operating speeds of the equipment.

Spring mountings shall be free-standing laterally stable springs with at least 12mm clearance between springs and other members such as bolts and housing:

- Ratio of mean coil diameter to compressed length at the designated minimum static deflection: >0.8:1

Minimum travel to solid of at least 150% of the designated minimum static deflection.
Levelling bolts and lock nuts
5mm neoprene acoustic isolation pads between baseplate and support
Vertical resilient limit stops: To prevent spring extension when unloaded, to serve as blocking during erection and which remain out of contact during normal operating.
Snubbing: Snub the springs to prevent bounce at start-up.

Set and adjust vibration isolation mounting supports to give adequate clearance for free movement of the supports.

Provide inertia bases with mass at least that of the equipment supported.

Steel, or steel-framed reinforced concrete. Position foundation bolts for equipment before pouring concrete.

Support on vibration isolation mountings using height saving support brackets.

Internal noise levels from hydraulics plant inside the development should not exceed the levels given below. Unless stated otherwise, the noise level criteria should not be exceeded with the plant operating under all normal operating conditions. Provide treatment to achieve the specified noise criteria.

Table 1 – Noise Criteria for Spaces in Residential Apartments

SPACE/ACTIVITY TYPE	**NOISE LEVEL 1_{eq} dB(A)**
Bedrooms	35
Living/Dining Room	40
Kitchen	45
Lobbies	45
Bathrooms	45
Laundry	50

Table 2 – Noise Criteria for Level 1 Commercial Buildings

SPACE/ACTIVITY TYPE	**NOISE LEVEL 1_{eq} dB(A)**
Carparks	65
Lobbies	50
Retail Spaces	50
Office Spaces	45
Gymnasium	50
Pool	55
Toilet	65

External noise levels emitted by noise producing hydraulics plant such as booster pumps, etc at all property boundaries and nearby buildings on adjacent properties shall meet the requirements of:

Local Council
Environment Protection Authority
Any other relevant statutory authority.

Noise from the hydraulics system should be minimised by:

Limiting pipe velocities in water systems to not more than 1.5m/s
Laying out pipes to minimise the number of changes in direction and installing pipes so that the effective cross sectional area of the pipe is maintained at pipe bends and junctions.
Selecting valves and fittings that minimise the generation of noise.
Installing pressure reducing stations as required to eliminate excessive pressure at the terminal valves.
Controlling structure-borne noise (ie plant and pipe vibration transmitted into the building structure) with the use of plant isolation mounts, resilient sleeves, etc.
Provision of water hammer arrestors in reticulation piping to dishwashers and washing machines.

The Sub-Contractor shall minimise the transmission of vibration to the building structure to ensure the noise and vibration criteria are achieved by:

Statically and dynamically balancing rotating plant and equipment. Out of balance should not exceed 0.03mm kg/kg of rotating element after installation. Where specified, provide balancing test certificates.
Providing isolation mounts or hangers for vibrating plant and equipment.
Providing inertia blocks where required to limit the vibration amplitude.
Isolating piping, electrical conduit, etc subject to vibration from the building structure.
Providing flexible connections where piping is connected to vibrating plant and machinery.

Submit a schedule of isolation mounts indicating make, model, rated load and static deflection, actual load and static deflection, unloaded height, fully loaded height.

Waste pipes over habitable rooms or noise sensitive areas shall be lagged with a layer of 8kg/m^2 loaded vinyl having an outer aluminium foil backing, separated from the pipe with a layer of 25mm thick open cell foam. Overlap all joints in the loaded vinyl by minimum of 50mm and tape airtight with aluminium tape.

1.23 PIPE AND VALVE IDENTIFICATION

General: Colour code service pipes and conduits exposed to view or in accessible locations such as ducts and ceiling spaces. They shall be painted and labelled to conform to the requirements of AS 1345 – Identification of Piping, Conduits and Ducts as follows:

PIPE IDENTIFICATION COLOUR

SERVICE	**COLOUR**
Sanitary Plumbing	Black
Stormwater	Black
Cold Water Service	Green (G21)
Hot Water Service	Green (G21)
Warm Water Service	Green (G21)
Air Supply	Light Blue (B25) with Dark Blue band (B24)
Oxygen Supply	Yellow (Y14) with Dark Blue band (B24)
Suction	Primrose (Y21)
Heating	Green (G21)
Fire Hose Reel & Fire Hydrant	Red (R13)
Steam	Silver Grey
Gas	Primrose (Y21)

Exposed pipework and pipework located in walk-in duct, ceiling spaces and plantrooms shall be painted continuously in the colour indicated above and identification markers added.

Copper pipes shall be painted with a suitable etching paint before applying finishing enamels. Other steel pipes shall be painted with a coat of zinc chromate primer.

After applying one layer of etching or primer undercoat, two (2) layers of enamel paint shall be applied.

Painting shall be carried out by an experienced painter.

Pipe markers shall be of the vinyl, pressure sensitive, self adhesive type consisting of combined flow direction arrow and name of service.

Markers shall be provided on all hydraulic pipe lines at not greater than 3 metre centres. Additional markers shall be provided for:

Both sides of a wall or partition through which a pipe passes;
A marker adjacent to tee, valves, outlets and pumps;
Both legs of a bend;
Both sides of a pipe which can be approached from two directions.

Marker sizes shall be as follows:

PIPE SIZES	**MARKER SIZE**
65 O.D. and above	460 x 57
40 O.D. and less than 65 O.D.	460 x 29
Up to 40 O.D.	460 x 29 (cut to suit)

Marker locations shall be approved prior to their application to the service pipework.

Prior to the application of pressure sensitive, self adhesive type pipemarkers, clean pipe surfaces with steel wool to remove oxide films and dirt.

Each vinyl pipe marker shall in addition to the pressure sensitive, self adhesive attachment be secured to the pipework by two (2) 4.8mm wide, light duty, nylon, cable ties, with the ties positioned 50mm from each end of the pipe markers, securing the pipe markers to the pipework.

Pipe markers that peel off or crack shall be replaced with new pipe markers without additional cost.

Instruments, gauges, indicators, control equipment and valves, installed as part of the works shall be clearly labelled and identified with the correct associated function. Coordination of references used within the building management system shall be undertaken to ensure compatibility of all nomenclature.

Equipment identification shall be accomplished with “Traffolyte” labels – white on a black background fixed by screws or rivets.

Adhesive type fixings with labels attached to equipment are not acceptable.

Provide and attach to each isolation valve a round metal tag, 50mm in diameter manufactured from 1mm thick aluminium sheet. Each valve shall be engraved with an identification number, the service and areas served. Provide inscribed on the tags the design flow rate for each valve when it is in the system balanced position. The numbering system shall relate to the ‘As Installed” set of drawings. Fix metal tags securely to balance valves with 2mm diameter copper wire.

Equipment identification shall be with Traffolyte labels and equal, having white letters on background. All valves are to be identified by brass discs, engraved and fixed to the handwheel with screws or bolts. Comprehensive schedule of valve and relative function shall be incorporated in the maintenance schedule.

1.24 ELECTRICAL WORK

All equipment supplied and work carried out under the contract shall comply with the requirements of the latest appropriate Australian Code of Practice.

The electrical installation shall be carried out in accordance with the requirements of the Local Supply Authority.

All items of equipment shall be of first grade with regard to design and manufacture and shall be completely satisfactory for operation, control, safety and maintenance under all conditions of service.

Uniformity of type and manufacture of switch gear, control gear, fittings and accessories shall be preserved throughout the whole of the installation, refer to the Electrical and Mechanical Specification for the type of fittings, wiring, conduits, control gear, etc.

1.25 MANUFACTURER’S DIRECTIONS

Manufactured articles, materials and equipment are to be supplied, installed, connected, erected, used, cleaned and commissioned in strict conformity with manufacturer’s printed directions unless otherwise specified. In any case, the Hydraulic Sub-Contractor is to obtain from the Supplier agreement that the product as used or specified is being used or specified in accordance with the manufacturer’s requirements and practice. Retain manufacturer’s directions for such articles on site for the Proprietor’s reference.

1.26 SPARE PARTS AND SPECIAL TOOLS

The Contractor shall supply any special tools necessary for the regular maintenance of new and/or existing refurbished equipment as required under the maintenance schedule and one complete set of spare parts (ie washers etc) which are normally required when carrying out the maintenance schedule. Spare parts and tools to be supplied shall be enumerated and described within the tender.

1.27 CAPPING OFF

During the construction, leave all unfinished work in safe condition as per Work Cover requirements, protect the works against damage or loss through any cause whatsoever, and seal off open ends of pipe in such a manner as to prevent the entry of foreign matter into the lines until the works have been handed over on completion.

1.28 CLEANING OF SERVICES

After installation and prior to testing the piping and storage vessels, each service shall be thoroughly cleaned and flushed out. All valves, seats, tap washer and strainers shall be checked for any foreign matter and cleaned. Damaged seats and washers shall be replaced.

On completion of all work, all tools, supplies, unused materials and waste materials shall be removed and the work left in a clean and tidy condition.

1.29 GUARANTEES

The Hydraulic Sub-Contractor shall obtain all guarantees, certificates, etc for the work specified to be guaranteed or certified satisfactorily completed and lodge same with the SI on completion of the Agreement. Guarantees shall apply to all existing pipework, equipment etc, that is to remain in the completed development and all new pipework, equipment etc, for the full guarantee period.

1.30 COMMISSIONING

The Hydraulic Sub-Contractor shall engage a qualified Hydraulic Consultant to witness and certify commissioning of all hydraulic service systems including pipework, fittings, equipment, etc.

The Hydraulic Sub-Contractor shall be responsible for commissioning the various installations carried out under this sub-contract in accordance with the programme and to the approval of the Proprietor and Local Authorities.

Subject all systems to a commissioning and testing procedure before they are put into service.

Provide all test instruments and other testing facilities required to verify system and equipment performance and to complete all inspection test plan records.

Any work which does not comply with the specification shall be made good.

Allow in the Tender Price to pay the Authorities for any necessary and chargeable testing work.

Give at least two (*2) weeks notice of the commissioning of any particular system and shall submit a programme of testing and commissioning procedures for that system. Modify the programme as required.

Prepare a detailed and comprehensive Inspection Test Plan (ITP) prior to commissioning and testing. Prior to the start of commissioning commence gathering information required for this check list.

The purpose of the check list is to:

Ensure that all items that should be checked are checked.

Produce a permanent record of the commissioning checks carried out.

Accordingly the check list must be built up from information contained in this specification from suppliers, manufacturer's installation and commissioning data and from experience in commissioning similar equipment and systems.

Final tests shall be conducted in the presence of the SI. Provide all necessary instruments, connections, skilled and unskilled labour required for the test. The cost of such provision shall be included in the price.

Commissioning tests shall be concluded successfully, before Authorities inspections.

1.31 WARRANTY

All plant, equipment and materials supplied under this contract shall be covered by twelve (12) months warranty against faulty manufacture, workmanship and/or materials. The Hydraulic Sub-Contractor shall be responsible for the rectification and/or replacement of any portion of the installation which fails during the warranty period.

The warranty period shall commence as from the date of practical completion or replacement, as applicable but extension of the period shall be made in respect of replaced portions only.

1.32 DEFECTS LIABILITY

The Hydraulic Sub-Contractor shall be responsible for the rectification of all defects in the work due to faulty materials and/or workmanship for the duration of the twelve (12) month defects liability period commencing from the date of practical completion. Such defects shall be made good immediately on receipt by the Hydraulic Sub-Contractor on advice from the SI.

Any defects discovered during the defects liability period which are due to default or negligence by the Hydraulic Sub-Contractor in the performance or observance of any of his obligations, shall extend the period to enable such defects to be made good by the Hydraulic Contractor and to allow the whole work after being made good in every way, to be proved satisfactory.

1.33 OPERATIONAL MAINTENANCE

Fully maintain the hydraulics services in proper working order for a period of twelve (12) calendar months from the date of practical completion.

The maintenance period shall be extended until such times as the hydraulic services have operated to the satisfaction of the SI for a period of one (1) calendar month, in the event of the maintenance proving unsatisfactory or of the breakage or serious defect occurring in any part of the equipment, or of unsatisfactory operation of the hydraulic services.

1.34 NOTICE OF PRACTICAL COMPLETION

When in the opinion of the SI the building and the works are practically completed, a Notice of Practical Completion will be issued, stating the date upon which the works were practically completed.

This date shall be the date from which the guarantee, warranty and defects liability periods shall operate.

This notice will not be issued until the systems have been property commissioned and until the Hydraulic Sub-Contractor has supplied operating and maintenance instructions.

1.35 EXPIRATION OF DEFECTS LIABILITY PERIOD

On expiration of defects liability period the Hydraulics Sub-Contractor is to produce certification for all Hydraulic services essential services installed by the Hydraulic Sub-Contractor as required by the BCA.

1.36 SCHEDULE OF RATES

The Hydraulic Sub-Contractor is to supply a detailed Schedule of Rates.

The Schedule of Rates are to be agreed upon by both the Hydraulic Sub-Contractor and the SI.

They shall be used for the purpose of assessing progress claims and variations.

No payments shall be made to the Hydraulic Sub-Contractor until the Schedule of Rates is supplied.

1.37 EQUIPMENT

All equipment offered in the tender must comply with the requirements of the specification.

If equipment is offered as complying with the specification and at a later date this is found not to be so then the particular item of equipment will be rejected and replaced with the complying equipment at no extra cost.

Non-complying equipment may be offered as an alternative only.

The Hydraulic Sub-Contractor is free to submit details for potential cost savings with regards to alternative materials and fixtures in addition to their complying tender.

Attention should be given to the delivery time of equipment and in this respect tenderers shall only offer equipment that can be delivered in time to work in with the construction programme.

Equipment capacities shall be as scheduled on the drawings or in this specification.

1.38 WORKMANSHIP

All equipment to be installed in a tradesman like manner, complying with AS 3500, the latest relevant regulations, all local requirements and this specification.

Wherever possible, pipes shall be suspended from slab and walls to eliminate the number of vertical risers from ground to structure. Pipes shall be run parallel with walls, slabs and each other.

EXCAVATION AND PIPE WORK REQUIREMENT SECTION

SECTION 2 : EXCAVATION AND PIPE WORK REQUIREMENTS

2.1 EXCAVATION

Excavation work backfilling and surface reinstatement shall be undertaken by the Contractor as part of his contract scope of work for all buried services installed within the scope of works of this contract. All excavations and backfilling shall be in accordance with the relevant section of the following referenced documents.

Water

AS3500 Parts 1.1 and 1.2 – Water Supply
AS3500 Parts 4.1 and 4.2 – Hot Water Supply

Sewerage

AS3500 Parts 2.1 and 2.2 – Sanitary Plumbing and Drainage

Stormwater

AS3500 Parts 3.1 and 3.2 – Stormwater drainage

Note: Generally all inground pipework excavation shall be allowed for as excavation in

Excavate to the lines, levels and grades as required for underground services specified in the relevant services sections, including drainage, hydraulic and the like. Unless otherwise specified make the trenches straight between manholes, inspection points, junctions etc, with vertical sides and uniform grades. Excavation around trees to be done by hand ensuring protection of existing flora.

Shall consist of the removal of natural unweathered materials which cannot be removed until broken up by means of jackhammers. This does not include loose bounders, brick and old pavements.

Excavate trenches in sections of suitable length, lay and bed the relevant service length and backfill the trench section, with the minimum of delay and if possible on the same working day, unless otherwise specified or permitted.

Trench Widths shall be subject to regulatory authority requirements, keep trench widths to the minimum consistent with the laying and bedding of the relevant service, and the construction of manholes and pits.

If the Hydraulic Sub-Contractor has exceeded the sectional area of excavations in consequence of any injudicious working, slips, falls blasting or any other cause other than by directed, then the Hydraulic Sub-Contractor shall, at his sole cost, remove such extra material and make good and fill.

Trench Depths shall be as required by the relevant service and its bedding method.

Cut back roots encountered in trenches to not less than 600m clear of the relevant service. Remove such other obstructions including roots, stumps, boulders and the like which may interfere with the proper functioning of the service.

During excavation the Sub-Contractor shall advance the work in a careful, secure and safe manner and shall take all precautions against accidents and where necessary erect shoring/timbering to prevent earth or other material slipping or failing in or being shaken from the faces or sides of the excavation. Payment for the supply, erecting, withdrawing or abandoning or shoring/timbering shall be included in the Sub-Contractors tender price.

The dewatering and disposal of all waters entering the Sub-Contractor's excavations shall be solely the responsibility of the Sub-Contractor. Any damage incurred by rainwater or rainwater runoff into the Sub-Contractor's excavations shall be solely the responsibility of the Hydraulic Sub-Contractor. Such damage

shall be reinstated by the Sub-Contractor to the satisfaction of the regulatory authority at his cost and no claim for additional cost will be allowed.

The Hydraulic Sub-Contractor shall provide and maintain efficient hoardings, barriers, night lights and temporary traffic arrangement as required by the Authority having control of the streets and/or roads. The Sub-Contractor shall apply for and obtain approval of all proposed temporary traffic arrangements required to carry out the works. The Sub-Contractor shall restore to the satisfaction of the local authorities all public and private streets, roads, lanes, footpaths, paved areas cultivated or grassed surfaces and all fences which may be disturbed by the operations of the Sub-Contractor. All trenches over 1.5mm in depth shall have parrawebbing erected on both sides of the trench.

Surplus spoil shall mean such excavated material that is not required for the purpose of this contract and shall be removed from the site by the Sub-Contractor. The Sub-Contractor shall bear all costs associated with the disposal of surplus spoil including all cartage and tip fees.

The use of explosives will not be permitted.

2.2 TUNNELLING

Provide tunnelling in lieu of trenches where required by Authorities.

Tunnelling shall comply with the requirements of the required authority. The use of explosives will not be permitted. Use adequate shoring to prevent the collapse of the tunnel under all conditions.

Leave shoring in tunnel and backfill with sand under pressure after approval of pipework by Authorities and the Proprietor.

2.3 PUBLIC UTILITIES AND EXISTING SERVICES

Where underground public utility lines and surface drainage works and underground pipes, conduits or cables exist in the vicinity of the works, the Hydraulic Sub-Contractor must take care to protect such services. Any damage to such services must immediately report to the responsible Authority and to the Proprietor.

The cost of the necessary repairs or renewals shall be borne entirely by the Hydraulic Sub-Contractor, should negligence on the Sub-Contractor's part be proven.

2.4 EXCAVATION IN EXISTING PAVEMENT AND ROADWAYS

When excavating through existing pavement, saw the pavement and/or road to a depth of at least 100mm and then remove the material with pneumatic tools. If required by the Proprietor, trenches across the existing roads shall be excavated and the pipeline constructed therein so that half the roadway is always maintained open to traffic.

Allow to place 25mm thickness steel plates to Council approval over open drainage trenches during and after each day's work so as vehicular and pedestrian traffic flow is maintained.

2.5 MAKING GOOD

The Sub-Contractor shall be responsible for and shall make good any damage he may cause to the building and surfaces generally and any other works that may be distributed or injured by cartage, work generally or other operations. The reinstatement shall be at least as good as state of repair as before commencement.

2.6 EXISTING SERVICE CONNECTIONS

The Hydraulic Sub-Contractor shall seal off all existing service connections to Authorities mains to their satisfaction and approval.

2.7 GRADIENTS

Lay drains to gradients complying with the relevant authority's requirements to the levels, if any shown on the Drawings and in any case not less than the following:

Pipe diameter (mm)	Sewer Drains	Stormwater drains
65-80	1 in 40	1 in 60
100	1 in 60	1 in 100
150	1 in 80	1 in 100
225	1 in 90	1 in 200

2.8 PIPE LAYING

Lay pipelines to uniform gradients falling to the outlets, straight between required changes of direction, properly supported, with watertight joints aligned flush at internal surfaces and with spigot ends pointed in the direction of flow. Provide the necessary fittings and accessories, including junctions, branches, inspection and cleaning openings, expansion joints, and the like.

Provide inspection openings as required by the regulatory authority and in any case so that each straight length of sewer line can be inspected in at least one direction. Seal the openings with purpose-made covers fixed by a jointing method appropriate to the pipework. Raise the openings to surface level.

Flush the pipeline with clean water and leave it clean and free from debris on completion.

Lay a detectable strap or plastic tape in the trench after pipelaying, testing and initial backfilling for all services.

Provide a marker plate at ground level at each change of direction of the underground pipeline, engraved to show the direction of the line and the name of the service. Inset the marker in a 150 x 150 x 150mm concrete block, with top set flush with the finished ground or surface level.

2.9 BEDDING AND BACKFILLING - UNDERGROUND PIPE INSTALLATION

Unless otherwise specified bed the pipework on a continuous underlay of pipe bedding material, compacted in granular, or minimum thickness after compaction as required by the relevant standard, but in any case not less than 75mm. Grade the bedding evenly to the required gradient of the pipework.

Where the base of a trench is unstable or water charged ground, drains shall be supported on steel reinforced concrete beams and piers designed for that purpose.

Submit details of all beams and supports for approval before commencing installation.

Form chases where necessary to prevent sockets, flanges or the like from bearing on the trench bottom or the bedding. Fill and compact the chases with granular bedding material after the laying and testing of the pipes.

Backfilling of excavations shall be carried out under this contract.

Backfilling over Mains may, subject to the approval of the SI and testing authority be carried out prior to testing of the Mains, except at the pipe joints.

Backfilling of Mains shall be minimum 150 mm thick over the top of the pipe at the joints. The remainder of the backfill in the trench shall be stabilised selected excavated fill, as approved by the SI and Consultant.

Immediately after the pipe line has been tested to the satisfaction of the Consultant the trench shall be backfilled in the following manner:-

EXCAVATION AND PIPE WORK REQUIREMENT SECTION

(a) The fill material shall then be carefully and continuously placed, rammed, and watered around and over the pipe until the firmly compacted filling completely covers the pipe for the full width of the trench.

(b) The remainder of the trench shall then be backfilled with approved material, placed in layers not exceeding 150 millimetres loose thickness and compacted to a density of at least 95% of modified Maximum Dry Density as determined by AS 1289 procedures.

In PIPE TRENCHES compact so that the pipe is buttressed by the walls of the trench. Unless otherwise specified, backfill with general filling, with no stones retained on a 25mm sieve occurring within 150mm of the service. For materials other than the above as cover or back-filling to particular services, refer to the relevant services Sections.

Do not place filling against concrete until the concrete has been in pace for fourteen days, unless otherwise approved.

Back-fill for services under roads, pavements and concrete slabs shall be gravel sub-base class 2 compacted to 98% MMDD placed as nominated for general filling.

Provide compaction tests for all service trenches on the basis of not less than one test per service branch or as directed.

Protect the works during compaction from damage by compaction operations. Compact by hand if necessary to prevent damage or disturbance to services, pipe joints and the like.

Prior to and during placing, bring the materials to within 2% of the optimum moisture content determined to AS 1289 Method E1.1 for the filling type. The surface may be lightly sprinkled with water during compaction if necessary to replace moisture loss.

Unless over-ridden by regulatory authority requirement or otherwise specified, the following table shall apply for minimum cover over pipes:

Pipes not subject to vehicular loading:	450mm
Pipes subject to vehicular loading –	
Not in roadways:	600mm
Under sealed roadways:	600mm
Under unsealed roadways:	750mm
Pipes in embankments or subject to construction equipment loading:	750mm

ANCHORAGES

Install anchorages in the form of lateral or longitudinal anchor blocks, of not less than 15 MPa concrete, to restrain lateral movement in pipelines at bends and changes of direction on pipework above 100mm diameter. Bear anchor blocks against the body of the fitting only, clear of joints, and against firm undisturbed ground or compacted filling.

Where Rubber Ring Jointed Pipelines and the gradient is greater than 1 in 20 (5%) concrete stops shall be provided 150mm thick and built around the pipe extending from the bottom of the trench up to a height of 300mm above pipe and recessed 75mm into each side of the trench.

Submit to the SI all details of the inground pipe systems including proposed positions of concrete thrust blocks for approval before installation of pipework commences.

BEDDING FITTINGS

Provide flexible joints by installing short lengths (not more than 600mm) of flexibly jointed pipe on each side of concreted fittings, pits, manholes and the like, in principle as illustrated in AS 3500 Part 2.

CONCRETE ENCASING
Unless otherwise permitted by the relevant authority, concrete encase the following:

Vitrified clay sewer pipelines beneath buildings;
Pipelines which cannot be provided with the required minimum cover;

Encasement shall consist of 15 MPa concrete, not less than 150mm above and below the pipe and 150mm each side or the width of the trench, whichever is the greater.

DRAINS BENEATH BUILDING
Where sewer drains pass beneath footings surround pipes by not less than 150mm of 20 MPa concrete measured clear of the line of collars.

With the exception of cast iron penetrations build into structural concrete, where drains of any kind pass through foundation walls make neat opening, minimum 6mm clear of pipe all round.

Suitable arch wall construction so that no superimposed loading is imparted to pipe. Seal pipe in approved manner. At outer walls make suitable approved provisions to prevent ingress of rodents and other vermin.

CONNECTIONS TO EXISTING
Connect new pipelines to existing drains as follows:

To existing pipelines less than 300mm remove an appropriate length of the existing pipeline and insert a new junction and new pipework consistent with the existing pipeline.

Provide an inspection chamber to new branch drains greater than 100mm

Connections to the street gutters (Stormwater lines where shown) shall be made by entering the pipe into an opening made in the kerb, to finish with the kerb face, and seal. Restore the kerb and pavement as necessary, to match existing.

Arrange valves together where practicable in operational grouping, in convenient and readily accessible positions.

2.10 ABOVE GROUND PIPEWORK INSTALLATION

Install pipework in straight lines and uniform grades without sags. Provide bends and sets as required, and sufficient unions, flanges, isolating valves and the like for satisfactory removal of piping and fittings for maintenance. Arrange and support pipework as necessary where suspended, so that it remains free from vibration whilst permitting necessary movements such as thermal expansion and contraction. Provide the fittings and components connected up and ready for testing the service. Keep the number of joints to a minimum.

Do not install copper in contact with steel, zinc or other materials likely to generate electrolytic, galvanic or corrosive action. Make junctions between dissimilar metals with special fittings manufactured in suitable compatible material.

Use bends where practicable in preference to elbows. Use elbows where pipes are led up or along walls and then through to fixtures.

Arrange valves together where practicable in operational grouping, in convenient and readily accessible positions.

Pipework runs in false ceilings, roof spaces, under suspended ground floors plant rooms, and the like. Arrange adjacent to and horizontally parallel with each other and with walls, beams and the like. Keep at least 150mm above ground surface if under suspended ground floors. Provide adequate spacing of at least 25mm between pipes or pipe insulation, 50mm between pipes or pipe insulation and electrical cables. Take off branches at right angles.

ACCESSIBILITY
Check size and location of all access doors and openings shown on architectural, structural and hydraulic services drawings to ascertain if they satisfy authorities requirements.

Locate pipework in accessible positions, with adequate clearance, pipe fittings requiring maintenance or servicing, including inspection openings, cleaning points, joints designed to enable removal of pipes, control valves and the like.

As far as practicable, install plumbing work inside buildings so that it is removable without damage to the building structure or finishes.

Where practicable, conceal pipework so that it is accessible within ducts or non habitable enclosed spaces and does not appear on external walls. Obtain prior approval for the location of exposed pipework.

If pipework is proposed to be enclosed so as to be not accessible after completion, obtain prior approval for the location of pipe runs and pipe fittings, and record the actual locations on work as executed drawings.

CAPPING OFF
During construction, temporarily seal open ends of pipes to prevent the entry of foreign matter into pipe systems. Provide purpose-made covers of pressed steel or rigid plastic. Do not use rags, paper or wood plugs.

CHASES AND ENCASING
Refer the Preliminaries Section 1.18

CLEANING OUT
Clean out piping of loose scale and dirt before installation, and again after installation and sealing of joints. Flush piping systems through with clear water at a velocity sufficient to remove foreign matter and until only clean water is discharged at outlets. Leave the system free of foreign matter on completion.

CLEAR-OUTS
Install clear-outs in positions as indicated on the drawings, and as required by local authorities. Allow to extend from drain lines to finished surface level using a 60% junction and 30% bend.

Provide 100mm diameter, brass clear-outs at finished floor level.

2.11 WORKMANSHIP GENERALLY

Co-ordinate installation of pipework with other types of trade pipe runs or duct runs so that all services can be installed and maintained without hindrance.

Lay pipes in continuous lengths wherever practicable and bend in order to minimise joints.

EXCAVATION AND PIPE WORK REQUIREMENT SECTION

Make all connections to valves, taps, tanks, etc., pipes of other materials and dismantling points. For pipes 65 bore and over, connections shall be made with flanged joints and with threaded union joints for pipes 50 bore and under.

Brazing shall be carried out by first-class tradesmen experienced in work being carried out.

Open ends in pipework being erected shall be properly protected by metal caps at end of each day's work or at the end of each section of work.

Valves and inspection panels and all items, which require access at any time, shall be placed in a position that is fully accessible for maintenance and operation.

Where pipes are led up or along walls and then through fixtures, pipes shall not be bent but shall be fitted with gunmetal elbows to allow for correct fitting of cover plates. Mitred elbows will not be permitted.

Except where specifically mentioned in conjunction with a particular item of work, cast bends shall not be used. Care must be taken that sufficient unions or flanged joints are installed to allow satisfactory removal of fittings for inspection or repair, all as approved on site by the Consultant.

Pipes shall be spaced clear of all services. A minimum of 75 horizontally and 150 vertically shall be maintained from any electrical conduit cable or fitting.

All piping shall be cut square with the run and all cutting burrs removed with a proper pipe reamer. Pipework generally shall be concealed in false ceiling spaces or in the ducts provided.

Joints will not be permitted within the thickness of walls or floors unless it can be demonstrated that no other option is practicable or possible.

Only hexagonal nipples shall be used on screwed pipework; barrel nipples or running joints will not be permitted.

Pipework concealed in pipe ducts or plinths shall be provided with easy access to cleaning eye.

MATERIALS SECTION

SECTION 3 : MATERIALS

3.1 GENERALLY

All materials and workmanship shall be in accordance with the relevant section of the following referenced documents.

Water

AS3500 Parts 1.1 and 1.2 – Water Supply
AS3500 Parts 4.1 and 4.2 – Hot Water Supply

Sewerage

AS3500 Parts 2.1 and 2.2 – Sanitary Plumbing and Drainage

Stormwater

AS3500 Parts 3.1 and 3.2 – Stormwater drainage

All materials shall be of the best quality and type of their kind. They shall conform to the requirements of the latest relevant specification of the Standards Association of Australia, or if no Australian Standards exist, to the requirements of the relevant British Standard Specification.

All materials delivered to the site must be protected in a manner suitable for storage on a building site. materials shall be stored away from all damp and the ends of pips shall be sealed.

Obtain pipes and pipe fittings from approved manufacturers.

The work 'piping' shall mean all pipes, fittings and accessories connected there to.

Piping shall be of the diameter as shown on the drawings. (All diameters are internal diameters).

Copper pipe sizes as indicated on drawings are minimum outside diameter Australian Standard Size references soft metric conversion. Steel and cast iron are minimum bore size.

3.2 MEASUREMENT OF MATERIALS

Make available appropriate and approved metric gauges and/or scales for measuring and/or weighting all materials supplied.

3.3 REJECTION OF UNSATISFACTORY MATERIALS

In the event of materials being of a mixed description and quality, the Company shall have power to order to have those portions of the materials which in his opinion are unsuitable for the works, picked out, marked and stacked where directed and all defective or unsuitable materials removed from the site.

3.4 COPPER TUBES AND FITTINGS

Copper Tubes shall be solid – drawn couplings with the following standards:

- Water Services Pipes	AS 1432	Type B
- Gas Service Pipes	AS 1432	Type B
- Soil and Waste Pipes	AS 1432	Type D
- Vent Pipes	AS 1432	Type D
- Stormwater Pipes	AS 1432	Type D

Copper Fittings to AS 1589

Capillary Fittings to AS 3688 Silver solder joints only.

Flanges to AS 2129

Use capillary fittings, silver brazed slip joints, or flanged joints.

Use low temperature silver brazing alloy rods to AS 1167, classification B2 and oxyacetylene heating.

Screwed joints to AS 3500.4.

Using a proper tool, soften and expand the pipe to form a slip joint of not less than the following lengths.

Nominal Pipe Size	**Length of Slip Joint**
15-20 mm	10 mm
25-32 mm	12 mm
40-65 mm	16 mm
80-100 mm	20 mm

3.5 BRASS TUBES AND FITTINGS

Brass tubes for sanitary plumbing lines to urinals and trade waste applications and any associated vent pipes to a minimum height of 300mm above the floor level shall be round section of 70/30 brass solid drawn, having an arsenic component, 1.6mm minimum wall thickness complying with AS 1572 – Copper and Copper Alloys – Seamless Tubes for Engineering Purposes and dimensionally with AS 1432 – Copper Tubes for Plumbing, Gas Fitting and Drainage Applications. Fittings shall comply with AS 1589 – Copper and Copper Alloy waste fittings and shall be dezincification resistant.

Jointing shall be by silver brazing with filler rods complying with AS 1167 – Welding and Brazing – Filler Metals and containing not less than 15% silver.

3.6 UNPLASTICISED POLYVINYL CHLORIDE PIPES (UPVC)

UPVC pipes and fittings shall be approved for use by the local Authority and shall be to the appropriate Australian Standard and shall where applicable, be installed in accordance with the current requirements of AS 3500.

UPVC pipework passing through fire rated building elements shall have appropriate fire stop collars installed so as to maintain that building elements required fire resistance level.

UPVC pipes and fittings should be so positioned that identifying marks are readily visible for inspection when installed.

UPVC pipes shall be of approved manufacture and shall conform to the following Australian Standards as appropriate:

AS 1254	Unplasticised PVC (UPVC) Pipes and fittings for Storm or Surface Water Applications.
AS 1260	Unplasticised PVC (UPVC) Pipes and Fittings for Sewerage Applications.
AS 1415	Unplasticised PVC (UPVC) Pipes and Fittings for Drainage, Waste and Vent (DWV) Applications.

UPVC pipes and fittings used for stormwater drainage pipelines shall be class HD conforming to Australian Standard 1254 and solvent weld jointed

MATERIALS SECTION

3.7 CAST IRON PIPEWORK

Cast iron pipes and fittings are to comply to AS 1631 and to AS 1631, Table 1A with bituminous coating and lining to AS 1631, Clause 13.2. Epoxy coated for trade waste applications and Spigot and socket joints to AS 1646 with rubber joint rings.

Bolted gland joints to AS 1631 Clause 10.2 and Spigot end joints Gibault or other approved clamp type fittings and galvanised iron bolts.

3.8 FIBRE REINFORCED CEMENT PIPES AND FITTINGS

Fibre Reinforced Cement (FRC) pipes and fittings for sanitary plumbing and stormwater drainage systems shall be first quality and in accordance with AS 4139 and shall be rubber ring jointed in accordance with the manufacturers instructions.

3.9 DUCTILE IRON PIPES AND FITTINGS

Ductile iron pipes and fittings for water services shall be

a) First quality and in accordance with AS 2280, AS/NZS 2544 classed as

b) Below ground class 9 or above ground class 10.

c) Jointed in accordance with manufacturers instructions with flanges for above ground installations and rubber ring for below ground installations

3.10 GALVANISED MILD STEEL PIPING AND FITTINGS

Galvanised mild steel pipe shall be:

In conformity with heavy grade AS 1074 – Steel Tubes and Tubulars for Ordinary Service

Approved by Local Authority

Equal to Tubemakers Australia

Galvanized in accordance with AS 4118.2.1 Fire Sprinkler Systems and AS 1650 Hot Dipped Galvanized Coatings on Ferrous Articles.

Screw jointed with approved compound for the service or patented approved galvanized rolled grooved coupling.

Polytec coated or wrapped with approved protective tape where located underground.

Galvanized malleable iron fittings shall:

Conform with BS 1256

Be hot dipped galvanized

Be screw jointed with approved compound for the service or patented approved galvanized rolled grooved coupling.

Polytec coated or wrapped with approved protective tape where located underground.

3.11 STAINLESS STEEL MATERIALS

Stainless steel sections shall:

Conform to AS 1769 – Welded Stainless Steel Tubes for Plumbing Applications – for pipe sections.

Conform to AS 1449 – Wrought Alloy Steels – Stainless and Heat Resisting Steel Plate Sheet and Strip – for fabricated sections.

Grade 321 for flue pipes

Grade 316 for special corrosive agents

Grade 304 for general fabrication

Approved by Local Authority

Joints shall be lapped and Argon arc welded.

Compression fittings are only to be used on seamless stainless steel tubing.

MATERIALS SECTION

3.12 UPVC PRESSURE PIPES AND FITTINGS

UPVC pressure pipes and fittings for water services and pumped discharges shall be:

a) First quality and be in accordance with AS 1477 Parts 1-6 and AS 2032.

b) Solvent-cement or rubber ring joints: To AS 2032.

c) Pipe Classes:

Class 4.5 for a maximum working pressure of 0.45MPa (45m head approximately) at 20^{o}C material temperature.

Class 6 for a maximum working pressure of 0.6 MPa (60m head approximately) at 20^{o}C material temperature.

Class 9 for a maximum working pressure of 0.9 MPa (90m head approximately) at 20^{o}C material temperature.

Class 12 for a maximum working pressure of 1.2MPa (120m head approximately) at 20^{o}C material temperature.

Class 15 for a maximum working pressure of 1.5MPa (150m head approximately) at 20^{o}C material temperature.

Class 18 for a maximum working pressure of 1.8MPa (180m head approximately) at 20^{o}C material temperature.

3.13 UPVC PRESSURE PIPE FOR FIRE HYDRANT SERVICES

UPVC pipe and fittings for fire hydrant services shall be first quality and in accordance with AS 1477 Parts 1 to 6 equal to Blue Brute manufactured by Hardie Iplex.

3.14 CROSS LINKED POLYETHYLENE PIPE & FITTINGS (PE-X)

Cross linked polyethylene pipe and fittings (PE-X) for hot, warm and cold water system, shall be

a) first quality and in accordance with AS 2492.

b) Water services pipes shall be not less than Class 16 as specified in AS 3500 and shall have Brass Dezincification Resistant fittings as to AS 3688 with jointing method as per manufacturer's instructions.

c) Tubes which are to be installed within concrete slabs are to be run in conduits and shall comply with the requirements of the appropriate building authority (AS 3500).

d) Cross linked polyethylene will not be used in areas as specified in AS 3500.

3.15 POLYPROPYLENE PIPE AND FITTINGS (HDPE)

HDPE pipes and fittings for trade waste, greasy waste and laboratory discharges shall be

a) first quality and be in accordance with ISO 9001.

b) Black injection moulded polypropylene pipes and fittings used for underground services are to be fusion welded and above ground pipes to be mechanical jointed.

3.16 PLASTIC PIPE – GAS SERVICES

Plastic pipes for gas systems shall be first quality and be in accordance with those in AG 601 Table 3.1.

UPVC to AS 1464 Part 1, class 100 Type 1, 2 or 3 or class 450 Type 3 with solvent-cement or mechanical joints to AS 3723, operating limit of 7kPa.

Polyamide Nylon 11 and 12 to AS 2944 Part 1, class 300 or class 400 with adhesive jointing or mechanical joints to AS 3723, operating limit 200 kPa.

Limiting Conditions: **-** not permitted beneath a building
- not permitted above ground

MATERIALS SECTION

3.17 PRE-CAST REINFORCED CONCRETE PIPES

Pre-cast reinforced concrete pipes for stormwater systems shall be

a) first quality and in accordance with AS 4058 Class 'X' (2) and to be installed in accordance with AS 3725.
b) Junctions and bends shall be made with pits.
c) Use rubber ring joints in accordance with manufacturer's instructions conforming to AS 1646.

3.18 MATERIALS FOR SUB-SOIL DRAINAGE

Pipework shall be either:

Rigid UPVC pipe with longitudinal slots and filter sock or approved plastic drainage cell

a) Sub-soil drainage to be laid on blue metal 20mm single size round or crushed aggregate conforming to AS 2758.1.
b) Geotextile fabric of mass not less than 150 gms per square metre.

3.19 VITRIFIED CLAY PIPES & FITTINGS

Vitrified clay pipes and fittings for sewer systems shall be

a) first quality and in accordance with AS 1741, Class Y.
b) shall be jointed with black sewer standard type rubber rings, complying with AS 1693 or 'HEPSLEEVE' type jointing process.

3.20 ACCESS CHAMBER AND PIT CONSTRUCTION

Construct pits, sumps, access chambers and the like to the dimensions and locations as shown on the drawings and as follows, unless otherwise specified.

a) Access chambers, pits and sumps shall be precast concrete where scheduled, cast in-situ structures shall be made on site.
b) Floors and Walls in situ concrete: 20Mpa unreinforced unless otherwise shown. Thickness not less than 100mm, unless otherwise shown or specified.
c) Walls of square of rectangular pits not more than 1500mm deep may be brickwork 230m thick in cement mortar, rendered instead of unreinforced concrete.
d) Walls of spun precast sections not less than 60mm thick. Floor cast in situ or prefabricated. Provide cored holes as required.
e) Finish to exposed surfaces to be smooth, equal to steel trowelled render or concrete cast in steel forms. Cove of splay internal corners. Bench floors and fall to drain.
f) Render (If required): 1 cement:3 sand minimum thickness 20mm.
g) Reinforcement: If depth of pit exceeds 1500mm: F718 mesh to AS 1304 in floor, and in walls from depth 1200mm downward. Cover 50mm from inner face of walls and lower face of floor. Place main wires in walls horizontally.
h) Ladders to AS 1657 stile type to clause 5.7 or individual rung type to clause 5.8 as applicable. Provide ladder to pits deeper than one metre, cast or built into the pit walls clear of drain outlet openings or discharges.
i) Rungs of mild steel rod, galvanized to AS 1650, 450mm wide.
j) Rung spacing to be 300mm maximum, 250mm minimum with bottom rung not more than 450mm from the floor and top rung not more than 450mm below surface level.
k) Top level of cover or grating, including frame: in paved areas, flush with paving surface Gratings taking surface water run off: As necessary to receive the run off without ponding.
n) Build inlet and outlet pipes into the pit walls during construction. In existing pits, make openings of the correct size and pack the joint around the pipe to the full thickness of the wall with 1:3 mortar.
o) All access chambers, stormwater pits and grated sumps whether of the precast type or cast in situ shall have the entire base of each pit or sump benched with 4:2:1 concrete to form half pipe channels for straight through or branch flow. The benching shall have considerable slope from the structure walls to the half pipe channel. In all cases 50mm cross fall shall be provided at the pipe inverts across the structure.

MATERIALS SECTION

PIT COVERS

Provide each pit with a pit cover as shown on the drawings or scheduled, of a size appropriate to the pit.

Cast iron covers shall be complete with frames with all edges machine fitted and have removable plastic lifting hole plugs. All covers and frames shall be set to the level of the finished surface levels and filled in with the same materials as used for the surrounding surface. Provide a brass edge trim around each cover situated inside the building.

Provide and install as supplied by Auswave Products Pty Ltd in ductile iron material, set in a concrete surround complete with 2(no) 225 diameter brass gas sealed inspection covers. Covers are to suit the clear opening of the pit according to the Local Authority Trade Wastewater requirements.

GRATINGS FOR SUMPS AND GRATED DRAINS

Cast iron grating and frames shall be set to the level of the finished surface levels. Grating sizes and type shall be as indicated on the drawings.

Grates shall be provided for the following duties:

Class A Light Duty	10 kilonewtons (1 tonne)
Class B Medium Duty	80 kilonewtons (8 tonne)
Class C Heavy Duty	150 kilonewtons (15 tonne)
Class D Extra Heavy Duty	210 kilonewtons (21 tonne)

VINYL FLOOR WASTES

Provide and install where required in vinyl areas SPS model LG 100CS (in 316 stainless steel floor drains).

BUCKET TRAP DRAINAGE WASTES

Supply and install where indicated on the hydraulic services drawings bucket floor wastes with grate suitable for specified floor finish and with secondary strainer. Bucket traps to be SPS model Q225 ABA

GARBAGE FLOOR WASTES

Supply and install where indicated on hydraulic services drawings to the Garbage Room SPS model Q225 ABA, the grate to be in Aluminium Bronze or (316 Stainless Steel). Provide 100 diameter “P” trap under the floor wastes and connect to the sanitary system with secondary strainer.

DISCONNECTOR TRAPS

Provide disconnector traps (including gully traps and boundary traps) of the same material as the pipework.

Covers: Gully traps: Cast iron grating
Boundary traps: Sealed inspection cover

VALVE BOXES

Provide cast iron valve boxes with removable covers for access to underground valves.

Set beneath each box a shaft formed of UPVC pipe to give clear access to the valve wheel or spindle. Set top flush with pavement surface, or 15mm above unpaved surfaces and encase in formed concrete 150mm deep and 150mm wide to sides of box with top surface trowelled smooth.

ACCESS PITS

House water meters, stop valves, control valves and the like if installed below ground in concrete access pits with removable pit covers.

Internal Dimensions to give 300mm clear space below and on all sides of the fittings in the pit.

MATERIALS SECTION

Sides and Floors 20 MPa concrete, 100mm thick, reinforced with F82 fabric to AS 1304.

Grade floor to a point on one side and connect to the stormwater drainage system in 100mm UPVC or vitrified clay pipe. Carry the pit walls up to 50mm above finished ground level. Cast in the pit cover frame flush with the top. Trowel the top smooth.

WALL BOXES
Provide wall boxes to accommodate above ground valves, regulators and the like.

1.2mm galvanized steel plate continuous welded box construction with leading edge twice folded at 90^{o} to form 25 x 25mm frontal surround.

Fix to masonry backing with four 10mm galvanised masonry bolts.

The bottom of the box shall fall outwards. Form four 20mm diameter holes in the frontal surround section at box floor level.

3.21 FLANGES

Flanges shall:
conform with AS 2129 Table E.
be brass for copper tube.
be hot dipped galvanised mild steel for galvanized mild steel tube.
be jointed with 6mm thick reinforced neoprene insertion.
Use gunmetal bolts with a tensile strength of 500 MPa on brass flanges.
Use galvanized steel bolts in accordance with AS 2451 on cast iron and steel flanges.
Bolts and nuts below ground shall be insulated with PVC washers and sleeve and the pipe protected with Denso Primer and Tape for two metres either side of the flange as specified.

3.22 FITTINGS GENERALLY

Provide the necessary fittings for the proper functioning of the hydraulic service, including taps, valves, pressure and temperature control devices, strainers, gauges, automatic controls, alarms and the like to the following standards unless otherwise specified:

a) Safety valves generally (including relief valves): To AS 1271
b) Pressure and temperature relief valves for storage water heaters: To AS 1357.
c) Pressure reducing, pressure limiting and pressure ration valves for storage water heaters: To AS1357.
d) Non-return devices for water storage heaters: To AS 1357.
e) Vacuum relief valves for storage water heaters: To AS 1357.
f) Air release valves to AS 1271.
g) Water hammer devices to be 15mm stainless steel. Installed on all cold water supplies to each apartment, retail outlet, etc.
h) Thermostats and energy regulators generally: To AS/NZS 3161.
i) Thermostats and over-temperature energy cut-outs for electric water heaters: To AS 1308, adjustable or fixed settings as required.
j) Water gauges to AS 1271.
k) Mark each fitting in accordance with the relevant standard.

MATERIALS SECTION

3.23 VALVES: GENERAL

Valves shall be placed in easily accessible position for operation and repairs.

Approved type of valves **only** shall be used.

All valves shall be "John" or equal and shall be approved by the SI.

Control valves shall be of the loose jumper valve pattern unless indicated otherwise.

All valves 65mm and over shall be flanged. All other valves shall be screwed. Screwed valves shall be provided with unions to facilitate maintenance removal. Valves up to 65 mm shall be all bronze. Valves 80 mm and over may be cast iron with DR bronze trim. The spindles for gate valves shall be non-rising type and must not project into the bore of the valve when the valve is in full open position. The bore must be clear and unobstructed in this position.

The internal seats and washers of valves must be cleaned of all foreign material during installation. Any valve faces or seats found damaged on completion of the installation shall be replaced.

Stopcocks shall be used generally for domestic cold water services, gate valves for hot services.

Valves with the exception of built-in recess cocks shall not be directly silver soldered in to pipe lines.

All valves shall be suitable for the system pressure or test pressure together with shock loadings imposed by check valve closure.

Gate and Non-return Valves:	Copper alloy to AS 1628, sizes less than 80mm. Cast Iron to AS 2638, sizes 80mm and larger.

Check valves shall be approved by the Supply Authority, manufactured and tested to AS 3718 and AS 1628. All check valves are to have non-water hammer characteristics incorporating spring loaded bronze valve seat, installed in the horizontal position only.

Install valves with spindles in a vertical position where practicable.

Conceal valves wherever possible in ducts or non-habitable enclosed spaces provided that they shall in any case be accessible. Valves installed in ducts shall be positioned at 600mm above finished floor level.

Valves in Visible Positions: Match finish to that of adjoining visible pipework.

Sluice Valves to be installed on all incoming water, fire hydrant and sprinkler services. Provide and locate flanged valves in underground valve box to comply with AS 2638.

Where valves are located in service ducts or other enclosed space, provide access openings approximately 300mm square in the structural elements and cover with removable cover plates.

Install valves to control and cut off gas flow in gas lines to AG 601, Clause 2.6.2 and to approval list AG 201 of AGA and ALPGA 'Approved Appliances and Components'.

Reduction valves, pressure limiting valves, or ration valves to produce the specified reduction in pressure. Prior to installation obtain a guarantee from the manufacturer stating the reduction in pressure and flow rates obtained under test conditions.

MATERIALS SECTION

Provide isolating valves on each branch line from the main service lines of all hydraulic services to isolate all connected equipment, including hot water units, amenities, fixtures and elsewhere as shown on the drawings. Stop valves shall be loose jumper type fitted with 'O' ring seals to the spindle, manufactured and tested to AS 3718 and AS 1718.

Install globe valves on hot water reticulation systems to AS 1357.2 and as indicated on drawings. Fit with unions on each side of valve for easy maintenance and removal.

Balancing Valves to be installed on all hot water return lines as indicated on drawings to comply with AS 1357.2. Valves 50mm and under series STAT for valves 65mm to 100mm series STAF. Valves to be installed with unions for easy maintenance and removal. Valves shall be suitable for water temperatures not exceeding 99^{o}C and pressures not exceeding 1600 kPa.

Ratio Valves shall be hand wheel operation, cast iron rubber lined diaphragm valves installed to the discharge side of the sub-soil and sewage drainage pumps.

Hot Water Tempering Valves to comply with the performance requirements of AS 1357.2 and installed in accordance with AS 3500.4. Tempering valves to be adjustable between 35^{o}C – 55^{o}C.

3.24 GATE VALVES

Gate valves up to and including 80 mm diameter shall be

a) manufactured of DR brass, having a solid wedge, inside screw and non-rising stem.
b) Handwheel baked epoxy enamel coated aluminium alloy on all sizes, secured by brass handwheel nut.
c) Gland to be machined from brass bar; of generous length for adjustment of packing as required d) matching piece machined from DR brass bar: ample depth of thread for amp adjustment of gland
e) Ceramic cord packing
f) Stem machined from DR brass bar; smoothly finished Acme form actuating thread to fit wedge.

NOTE: All bronze gate valves shall conform to Australian Standard AS 1628, 1977, having DR stamped on the valve body to indicate that they are de-zinc resistant.

Gate valves over 80mm diameter shall be flanged and constructed of cast iron with the following:

a) Cast iron handwheel
b) DR Bronze wheel
c) Cast iron stuffing box
d) DR Brass stem
e) Cast iron bonnet
f) DR Bronze wedge nut
g) DR Bronze wedge facing ring and wedge
h) DR Bronze body seat ring
i) Cast iron body.

LOCATION	SIZE	TYPE	MATERIAL	CONNECTIONS
All locations	Less than 80mm	Full bore gate	Copper alloy	Screwed
Above ground and in pits	Less than 80mm	Full bore gate	Copper alloy	Screwed
Above ground and in pits	80mm or larger gate, or	Full bore sluice	Cast iron	Flanged

Landing Valves – Fire Hydrant to conform to AS 2419.2

LOCATION	SIZE	TYPE	MATERIAL	CONNECTIONS
All locations	65mm	Full bore	Brass with brass cap	Screwed

3.25 STOP VALVES

Stop valves up to and including 50 mm diameter shall conform in all respects to the requirements of the local water authority.

Stop valves shall be connected to the pipework by means of screwing connections; silver soldering or brazing of cocks or valves directly to copper pipes will not be permitted.

Stop valves shall have loose jumpers; replaceable washers and seats 'O' ring seals in preference to packed glands and shall be clearly marked to show the direction of flow.

Over 50 mm (Including Globe Valves): These valves shall be constructed of DR bronze and shall have a stem machined from cast bronze rod to BSLG4. They shall be provided with a replaceable stainless steel valve and seat hand wheels are to be fibre filled plastic.

3.26 NON-RETURN CHECK VALVES

Construction of valves shall be as specified for valves generally, Check valves shall be horizontal pattern with non water hammer characteristics incorporating a spring loaded bronze valve seat. The body shall be globe shaped and designed to give a clear passage equal in area to that of the pipe to which it is to be connected. The body is to be fitted with a screw hexagon headed inspection cap or cover and a flow direction arrow cast on raise metal on one side.

3.27 FLOW CONTROL VALVES

Supply and install to all tapsets, flow control valves similar to those manufactured by “JEM FLO” or approved equal.

Each flow valve shall incorporate a spring loaded non-return valve and shall control flow in the cold and hot water lines to achieve 9 litres per minute for showers, 6 litres per minute for basins, 8 litres per minute for sinks and 6 litres per minute for WC cisterns.

Furnish and install to each hot and cold faucet a flow regulated water management system.

The constant flow regulators shall automatically adjust to pressure variation in the hot and cold water systems. The maximum tolerance to the flow rate shall be 10%.

The installation of the constant flow regulators must be carried out by our approved installers and a written guarantee for 12 months shall be provided at the completion of the work.

The installation of hot and cold faucets flow rates must be balanced to suit a 50% - 40% hot and cold water mix to eliminate temperature fluctuations and maintain a shower balance of no more than $1^{o}C$ variation.

3.28 THERMOSTATIC MIXING VALVES

Water temperature regulated by a single hand control and capable of delivering water at the temperature of either of the supply systems and at any temperature in between and suitable for controlling single or multiple outlets, as appropriate, to comply to AS 4032 and AS 3500.

MATERIALS SECTION

The valve shall be approved and be equal to Enware Aqua blend 1500 pressure balanced thermostatic mixing valve in a lockable stainless steel cabinet or approved equal. The installation shall be complete with isolation valves, check valves, unions, temperature test point etc, as required for a complete installation.

Controls**:** incorporate the following:

A temperature sensitive automatic control which maintains temperature at the pre-selected setting and rapidly shuts down the flow if either supply system fails, or if the normal discharge water temperature is exceeded.
Hot water flush facility.
The temperature must be set at 43.5^{o}C for all childhood centres, primary and secondary schools, nursing homes, aged care facilities and sick and disabled facilities.
The temperature set at 50^{o}C in all other cases.

At completion a complete service log sheet for each valve and a certificate of the whole installation must be submitted to the SI.

Servicing and maintenance to be performed 12 months from the date of installation.

3.29 Y' STRAINER

Strainers shall be installed after the water meter and on each branch line with a flow control valve, solenoid or thermostatic mixing valve.

Strainers are to be capable of arresting particles larger than 1.2mm having a mesh surface area of not less than four (4) times that of the pipe.

Check valve and control valve before each strainer. Fit each strainer with valve and drain line to facilitate east of maintenance.

3.30 UNIONS

Unions shall be three (3) piece brass, bull nose taper type unions. Brass and nylon olive type connections shall not be used under any circumstances. Unions shall be located on the outlet side of all valves.

3.31 BACKFLOW PREVENTION

Supply and install backflow prevention devices to all water supplies serving fixtures with possible cross connection hazard to conform with AS 3500.1 Section 4 and AS 2845 Parts 1 to 3.

Water supply to the mechanical plantrooms is to incorporate reduced pressure zone devices (RPZD's). RPZD's are to be Conbraco by Ryemetal Holdings Pty Ltd or approved equal and to be supplied and installed complete with resilient seated isolation valves immediately upstream and downstream of the device. All pipework to be flushed clean prior to installation of RPZD.

All fire hose reels that are to be supplied with water from the metered domestic service shall have a testable double check valve installed on the water supply prior to the hose reel as required by AS3500 Part 1.2. The double check valve shall be equal approved to RMC (Product Code No. 007) and be supplied and installed complete with resilient seated isolation valves immediately upstream and downstream of the device.

Provide three (3) copies of the certification certificates for the backflow prevention devices installed to enable them to be included into the maintenance manuals.

Provide details of all cross connections and register the same with the local water authority.

Commission all backflow devices prior to practical completion. Internal devices to be housed in a purpose made stainless steel cabinet with exposed related tundishes to be chrome plated.

MATERIALS SECTION

3.32 TUNDISH

Tundish shall be constructed of 1.6mm thick copper. Where exposed to view, tundish shall be chrome plated except in plantroom and carparking areas.

3.33 SAFE TRAYS

Supply and install safe trays constructed of 1.8mm sheet copper to AS 1566. Joints shall have soldered edges, be reinforced and turned up 50mm. A 50mm outlet shall be fitted

3.34 GAUGES / THERMOMETERS

Pressure gauges shall be installed on the suction and discharge sides of all pump sets and equal to those manufactured by Shearer Wright, be a minimum of 100mm diameter and be graduated in metres head and kilopascals of bronze construction mid pointing and activated by a double spring. Each gauge shall be complete with an approved gunmetal stop cock under the gauge and connected to the pipework, in accordance with CB 0 Code for pump tests.

Provide adjacent to the hot water flow and return lines vapour pressure type thermometers with a range of 10^{o}C to 120^{o}C.

Fix each thermometer head to a 150 x 25mm pre-painted timber panel in a position adjacent to the equipment served and easily visible for the balancing of the system.

Provide on the upstream side of each balancing valve a thermometer well having an internal bore of not less than 16mm and inserted in a section of pipe having a free flow area of not less than the line being served.

3.35 JOINTING MATERIALS

Rubber Ring Gaskets for spigots and socket joints on CI pipes shall be moulded on the type recommended by the pipe manufacturer for the joint to be used. This shall be sufficiently durable to last the life of the pipe without leaking under the proposed conditions of usage.

Lubricant for lubricating the rubber ring gasket and the outside surface of the spigot end of the pipe shall be of an approved non-toxic vegetable base type and shall be applied in accordance with the manufacturer's instructions.

Bolts and Nuts shall conform to Australian Standards AS 1110 and AS 1112 and shall be 316 stainless steel where pipes are buried, or hot dipped galvanised where above ground.

Where flanged joints are to be made between copper pipes and cast iron pipes or fittings, high tensile brass bolts and nuts conforming dimensionally to the above standards shall be used. The high tensile brass shall have an ultimate tensile strength of at least 460 MPa.

Rubber insertion for flanged joints shall be of approved quality and sufficiently durable to last the life of the pipe without leaking.

Cement Mortar for pipe jointing shall be proportioned accurately by volume and mixed thoroughly with water as directed by the SI Mortar shall be used fresh and in proportion of one (1) part cement to two (2) parts sand.

Polyvinyl Chloride (PVS or UPVC) pipes shall be jointed by solvent-welding of the type recommended by the manufacturer. Clean joint with approved solvent cleaning fluid. Apply liberally an even layer of the approved solvent cement to both surfaces of the joint and allow to stand to become touch dry. Apply a second coat to both surfaces of the joint and push together. Remove surplus solvent with a clean, dry cloth complying with AS/NZS 3879.

MATERIALS SECTION

Silicone sealant shall be self-polishing with anti-fungicide addictive equal to Ciba-Geigy manufacture and used as recommended by the manufacturer. White shall be used around vitreous china sanitary ware and clear for seal under fixture taps and stainless steel.

Silver Brazing: Joints in copper tubes and brass pipe shall be made with copper phosphorous brazing alloy complying with the requirements of Australian Standard 1167 - 1971 Table 2 Copper Phosphorous brazing alloy, alloy designation B4 having a silver content between not less than 14.5% and 15.5% and the remainder being phosphorous between 4.5% and 5.5% with a melting range of 645 deg. C Solidus and 700 deg. C Liquidus.

The tip colour identification shall be AS K185 (or BS 381 C) Brown.

Soft solder joint will **NOT** be acceptable.

3.36 PIPING INSULATION

For insulated piping, completely cover the pipe with insulation fitted tightly to the pipe surface and secured with wires, straps, adhesive, adhesive tape or other appropriate means. If insulation is installed in sections, butt the joints closely together without gaps. Over connection unions and couplers, install the insulation so that it is readily removable.

Fittings: Provide insulation of thermal resistance equivalent to the piping.

Hot water, Warm water, Cold water in air conditioned plenums etc, and hydronic heating pipelines wherever they are installed throughout the building shall be insulated with 20mm thick Thermotec 4-zero [or Armstrong FR or Tontine], insulation in one (1) metre lengths.

"Thermotec 4 Zero" insulation shall be covered with reinforced aluminium foil incorporating an overlap. Provide and fix to longitudinal joints and circumferential butt joints 75mm wide, self adhesive reinforced aluminium tape.

Metal sheathing location: Insulated piping in plantrooms, external locations and where exposed to view.

Cover piping with metal sheathing sprung over the insulation in one piece with laps at least 30mm wide, and fastened with self tapping screws or snap head rivets at 150mm maximum centres. Preform the sheathing to match the shape of the insulated pipe and fittings. Position laps to avoid water penetration. In external locations weatherproof the joints and fixings using a non-setting mastic.

Material: 0.5mm thick zinc-coated steel sheet.

Hot water and Cold water copper pipework within stud wall framing, chased in masonry or concrete walls shall be hard drawn pre-lagged type similar to 'KEMLAG".

Clean the surfaces to remove scale, rust, grease and dirt and prepare surfaces to suit the insulation. Restore surface coatings, which have been damaged or affected by welding.

Do not install insulation until the piping has been tested.

Identification markers to be added after insulation has been completed.

Provide pipe supports formed to fit around the insulation.

Protection for pipes larger than DN25 either

a) protect the insulation at the support point with metal sheathing; or
b) replace the insulation at the support point with a shaped wooden spacer block. Butt the insulation up to the wooden block and seal with silicone compound. Clad the block and insulation in 0.5mm zinc-coated steel sheet extending 100 mm each side of the support.

3.37 EXPANSION JOINTS

Supply and install approved expansion joints to all copper and PVC soil, waste, relief and main vent lines. Expansion joints in copper tube and PVC for all vent lines, drainage lines, hot water flow and return lines, cold water lines, gas lines etc, shall be installed on each line at intervals not exceeding 3000mm on both vertical and horizontal pipelines and on either side of building expansion joints.

SECTION 4 : SEWER DRAINAGE

4.1 GENERALLY

Supply, install, test and commission all sewer drainage from soil and wastes and fixtures to the sewer connection. Provide all necessary pipes, junctions, bends, pits, floor wastes, excavation, supports, backfilling, testing and sundry equipment required for the installation. Pipeline positions shall be determined on site in conjunction with all other disciplines to ensure adequate coordination of all services and elements. Coordination shall be carried out prior to any setting out, excavation and pipe installation taking place.

Execute the works, using only materials and structures as approved by the local authority and to the satisfaction of the SI.

SEWER CONNECTION

Make the connection to the House service sewer in an approved manner and to local inspector's requirements.

Ascertain the depth, position and suitability of the sewer connection points prior to the commencement of any work and incorporate any adjustments required to execute the work. No claims for redundant work will be considered due to failure to comply with this requirement. Make connection to the sewer lead-in.

MATERIALS

Pipes and fittings for sewer drainage shall be of vitrified clay or UPVC material all as specified under 'Materials". Joints shall comply with relevant clauses under "Jointing". Pipes and fittings for greasy waste or trade waste shall be vitrified clay or HDPE all as specified under "Materials".

EXCAVATION

Carry out all necessary excavation as specified under "Excavation & Pipework Requirements" section.

BACKFILLING

Supply all necessary material and carry out backfilling as specified under "Excavation & Pipework Requirements" section.

GRADIENTS

Pipelines shall be laid true to line and bore from point to point.

Unless otherwise indicated on the drawings pipelines shall be graded in accordance with the Authorities requirements and as specified under "Excavation & Pipework Requirements" section.

FILLED GROUND

Where indicated on the drawings and/or encountered on site pipelines shall be supported as directed and as previously specified under "Excavation & Pipework Requirements" section.

OVERFLOW GULLY

STORMWATER DRAINAGE AND DOWNPIPE SECTION

Supply and install an overflow gully to provide a safe release from the connection point. Gully shall be constructed of 100mm diameter "P" trap and 100mm riser. Top of riser shall incorporate 200mm cast iron grate with concrete surround. Terminate gully top to comply with current authorities' regulations.

TESTING

Provide a hydrostatic test to choke level for a minimum period of 15 minutes and as required by the testing authority and the SI and as specified under "Preliminaries" section.

ACCESS / INSPECTION PITS

Supply and install inspection pits at changes of direction. Pits to be reinforced concrete of appropriate dimensions to Code with depths to match invert levels of pipeline and as specified in "Materials" section.

Pits, covers and frames shall be as specified under "Materials" section.

CLEAR OUTS

Provide and install clear-out inspection fittings to provide rodding access to all lines.

Riser from pipeline shall extend vertically to finished floor level and terminate with a brass screw out and frame.

PIPELAYING

Carry out necessary pipelaying as specified in "Excavation & Pipework Requirements" section.

CONCRETE ENCASING

Carry out all necessary concrete encasing as specified in "Excavation & Pipework Requirements" section.

REFLUX VALVES

Supply and install all reflux valves in the locations indicated or as required by the local sewer authority and as specified in the "Materials" section.

4.2 FLOOR WASTES

Supply and install floor wastes in locations as indicated on the drawings or as required by the local sewer authority and as specified.

4.3 BUCKET TRAPS

Supply and install all bucket traps in the locations indicated or as required by the local sewer authority and as specified in the "Materials" section.

ECTION 5 : STORMWATER DRAINAGE & DOWNPIPES

5.1 GENERALLY

Supply, install, test and commission all stormwater drainage to the stormwater connection. Provide all necessary pipes, junctions, bends, pits, floor wastes, excavation, supports, backfilling, testing and sundry equipment required for the installation. Pipeline positions shall be determined on site in conjunction with all other disciplines to ensure adequate coordination of all services and elements. Coordination shall be carried out prior to any setting out, excavation and pipe installation taking place.

Execute the works, using only materials and structures as approved by the local authority and to the satisfaction of the SI.

STORMWATER CONNECTION

Make the connection to the local authorities stormwater in an approved manner and to local Authorities requirements.

Ascertain the depth, position and suitability of the stormwater connection points prior to the commencement of any work and incorporate any adjustments required to execute the work. No claims for redundant work will be considered due to failure to comply with this requirement.

MATERIALS

Pipes and fittings for stormwater drainage shall be of vitrified clay or UPVC sewer grade up to 255mm and precast concrete or fibre reinforced cement pipe over 225mm as specified under “Materials” section.

EXCAVATION

Carry out all necessary excavation as specified under “Excavation & Pipework Requirements” section.

BACK-FILLING

Supply all necessary material and carry out back-filling as specified under “Excavation & Pipework Requirements” section.

GRADIENTS

Pipelines shall be laid true to line and bore from point to point.

Unless otherwise indicated on the drawings pipelines shall be graded in accordance with the Authorities requirements and as specified under “Excavation & Pipework Requirements” section.

FILLED GROUND

Where indicated on the drawings and/or encountered on site pipelines shall be supported as directed and as previously specified under “Excavation & Pipework Requirements” section.

TESTING

Provide a hydrostatic test to choke level for a minimum period of 15 minutes and as required by the testing authority and the SI and as specified under “Preliminaries” section.

ACCESS / INSPECTION PITS

Supply and install inspection pits at changes of direction. Pits to be reinforced concrete of appropriate dimensions to Code with depths to match invert levels of pipeline and as specified in “Materials” section.

Pits, covers and frames shall be as specified under “Materials” section.

STORMWATER DRAINAGE AND DOWNPIPE SECTION

GRATINGS
Supply and install all pit gratings as specified in “Materials” section.

PIPE LAYING
Carry out necessary pipe laying as specified in “Excavation & Pipework Requirements” section.

CONCRETE ENCASING
Carry out all necessary concrete encasing as specified in “Excavation & Pipework Requirements” section.

5.2 SUB SOIL DRAINS

Provide subsoil drains to intercept groundwater seepage and prevent water build-up behind walls and under floors, pavements and landscape beds. Connect subsoil drains to surface drains or to the stormwater drainage system as applicable.

Follow the minimum clear depths, measured to the crown of the pipe, where the pipe passes below the following elements:

100mm below formation level of the pavement, kerb or channel
100mm below the average gradient of the bottom of footings.
Below the finished surface of unpaved ground, levels as indicated on drawings.

At junctions of subsoil pipes provide tees, couplings or adaptors to AS 2439.1.

Minimum trench width to be 450 mm.
Grade the trench floor evenly to the gradient of the pipeline. If the trench floor is rock, correct any irregularities with compacted bedding material. Bed piping on a continuous underlay of bedding material, at least 75 mm thick after compaction. Lay the pipe with one line of perforations at the bottom.

If necessary, form chases to prevent projections such as sockets and flanges from bearing on the trench bottom or underlay.

Place the material in the pipe surround in layers # 200 mm loose thickness, and compact without damaging or displacing the piping.

Depth of overlay:
To the underside of the bases of overlying structures such as pavements, slabs and channels.
To within 150 mm of the finished surface of unpaved or landscaped areas.

Provide polymeric fabric formed from plastic yarn composed of at least 85% by weight propylene, ethylene, amide or vinyledenechloride, and containing stabilisers or inhibitors which provide resistance to deterioration due to ultraviolet light.

Provide heavy-duty protective covering. Store clear of the ground and out of direct sunlight. During installation do not expose the filter fabric to sunlight for more than 14 days.

Provide polyester permeable filter socks capable of retaining particles of 0.25 mm size. Securely fit or join the sock at each joint.

STORMWATER DRAINAGE AND DOWNPIPE SECTION

Subsoil pipeline schedule

Location	Pipe size (nominal)	Pipe type
General	100	Slotted rigid PVC
General	150	Slotted rigid PVC

PITS

Provide a smooth, seamless finish, using steel trowelled render or concrete cast in steel forms and as specified in the “Materials” section.

Cove or splay internal corners with metal access covers and grates to AS3996..

The top of cover or grate, including frame in paved areas shall be flush with the paving surface.

In landscaped areas 25 mm above finished surface and Gratings taking surface water runoff located to receive runoff without ponding.

Pit Schedule

Pit Type	Size mm	Cover Type	Remarks
Inlet Pits	450 x 450	Grated	Base of pits to be benched to suit pipe
Inlet Pits	600 x 600	Grated	Base of pits to be benched to suit pipe
Access /Inlet pits	900 x 900 with	600x600 grate	Base of pits to be benched to suit pipe

SUB-SOIL / STORMWATER PUMPS

Supply and install sub-soil/stormwater pumps as specified in “Pumping” section.

SANITARY PLUMBING SECTION

SECTION 6 : SANITARY PLUMBING

6.1 SCOPE OF WORK

Sanitary plumbing works above ground shall include all those works generally considered by authorities and trade practice to be soil, waste, vent above ground as distinct from drainer's work.

Plumbing as defined in this Section shall comprise the following: -

Plumbing waste, condensate and vent pipes above ground.

DESCRIPTION OF WORK

Plumbing shall be the connection of the above floor fixtures and vents to the drainage system.

The sub contractor shall provide for protection of all fittings and pipework after installation and secure them against damage and shall be completely responsible for the replacement of any damaged or disfigured fitting, pipe or fixture at his own cost.

MATERIAL SCHEDULE

Description	Size	Material
Sanitary Plumbing	40 – 150	UPVC DWV grade
Vents	50 – 100	UPVC DWV grade

Except as otherwise specified or directed, all internal exposed piping adjacent to plumbing fixtures, including traps and fittings shall be chromium plated finished. Where passing through a finished wall, floor or ceiling, piping shall be fitted with approved chrome plated wall plates. Chrome plating to comply with AS 1192 – 1973 – Electroplated Coatings of Nickel and Chromium.

All other exposed piping shall be cleaned free of cement droppings and other debris.

All UPVC/HDPE pipes penetrating floor slabs, fire and smoke walls and any fire rated element shall be provided with an approved fire stop collar to match the required FRL.

SUPPORTING AND FIXING PIPES

All pipes shall be adequately supported and securely fixed in accordance with the drawings and to the satisfaction of the SI. Such supporting and fixing to be carried out without causing any distortion, damage or stress on the pipes or pipe joints. Pipes shall be supported at each collar and at spacing as specified in “Preliminaries” section.

FIXTURE TRAPS

75mm water seal traps shall be provided for the following fixtures:

Sinks 50 mm two part universal pattern.

Basin 40 mm CP copper two part S or P-trap with 40 mm CP extension riser.

VENT PIPES

Terminate all vents through roof with a cowl. Finish vents 3 metres above ground level, 300mm above roof level and 6 metres clear of openings and fresh air intakes as required by the local authority and as indicated on the drawings. Flashing of vents, which penetrate the roof, shall be carried out within the hydraulics scope of works.

SANITARY PLUMBING SECTION

INSPECTION OPENINGS & GATES

Install inspection openings in accessible locations so that each section of pipework can be cleaned. Inspection opening sizes shall be in accordance with authorities' requirements. Install bolted testing gates on all stacks at each floor level, at each stacks base and on all relief vents at each alternate floor.

JOINTS

All joints shall be in conformity with that specified under the relevant "Materials" clause.

EXPANSION JOINTS

Supply and install approved expansion joints to all copper and PVC soil, waste, relief and main vent lines. Expansion joints in copper tube and PVC shall be installed on each line at intervals not exceeding 3000mm on both vertical and horizontal pipelines and on either side of building expansion joints.

BRANCHES

When a branch line enters a vertical pipe the branch fitting must be wholly outside the vertical pipe such that the internal bore of the pipe is maintained at all times. For vertical branches of up to and including 80mm a radius of at least 25mm must be maintained on the throat of the bend and a radius of 50mm for larger junctions.

All horizontal branches shall connect to the main branch line through a 45^{o} or sweep type junction.

OFFSETS

Use sweep bends of 300mm radius (or alternatively No 2 x 45^{o} bend), and provide maximum fall between bends.

PAN COLLARS

Unless otherwise noted all pan collars to soil type fixtures shall be of approved PVC materials and pattern. Collar shall incorporate an approved neoprene rubber ring joint.

TUNDISHES

Supply and install UPVC tundishes in areas required for mechanical drainage. Tundishes to be chrome plated where exposed and to comply to "Materials" section.

TESTING

Provide a hydrostatic test to maximum choke level to the satisfaction of the authority and the SI and to comply to "Preliminaries" section.

6.2 FLOOR WASTES

Use PVC trap with 100mm riser and 50mm or 65mm outlet of self-cleansing pattern.

Standard floor wastes grates in suspended slabs shall comprise 100mm Dia 'Palazzi" gullies complete with CP brass screwed grate set at a level to ensure correct drainage of floor areas.

Floor waste / shower wastes installed in areas where vinyl flooring is to be installed are to be SPS Lo-Grime variable height type suitable for vinyl flooring and to have clamp ring. (Product Code No. LG100N/C). The Hydraulics Sub-Contractor is referred to the AFC issue of the Architectural Contract Drawings for information as to where vinyl flooring is proposed.

Each floor waste gully or shower waste gully is to have an inspection opening at its base.

Where located in showers, kitchens and similar frequently washed down areas provide a standard PVC safe waste tray, solvent welded to PVC riser. Drill three 4mm diameter holes through riser above tray to drain seepage trapped by tray.

Refer the "Materials" section for specification.

SANITARY PLUMBING SECTION

6.3 ACOUSTIC TREATMENT

Allow to acoustically treat all suspended sanitary plumbing, stacks and downpipes installed within the apartments within ducts and ceiling space where located above living areas.

Acoustic treatment of UPVC and Copper Waste Water Pipe shall be a lagging material consisting of a 4kg limp barrier, faced with light weight Aluminium Foil, and a laminate of 12mm thick (minimum) acoustic grade, hydrolysis resistant foam.

Acoustic wrapping is to be “Acou-Stop” ABW4-12.

Install in strict accordance with manufacturers recommendations and specifications.

Contact: CMG - telephone: 02 9682 7277.

Installation to the pipe shall ensure at all times a tight butt join of the foam and a minimum limp barrier overlap of 20mm.

All joins are to be taped with a 48mm wide aluminium tape such as PPC 493 reinforced tape.

“S” trap and other difficult fittings shall be “boxed”, ensuring that overlaps are maintained on all joins.

“Boxing” should take place primarily and pipework then “lagged up” to them ensuring a snug fit.

SECTION 7 : DOMESTIC COLD WATER SERVICES

7.1 GENERALLY

Supply, install, test and commission all domestic cold water pipes from the authority's main to all fixtures, fittings and faucets requiring domestic cold water. Include for all pipework, bends, offsets, brackets, pumps, taps and faucets and sundry equipment required for the installation.

Pipe materials shall be as follows:

Domestic Cold Water below ground: Copper Type B
Domestic cold water above ground: Copper tube Type B
All pipes in masonry walls or within stud walls shall be pre-lagged copper tube or polypropylene. All copper pipes beneath buildings shall be wrapped or lagged. Copper tube shall not be used in ground where corrosive soils have been identified, pipework shall be HDPE or UPVC pressure pipe.

Except as otherwise specified or directed, all internal exposed piping adjacent to plumbing fixtures, including valves, taps and fittings shall be chromium plated finished. Where passing through a finished wall, floor or ceiling, piping shall be fitted with approved chrome plated wall plates. Chrome plating to comply with AS 1192 – 1973 – Electroplated Coatings of Nickel and Chromium.

All other exposed piping shall be cleaned free of cement droppings and other debris.

Negotiate with authority for the supply of all meters, take delivery from authority's store and install on site, complete with all valves and fittings required.

WATER MAIN CONNECTION
Excavate, locate and connect to the existing water mains for the services as required and extend to the reticulation.
Allow to obtain a suitable water meter from the local authority and install water meter assembly complete with backflow prevention device in location as indicated on the drawings in an approved manner.

VALVES (IN-LINE)
To pipelines supplying cold water to each group of fixtures, supply and install valves for the purpose of shutting down the system for isolation and maintenance purposes as specified in "Materials" section.

Locate valves behind access panels or within accessible ducts. Valves located in ground shall be provided with CI path box and lid set into concrete surround with PVC pipe riser around valve stem as specified in "Materials" section.

CONNECTION TO FIXTURES
Provide unions at wall or floor surface and at fixtures and appliances to allow removal and replacement without the need to adjust connections.

TESTING
Provide a water pressure test of 1500 kPa for a period of two hours. Disconnect any equipment connect to the service not rated to the test pressure, before testing commences and to conform to the "Preliminaries" section.

TAPS AND FAUCETS
Supply and fix the taps and faucets specified in the "Sanitary Fixtures & Fittings and Tapware" section or as selected by the Architect or SI. Unless indicated otherwise taps and faucets shall be all brass construction. All connections and cover plates shall be bright chromium plated finish. Taps shall be fitted with anti-splash nozzles, except for hose cocks and/or where otherwise specified.

Taps shall incorporate:

- Loose Jumper Valve incorporating neoprene washer
- Fitted with O ring seal
- Vandal resistant handle
- Vandal resistant aerator
- Flow control devices.

FLUSHING & CLEANING OF WATER SUPPLY SERVICES

Immediately after the satisfactory completion of the sectional/first fix and the whole system/final fix hydraulic pressure tests the Hydraulics Sub-contractor shall flush out, remove all foreign matter and clean all the systems. Water systems shall be flushed out with clean water. Whenever possible the flushing medium shall be fed into the system at high points and flushed out at low points on the system via suitably sized valve or plugged wash-out points. The flushing and cleaning medium shall be fed into the system at the highest pressure that the system will safely withstand and be carried out for a sufficient period of time to ensure that all foreign matter is removed. The flushing shall be witnessed by the SI for the duration of the flushing of each service and shall be recorded by the Hydraulics Sub-contractor and certified by the SI.

7.2 BACKFLOW PREVENTION

Supply and install an approved BFPD in the domestic cold water supply and irrigation system as required by the Water Authority and as specified in the “Materials” section.

Contractor is to maintain device for a period of 12 months and will include maintenance instructions in as-built manuals to be supplied at end of project establishing an authorised maintenance programme including registration and certification of device.

In order to comply with AS3500 Part 1.2 Section 4, a caution sign complying to AS1319 must be made and installed at every outlet that is served with water from the reduced pressure zone devices (RPZD’s). The caution sign shall be clearly and permanently labelled to state

‘CAUTION NOT FOR DRINKING’

Provide isolation valves upstream and downstream of valve and line strainer at inlet to BFPD.

Flush piping before installing device and test device after installation and prior to operation in service.

DOMESTIC COLD WATER SERVICES SECTION

HOSE TAPS

Provide and install hose taps with anti-vandal heads and hose connection vacuum breaker.

EXTERNAL HOSE TAPS

Each tap shall consist of a 20mm diameter copper riser with a back plated elbow and a 20mm diameter brass finish hose tap. The tap shall be 450mm above the floor unless otherwise directed.

The hose tap shall be installed against a block or concrete wall, the back plated elbow fixed to the wall or hardwood timber post with three (3) x 20mm brass screws, screwed into 20mm x 6mm expanding plastic plugs.

INTERNAL HOSE TAPS

Internal hose taps shall have concealed pipework connection with chrome plated cover dome. Hose tap and vacuum breakers to be chrome plated. Hose tap handles to match tap handles where applicable.

SECTION 8 : DOMESTIC HOT WATER & WARM WATER SERVICES

8.1 GENERALLY

Supply, install, test and commission the gas boosted Solar domestic hot water service and warm water service from the hot water heaters to the fixtures and appliances. Include for all piping, fittings, supports, insulation, hot water heaters, valves, circulating pumps and other sundry items of equipment required for the installation.

The new hot water system shall consist of a flow and return system from the hot water plant where indicated on the drawings. The hot water is to be circulated at 65°C. Thermostatic mixing valves will be located in all other areas to maintain the water at 50^{o}C or 38^{o}C as appropriate.

All pipes shall be copper tube insulated as specified in “Materials” section.

TESTING

Provide a water pressure test of 1500 kPa for a period of two hours. Disconnect any equipment connected to the service not rated to the test pressure before testing commences. Testing is to conform to “Preliminaries” section.

CONNECTION TO FIXTURES

Provide unions at wall or floor surface and at appliances to allow removal and replacement without the need to adjust connections.

CONTROL VALVES

Supply and install control valves to each group of fixtures. Locate behind access panels or within accessible ducts as specified in “Materials” section.

EXPANSION AND CONTRACTION

Make adequate provision for expansion and contraction by the provision of clips/brackets with wooden expansion blocks so that under all working conditions no strain is imposed on pipework or fittings, Pipes located in walls and floors shall be provided with sufficient insulation so that expansion and contraction does not impose a strain on the pipework or finished surfaces. No joints will be allowed within or under concrete slabs where slab is on ground.

Branch pipes off straight lengths of unrestrained supply pipes shall incorporate a minimum of 3 long radius pipe bends and a straight length of pipe not less than 1000mm long between the branch connection and the first branch pipe restraint to facilitate movement of the supply pipe without imposing strain on the pipe connections and fittings.

VALVES

Refer to “Materials” section for valves. Balancing valves shall be all bronze globe valves with limited stop in the open position. All other valves must be bronze.

PIPE SUPPORTS

Pipes shall be supported at each collar and at spacing as specified in “Preliminaries” section.

NOISE & VIBRATION SUPPRESSION

Supply and install all necessary equipment to identify the system to conform to the “Preliminaries” section.

PAINTING & IDENTIFICATION

Supply and install all necessary equipment to identify the system to conform to the “Preliminaries” section.

DOMESTIC HOT WATER & WARM WATER SECTION

FLUSHING & CLEANING OF WATER SUPPLY SERVICES
Flush and clean the system as specified in the “Cold Water” section.

SAMPLES
Submit samples of accessories not specified as proprietary items as specified in the “Preliminaries” section.

TAPWARE
Supply and install all Tapware to comply to the “Cold Water” and the “Sanitary Fixtures, Fittings and Tapware” sections or as selected by the Architect or SI.

8.2 THERMOSTATIC MIXING VALVES

Supply and install thermostatic mixing valves to all disabled toilets and all sanitary fixtures, as indicated on the drawings, used for personal hygiene strictly to manufacturers requirements and in accordance with the local authorities requirements. All valves where accessible by children must be set at 38ºC. all other areas for use by adults shall be set at 50ºC.

All valves to comply to those specified in “Materials Section”.

8.3 HOT WATER HEATERS

Supply and fix the hot water heaters in the locations indicated on the drawings.

Each hot water heater shall be constructed with a double coating of high temperature corrosive resistant vitreous enamel lined steel cylinder, insulated with a high density insulation or approved equal and totally enclosed in a heavy gauge zincanneal outer jacket.

The jacket shall be finished in baked enamel to an approved colour.

Provide heaters with the following:

An automatic surface mounted temperature control thermostat with adjustable ranges on automatic over-temperature cut out to shut down the fuel or power supply should the thermostat malfunction.
A temperature and pressure relief valve to conform to the requirements of AS 1357 and terminate over a tundish or FW as noted on drawings.
Electric hot water heaters shall be in accordance with AS 1056 and be tested and approved by the electrical supply authority.
Gas hot water heaters shall be in accordance with AG 102 and be read in conjunction with AS 1056 Parts 2 and 3.
A copper safe tray shall be supplied and installed under the hot water heater and shall be constructed of 1.8mm sheet copper. Joints shall have soldered edges, be reinforced and turned up 50mm. A 32mm outlet shall be fitted and sealed to the tray and discharge in the position noted on the drawings.
Hot water heaters shall be mounted on the safe trays and supported on 40mm x 25mm hardwood batons, no closer than 20mm from the sides of the tray.

Heater sizes and duties are to comply to the “Sanitary Fixtures, Fittings & Tapware” sections.

8.4 HOT WATER CIRCULATING PUMP

Supply and install a hot water circulating pump to the requirements as specified in the “Pumping” section.

8.5 BOILING WATER UNITS

Supply and install boiling water units finished in white enamelled casing, equal to “Zip”. Each unit shall have a storage capacity and single phase element as scheduled, and shall be thermostatically controlled.

DOMESTIC HOT WATER & WARM WATER SECTION

Each unit shall fit automatically and be complete with inlet and outlet connection, drain plug, steam condensing, cowl and spring loaded non-drip fixed outlet tap.

Boiling Water Units shall comply to the “Sanitary Fixtures, Fittings & Tapware” section.

8.6 BACKFLOW PREVENTION

Supply and install an approved BFPD in the domestic hot water supply as required by the Water Authority and as specified in the “Materials” section.

Contractor is to maintain device for a period of 12 months and will include maintenance instructions in as-built manuals to be supplied at end of project establishing an authorised maintenance programme including registration and certification of device.

Provide isolation valves upstream and downstream of valve and line strainer at inlet to BFPD.

Flush piping before installing device and test device after installation and prior to operation in service.

8.7 THERMAL INSULATION

Provide all necessary insulation to hot water piping to prevent heat loss.

Insulation shall not be provided until all relevant tests and inspections have been carried out.

Insulation shall be as specified in “Materials” section.

Insulation to piping chased into walls to be Prelag by Kembla or approved equal. Ensure that such insulation permits adequate expansion and contraction.

HOSE REEL SERVICE SECTION

SECTION 9 : HOSE REEL SERVICE

9.1 GENERALLY

Supply, install, test and commission the hose reel service from the point of connection to all fire hose reels all in accordance with the BCA Part E1.4 and AS 1221 and AS 2441.

Extend as specified, supplying all fittings, valves, brackets, pumps and sundry items to complete the installation including the hose reels to the approval of the NSW Fire Brigade, the local Council and the SI.

After commissioning of the installation submit a certificate to the SI certifying the installation as required in Clause 27 (Certification of Essential Services) division 4 of the Local Government (Approvals) Regulation 1993. Provide a flow test certificate to comply to AS1221 section 3.2.4.

9.2 MATERIALS

The reticulation shall be constructed of solid drawn copper tube and dezincified brass or copper fittings all as specified previously under “Materials”. Joints shall be silver soldered as specified previously under “Jointing Materials”.

9.3 FIRE HOSE REELS

Hose reels shall be wall mounted containing 36m of 20mm internal diameter fabric reinforced non-kinking rubber hose with adjustable nozzle. The reels shall be fitted with a gunmetal hub, red baked enamel mild steel side plates and stainless steel spacing rods and shall be in accordance with AS 1221 and approved by the Insurance Council of Australia.

The hose shall be led off by a fair lead to give a completely free withdrawal in any direction by one person and mounted 1500mm AFFL to the centre of the hub.

The hose shall be supplied with water from the water service through a 25mm screw down loose jumper type valve fitted with a union between valve and reel for maintenance purposes. The nozzle shall be attached to the valve by a device so that it cannot be removed until water supply is turned on.

The hose shall operate with a minimum flow rate of 0.33 litres per second and a running pressure of 210 kPa at the outlet of the nozzle when the hose is fully extended.

Fire hose reels shall be provided in accordance with the BCA requirements. The system shall also be approved for use by the local water authority.

9.4 PIPE SUPPORTS

Pipes shall be supported at each collar and at spacing as specified in “Preliminaries” section.

9.5 VALVES

All valves to be installed to comply with the “Materials” section

9.6 PAINTING & IDENTIFICATION

Supply and install all necessary equipment to identify the system to conform to the “Preliminaries” section.

9.7 TESTING

All as previously specified under “Preliminaries” section

9.8 FLUSHING & CLEANING OF FIRE HOSE REEL SERVICES

Flush and clean the system as specified in the “Cold Water” section.

SECTION 10 : FIRE HYDRANT SERVICE

10.1 GENERALLY

Supply, install, test and commission the Fire Hydrant Service from the incoming water main to all fire hydrants required.

Include for all piping, fittings, valves, hydrant valves, pumps, control equipment electrical wiring and other sundry items of equipment as required for the installation in accordance with the Building Code of Australia Part E1.3 and AS 2419. Provide a flow test to comply to AS2419.1 Table E2.

After commissioning of the installation submit a certificate to the SI certifying the installation as required in Clause 27 (Certification of Essential Services) division 4 of the Local Government (Approvals) Regulation 1993. Provide a flow test certificate to comply to AS2419.1 table E2.

Where located in an above ground situation, the service shall be constructed of medium grade galvanised mild steel piping jointed by approved patented rolled grooved pipe and fittings equal in all respects to Victualic pattern.

Where located in below ground situations the service shall be constructed of copper tube and fittings or UPVC pressure pipe. To all changes of direction where DICL fillings are used supply and construct concrete thrust blocks of sufficient size, design and location to prevent movement of the pipeline by means of the internal pressure. Thrust blocks shall be as specified under “Domestic Cold Water”.

All gate valves installed on the fire hydrant piping system shall be “remotely monitored” gate valves with electronic anti-tamper devices. Fire trip wiring to the FIP to be by the fire services contractor.

PIPE SUPPORTS

All pipes shall be adequately supported and securely fixed in accordance with the drawings and to the satisfaction of the SI. Such supporting and fixing to be carried out without causing any distortion, damage or stress on the pipes or pipe joints. Pipes shall be supported at each collar and at spacing as specified in “Preliminaries” section.

VALVES

Supply and install all valves as specified in “Materials” section.

Valves located in ground shall be provided with CI path box and lid set into concrete surround with PVC pipe riser around valve stem as specified in “Materials” section.

PAINTING & IDENTIFICATION

Supply and install all necessary equipment to identify the system to conform to the “Preliminaries” section.

FLUSHING & CLEANING OF HYDRANT SYSTEM

Flush and clean the system as specified in the “Cold Water” section.

SAMPLES

Submit samples of accessories not specified as proprietary items as specified in the “Preliminaries” section.

10.2 FIRE BRIGADE BOOSTER CONNECTION

Connect to existing fire hydrant service pipework in position shown on the site plan.

FIRE HYDRANT SERVICE SECTION

10.3 FIRE HYDRANTS

EXTERNAL FIRE HYDRANTS

Install each external hydrant on a 100mm GMS riser complete with a 450 x 450 x 100 thick concrete base finished 25mm above ground level. Paint a white band 100mm wide on riser and the letters FH in signal red 80mm high. Locate hydrants at least 10m away from building unless protected by a fire rated surround. Two hydrant valves shall be provided on each hydrant riser. Hydrant outlets to be 750mm above ground, fitted with a brass cap and chain.

10.4 TESTING OF PIPEWORK

Test all pipework 1700 kPa for a period of two hours. On completion test the installation under full supply conditions all to the satisfaction of the N.S.W.F.B and the Superintendent. Record pressure and flow results and advise, in writing, to the SI. All to conform to the requirements in the “Preliminaries” section.

10.5 BLOCK PLANS

Provide an updated Photo-sensitised aluminium plates, showing a diagram of the complete fire hydrant/hose reel system including all existing and new additions and replace the existing block plans adjacent to theexisting Fire Brigade booster arrangement.

10.6 THRUST BLOCKS

To all changes of direction on rubber ring jointed pipelines below ground install concrete thrust blocks to restrain the internal operating pressures of the pipeline under all conditions. Concrete mass shall be poured around and behind fittings and bear against virgin soil material. A minimum of 0.75 cubic metres of concrete shall be used at each position.

FIRE EXTINGUISHERS SECTION

SECTION 12 : PUMPING

12.1 RAINWATER BOOSTER PUMPS

Servicing domestic cold water/fire hose reel, in location as indicated on the drawings
Provide pumps to deliver 1.0 L/S @25 M/H.

Booster pumps to include:

a) pumps (number as required to meet performance curve of nominated system)
b) manifold piping
c) controls
d) base plate
e) pressure tanks

and be automatically controlled.

Pumps to:

a) be single stage centrifugal type
b) have cast iron casings, stainless steel shaft and stainless steel impellers
c) have mechanical seals
d) have screwed connections
e) be driven by 415 volt, 3 phase 2900 rpm TEFC electric motor.

Refer to "Pumping System Schedule" this section for pump description

Control panel to incorporate the following:

Main isolation switch
duty selector switch
Manual /off / auto selector switch for each pump
Motor and control circuit breakers
DOL contractors with hand reset thermal overloads
Automatic alternation
Lights for: power on 1 off
pump run 1 off per pump
pump fail 1 off per pump
Loss of prim alarm
Volt free contacts
Run on timers
Audible alarm with mute button
Wiring from level switches in tanks and pressure switches to activate booster pumps

Provide all necessary wiring between control panel, pumps and within control panel. All wiring to comply with SAA Wiring Rules and Governing Authority requirements.

Manifold piping to:

a) be copper, as before specified for cold water
b) include valves
c) be generally as indicated on the drawings
d) include anti-vibration (flexible) couplings at pump sections and discharges
e) enable
    1. removable of each pump while remaining components operable
    2. by-pass
    3. test drain
    4. testing pump operation and pressures

Note that pumps, piping to be suitable for working pressure equal to maximum mains pressure plus maximum pump pressure (ie with "closed" head).

Provide pressure gauge and pet cocks to inlet and outlet of pump sets.

FIRE EXTINGUISHERS SECTION

12.2 HOT WATER CIRCULATING PUMPS

Supply and install at each hot water return pump set vertical support frames comprising galvanised steel unistrut P1000 channel. Fix the hot water return pumps associated pipework and electrical control panels to the vertical support frames.

Dual Pumps shall be equal to Grundfos UPS model UPS 32-80N mounted in the vertical position with interconnecting pipework and valves.

Provide and install gate valves, check valve, pressure gauges and gauge control valves on the inlet and outlet of each pump.

Provide stainless steel flanged vibration eliminators on the suction and delivery connection to each pump. Provide stainless steel vibration eliminators on the pipework connection to and from the pump set group.

Provide air eliminators on each side of the pump.

Provide and install anti-vibration mounts as required.

Provide electrical power, control and alarm wiring with conduits from the pumps electrical control panels to pump motors. Pumps to have thermal overload protection auto/off/manual selector for each pump, auto/change-over selection switch, motor, circuit breakers, AC on light, pump run lights, pump fail lights, alarm button and mute button.

Electrical wire each pump for 24 hours running with an automatic change over to the second pump after each 24 hour duty.

12.3 PUMP CONTROL PANELS

Supply and install all equipment necessary to operate the pumps specified under hydraulic services.

Allow for all control cabinets, mounting brackets, contactors, isolating and control switches, auxiliary switches, alarms, wiring between pump and panel, panel and level controls, and other associated equipment necessary for the safe and effective operation of the pumps as required for the installation and in accordance with statutory requirements to AS 3000.

Provide a complete specification and drawings of pumps and control equipment prior to installation.

12.4 PUMPING SYSTEM SCHEDULE

RAINWATER PRESSURE SYSTEM	
Quantity l/s	1.0 Litres per second
Head duty	25 metres
Minimum available head	25 metres
Operation/rating	Electric
Type	Centrifugal
System	Dual
Pressure vessel	100 metres head
Make/Model	

SECTION 14 : NATURAL GAS

14.1 SCOPE

Supply, install, test and commission the gas service from the point of connection to all gas points. Extend as specified supplying all meters, regulators, filters, pipework and sundry items to complete the system to comply to the local gas authorities regulations.

GENERAL REQUIREMENTS

Pipework shall be copper tube Type B to AS 1432.

Carry out the gas installation in accordance with the requirements of the regulatory authorities and the following codes:
AS 5601 and AS 5603 and AS 5501 (Commercial appliances)
AS 1697 Division 1 system.

AUTHORITIES' APPROVALS

Provide documents evidencing approval of regulatory authorities before Practical Completion.

If the responsible authority is required to or, pursuant to the powers vested in it, elects to perform or supply part of the Works, make the necessary arrangements with the authority and pay and bear the fees payable in connection therewith.

INSPECTION

Give sufficient notice so that inspection may be made at the following stages, where applicable:
Works ready for specified testing.
Enclosed work ready to be covered up or concealed.

TESTING

Carry out the required tests in the presence of the Superintendent and an authorised representative of the relevant authority. Supply the apparatus and materials necessary. Submit the test results in writing. Replace and retest components, if any, which fail the required test.

Seal off items of equipment not designed to withstand the test pressure. Securely anchor pipes and fittings in position to prevent movement during the tests.

Do not cover or conceal work until it has been tested. Leave pipe joints exposed to enable observation during the tests.

PAINTING AND IDENTIFICATION

Supply and install all necessary equipment to identify the system to conform to the “Preliminaries” section.

EXCAVATION

Carry out all necessary excavation as specified under “Excavation & Pipework Requirements” section.

PIPE SUPPORTS

All pipes shall be adequately supported and securely fixed in accordance with the drawings and to the satisfaction of the SI. Such supporting and fixing to be carried out without causing any distortion, damage or stress on the pipes or pipe joints. Pipes shall be supported at each collar and at spacing as specified in “Preliminaries” section.

VALVES

All valves to comply to those specified in the “Materials” section.

NATURAL GAS SECTION

COMPLETION
On completion of installation and testing, turn on isolating and control valves, and purge and charge the installation.

Hand over the installation fully charged with gas.

ACCESSIBILITY
Locate pipe fittings requiring maintenance or servicing, including control valves, joints designed to enable removal of pipes, and the like, in accessible positions with adequate clearance and ventilation.

As far as practicable install components such as pipe fittings so that they are removable without damage either to themselves or to the building structure or finishes.

14.2 INSTALLATION

Connect to authorities gas main in an approved manner in accordance with NGC rules. Make arrangements, and meet all charges, for connection to the main supply, including the provision of the main meter.

14.3 GAS METER

Provide and install gas meter assembly in the location as indicated on the drawings. Copper pipework assemblies shall be complete with flanges, unions, bends and support brackets.

Provide adequate ventilation to all areas where gas appliances are installed to AG 601.

Install regulators in the positions indicated on the drawings an under and over pressure shut-off regulator with the capacity to pass the required amount of gas reducing the pressure from 210 kPa to 5kPa or 2.75 kPa. The regulator shall shut off between 4.98 kPa and 0.87 kPa and shall be approved.

Regulators are to be the OPSO type and be capable of delivering the required megajoile rating and be vented to the requirements of the Gas Authority.

Allow to purge the pipework in accordance to AG 601 and local authorities.

Gas pipework shall maintain a gradient of 1:230 unless otherwise indicated or directed by the gas authority. The graded pipes are to grade to low points terminating in a tail pipe with a 20mm capped valve in an approved easily located and nominated position.

14.4 CONNECTION TO GAS HEATERS, APPLIANCES, EQUIPMENT AND OUTLETS

Provide and install all gas piping, appliance or equipment gas control valves, gas appliance regulators, stainless steel flexible pipe connections, gas unions and ancillary fittings for all gas burning appliances and other equipment or machines wherever located in the building to ensure the full operation of these items of equipment.

Before connecting gas to gas heaters, appliances and equipment ensure that the appliance is approved in accordance with the requirements of The Natural Gas Company and is correctly installed and that all supports, flues, connections, flame failure devices comply with the regulations.

14.5 UNDERGROUND INSTALLATION

During backfilling lay warning tape 300 mm above, and for the full length of, buried gas pipes.

Warning tape: Minimum 100 mm width, of durable plastic material, colour to AS 1345, with "GAS PIPE UNDER" marked continuously.

NATURAL GAS SECTION

Marker plates are required, provide brass marker plates at ground level at each change of direction in the underground pipeline, engraved to show the direction of the line and name of the service. Inset the marker in a 150 x 150 x 150 mm concrete block, with the top set flush with ground level.

Reinstate the ground surface to the original condition and to match adjacent surfaces.

14.6 VALVE BOXES

Supply and install valve boxes for access to underground valves. The boxes shall be standard cast iron boxes with hinged covers. Set tops flush with pavement surfaces, or 15 mm above unpaved surfaces. Provide an in situ concrete surround 150 mm thick, to the top, bottom and sides of the box, with exposed surface steel trowelled. Set a shaft of UPVC pipe beneath each box to give access to the valve. Stamp the box cover with the word "GAS".

14.7 WALL BOXES

Provide wall boxes to accommodate above ground valves, regulators and the like. The boxes shall be constructed of 1.2mm stainless steel plate continuous welded box construction with leading edge folded twice at 90^{o} to form 25 x 25mm frontal surround. Fix to masonry backing with four 10mm galvanised masonry bolts. Set the bottom of the box to fall outward. Form four 10mm diameter holes in the frontal surround section at box floor level. Provide, to the box floor inlet and outlet pipes, sleeves formed of 1.2mm thick steel tube with 1.2mm galvanised flanges to pipe diameter plus 50mm. Bed each flange on epoxy mortar and rivet to the floor of the box with four 3mm diameter rivets.

Provide metal frame doors with 2.5mm clear float glass glazing. Affix to the glass with adhesive a white laminated plastic label 200 x 100mm, engraved with red letters "IN CASE OF EMERGENCY BREAK GLASS AND SHUT VALVES". Provide lock, keys and two 100mm brass hinges.

14.8 PIPING

If practicable, install piping so that it is concealed within service ducts or non-habitable enclosed spaces and does not appear on external walls. Otherwise, provide metal piping mounted on metal brackets and provide metal cover plates at penetrations. For piping embedded in concrete, install in continuous lengths without fittings. Do not lay across joints between adjoining sections of concrete through which reinforcement does not extend.

Gas Pipeline Schedule

Location	Pipe Material	Grade or Class	Jointing	Nominal size
In ground	Copper	Type B	Silver solder 25%	Refer to drawings
In ceiling	Copper	Type B	Silver solder 25%	Refer to drawings
Exposed Internal	Copper	Type B	Silver solder 25%	Refer to drawings
In wall, chased	Copper	Type B	Silver solder 25%	Refer to drawings

14.9 PITS

For below ground, house control valves and regulators in concrete access pits with removable pit covers.

Constructed to give 300mm clear space all around the fittings in the pit.

Use Grade N20 concrete to AS 1379, 100mm thick, reinforced with F82 fabric with concrete covers to AS3996. Mark pit covers with the work '***GAS***'.

Grade floor to a point on one side and provide a gravity drain to remove water from the pit. Do not connect the drain to other substructures or drains. Carry the pit walls up to 50mm above finished ground level. Cast in the pit cover frame flush with the top. Trowel the top smooth.

14.10 STANDARDS

Referenced Documents: The following Standards are applicable to this Subsection.

AS 1074	Steel tubes and tubular threaded or suitable for threading with pipe threads of Whitworth form
AS 1135	Rules for the design, fabrication, installation and inspection of non-ferrous pressure piping
AS 1216	Classification, hazard identification and information systems for dangerous goods
AS 1216.1	Part 1: Classification and class labels for dangerous goods
AS 1228	Boilers - Water tube
AS 1271	Valves, water gauges and other fittings for boilers and unfired pressure vessels
AS 1345	Identification of the contents of piping, conduits and ducts
AS 1349	Bourdon tube pressure and vacuum gauges
AS 1375	SAA Industrial Fuel-fired Appliances Code
AS 1585	Capillary and brazing fittings of copper and copper alloy
AS 1697	SAA Gas Pipeline Code
AS 1797	Boilers - Fire tube, shell and miscellaneous
AS 2129	Flanges for pipes, valves and fittings
AS 2430	Classification of hazardous areas
AS 2430.1	Part 1: Explosive gas atmospheres
AS 2700	Colour standards for general purposes
AS 2832	Cathodic protection of metals
AS 2832.1	Part 1: Pipes, cables and ducts
AS 2832.2	Part 2: Compact buried structures
AS 2885	SAA Pipeline Code
AS 3000	SAA Wiring Rules
AG 102	(1976) Approval requirements for gas water heaters equipped with natural draught combustion systems - issued by the Australian Gas Association and Australian Liquefied Petroleum Gas Association Ltd.
AG 601	Installation code for gas burning appliances and equipment
AGL	Gasfitting Rules Vol. 1
AGL	Gasfitting Rules Vol. 2

SECTION 15 : SANITARY FIXTURES, FITTINGS AND TAPWARE

15.1 GENERALLY

Take delivery, install and commission all sanitary fixtures, fittings and tapware connected to the hydraulic services.

Allow to take delivery, store as necessary and install. Provide all fixings, necessary cutting, securing of brackets to walls, levelling and connection to various services required for satisfactory operation.

All items shall be new and of first quality, free of chips, cracks and crazing and defects and shall be subject to inspection prior to installation.

Prior to placing orders, obtain guarantees from the manufacturer that any items which craze or show any other defects within twelve months of issue of certificate of practical completion will be replaced providing that such crazing or other defects are not caused by abuse.

Fix and support fixtures strictly to the manufacturers recommendations.

All exposed brackets shall be white enamelled.

All exposed connections shall be chrome plated unless specified.

Supply and install the following or equivalent fixtures, fittings and tapware.

SANITARY FIXTURES

Refer to the Architectural Specification for the specification and selection of all fixtures.

MEDICAL GAS & SUCTION SYSTEM SECTION

SCHEDULE OF RATES SECTION

SECTION 18 : SCHEDULE OF RATES

18.1 TENDER SCHEDULES

I / We, the undersigned hereby tender for the supply, delivery, installation, commissioning and testing of the Hydraulic Services Installation associated with the abovementioned project in accordance with the drawings and specification prepared by Hughes Trueman in accordance with the specification, the defects liability period applicable after practical completion.

Itemised Lump Sum Tender Price:

		Fixed Price
1.	Sanitary plumbing and drainage	$.....
2	Stormwater plumbing and drainage	$.....
3.	Domestic hot and cold water supply	$.....
4.	Fire hose reel system	$.....
5	Fire hydrant service	$.....
8	Natural gas supply	$.....
9.	Sanitary, fixtures, fittings and tapware	$.....
10.	As built documentation and maintenance manuals	$.....
	GST	**$.....**
	TOTALS	**$.....**

Total fixed price (in words) ……..

……..

I / We unconditionally guarantee the performance of the installation and completion of the works in accordance with this specification and accompaying drawings.

Company: .....

Signature: .....

Witness:.....

Date: .....

18.2 HYDRAULIC SERVICES

Provide rates for the following, including in position as per specification:

EXCAVATION	**$**
Excavation – other than rock /m^3	
Excavation – in rock /m^3	

SCHEDULE OF RATES SECTION

STORMWATER DRAINAGE	**$**
450mm RCP pipe 1 metre deep	
450mm RCP pipe 1.5 metres deep	
450mm RCP pipe 2 metres deep	
450mm RCP pipe 3 metres deep	
375mm RCP pipe 1 metre deep	
375mm RCP pipe 1.5 metres deep	
375mm RCP pipe 2 metres deep	
375mm RCP pipe 3 metres deep	
300mm RCP pipe 1 metre deep	
300mm RCP pipe 1.5 metres deep	
300mm RCP pipe 2 metres deep	
300mm RCP pipe 3 metres deep	
225mm PVC pipe 1 metre deep	
225mm PVC pipe 2 metre deep	
225mm PVC pipe 3 metre deep	
225 mm PVC bend	
225mm x 225mm PVC junction	
150mm UPVC pipe 1 metre deep	
150mm UPVC pipe 2 metre deep	
150mm UPVC pipe 3 metre deep	
150mm UPVC bend	
150mm x 150mmUPVC junction	
100mm UPVC pipe 1 metre deep	
100mm UPVC pipe 2 metre deep	
100mm UPVC pipe 3 metre deep	
100mm UPVC bend	
100mm x 100mmUPVC junction	
1500mm square sump and grating 2 metre deep	
Dual sub-soil drainage pumps, control panel and pit	
100mm flanged diaphragm valve	
100 x 100 RHS/metre	
600 x 600 x 600d precast concrete HD grated pit	
600 x 600 x 900d precast concrete HD grated pit	
900 x 600 x 900d precast concrete HD grated pit	
900 x 600 x 1200d precast concrete HD grated pit	
1200 x 1200 x 1500d precast concrete HD grated pit	
1200 x 1200 x 2000d precast concrete HD grated pit	

SEWER DRAINAGE	**$**
100mm UPVC pipe 1 metre deep	
100mm UPVC pipe 2 metres deep	
100mm UPVC pipe 3 metres deep	
100mm UPVC bend with IO	
100mm x 100mm UPVC junction with IO	
100mm ‘P’ trap with chrome plated brass grate	
150mm UPVC pipe 1 metre deep	
150mm UPVC pipe 2 metres deep	
150mm UPVC pipe 3 metres deep	
150mm UPVC bend with IO	

SCHEDULE OF RATES SECTION

150mm UPVC junction with IO	
150mm x 150mm UPVC junction with IO	
225mm UPVC pipe 1 metre deep	
225mm UPVC pipe 2 metre deep	
225mm UPVC pipe 3 metre deep	
225mm UPVC bend with IO	
225mm UPVC junction with IO	
100mm cast iron reflux valve	
150mm cast iron reflux valve	
225mm cast iron reflux valve	
225mm Boundry trap assembly	
150mm Boundry trap assembly	
100mm overflow gully assembly	
100mm induct pipe mica flap	
Sewer pumps and control panel	

SANITARY PLUMBING	**$**
150mm UPVC pipe per metre	
150mm UPVC bend	
150mm UPVC junction	
100mm UPVC pipe/metre	
100mm UPVC junction	
100mm UPVC pipe/metre	
100mm UPVC bend with IO	
100mm UPVC junction with IO	
100mm x 80mm UPVC junction with IO.	
100mm x 50mm UPVC junction with IO.	
80mm UPVC pipe/metre	
80mm UPVC bend with IO	
80mm UPVC junction with IO	
80mm x 50mm UPVC junction	
65mm UPVC pipe/metre	
65mm UPVC bend with IO	
65mm UPVC junction with IO	
50mm UPVC pipe/metre	
50mm UPVC bend with IO	
50mm UPVC junction with IO.	
40mm UPVC pipe/metre	
40mm UPVC bend with IO	
100mm x 65mm floor waste and chrome plated brass grating and safe tray	
100mm x 50mm floor waste and chrome plated brass grating and safe tray	
150mm UPVC expansion joint	
100mm UPVC expansion joint	
80mm UPVC expansion joint	
65mm UPVC expansion joint	
50mm UPVC expansion joint	
100mm garbage sump with 100mm trap	
Floor waste with 100mm trap	

SCHEDULE OF RATES SECTION

100mm Plant room waste with 100mm trap	
100mm cowl complete with flashing	
50mm cowl complete with flashing	
225mm Fire collar	
150mm Fire collar	
100mm Fire collar	
80mm Fire collar	
65mm Fire collar	
50mm Fire collar	
40mm Fire collar	
150mm Copper pipe/metre	
150mm Copper bend	
150mm Copper junction 100mm Copper pipe/metre	
100mm Copper bend	
100mm Copper junction	
100mm Copper floor waste	
Sound lag / metre	

ROOF AND BALCONY OUTLETS	**$**
150mm cast iron roof outlet	
100mm cast iron roof outlet	
100mm cast iron side roof outlet	
80mm cast iron side roof outlet	
50mm cast iron balcony outlet	
Soundlag / metre	

COLD WATER SERVICE	**$**
150mm copper pipe/metre	
150mm copper tee	
150mm copper bend	
100mm copper pipe/metre	
100mm copper tee	
100mm copper bend	
80mm copper pipe/metre	
80mm copper tee	
80mm copper bend	
65mm copper pipe/metre	
65mm copper tee	
65mm copper bend	
50mm copper pipe/metre	
50mm copper tee	
50mm copper bend	
40mm copper pipe/metre	
40mm copper tee	
40mm copper bend	
32mm copper pipe/metre	
25mm copper pipe/metre	
20mm copper pipe/metre	
15mm copper pipe/metre	
150mm control valve	

SCHEDULE OF RATES SECTION

100mm control valve	
80mm control valve	
65mm control valve	
50mm control valve	
50mm gate valve	
50mm check valve	
50mm tank filling valve	
80mm tank filling valve	
20mm external hose tap	
15mm flow control valve	
20mm flow control valve	
50mm backflow prevention valve	
40mm backflow prevention valve	
32mm backflow prevention valve	
25mm backflow prevention valve	
15mm backflow prevention valve	
15mm pressure limiting valve	
20mm pressure limiting valve	
25mm pressure limiting valve	
36mm Fire Hose Reel	
Main Cold Water transfer pumps and control panel	
Cold Water pressure system and control panel	

SCHEDULE OF RATES SECTION

WARM/HOT WATER SERVICE	**$**
100mm lagged copper pipe/metre	
80mm lagged copper pipe/metre	
65mm lagged copper pipe/metre	
50mm lagged copper pipe/metre	
40mm lagged copper pipe/metre	
32mm lagged copper pipe/metre	
25mm lagged copper pipe/metre	
20mm lagged copper pipe/metre	
15mm lagged copper pipe/metre	
100mm gate valve and union	
80mm gate valve and union	
65mm gate valve and union	
50mm gate valve and union	
40mm gate valve and union	
32mm gate valve and union	
25mm gate valve and union	
20mm gate valve and union	
15mm balancing valve	
20mm balancing valve	
25mm balancing valve	
25mm pressure limiting valve	
20mm pressure limiting valve	
15mm pressure limiting valve	
15mm air release valve	
20mm air release valve	
25mm Thermostatic mixing valve	
20mm Thermostatic mixing valve	
15mm Thermostatic mixing valve	
20mm Tempering valve	
15mm Tempering valve	
Hot water circulating pump and control panel	

GAS SERVICE	**$**
100mm copper pipe/metre	
80mm copper pipe/metre	
65mm copper pipe/metre	
50mm copper pipe/metre	
40mm copper pipe/metre	
32mm copper pipe/metre	
25mm copper pipe/metre	
20mm copper pipe/metre	
15mm copper pipe/metre	
100mm Ball valve	
80mm Ball valve	
65mm Ball valve	
50mm Ball valve	
40mm Ball valve	
32mm Ball valve	

SCHEDULE OF RATES SECTION

25mm Ball valve	
20mm Ball valve	
15mm Ball valve	
Meter assembly	
Safety shut off valve	
125mm Flue	
200mm Flue	

FIRE HYDRANT SERVICE	**$**
150mm copper pipe/metre	
100mm copper pipe/metre	
80mm copper pipe/metre	
65mm copper pipe/metre	
150mm copper elbow	
150mm copper tee	
100mm copper elbow	
100mm copper tee	
150mm GMS pipe/metre	
150mm bend	
150mm x 150mm GMS tee	
150mm x 100mm GMS reducing bush	
80mm x 65mm reducing bush	
100mm GMS pipe/metre	
100mm GMS elbow	
100mm GMS Tee	
150mm control valve	
150mm check valve	
100mm Control valve	
100mm Check valve	
65mm fire hydrant valve	
36 metre fire hose reel	
Diesel booster pump and control panel	
Electric booster pump and control panel	
150mm tank model booster valve	
100mm tank model booster valve	
150mm Mains pressure model booster assembly	
100mm Mains pressure model booster assembly	
Electrical wiring	
Ratio valve station (complete)	

SANITARY FIXTURES, FITTINGS & TAPWARE	**$**
Supply and install price as specified.	
WC suit with toilet seat	
Disabled WC suite with toilet seat	
Vanity basin	
Wall basin	
Disabled wall basin	
Cleaners sink	
Bath	
Kitchen sink	

SCHEDULE OF RATES SECTION

Laundry tub	
Cistern cock	
Bath tap set with spout	
Basin tap set with spout	
Shower tap set with rose	
Sink tap set with spout	
Laundry tap set with spout	
Cleaners sink with taps and spout	
Washing machine taps (pair)	
15mm chrome plated hose tap	
20mm External hose tap	
315litre Hot water unit complete with safe tray	
260litre Hot water unit complete with safe tray	
170litre Hot water unit complete with safe tray	
80 litre Hot water unit complete with safe tray	
50 litre Hot water unit complete with safe tray	
Boiling water unit	
Drinking fountain	
Safety shower	
Eyewash	

DRILLED PENETRATIONS	**$**
150mm Thickness Concrete Slab	
50mm diameter	
65mm diameter	
80mm diameter	
100mm diameter	
150mm diameter	
200mm diameter	
250mm diameter	
300mm diameter	
200mm Thickness Concrete Slab	
50mm diameter	
65mm diameter	
80mm diameter	
100mm diameter	
150mm diameter	
200mm diameter	
250mm diameter	
300mm diameter	
250mm Thickness Concrete Slab	
50mm diameter	
65mm diameter	
80mm diameter	
100mm diameter	
150mm diameter	
200mm diameter	
250mm diameter	

SCHEDULE OF RATES SECTION

300mm diameter	
300mm Thickness Concrete Slab	
50mm diameter	
65mm diameter	
80mm diameter	
100mm diameter	
150mm diameter	
200mm diameter	
250mm diameter	
300mm diameter	

NAME OF TENDERER:_____

ADDRESS:_____

SIGNATURE:_____ DATE: _____