HYDRAULIC SERVICES SPECIFICATION

Kondinin CRC Upgrade
Lot 263, 49 Gordon Street, Kondinin
AZ17029

Prepared for
Kondinin CRC Committee & Shire

30 June 2017

Document Control

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PART A PROJECT SPECIFIC REQUIREMENTS

A1 Project Description

A1.1 General

This document is the Hydraulic Services specification for the proposed upgrade of the Kondinin CRC located at Kondinin WA to include for, but not limited to;

- Sanitary Plumbing and Drainage;
- Cold Water Services;
- Hot Water Service;
- Gas Service;
- Sanitary Fixtures and Fittings;

A1.2 Site Address

The proposed development is located at Lot 263, 49 Gordon Street, Kondinin.

A1.3 Project Team

Role	Company	Contact	Phone Number
Architect	Rosalie Pech Eva Architect	Rosalie Pech Eva	0429 421 287
Mechanical	Alphazeta Group	Jittu George	08 6311 5577
Electrical	Alphazeta Group	Ivy Feng Guan	08 6311 5577
Hydraulic	Alphazeta Group	Rachael McGowan	08 6311 5577

A1.4 Drawing List

Drawing Number	Drawing Name
AZ17029-H00	Cover Sheet, Legend and Specification Notes
AZ17029-H01	Hydraulic Schedules
AZ17029-H02	Floor Plan – Drainage Layout
AZ15006-H03	Floor Plan – Water and Gas Layout
AZ17029-H04	Roof Plan – Drainage Layout

A2 Scope of Works

The work contained in this specification and associated drawings for the hydraulic services includes design coordination, engineering, workshop drawing documentation, all site coordination, construction and installation, obtaining all relevant approvals and permits, commissioning, maintenance, training and warranty of the installed systems.

The drawings are diagrammatic, demonstrating indicative layouts of the hydraulic services. Existing services locations are to be checked and coordinated with the other services on site. The work includes but is not limited to the following elements:

Authority Applications

To include for;

- Water Corporation; Water service
- Government of Western Australia, Department of Health; Septic Tanks

Preparation of workshop drawings

To include; fully coordinated with associated trade contractors; mechanical, electrical and fire services. Shop drawings shall provide dimensioned layouts of; plant & equipment, slab penetration set out drawings, noting pipe sizes, invert levels, equipment control panel details and the location and sizing of all required valving access panels.

Locate, Decommission and Remove

The contractor shall allow to locate, decommission and remove the following services being made redundant;

1. Locate incoming existing cool room and bar services, including all water and drainage services and allow to cap for reconnection. No works are required within these areas.
2. Locate existing inground septic system and confirm location and depth and ensure in working order. Allow to remove existing incoming drainage pipework and seal entrance to septic system for reconnection ducting construction phase.
3. Incoming water service to be located upon entry to the building and capped for reconnection of services.
4. Remove fixtures and fittings within the existing kitchen and toilet areas. Strip back existing incoming water and drainage services.
5. Gas bottles and all associated valves to be removed, checked for faults and stored for future reuse.
6. All inground sewer pipework to be stripped back to septic tank entrance.

Services Trenching

The plumbing contractor shall include within the tender price, the provision of common trenching excavation, backfilling and compaction as detailed on the drawings for the following services in addition to hydraulic services:

- Electrical
- Communications
- Telstra

Coordinate set-outs of services with the electrical contractor.

Sanitary Plumbing and Drainage

As nominated, the drawings are to comply with the PCA, AS/NZS 3500.2 and the Department of Health

Cold Water Service

Extending, from the existing authority water meter, to serve all fixture taps and outlets. Provide for the following associated valving and equipment, location as nominated on the drawings:

- Required backflow prevention devices as nominated on the drawings, to AS/NZS 3500.1 and Water Corporation requirements.

Cold water piping systems, where located within the ceiling zone, directly under roof sheeting, shall be provided with thermal insulation as specified herein to prevent the heating of cold water within the piping system. Maintain a minimum of 50mm separation between hot and cold water pipework installed within the same cavity.

Cold water pipework to run in ground and connect to existing cold water service pipework capped within the demolition process.

Hot Water Service

Provision of hot water services, supplying the following individual zones nominated on the drawings;

- Toilet/ Change rooms
- Kitchen

Provide temperature control as nominated and to comply with AS/NZS 3500.4. Heated water temperature control shall be via a suitably sized Thermostatic Mixing Valve (TMV) located within bathroom ceilings to serve U.A.T areas. Tempering valves to be provided and located at high level within the ceiling voids to service the toilet areas as documented on the drawings. Tempering valve located within the kitchen to service the wash hand basin, should be located at low level within a lockable cabinet.

Hot water piping systems shall be provided with thermal insulation in accordance with AS/NZS 3500.4 and as specified herein. Maintain a minimum of 50mm separation between hot and cold water pipework installed within the same cavity.

Gas Service

Metered gas service terminating for future extension on the fit out of the proposed restaurant.

Supply and Installation of Fixtures and tapware

Supply and install fixtures and tapware as scheduled by the architect. All fixtures and tapware require to be WELS rated with the appropriate Watermark Certification.

Testing and Commissioning

Test and commission hydraulic services, to comply with the requirements of; AS/NZS 3500, this specification and all the local authority requirements having jurisdiction over the works.

On completion allow to flush out and disinfect all potable-water systems to comply with AS/NZS 3500.1 and as specified herein.

As Built Drawings and O&M Manuals

Provide ‘As Built’ drawings and Operation and Maintenance Manuals for the complete installation to the satisfaction of the requirements contained herein this specification.

Allow to update Drainage Plumbing Diagram (DPD) to the requirements of the Plumbers Licensing Board (PLB) Technical Note.

Maintenance

Provide maintenance of the hydraulic systems installed under this contract, commencing from the date of Practical Completion.

A3 Associated Works

A3.1 General

The description of ‘associated works’ in this trade section of the Specification relates to the extent of the work described in this section of the Specification only, without diminishing the scope and extent of works defined by the Contract Documents in their totality.

Reference to associated work trades is a comment on the suitability of the trade to do the work which the Contractor may or may not subcontract at its discretion.

NOTE:

It is the Plumbing Contractors responsibility to inform the Main Contractor of any works he will not be undertaking.

Should the Plumbing Contractor fail to inform the Main Contractor which works the Plumbing Contractor will not be undertaking then the costs shall be borne by the Plumbing Contractor for failing to inform the Main Contractor.

A3.2 By Builder

The following items are not intended to be a full specification of items provided by the Builder. They are provisional only and indicate the general extent of works.

The Builder (or their delegate) will furnish and install the following works associated with the Hydraulic Services installation:

- Provide all hydraulic ducts and form large hydraulic penetrations as shown on structural drawings only. All other penetrations by Plumbing Contractor.
- Access panels in ceiling are to maintain all isolation valves located within ceiling space. Builder to coordinate access panel locations with mechanical and hydraulic services drawings.
- Cut all holes in finished surfaces, timber, cupboards, false ceilings, vanity units, shelves, etc., as required by the Plumbing Contractor.
- 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.
- Forming and pouring of concrete plinths for equipment. The plumbing contractor is responsible for providing plinth sizes and set outs to the builder.
- Painting of all exposed pipework to architects approved colours.

A3.3 By Electrician

Electrical supply and a connection to all equipment requiring power and mentioned within this specification to the control panels where required and direct to equipment where required, including the following:

- Electrical supply to electric hot water units, nominated and scheduled on the drawings.
- Electrical supply to hot water circulation pump set.

Note: the plumbing Contractor is to supply the connection from the control panel to the equipment where required.

A3.4 By Mechanical Contractor

The following table outlines the Hydraulic work which is associated with the mechanical services and is specified elsewhere. The termination points describe the extent of work required by each contractor.

Item	Work By	Extent of work
Floor wastes and tundishes in mechanical plant areas	Mechanical	• Provide required locations of mechanical units on workshop drawings
	Hydraulics	• Provide air conditioning condensate soak well in ground. • Provide condensate pipework as documented on the drawings and discharging over tundishes

A4 General Requirements

A4.1 Authorities and standards

The whole of the work shall be carried out by or under the full supervision of a fully licensed Plumbing Contractor in accordance with the drawings and specification, reviewed by the Superintendent and approved by all relevant authorities.

All materials and equipment shall be equal to the appropriate current Australian Standard. Any proposal to install alternative items to those specified shall be accompanied by a written confirmation by the Manufacturer that the proposed article complies in every respect to the relevant Australian Standard.

The submission shall be made and the approval obtained prior to the ordering of materials and commencement of the respective section of work.

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

The relevant Authorities shall include but not be limited to the following;

Water/Sewer Authority	Water Corporation of Western Australia
Council	Shire of Kondinin
WorkCover	WorkCover Authority of WA
W.A.H.D	Western Australia Department Health
PLB	Plumbers Licensing Board
Fire	Department of Fire and Emergency Services (DFES)

It is the responsibility of the Plumbing Contractor to carry out at their cost, all liaison and coordination with all Authorities and to ensure satisfaction of their requirements.

A4.2 Tender Price

The tender price shall be based on current standards and associated amendments as of the date the tender is submitted and/or lodged.

A4.3 Applications, Fees and Charges

The Plumbing Contractor shall be responsible for making all applications and paying all fees and charges rendered by the respective Authorities in reference to, the project which shall include but not be limited to the following:

Commencement of Work fees
Inspection Fees
Document inspection fees
Restoration Charges
Water main connection Fees
Service Connection Charges
Plumbers Licensing Fees and Permits
Headworks Costs

A4.4 Long Lead Items

Ensure orders are placed for plant and equipment, for the delivery, installation and testing to meet the critical path of the works programmed. Technical data sheets for all plant and equipment shall be submitted to the

consultant for approval prior to the placing of orders. Plant that may have long lead times include, yet not limited to:

- Hot water plant
- Grease Trap
- Taps and fixtures

A4.5 Certification of Works

At the completion of the works and prior to the submission for final payment the Plumbing Contractor shall make all necessary applications, pay all fees, obtain and issue to the Superintendent 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 Plumbing Contractor shall provide a Certificate or Letter of Certification, which will guarantee that the works comply with the relevant Authorities regulations, requirements and conditions.

A4.6 Maintenance

The Plumbing Contractor shall allow for maintenance and servicing of the works for a period of 12 Months from the date of practical completion of the works. This shall include all pipework, filters, tempering valves, thermostatic mixing valves, relief valves, etc. as supplied and installed by the Plumbing Contractor.

A4.7 Service Drawings

The accompanying drawings indicate the approximate positions and number of sanitary fixtures and other items requiring connection to the hydraulic services. Allow for all necessary diversions and minor adjustments of pipework and equipment as may be necessary to carry out the work as required and as necessary to complete the works. Refer to architectural drawings for location of equipment and coordinate with other services where applicable.

A4.8 Dimensions and Levels

All invert levels must be checked on site prior to the manufacture and installation of pipework, to ensure connection to supply services. Advise the Superintendent of any apparent discrepancies before the commencement of any work; claims for redundant work as a result of failing to do so, shall not be considered valid.

Note:
Ascertain the depth, position and suitability of the sewer connection points prior to the commencement of any work (pipe laying & excavation) and ensure that the sewer can gravitate to the existing septic tanks, as documented on the drawings. The Superintendent shall be advised immediately should any adjustment be required to execute the work.

No claims for redundant work will be considered due to failure to comply with this requirement.

A4.9 Testing

Allow for the cost of carrying out all tests set out on the drawings or in the specification or as required by the respective authorities. Supply all plugs, apparatus, and other materials necessary for the tests. Enclosed work shall not be concealed from view until it has been inspected, tested and sighted by the Superintendent and approved by the Authority concerned.

On completion of the works included under this part of the specification the Plumbing Contractor shall carry out any procedure required to prove that the respective systems are operational under normal working conditions, as requested by the Superintendent and associated authorities.

Provide a minimum of two (2) working days' notice to the Superintendent before the commencement of testing.

Maintain a separate set of drawings on site to record progress of testing. The Superintendent shall initial the drawings of each section of work that has passed a satisfactory test. Remedy any defects in the piping found during testing and re-test as specified under each section of work

A4.10 Samples and Technical Data Submissions

A4.10.1 Samples

Samples are required to demonstrate workmanship, techniques, designs and materials of key components within the installation. The following samples at least will be supplied in adequate dimensions and detail to demonstrate the above:

- Submit samples 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.

A4.10.2 Technical Data Sheets

Provide technical data sheets for hydraulic system; plant, equipment and componentry. Where alternate products are offered to that specified herein and as documented on the drawings, provide a comparison matrix to demonstrate the alternate product being offered is equal in all respects and performance. Technical data sheets shall be submitted to the consultant for review prior to purchase orders being made.

Technical data sheets shall be provided for, yet not limited to the following;

- Hot water units
- Pumps and controllers
- Valving
- Thermostatic Mixer Valves
- Tempering Valves
- Backflow preventers
- Grease arrestors

A4.11 Piping

All piping shall conform to the standards and descriptions and be in accordance with materials and sizes shown on the drawings and/or detailed in the specification.

Pipelines shall be installed using the longest practicable length of tube/pipe to eliminate unnecessary jointing. Building up lengths from short off-cuts shall not be permitted.

A4.12 Capping Off

During construction, leave all unfinished work in a safe condition and protect the works against damage or loss through any cause whatsoever. At all times, open ends of pipes shall be sealed off in such a manner as to prevent the entry of foreign matter into the lines. Plugs of rags, paper or wood will not be acceptable for this purpose. Drainage risers shall be temporarily sealed off with patented plastic caps.

A4.13 Fixing and Supporting of Pipes

General

Pipework and fittings shall be:

a) Only fixed in approved locations.

b) Adequately secured to the structure to support the pipework under full load conditions with a safety margin of 2:1.
c) Kept clear of structure and other services.
d) Provided with 0.75 mm galvanised sheet metal sleeves where passing through structure.
e) Installed to not cause stress to pipes or joints due to expansion or contraction.
f) Fixed on hanger brackets to allow adjustment for falls.
g) Not to be fixed with explosive power tools.
h) Cleaned of all cement dropping upon completion.

Materials

a) Use purpose made galvanised mild steel channel equal to "Unistrut P1000" complete with purpose made fittings. Provide plastic end caps on exposed brackets.
b) Obtain approval for any alternative fixing methods before commencement of work. All mild steel must be hot dipped galvanised.
c) Use 4 mm thick PVC between copper pipes and steel brackets.
d) Use galvanised bolts and fixings of adequate size.
e) Use patented masonry anchors for fixing into masonry elements.
f) PVC coated brackets shall not be used.

SPACING OF BRACKETS AND CLIPS as per AS 3500.1 TABLE 5.2

Nominal pipe size DN	Maximum Spacing of brackets and clips in Metres			
	Copper Stainless Steel Copper Alloy	Galvanized Steel Ductile Iron	uPVC Polyethylene Polypropylene Crossed Link Polybutylene	
			Horizontal	Vertical
15	1.5	2.0	0.60	1.20
20	1.5	2.0	0.70	1.40
25	2.0	2.0	0.75	1.50
32	2.5	2.5	0.85	1.70
40	2.5	2.5	0.90	1.80
50	3.0	3.0	1.05	2.10
65	3.0	3.0	1.20	2.40
80	3.0	4.0	1.35	2.70
100	3.0	4.0	1.50	3.00

Note 1: Pipework in walls shall be fixed every 900mm.

2: Hoop Iron **WILL NOT** be acceptable for pipe hangers or Brackets.

A4.14 Exposed Pipework Treatment

Except as otherwise specified or directed all internal exposed piping adjacent to plumbing fixtures, including traps and fittings shall be **chromium plated finished** and where passing through a finished wall, floor or ceiling, shall be fitted with approved chrome cover plates.

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

A4.15 Identification

Labels on pipework shall be installed in accordance with AS 1345. Identification of the Contents of Pipes, Conduits and Ducts shall be equal to Safetyman pattern positioned on each side of valves, bends and junctions and along the length of the pipeline at maximum 3000mm centres. Where pipes are installed within ducts or false ceiling areas additional labels shall be installed to be visible at the access panel position.

A4.16 Painting

All exposed piping situated in service yard, external areas and ducts and where not chrome plated shall be painted continuously in the colours specified below and in addition shall be fitted with identification labels.

Painting to pipework shall be in accordance to the colour coding as indicated in the schedule of colours for identification of piping in AS1345 - Identification of the Contents of piping, Conduits and Ducts.

Description	Colour
Soil wastes and vents	Black
Potable water	Emerald Green No. 20
Non-potable cold water	Shamrock Green
Gas	Light Beige No. 366
Storm water	Jade Green

Where potable water pipes are laid in parallel with other pipes of similar colour, provide additional blue identification banding to the potable pipe.

Label each service with proprietary labels to accurately identify the service and its direction of flow.
Where pipe work is not required to be painted in locations such as in ceilings, service ducts and under floors, it shall be marked with colour bands 450mm long and at 3000mm spacing. Fit supplementary markers at all colour bands similar to '3M Safetyman'.

Painting shall be carried out by experienced Painters.
Where piping is specified to be painted, the supports and brackets shall be similarly painted in selected colours.

Copper pipes shall be painted with a suitable etching paint before applying finishing enamel. Paint cast iron pipes with all metal undercoat and finishing enamel. All steel pipes shall be painted with one coat of zinc chromate primer and undercoat before application of finishing enamel.

Note
The plumbing contractor shall allow to wrap pipe labels for painting and remove wrapping on completion. All labels shall be placed in visible locations.

A4.17 Underground Pipe Waring Tape

During the process of backfilling, lay plastic warning tape 150mm above all underground pipes. Maker tape shall extend for the full length of the pipe. Marker tape shall be 100mm in width manufactured of approved durable plastic with service indicator colour to comply with AS 1345 printed with the words ‘DANGER – BURIED …….. PIPE BELOW’ repeated continuously.

Warning tape shall contain a copper trace wire which shall be secured and terminated at each end.

A4.18 Protection of Finished & Polished Surfaces

Throughout the project, all finished surfaces shall be adequately protected against damage. Provide suitable material for protection of finished surfaces as required and as may be directed.

Remove protection from finished surfaces on completion of project and leave surfaces in such a manner that final cleaning of dust is only required.

Scratched or damaged finished surfaces will not be accepted.

A4.19 Core Holes and Sleeves

Set out all core holes and sleeves in floors, walls, beams and columns in conjunction with the fixing of the reinforcement to prevent weakening of the building structure. All core-hole locations shall be approved prior to placing concrete. Material for forming core shall be of 0.7mm galvanised sheet metal or UPVC and shall have a diameter of at least 75mm greater than pipe it serves.

Determine the exact location of all penetrations through tilt up panels where installed and provide the Builder with drawings indicating their locations. Supervise and approve the location of penetrations prior to the pouring of the panel.

A4.20 Concealed Piping

Unless otherwise approved or directed, pipes shall be concealed.

All piping shall be concealed where possible in the stud walls, ceiling spaces, ducts and voids.

Chasing will not be allowed in concrete walls unless agreement in writing is obtained from the Superintendent.

In general, chases in block work shall not exceed 1200 mm horizontally and not closer than 600 mm to supporting elements vertically. No face walls shall be chased. Where pipes cannot be chased, they shall be built in as the work proceeds. Discuss with the Superintendent the location of services in masonry walls. Where pipes are concealed in walls, they shall be insulated. The insulation shall be placed on the pipes in such a manner that expansion and contraction will be unhindered and the wall finish will not crack or otherwise be damaged.

Where piping is to be concealed in timber or metal stud walls:

- Holes through studs, noggins etc. shall be carefully drilled, with piping kept in straight lines.
- Copper hot, warm and cold water piping – 20mm and smaller shall be fixed with 'Plastic' sleeves / brackets. Each such sleeve / bracket to be screw fixed.
- Unless otherwise noted each penetration through studs, noggins etc. shall include a PVC sleeve with a wall thickness not less than 2mm.
- Ensure that all pipework is adequately fixed that no water hammer occurs.
- Provide timber noggins, not less than 70mm x 35mm and adequately fixed to studs, for fixing of faucets / tapware, including ancillary pipe fittings.

A4.21 Acoustic Treatment of Hydraulic Systems

The acoustic treatment of hydraulic services shall comply with the requirements outlined herein.

A4.21.1 Bracketing

Pipework located in plumbing ducts and ceilings shall not be directly bracketed to the walls and/or structural elements. Provide a minimum of 50mm clearance between the wall and the pipe. All pipework shall be fully supported by resilient pipe hangers similar to 'binder clips. Alternatively, separate pipework from the bracket with 13mm thick closed cell neoprene rubber.

A4.21.2 Water Services Pipework

Pipework shall be sized to limit velocities to no more than 1.5m/s for main reticulation pipework and 1.2m/s for hot and cold pipework located within walls. Limit supply pressures to 350kPa.

The following guidelines shall be followed when laying out pipework;

- Where required provide within the water system approved water hammer arrestor.

A4.21.3 Toilet Cisterns

All cisterns shall be fitted with quiet fill valve systems. Separate cistern from the wall with 6mm neoprene rubber.

A4.22 Programming of Work

Allow to comply with the program of the main contract.

A4.23 Existing Services

The contract drawings indicate services adjacent to the site and have been prepared from available records and information provided by third parties. Investigate the exact location, depth and size of services. Deviations of services other than that indicated are to be brought to the attention of the Superintendent prior to the commencement of any installation relating to such deviation.

A4.24 Authorities Services Search – Dial Before You Dig

The Plumbing Contractor shall allow to undertake an Authorities services search and obtain all available information on Authorities services within the street and site area.

A4.25 Excavation near Authorities Services and Easements

The Plumbing Contractor shall allow to hand dig when excavating Authorities services and easements. The Authorities shall be given 48 Hours' notice prior to any excavation-taking place. If required or requested by the Authority, excavation shall take place only under their supervision

A4.26 Connection to Existing Services

It is the responsibility of the Plumbing Contractor to ensure that when connecting or diverting existing services they have clearly located & ascertained that the services are in fact the services in question.

A4.27 Disconnection of Existing Services

Disconnection to existing services shall be completed by the appropriate method. Discontinued services shall be cut and Capped or Valved off. Crimping the end of the pipe shall not be accepted.

A4.28 Site Visit

Visit the site before submitting final tender to assess the "on site" conditions. Failure to do so will forfeit any claim for not being aware of conditions affecting the tender.

A4.29 Services Coordination

Plumbing Contractor shall coordinate with the other Services Sub-Contractor's and Builder to ensure all coordination of pipework and equipment is undertaken.

Detailed coordination is the responsibility of the plumbing contractor; the Hydraulic drawings are diagrammatic and demonstrate design intent only.

A4.30 Installation Coordination

Various items of apparatus and equipment will be provided and fixed by others.

The Plumbing Contractor shall familiarize themselves with the requirements of the other subcontractor's works requiring coordination and shall examine the plans covering each of these services.

It shall be the responsibility of the Plumbing Contractor to schedule work closely so that the work may be installed at the proper time and without delaying the completion of the entire project.

The Plumbing Contractor shall carefully check space requirements with other Subcontractors to ensure that the equipment, piping, etc., can be installed in the spaces allotted.

When equipment and/or installations associated with the work of the contract are installed by other Subcontractors, the Plumbing Contractor shall attend and coordinate as necessary.

Associated fittings required to prevent clashes with other trades shall be deemed to have been included in the tender price.

Check all dimensions on site prior to commencing work.

The design drawings do not relieve the Plumbing Contractor of the coordination or buildability responsibility.

All design changes occurring after the letting of the Plumbing Contract, by other trades including architectural, structural and mechanical services, shall be coordinated into the installation by the Plumbing Contractor as necessary

The Plumbing Contractor shall be responsible for the installation of all services elements associated with this subcontract, within the ceiling, duct and plants spaces provided in accordance and coordinated with all other services trade designs.

A4.31 Inspection & Flushing out of Services- Gravity Systems

On completion of the installation of all services and before application for Certificate of Practical Completion, allow to lift all access chamber covers and major access gates and inspect gravity lines. Clear out any debris from lines and flush entire system to ensure clean bore. Replace access chamber covers and access gates after inspection, clearing and flushing. Provide Superintendent with a minimum of 48 hours' notice prior to inspection and flushing procedures.

A4.32 Disinfection of Water Systems

Disinfect potable-water pipework installations before practical completion.

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.

A4.33 WELS Scheme

All, taps, spouts, showers, WC's etc. shall be rated under the Wels Scheme.

Proof of Wels authorization shall be presented when requested by the superintendent.

Wels authorization certificates shall be located within the O&M manuals.

A4.34 MP52 Authorisation

All plumbing and drainage products shall be approved in accordance with ATS 5200 Technical Specification for Plumbing and Drainage products and shall be watermarked in accordance with ABCB, Watermark Certification Scheme (WMCS)

A4.35 WA Code of Practice, AS/NZS 3500 and NCC

All work shall be in accordance with the Western Australia (WA) Code of Practice, the relevant sections of AS/NZS 3500-Plumbing and Drainage and the National Construction Code (NCC)

A4.36 Development Application

All work shall be in accordance with the relevant sections of the Council Approved Development Application. (DA)

A4.37 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 regards 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.

A4.38 Tender Documents

The drawings as scheduled are issued as a guide only and shall be considered, as diagrammatic and approximate. The drawings and Specification are intended to be mutually explanatory and complete, but all work called for by one, even if not by the other, shall be fully executed. Should the documents be in conflict, the Plumbing Contractor shall be deemed to have included for the larger quantity and/or the more expensive components, as applicable.

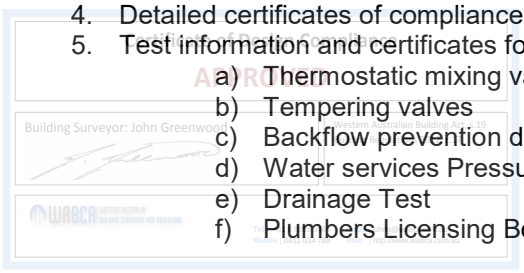
Should the drawings and specifications indicate ambiguities, the requirements of the Specification shall take priority unless the Plumbing Contractor advises regarding ambiguities or conflicts at the time of tender the requirements of the Specification will be expected as fulfilment of the Plumbing Contract.

A4.39 Documents before Practical Completion

Before practical completion provide:

1. As built drawings
2. Maintenance manuals including Manufacturers Operating Instructions.

3. Updated Drainage Plumbing Diagram (DPD) for the Building Commission of WA
4. Detailed certificates of compliance
5. Test information and certificates for each
   a) Thermostatic mixing valves
   b) Tempering valves
   c) Backflow prevention devices
   d) Water services Pressure test
   e) Drainage Test
   f) Plumbers Licensing Board Compliance Certificates



A5 Shop Drawings

In addition to those considered necessary for fabrication, attend all necessary meetings to coordinate services and prepare set-out and coordination drawings, based upon those meetings, for the whole of the Hydraulic Services work. Drawings shall be submitted and drawn to a minimum scale of 1:50 ratio. Quality shall be at least equal to the Tender drawings and show all coordination elements, such as structural elements, other services at, and adjacent to, the point of coordination, together with sufficient information to ensure that pipework will be installed within false ceilings, voids and duct areas. The Plumbing Contractor shall have the complete responsibility for the detailed drawings, coordination and final installation.

Drawings shall be submitted to the Building Contractor for checking prior to submission to the Superintendent for review and approval. As a guide in assessing the amount and extent of Workshop Drawings, the following requirements should be considered as minimum requirements to be detailed:

a) All areas detailed in the contract documents

b) All Plumbing Ducts

c) Plant and equipment set-outs for hot water plant and circulation pumps

d) Grease trap

e) All false ceiling and void areas where coordination with other services is required.

f) Other areas deemed to require drawings for coordination and execution of the work.

g) All access panel requirements, which are not already detailed or suitable on architectural drawings.

Manufacture and/or installation as applicable shall not be commenced prior to review of the drawings by the Superintendent.

Submit drawings to the Superintendent at least fourteen days prior to fabrication or installation of equipment and services.

Provide sufficient copies of the drawings to all other disciplines to ensure coordination with all other sections of the work.

Should the Plumbing Contractor be unable to prepare workshop drawings, contact Alphazeta Group office for assistance

A6 As Built Drawings & Operation Maintenance Manuals

A set of drawings shall be kept on site and progressively marked up by the Plumbing Contractor as the work proceeds to record the locations, inverts and details of all installed services, equipment and valves.

Before applying for the Certificate of Practical Completion, a set of "As Built" drawings (comprising of all floor plans, Diagrammatics and Details) prepared by the Plumbing Contractor to a minimum scale of 1:100 and relevant bound manuals indicating all items of service or equipment shall be submitted to the superintendent for review. Standard of drafting and minimum scales shall be equal to design documents, accurately plotted, showing dimensions of pipes, valves and services.

The hydraulic services drawings are available in AutoCAD.dwg format from the hydraulic consultant.

During construction when existing in-ground services are uncovered their exact locations and IL's shall be measured and included within the As-Built documents.

Should the Plumbing Contractor be unable to prepare As-built drawings, contact Alphazeta Group office for assistance.

A6.1 Submission Requirements

Contract Documentation must include submission requirements as follows:

1. One final draft copy of As-Builts and Manuals must be submitted for final review by the Superintendent prior to Practical Completion.
2. Two copies of final documentation must be submitted for approval within 4 weeks of Practical Completion.

A6.2 As-Built Drawings - Content and Format

As-Built drawings shall show dimensions, types and locations of equipment, piping and ductwork in relation to permanent site features and other underground services. Show the 'as installed' locations of building elements, plant and equipment. Show off-the-grid dimensions where applicable. Include relationship to building structure and other services, and any changes made during commissioning and maintenance periods. Include diagrammatic drawings of each system and all items of equipment.

Use the same border and title block as the contract drawings. Drawings to be submitted in electronic copy (AUTOCAD format) and 3 hard copies (PDF format) shall be supplied, Architectural backgrounds to be updated to the latest architectural layouts.

A6.3 Operation & Maintenance Manuals

Should the Plumbing Contractor be unable to prepare Operation & Maintenance manuals, contact Alphazeta Group office for assistance.

The Operation and Maintenance manuals shall include:

1.	A total of **Three (3)** hard copies of the manuals, to be supplied to the superintendent upon completion of the works.
2.	Directory: a) Plumbing Contractors information including Plumbers License number b) Hydraulic consultant's information c) Architects information d) Project manager's information Include: Name, address, telephone and facsimile numbers, email address and the names of responsible parties.
Contents	
3.	Drawing and Technical Data: As necessary for the efficient operation and maintenance of the installation.
4.	Table of Contents: For each volume. Title to match cover.
5.	Installation description: General description of installation.
6.	System description: Technical description of the system installed, written to ensure that the clients staff fully understand the scope and facilities provided. Identify function, normal operating characteristics, and limiting conditions.
7.	System performance: Technical description of the mode of operation of the system installed.
8.	Installed fixtures and fittings list
Service / Maintenance	
9.	A list of annual service requirements for the completed works.
10.	A list of items that require annual service agreements with pump suppliers, filter suppliers, thermostatic mixing valves, backflow preventers, etc.
11.	Manufacturer's technical literature as appropriate. Register with manufacturer as necessary. Retain copies delivered with equipment.
12.	Detailed recommendations for preventative maintenance frequency and procedures which should be adopted by the principal to ensure the most efficient operation of the systems installed.

13.	Schedule of spares recommended to be held on site, being those items subject to wear or deterioration and which may involve the principal in extended deliveries when replacements are required. Included complete manufacture and model numbers, and local sources of supply.
14.	Schedule of normal consumable items, local sources of supply, and expected replacement intervals.
15.	Instructions for use of Lifting tools etc.
16.	Emergency procedures, including telephone numbers for service, and procedures for fault finding.
Instructions	
17.	A copy of manufacturers technical literature, installation and commissioning instructions
18.	A copy of manufacturer's service and/ or maintenance instructions.
19.	Safe starting up, running-in, operating and shutting down procedure for systems installed. Include logical step-by-step sequence of instructions for each procedure.
Warranties	
20.	A copy of manufacturers warranties
Valve Schedule	
21.	Prepare and show a comprehensive schedule of control valves - Valve schedule shall include A – Position B - Size C – Function D - Valve number
22.	Valve settings
Approvals	
23.	Water and Sewer Authority Approval
24.	Plumbing Licensing Board
25.	Relevant Authorities approvals pertinent to this project.
Emergency	
26.	Emergency contact numbers – for installing Plumbing Contractor
27.	Emergency procedures
Certificates	
28.	A copy of the completed commissioning and test report for all pipework and equipment.
29.	Test and balancing reports
30.	Copy of test certificate for the installation and equipment.
31.	Certification of TMV's
Drawings	
32.	A paper set of the "As Built" drawings in A3 reduced size and in full scale size folded to fit into each Manual
33.	A USB copy of the "As Built" drawings in AutoCAD (DWG) format in each manual
34.	Charts of value tag numbers, with locations and function of each valve, keyed to flow and control diagrams.
Equipment description	
35.	Name, address, telephone & facsimile numbers, email address and Web Address of the manufacturer and supplier of items of equipment installed, together with catalogue list numbers.
36.	Schedules (system by system) of equipment, stating locations, duties, performance figures and dates of manufacture. Provide a unique code number cross-referenced to the record and diagrammatic drawings and schedules, including spare parts schedule, for each item of equipment installed.
37.	Manufacturers' technical literature for equipment installed, assembled specifically for the project, excluding irrelevant matter. Mark each product data sheet to clearly identify specific products and component parts used in installation, and data applicable to the installation.
38.	Supplements to product data to illustrate relations of component parts. Include typed text as necessary.
39.	Manufacturers and suppliers of items of equipment installed
40.	Any sub-contractors engaged in the works.
41.	A USB copy of the Manual in PDF version.

A6.3.1 Format

A4 size loose leaf, in commercial quality, 4 ring binders with hard covers, each indexed, divided and titled. Include the following features:

1. Pagination: Number pages consecutively.
2. Cover and Spine: Identify each binder with typed or printed title "OPERATION AND MAINTENANCE MANUAL". Identify title of project, volume number, volume subject matter, and date of issue.
3. Ring size: 50mm maximum, with composer bars.

4. Text: Manufacturers printed data, including associated diagrams, or typewritten, single sided on bond paper, in clear concise English.
5. Dividers: Durable divider for each separate element, with typed description of system and major equipment components. Clearly print short titles under laminated plastic tabs.
6. Drawings: fold drawings to A4 size and accommodate them in the binders so that they may be unfolded without being detached from the rings. Provide with reinforced punched binder tabs.

A6.3.2 Training

Conduct training at agreed time to induct the clients in the operation of equipment after practical completion and prior to occupation.

Maintenance: Immediately after practical completion, explain and demonstrate to the Maintenance Manager or nominee, the purpose, function and maintenance of the plant and equipment installed under this contact.

PART B PROJECT TECHNICAL REQUIREMENTS

B1 Excavation and Backfill

B1.1 Trench Excavation

All excavation shall be in accordance with WorkCover WA - Code of Practice for excavation.

All excavations shall be carried out in a safe, secure and prudent manner that will prevent any form of collapse, slip or failure of the sides of the excavation.

The ground shall be excavated in the form of trenches to enable the various pipelines to be constructed in the locations shown on the drawings with trench width increased where necessary to permit the construction of access chambers and pits. Trenches shall be excavated at uniform grades and in straight lines.

Upon commencement of excavations a general examination of the trenches shall be made to determine the presence or otherwise of any material considered by the Plumbing Contractor to be detrimental to the life and future condition of the pipeline to be installed.

Wherever such material is located, the Plumbing Contractor shall advise the Superintendent immediately together with a recommendation and costs of remedial action to be taken. No work in relation to this remedial precaution is to commence until written approval to proceed is obtained from the Superintendent.

Remove all excess excavation material from site, pay all cartage and disposal fees wherever applicable to provide a clean neat site devoid of all debris created by this section of works.

B1.2 Exceeding Excavation

If the Plumbing Contractor has exceeded the section area of excavation, as shown, in consequence of any injudicious working, slips, falls, or for any cause other than by direction of the Superintendent then the Plumbing Contractor shall, at sole cost, remove such extra materials from the site, make good and fill in the extra excavation with concrete, sand or approved filling as may be directed.

No extra payment will be made for excavation over and above, that required by the drawings and specification unless directed in writing by the Superintendent.

B1.3 Timbering Excavation

Subject to any Act of Parliament, Ordinance or Regulation, the Plumbing Contractor shall satisfy himself as to the necessity of timbering any excavation and shall accept the sole responsibility as to its being required and to its use in the works.

Where necessary for safe and efficient completion of the work erect shoring and timbering of sufficient strength and quality to prevent earth and other material slipping or falling in or being shaken from the side of the excavation. As the work proceeds, all shoring and timbering shall be withdrawn except in the cases where the Superintendent has indicated in writing that such shoring and/or timbering shall be left in position. The supply, erection and withdrawal of timber work shall be considered, to be included in the cost of excavation.

B1.4 Precautions and Safeguards

Carry out the work in a careful, secure, safe and tidy manner and take all precautions against damage whether arising from bad workmanship, breakage, machinery or plant, inefficient timbering, flooding or any other cause whatsoever. Provide, erect and maintain warning signs, temporary fences, barriers and warning lights adjacent to any works such as trenches and excavations or stacks of material which could be considered a danger to persons or traffic of any kind.

The Plumbing Contractor shall obey all directions given to him with regards to the provisions of lighting and barriers, but shall not be relieved of the responsibility to provide adequate lighting and barriers to prevent any accident or damage

B1.5 Use of Explosives

The use of explosives will not be permitted.

B1.6 Bedding Material

Where trench base is of stable sand material pipe barrels shall be directly supported on the undisturbed natural ground. In all other cases, pipelines shall be supported on either a granular bedding or cement mortar bedding in accordance with AS/NZS 3500.2 and the WA Code of Practice for Plumbing and Drainage.

Where a mechanical vibrator is employed, the lines shall be subjected to a second test upon completion of the compaction.

B1.7 Backfilling

Unless instructed otherwise where a length of trench has been inspected, the bedding material shall be placed and compacted. After a length of pipeline has been constructed, tested and inspected the trench where located under finished surfaces such as concrete, bitumen or paving shall be backfilled with granular material up to underside of the working surface. Granular material shall be in the form of sand, fine sized "run of river" gravel or similar, free of clay and rock. Thoroughly compact the material around and above pipes by flooding, hand tamping or mechanically ramming to not less than 95% compaction as set out below.

In open spaces backfill with granular material 150mm above pipe collars and then backfill with selected excavated material.

Selected excavated material shall be free from rocks or other hard particles, which would be retained in a sieve having 15mm openings. It may contain compactable clay lumps up to 75mm in size. The spoil from the excavation if it complies with the above, or can be sieved or broken up to comply, will provide a suitable material and shall be placed in successive layers and compacted to not less than 95% of the density obtainable from the Standard Compaction method in accordance with AS 1289 - Methods of Testing Soil for Engineering Purposes, shall be placed for the remainder of the trench depth up to 150mm from the finished surface level.

Unless otherwise directed the remainder of the trench filling shall be carried out using the original top soil (where suitable) or approved sand - sandy/loam fill.

Backfilling shall be completed as soon as possible after laying to avoid damage or floating of pipes if trench is flooded by water.

B1.8 Trenches Excavated in Filled Ground

Provide a schedule of rates in the tender for the items listed below, these items are a suggested means of support only. The local authority shall approve the type of support prior to installation. The plumbing contractor shall allow for a Structural Engineer to design and certify the support system:

B1.8.1 Where located externally:

Laid on concrete beams, with at least three steel rods of not less than 15mm nominal size laid longitudinally within the beam or two layers of trench mesh (type F8TM) and be not less than 150mm thick with a minimum width of 450mm for 100mm and 150mm pipework, 600mm minimum width for 225mm to 450mm pipework and 750mm minimum width for pipework over 450mm. Beams shall be supported by concrete piers of not less than 230mm x 230mm founded to a depth of firm natural strata and placed at intervals on not more than 3000mm with four steel rods of not less than 15mm nominal size with a minimum of 50mm cover and tied into the reinforcement of the beam for a distance of 300mm.

B1.8.2 Where located internally:

Laid on concrete beams as described in part (a) above, and supported by tie rods of not less than 12mm diameter reinforcing bar formed to fix the support beam steel to the concrete slab steel situated above the line. Tie rods shall be spaced at not more than 1500mm and sleeved with 100mm diameter UPVC tube extending from within the support beam and into the concrete slab. The entire length of UPVC tube shall be filled with concrete in such a manner that no section of the rod shall be exposed. Connect top of tie rod to slab steel with minimum of 300mm length bend.

Line the trench with a permeable fabric equal to "terra firma 700" then back fill to a depth of 450mm with 10mm blue metal gravel. The drainage line shall then be laid on the bed of gravel and backfilled with 10mm blue metal to a height of 150mm above the collars of the pipework. The trench fabric shall then be turned over the gravel and the remainder of the trench backfilled as previously specified.

Generally, drainage lines are not permitted to be laid in filled ground without additional support. Consideration to waiver the support may be given by the Superintendent and/or the governing authority

where the fill is compacted to 98% dry density ratio (Australian Standard AS1289 - Methods of Testing Soil for Engineering Purposes E1.1)

Where additional treatment to achieve a compaction of 98% dry density is carried out using mechanical compacting equipment and the Plumbing Contractor proposes to install pipes and pits in the compacted fill without additional support, comprehensive compaction test results, location plans and "letters of adequacy" from the supervising structural engineer stating that the compacted fill is suitable for the support of pipes and pits is required to be submitted to the Superintendent and the governing authority. Approval in full shall be obtained from both parties before any work proceeds.

All trenches are to be inspected by the Superintendent and governing authority prior to laying of drainage lines; claims for redundant work as a result of failing to do so shall not be considered valid.

B1.9 Trenches Excavated in Rock

It shall be deemed that excavation in rock has been allowed for in the tender.

Should the Plumbing Contractor encounter rock not previously anticipated during excavations, notify the Superintendent immediately so that the extent, quantity and type of rock excavation can be assessed by the Superintendent prior to commencement of rock excavation. Failure to observe this requirement shall forfeit the Plumbing Contractor's right to reimbursement of additional costs relating to the excavation of rock unless the extent, quantity and type of rock can be assessed later and there was not alternative to the excavated route.

Provide in the tender a schedule of rates, which will be the basis of assessing the cost of additional work associated with excavation in rock. The schedule shall be the Plumbing Contractor's price in cubic metre rates for additional cost (extra over) to excavate trenches in soft rock and in hard rock. The Plumbing Contractor shall also provide cubic metre rates for the additional cost to excavate pits in soft rock and in hard rock.

B1.10 Excavation in Existing Concrete Slabs, Pavements and Roadways

If required by the Superintendent trenches across existing roads shall be excavated and the pipeline constructed therein so that half the pavement & roadway is always maintained open to the public.

Slabs shall be saw cut and then the concrete removed with pneumatic tools.

Council road opening application and payment of all fees shall be made and approval granted prior to any works being undertaken.

B1.11 Excavation near Authorities Services and Easements

The Plumbing Contractor shall allow to hand dig when excavating Authorities services and easements. The Authorities shall be given 48 Hours' notice prior to any excavation-taking place. If required or requested by the Authority excavation shall take place only under their supervision.

B1.12 Drains in Deep or Wide Trenches

Before laying drainage in a deep trench (i.e. depth greater than 3 metres) or a wide trench (i.e. width at top of pipe greater than outside diameter plus 600mm) the following is needed:

- A certificate of structural adequacy for:
  - Class of pipe and
  - Bedding, haunch, pipe support and backfill issued by a practicing civil engineer
- Permission of the relevant Authority.

Note: pipes shall be installed in accordance with manufactures instructions / requirements.

B2 Materials

B2.1 Supply of Materials

Supply and fix all materials required to complete the works. All materials shall be first quality and the best of their respective kinds. Second quality or inferior materials shall be rejected. All costs associated with replacement of rejected materials shall be borne by the Plumbing Contractor. All materials shall conform to the latest Australian Standard Specification, Code or Interim Code. If no Australian Standard exists, they shall conform to the latest British Standard or the American Society for Testing and Materials in that order.

B2.2 Samples

Supply samples of materials when requested. Samples shall be labelled showing the location of their installation. After approval, all subsequent work shall conform to the quality of the sample.

B2.3 Measurement

Provide measuring or weighing equipment for materials as required. All measurement shall be taken from site and/or from dimensioned architectural drawings.

B2.4 Rejection of Unsatisfactory Materials

Rejected materials shall be marked by the Plumbing Contractor and removed from the site.

B2.5 Approval

All items in this section shall be approved by the local authority and be water marked.

B2.6 Installations

All materials and fittings shall be installed in accordance with the manufactures instruction and the relevant Australian Standards

B2.7 Dissimilar Material

The Contractor shall be responsible for separating dissimilar metals from direct contact with each other. All necessary gaskets, dielectric couplings, etc., required shall be supplied and installed by the Contractor. All metal screws, clamps, etc. shall be of the same metal and finish as the materials supported.

Where clips, brackets and pipe supports are of dissimilar metal to the actual piping used, completely insulate the piping at all fixing points with at least 10mm thick Aeroflex insulation or 8mm thick Vibration Resistant Rubber wrapped around the pipe prior to fixing in position.

B2.8 Corrosion Protection

“Denso 600 tape” shall be used to protect all underground copper piping, nuts and bolts on all fittings, valves, hydrants, mechanical joints, tapping bands and as directed.

All pipework in stud wall cavities shall be insulated with 8mm thick Aeroflex installed to manufacturers specification.

All copper service lines chased into masonry constructions shall be spirally wrapped with 6mm thick x 65mm wide foam insulation, with all joints tape sealed. The chase shall be fully grouted and packed firm.

Any service lines cast in concrete shall be spirally wrapped with foam insulation as specified in clause above and cover wrapped with Denso 600 tape per specification clause above.

All steelwork shall be hot dipped galvanised after fabrication.

All nuts, bolts, washers, clips etc., used in connection with any of the services shall be of non-corrosive material, compatible with materials in contact.

Surface rust, scale, build-up etc., on any component in the installation shall be removed during the progress of the works and the affected area de-scaled, brushed and treated with a compound recommended by the manufacturer of the product.

On completion of joints, all residual flux must be removed. This is to be done by quenching in water.

B2.9 Concrete Mortar & Render

Concrete used for drainage works will be of 25Mpa strength, when supplied by a ready-mixed concrete supplier. Site mixed concrete will not be allowed. Mortar shall be 2:1 sand, cement mix.

Waterproof render will be 3:1 mortar, waterproofed with approved waterproofing compound used directly in accordance with the manufacturer's directions.

B2.10 Cleanouts (CO)

Provide and install cleanout points in positions indicated on the drawings and AS/NZS 3500 and in accordance with PLB Technical Note. Extend from drainage lines of same diameter as pipe served to finished surface level using a 45-degree junction/bend and 45-degree bend.

Encase cleanout riser in 150mm thickness concrete surround. Where inside toilets or bathrooms, cleanouts are to be approved non-slip chrome plated brass or Galvin Engineering nickel bronze non-slip access cover, finished flush with surrounding finished floor surface.

External cleanout points as indicated on the drawings and AS/NZS 3500 shall be provided with screwed access cap under a cast iron hinged valve box or cast iron flushing point cover cast in concrete footing and set flush with surrounding finished surface level.

B2.11 Core holes & Sleeves

Pipes passing through walls and floors are to pass through a PVC/Metal pipe sleeve. Each sleeve will be sealed as described hereinafter.

Set out core holes and sleeves in floors, walls, beams and columns in conjunction with the fixing of formwork and/or placing of concrete and checking that the location of any core holes and/or sleeves already installed are correct.

To prevent weakening of the building structure core holes are to be approved by the structural engineer, prior to placing of concrete.

Pipe sleeve will be filled between the outside of the sleeve and the masonry or concrete structure with concrete or 2:1 cement mortar to approval. Holes not used are to be filled with concrete to approval.

Core holes for soil or waste pipes on suspended floors will be made by means of a patented plastic slab seal unit with rubber diaphragm type manufactured by Hilti and equal to AS 1930.4.

Fit each pipe passing through a core hole or masonry/concrete walls with a 24-gauge sheet copper pipe sleeve having grooved and seamed joint and finishing 25mm above surrounding surface level.

Alternatively, copper pipe may be used as the sleeve providing there is a gap of at least 10mm all around the circumference of the pipe passing through the sleeve.

Other core holes will be formed using 0.63mm thick (24 gauge) galvabond sheet metal, having a diameter of at least 50mm greater than the outside diameter of the pipe it serves.

Pack between each installed pipe and the core hole sleeve with 'Fiberfrax Fyre Putty' (FP) or equal.

B2.12 Fire Stop Collars & Penetrators

Allow to supply and install approved fire stop collars to all pipe penetrations through slabs, walls and all fire separated areas.

Fire stop collars shall be in accordance with AS1530.4 and AS 4072.1 and provide minimum 4 hour fire rating.

Fire Stop collars shall be provided on all UPVC and non-metal pipe penetrations through fire rated reinforced concrete slabs and walls. To provide 4 hour fire rating by expanding under 100°C heat to collapse the pipe

Fill in all penetrations and core holes in accordance with the NCC including approved fire stopping material.

B2.13 Fixings

Fixings are to be 'Dynabolts', 'Rawlplug' or Hilti expansion type plugs installed in accordance with the manufacturer's instructions and to approval. External fixings are to be stainless steel expansion fastenings.

B2.14 Copper Tube & Fittings

Copper tube shall:

a) Conform to AS 1432 - Copper tubes for plumbing, gas fitting and drainage applications.
b) Be installed in and commissioned in accordance with AS 4809
c) Be type B for Hot & Cold Water.
d) Jointing – Either Viega fittings or jointed with silver solder containing not less than:
   5% silver solder and 6 mm lapped joints for pressure supply pipes.
   2% silver solder and 6 mm lapped joints for non-pressure applications

Fittings for Copper Tube shall:

a) Conform to Australian Standard AS 3688 - Water Supply - Copper and copper alloy compression and capillary fittings and threaded-end connectors.
b) Be DE zincified brass or copper suitable for jointing by silver solder.
c) Minimum wall thickness shall be not less than the tube thickness it serves.
d) Be first quality high-pressure fittings for rising mains.

B2.15 Plastic Pipes and Fittings

Plastic pipes and fittings of polybutylene, polyethylene and polypropylene shall be suitable for the application of the relevant water service pressure and temperatures and in accordance with the relevant Australian Standard and as per the manufactures recommendations.

B2.16 UPVC Pipes and Fittings

All UPVC pipes and fittings for sanitary drainage shall be:

a) Be sewer grade in conformity with AS 1260-UPVC pipes and fittings for drain, waste and vent applications.
b) Solvent weld jointed in accordance with the manufacturer's instructions.
c) Incorporate fittings of similar manufacture to the pipe used.
d) The Burning out of fittings for reuse is unacceptable.
e) The Heating or annealing of UPVC pipes and fittings is unacceptable.
f) Jointing - Solvent weld cement (high bond solvent cement) as recommended by manufacturer and approved by authority.
g) Jointing – use fully moulded fittings only. Glue on Boss or saddle type clamp or strapped on joints shall not be used.
h) Be installed in accordance with:
   - AS/NZS 3500 Requirements
   - The WA Code of Practice
   - AS 2032 Code of Practice for installation of uPVC Pipe Systems

B2.17 High Density Polyethylene (HDPE) Waste Pipe

HDPE sanitary waste pipe and fittings shall conform to AS/NZS 3500. All pipework and fittings will be approved by the local water authority for sanitary drainage installations and shall be equal to "Geberit" in all cases. Where waste water temperature exceeds 60ºC and/or chemical properties of waste water dictate, pipework and fittings will be HDPE.

Joints shall be "Eurojoint" rubber ring push fit collars or electro fusion welded joints to the manufacturer's requirements. **Welded joints will not be accepted**.

Expansion and Contraction - shall be catered for as recommended by the manufacturer and relevant standards. Suspended installations shall have expansion sockets at maximum 6m fixing distance or deflection legs. In-ground installations can be installed rigid, without expansion sockets.

Fix points - shall be made at the location of every expansion socket or deflection leg, to direct movements into the desired direction. Fix points shall be designed to hold the pipe steady in position to ensure proper function of an installation.

Bracketing - distance shall be in accordance to AS/NZS 3500 and manufacturer's guidelines.

Storage - Pipes stored outside are to be protected against deformation by covering. Pipes may not be stacked to height, which could result in deformation.

B2.18 Galvanised MS Pipe & Fittings

Galvanized mild steel pipe and fittings:

a) Pipes shall conform generally with AS1074 - Steel Tubes and Tubular for Ordinary Service.
b) Shall be Equal to One Steel Fire Plus
c) Shall be in accordance with AS 2419.1
d) Shall be 3.04mm wall thickness for pipe diameters up to and including100mm and a minimum of 3.4mm for pipe diameters greater then 100mm and up to 150mm.
e) Shall be Hot Dipped Galvanized internally and externally and at their ends in accordance with AS/NZS 4792. – The Galvanized coating shall have a minimum zinc coated mass of 300g/m^2.
f) Are to be certified or listed by and tested and certified by a recognized body as being fit for purpose in hydrant systems in accordance with AS 2419.1
g) Shall not be On-site welded or modified.
h) Any cutting that exposes the base metal or damages the galvanized protective coating shall be repaired in accordance with AS 2419.1
i) Any disturbance of the protective coating by cutting, roll grooving or handling shall be repaired with a zinc-rich primer or equivalent in accordance with AS/NZS 4792
j) Shall be jointed with approved galvanized roll grooved couplings
k) Shall be protected with Petrolatum tape coating and over wrapped in accordance with AS2419 where located in ground. The pipe length shall not exceed 1.5m in total length in ground. (for risers, only)
l) Pipe marking shall be in accordance with AS 2419.1
m) Pipework to be marked and identified in accordance with AS2419.1 and AS1345. Pipes shall have the manufacturers name, wall thickness and grade and galvanizing specification ink mark in accordance with AS 2419.1

B2.19 Fibre Reinforced Cement Pipe

Fibre reinforced cement pipe and fittings shall:

a) Be manufactured and tested in accordance with AS 4139 Fibre Reinforced Concrete Pipes and fittings
b) Incorporate fittings being fibre reinforced for non-pressure applications and cast iron for pressure applications.
c) Be reinforced with Cellulose fibre.
d) Be jointed in accordance with manufacturer's instructions – with rubber ring joints in accordance with AS 1646. Lubricant for the joints shall be approved by the manufacturer.
e) Installation shall be in accordance with the manufacturers recommendations.
f) Be James Hardie FRC or approved equal

B2.20 Polypropylene Pipes & Fittings

Manufacturer	As Approved by Australian Standards
Material for **Cold** water	All polypropylene pipe & fittings shall be equal to SDR 11, class PN16 to DIN 8078 and DIN 16962, and to AS/NZS 4130.2003 Fittings – PPR / Brass Nickel Coated
Material for **Hot** water	All polypropylene pipe & fittings shall be mechanically stabilized through integrated reinforced fibres. SDR 11 class PN16 to DIN 8078 and DIN 16962 Fittings – PPR / Brass Nickel Coated PPR will NOT be permitted for use in 'Pipe Manifold' for hot water plant. Hot and cold water manifolds shall be manufactured from stainless steel extending for a distance of 1m from the plant before changing material to PPR with the use of approved flange joints

All pipework must conform with the following:	a) Be approved by Local Authority. b) Be socket fusion welded or electro fusion jointed in accordance with the manufacturer's instruction or compression type fittings. c) Incorporate fittings of the same manufacture as the pipe used. d) Have Australian Standard's approval.
Installation	Polypropylene systems of mixed manufacturing origin will NOT be accepted. All tradespersons assigned to the project are to be adequately trained by the manufacturer of the PP-R pipe system proposed, prior to commencement of work on site. All PP-R pipework to be installed in accordance with the installation catalogue, to be provided by the manufacturer, and any other written or verbal instructions provided. All pipework to be tested in accordance with the installation catalogue, to be provided by the manufacturer, prior to concealment.
Bracketing	Only a clipping system approved by the manufacturer shall be used for the PP-R pipe system. Spacing to be in accordance with the installation catalogue, to be provided by the manufacturer, and any other written or verbal instructions provided.
Expansion	Allowance for expansion in pipework materials shall be in accordance with the installation catalogue, to be provided by the manufacturer, and any other written or verbal instructions provided.
Insulation	All PP-R pipework, except in walls, shall be provided with insulation as per the insulation clause.

B2.21 Polybutylene

Polybutylene pipes and fittings shall be manufactured in accordance with Australian Standard Specification AS 2642 Parts 1, 2 and 3 and installed in accordance with Australian Standard Specification AS/NZS 3500 Part 1 and Part 4 or any subsequent revision thereof and of class as required by the local governing authority except the minimum acceptable polybutylene pipe used shall be Class 16.

B2.22 Polyethylene

Polyethylene pipes and fittings shall be manufactured in accordance with Australian Standard specification AS 1159 and installed in accordance with Australian Standard specification AS 2033.

B2.23 Jointing materials

Joints are to be cleaned free of any foreign materials, dirt and grease before any attempt is made to complete the joints.

Joints are to be cut true and square, burr and swarf shall be removed and chamfered lightly, ground or filed, around the pipe.

Silver Solder

Silver solder will contain not less than 5% silver. Verification of the silver content shall be given in writing for approval. Care shall be taken not to overheat the joint, and apply the correct flux as recommended by the manufacturer.

Pipe Flange Gaskets

Water Services Flange Gaskets: All flange gaskets in hot and cold water services shall be of SF3300 Aramid Fibre material (asbestos free) and shall be 1.5mm thick rated at 440ºC withstanding pressures of 14 MPa.

Lubricant

Lubricant for lubricating the rubber ring and insertion type gaskets and the outside surfaces of spigot ends of pipes shall be of an approved non-toxic vegetable based type and shall be applied in accordance with the manufacturer's instructions.

Nuts and Bolts

Nuts and bolts will generally conform to the relevant Australian Standard and be heavily galvanised by the not-dip process. Where galvanised iron to cast iron flanges butt, galvanized bolts are to be used. Where brass or brass to cast iron flanges butt and any underground or under water flanges are required, bronze or stainless steel bolts will be used.

Silicone Sealant

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

Solvent-Welding Joint

Polyvinyl Chloride (PVC or UPVC) pipes will be joined 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 185.

B2.24 Alternative pipe materials

In lieu of the pipe material selections as detailed in the previous clause, alternative pipe materials will be considered, provided an application is made to the design consultant team and approved by the principal. Tenders must however price and assume materials as identified in the above clause will be those which are to be used on the project UNO.

B2.25 Cement

Cement shall be 'Portland' cement of approved local manufacture conforming to AS. 3972. The cement shall be supplied and delivered to the site in the manufacturers branded and sealed bags and the Contractor shall arrange for adequate protective cover and storage to prevent deterioration.

Cement in which does not comply with the required standards or has been adversely affected in storage shall be removed from the site.

B2.26 Sand

Sand shall be clean, sharp pit sand, screened if necessary, free from all foreign or organic matter and confirming in cleanliness with all the requirements of AS 1465.

B2.27 Water

Water shall be fresh, clean and free from all impurities and fit for human consumption.

B2.28 Concrete

Concrete shall be minimum 20mpa strength.

B2.29 Galvanising

Galvanising of steel work will be hot-processed to give 0.1mm minimum thickness coating.

Works shall not be galvanised until all work has been completely prefabricated, drilled and all jagged edges, welds, etc. have been ground and buffed off. Galvanised standards are subject to the approval.

B2.30 Flanges

Flanges shall conform to AS2129 and be Table 'E' unless specified otherwise. Use brass flanges for copper tube and galvanised mild steel flanges for galvanised mild steel pipes. Where flanges are used in conjunction with plastic material there must be a stainless-steel backing ring provided at each surface interface with bolt heads or nuts or washers.

B2.31 Reconditioned Valves

Reconditioned and/or second hand valves of any type shall not be permitted for installation.

B2.32 Fittings – General

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:

Safety valves generally (including relief valves): To AS 1271.

Pressure and temperature relief valves for storage water heaters: To AS 1357.

Pressure-reducing, pressure-limiting and pressure-ration valves for storage water heaters: To AS 1357.

Non-return devices for water storage heaters: To AS 1357.

Vacuum relief valves for storage water heaters: To AS 1357.

Air release valves: To AS 1271.

Water hammer devices to be 15mm stainless steel. Installed on all cold water supplies to each apartment, retail outlet, etc.

Thermostats and energy regulators generally: To AS/NZS 3161.

Thermostats and over-temperature energy cut-outs for electric water heaters: To AS 1308, adjustable or fixed settings as required.

Water gauges: To AS 1271.

B2.33 Valves

B2.33.1 General

Unless otherwise indicated all valves shall be:

a) Manufactured in Australia.
b) In accordance with the respective Australian Standard as noted.
c) Installed in an accessible position for means of operation and/or removal.
d) Of bronze material for valves up to and including 80 mm diameter.
e) Of screwed pattern with a union fitted to the outlet each side of valves up to and including 50mm diameter.
f) Of non-rising spindle pattern, with clockwise closing.

B2.33.2 Positioning of Valves - Finished Areas & Ducts

The position of Valves shall:

a) Be at a height of approximately 400-mm above floor level adjusted to match the joints, where installed within a finished area.
b) Be at a height of approximately 1500 mm above finished floor level where installed within a duct.
c) Be centrally located within a duct where access is obtained from a small access panel. Valve position shall ensure ease of maintenance and co-ordination with other services.

B2.33.3 Control Valves - (Cold Water Supply)

Unless otherwise indicated control valves shall be:

a) Loose jumper valve type fitted with "O" ring seals to the spindle.
b) Manufactured and tested in conformity with AS 1718 - Water Supply - Copper Alloy Screw-Down Pattern Taps - Specified by Dimensions.
c) Constructed of brass materials.
d) Fitted with unions on each side of the valve for maintenance/removal. Alternatively, one union can be deleted provided an approved screwed joint is substituted.
e) Recessed stop / control valves shall be chromium plated all brass construction, of pattern and finish equal to that specified under Taps and Valves.

B2.33.4 Non-Return Valves

Unless otherwise indicated non-return valves shall be:

a) Manufactured and tested in conformity with AS 1718 - Water Supply - Copper Alloy Screw-Down Pattern Taps - Specified by Dimensions.
b) Horizontal pattern with a gunmetal swing check fitted with limit stop to prevent sticking in the open position. [Have non-water hammer characteristic incorporating spring loaded bronze valve and seat.)
c) Body fitted with screw headed inspection cap.
d) Constructed of brass materials.

B2.33.5 Relief valves to AS 1271.3 & Safety Valves to AS 1271.4

Relief valves and safety valves will be class A to AS1271 of a fail-safe design constructed of bronze in compliance with AS1210. The valve will be suitable for water air or steam with a blow off pressure predetermined by the system safe working pressure range or thermal expansion of water volume to be heated. Relief and safety valves are to be direct acting spring loaded with easing test lever. Valves shall be direct connected to the vessel or system being protected; no valves shall interpose the path of relief water from the connection to the drainage discharge point.

Each valve will be engraved or printed metal labelled identifying the following:

- Manufacturer
- Model type and size
- Pressure and relevant temperature at which the manufacturer intends the valve to be used
- The limiting maximum temperature in degrees Celsius followed by the abbreviation MAX where this is less than the rated temperature.
- Set pressure in kilopascals.

Where system contents of vessels are subjected to cooling and thermal contraction a vacuum breaker device will be provided to prevent implosion collapse.

B2.34 Backflow Prevention

Backflow prevention devices, check valves and atmospheric vacuum breakers will be fitted in accordance with the local water authorities' regulations and Australian Standard AS/NZS 3500 and will comply with the requirements of AS/NZS 2845.1.

Pressure gauges with isolation ball valves will be provided at the inlet and outlet of all backflow prevention devices that require mandatory routine servicing. Where the backflow device serves, buildings undertaking critical processes that prevents water supply shut down, back flow prevention valves are to be duplicated on an equal flow manifold.

Valves are to be equal to "Conbraco" in all cases.

B2.35 Unions

Unions will be three (3) piece brass, bull-nose taper type unions. Unions are to be located on the outlet side of valves in all cases. Brass and nylon Olive type connections will not be used for pipe size 20mm NB and over.

B2.36 Flexible Connections

Flexible connections (braded stainless hoses) shall

- NOT be used in exposed locations
- Shall be minimum required length
- Shall be installed in accordance with manufacturer's instructions
- Be approved by Superintendent before installation
- Shall be by one manufacturer throughout the project.

Should flexible connection be proposed, submit full details, including installation details for approval.

B2.37 Clear outs

Provide and install clear out inspection fittings where required for Testing, Cleaning and sighting and in accordance with the requirements of AS/NZS 3500.

Internal riser from pipeline shall extend vertically to finished floor level and terminate with a brass screw out lid and frame. – Chrome Plated

External- Riser from pipeline shall extend vertically to ground level and terminate with a brass screw out lid and frame. A 100mm wide concrete surround should be installed around the clear out.

B2.38 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.

B2.39 Valve Boxes

B2.39.1 Cast Iron

Provide cast irons 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.

Valve boxes shall be appropriately sized for the application and size of valve installed.

B2.40 Access Pits

House water meters, stop valves, control valves and the like if installed below ground in concrete access pits with removable pit covers. Construct with internal dimensions to give 100mm clear space below and on all sides of the fittings in the pit.

Pits shall be constructed of 20mpa concrete, 100mm thick, reinforced with F82 fabric to AS 1304. Provide pit covers of galvanised mild steel floor plate 5mm thick, with lifting holes, hinged to a galvanised steel angle frame with lugs for casting in.

B3 Sanitary Plumbing and Drainage

B3.1 General

Supply and install all Sanitary Plumbing and Drainage from soil and wastes fixtures to the existing sewer septic system onsite as indicated on the drawings.

Provide all necessary materials, pipes, junctions, bends, offsets, branches, couplings, brackets, cleanouts, floor wastes, testing and sundry equipment required for the installation as indicated on the drawings and to the regulations and requirements of the relevant authority and the satisfaction of the Superintendent

The location of pipelines indicated on the drawings is diagrammatic. 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 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 Superintendent.

B3.2 Sewer Connection

Investigate the condition, ascertain the depth, position and suitability of the existing sewer septic system, prior to the commencement of any works (Pipe laying & excavation) and ensure that the new sewer drainage can gravitate to the proposed connection point. The Superintendent shall be advised immediately should any adjustment be required to execute the work.

No claims for redundant work will be considered due to failure to comply with this requirement.

No pipe laying or excavation shall be undertaken until this has been undertaken.

B3.3 Gradients

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

Unless otherwise indicated on drawings pipelines shall be graded in accordance with AS/NZS 3500.2 and local Authorities requirements.

B3.4 Testing

Provide a hydrostatic test to choke level for a minimum period of 15 minutes and as required by the testing authority and the Superintendent.

B3.5 Locating Floor Wastes, Tundishes, Drainage points

Coordinate the locations of floor wastes, tundishes and drainage points with the architect and with special attention to the maximum lengths of unvented waste pipes in accordance with AS/NZS 3500.2 requirements.

B3.6 Floor Waste Gullies

Floor waste gullies shall be DWV grade uPVC with push in grates as scheduled.

Provide and install puddle flanges to floor waste gully risers.

All floor waste gullies shall be installed in a manner that facilities total effective drainage of the floor area intended or required to drain into the floor waste gully.

All floor waste gullies not receiving fixture discharge shall be charged through 6mm copper charge pipe from adjacent flush pipe or through tundish from adjacent tap assembly breach.

Provide and install floor waste gullies in the positions indicated on the drawings and as required to complete the work to the satisfaction of the Architect.

B3.7 Reflux Valve

Provide reflux valves for sanitary drainage. Manufactured and tested to AS 3718 and AS 3578.

Install within an access pit where positioned underground.

B3.8 Expansion Joints

Expansion joints should be installed in accordance with AS/NZS 3500 and for UPVC in accordance with AS 2032 – Code of practice for installation of UPVC pipe systems.

Supply and install approved expansion joints to all soil, and wastes where required.

B3.9 Inspection Openings, Clear Outs and Grates

Install inspection openings in accessible locations so that each section of pipework can be cleaned. Inspection opening sizes shall be in accordance with the authority's requirements.

Note: All Clean Outs finished internally shall be Chrome plated brass.

External Clear outs shall be installed in a Cast Iron Valve Box and be rated for vehicular traffic.

B3.10 Traps

Traps shall be of 'P' or 'S' type.
All concealed traps (i.e. traps located in cupboards) shall be UPVC
Exposed traps shall be chrome plated "Bottle" type to basins and "P & S" to other fixtures such as Cleaners Sinks.

B3.11 Vents

All vent pipes shall be of UPVC SWV class unless otherwise specified on drawings.

Provide and install all vents of sizes shown on drawings, complete with all bends, junctions and reducers.

Provide vent offsets where necessary. Vent pipes shall terminate 3metres from extract fans or openings into the building and 5metres from intake fans.

Provide expansion joints and appropriate anchors to all continuous vent risers, in accordance with requirements of the Water Corporation.

Vents shall be concealed within walls and/or risers. Where located external in plant/bin store areas, vents shall be fixed to wall with 'stand-off' brackets.

Where any vent pipes are installed in external cavity walls an "Alcor" or similar approved flashing material shall be provided to prevent moisture bridging the cavity.

Vent pipes shall be extended to 150mm above metal deck roofs and be fitted with "Dektite" or approved equal formed rubber flashing secured and sealed to roof in accordance with manufacturer's instructions to ensure a neat and water tight installation. Allow to paint flashings to match roof colour.

B3.12 Air Admittance Valves

Shall comply with AS/NZS 4936, and be similar and or equal to that manufactured by "Studor". Selection of valve shall be sized to comply with AS/NZS 3500.2.

Where installed in cupboards, ceilings and wall cavities, ventilation grills shall be provided with opening for the minimum free air flow to AS/NZS 3500.2. **Labelling shall be provided above grill stating 'Grill forms part of the sanitary drainage system – do not remove or plaster over.**

B3.13 Condensate Drains

All condensate drains installed above ground to be fully insulated with "Thermotec" insulation to the first point of connection to the drainage system.

B3.14 Pipework Cast in Slab

All pipework cast in slabs shall be wrapped/protected in accordance with AS/NZS 3500 and Authority requirements.

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

With the exception of cast iron, penetrations built 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.

B4 Cold Water Services

B4.1 General

Supply and install all cold water pipes from the existing Authorities water main to all fixtures, fittings and taps requiring cold water. Include for all pipework, bends, offsets, brackets, taps and sundry equipment required for the installation.

Pipe materials shall be in accordance with AS/NZS3500.1 as scheduled on the drawings.

B4.2 Domestic cold water service

Arrange for a new Water Corporation approved backflow prevention device to be installed upon the existing water meter and reticulate to the sanitary fixtures as documented on the drawings.

Extend Rehau branches downstream of zone/wet area isolation valves and connect to all sanitary fixtures, fittings and outlets requiring cold water all as indicated on the drawings and as required to complete the work to the satisfaction of the Water Corporation/Plumbers Licensing Board and the Superintendent.

All (exposed & concealed) hot and cold water connection points under fixtures to be either spuds or all thread with chrome plated wall plate.

Install pipework in straight lines and uniform grades. Provide bends and sets as required and sufficient unions, flanges and isolating valves for satisfactory removal of piping and fittings for maintenance. Arrange and support pipework as necessary so that it remains free from vibration whilst permitting necessary movements such as thermal expansion and contraction. Provide the fittings and components connected and ready for testing and 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. All sanitary fixtures and appliances other than showers will be fitted with a chrome plate terminal isolation valves and flexible coupling to the fixture served.

Use bends where practicable in preference to elbows. Use elbows where pipes are lead up or along walls and then through to fixtures. Plastic pipe systems will use metal bend formers in all cases.

Fit joints tightly, seal and make leak proof, with no internal projections, burrs or obstructions.

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, plantrooms, 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.

B4.3 Authority connection & backflow prevention device

Provide and install at the water meter backflow protection device equal to ‘Conbraco,’ designed for domestic cold water service complete with all necessary signage in accordance with AS/NZS 3500. Subject all valves to test procedures as required by the Water Corporation. Submit all required certification and test results to the Water Corporation on completion. These certificates shall also appear in the maintenance manual.

B4.4 Sub-meters

Provide and install sub-meters as indicated and scheduled on the drawings. Water sub-meters shall be equal to ‘Actaris’ and approved for use by the Water Corporation.

All sub-meters shall be provided with voltage free reed switch, for wiring back to common indicator panel provided by other nominated contractor.

B4.5 Valves (in-line)

To pipelines supplying cold water to each group/zone of fixtures, supply and install valves for shutting down the system for isolation and maintenance purposes.

Locate valves behind access panels, within accessible ducts or as indicated on the drawings.

All valves shall be tagged and clearly indicate what areas they serve. Valve location and function shall be referenced in the Operating Manuals.

Valves to be compliant with the services and in accordance with the relevant standards.

B4.6 Cross-Link Polyethylene (PE-X)

PE-X piping equal to 'Rehau' shall be used for all water rough-in. Rough-in piping shown in concrete slabs must be installed in retractable sleeving as per manufacturer's instructions.

B4.7 Connection to Fixtures

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

Provide Mini Stop Valves and Stainless Steel Braided flexes to all water connections located within joinery cupboards.

Exposed basin, cistern connections shall be chrome plated annealed copper tube. Bends and off-sets required in connections shall be bent using a mechanical tube bending tool.

B4.8 Testing

Provide a water pressure test of 1500kPa for a period of two hours.

Disconnect any equipment connected to the service not rated to the test pressure, before testing commences.

B4.9 Taps

Unless otherwise indicated, taps shall be Australian made of brass construction.

All taps, connections and cover plates shall be bright chromium plated finish.

Taps shall be fitted with anti-splash nozzles, except for hose taps and/or where otherwise specified.

Hose Taps shall be Chrome Plated and incorporate: Loose Jumper Valve incorporating neoprene washer and Vacuum breakers. Hose taps shall be provided in each toilet area for cleaning purposes whether shown on the drawings or not.

B4.10 Mini Stop Valves

At each wall connection for both hot and cold water to all basin and sink mixers, supply and install chrome plated 15 mm right angled, chrome plated mini stop valves.

B4.11 Sizing

The internal cold water system shall be sized in accordance with AS/NZS 3500.1 for a maximum flow velocity of 1.5m/s.

B4.12 Water Hammer

Water hammer shall be eliminated by suitable approved devices inserted in the water supply pipework, should it prove impossible to eliminate the problem by water supply pipework modification, and at the Contractors expense. Any pipework subject to water hammer shall be fitted with adequate anchors, and bends in the pipework and shall be arranged clear of brackets to avoid stress points. Where pipework is installed within buildings the maximum water velocity shall be 1.5m/sec.

B5 Hot Water Services

B5.1 General

Allow to supply and install all hot water units as nominated on the drawings, coordinate all locations with all other services prior to carrying out works.

Supply and install the hot water service. Include for all piping, fittings, supports, insulation, valves and other sundry items of equipment required for the installation.

All pipes shall be as per B5 Cold Water Services, fully insulated as per AS/NZS 3500.4.

Domestic hot water service in cavity near Hot Water Units (HWU) shall be Type A copper tube with matching fittings.

Extend Rehau branches downstream of zone/wet area isolation valves and connect to all fixtures, fittings and outlets requiring hot water all as indicated on the hydraulic drawings, specified or as required in order to complete the work to the satisfaction of the Plumbing Licensing Board and the Superintendent.

All hot water pipe work shall be installed in a manner that eliminates water hammer from the system. All branches shall be installed in a manner that ensures damage to pipe work will not occur due to movement.

All hot water pipes shall have 50mm minimum clearance from cold water pipes throughout.

All hot water pipework shall be installed in a manner that ensures damage to pipework will not occur due to movement.

All (exposed & concealed) hot and cold water connection points under fixtures to be either spuds or all thread with chrome plated wall plate.

B5.2 Temperature Settings

Temperature settings shall be as follows:

- Kitchen sinks/cleaners sinks etc. 60 degrees C (to AS/NZS 3500.4)
- Disabled amenities/Toilets & Showers 45 degrees C

B5.3 Testing

Provide a water pressure test of 1500kPa for a period of 30 minutes.

Disconnect any equipment connected to the service not rated to the test pressure, before testing commences.

B5.4 Connection to Fixtures

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

Exposed basin connections to be chrome plated copper.

B5.5 Control Valves

Supply and install control valves to each group of fixtures. Locate behind access panels or within accessible ducts.

B5.6 Cross-Link Polyethylene (PE-X)

PE-X piping equal to ‘Rehau’ shall be used for all water rough-in. Rough-in piping shown in concrete slabs must be installed in retractable sleeving as per manufacturer’s instructions.

B5.7 Expansion and Contraction

Make adequate provision for expansion and contraction. 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.

Hot water supply pipes shall be installed with appropriate allowance for expansion and contraction as per AS/NZS 3500.4.

B5.8 Cold Water Expansion Valve

Supply and install on all inlets to the hot water heaters a cold water expansion valve, the valve shall be in accordance with the heater manufacturer's instructions.

Extend 20mm copper drain to adjacent tundish.

The valve shall be as per the manufacturer's specification.

B5.9 Copper Safe Tray

Supply and install a copper safe tray 1.0mm thick for the hot water heater.
The safe tray shall be the same size as the heater cupboard minus 10mm all around for clearance. Grade tray to its outlet. Installation shall be in accordance with AS/NZS 3500 requirements. All exposed metal edges of safe tray to be folded minimum 10mm.

Provide approved PE water heater support between tray and water heater.

B5.10 Insulation

Insulate all hot water pipework and branches with "Thermotec 4Zero" 20mm thick preformed flexible insulation with all butt joints glued with proprietary adhesive.
Insulation shall be installed over piping before installation and shall not be cut longitudinally.

B5.11 Hot water units

Provide and install in location indicated on the drawings, hot water units shall be installed in accordance with manufactures instruction.

Supply and install hot water units as scheduled on the drawings.

B5.12 Thermostatic mixing valves

Supply and install thermostatic mixing valves to the positions indicated on the drawings. Each TMV shall be complete with ball valves, strainers and unions on both the hot and cold water inlets to each valve. TMV's to be equal to "Enware Aquablend 1500". TMV will be manufactured to AS 4032 are to fully comply with AS/NZS 3500.

B5.13 Tempering valves

Supply and install tempering valves to the positions indicated on the drawings. Tempering valves to be equal to RMC heat guard valve and set at 50degrees. Tempering valves to comply with AS/NZS 3500.

B5.14 Signage

In accordance with the WA Code of Practice and AS/NZS 3500.4 Heated Water where hot water is being delivered to an outlet used for personal hygiene the water shall not exceeds 50°C for situations other than aged care, childhood centers, primary and secondary schools and nursing homes or similar institutions.

B6 Gas Service

B6.1 Pipework Generally

Supply and Install a Gas Service from the gas bottles as indicated on the drawings.

Include for all pipework, bends, offsets, brackets, valves and sundry equipment required for the installation.

All Gas installations shall be in accordance with AS/NZS 5601.1.2013

B6.2 Pipework Material

The supply pipe material shall be Copper Tube to AS 1432 Type B in accordance with AS/NZS 5601.1.2013.

B6.3 Valves

Provide valves to individual branches adjacent to the flow meters and at the end of each branch line.

Valves shall be Full Flow Ball valves approved by AGA.

B6.4 Purging

Plumbing Contractor is to allow for purging of pipework in accordance with AS/NZS 5601.1.2013 regulations and in the presence of the Superintendent's Representative and gas supplier's inspector.

Gas system to be left 'charged' and ready for use.

B6.5 Testing

Provide an air pressure test in accordance with AS/NZS 5601.1.2013

Disconnect any equipment connected to the service not rated to the test pressure before testing commences.

B6.6 Labelling

Label gas service every 6 metres, on every level of the building, in all ducts and in accordance with AS/NZS 5601.1.2013.

Label shall indicate gas type and pressure in kPa - e.g.: Natural Gas pressure ..... kPa.

B6.7 Insulator

Supply and fix approved insulators if required by the Authority.

B6.8 OPSO Regulator

IF an OPSO regulator is required on the project it needs to be vented in accordance with AS/NZS 5601.1.2013

B7 Stormwater Drainage

B7.1 General

Provide new down pipes from new roof and associated box gutters. Rainwater pipework to discharge over rainwater sumps. Rainwater sumps to be connected to new in ground rainwater pipework. Pipework to run in ground to designated connection point as documented on the drawings.

B7.2 Design Criteria

The rainwater collection system shall be based on the Council's storm water policy and AS/NZS 3500.3.

Design intensities will be as follows:

- One in 100 years' event for Box gutters at a 5-minute duration
- One in 20 years' event for Eaves gutters at a 5-minute duration

B7.3 Sumps

Provide and install precast concrete Galvin Concrete rainwater sumps or approved equal with screw down plastic grate and 100mm outlet as scheduled on the hydraulic drawings.

B8 Sanitary fixtures & Tapware

B8.1 Sanitary fixtures

The fixtures shall be the best quality available and shall include all trim, traps, wastes, water connections and fixings required to make them complete and usable for the purposes required.

Refer to architectural drawings and details for specific fixing locations and heights of fixtures and for all fixture dimensions.

All exposed parts, such as clips and brackets shall be chromium plated and/or white P.V.C. coated and fixing mediums shall be a non-ferrous metal.

Flush pipes from induct cisterns shall be copper and chrome plated where exposed outside duct complete with chrome plated cover plate at wall.

Plug and washers to fixtures shall be chrome plated brass.

B8.2 Tapware & Valves

Shut off shall be fitted by screwing to a tube bush welded to the pipe on the inlet side and to a flared union on the outlet side.

Isolating valves for use with water services shall be high pressure stop cocks for 15 and 20 valves. 25 and 32 valves shall be ‘John Fig. 50’ screwed bronze gate valves.

Check valves shall be ‘John Fig. 4B’ bronze swing type with screwed ends up to and including 32 diameter.

Concealed assemblies shall be of the same manufacture as the taps and valves.

B8.3 Accessible Toilet & Basin

The accessible toilet & basin shall be installed in accordance with all dimensions to AS 1428 - Design Access and Mobility, Part 1 and Part 2

Refer to the Architects schedule for sanitary fixtures, tapware and appliances

Note: All grab rails specified by architect and supplied and installed by builder and fixed to wall in accordance with AS 1428

B8.4 Schedule

Supply and install all sanitary fixtures and tapware as scheduled by the architect.

2m either side or 3m above.

PART C TENDER SCHEDULES

B9 Tender Submission

This Tender is for the Supply, Delivery, Installation, Testing, Commissioning and Maintenance of Hydraulics Services for the proposed development at Kondinin CRC

I/We _____

Of _____
(Company)

Hereby tender for the supply, delivery, installation, testing, commissioning and maintenance of all work exactly in accordance with the current regulations having jurisdiction over this project and as per Alphazeta Group Pty Limited Drawings and Specification.

LUMP SUM TENDER PRICE FIXED FOR:-

_____
(In Words)

$ _____

Signature: _____

Dated: _____

Witness Name: _____

Signature: _____

B10 Schedule of Prices for Hydraulic Services

The following items listed below are for the supply, installation, testing, commissioning and maintenance in accordance with the current regulations having jurisdiction over this project and as per Alphazeta Group Pty Limited Drawings and Specification.

Description	Fixed Lump Sum Tender
Preparation of Workshop drawings	$
Authority applications and connections	$
Decommission and remove existing sewer services	$
Decommission and remove existing water services	$
Locate, identify and remove unidentified services nominated	$
Locate, identify and inspect existing septic tank and system	$
Common Services Trenching, Backfill and Compaction	$
Sanitary Drainage	$
Stormwater Services	$
Supply and install Sewer service	$
Cold Water Service	$
Hot Water Service (inclusive of hot water units)	$
Gas Service	$
Supply and install sanitary fixtures & Tapware	$
Testing and Commissioning	$
Fees and Charges (Including PLB, Water Corporation, Training, etc.)	$
As built drawings & Operation and Maintenance Manuals	$
12 months Maintenance Service	$
Sub-total	**$**
10% GST:	**$**
TOTAL:	**$**

B11 Tender Form – Schedule of Rates

The following rates will be used to price approved variations and shall include all costs, profit and GST associated with the design, supply, installation, testing and commissioning, and defects liability associated with such works. The rates shall allow for all materials, workshop drawing alterations, labour, tools, painting, appliances etc.

Should the Tenderer require differing rates for variation additions as distinct from variation omissions or reductions or differing rates during the various phases of the construction and defect liability period, then those additional rates shall be provided in addition to the following:

B11.1 Schedule of Unit Rates for Hydraulic Services

Description	Rate	Unit
15mm Type 'B' copper tube fixed generally within building	$	metre
20mm Type 'B' copper tube fixed generally within building	$	metre
25mm Type 'B' copper tube fixed generally within building	$	metre
32mm Type 'B' copper tube fixed generally within building	$	metre
40 mm Type 'B' copper tube fixed generally within building	$	metre
50mm Type 'B' copper tube fixed generally within building	$	metre
65mm Type 'B' copper tube	$	metre
100mm Type 'B' copper tube	$	metre
150mm Type 'B' copper tube	$	metre
15mm x 20mm Thermal Insulation	$	metre
20mm x 20mm Thermal Insulation	$	metre
25mm x 20mm Thermal Insulation	$	metre
40mm x 20mm Thermal Insulation	$	metre
20mm OD Plastic installed (15NB) SDR11 PE 100 PN16	$	metre
25mm OD Plastic installed (20NB) SDR11 PE 100 PN16	$	metre
32mm OD Plastic installed (25NB) SDR11 PE 100 PN16	$	metre
40mm OD Plastic installed (40NB) SDR11 PE 100 PN16	$	metre
50mm OD Plastic installed (50NB) SDR11 PE 100 PN16	$	metre
40mm uPVC 'DWV'	$	metre
50mm uPVC 'DWV'	$	metre
65mm uPVC 'DWV'	$	metre
80mm uPVC 'DWV'	$	metre
100mm uPVC 'DWV'	$	metre
150mm uPVC 'DWV'	$	metre
110mm HDPE	$	metre
15mm Stop Valve	$	unit

20mm Stop Valve	$	unit
25mm Stop Valve	$	unit
40mm Stop Valve	$	unit

B11.2 Schedule of Unit Labour Rates for Site Work

Trade	Normal Time $ per Hour	Out of Hours $ per Hour
Foreman	$	$
Licensed Plumber	$	$
Apprentice	$	$

The above rates should not include site allowances, travel time or other special allowances. The rates should reflect the cost of labour which is employed full-time on the site.

B12 Alternative Submissions for Hydraulic Services

Alternative Submissions

List alternative submissions below, together with the individual price adjustment to the base lump sum tender price and the individual time adjustment to the time required to complete the contract.

Submit full technical data for each substituted item of equipment.

Alternative Item	Adjustment to fixed Lump Sum Tender (+) or (-) $	Time Adjustment (+) or (-) Days
1.		
2.		
3.		