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	Project Number	210067

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ENGINEERING SPECIFICATION FOR HYDRAULIC SERVICES

RAIR KINGSCLIFF

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JHA CONSULTING ENGINEERS

LEVEL 23

101 MILLER STREET

NORTH SYDNEY NSW 2060

PH: (02) 9437 1000



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SECTION 1 - GENERAL CAUSES

1.1 COMPLIANCE

The Head Contract GENERAL CONDITIONS OF CONTRACT and GENERAL CLAUSES of the main specification shall apply to this specification as though herein written in full.

1.2 EXTENT OF WORK

The work under this section covers the complete supply, installation and testing of the following:

1. General Clauses
2. Drainage Systems
3. Sanitary Plumbing
4. Cold Water Service
5. Hot Water Service
6. Fire Extinguishers
7. Sanitary Fixtures, Taps and Outlets
8. Fire Hose Reels

1.3 SERVICE DRAWINGS

The accompanying drawings indicate the general layout of the plumbing work and are diagrammatic only. The Contractor shall allow for all necessary diversions and minor adjustments to pipework and equipment as may be necessary to complete the works.

1.4 REGULATIONS & AUTHORITIES

The whole of the work shall be carried out by or under the full supervision of a licensed plumber and licensed drainer in accordance with the drawings, specifications and to the satisfaction of the Local Inspector, Project Manager and any other Authority having jurisdiction over the work including:

1. Tweed Shire Council
2. Fire & Rescue NSW
3. National Construction Code (NCC), Formerly Building Code of Australia
4. Jemena
5. Electricity Authority
6. SAA Wiring Rules
7. NSW Fair Trading
8. SafeWork NSW

The Contractor must obtain certificates from the Authorities indicating satisfactory completion of the services.

1.5 WARRANTY

All plant, equipment and materials supplied under this Contract must be covered by a minimum twelve (12) months warranty against faulty manufacture, workmanship and/or materials. The Contractor shall be responsible for the design, rectification and/or replacement of any portion of the installations.

The warranty period shall commence as from the date of occupation or replacement, as applicable but extension of the period shall be made in respect of replaced portions only. This warranty shall be in addition to any manufacturer's warranty supplied with plant equipment or materials.

1.6 DEFECTS LIABILITY

Rectify all defects in the work due to faulty materials and/or workmanship for twelve (12) month period commencing from the date of occupation. Such defects shall be made good immediately on receipt of advice of defect.

Any defects discovered during the twelve (12) month period which are due to default, negligence, performance of the obligations shall extend the period to enable such defects to be made good and to allow the whole work after being made good in every way to be proved satisfactory.

1.7 ROUTINE MAINTENANCE REQUIREMENT DURING THE TWELVE MONTH DEFECTS AND LIABILITY PERIOD

The hydraulic trade shall undertake inspection services and carry out maintenance as scheduled below during the twelve month defects and liability period.

System Component	Task	Timing
Pumps	Activate each pump to start in correct order	3 months
Pumps Electrical Control Panels	Check that all controls are functioning in accordance with design requirements. Check with owner or building manager regarding operation of panel indicator lights. Correct, repair any non-functioning control or indicator lights.	3 months
Water level Sensors, Pressure Switches and System Shut Down Valves	Check that all sensors and switches activate the correct mechanism	3 months
Mains Pressure Hot Water Heaters	Activate temperature and pressure relief valve and ensure valve reseats	3 months
Thermostatic Mixing Valves	Remove and clean strainers on cold and hot pipe sides. Check warm water temperature	3 months
Hydraulic Services Pipes and Valves	Inspect for leaks	3 months
Urinal Automatic Flushing	Check that sensor automatically activates solenoid valve within acceptable time period	3 months
Tapware	Inspect for water drips when tap in closed position	3 months
Reduced Pressure Zone Devices (RPZD)	Remove and clean strainer on inlet side	3 months

1.8 FEES AND APPROVALS

The Contractor must pay all fees to Authorities for connection, approvals, testing and inspections, required for this project.

1.9 SITE CONDITIONS

The Contractor is obligated to inspect the site and satisfy himself as to the conditions under which the work will be carried out.

1.10 CERTIFICATE OF COMPLIANCE

Provide to the Authority and the Project Manager a Certificate of Compliance clearly noting the completion of all plumbing and drainage works. A Certificate of Compliance shall also be issued in relation to the Natural Gas Services to the Authority and the Project Manager.

1.11 TRAINING OF MAINTENANCE STAFF

Upon completion of the project or hand over of separable portion as directed, allow for full and comprehensive training of the Client's Maintenance staff in all aspects of the Hydraulic Services Operations. Training shall include a step by step guide through the As Installed Drawings and the

Operating and Maintenance Instruction Manual with on-site inspection, operation and demonstration of plant and equipment for all items indicated in the As Built drawings and Operation Manual.

1.12 WORK BY OTHER TRADES

The following schedule is issued as a guide to work associated with the hydraulic services works.

Builder & Carpenter

1. Ducts, access panels and inspection panels.
2. Roof gutters.
3. All access panels to ceiling space.
4. Supply and Installation of sink benches.
5. Grading of shower recesses.
6. Supply and installation of vanity basin benches.
7. Concrete work for grated drains.
8. Datum and grid line set outs at floor level and for external set-out.
9. Bench and cupboard units with suitable openings for the installation of sinks and basins.
10. Waterproof membrane to walls and floors.
11. Forming of trench drains (supply and fixing of grating, checking set-out overview of concrete placement and levelling of falls by Hydraulic Trade).
12. Removal and replacement of bitumen and concrete road surfaces and concrete pathways where pipes are to be installed.
13. Laundry, Kitchen and Serveries stainless steel sanitary fixtures, Tapware and water outlets.
14. Installation of steel purlins above roof to support solar absorber panels.

Electrical

Electrical supply to all equipment requiring power, to control panels & direct to equipment where required including:

1. Sewage pumps.
2. Hot water return pumps.
3. Isolating switch for hot water circulating pumps.
4. Electric wiring to Hot Water Units.
5. GPO for washing machines.
6. GPO boiling water and chilled water units.
7. Electrical Wiring into Control panels for sump pumps.

Roofer

1. Provision and fixing of all roof flashings where vent, flue or other pipes/services pass through roof covering.
2. Hanging straight and hanging stepped roof flashings.
3. All eaves gutters.
4. All external rainwater down pipes.

Mechanical Services

1. Extension of condensate drainage from AC equipment and plant to tundishes, floor wastes and pipe turn-ups (including seal by Mechanical Contractor) provided in the Hydraulics work.

1.13 ACOUSTIC TREATMENT

Provide acoustic treatment / insulation to all pipework, plant, equipment and associated fixings and in accordance with the Acoustic Engineer's report/requirements, Architect's requirements, National Construction Code of Australia and Authorities requirements. Insulation shall be complete with continuous vapour barrier over wrap.

1.14 ELECTRICAL WORK

All electrical work to be installed under this contract shall be carried out by a licensed electrician and in accordance with the electrical requirements for this project, the S.A.A. Wiring Rules and the requirements of the local supply Authority.

1.15 CO-ORDINATION

The Contractor must co-ordinate his work with other trades and the construction programme and follow-up all other trades as fast as the works proceed.

1.16 WORK AS EXECUTED DRAWINGS

The Contractor shall deliver to the Project Manager before application for Notice of Practical Completion for checking one copy of the work as executed drawings, accurately indicating the invert depths and installed position of all services, fixtures, fittings, valves, including diagrammatic, details drawings and maintenance manuals.

Any necessary corrections will be made and a further copy of the work as executed drawings submitted to the Project Manager for checking.

Once all necessary corrections required by the Project Manager are made to the drawings, three (3) copies of the drawings and 1 CD in CAD Format and the maintenance manuals shall be issued to the Project Manager.

1.17 MAKING GOOD

The Contractor shall be responsible for and shall make good to all surfaces and any other works that may be disturbed or injured by cartage, work generally or other operations. The reinstatement shall be at least as good a state of repair as before commencement.

1.18 DAMAGE TO SERVICES

Before work commences, check the location of all services, immediately notify the Superintendent and the Officer of the relevant Authority in charge of the area in the event of damage to any water, gas, electric, drainage, sewerage, telephone, fire alarm, control cable, optic fibre or other services in the area. Render any assistance required in connection with any such incident, but otherwise work in that vicinity shall be stopped immediately and not recommence until instructed by the Superintendent.

1.19 PROTECTION

Provide all apparatus, equipment in connection with the work. Special care shall be taken to protect all parts thereof in such a manner as may be necessary or as directed. This protection shall include covers, crating, sheds, stores, or other means to protect the apparatus, equipment and materials from the weather and to prevent dirt, grit, plaster or other foreign substances from entering the working parts of machinery or equipment.

Keep all open ends of pipes, ducts and flues closed while in storage or during course of installation.

1.20 CORE HOLES AND SLEEVES

The Contractor shall set out all core holes and sleeves in floors, walls, beams and columns in conjunction with the fixing of formwork and/or placing of concrete.

Protect all parts of the building and the work of other trades from damage which may be caused by the Contractor's workmen or Contractors. Make good any damage.

1.21 DIMENSIONS

The Contractor shall be responsible for taking all dimensions on site. The dimensions must be checked before work is commenced all levels and dimensions of existing services must be confirmed before

commencing work. The invert levels shown on the drawings are recommended only, and must be checked on site before excavation or installation of pipework to ensure connection to supply sources are correct.

1.22 FIXING AND SUPPORTING OF PIPES

Service pipes shall be positioned in approved locations before installation or fabrication of pipework commences.

Pipes shall be adequately supported and secured to adjacent walls and slabs.

Pipework shall not come into contact with any other service pipes or part of the building structure, except pipes in wall chases.

Pipework shall not be either permanently or temporarily fixed in position by the use of nails.

Should leaking pipework occur due to electrolytic corrosion between the pipework and the nails, then the contractor shall be responsible for all costs associated with the repair including pipework, walls, finishes, etc. whenever the leaks may occur.

1.23 CHASING OF PIPES

All chasing in masonry walls for pipework shall be carried out by the Contractor with a mechanical saw. All proposed wall chases shall be approved by the structural engineer before chasing proceeds. Generally avoid horizontal wall chases.

Note: All chased pipework shall be lagged.

1.24 WATER HAMMER

Before concealing of any water service pipework the Contractor shall carry out an operational test for water hammer.

Should there be any evidence of water hammer within the water services, the contractor will be required to remedy the problems at his own cost. Should any pipework be concealed prior to testing, and water hammer exist, then the Contractor will be required to remedy the problems and make good all surfaces, structure, fittings and fixtures.

1.25 PENETRATIONS AND SLEEVES

Set out all work and be responsible for accurate positioning and installation of all penetrations, core holes, water stop flanges and sleeves in conjunction with the fixing of form work and/or placing of concrete, brickwork and concrete cutting or core drilling.

To prevent weakening of the building structure, all penetrations shall be approved by the Structural Engineer through the Superintendent.

Generally all major penetrations in pipe ducts and shafts shall be purpose made to the required size and accurately positioned and supported. All others shall be core hole "Slabseal" plastic water stop assemblies accurately positioned and symmetrically provided for all pipes passing through floors.

Water stop flanges shall be provided to all pipes, plantroom sumps, roof outlets, floor wastes and pipes passing through floors and walls including basement perimeter walls, or wherever the possibility exists for water leakage. Each water stop flange shall be of the same material as the pipe served with an external diameter twice the diameter of the pipe. The flange shall be integral to the casting or welded, brazed, silver soldered or sealed as applicable.

Sleeves shall be fitted to all pipes passing through walls, floors and beams. Sleeves shall be 25mm diameter larger than the outside diameter of the pipe being served and project 50mm above finished floor level in ducts and 10mm from walls. The space between pipes and sleeves shall be caulked and sealed with an approved fire rated material.

All penetrations shall be fire rated to an equivalent rating of floor or wall. Ensure all required fire and acoustic ratings are achieved with the selected installation method.

1.26 CERTIFICATE OF FIRE STOPPING

At the conclusion of the work, provide a written guarantee that all fire stopping of penetrations have been carried out in accordance with the manufacturer's directions, and do not impair the fire resistance performance of the building element in which it is installed.

The written guarantee shall include a schedule of all penetrations through fire rated structures nominating the location, vertical or horizontal penetration, size and method of achieving fire rating.

1.27 FIXTURES AND FIXTURE POINTS

The Contractor shall supply and install all materials, backing plates and noggins necessary to make all fixtures and fixture outlet points rigid (i.e. sanitary fixtures and tap fittings).

1.28 EXERCISE CARE OF PUBLIC UTILITIES AND EXISTING SERVICES

Where underground public utility lines, surface drainage works and underground pipes, conduits or cables exist in the vicinity of the works, the Contractor must take care to protect such services. The cost of the necessary repairs or renewals shall be paid for, entirely by the Contractor, should negligence on the Contractors part be proven.

1.29 EXISTING SERVICES

Determine the exact location and position of all existing services on and adjacent to site prior to commencing work.

Allow for the disconnection, alteration, sealing off, connection to or from, extension of or removal of services to maintain supply to existing buildings and fixtures.

Prior to disconnection, sealing off, or modification to any service, a thorough check shall be made on site to ensure no service which is required to be retained is adversely effected.

Provide all temporary pipes, fittings, valves and sundry items necessary to maintain supply to existing buildings.

All shutdowns and connections shall be performed in a way to ensure minimal inconvenience to the existing users.

1.30 REDUNDANT SERVICES

Disconnect and remove redundant services and to the approval of the Authority having jurisdiction.

Report all site modifications, diversions and/or disconnections affecting the work. Provide necessary assistance for the resolution of such difficulties in conjunction with the Project Manager.

Prior to any site modifications, diversions and/or disconnections, provide all temporary pipes, fittings, valves and sundry items necessary to maintain the supply to the building.

1.31 SUPPLY OF MATERIALS

Supply all materials necessary for the work covered by this specification. All materials and finishes which are deemed not in accordance with this specification will be rejected and replaced with materials to comply with the instructions issued by the Project Manager at no extra cost to the Project.

1.32 SAMPLES

When required or specified, submit to the Project Manager identified duplicate samples of any materials or items specified to be used in the works. One each of the approved samples shall be signed by the Project Manager and returned to the Contractor and the other shall be kept on the works in a safe place and available for inspection.

Where due to the nature of materials or item concerned, the above procedure is impractical, make reasonably available an identified sample for the Project Manager's inspection.

1.33 SURVEY

On completion of the works provide "As Built" drawings from a registered surveyor of all pipes installed in-ground including water, gas, sewer, trade waste and stormwater drainage pipe system and certifying pipe sizes, invert levels, location of isolation valves.

Also provide "As Built" plans indicating the routes of all internal pipework including indication of the location of all isolation valves and pieces of plan and equipment.

1.34 DRAWINGS AND DIMENSIONS**Hydraulic Contract Drawings**

Pipe work and levels indicated on drawings are recommended only. Check on site before excavation or installation of pipework to ensure correct cover and fall. Submit proposed alterations to inverts and obtain approval before starting work.

Check dimensions on site before work is put in hand or prefabricated.

The drawings are issued as a guide only and shall be considered to be 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, it shall be deemed to have been included for the larger quantity and/or the more expensive components, as applicable.

Ensure that adequate detailed and dimensioned drawings have been co-ordinated with all other services and have the approval received of the Project Manager before the commencement of any trenches, pipework, fixtures and fittings.

Workshop Drawings

Prepare all necessary co-ordinated manufacturing and installation workshop drawings covering the works. Confirm final installation dimensions by site measurement, to ensure satisfactory set out and coordination with the structure and new or existing services.

All workshop drawings shall be AutoCAD 2012 drafted and submitted on paper print form in quantities as required. Such drawings shall be submitted to the Main Contractor for checking.

Manufacture and/or installation as applicable shall not be commenced prior to the Project Manager's approval of the workshop drawings.

The workshop drawings to be prepared and submitted shall be 1:100 scale for floor plans and 1:50 / 1:20 scale for plantrooms and equipment details and shall include the following:

- a. Manufacturer's drawings of purpose made equipment.
- b. Name, address and telephone number of manufacturer of equipment.
- c. Drawings showing the extent of the work.
- d. Detailed plans and sections showing the services installation including position of control equipment.
- e. Wiring and schematic diagrams of each item of equipment.

Approval of work shop drawings shall be given in principle only without responsibility for the proper co-ordination, installation and operation of the services.

The preparation of workshop drawings shall be scheduled to enable the necessary approvals to be gained and to comply with the program for installation of the services.

Submit three prints of each workshop drawing to the Project Manager and submit to the appropriate Authorities as necessary for their approval.

As-installed Drawings

Prior to practical completion of the Contract works, supply three (3) CAD discs in AutoCAD 2010, in PDF and DWG formats of all drawings and three (3) sets of hard copy prints showing the complete services installation as-installed complete with detailed dimensions of all services and branch lines. The above disks and prints shall be included within the operating and maintenance instructions.

The drawings shall be to the same scale as specified for "Workshop Drawings" and shall record details of the work actually installed and titled "As Installed".

In order to achieve accurate drawings, all relevant information relating to the Contract work shall be entered onto working drawing prints immediately it has been carried out. The information shown on prints and final records shall be actually physically measured from permanent buildings, boundaries or other permanent features. Also refer to specification clause referring to Survey of in-ground piping systems.

1.35 MAINTENANCE MANUAL

Prepare three (3) copies of an instruction manual prior to practical completion which shall include the following sections and information:

- a. A general description of services under all modes of operation.
- b. Locations of all mains connection points.
- c. Emergency procedures.
- d. A fully detailed preventative maintenance procedure and maintenance schedules.
- e. Maintenance information and manufacturer's brochures for all fixtures, valves and items of plant.
- f. Recommended spare parts and contacts for supply.
- g. Locations of all systems controls.
- h. Wiring diagrams of all electrically powered hydraulics equipment.
- i. "As installed" hydraulics drawings clearly identifying pipework and equipment,
- j. Methods for basic fault finding.
- k. Certification of systems by the relevant Authorities and/or installer.
- l. Recommended maintenance procedures and equipment maintenance intervals.
- m. New development drainage sewer plan to 1:500 scale. This is to include existing sewer drainage services on site.

The manuals shall be A4 size and each page of the manual shall be heavy quality paper. The hard cover shall be light plastic material and shall secure each page at a minimum of four (4) points.

The manuals shall be clearly identified as "DRAFT" or "APPROVED" as relevant to the version of the manual.

The "approved" manuals shall be provided to the Project Manager at the completion of works.

1.36 FLUSHING OF PIPELINES

On completion of each section of the work or part thereof and prior to the installation of any valves or appliances, the relevant service pipeline shall be thoroughly flushed out to remove all debris and foreign material. Thoroughly flush out existing services prior to connection.

1.37 EXCAVATION

1. General

Allow for all excavation to be in MATERIALS AS FOUND. A copy of the Geotechnical Report is included in the contract documents for reference. Allow for excavation to required depths in material identified.

2. Precaution 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 of machinery or plant, inefficient timbering, flooding or any other cause whatsoever. Provide, erect and maintain warning signs, temporary fences, barriers and night 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.

Obey all directions given with regard to the provisions of lighting and barriers, and be responsible for any accident or damage. Obtain permission from Authorities, when required, for placement of barricades.

3. Use of Explosives

The use of explosives will NOT be permitted.

4. Trench Excavation

Excavate in the form of trenches to enable various pipe lines to be constructed. Trenches shall be excavated at uniform grades and in straight lines.

Provide adequate de-watering equipment to maintain trenches free of water. Ground water shall be pumped to discharge clear of the excavation area.

No earth, rubbish or materials shall be unnecessarily deposited upon pavements, footways or crossings.

5. Hoisting and Removal of Spoil

Allow to hoist spoil and remove from site.

1.38 SURFACE REINSTATEMENT

Reinstate all surfaces or make good as directed by the Project Manager those surfaces that are damaged or removed as part of the installation works. Reinstatement work shall be carried out so as to match the surrounding surfaces and shall be left in a condition at least equal to that in which it was prior to the installation works, including reinstatement of existing turf.

1.39 BACKFILLING

Prior to any backfilling being placed the drainage lines shall be inspected by the Project Manager and/or representative who, if satisfied, shall indicate that backfilling may proceed.

Placing and Cover - backfilling shall be carefully packed and consolidated by mechanical means.

All trench backfill in trafficable areas shall be consolidated with approved material to 98% standard compaction.

All pipes shall have a minimum cover as per AS3500 requirements, except where a cover of structurally designed reinforced concrete is provided.

1.40 SAW CUTTING OF EXISTING SURFACES

Saw cut existing concrete and bitumen surfaces as required to install new pipelines. Obtain approval of Superintendent prior to commencement of work. Break up and remove spoil from site.

Allow to pay transport and tip costs.

1.41 BRACKETING AND SUPPORTS

- a. Pipes shall be adequately supported and secured in an approved manner.
- b. Pipes shall not be fixed to, supported by, or welded to other pipes.
- c. Pipework must be free to move without causing stresses in the pipework or pipe joints. Where provision has been made for movement in mains, the branch lines shall be unrestrained and in the case of copper tube, annealed for a minimum of 1500 mm from the main. Where this is not achievable, some other approved provision for movement shall be made. Vertical pipes passing through floors shall be supported at maximum 2400mm centres.
- d. Support all pipes with galvanised concrete inserts, galvanized steel channels, galvanized steel pipe clamps, and galvanized steel pipe hangers, etc., in accordance with the manufacturer's instructions and complying with the catalogue regarding spans and loads.
- e. Secure all supports and necessary sanitary fixtures with "Dynabolt" or equal approved metallic anchors.
- f. Power-driven fixings, wooden plugs or screw-ins shall NOT be used.
- g. Fixing and supports shall generally comply with the following:

Pipe Hangers

Hangers for supporting piping shall be of rolled steel sections of minimum dimensions as follows:

Pipe Size	Hanger Dimensions
Up to 65mm	10mm diameter
66mm to 125mm	12mm diameter
126mm to 225mm	16mm diameter
Over 225mm	to Australian Standard

Where vertical pipes are exposed in rooms, they shall be secured at floor and ceiling and shall have at least one intermediate support.

Span of Supports for Pipes

The distance between both horizontal and vertical pipe supports must not exceed the distances nominated in the Australian Standards for the respective service:

1.42 PAINTING AND IDENTIFICATION

Except where otherwise specified or directed all internal exposed piping throughout, adjacent to plumbing fixtures including traps and fittings shall be chromium plated. Where exposed pipes pass through a finished wall, floor or ceiling they shall be fitted with approved chromium plate.

All piping shall be cleaned free of cement droppings, etc. All piping shall be provided with a 450 mm long colour band to the requirements of AS 1345.

Colour bands shall be at a maximum of 3000 mm centres.

Markers shall nominate type of service and direction of pipe flow.

Additional markers are to be installed:

- a. on both sides of wall or partition through which a pipe passes;
- b. adjacent to tees, valves, outlets, pumps and items of plant.
- c. on both legs of a bend;
- d. on both sides of a pipe which can be approached from two or more directions;
- e. on pipes at the inlet and outlet of each piece of plant equipment;
- f. on riser pipes at each floor level.

Valves are to be labelled with a circular plate of Traffolyte material or similar engraved with their respective function and mounted in an approved manner on top of valve spindles with brass ring.

The service colour coding shall be:

Item	Colour (AS 1345)
Soil Wastes & Vent Pipes	Black
Stormwater Drainage Pipes	Dark Admiralty Grey No. 632
Cold Water	Emerald Green No. 220
Hot and Warm Water Flow	Brilliant Green No. 221
Gas Service	Yellow Ochre
Bracketing	To match pipe it is supporting

1.43 CHASES AND ENCASING

All internal walls that are brick shall not be chased unless approval has been requested and approved. Obtain approval of the Structural Engineer through the Project Manager prior to commencement of work.

Common walls separating resident's rooms or wall separating bedrooms from plant and service rooms shall not be chased.

Cut all chases with a mechanical saw. Do not chase reinforced concrete work without approval.

Pipes chased into masonry or encased in concrete shall not cross any movement joint and shall be insulated so that expansion and contraction can take place without damage to the pipe or to the material or surface finish of the surrounding element.

Conduit pipes encased in concrete shall have a minimum cover of 25mm of concrete and shall be in continuous lengths without fittings unless the fittings are permanently accessible.

Refill chased cavities with 2:1 cement mortar mix or approved equal after pipe has been installed.

1.44 COPPER TUBES AND FITTINGS

Copper tubes shall be solid-drawn in accordance with the following standards:-

- a) Water Service Pipes shall be to AS 1432, Type "B"
- b) Soil and Waste Pipes shall be to AS 1432, Type "B"
- c) Vent Pipes shall be to AS 1432, Type "D"
- d) Gas pipes shall be to AS 1432, Type "B"

Fittings shall comply with the respective Australian Standard.

1.45 CROSS LINKED POLYETHYLENE PIPE & FITTINGS

Pipe materials shall be PE-Xa/PE construction, consisting of PE-Xa inner layer and a PE outer marking layer, certified to AS/NZS 2492 for water service applications.

Suitable for use in hot and cold water applications in buildings in accordance with AS/NZS 3500.

Water services pipes - not less than PN 20

Fittings: Brass Dezincification Resistant as to AS 3688.

Joining Method: Compression fittings and sleeves

- Connections shall be axial compression sleeve mechanism
- Self-sealing pipe material – connection without the use of an O-ring
- As per manufacture instructions

Fittings and sleeves shall be REHAU RAUTITAN PX or MX, Watermark approved and certified to AS/NZS 2537.

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

Prohibited Areas: Cross Linked Polyethylene will not be used in areas as specified in AS 3500.

LIMITATION OF PE-X

The following limitation apply for the use of PE-X pipe

- Purpose built brackets/hangers (approved by manufacturer) are only to be used.
- Only to be used for rough-in pipework for hot and cold-water services. I.e. downstream of apartment isolation valves/ meters.
- Not to be used for hot water systems with temperatures in excess of 60 degrees Celsius
- Not to be used where subject to pressure in excess of 600kPa
- Not to be used for pipe sizes in excess of Ø28mm
- Where cast in the slab, the product may be tested in accordance with AS 1530.4 - 2014

ALTERNATE PE-X PRODUCTS

Should the manufacturer wish to submit an alternate PE-X product they are entitled to provided that the alternative meets the following criteria:

- Evidence must be provided that the alternate product has been installed and functioning for a minimum of 10 years within Australia
- Warranties and insurances must be provided demonstrating that the alternate product has financial backing in Australia
- All installers must be certified /trained by the relevant manufacturer.
- All tools must be certified as per the relevant manufacturer's recommendations.
- All tools must be recertified as per relevant manufactures recommendations and log books retained on site for inspection.
- Allowance is to be made to allow manufacturer to undertake site checks of works as works are progress and detailed reports issued for each visit. Frequency of site visits to be dictated by site progress but minimum of 50% of installed works to be inspected.
- Allowance to be made for random sections of pipe and fittings to be taken (before installation) for testing by independent tester, to ensure quality of pipe in accordance with manufactures literature. This must be tested and returned with certified results within 7 days.
- The relevant manufacturer must have a QA procedure in place which provided traceability for:
 - Country of origin
 - Date of manufacture
 - QA sheets for each batch

1.46 POLYETHYLENE SLEEVING FOR PROTECTION OF COPPER PIPELINES

All in-ground copper pipework and fittings shall be protected with polyethylene sleeving. Sleeving to pipes shall comprise polyethylene tube. Polyethylene sheet shall only be permitted as sleeving at fittings and valves, or for the repair of damaged tubing.

1.47 POLYETHYLENE (PE) PIPES AND FITTINGS

PE pipes shall be first quality, conforming to AS 4130.

PE pipes and fittings shall be installed using electro-fusion socket type joints.

1.48 FIRE SEALS

Where pipework penetrates a fire rated element such as floors and walls, allow to provide a fire seal to the required fire resistance rating for the element.

1.49 JOINTING MATERIALS

- a) Silver solder shall contain not less than 5% silver.
- b) Cement shall be Portland cement type "A".
- c) Rubber Ring Gaskets to AS 1693 of approved manufacture.
- d) uPVC pipes shall be jointed by solvent welding of the type recommended by the manufacturer.

1.50 VALVES

All valves used shall be standard marked.

1.51 UNDERGROUND ISOLATION (PATH) VALVES

All valves used shall be standard marked.

Underground valves must be ball type, resilient seated and have a blow-out proof stem equal to Zetco Series 2505. The valve drive must be a 40mm tall square head socket and meet the standard dimensions of 28.5mm square at the top tapering to 31.75mm at the base.

1.52 CAST IRON SURFACE BOXES

Supply and install cast iron surface boxes marked as per service over all underground valves.

Surface boxes shall be surrounded with concrete and shall be provided with a 150 mm diameter uPVC pipe riser extending up from the valve spindle.

1.53 INSULATION MATERIALS FOR IN WALL WATER SERVICE PIPES

Cold, hot and warm water copper pipework where installed within masonry wall, shall be pre-insulated, Kemlag covered, copper tube.

1.54 CONCRETE

Concrete shall be of 20 MPa strength when supplied by a ready-mixed concrete supplier, or site mixed concrete shall be of 4:2:1 mix. Mortar shall be 2:1 cement mix.

1.55 PITS AND SUMPS

Excavate, supply, install and backfill around pre-cast concrete pits and sumps to the dimensions locations as shown on the Hydraulic Service Drawings.

Nylon coated step rungs shall be installed in pits and sumps over one (1) metre deep. Covers, grates and frames shall be as shown and specified. Bench up base to match pipe size.

Where pits and sumps are to be installed within concrete paving or floor slabs they shall be installed complete with starter bars to adequately prevent uplifting of the pit

1.56 COVERS, GRATES AND FRAMES

Unless nominated on drainage covers, grates and frames shall be cast iron with all edges machine fitted and have removable plastic lifting hole plugs.

All grates shall be heel guard with max openings 13mm x 150mm complying with AS 1428.

1.57 BEDDING MATERIALS

After length of trench has been approved the following bedding material shall be placed therein to approval:

- a) PVC Pipes for sewer drainage shall be bedded on a compacted 75 mm thick layer of blue metal (9.5 mm maximum).
- b) PVC Pipes for stormwater drainage shall be bedded on a 75 mm thick layer of blue metal (9.5 mm maximum).
- c) Precast Concrete Pipes shall be bedded on a 150 mm layer of coarse river sand.
- d) Nylon pipes shall be bedded on a 150 mm layer of coarse river sand.
- e) Copper and Polyethylene water pipes shall be bedded on a 150mm layer of coarse river sand.

1.58 OVERLAY MATERIALS

After length of trench has been approved the following overlay material shall be placed therein to approval:

- a) Sewer PVC drainage side support and pipe overlay material shall be equal to the bedding material with a minimum 100mm overlay.
- b) Stormwater PVC drainage side support and pipe overlay material shall be equal to the bedding material with a minimum 100mm overlay

- c) Precast concrete pipes side support and pipe overlay material shall be equal to the bedding material with a minimum 150mm overlay or as per the manufactures' recommendation, whichever is the greater.
- d) Precast concrete pipes side support and pipe overlay material shall be equal to the bedding material with a minimum 150mm overlay or as per the manufacturers' recommendation, whichever is the greater.
- e) Copper and Polyethylene pipes side support and pipe overlay material shall be equal to the bedding material with a minimum 150mm overlay.

1.59 CAPPING OFF PIPELINES

During construction, temporarily seal floor wastes, open ends of pipes and valves to prevent the entry of foreign matter into pipe systems. Provide fitted covers of pressed steel or plastic. Do not use rags, paper or wood plugs.

1.60 TESTING OF PIPE SYSTEMS

All tests set out in the specification or as required by the respective governing Authority shall be carried out to approval. Supply all plugs, apparatus and sundries necessary for the test. Enclosed work shall not be covered or concealed from view until it has been inspected, tested and approved.

On completion, all works shall be tested under normal working conditions, in accordance with the Authority's requirements and as may be further directed to prove compliance with the specified requirements of the works. All defects are to be remedied immediately and the test reapplied until a satisfactory result is obtained.

Sewer Drainage -	Hydrostatic Test
Sanitary Plumbing -	Hydrostatic Test
Stormwater Drainage -	Hydrostatic Test
Water Services -	Hydrostatic Test up to 1500 kPa
Fire Services -	Hydrostatic Test up to 1700 kPa
Natural Gas Service -	Nitrogen Gas Pressure Test as per AS5601.1:2013

All test results shall be recorded and made available at the site office upon request.

1.61 COMMISSIONING OF HYDRAULIC SERVICES

The hydraulic trade shall provide specially trained and skilled personnel to operate each of the hydraulic services installed for this project. Ensure that each system functions to full capacity under simulated hydraulic loads and flow rates. Provide additional valved connections to that indicated on the design drawings in order that testing can be undertaken.

System commissioning must include pressure testing, flow testing, system drain down and automatic and electrical control mechanisms through the full range of control functions.

Undertake thorough commissioning of the following:

1. Pump electrical control panels.
2. Pressure switch and flow switch activation.
3. Reduced pressure zone valves.
4. Thermostatic mixing valves.
5. Hot water circulating pump sets.
6. Sewage pumps sets.
7. Electrical storage water heaters.
8. Oil Water separator inc all associated equipment

SECTION 2 - DRAINAGE SYSTEMS

2.1 EXTENT OF WORK

The work specified in this section comprises the modification, supply, installation and testing of the various drainage systems including all necessary accessories, testing and commissioning of the systems.

The work includes the supply of all necessary fittings, inspection openings, and sundry items including dewatering of the ground. Make any necessary application to the Authorities and pay all fees and charges associated with the installation, testing and supervision of the work.

Sanitary Drainage System - comprises connection and extension from sanitary fixtures and connection to the authority sewer main. Includes removal of existing drainage pipes.

Trade Waste Drainage System – comprises of connection and extension from the vehicular wash bay to a holding tank and coalescing plate oil separator and all associated components

It is noted continuation of downpipes in ground, surface drainage, OSD, etc is documented in the civil package.

2.2 MATERIAL SCHEDULE

Pipes and fittings shall be in materials as follows:-

Service	Size	Material
Sanitary Drainage	65-100	uPVC (DWV). Solvent welded uPVC. Provide SN8 or SN10 uPVC pipe (SEH) where depth exceeds 2m. Exposed waste pipework to be copper and chrome plated.

2.3 P.V.C. PIPES AND FITTINGS

Pipes and fittings shall be uPVC (DWV) sewer quality and shall conform to the Authorities' requirements having jurisdiction and to AS 1260, AS 1462, and AS 2032.

2.4 POLYETHYLENE (HDPE) PIPES AND FITTINGS

HDPE pipe and fittings for gravity sewer or trade waste drainage shall be sewer grade jointed with electro-fusion socket type fittings.

2.5 TUNDISHES

Provide 50 x 40 (unless noted otherwise) chrome plated copper concentric reducers complete with pipe drainage connection to the sewer drainage system.

Tundishes shall be chrome plated complete with screwed outlet and cover dome at wall and floor penetrations.

All tundishes are to be located so they are not subject to mechanical damage.

Tundish locations shall be coordinated with mechanical contractor on site.

2.6 SEWER CONNECTION

Contractor shall allow for all fees to coordinate and install the connection of the private sewer to the council authority service. This may require an Authority Wastewater main extension, including design costs. Refer to hydraulic site plan for connection and further details.

2.7 PIPE SUPPORT BRACKETS TO PIPES UNDER FLOOR

All pipe support brackets where installed in service trenches under the floor of the building shall be 316 grade stainless steel. This includes the hanging rod.

2.8 TRENCHES

Trenches for drains shall be parallel with the design invert of the drains. Additional material below the bottom of the drain shall be excavated as necessary to provide the required bedding conditions.

Trenches shall be excavated to such width as to provide a minimum space of 150mm between the innermost face of the trench and the outside edge of the drain

2.9 PIPE LAYING

General - all drains shall be laid and jointed accurately to lines, grades and levels. All pipes shall be laid so that the underside of pipes have solid bearing throughout their length.

Setting out - all pipes shall be set out and laid so that the intersection of the centreline (in the plan view) occurs at the downstream pit face.

Unless otherwise approved, laying shall commence at the low points of the drainage line and proceed uphill, with the spigot end of the pipe located downstream from the socket end.

Jointing - all pipes fitted with approved rubber joint rings shall be installed to the manufacturer's specifications.

Spacing - the distance between pipes in multiple pipelines shall be at least one third (1 /3) the external diameter of the pipe, or 300mm, whichever is the greater.

2.10 USE OF CONCRETE

Provide 20 MPa concrete not less than 100mm thick with exposed surface cement rendered as follows:-

- a) Around pipes and fittings as required by the regulatory Authority;
- b) Around and under traps and gullies;
- c) Around exposed pipes and fittings;
- d) Under and around bases of inclined junctions and bends.

Where regulation cover cannot be provided over drains, surround pipes with 150mm of 1:2:4 concrete.

2.11 FLOOR WASTES

In positions indicated "FW" provide 100mm "P" trap floor wastes with riser extended to 100mm CP brass drainage grate set at a level to suit floor grading.

Floor wastes (FW) in plant rooms shall be fitted with "Specialty Plumbing Services" manufacture galvanised flat and cast iron body with membrane flange.

2.12 SQUARE TOP. STONE/TILE INSERT FLOOR WASTES

In positions indicated "FW" provide 100mm "P" trap floor wastes with riser extended to stainless steel square top stone/tile insert hinged top floor wastes set at a level to suit floor grading. Square top floor wastes shall be OPIE Manufacturing Group SMC Stainless Mett Manufacture Code FW3 Available Tel: 02 4735 5666.

2.13 VINYL FLOOR WASTES

Provide and install SPS manufacture chrome plated, all bronze model LG100 CPA, Push-in Sheet Vinyl Floor Wastes where floor wastes are in areas with vinyl floors excepting where model SS VFW is required by notation on the drawings.

2.14 BASKET TRAP FLOOR WASTES

Provide and install Opie Group SMC Stainless Trade Waste Floor Sump Code AT-5-HST incorporating three part strainer. Where vinyl floor coverings are to be provided, supply floor sump with vinyl clamp ring. Provide under each floor waste a HDPE 'P' trap and HDPE waste pipe.

2.15 CLEAROUTS

Install 100mm diameter brass or stainless steel clear outs at finished floor level as necessary for rodding maintenance of the drainage lines.

Clear outs shall be chrome plated where located internally.

Where vinyl floor sheeting is laid, provide SPS manufacture, 100mm chrome plated brass, push-in sheet vinyl floor clear out.

Clear outs for sub soil drainage shall consist of uPVC DWV grade sewer socket with thread then screw on loose sewer inspection cap terminated 150mm below finished ground level.

Clearouts located in concrete pavement or brick paver shall be terminated flush with finished levels complete with brass or stainless steel, bolted trap screws.

2.16 CAST IRON REFLUX VALVES

Reflux valves shall be of epoxy coated cast iron material.

Cast iron reflux valves are to be located in a pit with gas tight lid with pit size to comply with AS 3500.

2.17 UPVC REFLUX VALVES

uPVC reflux valve shall have 150mm diameter riser to surface and be finished with a stainless steel bolted trap screw.

2.18 RAFT SLAB SUPPORTS

All sanitary and trade waste drainage pipelines located on unstable ground shall be fully supported on a continuous reinforced concrete raft suspended from structural slab over, or supported on a sub base certified by a qualified engineer, as required, to the Authorities' requirements all in accordance with AS 3500.

2.19 MANHOLES AND STRUCTURES

Manholes and structures shall be steel reinforced concrete, manufacture and constructed in accordance with approved precast systems to the required dimensions, depth and levels complete with approved ductile covers and frames. Alternate in-situ construction shall be complete with minimum 150mm thickness reinforced concrete and subject to approval from a Structural Engineer.

All pits and structures in paved areas shall be furnished with brass edge strips to allow paving to occur within the cover to match the surrounding finishes.

2.20 TRENCH BASE SUPPORT FOR SEWER, GREASE WASTE AND STORMWATER DRAINAGE

As the general area in which sewer and grease waste drainage is to be installed is filled ground and compaction standard is unknown, comply with the requirements of the Australian Standard AS 3500.2. Department of Fair Trading will require compliance with the Standards through their Plumbing and Drainage Inspector.

To avoid a situation arising where uncompacted trench bases are encountered during installation the following procedures shall be followed and costed.

Procedures would be:

1. Excavate trenches to depths indicated on hydraulic drawings.

2. Engage geotechnical engineer to pot hole and take samples at 3 metre intervals along trench bases. Leave trenches open. Risk of trench side cave in and filling with water is with contractor, therefore incorporate procedural work that will prevent or limit this.
3. Geotechnical engineer to confirm whether "as found" trench base will be capable of withstanding mass of pipe and imposed load of trench refill plus drainage pipe. If acceptable, geotechnical engineer to confirm to Contractor to lay drainage and refill trench after inspection by geotechnical engineer.
Geotechnical engineer to issue certificates for each trench, which is to be provided to the Department of Fair Trading Inspector by Contractor.
4. Should the trench base not be acceptable to geotechnical engineer further excavate trench base to require depth and backfill depth with selected road base. Compact road base to required invert level of drainage pipes and then repeat the pot holes and laboratory testing as before.

2.21 DRAINAGE PIPES PASSING THROUGH CONCRETE GROUND BEAMS OR SUSPENDED SLAB BEAMS

Where drainage pipes pass through concrete ground beams and concrete suspended slab beams install the pipes after footing trench is dug then provide and install Bradford white polystyrene sectional pipe insulation (telephone Bradford 02 97351480) over the pipe. Insulation shall be 25 mm thickness and shall be provided in two (2) SEMI CIRCULAR HALVES, insulation shall extend 100 mm past concrete waffle pod beams each side. Tape along joints with 75 mm reinforced tape.

2.22 PIT COVERS AND FRAMES

Covers and frames shall be ductile iron, complete with frames set into rebates to conform with finished levels. Covers and grate shall be of adequate local rating to conform to AS 3996 and generally as follows:

Internal Pedestrian Traffic (no travels) -	Class A
Pedestrian-ways -	Class B
Roadways/ car parks -	Class D
Heavy Duty Forklifts & Earthmoving Equipment -	Class E

Provide brass machined edge trim strips to all pits located within paved and tiled areas.

Covers shall be bolt down type where any back pressure / over flow surcharge may occur or where located subject to vehicular traffic.

The alignment of these pits, with respect to the adjacent walls, finishes and patterns shall be fully coordinated on site prior to any installation proceeding.

2.23 GRATING AND FRAMES FOR SUMPS AND GRATED TRENCHES

Gratings shall be complete with frames and shall be hot dip galvanised steel, each grating and frame shall be set flush with the finished surface levels. Grating sizes and type shall be as indicated on the Hydraulics Services drawings. All gratings shall be push bicycle safe type.

Each grate and or section of grating shall be bolted down. All heel grates shall be heel guard type with max openings 13mm x 150mm complying with AS 1428.

2.24 COALESCING PLATE INTERCEPTOR AND ASSOCIATED EQUIPMENT

Supply and install Fox Environmental waste water treatment plant and equipment comprising:

1. FX1000SS-D, 1000L/hr stainless oil separator
2. Fox waste oil reservoir
3. FXP 10000 – Diaphragm Pump
4. Fox X2 control box (240 V 10amp Power Supply)

5. Set of UPVC suction and delivery pipework.
6. Electrical controls including conduits and wiring.
7. Wash down water collection pit high level float switch and flashing alarm light positioned on wall adjacent to plate interceptor.
8. FSK-40 floating skimmer

2.25 PRE-CAST CONCRETE GENERAL PURPOSE PIT

Excavate for and install a polyethylene holding tank as located on the Hydraulic Services drawings. The product shall have minimum 1000L capacity and equal to Aline Maxi E series with a Class D access lid

2.26 LOW LEVEL INDUCT VENTS

Low level induct vents where indicated on the drawings are to be of zincalume sheet metal to the approval of the authority. At the ground surface around each induct vent provide concrete 150 x 150 x 100 deep concrete.

2.27 SEWER OVERFLOW GULLY

Overflow gully shall be installed in the position indicated to provide a safe release of sewage from the connection point. Gully shall be constructed of a 100 mm "P" trap and riser.

Top of riser shall incorporate 75mm above the surrounding surface area. Gully shall be provided with concrete bedding and surround as per AS 3500.

Hose tap shall be provided over the sewer overflow gully.

2.28 SEWER PUMP OUT WELL

Provide and install a 1200L sewer pump out well to collect discharge from the car wash bay & ambulance plant. Well shall be constructed of polyethylene fit with an approved class D lid. Alternative products must be presented to the builder & hydraulic consultant for review prior to procurement

2.29 DOWNPIPE CONNECTORS TO STORMATER DRAINAGE

Refer to civil documentation

2.30 WASH DOWN DRAINAGE FLOOR SUMP

Provide and install Fox PT/600 silt trap with Class D grates for all pits within vehicle plant room. Provide with the sumps lift out stainless steel strainer buckets with handle. Strainer buckets to be drilled to standards of Water Authority Trade Waste Division. Also provide to each sump a fixed secondary strainer driller to authority trade waste requirements. Aglass 450 pits are deemed as acceptable alternative products for selection for the wash down sump & pits contained within the ambulance bay.

2.31 PIPE SUPPORT BRACKETS TO PIPES UNDER FLOOR

All pipe support brackets where installed in service trenches under the floor of the building shall be 316 grade stainless steel. This includes the hanging rod.

2.32 RECORDS OF INGROUND DRAINAGE SYSTEMS

During construction submit progressive 'Work as Executed' drawings for all the services specified in this section, showing the locations and depths of pipes and fittings including inspection openings, pits, inverts of underground services, positions of control valves and the like. Give coordination dimensions where applicable. At the completion of the contract prepare fully detailed 'Work as Executed' drawings and maintenance manual as previously specified.

Accurate set-out dimensions to new or existing buildings must be included, especially where services have been approved on site to be located differently to the design drawings. Accurate set-out

dimensions to new or existing buildings must be included, especially where services have been approved on site to be located differently to the design drawings.

2.33 TESTING

Supply all materials necessary for the test and carry out all tests required by the regulatory Authorities.

Do not cover or conceal from view underground or enclosed work until it has been inspected, tested by the Contractor and approved by the Project Manager and the relevant Authority.

Apply the following tests to all stormwater, sanitary, trade waste drainage pipelines;

Water test the system by sealing all openings below the top of the section to be tested and filling the section with water under a head equal to the maximum head which would result from a chokeage in the section under test or three (3) times the pump head in the case of rising mains, for a period of twenty four (24) hours,

2.34 ON COMPLETION

Clear and clean the following:

- Pits and in ground structures.
- Bottom of each floor waste 'P' trap.
- Chrome plated floor waste grates, remove grates, clean and grease sides of grates.
- Labels.

SECTION 3 - SANITARY PLUMBING**3.1 EXTENT OF WORK**

The work specified in this section comprises the supply installation testing and commissioning of the soil, waste, vent pipes and rainwater/overflow downpipes including all bends, offsets, branches, brackets and other items necessary to complete the installation.

The work shall commence from the point of connection to the drainage systems, and shall be carried out as hereunder scheduled and to the satisfaction of the Authorities.

3.2 MATERIAL SCHEDULE

Pipes and fittings shall be in materials as follows:

Service	Size	Material
Soil wastes and vents	40-100	Sewer grade uPVC, DWV
Rainwater and overflow downpipes	100,150	Sewer grade uPVC, DWV/Colorbond

3.3 P.V.C. PIPES AND FITTINGS

P.V.C. pipes and fittings shall be approved manufacture "DVW" Class comply with AS 1260.

Pipes and fittings shall be jointed by using approved solvent welded joints.

All workmanship and materials used shall comply with all local conditions and regulations imposed and/or required by the local Authorities having jurisdiction.

3.4 PIPE GRADIENTS

Soil and waste pipes shall be installed at the minimum gradients approved by the Australian Standard. Pipes are not to be oversized to reduce grade.

3.5 FIRE STOP COLLARS FOR UPVC AND OTHER PLASTIC PIPES

Wherever uPVC pipes or other plastic pipes are installed through fire rated floor and or walls, then provide at each position a Promat manufacture Hi-Blu or equivalent providing for 2 hour rating.

Where pipes pass through existing concrete floor slabs and fire rated walls then fire stop collars shall be retrofit type.

3.6 INSPECTION OPENINGS AND SCREWED CAPS

Install inspection openings in pipes so that each section of pipework is accessible in at least one (1) direction.

150 and 100mm diameter horizontal pipework: One (1) inspection screw cap square junction every twelve (12) metre length or where total length is less than twelve (12) metres, provision of one (1) inspection screw cap square junction. Downpipe testing inspections: Install 100mm diameter testing screw cap square junction at the foot of each downpipe. Foot shall have the meaning, just above turn out from vertical downpipe to either underground drainage or turn out from vertical downpipe to horizontal suspended stormwater drainage.

Downpipe access inspection: Provide as part of each main junction connection point in vertical downpipes a 100mm access inspection. Generally this gate will be at high level each floor. The high level 100mm access gate shall be provided in a position to give rodding access into pipes within false ceiling spaces from the downpipe position. In addition a 100mm access inspection shall be provided at each second floor level of the building approximately 400mm centre line above floor level. This low level inspection shall be used to place testing plug.

3.7 VENT PIPE TERMINATIONS

All vents passing through roofs shall be fitted with neoprene rubber waterproof seal. The flashings shall be clamped to the pipe with a stainless steel band and fixed to the roofing material with a zincalume steel plate.

All exposed vents shall be uPVC, provided with a cowl and painted to the architect's requirements.

3.8 ACCEPTANCE AND RESPONSIBILITY OF SANITARY FIXTURES

The Contractor shall allow to take receipt of all sanitary fixtures when delivered to site by the manufacturer. Co-ordinate this operation with the Project Manager.

On receiving the goods be totally responsible for their numbers and condition until the completion of the project.

3.9 ACOUSTIC INSULATION FOR SANITARY PLUMBING AND RAINWATER DOWNPIPES PIPEWORK

Supply and install Thermotec NuWrap 5™ Pipe & Duct Insulation / Sound Lagging acoustic pipe insulation in preformed sections or flat sheets formed to shape. All pipework located above or within living areas and/or bedrooms require the application of Thermotec NuWrap 5™ unless otherwise noted.

Acoustic Insulation shall be applied to the manufacturer's specification. The minimum overlap of the pressure sensitive reinforced aluminium foil tape is 50mm. The Acoustic Insulation shall be fitted as a one piece preformed section or where required flat sheets cut to size and wrapped completely around fittings and sealed with pressure sensitive reinforced aluminium foil tape with a minimum width of 75mm.

3.10 FIXTURE TRAPS. PLUG AND WASHERS

Wherever possible fixtures shall have integral traps. Concealed traps shall be polypropylene, universal "S" or "P" type and have self-cleaning characteristics, and be of the same size as the outlet of the fitting. Fixture traps shall have a 75mm deep seal.

Basin traps shall be 40 diameter chrome plated copper bottle trap with 40 waste pipe in wall. All plug and washers installed in basins shall be chrome plated brass.

Wash trough and drinking trough, traps and waste pipes shall be 50mm diameter chrome plated copper, "P" trap with waste pipe concealed in wall. All plug and washers installed in wash troughs and drinking troughs shall be chrome plated brass.

All waste pipes concealed within brickwork or concrete shall be insulated with expanded vinyl equal to Kemlag. Over-wrap all joints to approval.

3.11 FLOOR TUNDISHES

Where indicated on the drawings provide and install Opie Group (formerly SMC Stainless) floor mounted tundish manufactured from 316 Grade Stainless Steel, model TURE1A.

3.12 RECESSED TUNDISHES

Where indicated on the drawings provide and install Opie Group (formerly SMC Stainless) recessed in wall tundish manufactured from 316 Grade Stainless Steel, model FMT7 (152x96)

3.13 FLOOR WASTES

Floor wastes shall comprise 100 diameter gullies, complete with chrome plated brass grate set at a level to ensure correct drainage of floor areas. 80mm diameter floor waste risers are not acceptable.

Provide uPVC puddle flange at floor level to receive membrane.

Provide and install 100 mm diameter chrome plated brass square push in floor waste unless nominated by the architect.

3.14 VINYL FLOOR WASTE (VFW)

Provide and install SPS manufacture chrome plated, all bronze model LG100 CPA, Push-in sheet vinyl floor wastes where floor wastes are in areas with vinyl floors excepting where Model SS VFW is required by notation on the drawings.

3.15 BASKET TRAP FLOOR WASTES

Provide and install Opie Group SMC Stainless Trade Waste Floor Sump Code AT-5-HST incorporating three part strainer. Where vinyl floor coverings are to be provided, supply floor sump with vinyl clamp ring. Provide under each floor waste a HDPE 'P' trap and HDPE waste pipe.

3.16 TESTING

On completion all work shall be hydrostatically tested under expected maximum choke conditions for a period of two (2) hours. Any defects shall be remedied and the test reapplied. Provide all testing gates and apparatus necessary for the test.

3.17 ON COMPLETION

On completion flush and remove all debris within the systems, remove all external labels and polish all chrome plated finish to remove any marks.

Clear all drainage lines with suitable automatic drain cleaning machine to ensure blockages will not occur prior or during the twelve (12) months warranty period.

Maintain the entire plumbing system during twelve (12) months warranty period including attendances should problems arise through blockages in the piping system.

SECTION 4 - WATER SERVICES**4.1 EXTENT OF WORK**

The work specified in this section comprises supply, installation, testing and commissioning of the potable cold water services, potable hot and warm water services. Work also includes the installation of a fire hydrant system, incoming fire sprinkler watermain including brigade booster assemblies and in ground fire sprinkler watermain to sprinkler valve sets and from sprinkler valve sets to building (refer to the Hydraulic drawings to confirm if applicable).

Work also includes rainwater pressure pumps, electrical control panel, power and control wiring and rainwater reuse distribution pipeline.

4.2 MATERIAL SCHEDULE

Service	Size	Material
Potable Cold-Water Service	As indicated on the drawings 20-25mm	Large water mains Underground - PE pipe with blue stripe PN 16 with electrofusion fittings. Provide coloured detectable marker tape over with words Potable Cold Water Service tape to have copper wire bound within Small Water Services Underground - Type "B" copper tube, silver brazed joints. Pipework to be within blue poly bag. Above Ground - Type "B" copper tube, silver brazed joints/press fit
Potable Cold, Hot and Warm Water Service including hot water flow and return pipes	15 - 40mm	Copper Pipe. Insulate all hot and warm water pipes where not within walls with 32mm Thermotec 4 Zero sectional insulation. This includes all non-circulating hot and warm water pipe runs.
Potable Cold, Hot and Warm Water Service Branches in Masonry Walls only	15 - 100	Green plastic covered Kemlag Copper Pipe
Potable cold, hot, warm water services branches in dry walls	16-25	Rehau cross linked polyethylene pipe with non-metallic fittings.
Exposed Water Pipes	15 - 25	Chrome plated copper tube and fittings

Bolts and nuts used underground and above ground shall be 316 grade stainless steel.

Flanges required underground shall be 316 grade stainless steel.

Metal backing flanges behind polyethylene electrofusion stub flanges required underground shall be 316 grade stainless steel.

4.3 CONNECTION TO EXISTING WATERMAIN

The Contractor shall allow to locate, excavate over, and connect to the existing main and backfill, to the satisfaction of Local Council and the Project Manager. Pay all fees to Council, NSW Department of Fair Trading and all relevant Authority's.

4.4 ACCEPTANCE AND RESPONSIBILITY OF TAPS AND WATER OUTLETS

The Contractor shall allow to take receipt of all taps and water outlets when delivered to the site.

Co-ordinate this work with the Project Manager.

4.5 COPPER PIPES AND FITTINGS

Pipework

Shall be installed in a neat workmanlike manner and shall include all necessary sets and be complete with sufficient unions, flanges and isolating valves for satisfactory removal of piping and fittings for maintenance or repairs, whether or not such items are shown on the drawings or specified.

In addition to general provisions for installation of copper pipe, pipes shall be fixed in continuous lengths wherever practicable and bent at changes of direction in preference to using fittings.

Copper Tube

Shall conform to Australian Standard AS 1432 Type B.

Joints

Braze copper and brass with silver brazing alloy containing not less than 5% silver. Use oxy-acetylene heating for all brazing.

Fittings

Manufactured fittings shall be of approved type either dezincification resistant brass or correctly formed large radius copper bends with long socketed enlargements.

Where branches of smaller size from main pipe occur, "T" joints shall be drilled, softened and flared to form a slip joint.

Flushing

Water mains and water services shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure test has been carried out.

4.6 CROSS LINKED HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS (PE-X)

Requirements: Cross linked polyethylene pipe and fittings (PE-X) for hot and cold water systems, shall be first quality and in accordance with AS 2492.

Water Services Pipes:	PN 20 complying with AS 3500.1 PE-X pipes
Fittings:	Rehau plastic fitting range and fittings manufactured of Brass which are Dezincification Resistant to AS 3688.
Joining Method:	As per manufacturer's instructions.
Prohibited Areas of installation:	Cross Linked Polyethylene will not be used in areas as specified in AS 3500.1
Colour of Pipes:	Cold drinking water - silver Hot and warm drinking water - Red Rainwater reuse - green Recycled water - purple

4.7 PRIVATE WATER METER

Purchase and install a 32mm diameter council/local Authority approved water meter to record all water used in the new building. Provide bronze unions each side of water meter.

Provide a 32mm lever handle ball valve preceding the water meter with a 500kPa PRV and RPZD.

Stainless steel chain open the ball valve and provide 50mm wide brass Lockwood padlock with 003 key. Give two keys to project manager.

Refer to the Hydraulic drawings for project specific requirements.

4.8 AIR RELIEF VALVES

Air relief valves shall be Spirax Sarco telephone (02) 9621 4100 model AE 30. Connect to pipelines where indicated with 15mm ball valve and extend 15mm pipeline from 8 mm connection on valve to drain.

4.9 REDUCED PRESSURE ZONE DEVICES. VALVE CONTROL GROUPS -RPZD/VCG

Reduced pressure zone assemblies (RPZ) shall be ValvCheq RP03 manufacture, complete with:

- Stainless steel in wall box with Perspex lockable front panel.
- Two RPZD valves inside box cold 20mm and hot 20mm with ball valves, strainers and unions each side of each RPZD.
- 50mm drain in wall connected to floor waste.
- Screw fixed signage on cover of box:
- "These valves require regular service by a qualified tradesperson"
- Metal disc with valve number engraved fixed to inside box on back wall.

Available through Flotech Solutions Tel: (02) 4572 0974.

Test and certify all RPZD installations.

4.10 TEMPERING VALVES

Tempering valves shall be Caleffi manufacture.

4.11 PIPE FIXING THROUGH STEEL WALL FRAMING

Where pipe work is inserted through holes in steel wall framing, provide proprietary rubber grommets to isolate pipe from steel to prevent vibration noise and corrosion.

4.12 ADJUSTABLE PRESSURE REDUCING VALVE

Adjustable pressure reducing valves shall be:

- Caleffi 535 series, bronze, spring adjustable pressure reducing valve. Set outlet water pressure to 500kPa.
- Screwed 20 to 50mm.
- Provide screwed bronze union each side of screwed pressure reducing valves.

4.13 HOT WATER TEMPERATURE

All sanitary fixtures delivering hot water shall be in accordance with AS 3500 Part 4 clause 1.9 and shall not exceed 50°C (residential buildings) at the outlet of all sanitary fixtures used primarily for personal hygiene purposes (i.e. bathrooms, ensuites, showers and hand washing.)

Hot water to kitchens and laundry other than personal hygiene fixtures shall be fed directly from the hot water source.

4.14 HOT WATER STORAGE TANKS

Supply and install where shown on the drawings one (1) 315L Rheem electric storage hot water unit with 4.8kW element.

- Pipework connections, ball valves, check valves, pressure relief valve, copper relief drain to DTU and unions at each pipe connection.
- Relief drain terminated 25mm above drainage turn-up or 100mm above ground if outside the building.
- TP & R valve fitted and checked for correct operation.
- Pressure Limiting Valve on cold water supply when water pressure is over 500 kPa.
- Copper safe tray manufactured from 0.5mm copper sheet and with joints soft soldered. Fold upper edge of sides to form safety edge. Provide 50mm drain outlet in one corner discharging over drainage turn-up.
- A "Baytak" manufacture polypropylene heater base of the type and appropriate diameter for the diameter of heater cylinder positioned under each heater and within safe tray.

4.15 HOT WATER CIRCULATION PUMP SET

Requirements are:

- Locate on Kelair galvanized steel wall frame adjacent to hot water heater.
- Provide pumps constructed of materials and with flow and head characteristics as described in the pump schedule.
- 100mm dial face pressure gauge to be provided on suction and delivery pipework to each pump. Provide ball valve preceding each gauge.
- 100mm dial face temperature gauge to be provided on delivery pipework of pump set.
- Arrange pipework in "Z" configuration to receive temperature gauge element.
- Provide TA bronze stad valve to regulate flow on discharge of each pump.
- Provide bronze swing check valve on outlet of each pump.
- Provide bronze ball valve on suction of each pump.
- Provide stainless steel braided hose vibration eliminators on suction and discharge of each pump.

1. Hot Water Circulation Pump Set

Provide, install, balance, commission, warrant and maintain for twelve (12) months, the following pump sets and electrical controls.

Engineering Service	Hot Water Circulation
Pump Set	
Model	Kelair/Grundfos UPS 32 - 80B
Quantity	Two (2) required
Flow	0.3 l/s
Head	3m
Motor Rating (kW) Volts	240
Pressure Gauge	100mm diameter dial face
Temperature Gauge	100mm diameter dial face
Pipework	Type B Copper Tube AS 1432
Pump Frame Support	Galvanised Mild Steel
Electrical Control Panel	As specified in other clause

2. Hot Water Circulation Pump Set Electrical Control Panel

Requirements are:

- Panel to be IP54.
- Manufacture cabinet from 1,2mm zinc coated sheet metal.
- Provide concealed hinged and key locking.
- Provide 15% spare space inside panels for system enlargement.
- Colour of indicator light shall be Red (fail and alarm) Amber (operating), Green (power available).
- Provide black letter on white background labels, screwed to panel. Lettering shall describe pump set controlled.
- Spray paint panel with metal primer and two (2) coats of finishing paint.
- Provide and install electrical power control and alarm wiring within electrical conduits.
- Fix panel to wall with top 1800mm floor or ground surface.

Electrical Control Panel shall be manufactured by Kelair Pumps, located above the pump assembly installation and complete with:

Description	Indicator/ operation
Power On	Green light
Hot Water Return Pump 1 Run	Amber light
Hot Water Return Pump 1 Fail	(Mechanical Reasons) Red light and remote alarm
Hot Water Return Pump 1 Fail	Reset
Hot Water Return Pump 2 Run	Amber light
Hot Water return Pump 2 Fail	(Mechanical Reasons) Red light and remote alarm
Hot Water Return Pump 2 Fail	Reset
Hot Water Return Pump 1	On/Off Auto Switch
Hot Water Return Pump 2	On/Off Auto Switch
Hot Water Return Pump 1 Fail	Remote Alarm Cancel
Hot Water Return Pump 2 Fail	Remote Alarm Cancel
Hot Water Return Pump 1 - Hour Run Meter Record	through BMS
Hot Water Return Pump 2 - Hour Run Meter Record	through BMS
Electrical Control Panel Light Bulb Test	Push Button
Alternation of Hot Water Return Pumps 1 and 2 on 24 hour sequence	
Transformer 415/240V to 24V for Control Wiring	
Hot Water Return Pump 1 Fail - (Mechanical Reasons)	
Hot Water Return Pump 2 Fail - (Mechanical Reasons)	
Hot Water Return Pump 1 - Hour Run Meter	
Hot Water Return Pump 2 - Hour Run Meter	

Provide inside the pump control panel a HPM 24 hour adjustable electrical timer. The timer shall be capable of locking out one whole day of pump operation should the client so select.

4.16 WATER HEATERS - MAINS PRESSURE. ELECTRIC

Mains pressure electric water heater shall be complete with:

4.17 THERMOSTATIC MIXING VALVES / VALVE CONTROL GROUPS (TMV/VCG)

Thermostatic mixing valves (TMV) shall be Enware manufacture complete with:

- Enware 4 and 5 point Aqua Blend 1500 valve control group TMV/VCG as detailed on the drawings.
- Special stainless steel box enclosure with hinged lockable cover and frame.
- Box cover epoxy paint coated by Enware to colour selected by Architect from the Dulux colour range.
- Provide screw fixed signage on cover of box, "Thermostatic Mixing Valve, this valve requires regular servicing by a qualified tradesperson". Submit sample for approval.
- Metal disc with valve number engraved and fixed to inside box on back wall.
- As the boxes are approx. 70mm deep then cut brickwork with masonry chasing machine to this depth.

4.18 FLUSHSAVER URINAL INWALL BOXES

FlushSaver Urinal in-wall boxes shall be manufactured and supplied complete (in parts)

- Special stainless steel box enclosure with key. All boxes keyed alike.
- Face plate epoxy paint coated to colour selected by Architect from Dulux colour range.
- Boxes will be 70mm deep and cut into the brickwork with masonry chasing machine to this depth to entirely recess the boxes.

Urinal FlushSaver Box Sets are available from Water Conservation Services International – Tel (02) 9971 1014 - Fax (02) 9971 6858 - email watercon@optusnet.com.au - or phone Roger 0408 677978 for further information.

Install single or double FlushSaver Box Sets in locations indicated on the drawings.

FlushSaver Urinal Box Set - Single. - Code FU-BS-S

COMPONENTS:

- 1 x Urinal sensor/control module
- 1 x 13mm Burkert Solenoid Valve
- 1 x set figure eight cable
- 1 x 13mm air gap valve
- 1 x 24V power adaptor
- 1 x plastic box to hold sensor
- 1 x in-wall stainless steel in wall storage box - face plate colour as selected by Architect from Dulux range of colours.

FlushSaver Urinal Box Set - Double. - Code FU-BS-D

COMPONENTS:

- 1 x Urinal sensor/control module
- 2 x 13mm Burkert Solenoid Valve
- 2 x sets of figure eight cable
- 2 x 13mm air gap valve
- 1 x 24V power adaptor
- 1 x plastic box to hold sensor

2 x in-wall stainless steel in wall storage box - face plate colour as selected by Architect from

Dulux range of colours.

Provide and install purpose made stainless steel angle brackets with stainless steel expansion wall fastening and nuts and bolts to fix the plastic boxes containing sensors to Wall.

Single Box Sets shall contain one single 240V GPO (installed by the Electrician) attached vertically to the internal side wall of the in-wall box.

Double Box Sets shall contain one single 240V GPO (installed by the Electrician) attached vertically to the internal side wall of the in-wall box - can be installed in either box.

After commissioning give keys to the Property Manager on site.

4.19 PRESSURE LIMITING VALVES

Pressure Limiting valves shall be equal to RMC and have the outlet pressure pre-set to 500 kPa.

The valve shall be the same size as the pipeline.

4.20 PRESSURE REDUCTION STATIONS

Provide pressure reducing valve stations, to the size and capacities on the drawings. The Valve Station shall consist of multiple pressure reduction valves in series and be equal to Bermad.

Each station shall be complete with 3 off pressure reducing valves installed in parallel and shall be provided with all valves, controls and pressure gauges, and thermostats.

Pressure reduction Valves for the cold water system shall be as per "Pressure Reduction Station Schedule"

Pressure reduction for the Hot Water system shall be suitable for temperatures up to 82 degrees.

4.21 ELECTRICAL CONDUITS AND WATER LEVEL SENSORS

Provide and install orange uPVC electrical conduit from fire hydrant pumps electrical control panels, underground, externally to tanks and internally to tanks. All conduit brackets external to tank shall be hot dip galvanized steel. Bracket internal of tanks shall be 316 grade stainless steel.

Provide and install in each tank Kelair low water level pump stop water level switch. All water level switches and electrical wiring shall be 24 volts type.

4.22 FLEXIBLE BRAIDED WATER CONNECTIONS

Braided connection (Plumb-easy or similar) shall not be used in hot water unit installations service ducts or plantrooms. They may be used in ablution areas where 100mm floor wastes are provided and, if they fail, no real damage is caused. Where they are used they shall be of the correct type to prevent straining, kinking or twisting or stresses on the connections. They shall be correct length to match the installation requirements.

4.23 WATER CONNECTIONS TO BASINS AND SINKS

Provide and install 15mm BSP brass male thread at the wall for both cold and hot water points.

Provide and install chromium plated cover plate at wall for cold and hot water points.

Provide and install approved stainless steel braided flexible connector, "Aquaconnect" or equal.

Cold and hot water connections to wall basins shall be carried out with annealed, 15mm diameter, chromium plated Type B copper tube. Join the tube to fitting threads at the wall and at the tap sets complete with chromium plated brass Kinco nuts and formed Kinco Knurl ("olives" connection shall not be used)

4.24 COVER DOMES

Provide cover domes to all water services connection where horizontal connections are made at wall and cupboard surfaces.

Cover domes are to be a close fit around the pipe of which they surround, and close against the wall or floor and be chrome plated.

4.25 INSULATION

Insulate pipe works generally as detailed hereunder.

All hot water piping concealed in ducts and ceilings spaces shall be insulated with 32mm thickness Thermotec 4 Zero type sectional lagging incorporating aluminium foil wrap and overlap secured as below and to approval.

All cold water, hot water and warm water piping concealed in brickwork and or blockwork shall be insulated with expanded vinyl equal to "Kembla" or "Crane" Prelag. Over wrap all joints to approval.

Prior to application of insulation materials, all surfaces shall be thoroughly cleaned to remove scale, grease, oil, dirt and any other foreign matter, and where subject to condensation shall be protected against corrosion. All insulation material shall be of best quality in their respective types.

Irrespective of the method of attachment, all insulating materials shall be in close contact with the surfaces to which they are applied. Where performed sectional insulation is used, the edges and ends of sections shall be arranged to butt up close to one another over the whole insulated surface.

Edges or ends of section shall be cut or shaped at site where necessary.

Pre-formed sections shall be complete with a sisal covering connected to the entire external surface.

The covering shall be installed to provide a lap of not less than 25mm at all longitudinal and circumferential joints. The insulation thus applied shall be further secured with bands of noncorrosive metal. Metal bands shall be not less than 19mm wide, installed generally on 450mm centres and at all points where insulation has been cut or shaped.

At flanges, valves and other similar connections, the insulation shall be bevelled and cut back to provide adequate access to bolts and fittings. Valves, flanges and unions, are not required to be insulated.

No insulation shall be applied prior to pressure testing of the respective parts of the installation.

Insulation shall be applied in an approved manner.

Approved wood blocks, the same external diameter as the insulation material shall be provided at all bracket points. The blocks shall be in two halves and shall be a minimum of 25mm wide.

4.26 EXTERNAL HOSE TAPS

Provide and install Type B copper tube extended to hose tap points.

Depth of pipe work shall be 300mm minimum below finished levels.

Hose taps shall be Cimberio lever handle hose taps Code CIM 34 available from All Valve Industries Tel 9558 9911.

Support each hose tap standpipe by securing brass back plate elbow to 100 x 50mm treated pine post concreted (minimum 150mm concrete base and surround) into the ground behind each hose tap. Secure each back plate elbow to post with three (3) round head brass screws, 25mm in length.

Supply and fix with brass screws adjacent to recycled water hose taps, an approved sign with the words "Not Suitable For Drinking" and in accordance with Authorities requirements.

Where hose taps are shown on the drawings to be fixed to external walls, provide brass back plate elbow and secure with three (3) stainless steel screws into expansion fastenings.

4.27 UNDERGROUND PIPE WARNING TAPE

Plastic warning tape 100mm wide shall be laid above all underground water service pipes. Tape be colour to comply with AS 1345 printed with the appropriate water service words. Tape shall contain copper wire fixed each end at ground surface and tested upon project completion to confirm continuation of detection along the length of the pipe.

4.28 LINE MARKING FIXING BLOCKS AND IDENTIFICATION PLATES FOR UNDERGROUND PIPE WORK SERVICES

Provide and install Line Marking Fixing Blocks and Identification Plates for Underground Cold Water pipe work. Different identification plates shall be provided for each water service. Plates shall be 100mm x 100mm x 3mm thick stainless steel screw fixed to concrete with stainless steel expansion fastenings. Engrave details onto plates.

4.29 PIPEWORK PROTECTION FOR POTABLE WATER SERVICES

Install all external, in-ground copper pipework in polyethylene blue sleeve protection bag conforming to AS 3680 with joints lapped 600mm and tape sealed.

4.30 ROOM OR GROUP CONTROL RECESSED STOP TAPS FOR COLD, HOT AND WARM WATER SERVICES

Provide ENWARE manufacture Code VP 356 brass key operated, full way recess stop taps with chrome plated internally threaded and colour coded screw off cover dome without any spindle hole.

Install the VP 356 recess stop taps in cold, hot and warm water branch pipelines side by side and 150mm apart in accordance with the detail drawing.

4.31 VALVES

All valves shall have "Standards Mark" certified to the relevant Australian Standard and compliant to MP52 Specification.

All valves installed in hot water or heating water systems shall be bronze for all pipe sizes.

Valves up to and including 80mm diameter shall be all bronze. Valves 150mm or over may be cast iron with bronze trim, excepting when installed in hot water or heating water pipelines, in which case they shall be 100% bronze or stainless steel.

Valves to pump connections, main branch lines and outlet positions shall be butterfly type.

Valves shall be tested to a pressure of 2,100 kPa by an approved testing Authority.

A. FLANGED VALVES: Valves 55mm and over shall be flanged. All other valves shall be screwed complete with union connection located on the outlet side of the valve.

B. BALANCING VALVES shall be "Tour and Anderson" manufacture "STAD" type screwed up to 50mm in diameter and "STAF" type flanged 55mm and larger diameter.

Above ground valves shall be complete with hand wheel unless they are lever operated ball valves or butterfly valves.

C. BRONZE SCREWED BALL VALVES: Valves 10mm up to and including 50mm shall be either:

Pegler Beacon Australia Fig No. 350G, 350DR, 353DK.

All Valve Industries CIMBERIO Fig No. 11-CR 10mm to 50mm.

Austral Engineering ISIS DZR 10mm to 80mm.

Valves to be brass construction approved for use with hot and cold water supply systems.

D. BUTTERFLY VALVES shall be either:

All Valve Industries Keystone cast iron butterfly valves, wafer style to suit Table

"E" flanges.

Austral Engineering Valve Butterfly Valves Fig 725 Wafer Style or 755 Lugged design, working pressure 15 bar, AS 2129 Table E, disc, 315 stainless steel, one piece shaft, square disc drive with no locating bolts on taper pins. Components of these valves shall be manufactured from the following materials:

Body - Cast Iron

Shaft - Chrome and stainless steel

Disc - Cupro - Aluminium

Liner - E.P.D.M.

E. BRONZE SCREWED GATE VALVES: Bronze screwed gate valves for valves up to 50mm in diameter shall be either:

Pegler Beacon Australia Fig No. 1070M DZR brass gate valves, 10mm to 100mm screwed.

Austral Engineering Toyo tested AS 1528-1999 Gate and Check valves, 15mm to 100mm screwed.

F. BRONZE FLANGED GATE VALVES: Bronze flanged gate valves for valves from 65mm to 100mm in diameter shall be either:

Pegler Beacon Australia Fig No. 1035E.

Austral Engineering Braemar Fig No. T60M

G. GLOBE VALVES: Bronze screwed globe valves for valves up to 50mm in diameter shall be either:

Pegler Beacon Australia Fig No. 5, GL-5BSP

Austral Engineering Fig No. RHB-3 screwed bronze globe valves 10mm to 50mm.

H. CAST IRON FLANGED GATE VALVES: Cast iron flanged gate valves for 100mm diameter and above shall be local water authority approved.

I. UNDERGROUND VALVES: 100 diameter and above shall be local water authority approved "Sluice Valves" to AS 2638 Class 21, flanged Table F. Provide 150mm diameter UPVC pipe as riser to ground surface with hinged cast iron (SV) path box and concrete surround.

J. CHECK VALVES: Bronze screwed swing check valves for valve up to 40mm in diameter shall be either:

All Valve Industries 15mm to 80mm

Austral Engineering Fig No. C236A 15mm to 80mm screwed.

Check valves on outlet connections to all pumps to be "Mission Duo" check II. Water check: Valves style C, Fig G, 15 BMF, Bronze Alloy 952 body with Vulcanized Buna 'N' seal.

Bronze flanged wafer check valves for valves 50mm and above shall be Austral Engineering Fig No. 301E 50mm to 300mm.

With the exception of loose jumper type valves, spindles shall be non-rising type and must not project into the bore of the valve when the valve is in the fully open position. The bore shall be clear and unobstructed when in this position.

Underground loose jumper type valves shall be path taps, which shall have the bonnet locked into position with the valve body with a bronze set screw. Provide 100 diameter UPVC pipe as riser to ground surface with hinged cast iron (W) path box and concrete surround.

Prior to practical completion provide to the Superintendent valve keys, suitable for each kind of valve spindle head installed underground inside valve surface boxes.

Each valve key shall consist of a socket suitable to fit over the spindle head, a length of steel rod or pipe and Tee handle.

Valve keys shall be hot dip galvanised.

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

4.32 FLANGES AND UNIONS

Disconnecting unions shall be utilized to connect pipework up to 50mm diameter and flanges are to be utilized to connect pipework (50mm diameter and larger) to items of valves, plant and equipment, so all plant and valves can be easily removed and maintained.

Flanges shall conform with AS 2129. Use brass or bronze brazing flanges for copper tubing. All flanges provided as mating flanges to valves where water pressure exceeds 1000 kPa shall be Table E.

Cop-A-Mate flanges with loose painted steel flanged backing ring are not considered to be equal to bronze brazing flanges and will not be accepted for this project.

4.33 PRESSURE GAUGES

Gauges shall be K.D.G. type except where otherwise noted on the drawings. The faces on the gauges shall be 100 mm diameter. Gauges shall be graduated in metres head and kilo Pascal.

Gauges shall register one-third kPa more than the maximum possible pressure obtainable from the system served.

Each gauge shall be complete with bronze ball valve and sufficient copper piping for connection to the pipe work.

4.34 PRESSURE SWITCHES AND ALARM HOOTERS

Provide all electrical wiring within PVC conduits from pumps electrical control panels to pressure switches shown on the drawings.

4.35 DIAL TYPE TEMPERATURES THERMOMETERS

Thermometers indicating temperature shall be dial type, manufactured by DOBBIE, each with dial face 100mm diameter shall be model V541 direct reading, stern mounted bottom entry type.

The thermometer probe shall be installed into mounting tube of copper pipe a minimum dimension of 150mm long and to a suitable diameter.

Dial type thermometers shall be fitted in the following locations:

- The discharge side of all hot water and warm water return pumps.
- The discharge pipe from a group of hot water heaters.
- On hot water and warm water return headers.

4.36 AIR RELIEF VALVES

Air relief valves shall be Spirax telephone (02) 9621 4100 model AE 30. Connect to pipelines where indicated with 15mm ball valve and extend 15mm pipeline from 8 mm connection on valve to drain.

4.37 STRAINERS

Strainers shall be RMC LS50, LS75 or LSI 00 with 60mm stainless steel gauze.

Plantrooms: Strainers shall be 'Spirax Sarco' bronze bodied on all lines up to and including 50mm and Cast Iron above 50mm with easily removed perforated stainless steel strainer having perforations 0.4mm maximum.

4.38 PATH BOXES

Valves located below ground shall be supplied with cast iron path boxes complete with hinged lid to allow for later access and clearly marked for their respective service type complete with 150mm PVC riser conduit from valve spindle and bedded in minimum 150mm concrete base and surround to finish

flush with finished ground or paving level. Maintain 75mm minimum clearance between the top of the valve spindle and the underside of the lid of the box.

4.39 REDUCED PRESSURE ZONE DEVICES. VALVE CONTROL GROUPS - RPZD/VCG

Reduced pressure zone assemblies (RPZ) shall be Tyco manufacture, complete with:

- Stainless steel inwall box width 500mm height 630mm depth 90mm with Perspex lockable cover.
- Two RPZD valves inside box cold 20mm and hot 20mm with ball valves and unions each side of each RPZD.
- 50mm drain in wall connected to floor waste.
- Screw fixed signage on cover of box:
- "These valves require regular service by a qualified tradesperson"
- Metal disc with valve number engraved fixed to inside box on back wall.

Test and certify all RPZD installations. Available Tel: (02) 4572 0974.

4.40 RECESSED VALVE BOX FOR CONCEALED HOSE TAP AND GAS BAYONET VALVE

Provide and install specially manufactured key lockable recessed valve box, by Stainless Metal Craft, product code GVC-IR. Refer detail drawing.

Provide within each box a 20mm star head, quarter turn hose tap and a pillar type gas bayonet valve.

Essential Ensure the entire inside of box is gas and air tight.

4.41 STERILISATION OF WATER SERVICES

Disinfect pipe work installation in accordance with AS 3500 before practical completion. All storage tanks and pipelines shall be flushed clean then 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.

4.42 CLEANING AND TESTING OF PIPEWORK

All cleaning and testing of pipework shall be carried out as early as possible after testing of each section of the piping and before any points are concealed, ceilings installed, or finishing trades have commenced their work.

All services pipework shall be thoroughly washed out and the system operated with a full flow of water until all foreign matter is removed. Temporary conditions to supply and drain shall be carried out as required and all equipment shall be bypassed during the cleaning and testing period.

Hydrant and fire sprinkler pipework shall be tested hydraulically to 2100kPa and potable water, rainwater reuse pipework shall be tested hydraulically to 1400 kPa. Maintain test pressure for minimum period of eight (8) hours.

4.43 TESTING

On completion, all pipework shall be subject to a pressure test of 2,100 kPa for a period of twenty four (24) hours. Any defects found in the system shall be remedied and the test reapplied. Disconnect pipes from mechanical and hydraulic equipment prior to testing and reconnect on completion.

SECTION 5 - FIRE HOSE REEL SYSTEM

5.1 EXTENT OF WORK

The work specified in this section comprises supply, installation, testing and commissioning of the potable cold water services and fire hose reels. Work also includes the installation of a fire hose reel pump set, together with electrical control panel, power and control wiring.

5.2 MATERIAL SCHEDULE

Service	Size	Material
Potable Cold Water Service and fire hose reel service pipes.	As indicated on the drawings.	<p>Large Watermains Underground - PE pipe with blue stripe PN 16 Jointed with electrofusion fittings. Provide coloured detectable marker tape over with words Potable Cold Water Service tape to have copper wire bound within.</p> <p>Small Water Services Underground - Type "B" copper tube, silver brazed joints. Pipework to be within blue poly bag.</p> <p>Above Ground - Type "B" copper tube, silver brazed joints</p>
Potable Cold Water Service and fire hose reel services branches in Masonry Walls	25mm	Green plastic covered Kemlag Copper Pipe

Bolts and nuts used underground and above ground shall be 316 grade stainless steel.

Flanges required underground shall be 316 grade stainless steel.

Metal backing flanges behind polyethylene electrofusion stub flanges required underground shall be 316 grade stainless steel.

5.3 COPPER PIPES AND FITTINGS

Pipework

Shall be installed in a neat workmanlike manner and shall include all necessary sets and be complete with sufficient unions, flanges and isolating valves for satisfactory removal of piping and fittings for maintenance or repairs, whether or not such items are shown on the drawings or specified.

In addition to general provisions for installation of copper pipe, pipes shall be fixed in continuous lengths wherever practicable and bent at changes of direction in preference to using fittings.

Copper Tube

Shall conform to Australian Standard AS 1432 Type B.

Joints

Braze copper and brass with silver brazing alloy containing not less than 5% silver. Use oxy-acetylene heating for all brazing.

Fittings

Manufactured fittings shall be of approved type either non-dezincifiable brass or correctly formed large radius copper bends with long socketed enlargements.

Where branches of smaller size from main pipe occur, "T" joints shall be drilled, softened and flared to form a slip joint.

Flushing

Water mains and water services shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be carried out after pipework has been pressure tested..

5.4 CONNECTION TO POTABLE WATER SUPPLY

The Contractor shall allow to extend from the potable cold water supply as noted on the hydraulic drawings.

5.5 PIPE FIXING THROUGH STEEL WALL FRAMING

Where pipe work is inserted through holes in steel wall framing, provide proprietary rubber grommets to isolate pipe from steel to prevent vibration noise and corrosion.

5.6 SUPPORT POST FOR FREESTANDING FIRE HOSE REELS

Support posts shall be fabricated by utilising 89mm x 89mm x 3.6mm wall thickness, rolled hollow section steel. Weld at the top of post a blank cap and at the base a 250mm square x 10mm thick, steel foot plate. Fire hose reels shall be bolted to the steel posts at 1500mm centre line above floor. Provide four x 12mm diameter bolt holes in the base plates for fixing to floor. After fabrication hot dip galvanise the entire support post and foot plate. Install vertically and secure foot plates with 12mm stainless steel dynabolts or similar fixing method into concrete floor or roof slabs.

5.7 FIRE HOSE REELS

Each fire hose reel shall be wall mounted with swivel hose guide complete with all fittings including stop valve and containing 36m length of 20mm internal diameter fabric reinforced nonkinking rubber hose.

Fire hose reels shall conform to AS 1221 complying with the type approved by the local fire brigade. The reels shall be painted and finished with the colour No. 537 Signal Red. The mounting plate shall be secured in a rigid workmanlike manner without damage to the surrounding areas in an approved manner using galvanised steel, stainless steel bolts or other approved fixing methods sufficient to understand, with and adequate margin of safety the fixing test and the minimum static and dynamic loads likely to be applied to the fixing. Provide detailed fabrication drawings of fire hose reel support bracket for fixing to stud walls in cupboards for approval prior to construction.

Marking and signage shall comply with AS 2441. Architectural drawings and specification shall be referred to for exact location and type of installation such as cupboard, inwall cabinet or semirecessed inwall cabinet with wall flange.

Hose reels, unless otherwise stated, shall be installed with the centre of the hub 1.5 m above the floor level and all to comply with the latest amended Code AS 1221, AS 1851.

Secure hose reel to masonry walls by means of 10 mm diameter "Dynabolt" type fixing and to plasterboard walls by means of fixing approved by the Project Manager.

Additional operating instruction sheets shall be procured and secured in a position adjacent to the reel in a permanently upright position.

To comply with the Water authority requirements, all fire hose reels shall be provided with a 25mm diameter bronze double check valve fitted directly after the lever ball valve supplied with each fire hose reel.

5.8 POLYETHYLENE FIRE HOSE REEL COVERS

Provide and install to all fire hose reels that are located external to buildings including fire hose reels that are fixed to external walls of buildings, red colour polyethylene fire hose reel covers, product code FCFHRC36R.

Product is available from F & C Mining Products, www.industrysearch.com.au/Products/Red-Polyethylene-fire-hose-reel-cover.

5.9 PIPEWORK PROTECTION FOR POTABLE WATER AND FIRE HOSE REEL SERVICES

Install all external, in-ground copper pipework in polyethylene blue sleeve protection bag conforming to AS 3680 with joints lapped 600mm and tape sealed.

5.10 VALVES

All valves shall have "Standards Mark" certified to the relevant Australian Standard and compliant to MP52 Specification.

Valves up to and including 80mm diameter shall be all bronze.

Valves to pump connections, main branch lines and outlet positions shall be bronze ball valve type.

Valves shall be tested to a pressure of 2,100 kPa by an approved testing Authority.

A. BRONZE SCREWED BALL VALVES: Valves 10mm up to and including 50mm shall be either:

- Pegler Beacon Australia Fig No. 350G, 350DR, 353DK.
- All Valve Industries CIMBERIO Fig No. 11-CR 10mm to 50mm.
- Austral Engineering ISIS DZR 10mm to 80mm.

Valves to be brass construction approved for use with hot and cold water supply systems.

B. CAST IRON FLANGED GATE VALVES: Cast iron flanged gate valves for 100mm diameter and above shall be local water authority approved.

C. UNDERGROUND VALVES: 100 diameter and above shall be local water authority approved "Sluice Valves" to AS 2638 Class 21, flanged Table F. Provide 150mm diameter uPVC pipe as riser to ground surface with hinged cast iron (SV) path box and concrete surround.

D. CHECK VALVES: Bronze screwed swing check valves for valve up to 80mm in diameter shall be either:

- All Valve Industries 15mm to 80mm
- Austral Engineering Fig No. C236A 15mm to 80mm screwed.

5.11 FLANGES AND UNIONS

Disconnecting unions shall be utilized to connect pipework up to 50mm diameter and flanges are to be utilized to connect pipework (50mm diameter and larger) to items of valves, plant and equipment, so all plant and valves can be easily removed and maintained.

Flanges shall conform with AS 2129. Use brass or bronze brazing flanges for copper tubing. All flanges provided as mating flanges to valves where water pressure exceeds 1000kPa shall be Table E.

5.12 PRESSURE GAUGES

Gauges shall be K.D.G. type except where otherwise noted on the drawings. Faces on gauges shall be 100 mm diameter. Gauges shall be graduated in metres head and kilo Pascal.

Gauges shall register one-third kPa more than the maximum possible pressure obtainable from the system served.

Each gauge shall be complete with bronze ball valve and sufficient copper piping for connection to the pipe work.

5.13 PRESSURE SWITCHES AND ALARM HOOTERS

Provide all electrical wiring within PVC conduits from pumps electrical control panels to pressure switches shown on the drawings.

5.14 PATH BOXES

Valves located below ground shall be supplied with cast iron path boxes complete with hinged lid to allow for later access and clearly marked for their respective service type complete with 150mm PVC riser conduit from valve spindle and bedded in minimum 150mm concrete base and surround to finish flush with finished ground or paving level. Maintain 75mm minimum clearance between the top of the valve spindle and the underside of the lid of the box.

5.15 STERILISATION OF WATER SERVICES

Disinfect pipe work installation in accordance with AS 3500 before practical completion. All storage tanks and pipelines shall be flushed clean then 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.

5.16 CLEANING AND TESTING OF PIPEWORK

All cleaning and testing of pipework shall be carried out as early as possible after testing of each section of the piping and before any points are concealed, ceilings installed, or finishing trades have commenced their work.

All services pipework shall be thoroughly washed out and the system operated with a full flow of water until all foreign matter is removed. Temporary conditions to supply and drain shall be carried out as required and all equipment shall be bypassed during the cleaning and testing period.

Cold water and fire hose reel pipework shall be tested hydraulically to 1500kPa. Maintain test pressure for minimum period of eight (8) hours.

Any defects found in the system shall be remedied and the test reapplied. Disconnect pipes from hydraulic equipment prior to testing and reconnect on completion.

5.17 CERTIFICATION OF FIRE HOSE REEL SYSTEM

Allow in Tender and pay fees for Registered Certifier to attend the site to carry out tests on the fire hose reel system and to provide certification for installation and pipework systems. Such a firm and personnel shall produce documentation to provide evidence as being accredited to undertake the work required.

The certifying company shall provide type written results of flow test, static pressure test and flow pressure test at each fire hose reel in the project.

At completion provide filled out and signed originals of all certification forms required by Authorities.

SECTION 6 - FIRE EXTINGUISHERS AND FIRE BLANKETS

6.1 GENERAL

This section of the specification provides for the supply and installation of hand held fire extinguishers and fire blankets and located in accordance with AS 2444.

All fire extinguishers shall be fully charged at date of handing over.

All fire extinguishers and fire blankets shall be complete with appropriate mounting brackets, horns, nozzles, operating instructions and location signs as per AS 2444 as amended.

Supply and install necessary fire extinguishers and fire blankets in accordance with authority and standards requirements.

All fire extinguishers and fire blankets to be maintained to AS 1851.

Fire extinguishers shall be manufactured in accordance with AS 1841.

Fire blankets shall be manufactured in accordance with AS 3504.

SECTION 7 - SANITARYWARE, APPLIANCES AND TAPWARE SCHEDULE

7.1 EXTENT OF WORK

The work specified in this section comprises the ordering, storing on site and installation of sanitary ware, appliances, Tapware fittings as detailed in the fixture schedule and necessary for complete installation.

All items shall be new and of first quality, free of defects and shall be subject to inspection prior to installation. Such inspection shall not relieve the Contractor of responsibility to ensure all items are free of defects at Occupation Certificate.

Prior to placing order provide samples and obtain guarantees from the manufacture that any items which craze or show any other defects within twelve months of issue of Occupation certificate will be replaced providing that such crazing or other defects are not caused by abuse or inappropriate use of the item.

Fixtures

Fix and support fixtures strictly to respective manufacturer's recommendations.

Tapware and Outlets

Store all taps and outlet fittings and be responsible for fixing of same to the fixtures and appliances nominated and connect same to the water service. All exposed pipework including fixture traps to be chrome plated finish.

Tapware Indication Colours

Cold water taps - Blue

Hot water taps - Red

Warm water taps - Yellow

Refer to architectural FF&E schedule for sanitary fixtures and tapware selection.

7.2 ITEMS RELATING TO SANITARY FIXTURES AND TAPWARE PURCHASE AND INSTALLATION

Provide and install 350 kPa pressure limiting valve within cupboards on cold water supply to boiling and chilled water units.

Provide and install on the outlets of dish drawer and dishwashers machine right angle stop taps a CP brass Nylex Flomasta Flood Stop Safety Valve available from Nylex telephone 1800 338 105.

Provide CP right angle stop taps (mini type) at rough in point preceding connection to lever mixer taps. Taps, water and gas outlets and other fittings shall be bright chromium plated. Mattsson single lever mixer taps shall be of the following models:

- Single bowl sinks and tubs Model 4LOO, 150mm long spout.
- Double bowl sinks Model 4L00, 240mm long spout.
- Basins Model 4L50.
- Showers, Model 4L75 - 7070 concealed bath / shower mixer.

Provide CP right angle stop taps (mini type) at rough in point preceding connection to lever mixer taps.

Taps, water and gas outlets and other fittings shall be bright chromium plated. Tap ware handles shall be anti-vandal type and the colour of the indicator shall be in accordance with the following: -

Standard Tap Handles:

Cold Water Taps - Blue

Hot Water - Red

Warm Water Taps - Yellow

Mattsson Lever Mixer Taps:

Two Cold Water Leads - Blue

Cold & Warm Leads - Blue and Yellow

Cold and Hot Leads - Blue and Red

Provide and install to all wall mounted and hob mounted taps, extension spindles of sufficient length to enable top cover plates to be screwed onto spindles. In determining the length check thickness of wall finishes and benches described in the architectural drawings and specification section.

Provide and install to each tap spindle and bonnet assembly where within dry and masonry walls a "Water Bar" tap penetration flange designed for the purpose of preventing water entering the wall. Provide these flanges to all taps and outlets at baths, showers, sinks and tubs.

Water outlets shall be the aerated type unless otherwise specified to be spray type or without aerator or spray nozzle.

Seal sanitaryware, wall surfaces, bench/counter tops with white anti-fungal silicone sealant.

Plugs and washers for basins shall be 40mm diameter chrome plated brass, complete with approved type plastic plug, grey in colour. Plug and washers for stainless steel sinks shall be stainless steel on plastic type complete with approved type plastic plug, grey in colour. Plastic plug and washers in wash basins are not acceptable. Set each plug and washer in position with clear anti fungi Silicone Sealant.

The number of tap holes in sanitary fixtures must be the same number of outlets required by the Tapware Schedule.

Water closet pans shall be set to the floor with 2:1 cement mortar mix. Pure white sand shall be used in the mortar mix.

Provide "Clark Epure" Model EML W Multilink 50mm plus and waste with high level offset to vertical waste pipe at back of tea and kitchen cupboards this is required so maximum usable space is achieved inside cupboards.

SECTION 8 - SEISMIC BRACING / RESTRAINS**8.1 GENERAL****8.1.1 CROSS REFERENCES****General**

Conform to the *General requirements* work section.

Related work sections

Conform to associated work sections as follows:

Hydraulic general requirements.

8.1.2 STANDARDS**AS1170.4 Structural Design Action - Earthquake Actions in Australia**

All hydraulic plant, equipment and supports shall be fixed to the building in accordance with AS1170.4 (including Section 8).

For IL4 buildings (projects with post disaster function), a special study is required to ensure the facility remains 'Serviceable for Immediate Use' post-earthquake and cyclone events (1 in 500 years). Building importance level definition remains the responsibility of the building owner/end-user via a risk assessment mechanism in the NCC.

AS5216 - Post-installed Anchors

All anchors used for seismic bracing shall be rated by the manufacturer for seismic loads

8.2 DESIGN**General Provisions**

Arrange all components, other than service items exempted in AS 1170.4 Clause 8.1.4, to resist seismic loads determined in accordance with AS 1170.4

- Securely fix all hydraulic plant and equipment to the building structure. Do not rely on gravity and/or friction to resist seismic forces.
- Where anti vibrations devices (such as spring mountings) are used, they shall be horizontal and vertical restrained type, to inhibit the development of resonance in the flexible mounting system, and to prevent overturning. If these cannot be used equipment to be fixed or restrained separately to the spring mountings.
- Do not use hydraulic equipment or components that will be damaged by earthquake conditions. Protect systems against the adverse effects of components such as mercury switches that, although not damaged by earthquake, may malfunction.

8.2.1 Seismic Restraint and Expansion/contraction

- General: Seismic restraint shall be in accordance with AS1170.4 and an associated Seismic Engineering Specialist detail drawing.
- Method of fixing floor mounted equipment shall be in accordance with AS1170.4 and an associated Seismic Engineering Specialist detail drawing.

8.2.2 Description of Work

- Seismic restraints are designed to limit the movement of equipment and to keep equipment captive during a seismic event.

- Non-compliance with seismic restraint requirement shall be corrected by the contractor in an approved manner.
- The work in this section includes, but is not limited to the following:
 - Seismic restraint for hydraulic systems and equipment.
 - Equipment and conduit buried underground is excluded but entry of services through the foundation wall is included.

Typical Hydraulic equipment to be restrained is as follows:

- Piping distribution systems
- Suspended gravity drainage systems
- Hot water plant

Items not specifically mentioned in AS1170.4 section 8.1.4 are considered to require restraint by "All other components similar to those listed" and may include shelving, items installed in ceiling voids, cranes, building maintenance units, water storage tanks, systems involving hazardous materials, pressure vessels and heat exchangers, solid fuel heaters, water treatment equipment, waste disposal equipment, air handling plant and fans, automatic control systems and BMS, cable trays, ladders, busbars, conduits, plinths, fuel storage systems, batteries and UPS.

- Seismic restraint shall be installed in accordance with AS1170.4. Provide calculations signed by structural engineer licensed in the Australia in which the work is to take place certifying that seismic restraints will act in accordance with the relevant standards stipulated in the specification and will maintain equipment in captive position

8.2.3 Seismic Design Criteria

The following is a list that is needed for seismic engineering and may be obtained from the structural engineer associated with the project.

- Building/Structure Importance level (IL#)
- Earthquake design category (EDC)
- Hazard Design Factor (Z)
- Site sub-soil class
- Probability Factor

8.2.4 Provisions

Comply with the following as a minimum:

Arrange all components to resist the design earthquake loads as determined by the use of AS 1170.4-2011.

Restrain all hydraulic components against seismic loads including those parts and components identified in Clause 8.1.4, AS 1170.4-2011.

Plant and equipment: Securely fix all hydraulic plant and equipment to the building structure. Fixings shall have a load-transferring capacity equal to or more than that determined by the use of AS 1170.4-2011.

Fixings: Fix all hydraulic components to withstand earthquake loads determined in accordance with AS 1170.4-2011 Do not rely on gravity and friction to resist seismic forces.

Anti-vibration mounts: Use horizontally restrained type with a load-transferring capacity equal to or in excess of that determined by the use of AS 1170.4-2011. If this is not possible use snubbers or equipment clips to restraint with free springs.

Submission: Provide evidence that the fixings and vibration isolation installed comply with the requirements of AS 1170.4-2011. Include the provision of a design certificate with calculations certified, by an experienced and practicing structural engineer.

Material submittals shall include, but not limited to the following information:

- Catalogue cuts and data sheets on specific restraints on other equipment to be utilised, showing compliance with the specification.
- A list of the items of equipment to be restraint, the proposed seismic restraint types and models, and seismic restraint loading.

8.3 SUBMISSIONS

8.3.1 Shop Drawings:

- Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations as well as the integration of vibration isolation.
- Where walls, floors, slabs, or supplementary steel work are used for seismic restraint locations; details of acceptable attachment methods must be included and approved before the condition is accepted for installation. Restrain manufacturer's submittals must include spacing, static loads and seismic loads at all attachment and support points.
- Provide specific details of seismic restraints, vibration isolation and anchors; include number, size, and locations for each piece of equipment.

8.3.2 Seismic Analysis:

- Seismic restraint calculations must be provided for all connections of equipment to the structure.
- Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilised for connections to equipment and structure.
- Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, acting through the equipment centre of gravity. Overturning moments may exceed forces at ground level.

8.3.3 Contractor's Responsibilities

The following is the minimum contractor's responsibility:

- Engage a Seismic Design Specialist to:
 - Conduct a Special Study as required by AS1170.4
 - provide specific engineering design of all seismic/wind restraints.
 - advise appropriate service clearances.
 - perform installation inspections, and
 - provide certification the design requirements have been met.
- Confirm with relevant trades that all walls, ceiling and partitions are engineered for the loads of engineering services elements and ensure that appropriate service clearance requirements have been met.
- Ensure values for all parameters with the Structural Engineer and allow to adjust calculations and equipment selections as required prior to ordering equipment

- Carry out all remedial works due to failure to meet the above responsibilities at no cost.

8.3.4 Document Submittals

Submit the following documentation prior to commencement of work or ordering of equipment

- Design computations for all design items and check as required within this specification including:
- Equipment support seismic computations.
- Seismic restraints design, locations and auditable load calculations
- Adjusted services pathway illustrating minimum service clearances as outlined in specific engineering design and coordination with relevant trades.

8.4 INSPECTIONS AND VERIFICATION

Prior to installation of ceilings, notice shall be given for inspection by Seismic Design Specialist and main contractor of in-ceiling systems, seismic anchors and seismic restraints.

Seismic Design Specialist to provide a Construction Monitoring Report for submittal for installed restraints and braces.

Failure to give notice will result in cutting and patching of coverings for spot checking. Prior to practical completion, Seismic Design Specialist shall issue certification that installation meets design requirements, signed by qualified structural/seismic engineer.

8.4.1 Services Expansion/contraction

Refer to structural drawings for location and details of building expansion joints. Perform, submit, coordinate and provide calculations for all aspects of pipe and duct expansion and contraction including:

- Building expansion joints (movement 75mm in all directions as described)
- Temperature variations across all conditions including construction, operation, building or part building isolation/shutdown under all possible weather conditions
- Anchor locations, forces and construction details. Coordinate with the Managing Contractor and provide all necessary structural support as required.
- Arrange reticulated services and equipment to avoid excessive movement, forces and stress in pipework and ductwork and to eliminate the risk of pipe, duct and equipment connection fractures.
- Provide appropriate lengths of hanger, pipe/duct guides, saddles, rollers, anchors, changes of direction, expansion loops, spring hangers, expansion bellows, etc. as required.
- Acoustic penetrations shall be arranged to allow necessary longitudinal and lateral movement.

Provide design certificate with calculations, certified by an experienced and practicing Structural/Seismic Engineer.

All pipe and duct systems shall accommodate the following building joints expansion:

- Horizontal movement:
- Vertical movement:

8.4.2 Services Clearances

- Minimum clearances for services shall apply as per below table

- These clearances include services and other structural and non-structural elements, including but limited to pillars, ceiling hangers, wall studs, etc.
- Such service clearances need to be allowed for in the design, with pathways adjusted, and any changes communicated to other trades and project management.

The following minimum clearances must be achieved:

Condition being considered	Minimum Clearances	
	Horizontal	Vertical
Unrestrained component to unrestrained component	250 mm	50 mm
Unrestrained component to restrained component	150 mm	50 mm
Restrained component to restrained component	50 mm	50 mm
Penetration through structure such as wall or floor	50 mm	50 mm
Restrained services passing through the ceiling	25 mm	25 mm
NOTE: ceiling hangers and braces are considered to be restrained components for the purpose of this table, hence 150 mm horizontal clearance is required between ceiling hangers and unrestrained services		

8.4.3 Seismic Testing & Component Importance Factors

The Equipment Schedule indicates the Component Importance Factors (I_p) applicable to equipment and the systems associated.

The Equipment Schedule indicates where equipment/plant shall be capability to maintain its integrity and remain operational in the event of earthquake. Such evidence shall be provided by the Manufacturer/supplier.

8.4.4 Equipment Fixing

All equipment mounting and fixing points to be verified as adequate to withstand seismic events nominated in the project documentation, utilising seismic fixings/restraints where required to provide a complete system.

Anti-vibration and acoustic isolations systems shall be fixed with seismically stable isolator mounts or restraints incorporated.

All bracing shall be independent of the main item support (gravity/vertical support system) unless designed by a Seismic Design Specialist. All post-installed anchors for bracing shall meet the requirements of AS5216.

All fixing of equipment to concrete plinths and piers shall be in accordance with seismic requirements from the contractor's Seismic Design Specialist. Plinths shall be designed to withstand seismic loads being imposed by the supported equipment, with adequate depth and edge distances for anchor capabilities and suitably connected to the structure to transfer the required loads.

IL4 structures fix only to building structural elements or to steel framing fixed to structural elements. Do not fix to masonry infill panels unless specifically designed and certified by a Seismic Design Specialist.

8.4.5 Bracing Location

The Seismic Design Specialist shall provide bracing locations, restraint capacities, suggested brace types and transparency of calculations.

General rules of bracing

Unless exempted, all building services shall be braced:

- when penetrating walls/soffits/floors, unless directed by Seismic Design Specialist.
- both sides of piping, conduit or ductwork at flexible connections
- to avoid collisions between piping, conduit or ductwork and adjacent other non-structural components
- within 600mm of changes in direction, whether it be horizontal or vertical changes (note that offsets of less than 600mm along a run are not considered a change of direction)
- in both directions at the top of all risers where risers exceed 900mm.

8.4.6 Restraint exemption clarification

The exemptions outlined in AS1170.4 Section 8.1.4(b)(x) require specific engineering design knowledge, although the following is noteworthy:

- The exemptions apply to IL2 & IL3 structures only.
- IL4 structures require a Special Study (Specific Engineering Design) before any exemptions apply.
- The exceptions only apply to 'individually supported services'.
- If a straight run of service is exempt at one end and ends non-exempt at the other end, then the whole run should be braced, not just the non-exempt section. The same applies where the hanging distance varies from less than 300mm to more than 300mm in a straight run.
- Where below threshold items are supported on a trapeze or multi service hanger exemption is no longer valid.
- Where a mix of exempt and non-exempt items are within the same support exemption does not apply.
- Exemptions do not apply to the following services:
 - Smoke control systems.
 - Emergency electrical systems (including battery racks).
 - Fire and smoke detection systems.
 - Fire suppression systems (including sprinklers).
 - Life safety system components.
 - Boilers, furnaces, incinerators, water heaters, and other equipment using combustible energy sources or high energy sources, chimneys, flues, smokestacks, vents and pressure vessels.
 - Communication systems (such as cable systems, motor control devices, switchgear, transformers and unit substations).
 - Reciprocating or rotating equipment.
 - Utility and services interfaces.
 - Anchorage of lift machinery and controllers.
 - Lift and hoist components including structural frames providing support for guide rail brackets, guide rails and brackets, car and counterweight members
 - Escalators
 - Machinery (manufacturing and process)
 - Lighting fixtures
 - Electrical panel boards and dimmers
 - Conveyor systems (non-personal)

SECTION 9 - TENDER FORM – HYDRAULIC SERVICES**PROJECT NAME:** _____

I/WE _____

hereby tender for the supply, installation, testing and commissioning of Hydraulic Services in the abovementioned complex all in accordance with the Drawings and Specification prepared by JHA Consulting Engineers

Itemised Lump Sum Tender Price	Fixed Price \$
Sanitary drainage system including trade waste pretreatment structures	
Downpipes	
Trench base support for sewer and stormwater drainage as specified. Tender to include costs for payment of geotechnical engineer to test base of trenches	
Hot, warm and cold water systems including hot water heaters and pumps	
PC Sum for the Oil Water Separator	
PC Sum for sewer pump station	
PC Sum for sewer rising main relocation	
Preparation and submission of workshop drawings	
Purchase and install sanitary fixtures and tapware	
"As built" drawings and operating instructions manuals	
Testing, commissioning and certification of all hydraulic services, pumps, controls, valves and vessels including hydrant flow test with appliance and all other required tests	
Preventative maintenance for twelve months as specified	
Fire extinguishers and fire blankets	
P & D inspectors fees and council fees	
Total tender price	
GST	
Total tender price including GST	

Total in wordsDollars

I/we.....

Unconditionally guarantee of plant, equipment and system performance as detailed in the specification and tender drawings and completion in accordance with the building programme

NAME ON TENDER	
SIGNATURE	
COMPANY POSITION	
WITNESS	
DATE	

SECTION 10 -	TENDER FORM – LABOUR MONETARY RATES
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PROJECT NAME: _____

LABOUR MONETARY RATES

Labour monetary rates shall include all current Award Allowances and any Special Site Loading or specified Site Allowances.

PERSONNEL CATEGORY	RATES per hour \$ excl GST
Foreman Plumber	
Leading Hand Plumber	
Journeyman Plumber	
Labourer	
Designer and Draftsperson	
Apprentice Plumber	
Other	

NAME ON TENDER	
SIGNATURE	
COMPANY POSITION	
WITNESS	
DATE	

SECTION 11 - TENDER FORM – SCHEDULE OF RATES

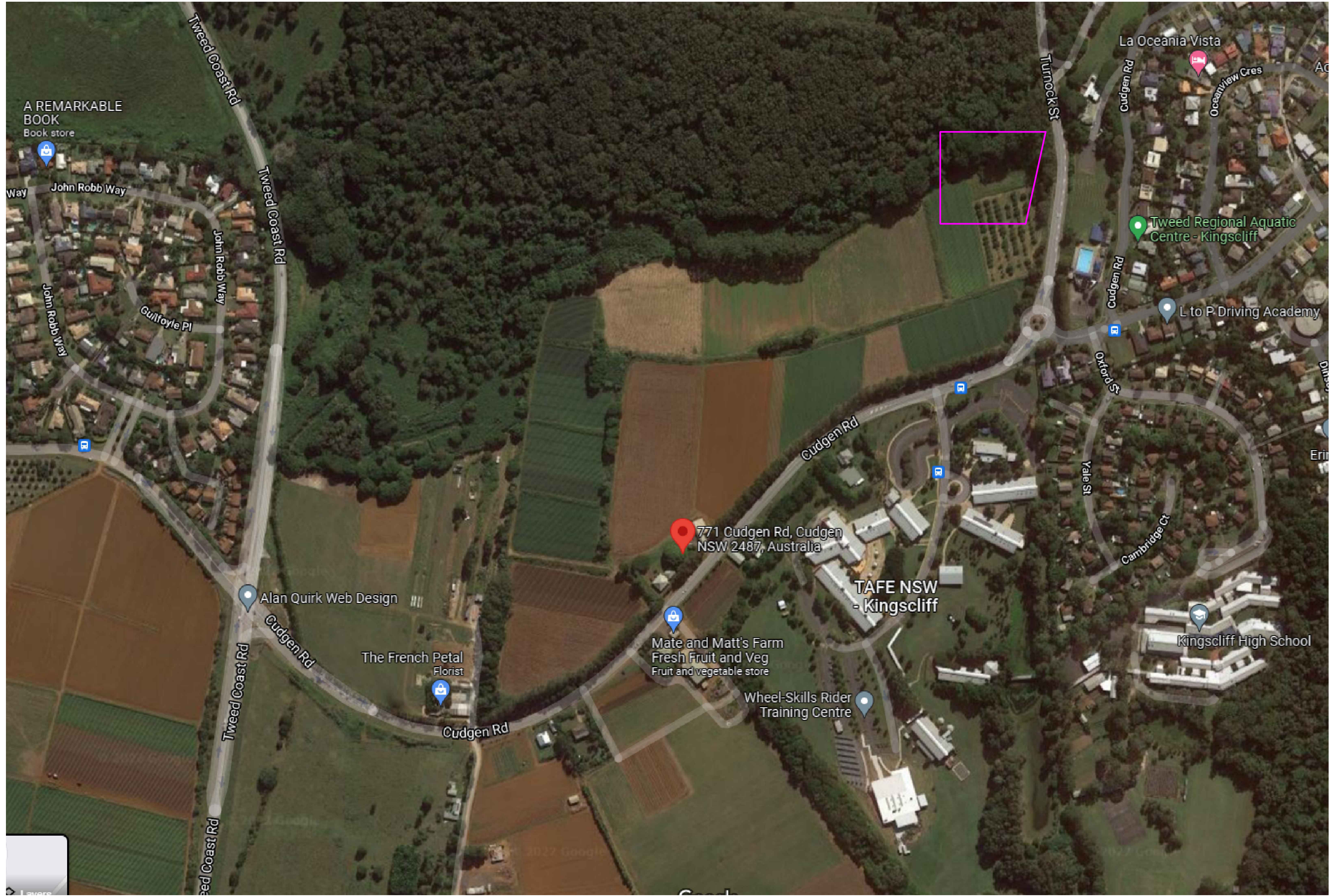
I/We _____ hereby provide the following alternative pricing for the alternative pricing for the alternative materials specifications listed below.

Description	Rate	Unit
Sewer/ Sanitary/Stormwater		
65 dia uPVC drainage, supply and install (inground)	\$	per m
100 dia uPVC drainage, supply and install (inground)	\$	per m
150 dia uPVC drainage, supply and install (inground)	\$	per m
Floor Waste, supply and install	\$	per item
100 dia chrome plated clear out, including penetration and pipework)	\$	per item
Vinyl Floor Waste, supply and install	\$	per item
Stainless steel Fox wash bay sump	\$	per item
Coalescing oil plate separator	\$	per item
1200L holding tank	\$	per item
Sewer Pump Station	\$	per item
Sewer Rising Main relocation	\$	per item
Water Services		
25 dia Copper type "B" water/ gas service, supply and install (suspended)	\$	per m
32 dia Copper type "B" water/ gas service, supply and install (suspended)	\$	per m
20 dia Tempering Valve, supply and install	\$	per item
20 dia TMV Assembly, supply and install	\$	per item
20 dia RPZD Assembly, supply and install	\$	per item
32 dia RPZD Assembly, supply and install	\$	per item
20 dia Isolation Valves (water)	\$	per item
25 dia Isolation Valves (water)	\$	per item
32 dia Isolation Valves (water)	\$	per item
Hot water unit	\$	per item
Dual hot water circulating pumpset with control panel	\$	per item
Hose tap outlet, including 3m of 20 dia. copper water service	\$	per item
Additional items		
Excavation in rock for 800mm wide trench and 2m deep		per m

RURAL AMBULANCE INFRASTRUCTURE RECONFIGURATION PROGRAM - KINGSCLIFF

DISCIPLINE: HYDRAULICS SERVICES





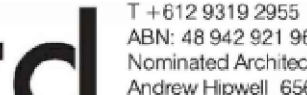

CLIENT: NSW GOVERNMENT HEALTH INFRASTRUCTURE



SITE PLAN
SCALE: N.T.S.

DRAWING LIST

R25-HY-DRG-0000	COVER SHEET AND DRAWING LIST
R25-HY-DRG-0001	HYDRAULICS LEGEND
R25-HY-DRG-0002	SITE PLAN
R25-HY-DRG-0100	LOWER GROUND FLOOR SEWER DRAINAGE LAYOUT
R25-HY-DRG-0101	GROUND FLOOR SEWER DRAINAGE LAYOUT
R25-HY-DRG-0102	ROOF PLAN SEWER DRAINAGE LAYOUT
R25-HY-DRG-0200	LOWER GROUND FLOOR PRESSURE SERVICES LAYOUT
R25-HY-DRG-0201	GROUND FLOOR PRESSURE SERVICES LAYOUT
R25-HY-DRG-0300	HYDRAULIC DETAIL SHEET 1

REVISIONS / AMENDMENTS				REVISIONS / AMENDMENTS				 RAIR Rural Ambulance Infrastructure Reconfiguration Building the future response for our state	PROJECT MANAGER	CLIENT	ARCHITECT	CONSULTANT	PROJECT	TITLE	
Rev	Date	Description	Verified	Rev	Date	Description	Verified		<div>LEVEL 16 44 MARKET STREET SYDNEY NSW 2000 T +61 2 9239 3555</div> 	 Health Infrastructure 	 djrcd architects 64 Rose Street Chippendale NSW 2008 Sydney Australia djrcd.com.au	 Level 23, 101 Miller Street, North Sydney NSW 2060 Australia +61 (02) 9437 1000 general@jhaengineers.com.au www.jhaservices.com	RURAL AMBULANCE INFRASTRUCTURE RECONFIGURATION PROGRAM (RAIR) KINGSCLIFF, NSW 2487	HYDRAULIC SERVICES COVER SHEET AND DRAWING LIST	
P1	09.02.22	PRELIMINARY ISSUE	S.T.												
A	01.03.22	TENDER ISSUE	S.T.												
B	29.04.22	TENDER ISSUE	S.T.												
1	20.07.22	CONTRACT SET ISSUE	S.T.												

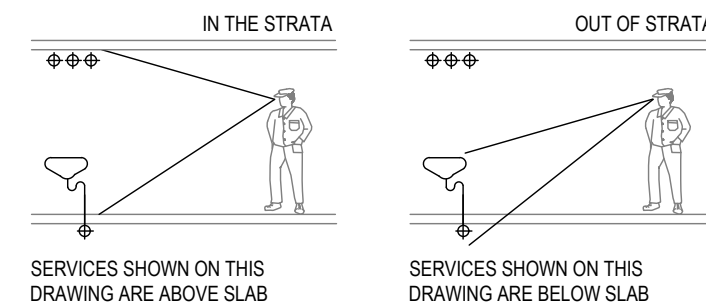
HYDRAULIC LEGEND

	COLD WATER SERVICE
	FIRE HOSE REEL SERVICE
	HOT WATER SERVICE
	HOT WATER FLOW
	HOT WATER RETURN
	WARM WATER SERVICE
	WARM WATER FLOW
	WARM WATER RETURN
	FIRE HYDRANT SERVICE
	FIRE HOSE REEL SERVICE
	ELECTRICAL SERVICE
	EXISTING SERVICE
	SANITARY PLUMBING
	VENT PIPE
	SRM - SEWER RISING MAIN
	TW - TRADE WASTE DRAINAGE
	TW - TRADE WASTE PLUMBING
	TWV - TRADE WASTE VENT
	CV - CHAMBER VENT
	STORMWATER DRAINAGE
	DOWNPIPE
	OF - OVERFLOW PIPE
	EXISTING COLD WATER SERVICE
	EXISTING SEWER SERVICE
	EXISTING GAS SERVICE
	GAS SERVICE

SYSTEM ACCESSORIES LEGEND

	PUMP
	CLEAROUT
	PIPELINE CONTINUES
	PIPELINE CAPPED OFF
	FHR - FIRE HOSE REEL
	FH - FIRE HYDRANT - INTERNAL
	DUAL FIRE HYDRANT - EXTERNAL
	OFG - OVERFLOW GULLY
	WM - WATER METER
	GM - GAS METER
	BT - BOUNDARY SHAFT
	BTFW - BUCKET TRAP FLOOR WASTE
	FW - FLOOR WASTE
	PDO - PLANTER DRAIN OUTLET
	RWO - RAIN WATER OUTLET
	VFW - VINYL FLOOR WASTE
	SPO - SPOON DRAIN OUTLET
	CPD - CARPARK DRAIN
	PDO - PLANTER DRAIN
	SMH - MAINTENANCE HOLE
	SMH - SEWERAGE MAINTENANCE HOLE
	SMWH - STORMWATER MAINTENANCE HOLE
	SWP - STORMWATER PIT WITH GRATE
	SWS - STORMWATER SUMP WITH GRATE
	PECP - PUMP ELECTRICAL CONTROL PANEL
	PC - PENETRATION CORE THROUGH STRUCTURAL ELEMENT
	IPMF - INDUCT PIPE MICA FLAP
	NJ - NEW JUNCTION INTO EXISTING PIPELINE
	NB - NEW BRANCH INTO EXISTING PIPELINE
	TD - TUNDISH
	OF - OVERLAND FLOW PATH
	POO - POO PIT

DESIGN ZONES



SYSTEM ACCESSORIES LEGEND

	BAV - BALANCING VALVE
	SV - STOP VALVE
	BV - BALL VALVE
	SV - SOLENOID VALVE
	MGV - MONITORED GATE VALVE
	PV - PATH VALVE IN CAST IRON SURFACE BOX
	GR - GAS REGULATOR
	RV - REFLUX VALVE
	NRV - NON RETURN VALVE
	DCV - DOUBLE CHECK VALVE
	DCV - TESTABLE DOUBLE CHECK VALVE
	GV - GAS VALVE
	RPZD - REDUCED PRESSURE ZONE DEVICE
	AAV - AIR ADMITTANCE VALVE
	B - BASIN, SINK, SHOWER OR BATH TAP SET
	B - BASIN, SINK, SHOWER OR BATH CW TAP
	B - BASIN, SINK, SHOWER OR BATH HW TAP
	TMV - THERMOSTATIC MIXING VALVE
	TG - TEMPERATURE GUARD
	HFH - STREET FIRE HYDRANT
	WMA - WATER METER ASSEMBLY WITH RPZD
	R - RISER
	D - DROPPER
	TR - TEE RISER
	TD - TEE DROPPER
	HUW - HOT WATER UNIT
	FHBV - FIRE HYDRANT BRIGADE BOOSTER ASSEMBLY
	FA - FLOW DIRECTION ARROW
	A - AMENDMENT SYMBOL
	IR - INDICATES PIPE RISERS
	ST - INDICATES SERVICE TYPE
	SS - INDICATES SERVICE SIZE
	ST - INDICATES SERVICE TYPE
	SS - INDICATES SERVICE SIZE
	ST - INDICATES SERVICE TYPE
	SS - INDICATES SERVICE SIZE
	ESI - EXISTING SERVICES IDENTIFICATION
	DRS - DROPPER / RISER / SIZE
	H-001 - FOR CONTINUATION REFER DRAWING No. H-001
	4.5KG DRY POWDER EXTINGUISHER
	5.0KG CO2 FIRE EXTINGUISHER
	9.0KG FOAM EXTINGUISHER
	NFBL - NEW FIRE BLANKET

VALVE ABBREVIATIONS

AST - ANGLE STOP TAP	NRV - NON RETURN VALVE
AAV - AIR ADMITTANCE VALVE	OPSO - OVER PRESSURE SHUT OFF REGULATOR
AP - ACCESS PANEL	PLV - PRESSURE LIMITING VALVE
AV - AIR ELIMINATION VALVE	PRV - PRESSURE REDUCTION VALVE
BFV - BUTTERFLY VALVE	PTR - PRESSURE/TEMPERATURE RELIEF VALVE
BV - BALL VALVE (GAS)	RGBV - RECESSED GAS BAYONET VALVE
BAV - BALANCING VALVE	RPZD - REDUCED PRESSURE ZONE DEVICE
CV - CHECK VALVE	RST - RECESSED STOP TAP
CV - CONTROL VALVE	RV - REFLUX VALVE
DCV - DUAL CHECK VALVE	STP - STOP TAP
DV - DRAIN OR TEST VALVE	SV - STOP VALVE
ESOV - EMERGENCY SHUT OFF VALVE	TDVC - TESTABLE DUAL CHECK VALVE
FCV - CONTROL VALVE	TEV - TEMPERING VALVE
FHV - FIRE HYDRANT VALVE	TMV - THERMOSTATIC MIXING VALVE
GV - GATE VALVE	TPR - TEMPERATURE AND PRESSURE RELIEF VALVE
HFV - HANDS FREE VALVE	TV - THROTTLING VALVE
HT - HOSE TAP	VCV - VALVE GROUP
IV - ISOLATION VALVE	

FLUID FLOW AND MATERIAL ABBREVIATIONS

AHD - AUSTRALIAN HEIGHT DATUM	L/s - LITRES PER SECOND
Br - BRASS	mm - MILLIMETRES
BRH - BLUE RHINO	m - METRES
CI - CAST IRON	m² - METRES SQUARES
CONC - CONCRETE	MDPE - MEDIUM DENSITY POLYETHYLENE
CICL - CAST IRON CEMENT LINED	MJ - MEGAJOULE
CP - CHROME PLATED	m/s - VELOCITY OF FLOW IN METRES PER SECOND
Cu - COPPER	mhd - PRESSURE IN METRES HEAD
DICL - DUCTILE IRON CEMENTED LINE	OD - OUTSIDE DIAMETER
FR - FIBRE GLASS REINFORCED CEMENT	PE - POLYETHYLENE
FJ - FIXTURE UNITS	PP - POLYPROPYLENE
GMS - GALVANISED MILD STEEL	RCV - REINFORCED CONCRETE PIPE
HDPE - HIGH DENSITY POLYETHYLENE	RHS - RECTANGULAR HOLLOW SECTION GALVANISED STEEL
ID - INSIDE DIAMETER	SS - STAINLESS STEEL
KPa - KILOPASCALS	PVC-U - UNPLASTICISED POLYVINYL CHLORIDE
KW - KILOWATT	VCP - VITRIFIED CLAY PIPE
L - LITRES	

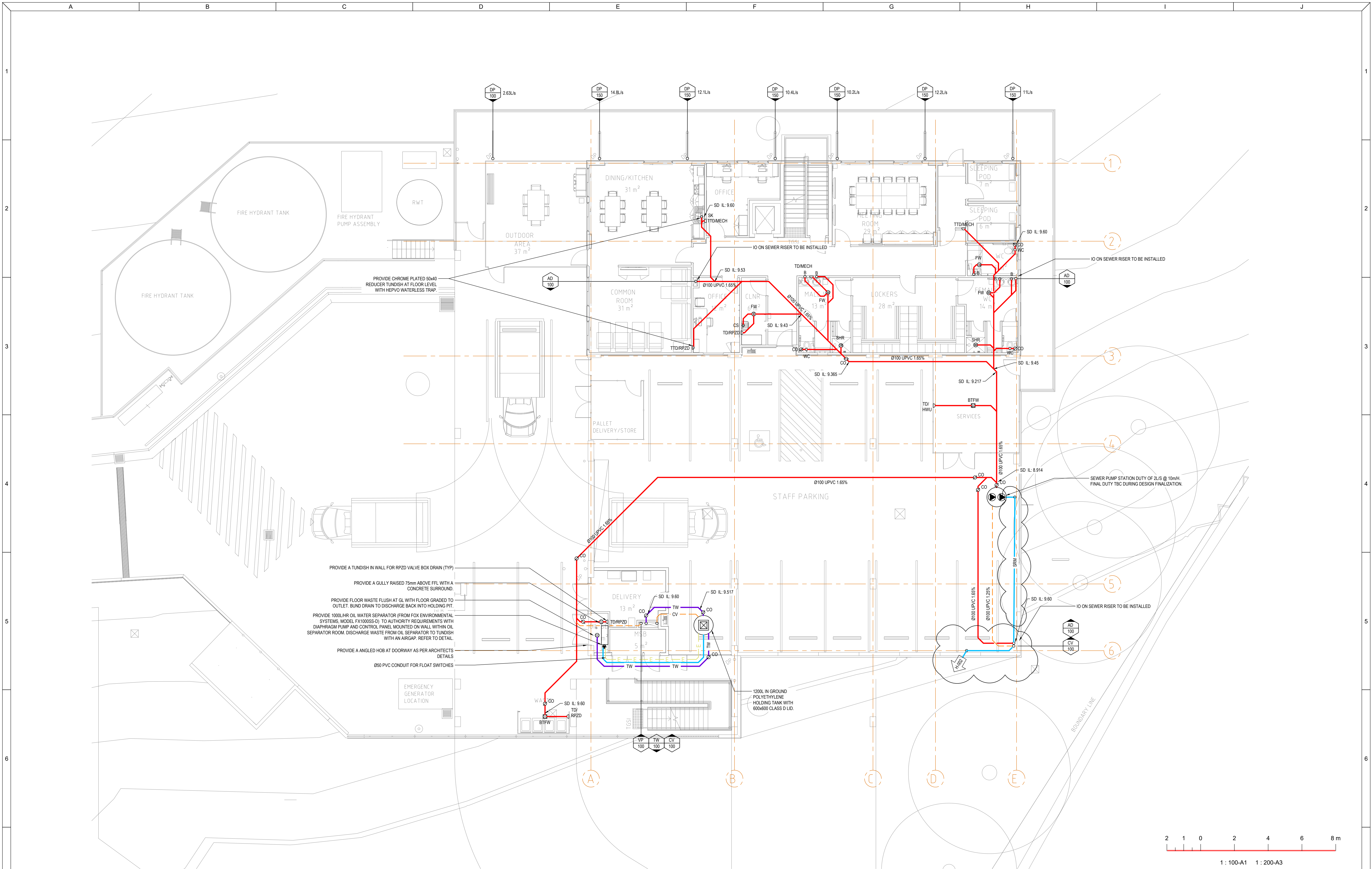
GENERAL ABBREVIATIONS

AAV - AIR ADMITTANCE VALVE	K - KAMLOK FITTING WITH CAP & CHAIN
AFFL - ABOVE FINISHED FLOOR LEVEL	KB - KITCHEN BASIN
AC - AIR CONDITIONING	KHW - KITCHEN HOT WATER
AD - AERIAL DRAINAGE	KIP - KERB INLET PIPE
B - BASIN	KS - KITCHEN SINK
BG - BOX GUTTER	LD - LIGHT DUTY
BID - BIDET	LL - LOW LEVEL
BM - BAIN-MARIE	LS - LAB SINK
BPS - BED PAN STERILISER	LT - LAUNDRY TUB
BPW - BED PAN WASHER	LTG - LONGITUDINAL TRENCH GRATE
BT - BOUNDARY TAP	MD - MEDIUM DUTY
BU - BUBBLERS	ML - MID LEVEL
BRT - BUBBLER TROUGH	NPCW - NON-POTABLE COLD WATER
CHW - CHILLED WATER	No. - NUMBER
CL - CEILING LEVEL	OF - OVERFLOW
CO - CLEAROUT	OSD - OVERFLOW GULLY
CP - CHROME PLATED	PA - PLASTER ARRESTOR
CS - CLEANERS SINK	PCW - POTABLE COLD WATER
CTE - CONNECT TO EXISTING	PRO - PARAPET RAINWATER OUTLET
CV - CHAMBER VENT	QT - QUENCHING TANK
CW - COLD WATER	REF - REFRIGERATOR
D - DRAINAGE	RL - REDUCED LEVEL
DCP - DISCHARGE CONTROL PIT	RPZD - REDUCED PRESSURE ZONE DEVICE
DE - DIESEL EXHAUST	RWO - RAINWATER OUTLET
DGCP - DRINKING FOUNTAIN	RV - RELIEF VENT
DH - DOUBLE GRATED GULLY PIT	SBF - STANDARD BAYONET FITTING
DHB - DISABLED PERSONS HANDWASH BASIN	SD - SAFE DRAIN
DL - DILUTION PIT	SOU - SANITARY NAPKIN DISPOSAL UNIT
DP - DOWNPIPE	SEP - SIDE ENTRY PIT
DTU - DRAINAGE TURN-UP	SEW - SEWER
DW - DISHWASHER MACHINE	SH - SLOP HOPPER
DWC - DISABLED PERSONS WATER CLOSET	SHR - SHOWER
DWG No. - DRAWING NUMBER	SIP - SEWER INSPECTION PIT
DWV - DRAINAGE WASTE AND VENT	SK - SINK
EG - EAVES GUTTER	SMH - SEWER MANHOLE
EJ - EXPANSION JOINT	SP - SOIL PIPE
EKI - EXTENDED KERB INLET	SRM - SEWER RISING MAIN
EX - EXISTING	SRO - SIDE ROOF OUTLET
EW - EYE WASH	SS - SUB-SOIL PIPE
FD - FIRE DRENCHER	SSH - SAFETY SHOWER
FFL - FINISHED FLOOR LEVEL	SSL - STRUCTURAL SLAB LEVEL
FGL - FINISHED GROUND LEVEL	ST - SANITARY DRAINAGE STACK
FH - FIRE HYDRANT	SW - STORM WATER
FHBV - FIRE HYDRANT BOOSTER VALVE	SWMH - STORMWATER MANHOLE
FHR - FIRE HOSE REEL	SWP - STORM WATER PIT
FJ - FIXTURE UNIT	SWRM - STORMWATER RISING MAIN
FW - FLOOR WASTE	TD - TUNDISH
G - GAS	TK - TOP OF KERB
GA - GREASE ARRESTOR	TTD - TRAPPED TUNDISH
GD - GRATED DRAIN	TTG - TRENCH GRATE
GFW - GARBAGE FLOOR WASTE	TW - TRADE WASTE
GST - GREASE STACK	TWL - TOP WATER LEVEL
GT - GAS TURRET	TYP - TYPICAL
GL - GROUND LEVEL	UG - UNDERGROUND
GO - GUTTER OUTLET	UNO - UNLESS NOTED OTHERWISE
GW - GREASE WASTE	UR - URINAL
GWV - GREASE WASTE VENT	UIS - UNDERSIDE
GW - GLASS WASHER	USFL - UNDERSIDE FLOOR LEVEL
HD - HEAVY DUTY	VB - VACUUM BREAKER
HP - HIGH POINT	VB - VANITY BASIN
HP - HOT PLATE	VFW - VINYL FLOOR WASTE
HL - HIGH LEVEL	VP - VENT PIPE
HR - HALF ROUND	WC - WATER CLOSET
HT - HOSE TAP	WD - WINDOW DRENCHER
HW - HOT WATER	WL - WATER LEVEL
HWF - HOT WATER FLOW	WM - WASHING MACHINE
HWH - HOT WATER HEATER	WM - WATER METER
HWR - HOT WATER RETURN	WP - WASTE PIPE
HUW - HOT WATER UNIT	WT - WASH TROUGH
IPMF - INDUCT PIPE MICA FLAP	WW - WARM WATER
IRR - IRRIGATION	WWF - WARM WATER FLOW
IS - INSPECTION SHAFT	VWR - WARM WATER RETURN
IL - INVERT LEVEL	YG - YARD GULLY
IM - ICE MACHINE	Ø - DIAMETER
IO - INSPECTION OPENING	

GENERAL NOTES

- THIS PLAN MUST NOT BE COPIED OR REPRODUCED IN ANY FORM OR USED FOR ANY PURPOSE OTHER THAN ORIGINALLY INTENDED WITHOUT APPROVAL FROM JHA CONSULTING ENGINEERS.
- THIS PLAN SHALL BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL, OTHER CONSULTANTS DRAWINGS, SPECIFICATIONS AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED DURING THE COURSE. REFER TO THE ARCHITECT FOR DECISIONS BEFORE PROCEEDING WITH ANY WORK.
- ALL WORKS TO BE IN ACCORDANCE WITH THE HYDRAULIC SERVICES SPECIFICATION, AUTHORITIES REQUIREMENTS, PLUMBING CODE OF AUSTRALIA, AS3500, AS5601, AS 2444, AS 2419, AS 2118.1, AS2441, AS1530, CURRENT NCC & NSW HEALTH DEPT.
- CONFIRM LOCATION, SIZE AND LEVELS OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF WORK.
- DISCONNECT AND REMOVE ALL EXISTING REDUNDANT SERVICES TO AUTHORITIES APPROVAL.
- LOCATIONS & FIXING OF PIPEWORK SHALL BE SUBJECT TO CO-ORDINATION WITH OTHER DESIGN DISCIPLINES, ie STRUCTURAL, MECHANICAL, ELECTRICAL AND OTHER SERVICES ENGINEERS.
- ALL LOCATIONS OF EXISTING SERVICES MAINS TO BE CONFIRMED BY MEANS OF DIAL BEFORE YOU DIG, PIPE LOCATOR AND TRACING PRIOR TO COMMENCEMENT OF WORKS.
- ALL WORKS TO INCLUDE TESTING & INSPECTIONS. OBTAIN REQUIRED CERTIFICATES ON COMPLETION & PAYMENT OF RELEVANT FEES.
- THE HYDRAULIC CONTRACTOR SHALL ALLOW IN THE TENDER TO SUBMIT PHOTO BASED INSPECTION AND TEST PLANS ESPECIALLY FOR SERVICE PENETRATIONS THROUGH FIRE AND SMOKE WALLS. REFER TO ARCHITECTURAL DRAWINGS FOR DEMOLITION PLAN AND SCOPE OF WORKS.
- ALLOW TO CLEAN / FLUSH OUT ALL EXISTING STORMWATER DRAINAGE.
- ALLOW TO SAWCUT/REMOVE HARD SURFACES AREAS AS REQUIRED TO COMPLETE THE INSTALLATION. ALLOW TO MAKE GOOD SURFACES UPON COMPLETION.
- CHECK EXISTING ELECTRICAL EARTHING TO METALLIC PLUMBING SERVICES. PROVIDE TEMPORARY EARTHING CABLES BETWEEN SERVICES WHICH ARE TO BE CUT, TERMINATED OR EXTENDED. CONFIRM WITH SITE ELECTRICIAN FOR SAFE PROCEDURES.
- CONTRACTOR IS TO SET OUT & DIMENSION ALL PENETRATIONS & GAIN APPROVAL FROM STRUCTURAL ENGINEER BEFORE WORK COMMENCES. PROVIDE SEPARATE PENETRATION FOR EACH SERVICE SO AS TO ENSURE ADEQUATE FIRE STOPPING. ALL PIPE PENETRATIONS SHALL BE FITTED WITH APPROVED FIRE STOP COLLARS/ DEVICES TO CONFORM TO AS1530.
- WATER, WASTE & GAS PIPES LOCATED WITHIN JOINERY CABINETS, SINK CUPBOARD etc. SHALL BE ARRANGED IN A MANNER SO AS NOT TO OBSTRUCT THE FREE SPACE AS FAR AS PRACTICAL INSTALLATION PERMITS.
- PROVIDE FLOW CONTROL TO ALL FIXTURES. REFER FIXTURE/FAUCET SCHEDULE.
- ALL WORK IS TO COMPLY WITH ALL AUTHORITY REQUIREMENTS, RELEVANT AUSTRALIAN STANDARDS AND THE NATIONAL CONSTRUCTION CODE.
- THE DOCUMENTS REPRESENT DESIGN CONCEPT ONLY. IT IS THE SUB CONTRACTORS RESPONSIBILITY TO DEVELOP DETAILED DRAWINGS, FULLY CO-ORDINATED WITH ALL SERVICE DISCIPLINES, NEW AND EXISTING STRUCTURE AND ARCHITECTURAL DOCUMENTATION.
- THE SUB-CONTRACTOR IS RESPONSIBLE FOR THE COMPLETE DETAILED DESIGN, CALCULATIONS AND SUBMISSIONS, SUPPLY AND INSTALLATION OF ALL SERVICES, CERTIFICATION AND APPROVALS, COMMISSIONING, TESTING & HANDOVER.
- THE SUB-CONTRACTOR IS TO ALLOW FOR THE PAYMENT OF ALL FEES AND CHARGES LEVIED BY THE VARIOUS AUTHORITIES AND PREPARE ALL SUBMISSIONS AS REQUIRED TO FACILITATE THE CONSTRUCTION OF ALL SERVICES.
- DO NOT SCALE DRAWINGS. WRITTEN DIMENSIONS GOVERN.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL DIMENSIONS SHALL BE VERIFIED ON SITE BEFORE PROCEEDING WITH THE WORK. THE CLIENT SHALL BE NOTIFIED IN WRITING OF ANY DISCREPANCIES.
- THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL RELEVANT CONTRACTS, SPECIFICATIONS, REPORTS AND DRAWINGS.

REVISIONS / AMENDMENTS				REVISIONS / AMENDMENTS				PROJECT MANAGER		CLIENT		ARCHITECT		CONSULTANT		PROJECT		TITLE		CONSTRUCTION ISSUE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Rev	Date	Description	Verified	Rev	Date	Description	Verified	 Rural Ambulance Infrastructure Reconfiguration <i>Building the future, responsible for our state</i>		 T + 612 9319 2955 44 MARINET STREET SYDNEY NSW 2000 T + 612 5209 5356		 NSW Ambulance		 djrd architects 64 Rose Street Chippendale NSW 2008 Sydney Australia djrd.com.au		 Level 23, 101 Miller Street, North Sydney NSW 2060 Australia +61 (02) 9437 1000 general@hengineering.com.au www.jhaservices.com		RURAL AMBULANCE INFRASTRUCTURE RECONFIGURATION PROGRAM (RAIR)		HYDRAULIC SERVICES HYDRAULICS LEGEND		SCALE @ A1 N.T.S.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
P1	09.02.22	PRELIMINARY ISSUE	S.T.						<p>All dimensions to be verified on site prior to commencement of on-site work and off-site prefabrication. Figured dimension to be taken in preference to scaled dimensions. This drawing is copyright and remains the property of JHA Consulting Engineers. Reproduction in whole or part of these drawings without written consent constitutes an infringement of copyright.</p>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				



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C	06.05.22	TENDER ISSUE	S.T.				
1	20.07.22	CONTRACT SET ISSUE	S.T.				

RAIR
Rural Ambulance Infrastructure Reconfiguration
Building the future response for our state

PROJECT MANAGER
LEVEL 14
44 MARKET STREET
SYDNEY NSW 2000
T +61 2 9229 3355

CLIENT
Health Infrastructure

ARCHITECT

T +612 9319 2955
ABN: 48 942 921 969
Nominated Architects:
Andrew Hipwell 6562
Daniel Beechwerder 6192
64 Rose Street
Chippendale NSW 2008
Sydney Australia
djrd.com.au

CONSULTANT

Level 23, 101 Miller Street,
North Sydney
NSW 2060
Australia
+61 (02) 9437 1000
general@haservices.com.au
www.haservices.com

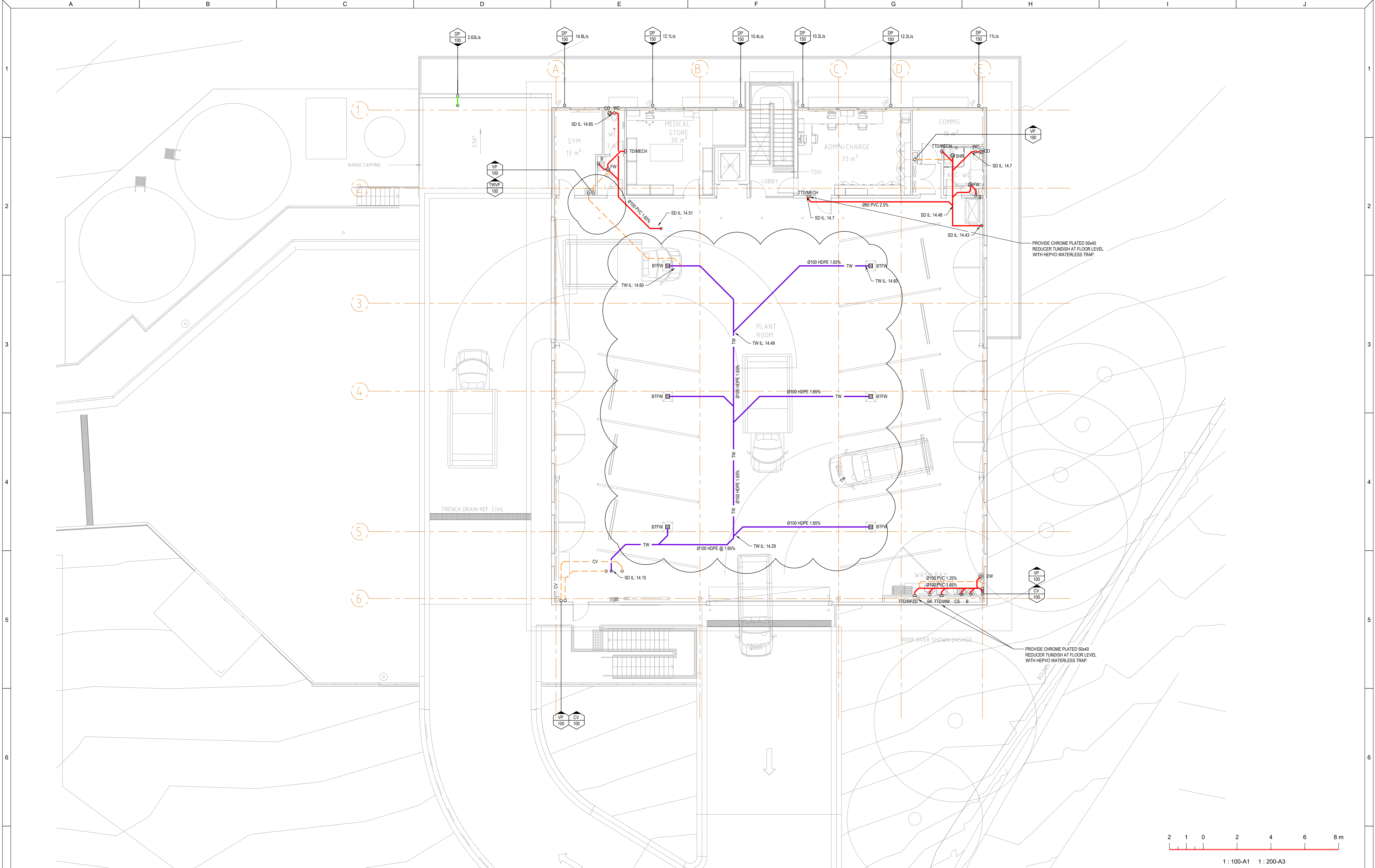
PROJECT
**RURAL AMBULANCE
INFRASTRUCTURE
RECONFIGURATION PROGRAM
(RAIR)**
KINGSCLIFF, NSW 2487





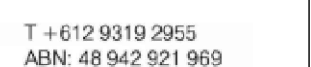
TITLE
**HYDRAULIC SERVICES
LOWER GROUND FLOOR
SEWER DRAINAGE
LAYOUT**

CONSTRUCTION ISSUE

DRAWN	S.L.	SCALE @ A1
CHECKED	S.T.	1:100
APPROVED	S.T.	
CREATED	FEB 2022	
JOB No.	210067	

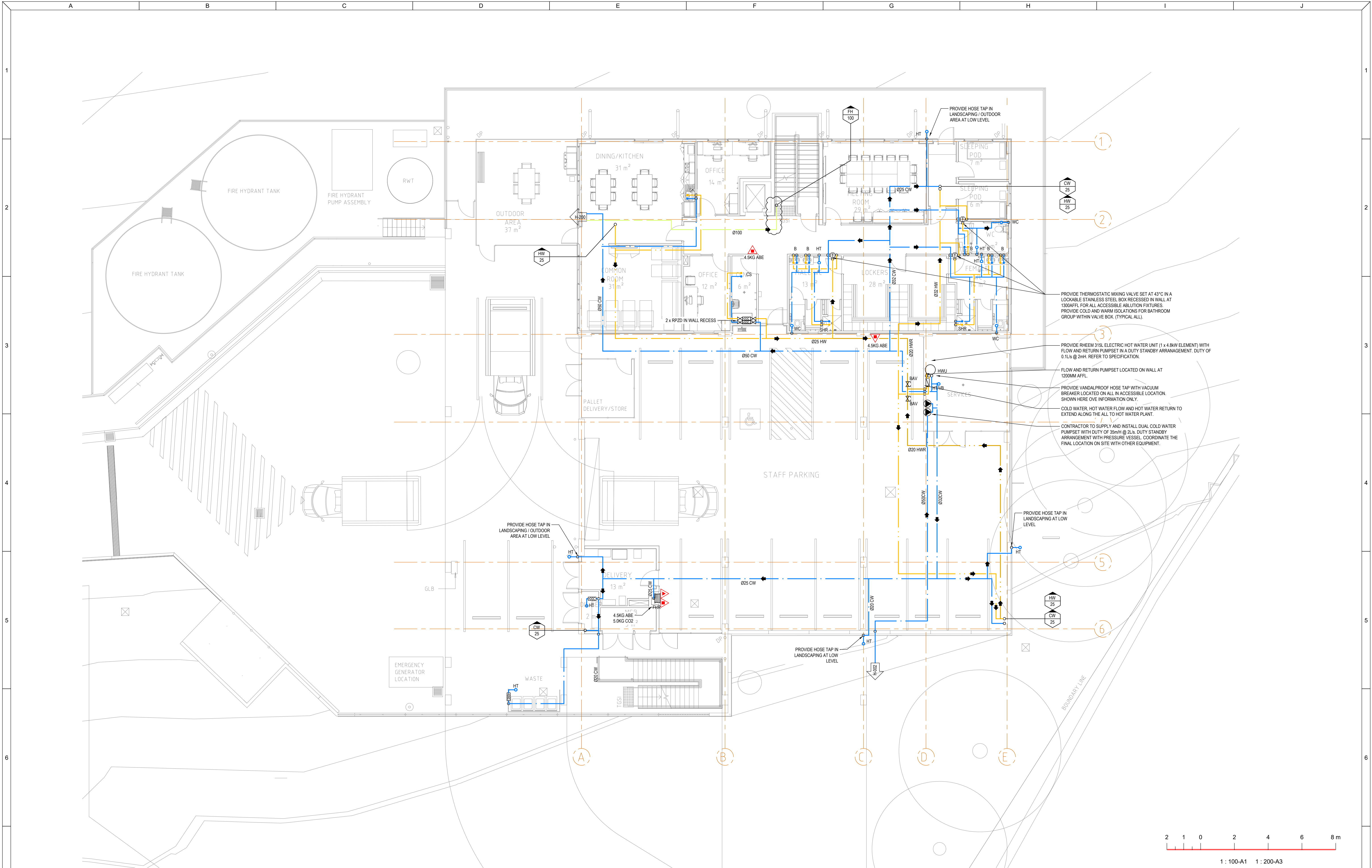
DRAWING No. **R25-HY-DRG-0100** REV **1**



REVISIONS / AMENDMENTS				REVISIONS / AMENDMENTS				PROJECT MANAGER		CLIENT		ARCHITECT		CONSULTANT		PROJECT		TITLE		CONSTRUCTION ISSUE					
Rev	Date	Description	Verified	Rev	Date	Description	Verified	 LEVEL 16 44 MARKET STREET SYDNEY NSW 2009 T +61 2 929 3556				 NSW Ambulance		 T +612 9319 2955 ABN: 48 942 921 969 Nominated Architects Andrew Hipwell 6562 Daniel Beechwerder 6192		 Level 23, 101 Miller Street, North Sydney NSW 2060 Australia +61 (02) 9437 1000 general@jhaservices.com.au www.jhaservices.com		RURAL AMBULANCE INFRASTRUCTURE RECONFIGURATION PROGRAM (RAIR)		HYDRAULIC SERVICES GROUND FLOOR SEWER DRAINAGE LAYOUT		DRAWN CHECKED APPROVED CREATED JOB No. DRAWING No. R25-HY-DRG-0101		SCALE @ A1 1:100 FEB 2022 210067 REV 1	
P1	09.02.22	PRELIMINARY ISSUE	S.T.																						
A	01.03.22	TENDER ISSUE	S.T.																						
B	29.04.22	TENDER ISSUE	S.T.																						
1	20.07.22	CONTRACT SET ISSUE	S.T.																						
A				B				C		D		E		F		G		H		I					



DRAWING No.	REV
R25-HY-DRG-0102	



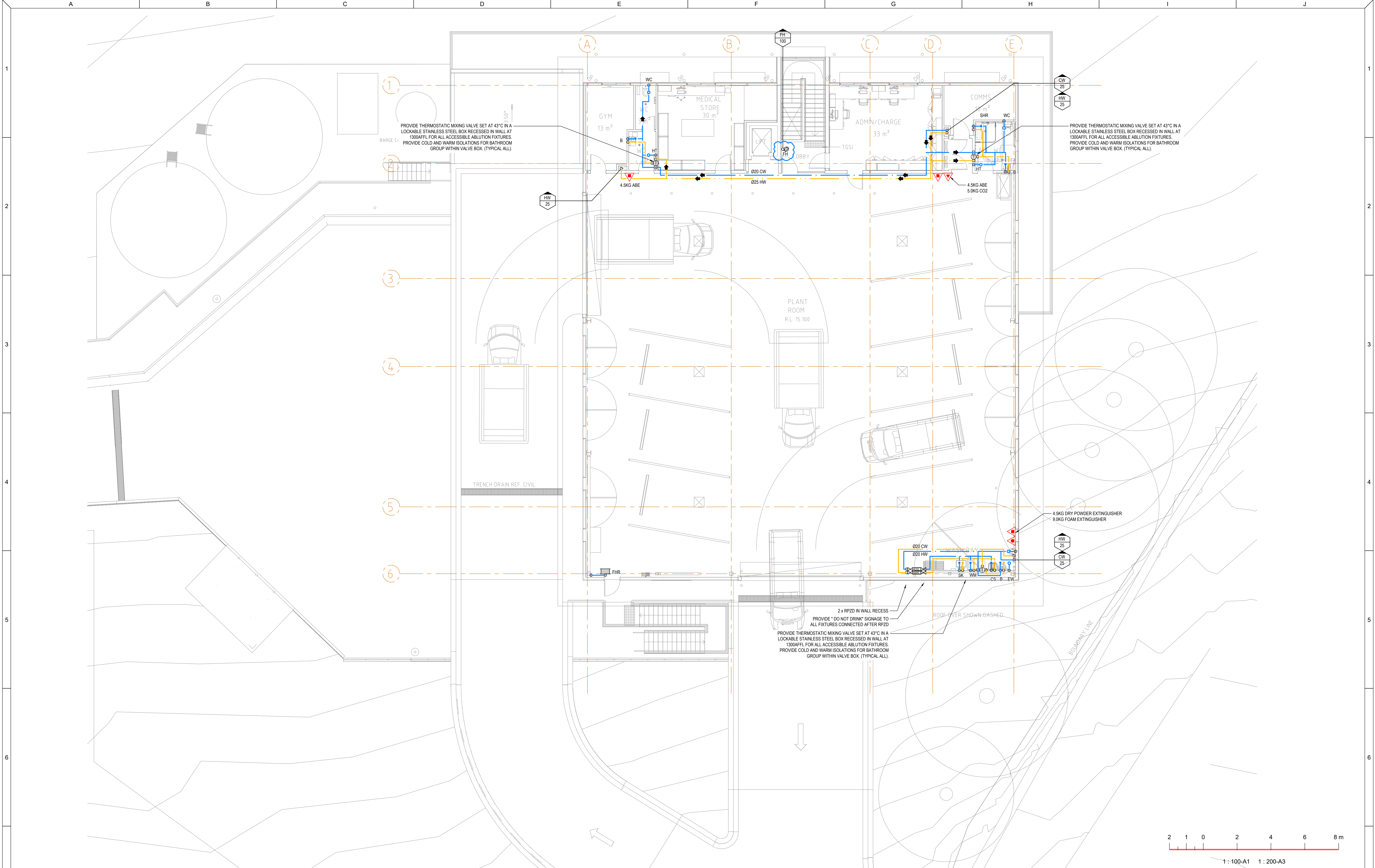
REVISIONS / AMENDMENTS				REVISIONS / AMENDMENTS			
Rev	Date	Description	Verified	Rev	Date	Description	Verified
P1	09.02.22	PRELIMINARY ISSUE	S.T.				
A	01.03.22	TENDER ISSUE	S.T.				
B	29.04.22	TENDER ISSUE	S.T.				
1	20.07.22	CONTRACT SET ISSUE	S.T.				



PROJECT
RURAL AMBULANCE INFRASTRUCTURE RECONFIGURATION PROGRAM (RAIR)
KINGSCLIFF, NSW 2487

TITLE
HYDRAULIC SERVICES LOWER GROUND FLOOR PRESSURE SERVICES LAYOUT

CONSTRUCTION ISSUE		
DRAWN	S.L.	SCALE @ A1
CHECKED	S.T.	1:100
APPROVED	S.T.	
CREATED	FEB 2022	
JOB No.	210067	
DRAWING No.	R25-HY-DRG-0200	REV 1



REVISIONS / AMENDMENTS

Rev	Date	Description	Verified
P1	09.02.22	PRELIMINARY ISSUE	S.T.
A	01.03.22	TENDER ISSUE	S.T.
B	29.04.22	TENDER ISSUE	S.T.
1	20.07.22	CONTRACT SET ISSUE	S.T.

REVISIONS / AMENDMENTS

Rev	Date	Description	Verified

RAIR

Rural Ambulance Infrastructure Reconfiguration
Building the future response for our state

PROJECT MANAGER

LEVEL 16
44 MARKET STREET
SYDNEY NSW 2000
T +61 2 9229 3555

CLIENT

Health Infrastructure

ARCHITECT

djrd
architects
T +61 2 9319 2955
ABN: 48 942 921 969
Nominated Architects:
Andrew Hipwell 6562
Daniel Beeckwiler 6192
64 Rose Street
Chippendale NSW 2008
Sydney Australia
djrd.com.au

CONSULTANT

JHA
Level 23, 101 Miller Street,
North Sydney
NSW 2060
Australia
+61 (02) 9437 1000
general@jaservices.com.au
www.jaservices.com

PROJECT

RURAL AMBULANCE
INFRASTRUCTURE
RECONFIGURATION PROGRAM
(RAIR)
KINGSCLIFF, NSW 2487

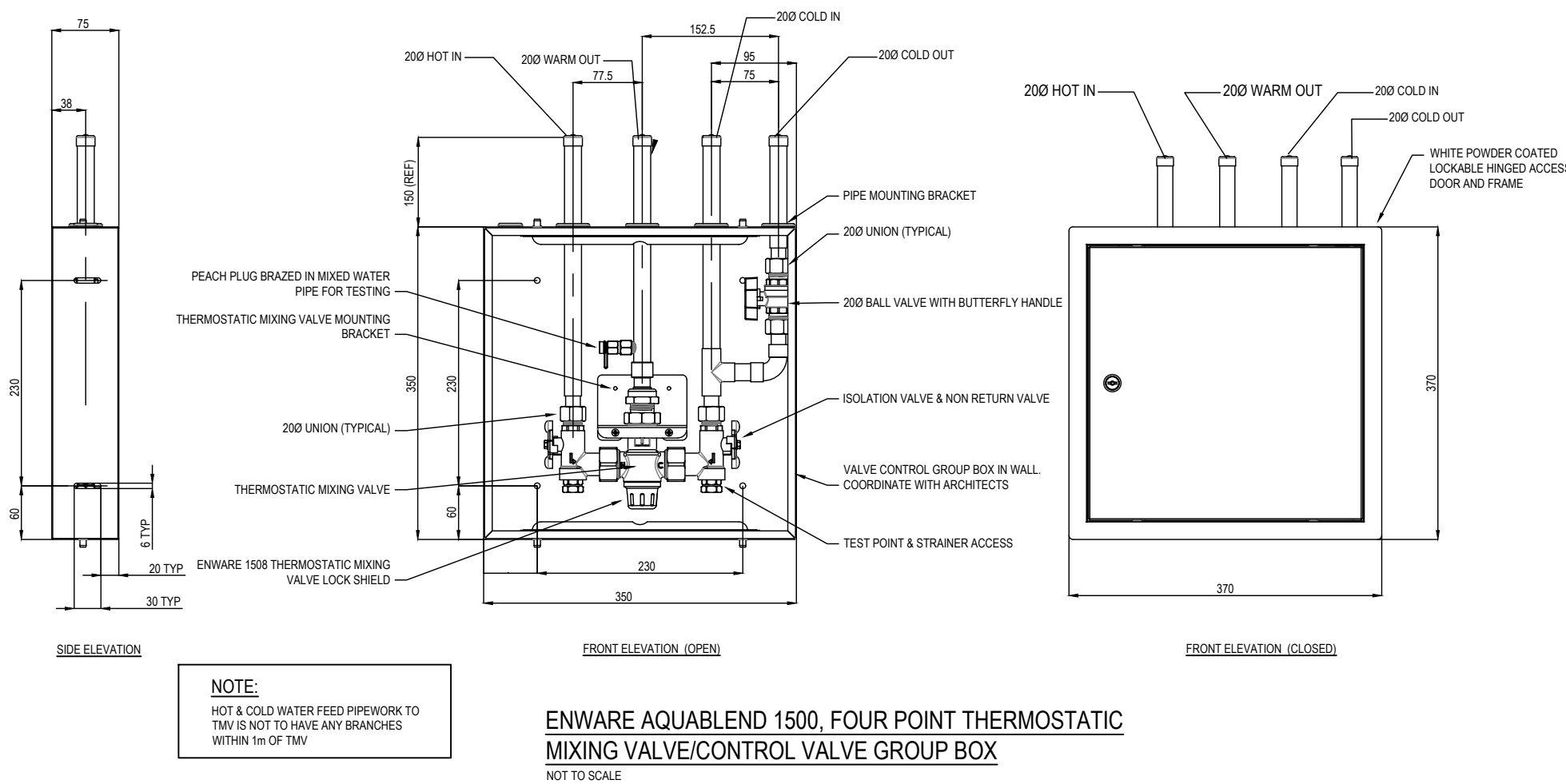
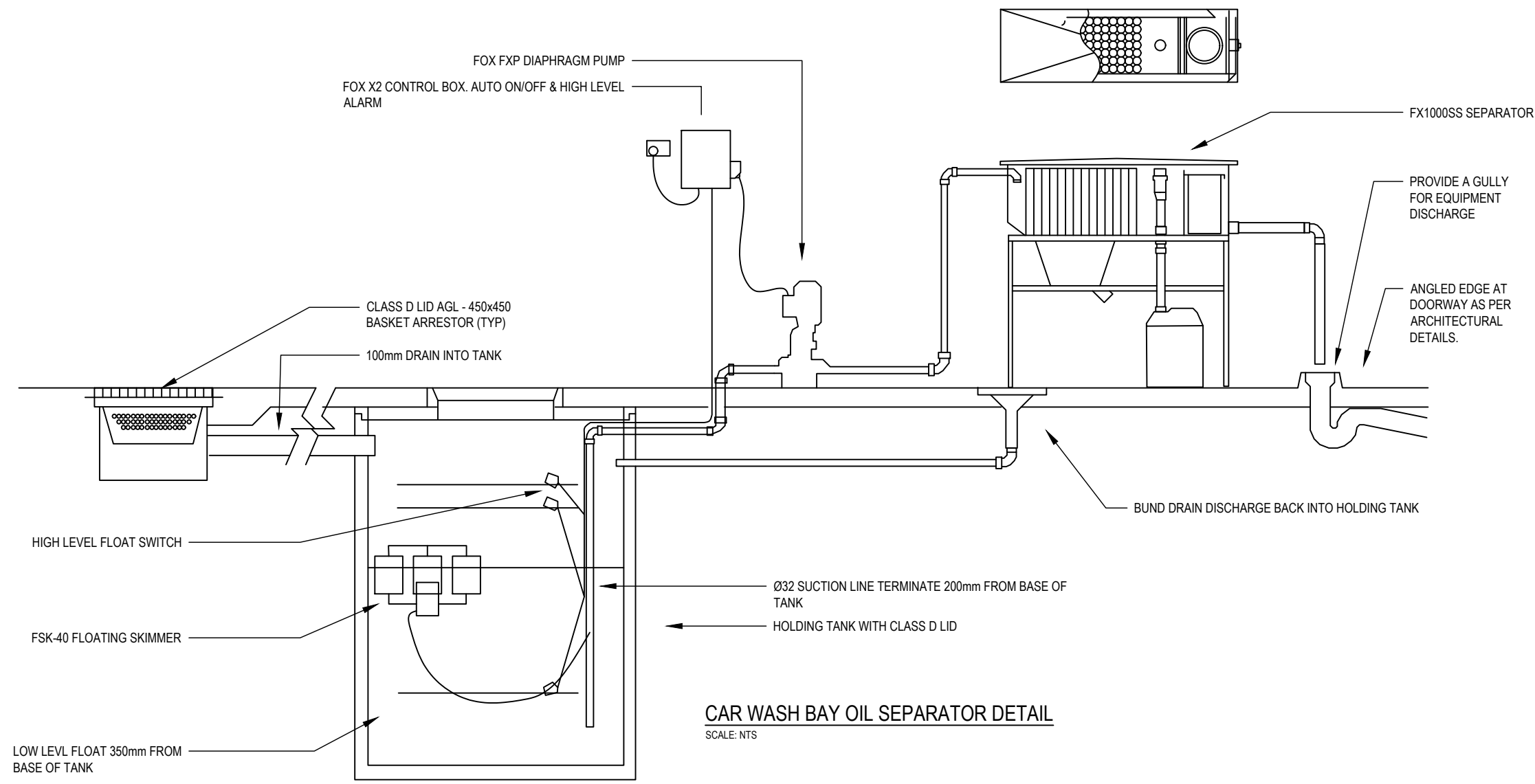
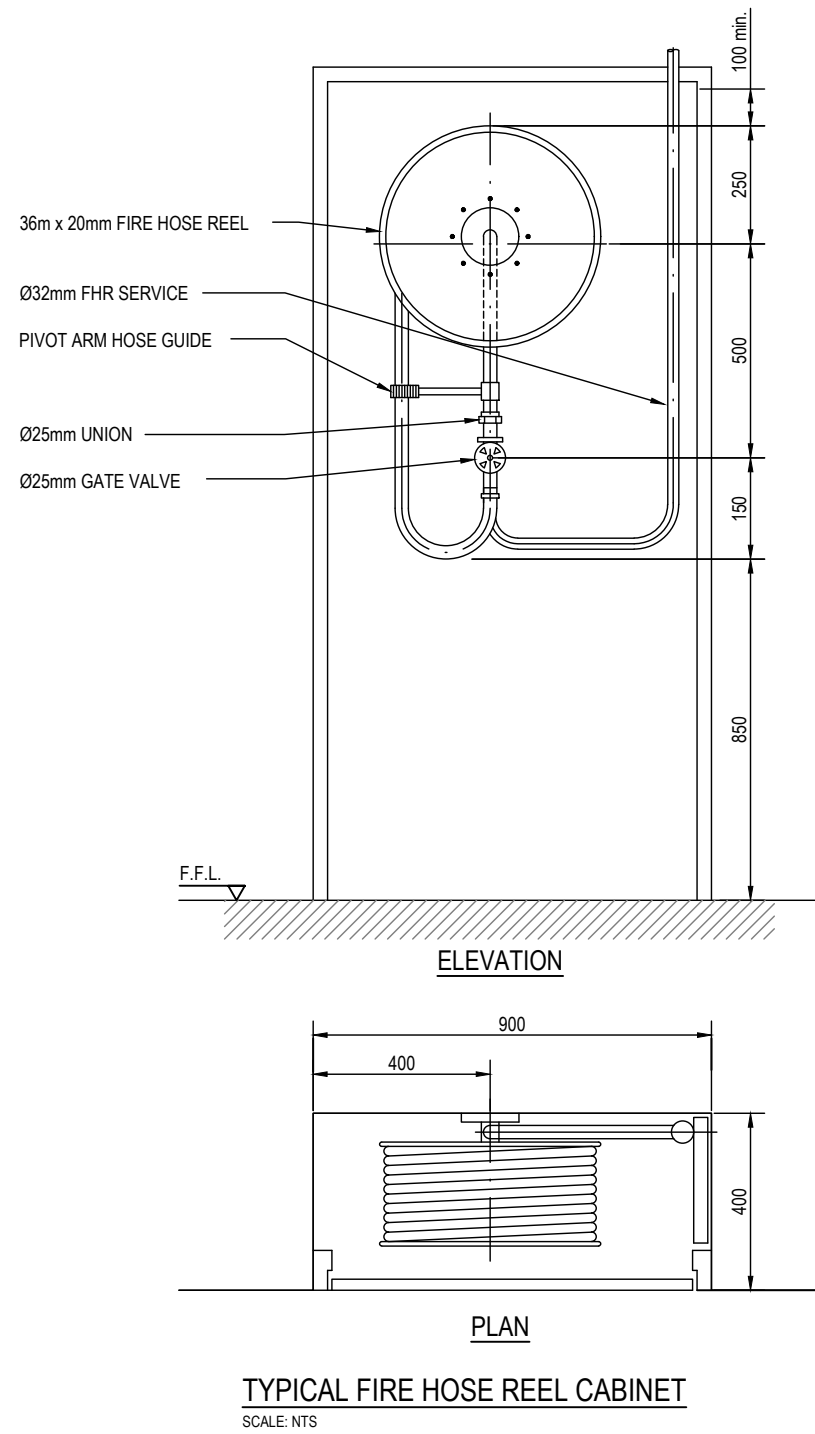
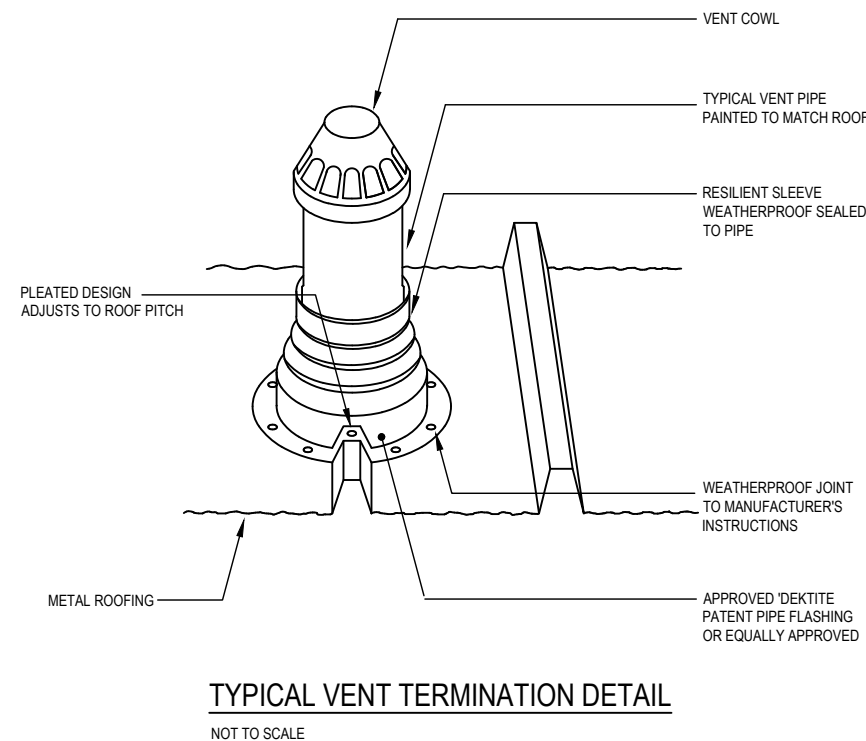
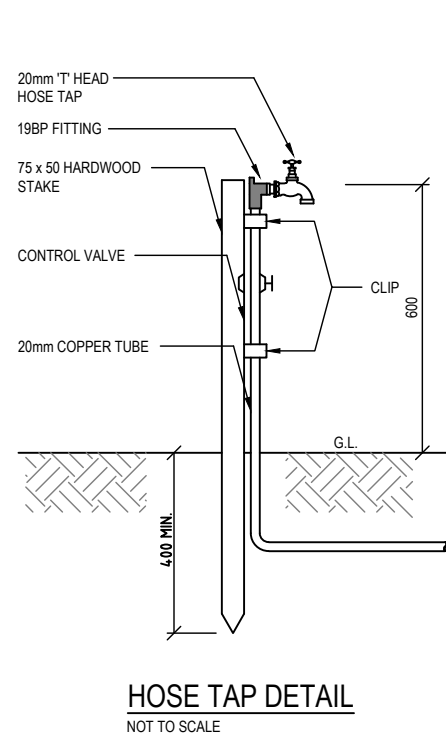
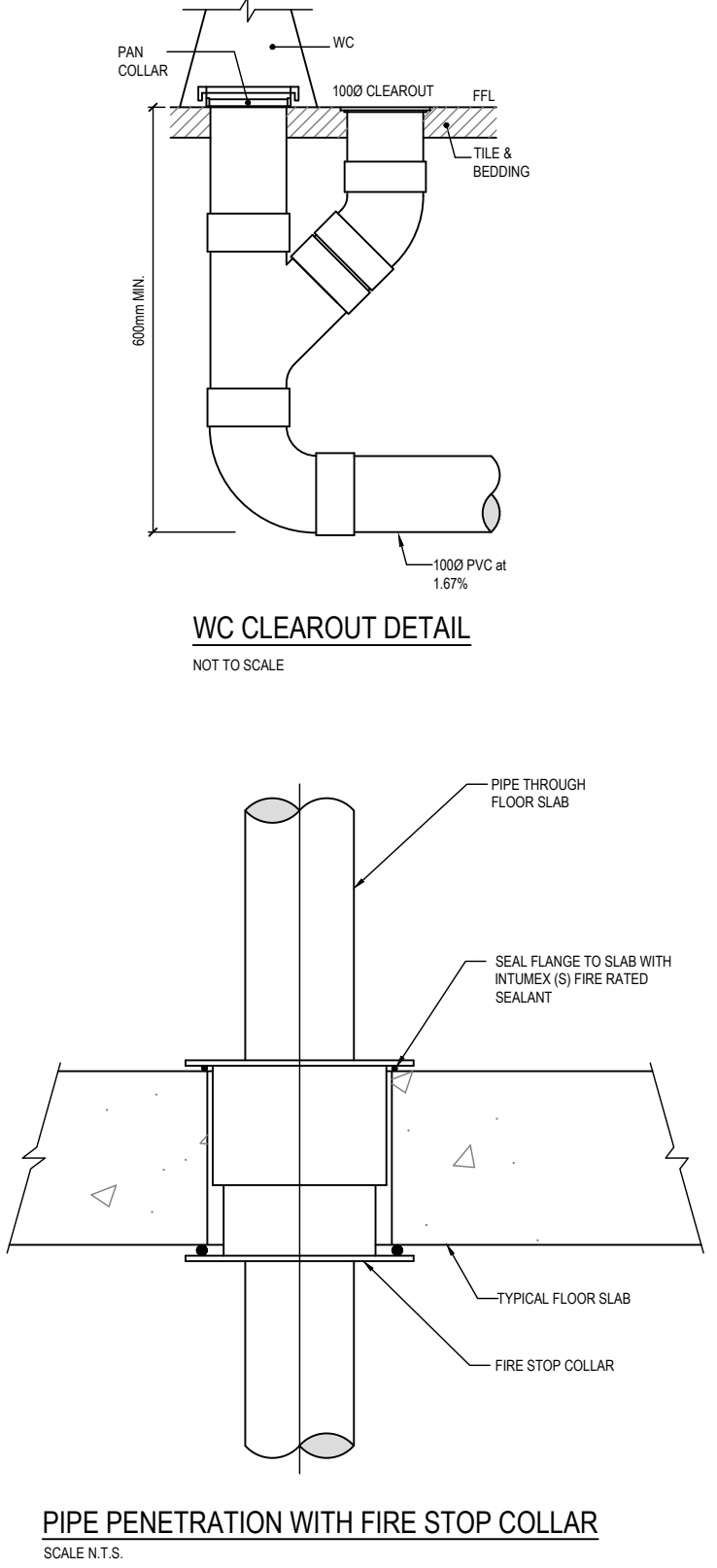
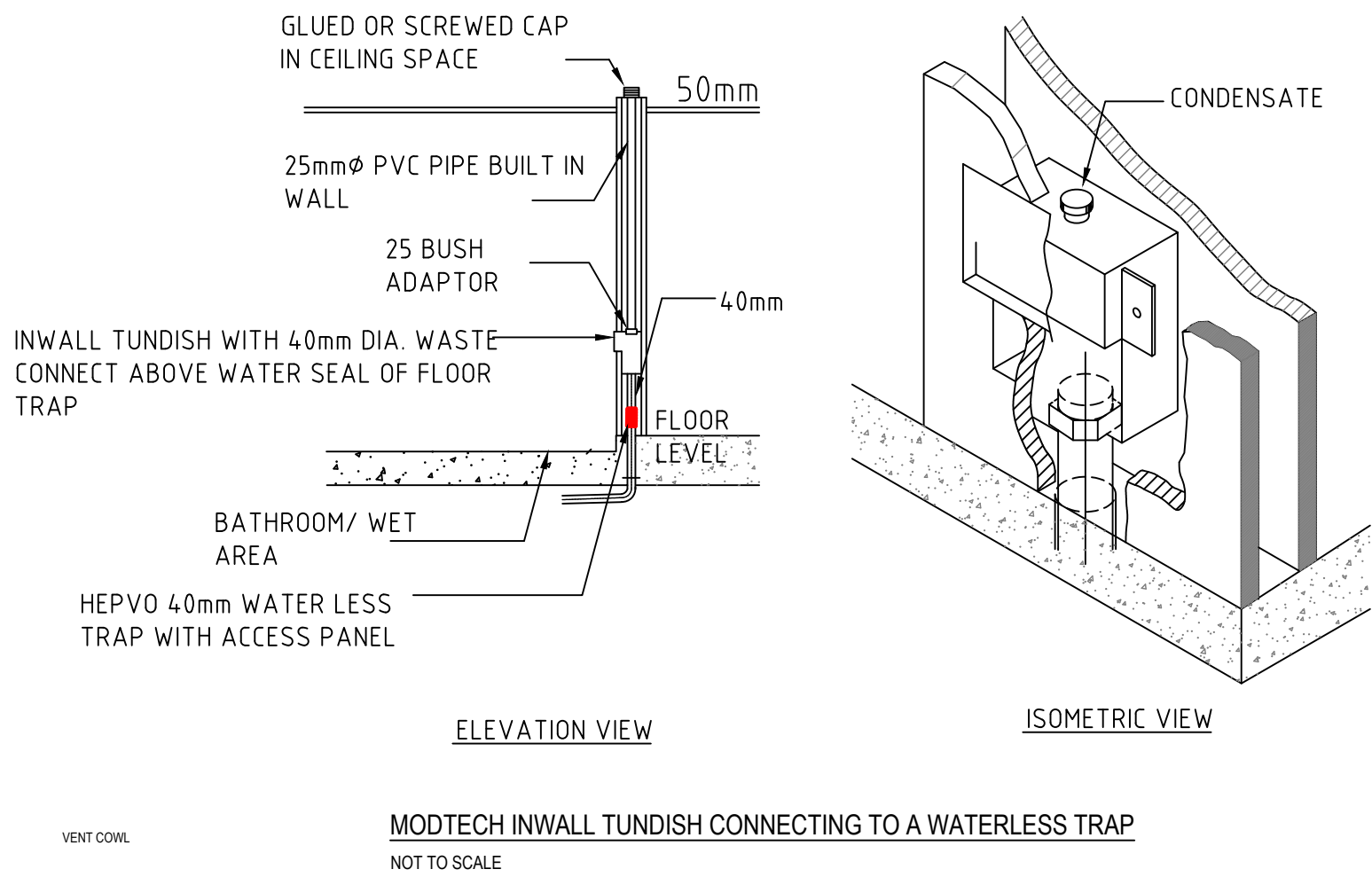
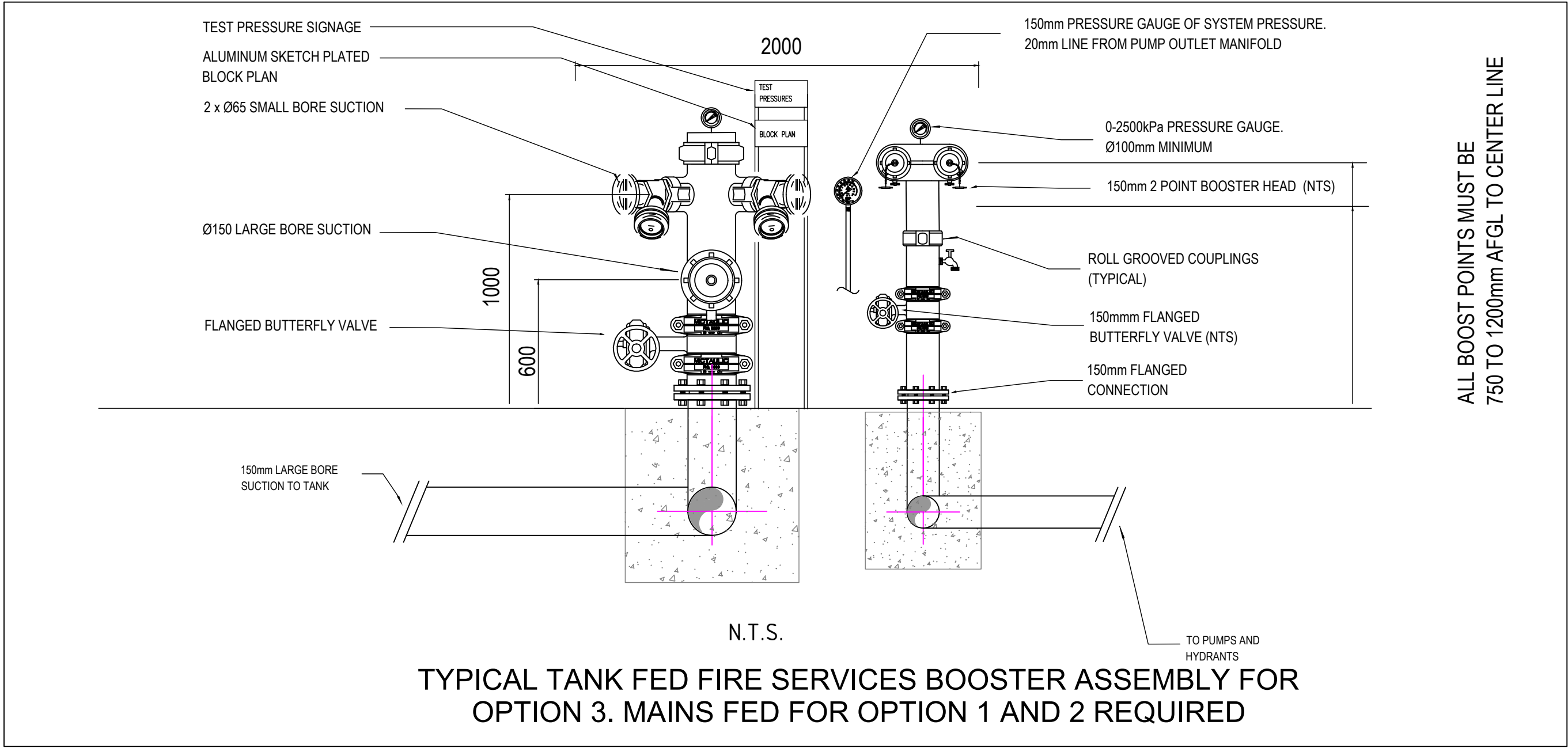
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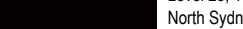


HYDRAULIC SERVICES
GROUND FLOOR
PRESSURE SERVICES
LAYOUT

CONSTRUCTION ISSUE

DRAWN	S.L.	SCALE @ A1
CHECKED	S.T.	1:100
APPROVED	S.T.	
CREATED	FEB 2022	
JOB No.	210067	
DRAWING No.	R25-HY-DRG-0201	REV 1

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REVISIONS / AMENDMENTS				REVISIONS / AMENDMENTS				 Rural Ambulance Infrastructure Reconfiguration Building the future response for our state		PROJECT MANAGER		CLIENT		ARCHITECT		CONSULTANT		PROJECT		TITLE		CONSTRUCTION ISSUE	
Rev	Date	Description	Verified	Rev	Date	Description	Verified			LEVEL 16 44 MARKET STREET SYDNEY NSW 2000 T +61 2 9239 3555		 Health Infrastructure	 djrd architects	T +612 9319 2955 ABN: 48 942 921 969 Nominated Architects: Andrew Hipwell 6562 Daniel Beeckwiler 6192	64 Rose Street Chippendale NSW 2008 Sydney Australia djrd.com.au	 JHA	Level 23, 101 Miller Street, North Sydney NSW 2060 Australia +61 (02) 9437 1000 general@jhaservices.com.au www.jhaservices.com	PROJECT RURAL AMBULANCE INFRASTRUCTURE RECONFIGURATION PROGRAM (RAIR) KINGSCLIFF, NSW 2487	TITLE HYDRAULIC SERVICES HYDRAULIC DETAIL SHEET 1	DRAWN CHECKED APPROVED CREATED JOB No.	S.L. S.T. S.T. FEB 2022 210067	SCALE @ A1 N.T.S.	DRAWING No. R25-HY-DRG-0300
A				B		All dimensions to be verified on site's prior to commencement of on-site work and/or off-site prefabrication. Figure dimension to be taken in preference to scaled dimensions. This drawing is copyright and remains the property of JHA Consulting Engineers. Reproduction in whole or part of these drawings without written consent constitutes an infringement of copyright.		C		D		E		F		G		H		I		J	