SECTION E.1 HYDRAULIC AND FIRE SERVICES - TABLE OF CONTENTS

LIST OF SUPPORTING DIAGRAMS

EME 0001 H Checklist for Consultant/Designers

EME 0002 H Asset Registration Form

EME 0003 H Non-Potable Tank Detail

EME 0004 H Thrust Blocks

EME 0005 H Laboratory Service Valve Compartment

EME 0006 H Site Backflow

EME 0007 H Bore Water Tap

EME 0008 H Recessed Tundish

EME 0009 H Laboratory Equipment Cooling

EME 0010 H Laboratory Reverse Osmosis System

EME 0012 H Stormwater Management Plan

EME 0013 H Stormwater Diversion Structures

EME 0014 H Basket Arrester

EME 0015 H Gas Meter Sizing and Selection

EME 0016 H Services Tunnel Cross Section

EME 0017 H Buried Valve

EME 0018 H Fire Hydrant Block Plan

EME 0019 H Fire Sprinkler Block Plan

EME 0020 H Fire Brigade Booster Arrangement

EME 0021 H Valve Selection Table

EME 0022 H P&ID Trade Waste Treatment

Schedule of Changes

As a guide only, attention is drawn to amendments that have been made in the following clauses since the last revision

Revision	Date	Details
General Revision	September 2004	General Update
General Revision	February 2007	General Update
General Revision	June 2011	General Update
General Revision	December 2012	General Update
General Revision	July 2013	General Update
General Revision Version 5.5	September 2013	General Update
General Revision Version 5.6	January 2014	General Update
General Revision Version 5.7	December 2014	General Update
General Revision Version 5.8	June 2015	General Update
General Revision Version 5.9	July 2017	General Update
General Revision Version 6.0	April 2018	General Update
General Revision Version 6.1	September 2019	HKA Revision + General Update
Minor Revision 6.2	May 2021	Protection of elevators
Minor Revision 6.3	June 2025	General Update
Major Revision 7.0	March 2026	Major Update Separation of Lab Standard to new document

E.1. HYDRAULIC SERVICES

E.1.1. CHECKLIST FOR HYDRAULIC CONSULTANT / DESIGNER

The checklist shall be completed by the design engineer to verify that the UNSW's specific and general requirements as set out in the UNSW DESIGN & CONSTRUCTION REQUIREMENTS manual have been incorporated into the developmental and final design documents.

By providing a signature or initial in the box, the designer declares that he/she has read and incorporated its intent into the hydraulic contract works. By this the designer will be deemed to have understood and complied with this part of the manual. Note: The whole of the manual shall be read, understood and complied with.

Refer to Diagram EME 0001 H Checklist for Hydraulic Consultant / Designer at the end of Section E.1.

The design engineer shall contribute to the relevant sections of the Sustainability Evaluation Matrix at every development stage and review as required by the UNSW's Estate Management (EM) Development Process procedures.

E.1.1.1. General

This document sets out additional design and construction technical requirements to those contained in the mandatory National Construction Code (NCC) Volume 1 and Plumbing Code of Australia - NCC Vol. 3 current edition and its referenced documents.

Fire installations requirements contained within NCC Volume 1), FM Global data sheets and the referenced Australian standards which apply.

Gas Installation Codes published by the Australian Gas Association and other relevant Australian Standards as applicable or as referenced by the NCC shall be deemed as minimum standard and in particular circumstances EM Engineering may have a standard over and above these.

In addition to the mandatory requirements of the above documents, these technical requirements shall be adopted in the execution of all UNSW projects, unless specifically altered in writing by the UNSW Senior Manager Engineering Services.

Where 'similar to' or 'equal to' is used in association with trade names, alternative products may be offered for UNSW EM Engineering approval on the basis that they are approved and perform either as well as, or better than those specified (with an equivalent warranty). The submission of an alternative product for approval is not an automatic endorsement or acceptance of that product by UNSW EM Engineering.

ANY alternative product to those specified MUST be approved in writing by UNSW EM Engineering before installation. Failure to gain written UNSW EM Engineering approval will result in the product being rejected and replaced with the approved product at the contractor's cost.

The Hydraulic Consultant is required to refer to and examine the UNSW Design and Construction Requirements document for guidance on special UNSW requirements,

which may be in addition to the Relevant Australian Standards, National Plumbing Code, BCA, FM Global, Sydney Water requirements, Jemena and Local Council.

Where requirements clash with each other, the more onerous of conditions shall apply.

UNSW Design and Construction Requirements document shall not be referred to or appended to any project documents (Except project briefs and design and construction contracts), but project-specific clauses shall be written into the project specification to ensure construction is carried out to meet those Requirements.

The design engineer shall:

- meet the minimum requirements stipulated in the Environmental Sustainability Plan, and
- with reference to the Capital Works Sustainability Framework, demonstrate how the Hydraulic Services could contribute to the project's outstanding performance as fit for its purpose, connected to its place and forms part of a coherent whole, in response to the relevant Focus Areas.

The design engineer shall work with the project team and UNSW's EM teams to identify potential performance levels for the project to meet a desired end state for an outstanding campus experience. The design engineer shall adopt an integrated design approach to ensure that alignment is achieved with the project team to meet these requirements.

Four reviews of designs are required at concept stage, 50%, 75% and 100% complete. At completion, the designer must supply a checklist as evidence that all items and requirements briefed by the UNSW Project Management have been met and that each one shall separately be signed off as incorporated into the design, unless otherwise instructed in writing. Upon completion of Documents, you are also required to issue UNSW with a Design Certificate with statutory Codes before they are issued for tender purposes. The Consultant must also supply the completed Sustainability Evaluation Matrix at the end of each design review and in line with UNSW's EM Development Process procedures.

E.1.1.2. Client Return Brief

The Client Return Brief must be submitted to UNSW EM after engagement and before the issue of concept or schematic design. As a minimum the client return brief is to incorporate the following:

- Describe the design criteria and philosophy proposed to be undertaken,
- Describe the services that will be included in the expected scope of the design,
- Include an explanation of the functional planning of the project,
- Include a summary of the materials proposed to be used,
- Include a works by others and/or design exclusions,
- Include details of the manner in which Evidence Based Design has been incorporated into the design,

- Include a description of the Site servicing strategy and provide details of all Infrastructure and Utility works / upgrades to be provided including details of proposed capacity, identified points of failure, proposed redundancy measures and intended service life of all major components of these works,
- Provide details of the flexibility and expansion measures incorporated within the design,
- Provide the sustainability vision to demonstrate a systems thinking approach and how the design response will align with the contextual boundaries and flows.
- Describe requirements for compliance with the minimum requirements of the Environmental Sustainability Plan 2022-24
- Describe how the project will achieve agreed targets to meet the Capital Works Sustainability Framework requirements
- Include a summary of the ESD Initiatives to be incorporated into the Project,
- List of items which are not in the design scope.
- Provide a deviations register, listing design requirements that do not comply with the UNSW Design Standards. This section shall include the design requirement, justification of deviation and whether EM approval has been received or not.

E.1.1.3. Authorities and Standards

All hydraulic services and associated supply and support infrastructure shall comply with the following codes and standards including amendments and referenced documents as a minimum. Where the requirements of this document exceed the below standards, then the requirements of this document shall take precedence.

Water Supply	AS/NZS3500.1
Sanitary Drainage	AS/NZS3500.2
Stormwater	AS/NZS3500.3
Heated Water	AS/NZS3500.4
Reverse Osmosis (RO) water	AS/NZS4187
NCC National construction Code	Volume 1
NCC Plumbing Code of Australia	Volume 3
Fire Hydrant Installations	AS2419.1
Fire Hose Reels	AS2441
Automatic Fire Sprinklers	AS2118
FM Global	Current Data Sheets
Portable Fire Extinguishers	AS2444
Fixed Fire Protection Installations—Pumpset Systems	AS2914

UNSW Design Specifications

Gaseous Fire Extinguishing Systems	AS4214
External Field Joint Coatings for Steel Pipelines	AS4822
Gas Code	AS5601

Authorities

- The local water authority having jurisdiction- i.e. Sydney Water, Icon Water
- The local gas authority- i.e.. Jemena
- any local council requirements any local council requirements
- Transport for NSW (TfNSW)
- UNSW
- NSW Department of Fair Trading

E.1.1.4. Material Standards

All hydraulic services and associated supply and support infrastructure shall comply with the following approved material standards including amendments and referenced documents as follows:

Approved Materials

Copper tube & Fittings	AS 4809
Steel pipe & Pipe Fittings [Fire Systems]	AS 4118.2.1
Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes	ASTM A312 / A312M - 16
Austenitic stainless-steel pipes and fittings [Waste & Drainage] Type 304, 304L, 316 or 316L or EN 10 088, Grade EN 1.4301 or 1.4404	BS EN 12056-1:2000. BS EN 12056-2:2000 & BS EN 12056-3:2000
Cast Iron pipe & fittings [Waste & Drainage]	EN877
Ductile Iron pipe & fittings [Water Supply]	AS/NZS 2280
PVC-U [DWV] Pipe & Fittings (above ground only)	AS/NZS 2032
PVC-U [STW] Pipe & Fittings (above ground only)	AS/NZS 2032
PVC-U [Pressure] Pipe & Fittings (above ground only)	AS/NZS 1477
PVC-O [Pressure] Pipe & Fittings (above ground only)	AS/NZS ISO 9001 & AS 3879
PVC-M [Pressure] Pipe & Fittings (above ground only)	AS/NZS 4765 & AS 3879
Polyethylene Pipes for Pressure Applications [HDPE & MDPE]	AS/NZS 4130
Plastics piping systems for soil and waste discharge (low and high temperature) inside buildings - Polyethylene (PE)	AS/NZS 4401
Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications	AS/NZS 5065

Polyethylene pipes and fittings for gas systems	AS/NZS 4130
Nylon [Rilsan] pipe & Fittings for natural Gas	AS 2944.1
Reinforced Concrete Pipes (RCP)	AS/NZS 4058

E.1.1.5. Installation Drawings

UNSW have produced Drawing Standards and Design Requirements, which shall be followed by the Consultant.

To assist interpretation of some aspects of this document, sketches have been prepared and are located at the back of Section E.1.

E.1.1.6. Fit for Purpose

Whilst this document sets out the UNSW additional design and construction technical requirements to those normally contained in the codes and regulations, it is still the designers and the installing contractor's obligation to document and install systems, equipment and materials that are "fit for purpose" from both a WH&S and operational perspective.

Where a system, item of equipment or material selected or installed is not deemed "fit for purpose" by UNSW EM Engineering, it shall be replaced with a UNSW agreed alternative, at no cost to UNSW.

Any disputes in regard to the interpretation of this clause shall be referred to NSW Fair Trading and/or the UNSW Project Manager for a final determination.

Manufacturer's requirements must be adhered to in all instances, unless specifically approved otherwise in writing by UNSW EM Engineering.

E.1.1.7. Work Health and Safety 2011

The interpretation of the word "Plant" as used in Work Health and Safety Act 2011 (hereafter WH&S) determined that all building services are classified as "plant". Therefore, designers of services, internal and external to buildings, must meet their responsibilities under this Act and Regulation.

Attention is drawn to WH&S 2011, Chapter 4 for controllers of premises to identify risks and WH&S 2011, Chapter 5 for designers to identify hazards and assess risks of the final design. UNSW require all designers to carry out such identification and risk assessment with a statement of how associated WH&S issues shall be addressed. This information shall form part of safety in design and be provided to UNSW prior to documents being "Issued for Construction" deliverable document

Provide WH&S Statement listing all construction, operation and maintenance activities or tasks likely to present risk to persons' wellbeing and measures provided in design to ameliorate these risks.

E.1.1.8. Departures from UNSW Specifications

Any departures from these minimum requirements are required to be agreed with UNSW EM Engineering. All departures are to be notified in writing detailing the following items:

- Reason for the departure
- Financial benefit
- Benefit to project
- Benefit to Contractor
- Maintenance and safety aspects

Departures will be accepted only on engineering grounds.

E.1.2. DESIGN REQUIREMENTS

Prior to documentation of refurbishment works, and in conjunction with UNSW Project Manager, survey all proposed user groups for each building to determine requirement for services.

Organisation of feedback from the user group shall be recorded by UNSW EM with comments to be issued to the design team for incorporation.

E.1.2.1. Contract, Workshop and As-Constructed Drawings

Each hydraulic services drawing shall have the following note displayed in a prominent location:

'Only licensed persons, or those under the direct supervision of a licensed person, shall install works covered by the Plumbing Code of Australia (National Construction Code, Volume 3), Fire industry standards and relevant Gas Installation Codes. Works required under these Codes are not detailed, as the licensee is expected to have full knowledge of these Codes. These drawings show the piping layout in the positions required by UNSW and the fittings shown may be additional to code requirements but shall not prevent the work from being carried out in accordance with these codes. Certificates of Compliance shall be furnished to UNSW for all works within 7 days of authority inspection'

An abbreviated 'UNSW Project Specific Requirements' list shall be provided on the legend sheet, or where practicable, on the relevant service drawing to which they pertain. The consultant shall identify in point form, the major departures from 'Industry Standard Plumbing & Fire Service Materials and Workmanship' brought about by the special requirements of the University or identified as problem areas of quality control.

For each hydraulic service including the fire services captured in this document, present on the first sheet of the series a statement on the Basis of Design for that service. It shall identify how the system works, basis of design and all substantial information are required to review the adequacy of the design intent.

All major projects are to include individual services schematic drawings including valves, meters, pumps, tanks, major plant, vents, stacks, fixture loads and include provisions for inspection, expansion, maintenance, testing and cleaning access. This

drawing shall be the first in the set and shall identify how the system works, basis of design and all substantial information are required to review the adequacy of the design intent. It shall be maintained up to date using Revision Numbering throughout the checking and review process.

Refer to 1.1.1 for further details

E.1.2.2. Authorities

For all plumbing and drainage works and trade waste services, an application shall be lodged with the Local Water Authority (such as Sydney Water) and as required by the Plumbing and Drainage Regulation 2017. Allowance shall be provided by the Constructors/Developers for lodgement and preparation of all documentation required for authority approval such as Section 73 Notices of Requirements & approvals.

Upon completion, the contractor carrying out the work shall submit to the Project Manager the signed original Owner's Copy of the Certificate of Compliance.

For Natural Gas installations, all works upon completion shall be inspected by the gas supply authority in accordance to the requirements of Gas Supply (Safety and Network Management) Regulation 2022 and those installations incorporating Type B appliances shall be approved and have AGA certification.

For essential fire safety measures, the contractor is to submit certification upon completion an Annual Fire Safety Statement to FRNSW or the local fire authority, local Council and UNSW EM Engineering.

UNSW EM Engineering will in addition to the above provide direction in accordance with these recommendations and where necessary be empowered to make site approvals.

E.1.2.3. Operating and Maintenance Manual

Refer also to 'Appendix 4 – UNSW Drafting Standards'

Documents are to be prepared, requiring the contractor to be responsible for the preparation of the Work as Executed Drawings and the Operating and Maintenance Manuals. Included in the manual shall be the following documents as a minimum:

- Fire pump AS2941 Conformance Test Certificate,
- Pump test curve where applicable,
- Pressure test certificates with actual pressures achieved,
- Certificate of Compliance with the local Water Authority requirements,
- Certificate of Compliance with the local gas authority requirements,
- All certificates signed by the contractor performing the work,
- All As Constructed drawings particularly where works are in ground

These documents are to be reviewed & approved by the hydraulic consultant.

E.1.2.4. Asset Registration List

In conjunction with the preparation of the Operating and Maintenance Manual, the Consultant shall list all plant and equipment either removed or installed as new on an attached schedule and include the completed list in the Manual.

Such items could include:

- thermostatic mixing valve,
- gas shut off valve,
- water filter,
- pump sets, including control panel,
- trade waste pit, & or plant,
- safety shower,
- safety eye wash,
- hot water unit,
- automatic toilet flushing device,
- fire hydrant landing valve,
- fire booster valves'
- fire sprinkler alarm valves,
- fire hose reel,
- water cooler or fountain,
- boiling water unit,
- dish washer (Not equipment supplied by School),
- backflow prevention device,
- pressure controls,
- hygiene station,
- water meter,
- gas meter,
- gas regulator,
- flow switch,
- gas safety shut off system,
- RO water treatment equipment,
- DI water treatment equipment.

The list shall be identical in all respects with the Microsoft Excel spreadsheet. *Refer to Diagram EME 0002 H Asset Registration Form at the end of this Section E.1.*

E.1.2.5. Hydraulic Services Samples

The tender documents are to make reference to the submission (and approval) of hydraulic samples to UNSW EM Engineering. "BEFORE installation of any hydraulic service pipe, fitting, fixture or fitment, the contractor is to submit to UNSW EM Engineering sample submission for the product being installed. This includes specified products and contractor's alternate products. Failure to submit or obtain approval of the sample submission will result in the product being removed and replaced at the contractor's own expense."

E.1.2.6. Pipework Design Velocities:

- In-ground water service 1.0 to 2.1 m/sec,
- Building services pressure pipe < 2.0m/sec,
- Water pump rising mains 1.0 to 2.7m/sec,
- Gravity flow pipes from upper storage (top 2 floors) 0.1 to 0.4m/sec,
- Gravity sewer pipes – self-cleansing for average daily flows,
- Sewer rising mains - > 1.0m/sec,
- Fire services - < 4.0m/sec.

E.1.2.7. User Design Pressures.

Generally working pressures within a work area, unit, or fixture shall be designed to be set at a minimum of 300kPa +/- 20%. Refer Section "pump pressures" for further details. Pressures for fire services shall be designed to conform to the site/building's requirements.

E.1.2.8. Variations

Variations to the scope of works will not be considered by UNSW EM Engineering unless they represent a genuine change in scope from that documented as part of the tendered works.

Variations will only be accepted when the variation is submitted and approved in writing (by UNSW EM Engineering or the authorised representative) before the variation works can proceed.

E.1.3. SERVICES LAYOUT & LOCATIONS

Services shall be laid out within the building and/or site logically following sound and practical philosophies to facilitate future locating and rationalisation of services as required by changes in building uses.

E.1.3.1. Water for Construction

Where bore water is available- Randwick and Kensington Campus:

During site establishment, arrange with UNSW EM Engineering for access to the site bore water system. Construct a temporary or adapt another bore water service to the site. Use bore water for such purposes as: washing down, street cleaning, trench compaction, pipeline cleaning and testing, etc. Temporary potable & bore water meters (complete with UNSW EM Engineering approved backflow protection) are to be installed for the construction site by the construction contractor. UNSW EM Engineering is to be provided with access to these meters at all times.

All other campuses:

Alternate sources of water such as recycled water mains and rainwater reuse shall be considered in water for construction purposes for the application listed above.

E.1.3.2. CCTV Survey

Any CCTV survey works, existing or new shall be presented to UNSW EM Engineering as a written report identifying the exact locations for the CCTV survey, the service being surveyed and any building or report reference.

This report needs to link CCTV footage to the survey using a line diagram identifying the entire system via node points. The survey would also identify all invert & surface levels (including services depths where available), bends, junctions IO's, damage, root infestation, pipes holding water or blockages.

All measurements shall be taken from the starting point of each node and referenced to a known building or landmark structure.

A digital copy of the report shall be supplied to UNSW EM for record.

E.1.3.3. Pipe Levels & Control Valves

Tank supplies, outlets and pump suction piping shall be at low level and of sufficient diameter to ensure that pump suction conditions do not fall below atmospheric pressure and is within Net Positive Suction Head required ($NPSH_R$). All other pipework shall be located as high as possible unless otherwise nominated by UNSW EM Engineering. The piping shall be configured and/or graded to ensure no air pockets are formed. Control and isolating valves are to be located to facilitate access and allow operation without the use of portable steps. The maximum height of valves above floor shall be 1500mm.

E.1.3.4. Core Holes

Core holes shall be cast in situ. Liner shall be removed prior to pipework installation. Incorrect positioning will require drilling new core holes, which are to be approved by the consulting Structural Engineer. Chopping out to extend core holes shall not be permitted.

All pipe penetrations shall be sealed in accordance with the following;

- Install puddle flange sealed to pipe wall and slab surface,
- Pipes are to be centred in the penetration,
- Minimum of 25mm cover between wall of pipe and penetration,
- Penetration is to be filled with non-shrink grout for entire depth,
- Penetration is to be waterproof,
- Fire stopping to AS1530.

E.1.3.5. Chases

Chases shall be sawcut in approved locations only. Chasing of columns or any structural element is not allowed under any circumstances.

E.1.3.6. Insulation

Kemlag is not acceptable for insulation other than for pipework chased into masonry.

Insulation shall be installed only after pipe testing. All hot water service pipework shall be lagged with fire retardant EPDM closed cell foam minimum 25mm incorporating a press seal fastener/factory laminated equal to 'Armaflex' manufacture and must be

zero ODP. Valves, flanges and unions are not to be insulated. In no case will insulation be less 13 mm thickness.

In noise-sensitive areas all piping shall be insulated with approved acoustic insulation to archive the noise level mandated under Vibration and Noise. Refer to Acoustic Engineers report for more detailed information.

Pipes in wall chases shall be Insulate with 3mm thick foamed PVC (Kemlag or equal) and fix with brass/copper clips shall only be used. 3 mm thick foamed PVC is not permitted for other locations.

Non-heated water supply pipes (cold water) located in hot environments shall be lagged to ensure water supply remains < 25°C.

Similarly cold water supply pipes located in cold environments such as Canberra shall be lagged to protect from freezing.

Cold water pipes located within spaces where high humidity prevail must be insulated to ensure a vapour barrier prevents condensation (sweating).

Lagging shall be consistent and continuous for the entire length of pipework.

E.1.3.7. Brick Cavities

Piping shall not be installed in brick cavities.

E.1.3.8. Water Connections to Fixtures

Pipework connections between the wall outlet (cistern valve) and the fixture, equipment, tapware, heater, etc shall be installed in hard drawn copper tube or chrome plated copper tube. The use of stainless-steel flexible connectors, plastic or similar piping systems shall not be used without written approval from UNSW EM Engineering.

E.1.3.9. Vibration and Noise

Pipework shall be constructed and installed to prevent vibration and noise. Make approved alterations to correct any faulty condition.

Where pipework is installed in noise-sensitive areas such as lecture theatres, libraries, study areas and public halls and rooms, provide acoustic insulation to all pipelines, with special attention given to gravity waste and stormwater lines. Refer to Acoustic Engineers report for more detailed information.

Measures with be implemented to limit the noise generated by hydraulic services into these occupied spaces. These measures as implemented should limit the noise level so that it does not increase by more than 1dB for typical use above the background noise level.

E.1.3.10. Expansion

The contractor is to incorporate a provision for expansion for all pressure and non-pressure systems consistent with applications, material types, exposure and in accordance with AS3500.

Expansion in fire systems, including fire hydrants, fire sprinklers and hose reels, shall be in accordance with AS2419.1, AS2444 and AS2118.9.

E.1.3.11. Depth of Cover

In all external locations, including roads, pavements and landscaped areas a minimum depth of cover of 800mm shall be maintained between the top the installed hydraulic service and the finished surface level. This minimum depth of cover will not be reduced under any circumstances unless approval in writing is obtained from a UNSW EM Hydraulic Engineer.

Explanation Note: This requirement specifically applies to Kensington Campus due to the large number of services running across the site and to provide clearance from structural zones. For projects not in Kensington, this condition can be relaxed subject to coordination and confirmation from UNSW early in design.

E.1.4. SOIL AND WATER MANAGEMENT

Soil and water management shall adhere to best practice and local council requirements at all times across all campuses.

Prevention of stormwater pollution due to oil and chemical spills shall be included in the Soil & Water Management Plan. Gross chemical pollutants entering aquifers must be prevented at all costs.

Kensington Specific Requirements:

Kensington Campus is a catchment area for aquifer recharge, as most rainwater and stormwater is captured and recycled for site and building non-potable water requirements via the University's bore field.

Identify suitable locations for bulk materials, delivered building materials, waste bins and delivery vehicle off-loading locations. Contaminated wastewater must not discharge into the stormwater system. Where the site is located within the Village Green detention catchment, provide signage around the site indicating this site drains to an environmentally sensitive structure.

Standard sand bagging cannot be maintained in place in such a space-restricted site. Please detail continuous sandbagging to protect UNSW & Randwick City Council's stormwater system downstream from being filled with building and demolition waste.

Note that all consolidation, dust suppression and washing down shall be carried out using bore water from the site reticulation. Provide temporary taps, pipes etc. as required.

Civil/hydraulic/landscape consultants are required to prepare a detailed site-specific Soil and Water Management Plan with Specification for each project, complying with the detailed requirements of Randwick City Council which are available on:

https://www.randwick.nsw.gov.au/planning-and-building/building/sediment-and-erosion-control.

There are 16 information sheets all dealing with soil and water management. The plan shall include those information sheets applicable to the specific project and shall treat Campus roadways as though they are Council public roads for the purpose of managing soil and water.

Prevention of stormwater pollution due to oil and chemical spills shall be included in the Soil & Water Management Plan. Gross chemical pollutants entering the aquifer must be prevented at all costs.

E.1.4.1. Excavation

The excavation and reinstatement of trenches within the grounds of the University of New South Wales and shall be considered as part of the contract for design and services installation. It shall be incorporated into the project specification and the general conditions of contract. If there are any discrepancies between the technical clauses regarding trenching in the project specification and this specification, the more stringent specification shall take precedence.

This section relates to narrow services trenches only and is not intended to be used for major structures such as large drainage culverts/pipes or for backfilling of large underground facilities such as basements or service tunnels.

Mechanical excavation for underground services shall not commence without approval of the UNSW Grounds Manager. This approval will only be given when the Grounds Manager is satisfied that all services have been properly located and identified. Where in pavement, saw cut bitumen and concrete prior to excavating.

Where saw cutting is required inside buildings or covered occupied areas, petrol or diesel powered machines are not acceptable, due to carbon monoxide emissions. Saw cutting shall be conducted using a hydraulic or electric pavement cutting machine.

Trenches for underground services shall be excavated in a straight line using a mechanical excavator or similar approved means. The trench width shall be 300 mm wider than the service shall be laid and shall be excavated to the depths shown.

Under no circumstances shall trenches be less than 150 mm wide as this will prevent adequate compaction of the backfilling.

If excavations in pathways, gardens, lawn areas encounter tree roots in excess of 50 mm diameter, work shall cease until approval and directions are obtained from the UNSW Grounds Manager. Under no circumstances will approval be given to cut or damage tree roots if it is possible to easily lay the pipe, etc., beneath or around the roots. The contractor may consider vacuum type excavation in and around tree roots, cables and other services.

Wider trenches may be approved by the Grounds Manager but only where the space is necessary for personnel to enter the trench to connect services. Where over excavation occurs, backfill with selected excavated or imported material to required levels in 150mm layers compacted to 95% modified dry density. Remove all spoil from

the UNSW site as the work proceeds using skips or trucks as the work requires. Provide timbering and shoring as required to protect workers and adjacent structures and remove prior to completion where possible.

Restoration for turfed areas in conformance with UNSW turf requirements. Generally, all new turf is to be laid by UNSW accredited contractors.

Where the depth of trenches is to exceed 1.2 m and personnel need to enter the trench, adequate measures shall be taken by the contractor to provide support for the trench. This may require shoring or battering the excavation at a suitable angle depending upon the type of material through which the trench is excavated. Geotechnical and/ or civil engineering advice shall be obtained for the shoring and battering requirements. The contractor shall comply with all WorkCover requirements for trench support.

All excavation must provide protection from pedestrian and vehicles. Traffic management must be present during excavation works and contractor vehicle movements.

All soft, yielding or other unsuitable material shall be removed and replaced with compacted clean, low plasticity soils or stabilised sand. Unsuitable material shall be removed from the site at full cost of the contractor.

Existing Services
The contractor will be provided with plans of all services that are known to the UNSW Asset Management in and adjacent to the proposed excavation. The contractor is responsible to confirm location, direction and invert levels from the site, from local I.Os, access pits, CCTV and depth sound prior to the commencement of the in-ground drainage works. The contractor shall be responsible for:

- Surveying the route of the excavation to locate all services shown on the plans,
- Identifying the location of any unmarked services using an approved cable/pipe locator,
- Hand excavating to uncover known services prior to commencing mechanical excavation,
- Vacuum type excavation in and around tree roots, cables and other services,
- Supporting the services across trenches during excavation as necessary and,
- Excavation and backfilling the trench in the manner set out in the ensuing section.

If the contractor proposes to use dyes to locate the route of sewerage or stormwater, they shall consist of approved vegetable base types only. The use of hydrocarbon-based dyes will not be permitted under any circumstances.

If during the excavation of trenches, unknown services are encountered, work shall cease, and UNSW EM Engineering shall be immediately notified. Work shall not

recommence until the service has been correctly identified and precautions taken to ensure that no damage occurs.

Under no circumstances shall services be cut or disconnected without prior approval of the Campus & Infrastructure Service.

When excavating near trees, the contractor must allow to undertake precautionary measures to protect trunk, branches, foliage and roots. In the event of damage to existing services or trees while excavating, the Contractor shall contact the following staff:

- EM Assist 9385 5111

The contractor shall be responsible for the repair of any services that were identified before excavation commenced or could reasonably have been located during the preliminary exploration.

E.1.4.2. Inspections

Inspections of the trench excavations shall be undertaken by the UNSW Grounds Manager at the following stages of the project:

- Before excavation commences to discuss the location of services and to undertake a dilapidation survey of surrounding environment,
- Upon completion of the excavation to check depths,
- Before backfilling commences to verify that the services are laid to the levels required,
- On final reinstatement.

It is the Contractor's responsibility to notify **EM Engineering 48 hours in advance of the above stages to ensure that the appropriate inspections are performed.**

E.1.4.3. Backfilling

Services shall be laid on compacted coarse river sand or crushed blue metal of a maximum of 7-10mm size aggregate which shall be extended to at least 100 mm above the top of the service and hand packed. Thereafter the backfilling of the service should take place as shown.

Hydraulic services shall be laid in accordance with AS3500 Plumbing and Drainage.

Where required, all services except sewer and subsoil, shall be backfilled and over laid to 75mm above pipe socket with approved granular fill of aggregate not larger than 50mm, larger stones are strictly prohibited.

Complete backfilling with approved excavated material only. Plug and charge all hydraulic services.

“Non-agricultural” pipe (i.e.; sewer, trade-waste, stormwater, etc.) and pipework with water to choke level or pressurise during ALL backfilling or over concreting operations and remain full of water until EM Engineering has inspected the system drain down.

Provide compaction to side support and backfill in 225mm thick layers using approved mechanical compaction equipment. Maintain moisture content to achieve optimum compaction.

Note: Provide 48 hours' notice prior to backfilling to the UNSW EM Engineering staff and survey draftsperson via the Project Manager to view, record and document all new and exposed underground services. Failure to comply will result in a re-test to EM Engineering staff directions.

E.1.4.4. Compaction

Surplus excavated material remaining after the backfilling of the trench shall be disposed in an approved manner offsite, or to areas nominated by the UNSW Grounds Manager. The disposal of surplus material shall be at the full cost of the contractor.

All services except sewer and subsoil shall be bedded on 50mm thick compacted sand. Sewer & subsoil bedding to suit site conditions. All backfilling shall be compacted by mechanical vibration using vibrating plate compactors (whacker packers) or similar equipment to the approval of the UNSW Grounds Manager. Backfilling shall take place in layers not exceeding 150 mm loose thickness and be compacted to the densities shown

Compaction densities of at least 100% standard maximum dry density are required for areas under roadways and concrete paving.

The contractor shall compact the trench backfilling until it is compacted to the appropriate standard. Reworking of inadequately compacted material shall be at the contractor's expense.

Compaction by flooding is not permitted under any circumstances.

Compaction of backfilling shall be carried out without damaging of the services. The laying of services and backfilling and compaction will not be permitted in trenches containing pond water or mud either from rainfall, surface runoff or groundwater flow.

E.1.4.5. Restoration of Ancillary Structures

Where excavations pass beneath kerb and guttering, vehicular crossings, etc., adequate support shall be provided for these structures until backfilling is completed. If compaction to the required standard is not possible, backfilling in trenches passing beneath ancillary road structures shall consist of lean mix concrete (minimum 10 MPa) or similar approved material.

Restore all surfaces to their original condition, using materials matching materials as found.

Bitumen, concrete and brick paved surfaces shall be restored by a UNSW approved contractor experienced in the relevant pavement restoration. This work shall be included in the contract documents.

E.1.5. EXCAVATION

E.1.5.1. General

Backfilling to the subgrade level in trenches across roadways shall be carried out using sand stabilised with 6% cement by weight unless otherwise directed. In all cases, compaction shall be to 100% of the standard maximum dry density as determined in tests AS1289.5.1.1: Methods of testing soils for engineering purposes - Soil compaction and density tests - Determination of the dry density/moisture content relation of a soil using standard compactive methods.

Prior to backfilling and compaction of vehicular trafficable trenches, trench stops/bulkheads consisting of polyethylene or hessian bags filled with clay or other approved material and sealed in an approved manner, shall be placed across the full width of the excavated trench directly beneath the kerb to contain the compacted materials. The trench/bulkheads shall extend from the top of the service backfilling surround material to the underside of kerb level.

Ensure any restoration is uniform to match existing surfaces and levels and does not pose a trip hazard.

E.1.5.2. Pavement Materials

The pavement shall be reinstated to the minimum depths shown in Table E1. The materials shall be used shall comprise good quality, durable, fine crushed rock and bituminous concrete (asphalt).

As a minimum for NSW projects only, the fine crushed rock shall conform to Transport for NSW (TfNSW) Specification No. 3051 specifically for the supply of "Unbound and Modified Base and Subbase Materials for Surfaced Road Pavements". The fine crushed rock shall be DGB20 (20 mm nominally sized densely graded base) and shall be compacted to 95% modified maximum dry density (Ref AS1289 E3.1).

E.1.5.3. Table E1 - Minimum Pavement Thicknesses (mm)

Flexible Pavements:

Pavement Type	**Wearing Surface Thickness (mm)**	**Base Thickness (mm)**
Heavy Traffic	30	300
Light Traffic	30	200
Car Parks	30	150

Concrete Pavements: (Fig 2)

Roadways	150	150
Footpaths	75	75

Paving Blocks: (Fig 3)

Heavy Traffic	80	50
Light Traffic	80	50
Pedestrian	50	50

N/R = Not required

Table E1

Where the total volume of material shall be used in the backfilling of road trenches is to exceed 10 cubic metres, the contractor shall provide tests certificates verifying that the material conforms to the relevant sections of the Transport for NSW (TfNSW) Specification.

E.1.5.4. Paving Blocks

Where service trenches shall be laid beneath existing paving block pavements, the pavers shall be carefully removed by the contractor prior to excavation. Any pavers broken during their removal shall be replaced at the contractor's expenses. Backfilling of trenches beneath paving block pavers shall be carried out using sand stabilised with 6% cement by weight compacted to a density of at least 95% of the standard maximum dry density. The general backfilling shall finish at least 150 mm below the underside of the sand bedding to allow for fine crushed rock base material shall be placed and compacted.

The paving block base shall be constructed in a manner similar to that carried out for fine crushed rock beneath roadways. Paving blocks shall be re-laid on sand bedding as recommended by the manufacturer so that the line and level are consistent with the surrounding pavers. A maximum tolerance in level between the undisturbed pavers and the re-laid pavers shall be 3 mm.

Where pavers are arranged in an intricate pattern, allow to prepare a replacement template on a drawing with numbered components which relate to each paver in a numbered sequence to ensure correct replacement.

E.1.5.5. Backfilling under Pavements and Floors

The following procedures shall be adopted in all instances, where more onerous geotechnical and civil requirements are not provided:

Backfill with approved granular material in 225mm thick layers and compact using vibrating mechanical compaction equipment to 95% maximum modified dry density or to match surrounding ground.

Specified compaction must be verified by compaction tests performed by a NATA registered testing agent and at the contractor's expense.

Should compaction fail any test, backfill shall be removed down to within 225mm of the top of the surface and compaction and backfilling recommenced with tests taken at frequent intervals. The number and frequency of tests shall be determined in

conjunction with Engineering Services and shall be dependent on size of excavation, quality of existing pavement and future pavement upgrading works.

E.1.5.6. Concrete Paving

Wherever economical or where specifically directed by the UNSW Project Manager, bore under roads and pathways for hydraulic services. Where this is not possible then the existing concrete paving shall be saw cut along the line of the proposed trench to the full depth of paving and the concrete material disposed of offsite when removed. The excavation shall then be carried out in the approved manner and backfilling performed as for roadways. The concrete paving shall be provided with a base layer consisting of 75 mm or 150 mm thickness of fine crushed rock if the concrete is for pedestrian or vehicular usage respectively. The fine crushed rock shall be compacted to the same standard as paving materials for roadways. Concrete shall be used in the restoration of concrete paving shall have the following compressive strengths:

- Roadways Min 25 MPa
- Footpath Min 15 MPa

The thickness of concrete paving shall be equal to that removed during the excavation but shall not be less than 75 mm for footpaths, or 150 mm for roadways.

Where a trench or excavation occurs through an existing concrete slab, the restored concrete finish shall be equal or better than the existing finish.

In most instances, there will be no requirement for strength testing of the concrete, however, the Campus Infrastructure Services reserves the right to carry out tests if there is any doubt on the quality of the materials being used. If concrete testing is required, it shall be carried out at the expense of the contractor by a NATA Certified laboratory.

The joints between the existing concrete and the restored concrete paving shall be filled with an approved jointing material to prevent ingress of water. The jointing material should preferably be a bitumen impregnated fibre board or similar, placed while the concrete is plastic. Alternatively, the joint may be grooved and filled with a silicon based joint sealant.

Where there is a shear or bearing force or the potential for new concrete to move either vertically or laterally from existing concrete, N20mm galvanised steel dowels shall be drilled into the existing concrete @ 300mm centres placed in the centre. Dowels are to be chemically sealed to a depth of 150mm with an approved epoxy resin.

E.1.5.7. Lawns and Sports Fields

At least 7 days prior to commencement of works, arrange with the UNSW Ground Manager for all affected plants to be removed for storage, to be transplanted back to their original position upon completion of the works. Damage to planting not removed by UNSW shall be rectified by the Contractor to UNSW direction and approval at contractor's cost. All costs of works incurred by UNSW shall be attributed to the project cost.

Backfill trenches with selected excavated material up to within 300mm of finished surface. Complete backfilling with sandy loam either gained from the excavation or imported as required. Compact at optimum moisture content with a mechanical vibrating foot up to within 150mm of surface, heap in the last 150mm and roll turf to be level with surrounding turf. An additional allowance of 25mm should be applied for final settlement to ensure the turf level is as before the disturbance.

Lawns and sports fields shall be restored with turf cut from the trench prior to excavation and set aside from the original surface, or with turf of the same species imported from a source approved by the UNSW Grounds Manager. Turf cut from the trench surface shall be stored on damp hessian and placed in the shade and kept moist and shall be re-laid within 24 hours of excavation.

All new areas to be vegetated shall be as specified and approved in writing by the UNSW Grounds Manager. UNSW Asset Management Services reserves the right to reject any re-laid turf surface.

E.1.5.8. Gardens

Where trenches are to pass through garden areas, the contractor shall seek direction from the UNSW Grounds Manager to confirm whether plants disturbed by the excavation shall be transplanted or replaced and reinstated at the completion of the work. Excavation and backfilling shall then be undertaken as instructed by the UNSW Grounds Manager.

E.1.5.9. Compaction Testing

Compaction testing of the backfill shall be carried out at a rate of one test per 50 lineal metres of trench. A minimum of one test shall be carried out for all backfilling of trenches beneath pavements, roadways, paving blocks and concrete paving areas.

Testing of the backfilling shall be undertaken in accordance with AS1289 - "Methods of Testing of Soil for Engineering Purposes".

Compaction testing shall be undertaken by a NATA registered laboratory and the results forwarded directly to the UNSW Grounds Manager and EM Engineering for approval. All layers will be tested to the full depth of the layer. An in-situ density test by sand placement or other NATA approved means will be required. The cost of all testing shall be borne by the contractor and shall be included the contract sum.

E.1.5.10. Barriers and Lights

Barriers and lights shall be erected on each side of open trenches to ensure the safety of pedestrians and to prevent traffic entering construction areas. Temporary site fencing shall be erected by the contractor to ensure that unauthorised entry into the trenches does not occur.

E.1.5.11. Pedestrian Safety

It is the contractor's responsibility to ensure the safety of pedestrians using the area in which trenching is being undertaken. All necessary barriers and fences shall be erected to guide pedestrians around the work area. These barriers and fences shall not be removed until the surface has been restored to the satisfaction of UNSW EM Engineering and the UNSW Grounds Manager. Temporary barriers and fences are to

be tethered to a solid fixing to ensure the structure will not collapse or fall during high wind events. All temporary site fencing is to include pedestrian buffers and must be erected to ensure stability to resist wind or other actions.

Trenches which have shall be assessed by pedestrians shall be covered with 8 mm thick standard floor plate.

Where the work area/zone obstructs an exit from any building, alternative egress is required to maintain the exit and path of travel.

E.1.5.12. Provision for Traffic

Where services shall be laid across roadways or other areas used by vehicular traffic, provision shall be made for traffic by providing either qualified traffic wardens, suitably signed detours or constructing the trench half road width. If required, trenches less than 1.5 m wide may be covered by 20 mm thick steel road plate to provide continued access for vehicular traffic.

E.1.5.13. Clean-Up

Equipment wheels shall be washed of excess soils prior to leaving the construction site. Following completion of the excavation, backfilling and restoration, the contractor shall clean the adjacent areas to the satisfaction of the UNSW Grounds Manager. Clay soils shall be removed from roadways, paving blocks or concrete areas using a high-pressure water blaster to clean the surface. Wet mortar spills on adjacent pavements, grass or other surfaces shall be cleaned before drying.

E.1.5.14. Shut Downs of Services

Definitions: Shut Down means the closure or shutting off a supply service only for maintenance or repair requirement.

A shutdowns notice shall be submitted to UNSW EM Engineering five (5) days (minimum) before the shutdown is to occur. Shutdowns must only be performed by accredited UNSW contractors, unless approved otherwise.

All services at the completion of the “shut down period” shall be correctly drained, flushed, cleaned, and purged out to ensure that NO foreign materials are permitted to enter the system. Other contaminants shall be prevented from polluting the working pipe infrastructure. It shall therefore be the sole responsibility of the site operator or services contractor or both, who is undertaking the shutdown to recommission the system in a clean state and ensure all service valves are reopened to the service.

E.1.5.15. Maintenance

All restored surfaces shall be maintained in a condition to which they were restored until the expiry of the contract maintenance period.

E.1.5.16. Subcontractors

Notwithstanding that the contractor may subcontract the backfilling and restoration of service trenches, it will be the contractor's responsibility to obtain all permits and approvals prior to excavation commences. The contractor shall supervise the work to ensure that it is carried out in accordance with the specification.

E.1.5.17. Erosion Sediment Control

Virtually all construction activities which require the disturbance of soil surfaces, and the existing vegetation predispose the construction site to erosion. The contractor shall take all necessary measures to reduce the erosion hazard and to control sediments in run-off water so that they do not enter the stormwater drainage system. The contractor shall also carry out progressive revegetation of the site where possible to reduce the area disturbed by construction activities.

E.1.5.18. As-Built Plans

Large Projects (length of trenching more than 50 metres)

UNSW will provide plans to the Contractor showing the nearest control points adjacent to the proposed excavation.

The Contractor is to submit as-built documentation, indicating the location, route and depths of services by referring to the control points, in electronic format as per CAD specifications.

Minor Projects (length of trenching less than 50 metres)

The Contractor is to submit as-built plans showing the location, route and depths of cables by referring to the nearest ground features (e.g.: building corners, kerbs, retaining walls). Plans shall be drawn to a scale, not exceeding 1:200 and annotated.

E.1.5.19. Testing

All services shall be tested in the presence and to the approval of EM Engineering.

Pressure Systems: As for cold & hot water supply

Fire Pressure Systems: As for fire protection systems

Gas Systems: As for natural gas supply

Gravity Pipelines: As for sanitary and stormwater drainage

Underground services shall be tested before backfilling, but after the installation of thrust support blocks.

Internal pipework shall be tested before finishing trades commence, before ceilings are installed and insulation of pipework. On site the contractor shall maintain records of all tests.

E.1.5.20. Damage to Services

Contractor shall replace at their own expense any service damaged during construction.

E.1.5.21. Materials and Workmanship

New materials and first-class Tradesmen and workmanship shall be used in all instances.

E.1.5.22. Thrust Blocks

Provide thrust blocks on mechanically and push fit jointed (or polyethylene pipe with electrofusion joint, where the joints are subject to the impact of thrust) underground pressure pipes (or non-pressure pipelines with a grade of 1:1 or steeper).

Thrust blocks are to be designed and certified by a registered structural engineer in accordance with the requirements of Sydney Water as documented by Water Services Association of Australia and UNSW Standard drawing EME 0004 H.

E.1.6. PIPEWORK AND MATERIALS

E.1.6.1. General

Pipework shall comply with Plumbing Code of Australia (NCC Volume 3) and relevant part of AS3500, AS2149 & AS2118, except that pipework flanges shall be rated higher for fire sprinkler and hydrant installations. No Pipework shall be run on the external fabric of the buildings without the expressed approval from EM Engineering.

E.1.6.2. Proximity of Services.

Pipe and pipework shall not come into direct contact with any other pipe, services, structure, plant or equipment. A minimum distance of 150mm clearance shall be provided for all above ground installations and be kept at a minimum of 300mm generally for in-ground services and otherwise in accordance with AS3500.1 Clauses 5.3 to 5.3.5 and AS3500.2 (Drainage) Clauses 3.6.1 to 3.6.8.

Non-potable services shall be a minimum of 300mm from any potable supply.

Explanation Note: So far as reasonably possible non-potable water shall be kept a minimum 300mm away from potable supply to manage from risks in cross connecting and contamination of systems. This shall be in addition to colouring and labelling of pipework.

E.1.6.3. Nominated Suppliers and Manufacturers

In the following sections, material and fixture suppliers have been nominated to ensure consistency and efficient repair across site.

UNSW EM approval will be required for alternative selections.

E.1.6.4. Buried Warning Tape

Underground warning tape shall be buried 300mm below the surface of the trench, directly over the centre-line of the entire pipe route.

Tape shall be colour coded, nominally 150mm wide heavy gauge polyethylene film or other approved material complete with detector trace cable. Wording to identify the nature of the buried pipe shall be repeated at 1m maximum intervals, in accordance with AS2648.1. Inscriptions shall be as per the following examples (or similar acceptable text).

a. Lilac (Purple) Tape

CAUTION BORE WATER PIPE

b. Red Tape

CAUTION FIRE SERVICES PIPE

c. Blue Tape

CAUTION WATER PIPE

d. Yellow Tape

DANGER NATURAL GAS PIPE

E.1.6.5. Wire Trace

In conjunction with the buried warning tape, a 2.5mm insulated copper earth wire trace line shall be installed on all non-metallic underground piping systems. It shall be laid directly beside the pipeline for the entire pipe route. Ensure the cable does not come into contact with the pipe, as trace wire can conduct a random electrical charge emanating from a lightning strike to ground, which has been known to damage the pipe wall.

On pipelines greater than 500 metres, the trace wire shall terminate at the below/above ground pipe interface enabling a stronger signal to be obtained. Where necessary, splices shall be soldered or crimp jointed.

E.1.6.6. Copper Pipe

For all pipe sizes use pipe that is appropriately pressure rated for the application in accordance with AS1432 as a minimum standard. Pipework shall be suitably rated to the proposed pressure. Jointing shall be either 5% silver soldered joints, rolled groove Victaulic bolted joints or flanges as required. Brazed tees formed by mechanical forming tools is only permitted for metal pipe on pipe sizes greater than 25mm and installed and only where installed above ground. Joints shall be 20mm long (minimum). Provide samples to EM Engineering prior to installation to demonstrate minimum quality of joint shall be used.

Where laid below ground, provide polyethylene sleeving taped to all pipework.

E.1.6.7. Copper Pipe Fittings

Proprietary fittings only shall be used for copper tube reticulation. Kinco nuts are acceptable providing the copper pipe retains the nut via tube deformation created by a Croxing tool.

E.1.6.8. Copper Pipe Fittings - Compression (Crimp) System

Compression crimp jointing systems are not an acceptable alternative to a fully welded copper system and shall not be used as an alternative for major new or refurbishment projects.

Crimp fittings shall NOT be used for main line or major infrastructure installations (in-wall or chased installations will not be accepted).

Compression & crimp systems MUST be submitted to and approved by UNSW EM Engineering in writing before installation (note: UNSW EM Engineering will only consider Veiga Propress, alternate manufactured systems will not be considered).

The use of a compression/crimp jointing systems within 300mm of an annealed section of copper pipe is not permitted.

Explanation Note: Welded systems are preferred to keep installation consistent across the multiple buildings on the Kensington Campus and minimise the variations of spares for repair work.

E.1.6.9. Black Steel Pipe

Black Steel pipes shall not be used.

E.1.6.10. Light Gauge Galvanised Pipe

Light gauge steel galvanised pipes shall not be used and will not be permitted to be used on UNSW sites. This includes for "Fire Light" galvanised Victaulic steel pipe for any or all fire systems. Minimum thickness of galvanised pipe for 100mm NB or above shall be 3.5mm. Refer to further specification under "materials" steel pipe for further detail.

E.1.6.11. Pipework Material Laboratory Use

Pipework for lab use shall be captures in HF Comments Section E.X - Hydraulic and Fire Services Lab Standard Rev 1

E.1.6.12. Pipe Flanges

Pipe flanges shall be utilised for all pipe and valve joints >Ø50mm. Flanges shall be Table 'E' for water and ANSI 150 for gas.

Flanges can be either bronze 'slip on' type (direct braze from tube to flange) or approved bronze backing plate type (similar to 'Copamate'). Bolts and set screws shall be 316 stainless-steel, either M16 or M20 designed to match the flange hole size complete with flat SS washers. Provide an electrolysis insulator between ferrous metal flange and copper adapter. Flanges for Natural Gas systems shall be ASA/ANZI 150 type.

E.1.6.13. Rolled Groove Joint

Install rolled groove joints on exposed internal pipework only. Rolled grooved couplings shall be 'Dixon', 'Quell' or 'Victaulic' joints only. Minimum pipe thickness of the pipe being roll formed must not be less than 3.5mm. **Roll groove joints made onsite will not be accepted. All roll groove joints shall be fabricated off site using approved and calibrated factory equipment complete with supporting QA documentation.**

E.1.6.14. Pipe Access for Cleaning and Maintenance

Cleaning eyes (inspection openings) for pipeline maintenance and inspection shall be provided at every section of pipe for all gravity pipelines.

Provide clear-outs to permit internal cleaning and clearing of blockages to the whole of the reticulation system. Extend risers up to the finished floor or surface, terminating under a heavy-duty inspection box. Inspection boxes shall be screw fixed brass where located internally and cast iron or stainless steel externally.

For specific requirements refer Appendix A - Section C, Sanitary Plumbing and Drainage Systems of the NCC, Plumbing Code of Australia.

Engrave brass clear-out covers with the following letters: S – sewer, S/W – stormwater, T/W – trade waste.

E.1.6.15. Dismantling

Unions and dismantling joints shall be provided at all plant connections and valves up to NB 65 mm to facilitate installation and dismantling. Provide isolation valves adjacent to union to allow removal of plant without shutting down service.

E.1.6.16. Exposed Threads

Where pipework is exposed to public view, keep external threads to minimum required to make the joint.

E.1.6.17. Mitred Joints

Not permitted unless noted otherwise.

E.1.6.18. Exposed Pipework

In toilets, kitchens and other public rooms, pipework shall be chrome plated and fitted with wall plates.

Pipes that are located in areas subject to condensation or in non-ventilated spaces or where a variation of temperatures prevail, such pipework shall be insulated with the fire-retardant EPDM closed cell foam minimum 25mm incorporating a press seal fastener / factory laminated equal to 'Armaflex' manufacture and must be zero ODP. Where condensation on the outside of cold-water pipes is liable to occur, insulate pipework.

E.1.6.19. Flexible Braided Connections

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

Braided flexible hoses shall NOT be joined to another braided flexible hose under any circumstance.

Braided vibration dampers on fire pumps shall be capable of working pressures of 2,200kPa.

E.1.6.20. Equipment and Valve Labelling

All equipment shall be labelled and all valves numbered. These shall be incorporated in the Operation and Maintenance manuals and drawings. Labels shall be manufactured from aluminium sheet and engraved on one side with valve number. On the back of the label, identify the plant isolated by the valve.

Obtain valve numbering from EM Engineering.

E.1.6.21. Valve Numbering and Schedule

Where numbering does not exist for a building, the following system shall be adopted.

Valves shall be identified by numbering in consecutive order as follows:

As an example, a main potable water service valve installed on Level 2 of Biological Sciences Building shall be numbered: D26 – 2 – PW – 1, where:

D26	=	Building Number
2	=	Level 2
PW	=	Potable Water
1	=	Consecutive Number

Service Abbreviations

DW	-	Cold Drinking Water
HW	-	Hot Drinking Water
WW	-	Warm Water
BW	-	Bore Water
LCW	-	Laboratory Cold Water
LHW	-	Laboratory Hot Water
CCW	-	Circulated Cooling Water
CW	-	Chilled Water
TW	-	Trade Waste
SP	-	Sanitary Plumbing
RO	-	Reverse Osmosis Purified Water
RW	-	Rainwater Reuse
NG	-	Natural gas
ECW	-	Equipment Cooling Water
CA	-	Compressed Air

N - Nitrogen

A - Argon

HE - Helium

V - Vacuum

Schedule

Valves shall be schedules as follows:

Valve ID	Service	Type & Size of Valve	Location	Area or equipment affected upon valve operation
D26-2-PW-1	Potable Water	50mm ball	In service riser next to RM221	Level 2, west side from RM245

Note: Buried valves must be fitted with colour coded surround and cover and engraved according to UNSW standard convention and in accordance with Drawing EME 0017 H (latest revision).

E.1.6.22. Corrosion Protection

Where services, plant or equipment is subject to corrosion whether by physical, galvanic or electrical processes, it shall be suitably protected based on location, environment and susceptibility to corrosion.

Inground pipe installations

To mitigate potential corrosion, a petroleum-based wrapping is to be applied to all joints which encapsulates the whole joint assembly and exclude the presence and interaction of ground water and aggressive minerals in the soil. For flange joints, bolts and nuts must be moulded and coated with a petroleum mastic before wrapping. Wrapping is to be fully sealed with a proprietary PVC over wrapping designed to protect the petroleum wrapping and exclude moisture from the joint.

To provide a suitable corrosion barrier the following corrosion materials are required to be applied. A typical underground application is a minimum of four (4) components all as follows:

1. Primer
2. Mastic
3. Petroleum tape
4. PVC SA overwrap

Denso or equal brand is acceptable.

Above ground installations

Materials suitable for use and approved by EM Engineering shall be used for the installation of all hydraulic services. Materials which may be subject to corrosion from the elements, other plant or corrosive environments, shall be protected. Service pipes, valves, brackets, plant and equipment is to be assessed for corrosion resistance and be treated accordingly.

E.1.6.23. Painting and Identification

Where directed, pipework which is not chromed but is exposed to view inside a room, shall be painted. Identify all pipes in accordance with AS1345 – "Identification of the Contents of Pipes, Conduits & Ducts" and requirements of AS3500 and NCC, Plumbing Code of Australia. Colour coding shall be in accordance with AS1318 – "Industry Safety Colour Code". Affix pipeline labels showing name of service and direction of flow. Gas services shall also have the pressure shown. Markers similar to '3M Safetyman'.

All installed fire pipework where exposed within plant rooms shall as a minimum be painted Signal Red & labelled to the appropriate fire system.

Refer also: Section E.2 - MECHANICAL SERVICES – Method of Identification.

E.1.6.24. Pipe Capping

Pipework shall be capped off as work proceeds to prevent ingress of dirt, concrete etc. Use proprietary caps/plugs. Crimping or flattening of pipework is not acceptable.

E.1.6.25. Fire Stop Collars

Ref: AS4072 and AS1530. Fire Stop collars shall be provided on all PVC or other non-metallic pipe penetrations through fire rated floors and walls. Where externally mounted as a retrofit fire collars shall be equal to "Promat" products and provide fire rating to suit location by expanding less than 100°C heat to collapse the pipe.

Fire collars are to be certified to the relevant Australian Standard upon completion of the works. Fire stopping for metallic piping through different fire compartments are to comply with AS1530.

The hydraulic documents shall provide details on the Construction Issue contract drawings advising the contractor/fixer as to which side, fire side(s), of the structure to fix the fire collar(s) and relevant F/R/L rating. Default fire rating shall be 4 hours.

E.1.6.26. Pipe Supports

Ref: AS.3500, AS2149.1 & AS2118. Use 'Stauff' pipe supports in exposed public areas. Provide 1.2mm thick extruded PVC insulation between supports and all piping. (Note that the purpose of the insulation is to stop slipping, allow clamps to be tightened, provide sound insulation, and where necessary to separate different metals). Tape or coated brackets are not acceptable, except that Abey Acoustic Clips may be used for pipe sizes up to and including 25mm to support pipes running laterally.

Steel supports shall be galvanised after fabrication and similar to 'Unistrut' or similar approved, complete with proprietary fittings and pipe clamps. Pipes over 25mm shall be fully supported with Unistrut angle brackets to ensure that pipe cannot drop even if clip becomes loose with vibration. Single pipes may be supported by UN16 medium duty hot dipped galvanised, double bolted brackets equal to 'Unistrut'. Where pipes

are located in vertical ducts, they shall be fully supported at floor level using 'Unistrut heavy duty P1000 channel' or equal bracing to prevent vertical and lateral movement when filled with water. Pipes shall also be supported with 'Unistrut heavy duty channel' and support bracket between floors at 2m (max) spacing. In roof top plant rooms and where externally exposed UNISTRUT channel, brackets and fixings shall be 316 Stainless Steel.

All brackets shall be fixed with structural grade fixings to the building works without distributing any loads to other pipes. Do not use one pipe to support another.

All fixings shall be similar to 'Hilti'. Horizontal wall mounted pipes shall be fully supported by cantilevered bracket. End-fill brackets with proprietary plastic caps. Use only one brand throughout the project. For RC slabs and beams, locate fixings as recommended by the structural engineer. Riser clamps (floor mounted anchor brackets) "Flexistrut" or similar shall be used on all pipe risers of 80 mm diameter and above.

Pear hangers, Abey "T" clips, saddles etc., shall NOT be used unless written approval is provided by the UNSW EM Engineering.

Unistrut or equal channel clips, shall not be used to support steel or galvanised steel pipes > Ø80mm. Heavy duty bolted saddles with channel is acceptable.

Table E.1.6.26

Spacing of Brackets for Hydraulic & Fire piping systems

Maximum spacing of brackets and clips [m] and Ø mm for Hanging Rod size

Nominal pipe size Ø DN	Copper, copper alloy and stainless-steel tube & fittings Water & Gas		Galvanised steel and ductile iron Water services		uPVC, Polyethylene, polypropylene and cPVC pipes. Sewer, Stormwater. Non-Siphonic systems		Galvanised steel and ductile iron.		Minimum Ø Hanger Rod Size [mm] Zinc Plated/Gal or Stainless-Steel Rod Note: nominate one (1) hanger per pipe		Minimum Ø Hanger Rod Size [mm] Zinc Plated/Gal or Stainless-Steel Rod Note: nominate one (1) hanger per pipe
	Hydraulic Services		Hydraulic Services		Hydraulic Services		Fire Services		Copper, copper alloy and stainless steel tube & fittings Water/Fire	uPVC, Polyethylene, polypropylene and cPVC pipes. Sewer, Stormwater. Non-Siphonic systems	Galvanised steel and ductile iron Water/Fire services
	Horizontal or graded	Vertical pipes	Horizontal or graded	Vertical pipes	Horizontal or graded	Vertical pipes	Horizontal or graded	Vertical pipes			
10	1.5	1.5*	1.5	2.0*	0.5	1.0	1.5	2.0*	8.0	----	10.0
15	1.5	1.5*	2.0	2.0*	0.6	1.2	2.0	2.0*	8.0	----	10.0
18	1.5	1.5*	----	----	----	----	----	----	10.0	----	----
20	1.5	1.8*	2.0	2.0*	0.7	1.2	2.0	2.0*	10.0	10.0	10.0
25	2.0	2.0*	2.0	2.2*	0.75	1.5	2.0	2.2*	10.0	10.0	10.0
32	2.4	2.0*	2.4	2.4*	0.85	1.7*	2.4	2.4*	10.0	10.0	10.0
40	2.4	2.0*	2.5	2.4*	0.9	1.8*	2.5	2.4*	10.0	10.0	10.0
50	2.5	2.0*	2.5	2.4*	1.05	2.1*	2.5	2.4*	10.0	10.0	10.0
63	----	----	----	----	1.1	2.2*	----	----	----	10.0	----
65	2.5	2.0*	2.8	2.4*	1.2	----	2.8	2.4*	10.0	----	10.0

80	2.7	2.0*	3.0	2.4*	1.35	2.7*	3.0	2.4*	10.0	----	10.0
90	----	----	----	----	1.4	2.8*	----	----	----	10.0	----
100	2.7	2.0*	3.0	2.6*	1.5	3.0*	3.0	2.6*	10.0	10.0	10.0
110	----	----	----	----	1.5	3.0*	----	----	----	10.0	----
125	2.7	2.4*	----	----	1.7	3.0*	----	----	12.0	10.0	----
140	----	----	----	----	1.7	3.0*	----	----	----	10.0	----
150	3.0	2.4*	4.0	2.8*	----	----	4.0	2.8*	12.0	----	12.0
160	----	----	----	----	1.8	3.0*	----	----	----	10.0	----
180	----	----	----	----	2.0	3.2*	----	----	----	12.0	----
200	4.0	2.5*	4.5	3.0*	2.2	3.2*	4.5	3.0*	16.0	12.0	16.0
250	4.5	3.0*	4.7	3.5*	2.5	3.5*	4.7	3.5*	20.0	16.0	20.0
300	5.0	3.0*	5.5	3.5*	----	----	5.5	3.5*	20.0	----	20.0
315	----	----	----	----	2.7	3.5*	----	----	----	16	----
350	----	----	5.5	3.5*	----	----	5.5	3.5*	----	----	25.0
400	----	----	5.5	3.5*	----	----	5.5	3.5*	----	----	25.0
500	----	----	5.5	4.0*	----	----	----	----	----	----	32.0
Notes	*Denotes pipes between floors must have a minimum of two (2) brackets per floor irrespective of the dimensions between floors.										
	Additional brackets and or hanging rods are required if valves or other equipment add additional mass to the pipeline										
	Pipes which are installed in a group shall be arranged to either be supported separately on a bracket and hanging rod or supported by a proprietary channel and bracket system e.g.: 'UNISTRUT' to cradle the pipe group. Channel shall be sized to meet minimum deflection due to dead load as per manufacturer's recommendations.										
	Siphonic drainage systems shall be supported by a rail system equal to 'Unistrut' as per the manufacturer and designer's specification.										

Refer also: Section E.2 – Supporting of Pipes.

E.1.6.27. Fixing Through Steel Wall Framing

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

E.1.6.28. Redundant Services Disconnection and Removal

Disconnect and remove all redundant services. Disconnection shall occur at the last live tee and the redundant branch line capped within 150mm of the main line with proprietary cap or plug. Do not remove main building infrastructure pipework unless agreed in writing by EM Engineering.

E.1.6.29. Electrical Hazard Zones

The Consultant shall be responsible for bringing to the Project Manager's notice the existence of electrical fixtures that could be affected by the installation of hydraulic works.

The documents shall require that contractors ensure they are not installing hydraulic works in electrical hazard zones. The following shall be included in the tender and contract documents. Should an electrical fixture be present which puts it within a restricted zone by the actions of the contractor, then it shall be the Contractor's responsibility and cost to have this fixture either relocated away from the zone or shall be replaced by a fixture appropriate to the zone.

The following standards are representative of those applicable to UNSW, but it shall be the Consultant's responsibility to ascertain all applicable standards and clauses.

AS/NZ3000 – Wiring Rules

Clause 7.1 Locations containing baths, showers or other fixed water containers

Clause 7.2 Swimming pools, paddling pools and spa pools or tubs

Clause 7.3 Locations containing sauna heaters

Clause 7.4 Refrigeration rooms

Clause 7.5 Locations where general hosing down operations are required

Clause 7.6 Fountain and water features

Clause 7.7 Extra-low voltage electrical installations

Clause 7.9 Hazardous areas

AS/NZ2430 - Classification of hazardous areas

AS/NZ2430.3.1 – Examples of area classification – General

AS/NZ2430.3.3 – Examples of area classification – Flammable liquids

AS/NZ2430.3.4 – Examples of area classification – Flammable gases

AS/NZ2430.3.6 – Examples of area classification – Laboratories including fume cupboards and flammable medical agents

AS/NZ2430.3.9 – Examples of area classification – Miscellaneous

E.1.6.30. Covers, Grates and Frames (General)

All grated pit covers shall be bicycle and wheelchair proof. This requires the slots shall be no wider than 10mm and no longer than 250mm Pit gratings shall be equal to ICON ductile iron Bicycle Safe Class B or D as required by AS3996. Provide heavy-duty hinged GMS gratings and frames on all grated surface water entry pits. Where the pit is required to accept high volumes of runoff, grates shall be size accordingly. Where doubt exists, contact UNSW EM Engineering for guidance.

Trench gratings shall be ACO type S100 or S200 Heel guard as required with maximum opening size of 8mm x 35mm. Ensure slip resistance of grates complies with Australian Standards HB197.

All grates shall be 'lock down' style.

Drop in style grates are not acceptable.

Refer also: Section D - EXTERNAL WORKS – Hard Landscaping

Garden beds
Concrete covers and frames. *Refer section 1.21.10 pit grates.*

Refer also: Section D - EXTERNAL WORKS – Hard Landscaping

External bitumen or concrete paved areas:
Cast iron gas-tight covers and frames equal to Mascot Engineering gastight access chamber covers, concrete filled, with reinforced concrete frame surround. Provide 10mm thick expansion joint between surround and adjacent paving.

Pits requiring regular maintenance (for example grease inceptors), but not in trafficable areas, should be fitted with heavy duty aluminium checker plate lid and surrounds, incorporating flush mounted lifting handle and locking device.

Refer also: Section D - EXTERNAL WORKS – Covers and Gratings

Tile, block or brick paved areas
Cast iron gas-tight covers and frame equal to Mascot Engineering Gastight Covers, with 3mm thick 316 grade stainless steel riser strips bolted to frame and covers. Riser height to suit paving thickness. Fix pavers with appropriate bonding and bedding compounds.

Where covers are likely shall be too heavy to meet WH&S requirements, colour-stencilled or coloured concrete infill may need shall be adopted rather than inserting pavers into covers.

Key openings shall suit Gatic SR150 lifters. Provide two sets of universal type lifting keys, lengthened to suit final cover thickness. Provide and fit covers to all keyholes. 'Gatic SR150'

All covers, grates and frames for the entire project shall be from one manufacturer.

Pit Grates shall be as a minimum class loading in accordance with the chart below, they shall be set into pre-cast concrete surrounds equal in size to the internal dimensions of the pit to which they are installed.

Load ratings - AS3996 Chart expresses load rating shall be in accordance with the following Chart:

Class	Typical Use	Nominal Wheel Loading kg	Serviceability Design Load kN	Ultimate Limit State Design kN
A	Areas accessible strictly by pedestrians. Not suited to vehicles.	330	6.7	10
B	Suitable for vehicles accessing driveways and footways. Low speed only (light traffic).	2,670	53	80
C	Residential roads and car parks trafficable to vehicles. Slow moving traffic and minor roads.	5,000	100	150
D	Major roads including freeway and motorway shoulders. Warehouses and loading docks.	8,000	160	240

Where isolating valves are housed beneath the cover, provide inserted inspection covers to suit.

Areas	Cover Weights
Pedestrian only	Class A
Pits requiring regular access	Class B maximum
Pits requiring regular access in Vehicle access areas	Class C
Pits requiring regular access in Grassed areas	Class B
Pits not requiring regular access in Roads and vehicle access	Class D

E.1.6.31. Vent Terminations

Sewer and trade waste vents shall be terminated in accordance with AS/NZS 3500.2 and water authority trade waste requirements. Generally, vents shall be terminated

at least 6m and preferably 8m laterally from air conditioning intakes and at least 3m from wall openings. Where required, vents should be diverted away from air conditioning units and cooling towers by increasing the vent size and providing guy wire supports. Under such circumstances, it is likely that stainless steel pipework would be required to meet aesthetic approval.

E.1.6.32. Pressure Gauges

100mm Ø Bourdon tube type glycerine filled shall be used, securely mounted and provided with shut-off tap & union, especially where pressure gauges are mounted on pump lines, where glycerine filled gauges offer protection against extreme pressures. Full scale reading shall be 150% of expected maximum pressure. Graduations shall be in KILOPASCALS.

E.1.6.33. Water Tanks

Materials for potable water tanks installed in or on buildings shall be, copper, cast iron, stainless steel or polyethylene.

Non-potable water tanks serving Primary Containment (PC) labs shall be 316 stainless steel. Standard galvanised mild steel shall not be used. However, purpose-built sectional tanks may be approved, subject to full engineering details on jointing of sections, corrosion protection, tank support, pipe penetrations, roof etc. being approved by UNSW EM Engineering.

Only polyethylene tanks shall be used for holding non-potable water due to the potential corrosive nature of bore water. These tanks shall be fitted with a dual supply, the primary supply from bore water and the backup supply drinking water.

All water storage tanks shall have overflow alarms fitted and connected to the campus wide BMS system.

All water storage tanks shall be fitted with an isolation valve serving each fill valve, outlet pipe and drain.

Refer to Diagram EME 0003 H Non-Potable Tank Standard Details at the end of Section E.1.

E.1.7. STORMWATER DRAINAGE

E.1.7.1. Council Conditions of Development Approval

Kensington Campus

Kensington Campus has a Campus Wide Stormwater Strategy agreement with Randwick City Council which details engineering design methodology. Stormwater shall be designed to the criteria shown on the Stormwater Catchment Management Plan and Stormwater Diversion Structures Plan, available from UNSW EM Engineering. These drawings identify overland flow paths, drainage structures forming boundaries of overland flow paths, detention basins, method of calculating and determining detention volumes and run-off from sub-catchment areas etc. Overland flow paths MUST NOT be disrupted or violated by construction, removal of kerbs, berms, crests or removal of kerb inlet pits. Where diversion occurs due to development, a full hydraulic computer modelling plan using the DRAINS model shall be carried out and submitted to UNSW EM Engineering and Randwick Council for approval. An extract of

the UNSW DRAINS model can be provided following a written request to UNSW EM Engineering. Existing detention basins and percolation chambers shall be retained. Where alterations due to development are proposed, identical footprint areas for percolation, identical volumes for detention and weir crest levels shall be maintained. Piped drainage capacities shall not be increased in areas draining to catchments outside the Village Green percolation chamber (OSR) due to potential flooding in Anzac Parade and surrounding streets.

The Village Green percolation chamber has been designed to accept flows from its existing catchment area. The detention storage is at maximum capacity and cannot accept additional catchment flows. Randwick Council will not permit stormwater being diverted from other catchments to the Village Green percolation chamber.

Dedicated rainwater tanks shall not be installed without consultation with UNSW EM Engineering. It should be noted that bore water is extracted from the Botany Sands Aquifer which is recharged with campus stormwater run-off via the aquifer recharge percolation chamber at the Village Green. This forms the major part of the University's water management strategy.

The Development Application should show that the proposed development drainage satisfies the requirements as set down in the UNSW Stormwater Strategy, which is part of the Campus Master Plan, the basis of all project DA assessments by Council.

Refer to Appendix 9 - UNSW Stormwater Masterplan Strategy

Refer to Diagrams EME 0012 H Stormwater Catchment Management Plan and EME 0013 H Stormwater Diversion Structures Plan at the end of this Section E.1

Randwick Campus
Randwick Campus does have specific building detention. Any alterations to building works or stormwater drainage will require special treatment. Any major project within the campus will trigger the requirement of detention based on a Greenfield site consideration basis. Randwick Council has placed the highest of constraints on the campus for storm water detention and discharge rates for this site and this shall be complied with.

All other campuses
Other campuses not listed above shall comply with the Civil engineering stormwater strategy and local council requirements.

E.1.7.2. Basis of Design

Show Basis of Design on the drawings, including: Design storm, design flow rates and pipe capacities, storm intensity, time of concentration and calculations of volumes for detention basins and percolation pits. Such basins and pits shall be formally designed and documented with the project.

E.1.7.3. Basement Emergency Stormwater Flood Protection

Where high risk or technical equipment is installed in building levels below the natural ground level, the design shall incorporate a pumped emergency flood protection system. The pumped emergency flood protection system shall operate in addition to

the regular sub-soil drainage system and is designed to reduce the impact of building flooding, by catastrophic fire or rainwater events.

The high-risk nature of equipment shall be confirmed with UNSW in the early design phase to confirm requirement of this system.

The pumped emergency flood protection system is to be capable of being operated from an external (plug-in generator) or off a building generator if available.

The system shall be arranged with four (4) mandatory pump specification, special pumps designed for low NPSH, Regent Autoprime 50SP-174-T211 pumps complete with 3kw electric motor (5L/s each at a required discharge head). The pumps shall have separate suction inlets to the draw point with a combined discharge manifold. The discharge manifold shall be directed to an external location as agreed with UNSW EM Engineering.

The control panel and operational logic shall be designed and supplied by Enhanced Cabling Systems Pty Ltd (ECS) in accordance with the UNSW approved drawings.

Building E10 contains an emergency flood protection system. This system, controls, monitoring and components are the standard for all emergency flood control throughout the campus.

E.1.7.4. Pipework

In-ground pipework shall be one of the following options and suitable for the application they are used for:

- reinforced concrete (RC)
- drainage PVC
- high density polyethylene (HDPE)

RC shall be spigot and socket jointed. MDPE and HDPE shall be poly fusion welded.

UNSW EM approved metal pipes shall only be used for above ground installations.

Minimum pipe size for downpipe drainage 100mm. (UNSW prohibits the use of 90mm UPVC).

Where buried pipework is greater than 2.0m below finished surface, side support and overlay shall be inspected and approved by EM Engineering before backfilling.

Where stormwater drainage is laid below an access road with expected high point loads, or at a depth which may impact the structural integrity of the pipe system, refer AS/NZS3725, a review of the standard RCP class shall be prepared and issued to EM Engineering for review before any works begin.

E.1.7.5. Downpipes

Minimum pipe size for downpipe drainage 100mm. (UNSW prohibits the use of 90mm UPVC).
Materials for downpipes shall include, galvanised steel, 1.2mm thick AS1432 Table C or higher quality Copper tube shall be installed for internal locations, mild steel, HDPE or uPVC.

For buildings over 2 storeys: cast iron or uPVC to AS/NZS1260 – DWV Pipes SN8 (150 up) and SN10 (100 only) concrete encasement of downpipes is discouraged.

Terminate cast iron pipes with watertight socket or mechanical joint at roof gutter spigots. Provide inspection openings (screwed access gate where possible) at the bottom of all downpipes and enter in-ground pipe with 2 x 45° bends or long radius bends.

Where box gutters are installed, downpipe connection to box gutter sumps shall be a watertight flanged connection or an approved alternative.

E.1.7.6. Roof and Terrace / Balcony Drainage

Rainwater drainage shall be sized at minimum to meet the 110% rain event plus 20% climate change. Should the ESD requirement be more onerous, that value shall be adopted.

Sumps: Proprietary nickel-bronze hinged grate and sump similar to Gatic TJ12. Capacity: Allow hydraulic capacity in gutters, rain heads and downpipes for hydrant flow testing up to 20L/sec where building is equipped with internal fire hydrants.

Roof outlets where pebble aggregate is used over sealed concrete form shall be provided with a full covered stainless-steel gauze surrounds over the Gatic grates and domes including the top as to prevent pebbles from entering the down pipe system. All Gatic grates surrounded by pebble aggregate are to be dome style.

Gravity type overflows are preferable, but where this is not viable siphonic overflows shall be permitted, subject to approval by UNSW EM.

Overflows shall be provided for all box gutters to provide 110% safe overflow off the roof in the event of roof drainage system failure.

Overflows shall be shown on the roof plan in order to locate & identify discharges that are located over doorways or open windows.

The minimum box gutter width shall be 450mm to enable ease of maintenance.

Eaves guttering shall be protected from air-born rubbish such as leaves, plastics, etc. with Gumleaf or similar colour bond expanded steel mesh.

E.1.7.7. Siphonic Roof Drainage Systems

All roof catchment areas, components and systems generally shall comply with AS3500.3 for Stormwater.

Provide to UNSW EM Engineering cross sections and details of roof drainage for approval to allow further assessment of the above prior to construction.

All box gutter profiles shall be designed to cater for 110% of the 1:100 year ARI design storm plus 20% climate change without flooding and shall be not narrower than 450mm unless approved otherwise.

All roof drainage downpipes & outlets shall be designed to withstand a 110% of the 1:100 year ARI storm plus 20% climate change without flooding.

Buildings fitted with Hydrants at roof level (See Hydrants) shall be capable of draining at the Hydrant test flow rate.

All land locked roof areas shall be design at a minimum of the 110% of the 1:100 year ARI storm plus 20% climate change without flooding.

The roof drainage system where not a "normal" system shall in all aspects be equal to "Geberit".

Siphonic drainage outlets in gutter are to be designed with the water level below overflow, resulting in overflows being above siphon operation water level. All siphon outlets are to be located within a box gutter sump. Overflow siphon outlets can be located within the sole of the box gutter.

All Siphonic Pipe materials shall be high to medium density polyethylene materials to AS4130 and joined by poly fusion methods.

All Siphonic pipes shall cater for thermal expansion and contraction to manufacturers' requirements.

Receiving stormwater pits shall be large enough of min 900mm square to provide a siphonic break or "still" the outfalls, it is preferred that the receiving outfall pipe diameter be oversized in consideration to removing siphon break pits.

E.1.7.8. Surface Drainage

Provide adequate surface drainage inflow nodes which require grated pits/sumps and door thresholds to effectively drain hard surface and landscape areas as required.

Ensure trapped low points and internal open courtyards, podium spaces and have overflow provisions either piped or flowing overland. Overland flow paths shall be coordinated with the civil engineer.

E.1.7.9. Subsoil Drainage

Provide and lay 100mm diameter corrugated PVC sub-soil drainage pipe around each stormwater manhole, stormwater gully pit and stormwater surface inlet pit and through concrete trench bulkheads. The sub-soil drains shall be positioned to drain the excavated bottom of the trench.

Sub-soil drains shall:

- enter into the stormwater access chamber or concrete stormwater structure on the highest side,
- subsoil piping to be provided with a flap valve terminating within the drainage pit,
- be surrounded with 150mm of blue metal.
- Install riser with access box with concrete surround 50mm above FSL.

E.1.7.10. Geotextile Fabric

Provide permeable polypropylene geo-tech fabric capable of excluding particles in excess of 0.25mm.

E.1.7.11. Rainwater Harvesting and Water Re-Use

General

For all new buildings and buildings undergoing significant refurbishment, a rainwater harvesting and water re-use system must be considered for installation to suit the requirements of UNSW sustainability policy.

Rainwater re-use is not required at the Kensington Campus, as bore water is in use.

Design and Installation Criteria

Rainwater re-use systems must collect rainwater from building roofs at minimum, including 'Green Roof' constructions and store the water in a dedicated rainwater re-use tank separate to any stormwater on-site detention (OSD) storage requirements. Stormwater collected from trafficable balconies, hard surfaces external to the building and water collected from sub-soil drainage must not be piped to the rainwater re-use tank unless confirmed with UNSW EM.

Mechanical condensate drainage may also be piped to the rainwater re-use tank.

Fire annubar test water may be piped to the rainwater re-use tank, however the fire system drainage pipework must not be piped to the re-use tank due to contaminants within the fire system pipework. Ensure the tank overflow is sized correctly to accommodate the maximum rainwater inflow and annubar discharge.

To reduce the possibility of contamination of the rainwater re-use tank, first flush systems must be installed on all rainwater re-use pipework prior to entry to the tank. Provide a bleed drain to stormwater waste as required. Access for maintenance must be provided to all first flush systems.

Rainwater tanks must be suitably sized to meet the re-use demand. Rainwater harvesting and re-use calculations based on available roof area and Bureau of Meteorology rainfall statistics for the local area are required for approval to support the design. Other information required is:

- Return on investment analysis (ROI),
- Applications for re-use,
- Forecast maintenance costs & consumables,
- Forecast energy costs.

Where directed by UNSW EM Engineering provide a variable speed drive pressure unit, multi-stage pump & proprietary pump, equal to 'Hydrovar' controller, two-way valve, pressure switches, gauges, diaphragm pressure cell, discharge non-hammer check and gate valve with interconnecting copper pipework from pump discharge to pressure tank, control panel all mounted and pre-wired on a mild steel fabricated base plate frame. Control panel shall be fitted with high level interface compatible with UNSW BMS.

The system shall include a distribution board mounted on the pump base frame fitted with main power supply isolating switch and surge suppressors for each pump unit. Pump run/ pump fail lights, volt free contacts, audio and visual alarm for BMS and

power surge protection are also included with the distribution board. The board would also be fitted with a float switch operated relay for pump cut off/ mains fill solenoid operation.

On the discharge manifold provide a pressure gauge, together with a pressure tank. This tank is fitted not for draw off purposes but to act only as a shock arrestor for any upstream 'SURGE' that may occur.

The system shall include a tank bypass /pump shut off system including, KA-MAC3-10M float switch and brass normally open 240 V AC solenoid valve site wired to the pump panel.

The pressure unit assembly, including the control panel, shall be assembled off site and commissioned on site by the manufacturer or supplier.

Supply and install flexible connections between the pump (inlet and outlet) and the valves. The flexible connection shall be the same size as the pump inlet and outlet.

Supply and install flexible mounts under each hold down pad of the base plate.

Rainwater must be treated prior to re-use and piped to a dedicated rainwater re-use pipework system. The rainwater treatment plant must include a mixture of mechanical filtration, chemical dosing, backwash or disinfection processes to ensure the quality of water supplied to the system complies with current NSW Health and all applicable standards and guidelines for the treatment of re-use water.

Sub meters for potable water and rainwater (non-potable water) shall be installed immediately upstream of the potable water make-up and immediately downstream of the non-potable pump set to measure the quantity of rainwater re-used. Refer to Section E.1.11.3 for further metering requirements.

A potable cold-water supply must be provided to the re-use system to accommodate periods of low rainfall. This supply must be connected to the tank with a registered air gap as well as an installed RPZD and be sub-metered.

The potable water supply must also be piped and valved and shall include a solenoid valve to be activated with the tank is empty to allow the rainwater re-use tank and water treatment plant to be fully by-passed and served only by the domestic potable water supply.

Prior to the rainwater re-use system being commissioned, the re-use tank shall be thoroughly flushed with clean water and fully sterilised, in accordance to the requirements of AS3500.1 Appendix H. The sterilisation process plan shall be submitted to UNSW EM for review and be compatible with the pipe material. In addition to UNSW EM witnessing this process, the consultant/contractor must provide documentary evidence confirming the provision of this process.

Chlorination shall not be used as a sterilisation process for stainless steel pipes due to the corrosive reaction.

Internal access to rainwater storage tanks must be provided to allow for cleaning. The consultant/contractor must provide a risk assessment fully detailing the safety aspects to be applied when draining, accessing, pumping out and cleaning the rainwater tank. The rainwater tank shall be fitted with a scour drain which can be piped to a stormwater waste pipe.

Rainwater re-use may be used for the following applications, subject to UNSW EM approval:

- Irrigation,
- Urinal and WC flushing,
- Cooling tower supply water.

E.1.7.12. Kerb Outlets

Where possible, direct all roof water and stormwater flows to the underground piped system. AC condensate must not discharge to kerb.

Where necessary, provide preformed aluminium or galvanised mild steel kerb outlets. Encase steel sections in 50 thick (min) 3:1 sand / cement mortar.

E.1.7.13. Pits and Sumps

All pits for use within Stormwater, Sewer, Rainwater Harvesting, reuse shall be manufactured of precast reinforced concrete as a minimum for all pits with dimensions and depths **greater than** 450x450x300 deep.

Where pits are greater in size than this, they shall be sized in relation to depth and flow in accordance with AS3500.3 Table 7.5.2.1.

Prepackaged polyethylene sumps may be used for stormwater pump out. The sumps shall be UV stabilised and resistant to corrosion, chemicals and impact. The sumps shall be rotationally moulded in one- piece for strength and leak protection. The sumps shall be compliant to AS/ NZS 4766. Pit lids shall be appropriate to the traffic they are subject to, as per Section E.1.7.15.

Precast stormwater pits shall be provided with 150mm deep silt trap and knockouts for pipe entries. Internal sizes to match cover and surround dimensions, make good pipe connections with watertight 100mm (min) thick epoxy concrete collar. Adjust wall heights to final levels and make connection with cover surround watertight using epoxy concrete or grout. All pit grates and covers shall have a minimum 150mm concrete surround. Drop in grates are not acceptable.

The use of Fibreglass pits within the grounds of UNSW Campus is not permitted unless specifically preapproved by UNSW EM Engineering.

TABLE 7.5.2.1 - MINIMUM INTERNAL DIMENSIONS FOR STORMWATER PITS AND INLET PITS

Depth to invert of outlet	Minimum internal dimensions, mm		
	Rectangular		Circular
	Width	Length	Diameter
≤450	350	350	-
≤600	450	450	600
>600 ≤900	600	600	900
>900 ≤1 200	600	900	1 000
> 1 200	900	900	1 000

E.1.7.14. Pits – Redundant

If inlet gully pits are redundant in the new landscape design, the following treatment of pits needs shall be carried out:

Pits in-line without other pipes entering can be converted into inaccessible chambers by removing the top of the pits and constructing or installing a sealed prefabricated reinforced concrete slab. The chamber can then be buried.

Where more than one pipe enters the pit, or a severe change of direction occurs on a single-entry pit, shall be accessible and hence fitted with a removable Gatic cover at surface level.

Where it is unlikely that entry will be required due to pipeline configuration and sizes, the removable cover could be buried if in grassed area. However, these instances would only be with consent of UNSW EM Engineering.

E.1.7.15. Pit Grates & Covers

Pit Grates shall be as a minimum class loading in accordance with the chart below, they shall be set into pre-cast concrete surrounds equal in size to the internal dimensions of the pit to which they are installed.

Load ratings - AS3996 Chart expresses load rating shall be in accordance with the following chart:

Class	Typical Use	Nominal Wheel Loading kg	Serviceability Design Load kN	Ultimate Limit State Design kN
A	Areas accessible strictly by pedestrians. Not suited to vehicles.	330	6.7	10
B	Suitable for vehicles accessing driveways and footways. Low speed only (light traffic).	2,670	53	80
C	Residential roads and car parks trafficable to vehicles. Slow moving traffic and minor roads.	5,000	100	150
D	Major roads including freeway and motorway shoulders. Warehouses and loading docks.	8,000	160	240

E.1.7.16. Drainage Pumps

Submersible pumps and close coupled submersible pumps

Submersible pumps and close coupled submersible motors shall be equal in all respects to Flygt pattern, with stainless steel or epoxy coated cast iron casings and bronze impellers with in-built suction strainers and stainless-steel shaft. Motors shall be 415V, four (4) pole type (minimum).

The pumps MUST BE installed complete with galvanised mild steel lifting rails and chains to enable pump to be lifted clear of pit for maintenance without entry into the pit. All pump out control valves, and non-return valves shall be located out of the pump well for access clear of the confined space.

Bore pumps installed in a horizontal plane SHALL NOT to be installed under any circumstances.

All Check Valves shall be of spring loaded resilient seated (Not Duo Check or similar butterfly pattern) and **shall be** located out to the pump sump well, pit or Chamber. All pumps that handle heavy water or sludge shall be fitted with stirring agitators as an integral part of the installation

Control panels shall be wall mounted, steel galvanised after fabrication, powder coated enamel finished orange colour. Provide key-lockable door master keyed to building requirements.

Mount the following equipment on the cabinet door:

Lights to indicate:

- Power on,
- Pump running,
- Pump failure,

- High level alarm,
- Pump duty selector,
- On/off/auto switch for each pump,
- Alarm mute.

Controls inside cabinet:

- Main power supply circuit breaker,
- Circuit breaker for each pump,
- Audible alarm.

Operation:

- Provide one duty and one standby pump with alternating start,
- Only one pump to operate at any one time,
- Discharge flow rate > 3.0L/sec,
- Standby pump is to start if duty pump fails to discharge or maintain flow,
- Automatic activation of alarms,
- Float switches shall be “Cable float switch type” Mercoid or similar.

Also refer to PUMPS & CONTROL EQUIPMENT (GENERAL)

E.1.8. SEWER DRAINAGE

E.1.8.1. Basis of Design

Show on the drawings the basis of design of the sewer drainage including proposed fixture unit loads, pipe grades & proposed material selection.

E.1.8.2. General

Supply and install all sanitary drainage from existing drainage, soil and wastes and fixtures to the connection point to the main house services drainage as required. Provide all necessary pipes, junctions, bends, pits, floor wastes, excavation, supports, backfilling, testing and sundry equipment required for the installation. Pipeline positions shall be determined during design in conjunction with all other disciplines to ensure adequate co-ordination of all services and elements. Co-ordination shall be carried out prior to any setting out, excavation and pipe installation taking place.

Execute the works, using only materials and structures as approved by the local Authority and to the satisfaction of the UNSW EM Engineering.

E.1.8.3. Drainage Design

As a consequence of lower flush volumes entering the sanitary drainage system (4.5 & 3.0 litre flushes), UNSW recommend the designer and contractor to install a sanitary drainage system which as far as practicable, creates a drainage system whereby fixtures should be installed upstream of WC’s to encourage flows through the system, e.g.; a group of basins or one (1) basin is installed upstream of a group or one (1) WC to assist flows in the system. This is recommended for sewer and sanitary plumbing systems.

E.1.8.4. Sewer Connection

Ascertain the depth, position and suitability of the existing site sanitary drainage prior to the commencement of any work and advise if any adjustment is required to execute the work. No claims for redundant work will be considered due to failure to comply with this requirement. Make connection to the existing site sanitary drainage in accordance with AS3500.

Internal (UNSW) sewer drainage 225mm or larger shall be installed by a Sydney Water approved Major Works Contractor or relevant water authority requirements should they be required.

The existing site sanitary drainage connection shall be inspected with a CCTV camera and tested for approval by the Contractor foreman and UNSW EM Engineering before being accepted for reuse.

Where the existing site sanitary drainage is subjected to surcharge conditions, all fixtures, pipes & fittings shall be protected by an approved reflux valve connection to protect the building from sewage surcharge. All reflux valves shall be installed inside an accessible pit, large enough to afford reasonable maintenance access.

E.1.8.5. Materials

Pipes & fittings used in the installation shall be selected from the following materials and as specified under materials.

Sanitary Drainage in Ground:

Up to 2m deep	• uPVC DWV Pipe and fittings (SN6 or greater), • Vitrified Clay • HDPE (cream stripe)
Over 2m deep	• uPVC DWV Pipe and fittings (SN8 & SN10), • Vitrified Clay • HDPE (cream stripe)
Aerial Drainage	• SN6 uPVC DWV Pipe and fittings (for buildings with a maximum of four levels above the aerial drainage) • SN8 to SN10 uPVC DWV Pipe and fittings (for buildings with over four levels above the aerial drainage) • HDPE (cream stripe)

For any pipeline installed deeper than 3m, EM engineering must be contacted before construction begins.

Selected piping and jointing must be compatible with the waste conveyed and as recommended by the Manufacturer.

For corrosive and/or high temperature wastes, obtain written approval from UNSW EM.

PROHIBITED: uPVC pipes and fittings are not permitted where high temperature waste discharges are greater than 60˚C. Confirm suitability approval prior to commencing work in all areas. Alternative materials such as HDPE, copper and stainless steel shall be considered for use. These materials shall be provided for a suitable length to allow

for drainage cooling before transitioning back to PVC. The calculations shall be submitted to UNSW EM Engineering for approval.

E.1.8.6. Pits & Chamber Construction

Unless noted otherwise all pits shall be constructed of pre-cast / pre-stressed concrete or Concrete GR type pits, manufactures of the size and depth as required by AS4198. Wherever possible, pits or chambers shall be supplied as one-piece units to reduce the number of extension risers required to achieve design levels.

All connections into pits and chambers shall be made through the pipework connection recess provided and have the joint sealed flush to the internal pit wall with 3:1 cement mortar. For sewer or trade waste pits, use type C (low heat) cement. The pit bases shall be benched with 3:1 cement mortar to provide a smooth transition from the invert level of inlet pipework to the invert level of outlet pipework.

Chambers which are installed to accept waste to be pumped to a receiving gravity sewer, shall be sized to the appropriate demand and usage. All pump wells shall be designed to have a minimum slope of 2% to an internal sump suitable to house pumps or suction pipe and foot valve to ensure wastewater is concentrated at the pump well.

An aeration system shall be installed in the base of the well formed by a stainless-steel array fed by dual air blowers installed external of the well. Alternatively, a wet well shall be considered to control sludge build up with-in the tank designed in accordance to WMTS-533:2022.

Below ground chambers are to be installed to resist buoyancy. Where maintenance is to be conducted on an existing below ground chamber, the contractor is to take appropriate steps to eliminate the possibility of floatation, if the chamber is to be drained to permit access.

E.1.8.7. Covers & Lids

Unless noted otherwise pit covers shall be pre-cast concrete type covers equal in size to the internal dimensions of the pit to which they are installed. Covers & Lids shall not be lockable unless required for security or to prevent uplift. Covers shall be installed flush to finish or existing surface levels on all paved areas, and 50mm above surface levels in all landscaped areas to allow for grasses and final fillings.

Covers shall be of sufficient strength to suit the installation application, span, location, and generally comply with the requirements of the relevant Australian Standard for access covers in public spaces namely – Heavy Duty Class “D” 240kN for roadways, Medium Duty Class “C” 150kN for light car access areas, and Light Class “B” 80kN duty for non-trafficable areas. Class “A” extra light duty 10kN shall not be permitted. Refer to Section E/1/7/15 for lid ratings.

E.1.8.8. Existing Drainage

The Sub-Contractor shall be responsible for identification, location and protection of all existing installed services during construction of the works specified under this contract.

Any existing drainage services and connections on the site which are not for re-use are to be located and sealed off to the complete satisfaction of the relevant Authority and UNSW EM Engineering.

E.1.8.9. Minimum Drainage Gradients

The minimum recommended drainage gradients are:

Sewer Drainage 100mm diameter 1.65% grade. (1 in 60).

Sewer Drainage 150mm diameter 1.2% grade. (1 in 80).

Sewer Drainage 225mm diameter 1.2% grade. (1 in 80).

Any drainage laid at less than the recommended minimum gradients will require special permission from UNSW EM Engineering or local authority.

E.1.8.10. Drainage Bedding

Drainage pipes shall be bedded solidly on a layer of compacted coarse river sand or 10mm aggregate a maximum of 150mm thick. Concrete support shall be a minimum of 150mm thick and shall support the following drains,

1. Under gully traps and boundary traps,
2. Under all inspection junction,
3. Under all bends >Ø65mm
4. For all sweep junctions, beneath the junction to a minimum thickness of 150mm continued vertically to the underside of the bend fitted to the junction fitting,
5. For all 45° junctions, beneath the junction to a minimum thickness of 150mm continued vertically to the underside of the bend fitted to the junction fitting.

E.1.8.11. Testing of Drainage

The Contractor shall allow static water tests, to all drainage services in accordance with requirements of the relevant Authorities, codes and regulations.

At least 48 hours' notice shall be given for inspection of works under test. Underground or enclosed pipework shall not be covered or concealed from view until it has been inspected and approved by UNSW EM Engineering, and the relevant Authorities.

All lines shall be subject to a hydrostatic test for a minimum period of 24 hours. The line must be free of air pockets while under test. Supply all plugs and other materials necessary for the tests, including string lines where required for inspection of grades and straightness. Certificate of testing shall be provided to UNSW EM.

E.1.8.12. Pump Rising Mains

Sewer rising mains in ground shall be PE80B PN6.3 metric polyethylene pipe and fittings, sized to suit the system demands. uPVC pressure pipe shall not be used.

Sydney Water limits pumped sewer flow rates to 2 L/s. Higher flows shall be submitted to UNSW EM for approval prior to any submission to Sydney Water.

E.1.8.13. Overflow Gully

Provide a sewer drainage overflow gully for the sewer drainage system to allow the safe release of sewerage in the event of a choke or sewer main surcharge condition at the new amenities and/or pump station site.

The gully trap and riser shall be as required by AS3500 regulation, finished with a pre-cast concrete grate and surround installed a minimum of 75mm above surrounding surface levels. Where existing units are found damaged, allow for the repair of the gully, or the damaged gully components, to working state in accordance with all regulations & this specification.

Locate the overflow gully with care taken so as not to locate gully in an overland flow path or near a stormwater inlet pit in accordance with AS3500.2 requirements, and to cause the least inconvenience in the event of its operation. In the event that the gully cannot be permanently charged via fixture connection, provide a 20mm bore (or cold water, if where approved by UNSW EM Engineering) water hose tap installed a minimum of 450mm directly above the gully grate.

E.1.8.14. Inspection Openings and Gates

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

In roads and other trafficable areas, provide a heavy-duty cast-iron cover and frame at surface level. In non-trafficable and pedestrian only trafficked areas, a bronze or stainless cover and frame bolted trap screw is acceptable.

uPVC bolted trap screws are NOT to be used under any circumstances.

E.1.9. TRADE WASTE

E.1.9.1. Basis of Design

Show on the drawings the basis of design of trade waste pre-treatment pits and chemicals known shall be discharged at the time of design. The purpose of pre-treatment shall be identified.

> *Kensington specific:* UNSW in the Sydney region is bound to a Commercial Trade Waste Agreement with Sydney Water or the local water authority, if not under Sydney Water's jurisdiction. This agreement permits wastewater to trade waste pre-treatment devices to only have trace quantities of contaminants including chemicals. Authority approval is required for trade waste installations.
>
> Prior to any new project, refurbishment, redevelopment or tenancy fitout involving trade waste discharges to the UNSW sewer drainage network, the proposed works, including proposed chemicals shall be submitted to UNSW EM Engineering for approval (in partnership with Sydney Water Trade Waste Inspector).

In ALL cases the consultant, project manager, contractor (or end user) shall first submit a concept proposal of the intended trade waste pre-treatment system for "pre-

installation approval in principle" by UNSW EM Engineering, who will review, comment and approve the concept design.

The application shall include:

- Completed water authority forms
    - For Sydney Water: the completed Sydney Water Tap In form "Discharge trade wastewater application".
    - For Icon Water: "Application for Discharge of Liquid Trade Waste to Sewer"
- A detailed plan (1:100 scale min) showing the proposed process & location of the works.
- The proposed equipment/process to be installed including any chemicals to be used in the process.
- The proposed arrestor, treatment system, floor wastes, vents, baskets, any chemical storage associated with the treatment, etc.
- Proposed access requirements for cleaning & maintenance
- Chemical manifest of discharge.
- Proposed method of waste treatment.
- Any other relevant information (number of seats in a restaurant, meals served, temperature of waste discharge, etc.)

The concept and final documentation for the proposed trade waste pre-treatment system shall be presented to UNSW EM Engineering and a consultant who will liaise with the Authority, lodge the application and ensure compliance for the proposed pre-treatment system. Upon completion of the works, UNSW EM Engineering will provide a "Notice of Completion" for the trade waste design and installation.

E.1.9.2. Ingress Of Rainwater

Rainwater shall not enter the trade waste system. Any trade waste generating area and treatment plant shall be rooved.

E.1.9.3. Pipework

In ground pipework shall be high temperature HDPE and installed in accordance with the manufacturer's instructions. Where rubber rings are required, they shall be acid resistant when connecting to existing drainage.

All other pipework shall be submitted to UNSW EM Engineering for written approval before installation.

E.1.9.4. Chamber Exhaust Duct Vents

All trade waste dilution pits, pre-treatment chambers, grease arrestors MUST be provided with an appropriate chamber vent (by the contractor) in strict accordance with AS3500.2 (Clause 6.9.3 for Interconnection), & (Clause 12.6.3 for Wet Well Venting) and water authority requirements.

Generally, all trade waste chamber vents shall be a minimum of 100mm and extend from the air space of the chamber through the building independently to roof air termination without interconnection from any other system of venting. The

requirement shall be taken from the Sydney Water trade waste guideline policy for pre-treatment.

E.1.9.5. Clay and Silt Arrester

Install a silt arrester to trap sand, silt and clays, typically 60L effective capacity 3 compartment PVC silt arrester with fixed baffle and weir and fitted PVC cover, under the sink it serves. Plumb with PVC Class DWV pipe and fittings. Drain sink directly to high level inlet without trap but install trap on discharge side.

Where mounted on floor, provide galvanised mild steel frame with castors to assist with removal of arrester for cleaning purposes.

E.1.9.6. Plaster Arrester

Install plaster arresters only where gypsum is present in the waste stream, (do not use for sand, silt or clay), typically 40L Grade 304 stainless steel plaster arrester with removable SS baffles and bolted down SS cover equal to Stainless Metal Craft pattern PA1 or CA1 units. Ensure that a S/S frame 50mm x 50mm on casters to assist with removal of arrester for cleaning purposes.

Locate the unit below sink or as closer to the fixtures it serves.

In each case the appropriate unit is to be selected for the specific task and application, should there be ANY doubt to type, apply to UNSW EM Engineering for approval.

E.1.9.7. Basket Arrester

Provide a fine stainless-steel basket arrester to the inlet of ALL trade waste pits serving laboratories to catch broken glassware, syringes and other foreign objects likely to enter the wastewater. The arrester shall be fitted into its own pit with top access for basket removal. Basket shall be manufactured as follows:

On the inlet side of the pit, a stainless-steel basket to catch all debris larger than 3mm diameter entering the pit via the inlet pipe. It shall be easily removed from above the pit for cleaning without the screenings entering the pit accidentally. The weight of the empty basket shall be no more than **5kg**. The unit shall be complete with stainless steel cradle and basket with extended lifting handle. The cradle shall be fixed to the pit wall by 2 x 6mm stainless steel masonry anchors so that the lip of the basket is immediately under the inlet pipe. Extend handle up to within 20mm of underside of pit cover frame. Approx. size of basket: 460 long x 200 wide x 100 deep front lip x 210 deep back.

Refer to Diagrams EME 0014 H Trade Waste Basket Arrester at the end of this Section E.1

E.1.9.8. Bucket Trap Floor Waste Unit

Within areas where trade waste bin storage facilities exist or otherwise where required for compliance with AS3500.2 and trade waste authorities, the contractor shall provide bucket trap floor waste fitting (or fittings) that provide for screening of the waste washings from the area into the trade waste system that has a permanent strainer on a minimum of 100mm diameter fixed into the base of the Floor waste unit

body. The Unit may be compatible for uPVC, HDPE, Copper or VCP materials. The Unit where applicable, shall be capable of receiving "Vinyl" floor coverings.

All bucket trap floor wastes are to be Cupro-Nickel or 316 Stainless Steel in construction with a minimum removable floor grate ring size of 225mm either square or round configuration.

E.1.9.9. Rare Earth Material Recovery Unit

As per user requirements and UNSW EM Engineering approval. Further requirements shall be captures in the E.1.1 Hydraulic and Fire Services Lab Standard

E.1.9.10. Grease Arrester

Provide a 1000L minimum precast concrete arrester in sized in accordance with water authority's requirements, similar to Halgan MGT series Grease Arrestor with heavy duty concrete lid with gas sealed "Gatic type" covers and frames. Coat all internal surfaces with acid and alkaline resistant epoxy. Internally the arresters shall be braced during all backfilling operations and remove at completion if not integral to the arrestor.

Polyethylene tanks shall be considered to non- Kensington site. Concrete tanks are recommended to be installed at Kensington for consistency across the site.

Provide a vent to the grease arrestor chamber and at the end of the grease waste drainage in accordance with AS3500 requirements. Minimum pipe size of all chamber vents shall be 150mm in-ground reducing to 100mm for the vertical riser. Chamber vent shall be independent of any other system vent and extend independently to roof air vent termination.

Low level vents on grease arrestors are not permitted.

All grease arrestor outlets (sewer drainage side) shall be provided with a (minimum) 65mm air admittance valve and be raised at least 3 metres above the arrestor, this is to prevent arrestor siphonage.

All trade waste equipment shall be approved before installation by UNSW EM Engineering and shall be subject to Sydney Water, or the local sewerage authorities trade waste approval.

E.1.9.11. Trade Waste Storage

Materials shall be compatible with stored liquid.

Where reinforced concrete tanks are used, internal surfaces shall be lined with a two-component, rapid curing, 4mm thick elastomeric pure polyurea lining system (equal in all respects to RHINO LININGS Rhino PP1195). Provide basket arrester on the trade waste inlet to the treatment (or pump pit) that is fully accessible (for maintenance) from outside of the pit.

Where trade waste is pumped, the pumps shall be located externally to the collection well. All floats, controls, foot valves, etc. shall full accessible from outside of the pit without the need to enter the pump pit. The selection of the pump, seals & pipework

shall be compatible for the waste being discharged and shall be approved by UNSW EM Engineering before installation.

E.1.9.12. Laboratory Services Design Standard

Requirements for the following items shall be captured in E.1.1 Hydraulic and Fire Services Lab Standard

- pH Correction/ Waste Neutralisation Plant
- Cooling Pit
- Dilution Pit
- Fume Cupboards
- Autoclaves
- Effluent Decontamination Systems
- Waterjet cutting machines

E.1.10. SANITARY / AERIAL DRAINAGE

E.1.10.1. Basis of Design

On the first drawing in the set, provide details on which the design was based. Such information shall include: fixture units on each stack, total drainage discharge flow rate, specifications, flow rate and pressure determination for sewage pumps, actual head and flow curve for pump as designed showing duty points, criteria for sizing pump station storage.

E.1.10.2. Pipe Material

Vertical stacks shall be uPVC stacks up to 5 storeys (with noise insulation installed where required for noise abatement in areas such as libraries, quiet rooms, lecture theatres, etc.) or deemed appropriate by the consulting Acoustic Engineer. Vertical stacks over 5 storeys should use cast iron. Horizontal branches should be uPVC.

E.1.10.3. Expansion Joints

Shall be shown on the schematic line diagram and provided as follows:

- On vertical stacks, between each floor,
- On each branch line exceeding 2.3m in length,
- On each branch line with fixed points more than 1.2m apart,
- On straight runs at 3.0m apart.

E.1.10.4. Aerial Drainage

Elevated drainage, or aerial drainage that reticulates up to two levels over the building's external gully may be classed as "elevated aerial drainage". Aerial drainage shall be installed in terms of design with the same installation requirements as drainage that lies within the ground, aerial drainage shall have a minimum pipe size of 65mm and include for "P" Trap outlets and "P Trap" riser branches. 50mm drainage is NOT permitted to be installed in the ground anywhere in the UNSW Campuses' installations.

E.1.10.5. Access and Clear-outs

In toilet drainage, provide a removable metallic access plate in the floor adjacent to the most-upstream WC on the branch.

In multistorey buildings, extend the most upstream clear-out through the upper floor slab and provide metallic screw down inspection plate in the floor above. At required clear outs at the stack junction, provide an access panel in the ceiling immediately below the clear-out and provide clearances all-round the clear-out as specified in AS3500. Provide access panels in building works for clear outs at the base of each stack and ensure the clear-out is accessible for rodding and removal of debris from the stack.

In residential building and public amenities, extend a clear out off each water closet and at the most upstream point through the upper floor slab and provide metallic screw down inspection plate in the floor above.

E.1.10.6. Floor Wastes

Provide commercial grade 100mm chrome plated brass bayonet grate to suit plastic waste fittings manufactured in accordance with AS2887. Make watertight around waste with epoxy concrete. Dry floor wastes are not to be installed anywhere on the UNSW Campus.

Arrange the sanitary drainage/aerial/inground so as to install fixtures such as basins upstream of WCs to encourage flow to the terminal.

In commercial kitchens and food preparation areas, provide approved dry basket arrester or bucket trap with internal strainer and fixed under basket cage. All such traps shall be approved by Sydney Water or relevant water authority trade waste requirements and have current product approval listing. Ensure grates are slip resistant and suitable for proposed use.

In Garbage Rooms and other spaces that are likely to produce liquid trade waste, provide stainless steel basket trapped floor waste. As a result, the space must be protected from rainfall as required by Sydney Water and EPA Authorities. To ensure they are cleaned out, a hose tap shall be provided with the space that drains to the trap.

Where the garbage room is susceptible to rainfall ingress, a Fox First Flush Diversion system shall be considered to separate the waste streams.

All plant rooms which are served by an elevator must be protected from minor flooding by way of a grated trench drain set a minimum 300mm away from the elevator doors. Surface to be graded from the doors to the grates at a minimum of 2%. Grated trench drain is to extend pass the doorway by 500mm each side. For all spaces which require an elevator waste, ensure the floor waste is charged appropriately. Where a fixture or other approved charging discharge is not available, install a lockshield floor waste or automatic charging device in accordance with AS3500.

Provide a SPS 304 stainless steel 200mm round push in floor drain (100mm outlet) under safety showers. Connect the eye wash basin to the floor waste.

E.1.10.7. Traps

Provide traps to fixtures not provided with integral traps. All traps except WC's shall be chrome plated, 'universal' in construction and have 75mm water seal. Provide screwed adaptors where traps join waste piping and / or drains and provide chrome plated cover plates where traps and waste piping joins floor and wall.

All basins shall be 'P' trap type, unless otherwise noted.

Where air conditioning condensate is the primary method of charging a trap, provide a 'waterless' trap equal to "Hep$_V$O Plumbing Hygienic Self-Sealing Waste Valves". Waterless traps shall be accessible for maintenance.

The minimum size of waste traps for basins shall be 40mm, with a 40mm plug/waste.

E.1.10.8. Under Sink Pump Units

Under sink pump units are to be constructed from 304 stainless steel and be equal in all respects to All Purpose Pumps "HYLIFT 70", with optional safety interlock kits. The pump well is to be vented, and the pump discharge pipework is to be installed in Class 12 uPVC from the pump well to the final connection point at the sanitary stack or drainage connection. The pump well shall not be vented using an air admittance valve.

APPROVAL IN WRITING SHALL BE OBTAINED FROM UNSW EM ENGINEERING BEFORE PROPOSED INSTALLATION.

E.1.10.9. Tundishes

Drain air conditioning condensation and other intermittent drainage into tundishes which drain through a Hep$_V$O waterless trap. Wherever possible, the tundish shall be mounted within a wall and shall meet all the design features of the Stainless Metal Craft model TU RE 2 Recessed Tundish with Perspex viewing window. Conical tundishes can also be provided. These shall be located within lockable joinery or plantroom to protect from tampering.

Locate the tundish low down for viewing and to facilitate servicing should it be required. Ensure the inlet pipe is cut with a taper to ensure all drips discharge towards the rear of the unit and prevent splashing discharging from the air gap below the window.

Provide access panel directly at Hep$_V$O waterless trap to facilitate maintenance and cleaning.

Refer to Diagram EME 0008 H Recessed Tundish at the end of this Section E.1

E.1.11. DRINKING (POTABLE) WATER

E.1.11.1. Basis of Design

On the first drawing in the set, provide details on which the design was based. Such information shall include: How flow rate and system pressures were determined, flow rate and pressure determination for pumps, design pressure head at top floor fittings, actual head and flow curve for pump as designed showing duty points, criteria for sizing water storage.

Kensington Specific: For the Kensington campus, the maximum permitted flow rate from UNSW's internal water mains is 4.0 litres/sec. Higher flowrates will not be available on request to UNSW EM Engineering.

E.1.11.2. Pipe Materials

The following pipe materials shall be used for potable water in accordance products that have been endorsed as compliant with AS/NZS4020 Testing of products for use in contact with drinking water. Additional requirements are as follows:

1. Copper AS1432 schedule tube with silver-soldered joints shall be used internal and external to buildings, both above and below ground. Where pipework is concrete encased below ground, wrap the pipe in 3mm thick Denso Tape and plastic overwrap, to prevent concrete contacting the pipe.

2. Blue stripe PN16 medium or high-density polyethylene with electrofusion welded joints may be used in above and below ground applications. (Refer below to Water Mains).

3. Pressfit stainless steel may be approved for non-potable water uses only.

4. Refer also to "Copper Pipe Fittings - Compression (crimp) System".

No other materials shall be used unless with written authority from UNSW EM Engineering for specific project technical reasons. Do not assume this authorisation shall be forthcoming. In particular "Rehau" or similar composite pipe shall not be used.

Explanation Note: The use of Rehau and PeX pipe is discouraged from use at UNSW in order to facilitate speed of maintenanwce, repairs and minimise the range of spares on campus.

E.1.11.3. Water Meter

Water meter(s) shall be provided to measure all water consumption at each building. This section shall apply to metering of hot water and non-potable water systems as well

Meter type (mandatory): Elster Metering Pty Ltd complete with pulse attachment (100 litres per pulse) for connection to UNSW remote monitoring system. Mandatory Requirement, Honeywell Elster.

Sub-meters shall be Elster Metering Pty Ltd complete with pulse attachment (mandatory) installed on all water consuming plant and equipment which is likely to use more than 20% of the total building average day demand. Such users may include:

- cooling towers
- amenities blocks
- laboratory non-potable water
- toilet flushing tanks
- pure water treatment plants. Note that it is likely these consumers will be supplied by bore or rainwater where available.

Additional sub-meters may be required to achieve ESD and Greenstar initiatives and shall be Elster type as well.

E.1.11.4. Water Filter

For laboratory, complex, large, or multi-storey buildings, provide 100-micron automatic backwash filter (Mandatory Requirement: JUDO JPF Series, complete with pressure differential / timer control). The filter is to be installed with a manual valved bypass immediately after the main building meter. Where continuity of water quality is essential to the building user requirements, provide dual auto backwash filters, each capable of a minimum of 100% of the calculated building water demand.

E.1.11.5. Water Mains

Site water mains are combined to serve fire and domestic use and are metered at the site boundary. Pipeline material shall be medium or high-density polyethylene PN 16 with electrofusion joints. Minimum pipeline size shall be 125mm outside diameter, sized for fire flows concurrent with distributed site domestic / industrial flow rates.

Sizes of any extension or diversion of existing mains system shall be engineered by EM Engineering. Provide all expected design flow rates for new conditions to EM Engineering. Minimum depth of cover under all roadways shall be not less that 800mm.

Where electrofusion jointed mains join onto existing pipelines, at major changes of direction, where spigot and socket fittings are used or as directed by UNSW EM Engineering, mass concrete thrust blocks shall be placed against bends, tees, ends etc. as required. A guide to thrust block sizing is provided.

Refer to Diagram EME 0004 H Thrust Blocks for Water Supply at the end of Section E.1

Connect long straight sections polyethylene pipe to existing long sections of straight cast iron (with ductile iron cement lined) with a flange-spigot and gibault joint. Where this is located within vehicle traffic areas, support the flange connection with concrete bedding and thrust block.

Connect to existing main with a tapping band and service valve for isolating service. Tapping bands shall comply with AS/NZS 4793 types F and R to suit flexible and rigid pipelines. Where tapping is into 'live' mains, perform all tapping's under pressure and as directed by UNSW EM Engineering. Make arrangements with EM Engineering at least 7 days prior to the required shut-down to ensure service interruption is convenient to the University's operations. Note that double tapings and breeching pieces are not to be used instead of a larger tapping or tee.

Upon completion of the works installation and before backfilling, the section of pipeline shall be isolated by the two closest valves and the whole pipeline filled with chlorinated water (for disinfection and flushing of the main) and at minimum pressure tested to 1500kPa for a period of 30 minutes. All new joints shall remain visible over the period of the test. There shall be no visible leakage of the new installation over this period. If the existing valves fail to hold pressure, pressure shall be maintained by pumping water into the section to maintain the pressure for the test period. A tapping band and temporary valve shall be used to provide an injection point and upon

completion the band plugged with a non-corrosive screwed plug. Water shall be bled from normal available draw-off points such as hydrants, hose taps, sinks, etc. Chlorination shall be performed to AS 3500.1.

A completed and signed UNSW Test Certificate shall be provided for that installation prior to commencing further work. Unless a completed Test Certificate is supplied and accepted for an Item of work, claim for payment for that Item shall not be accepted.

E.1.11.6. Services Flush Double Landing Valves

Kensington Specific: The UNSW water and fire mains within the grounds of the Kensington Campus have un-boosted landing valves that have been installed to enable UNSW EM Engineering to flush or to sanitise the water mains. The existing flushing points are not to be removed and are kept and maintained. In the event of any development on the campus, care needs to be applied by the developers/consultants not to design out these "services flush landing valves". These valves include "hydrant double landing valves" that are not affected by a boosted or pumped fire system.

Any new or modified "flushing landing valves" are to be external to all building and located on an open hard stand location suitable for full open operation of the system valve/s in flush down mode and drain to the local open stormwater system without nuance. Test and flush facility shall deem to be compliant to Hydrant Code AS2419.1.

E.1.11.7. Valves - Service Isolation

A main isolating valve shall be provided to each building in a readily accessible location as approved by EM Engineering. Isolate each building service line from the external water main and each branch line from the service lines.

For pipe sizes up to 50mm use 'Johns J360' or equal ball valves with screwed BSP and union connection.

For pipe sizes over 50mm use flanged epoxy-coated cast iron resilient seated valves similar to Tyco or equal with Table E flanges. Make provision for dismantling pipework and valve replacement. All valves shall be direct buried and not installed within pits or chambers.

All valves are to close in a CLOCKWISE direction. 

For new developments provide a fire sprinkler and a fire hydrant branch line adjacent to the domestic tee. Provide a cluster of five main isolation valves (one on each service and one on the ring main adjacent to the three connections to ensure isolation of either section of the ring can be affected while maintaining supply to the building.

Label each above ground valve with a circular plate of traffolyte material engraved with their respective function and mounted in an approved manner on top of valve spindles with a brass ring.

Refer to Diagram EME 0017 H Valve Installation Standard Detail

(Refer also to AS2419.1)

Valve box surrounds shall be equal in all respects to REPLAS 26VC453 valve box cover and shall be 335mm (max) diameter at surface level. Colour shall be Service Specific as follows:

Potable water and fire	-	Grey/blue
Bore water	-	Lilac
Natural Gas	-	Yellow

Provide the following details on all PVC valve box surrounds, by affixing a stainless-steel engraved plate, secured with stainless steel anti-vandal screws (see drawing EME 00017 H):

a) Direction of operation using arrow and wording “CLOSE” 

b) In addition to a), for quarter turn valves, include the wording “QUARTER TURN” if applicable.

c) Also include, engraving of the Grid Ref number & Valve number (as supplied by UNSW EM Engineering).

d) To facilitate the above (c) the contractor shall provide accurate as-built drawings of the valve/s to UNSW EM Engineering as a basis for the new valve numbering.

E.1.11.8. Valves in Service Risers and Ducts

Where branches are cut into service risers or services in corridors, valves shall be located on the new pipe parallel to the main service and not on the right-angle take-off. This is required to minimise intrusion into working space.

E.1.11.9. Cooling Towers

Where bore water system is provided, cooling towers to be provided with a dual feed make-up water supply, with towns mains as back-up water supply, with a manual changeover function.

E.1.11.10. Valves – Laboratory or Room Isolation

Where a number of fixtures are served with hot or cold water from outside the area, such as teaching laboratory, toilet areas, plant rooms, etc., provide isolating valves on the wall adjacent to the main entry door and inside a stainless-steel wall box mounted no higher than 1500mm above the floor.

Refer to Diagram EME 0005 H - Laboratory Service Valve Compartment at the end of this Section E.1.

E.1.11.11. Valves - Fitting Isolation

Provide a quarter turn isolating valve on supply to each cistern, sink and basin on hot and cold-water supplies shall be provided to permit individual fitting servicing. Valves shall be chromed and located on service as it penetrates wall under fixture.

Provide all valves with unions or flanges to permit replacement without cutting pipework. Loose-jumper type valves are not permitted.

E.1.11.12. Valves – Non-Return

Valves shall be from the following suppliers, for consistency of repair and maintenance across all campuses:

Reduced Pressure Zone Device (RPZD): - shall be ValvCheq RPZD. Mandatory Requirement: ValvCheq Model RP03.

Double check: - shall be ValvCheq double check valves, Mandatory Requirement: ValvCheq Model DC03.

Dual Check Valve: - shall be equal to Watts Series 7

E.1.11.13. Hose Taps

External drinking water hose taps shall only be installed where required for water supply to relocatable drink preparation units such as coffee carts, barbeques, etc. In these cases only, hose tap risers shall be 20mm copper pipe, fixed to masonry with copper brackets and masonry anchors or, if free-standing, to a 75x50 hardwood or treated pine post buried 500mm into 300 x 300 compacted gravel road base. Tap connection shall be 650mm above finished ground level. Provide isolating ball valve on riser. Hose tap shall be Lock-shield type fitted with a permanently installed dual check valve and "Drinking Water" signage. Refer to Section E.2 for a supporting diagram.

Hose taps shall be installed in all plant rooms where plant requires regular cleaning.

Hose taps shall be provided to amenities with urinals to facilitate wash down.

Hose taps are to be installed at roof level or similar location, to clean Photovoltaic arrays within 20 metres, (hose length).

E.1.11.14. Pump-Requirements for all Pressurised Water Systems

(Refer to next clause for 'Make-up Pumps to Elevated Storage Tanks')

General

Provide stainless steel, vertical spindle, multistage 'Lowarra/Hydrovar' VSD pumps (mandatory requirement). Include suction and discharge pressure gauges. Provide at least three complete pump units on stainless steel base. Isolate pump suction and discharge from fixed pipework with flexible high-pressure connectors.

Motors shall be energy rated 'high efficiency'. Provide a valved by-pass with check (non-return) valve around the pump-sets to allow mains pressure supply without pumping.

System Design

Design demand shall consider at least the following:

- likely operation of various pieces of equipment at the same time
- likely simultaneous operation of personal ablutions from accommodation units (Note that UNSW EM Engineering shall provide guidance in this instance)
- any additional simultaneous emergency water supply back-up to non-potable uses (in the case of bore water or water supply failure)

- simultaneous operation of 1 or 2 emergency safety showers (laboratories).

System pipework design shall be based on the requirements of AS3500. However maximum pumping installation demand shall be determined by the hydraulic designer based on the likely realistic requirements of the building operation and purpose. This shall be agreed in writing by UNSW EM Engineering.

Each pump duty flow rate shall be 50% of the likely maximum design demand, resulting in a total capacity of 150% of the design demand. Where pumping from water mains, design shall be based on the minimum pressure available shown in the UNSW EM Engineering Fire Flow Enquiry Statement or relevant pressure and flow statements for other water authority jurisdictions.

Design pressure at the highest point in the system shall be minimum **300kPa** (allowing 100kPa pressure loss for mechanical backflow devices), unless plant or equipment requires a specific higher pressure. Pumps shall be selected such that the calculated duty point (set point) lies at about 85% of the pump capacity. Select pump duties or number of pumps to ensure the pumping installation operates across the total spectrum of demand flow rates, from a single fixture up to the design maximum simultaneous demand, assuming all pumps are operational. (DO NOT OVERSIZE PUMPS as it reduces their working life & can impart water-hammer to the pipework). On the drawing, provide details on which the design was based. Such information shall include: How flow rate and system pressures were determined, flow rate and pressure determination for pumps, design pressure head at top floor fittings, actual head and flow curve for pump as designed showing duty points.

Pump Suction & Manifolds

Pump suction manifolds shall be sized to provide the total system design flow rate at a velocity of not greater than 1m/sec. Pump discharge manifolds shall be sized for a velocity of not greater than 2m/sec. Non-return check valves shall be placed on the individual pump discharge. Where pump suction manifolds are larger than the pump inlet, all pipe size reduction fittings shall be eccentric (fitted with a constant top-of-pipe level) to prevent air locks. Pump suction pipelines feeding from a storage tank shall either be constantly graded from the tank to the pump suction or, provided with a single low point between the tank and the pump as conditions require (to ensure entrapped air can escape to the storage). Provide all pump installations with space to install an additional pump should one be required in the future.

Connect all pump failure alarms to campus wide BMS system. Provide hours run meter to each pump. Provide multiple smaller pumps rather than a single large one. Controls to include “no-flow/low pressure” automatic cut-out and reset. Provide a signal terminal out from the pump fail signal to connect to the BMS.

Pump Controls

Control each pump by discharge pressure using a dedicated pressure transducer for each pump with variable speed integrated controllers. Controllers shall be ‘Lowarra/Hydrovar Master Controllers’ (Mandatory Requirement) only, mounted on the top of the pump motor. This arrangement shall provide total redundancy regardless of any component failure and UNSW campus wide compatibility.

Modbus Connection Boards within Panels

Interface to the logic systems for all intelligent VSD for all pump panels a Modbus protocol device intended to communicate given a unique Modbus address. Fit with RJ45 Ethernet, any device can send out a unique Modbus command that contains the Modbus address of the device it is intended for. Confirm that the Modbus device is compatible with the requirements of the NSW Energy Management D&C document in terms of interfacing equipment and ensure the complete supply and installation of the integrated devices ready for external connection before installation.

Power & Electrical Controls

Fit with non-overloading, 415V, 2,900 rpm electric motor where applicable. For small units and hot water circulators, provide plug-in 240V units with timer. Set timer to run pump between the hours of 7.00am and 8.00pm (or as applicable to the occupants).

*Refer to Appendix 7 – Energy Management Metering & refer to page 7 Metering – **UTILITIES MANAGEMENT – ELECTRICITY, GAS, AND WATER METERING**.*

E.1.11.15. Make-up Pumps to Elevated Storage Tanks

(Refer to previous clause 'Pump-Requirements for all Pressurised Water Systems' for pump, pipework and control requirements in addition to the following)

Power & Electrical Controls General

Provide at least two complete pump units on stainless steel base. Control shall be by a dedicated pressure transducer to each pump. This is to ensure any future tanks in other parts of the building can be filled without having to modify or extend control wiring or redesign controls. This will necessitate the water tank inlet float valves to close tightly when the tank is at "Pump Stop Level". Inlet float valves shall be specified with a differential water level between OPEN and CLOSED to ensure the valves open fully as the tank water level drops. Do not oversize inlet valves, otherwise the regulation tank overflow and air gap will need to be enlarged. Provide a valved by-pass with check (non-return) valve around the pump-sets to allow the tank to fill without pumping.

System Design

Design demand shall consider at least the following: likely peak hourly demand from all sources (Note that UNSW EM Engineering shall provide guidance in this instance), any additional emergency water supply back-up to non-potable uses (in the case of bore water supply failure) and operation of 1 or 2 emergency safety showers for up to 30 minutes (laboratories). Pump duty flow rate shall be selected at 75% design demand. Design running pressure at the inlet to the receiving tank shall be 150kPa. Where a backflow prevention device is required to be installed, (or where a building automatic backwash water filter is required to be installed), it shall be installed on the discharge side of the pumping installation. Provide a valved by-pass with check (non-return) valve around the pump-sets, regardless of available water pressures, to allow the tank to fill without pumping.

E.1.11.16. Fitting Flow Rates

Flow rates shall meet the following Greenstar WELS star ratings or ESD requirements, whichever is greater:

- Basins: 5 star (4L/min) (Note: Basins in public ablutions shall be fitted with a single cold water time flow tap)
- WCs: Minimum: 5-star dual flush with typical flush volumes: Full flush: ~4.5 L, Half flush: ~3 L
- Ablutions showers: 3 star or higher (7-9L/min)
- Dishwasher: 3 star or higher
- Clothes washer: 3 star or higher

E.1.11.17. Drinking (Potable) Water Backflow Prevention

a) Backflow Prevention

Generally, in addition to a registered break tank, other devices required include at least a dual check valve at or near the fitting outlet.

Kensington Specific: Backflow Prevention Policy
UNSW has a Policy on 'Back-flow Prevention of Potable Water Supplies'. To comply with the policy, the following must be met.

The back-flow provisions of AS3500.2 shall be rigidly adhered to, except where the supply Authority over-rules these requirements. This policy has been established to provide rigid rules for the provision of back-flow prevention devices at each of UNSW campuses to overcome the various individual interpretations of the requirements of AS3500. The Kensington campus has significant contamination potential, and this site has specifically been targeted.

Whilst clarification of this policy can be obtained from EM Engineering, it is unlikely that any deviation from this policy will be accepted.

Potential causes of pollution from within UNSW are many, due to the various biological, chemical, industrial and irrigation uses of potable and non-potable water on the campuses.

b) *Containment at Site Boundary*

Containment at the site boundary to protect the municipal water supply shall be handled solely by UNSW EM Engineering. SWC approved containment device - testable double check valve or RPZD.

Contractors or engineering consultants are not to address this work unless specifically instructed and briefed to do so in writing by UNSW EM Engineering.

c) *Levels of Protection*

Within the UNSW, three levels of protection shall be provided as appropriate to the proposed work:

Building containment will be required to protect UNSW general site reticulation (combined water/fire main. Devices shall be installed to suit the greatest hazard within the building, unless otherwise varied by UNSW EM Engineering.

Zone protection within the building areas or parts thereof - to contain contamination within a specific and separable part of the site. Within this zone and downstream of

the device, water must not be supplied for any potable uses. Zoning large areas or whole floors of buildings can cause major issues with respect to defining water potability. Where zoning is warranted, UNSW EM Engineering must approve it in writing.

Individual protection of each outlet - to prevent back-siphonage of contaminated substances into the water delivery system at the fixture/appliance.

In all situations, air gaps and registered air gaps are the preferred option. Mechanical devices shall only be used where it is not economically feasible to provide an air gap.

Where any activities in the building or on the site could cause potential backflow of contaminated water to the University's water reticulation, containment is required.

All other UNSW sub-campuses shall be compliant with AS3500 backflow prevention requirements.

Refer: Section F - SPECIFIC AREA REQUIREMENTS

d) *Non-potable water in Buildings*

Where non-potable water is supplied to a building, being bore water or rainwater reuse, the potable water shall be fitted with a reduced pressure zone device at its connection with the non-potable water system.

Where bore water is supplied to a building an RPZD shall also be fitted at the incoming potable water supply meter to comply with AS3500 backflow protection.

Mandatory Requirement: ValvCheq RP03 Complete with strainers and isolators. Provide drain from atmospheric zone to building drainage.

The bore water installation shall be fitted with a double check valve device.

Mandatory Requirement: ValvCheq DC03 Complete with strainers and isolators

e) *Connections for Fire Services*

Where fire hose reels, hydrants or sprinklers are pressurised by a fixed pump after the potable water connection, a ValvCheq backflow prevention device shall be fitted.

Kensington Specific: At Kensington campus, install a testable double check valve assembly with butterfly valves between the potable supply and prior to the booster feed hydrants. At other campuses where the fire supply is unmetered, provide a double detector check valve.

Bore Water System: The bore water system is a non-potable water supply. However, it shall be deemed to be a protected water supply. Air gaps and double check valves shall be used for significant risks of contamination.

Note that bore water shall be connected to all new user points where significant quantities of non-potable water are expected to be used. This includes such uses as cooling water, laboratory non-potable, washing, flushing and irrigation.

Irrigation is supplied from the bore water system. Backflow prevention devices are not required for irrigation.

Mechanical equipment and cooling towers - Connect the bore water supply via an air gap.

It is vital to provide an emergency back-up supply from the potable water system (as a back-up source of supply) at each plant location using either an air gap at the plant, or by connecting the two supplies together through a Reduced Pressure Zone Device (RPZD) assembly on the potable supply and a Dual Check Valve Assembly (DCVA) on the bore water. The potable water is maintained NORMALLY CLOSED.

Where connecting mechanical equipment and cooling towers to potable water, provide an airgap. Where this is not economically feasible, considering the long-term maintenance commitment to mechanical devices, a testable mechanical device could be used.

f) *Types of Devices*

Backflow prevention devices shall be ValvCheq (Mandatory Requirement) RP03 for RPZD's and DC03 for DVC's, complete with strainers and isolators.

All other UNSW sub-campuses shall be compliant with AS3500 backflow prevention requirements.

Refer to Diagram EME 0006 H – Site Backflow Device Schematic at the end of this Section E.1.

E.1.12. HOT WATER

E.1.12.1. Energy Efficient Design

Provide a circulated centralised system only where sufficient outlets would achieve an energy-efficient system.

The current UNSW policy is for non-gas fired appliances to generate domestic hot water. All future UNSW projects are to adopt an electric strategy for domestic hot water.

For UNSW commercial buildings that are likely to require hot water only for tea sinks, accessible toilet basins and cleaners' sinks. For these HW loads, provide small capacity stand-alone instantaneous electric units. Where individual units or small electric storage units are provided, they shall only serves fixtures on the level they are located on to facilitate maintenance and limit failures across multiple levels.

Where a new hot water system is required, the preference is for electric Heat Pumps either Air to Water or Water to Water. A hot water system comparison study shall be provided to UNSW, evaluating the efficiency of an centralised system versus individual units, with considerations to heat loss on flow and return loops. The location for proposed Domestic Hot Water plant should be carefully considered for space and access. UNSW preference is for Ground Floor or accessible plant space to facilitate maintenance and replacement at end of life.

E.1.12.2. Basis of Design

On the first drawing in the set, provide details on which the design was based. Such information shall include: how flow rate and system pressures were determined, peak periods, flow rate and pressure determination for pumps, design pressure head at top floor fittings, actual head and flow curve for pump as designed showing duty points, temperature control, statement on Legionella control.

E.1.12.3. Design of Hot Water

Traditionally the concept of designing hot water systems after the flow and heat losses are realised is to apply a diversity factor into the parameters for the system. Normally a peak load of 2 hours is introduced for recovery that would satisfy the initial recovery and ensure plentiful supply. Historically UNSW have found that this can grossly oversize the heating system and cause waste in terms of costs in energy, infrastructure, and maintenance as a result. Therefore the hot water system comparison study shall provide justification for the peak demand for UNSW EM Engineering review and approval.

The designing engineer shall be responsible for reporting to EM Engineering with the proposed parameters for their specific design and negotiate with EM Engineering to agree on an appropriate diversity and peak load that is matched to the building needs. Where appropriate, EM Engineering can supply historical DHW performance data to assist with DHW plant sizing.

E.1.12.4. Piping

All piping shall be copper.

Refer also to – HYDRAULIC SERVICES - Pipework & Materials.

E.1.12.5. Insulation

Only pipework chased into masonry shall be pre-lagged with Kemlag or equal.

All other hot water piping concealed in ducts and ceiling spaces shall be insulated with fire retardant EPDM closed cell foam minimum 25mm incorporating a press seal fastener/factory laminated equal to 'Armaflex' manufacture and must be zero ODP. Where condensation on the outside of cold-water pipes is liable to occur, insulate pipework as above. Refer also HYDRAULIC SERVICES - Pipework & Materials for insulation. The extent and design thickness of insulation shall be nominated on all hot water reticulation drawings and a BCA Part J certification for same provided to EM Engineering.

E.1.12.6. Hot Water System

With the exception of individually mounted *internal cabinet* type or PC Lab type small units, provide electric Heat Pump units, complete with dedicated switchboard, controls, BMS and back-up electric immersion elements (electric resistance). Power for the immersion elements shall be factored into the design where electric supplementary heating is required, or Heat Pump/s are in fault. Controls are automatically switch to immersion elements when the Heat Pump/s are in fault or the demand is greater than the Heat Pump/s output. Temperature sensors are to manage and control these functions. Typically, the demand setpoints should be 45°C. A manual

'on', 'off' switch is required. These may be Rinnai Infinity, Rheem or Bosch instantaneous type.

Generally, all hot water units shall comply with the requirement of AS3500.4 and be manufactured to AS3498. Unvented hot water units shall be fitted with pressure and temperature relief valves with pressure settings not exceeding the manufactures max requirement. Where relief pressures are expected or calculated above 850kPa, a 500kPa full way pressure limiting valve shall be provided to the cold-water supply upstream to the water heater unit. Temperature thermostat settings shall not be set to less than 60°C where a TMV is to be supplied to the system.

All fixture outlets shall be limited to the maximum temperature requirement for the room/area application in accordance with the National Construction Code (NCC) Volume 3 - Section B Water Services – Part B2 D5 and generally follow:

- Staff & Able Persons Ablutions – Max 50°C.
- Disable Persons, Assist Facilities - 40.5°C - 42.5°C
- Children, Childcare, Crèche, neonates – Max 38°C – 43.5°C
- Back of house, Laundry, Kitchens & Cleaners, commercial areas - to 65°C

Where a building of health or age care in accordance with **NSW Health Policy Directive Code for tempered water 2015/PD2015_008**, systems shall be designed to ensure potable water use is minimised by installing short dead legs or a circulated system.

Where under sink hot water units are required, consideration shall be given to the use of 240 Volt push through (non-storage) units (such as Stiebel Eltron) to avoid installation of safe trays and drainage.

Tea rooms shall be provided with hot and cold water at the sink. Under no circumstances will boiling water be used as a substitute for hot water at the sink.

Boiling Water Units shall be sized to suit duty and be similar to ZIP Hydro Tap under-sink boiling / chilled water unit or Zip four in one, or all in one, where approved. Provide signage indicating 'caution – boiling water outlet' adjacent to outlet.

E.1.12.7. Circulating Pump

Provide dual 'Grundfos' or Lowara speed selectable stainless steel 240V in-line pumps. Where economically justified, provide variable speed drive units where variable hot water flows are expected. Provide quartz 24/7-time clocks and thermostatic over-runs to automatically operate the pump/s. Set thermostat to start pump at 60°C and stop at 75°C. Set timer so that pump only operates during the regular hours of building use.

Systems circulating water at less than 60 °C shall not be installed (circulated warm water systems are not permitted on UNSW Campuses).

E.1.12.8. Tapware

In all new installations and refurbishments, only timed flow taps will be installed in public ablutions areas (does not include Student Housing).

Accessible toilets shall be fitted with a suitable "Access" lever-type mixer tap.

Where taps in public toilets and public washrooms are replaced, they will be replaced only with timed flow taps.

No warm water will be supplied to public toilet areas except for accessible toilets to save water and energy.

Timed flow taps will have a flow rate of not greater than 5 litres per minute and must be adjustable to enable operation for between 5 and 15 seconds. Installed default time flow shall be set at 7 seconds.

Push button taps should be specified for areas that are likely to suffer vandalism.

For accessible toilets, where a common or circulated warm water supply is required for other purposes within 10 metres of the toilet area, it shall be used as the supply for that area.

In all other areas, unless otherwise specified by the University's Energy & Utilities Manger, a low-delivery electric instantaneous water heater unit (Stiebel Eltron or approved equal) shall be installed with a thermostatic mixing valve. The delivery temperature of this system shall be adjustable to operate between 35 and 50°C. with the default delivery temperature of the TMV being 40°C.

E.1.12.9. Thermostatic Mixing Valves

Provide temperature-controlled water to all domestic hot water systems to reduce pipe delivery temperature, except for kitchen and cleaners' sinks and laundry fittings in accordance with the above Clause 1.12.6.

Provide Enware 'Aquablend 1500' thermostatic mixing valves (mandatory requirement) complete with all associated valves. Binder / Pete's 3mm points shall be provided for testing the warm water outlet, sized to suit the duty requirements. Test certificates shall be provided to EM Engineering. Locate mixing valves between 1500 and 1800mm above floor level, either in lockable hinged stainless steel wall boxes or built-in and framed wall cupboards within the room to facilitate servicing. Keys shall be to UNSW standard.

Tempering valves shall not be used.

E.1.13. NON-POTABLE WATER SYSTEMS

E.1.13.1. General

Non-potable water (NPW) applies to a dedicated water system supplying directly to potential sources of contamination such as: scrub up sinks, laboratory sinks, x-ray processing, etc. and is separated from drinking water by appropriate backflow prevention devices including break tanks.

Refer to E.1.1 Hydraulic and Fire Services Lab Standard for further information.

E.1.13.2. Basis of Design

On the first drawing in the set, provide details on which the design was based. Such information shall include: how flow rate and system pressures were determined, flow rate and pressure determination for pumps, design pressure head at top floor fittings,

actual head and flow curve for pump as designed showing duty points, criteria for sizing water storage

E.1.13.3. Pipework

Pipework shall be either:

Type B copper with silver soldered joints and lilac sleeved (before installation), or lilac stripe HDPE pipe, polypropylene PN16 pressure rating or higher to suit specific test pressure. Do not use copper pipe for raw bore water.

Cross-linked polyethylene pipework will not be accepted.

E.1.13.4. Colour Coating of Copper Pipework

Pipe materials shall comply with water authority requirements for non-potable water supplies, pre-coated lilac pipe. Where pipework is modified for jointing, coat pipes with enamel paint coloured lilac to distinguish it from potable pipework.

E.1.13.5. Break Tank

Materials shall be selected to suit the water stored. e.g. Do not use polyethylene, copper for de-ionised water or bore water. Non-potable water tanks serving Primary Containment (PC) labs shall be 316 stainless-steel.

All tanks shall be fitted with a min of 600mm diameter access hatch.

E.1.13.6. Non-Potable Signage.

Provide a sign "Caution not for Drinking" similar to 'Safetyman' over each non-potable outlet fixture wash down taps in trade waste and garbage storage areas.
Provide into all bin or garbage storage and all trade waste areas or trade waste arrestor rooms a 20mm wash down hose tap that is supplied from / off the local bore water reticulation system. The wash down tap shall be located adjacent to the contained area and fixed to either the masonry wall or fixed to a suitable hard wood 75x50mm stake driven into the earth. There is no requirement for UNSW to provide hot water to arrestor sites, as it is operational preference to jet blast with cold water.

E.1.13.7. Specialist Water Supply Units – (RO, Mille-Q, IONEX)

Refer to E.1.1 Hydraulic and Fire Services Lab Standard for further information.

E.1.14. BORE WATER

E.1.14.1. Basis of Bore Water Design

Shall be used for all non-potable uses (except for marine studies). Where available, use pH adjusted bore water (Treated Bore Water) for laboratory uses. Both bore water and treated bore water is acceptable for cooling tower make-up, although water treatment within the tower may need to be adjusted if un-treated bore water is used as both sources have higher conductivity values than potable water. The treatment contractor must be advised of the type of bore water available at the time of commissioning. Use of bore water shall be notified to the Mechanical Engineer for inclusion in the cooling tower project specification.

Bore water demand flow rates need shall be managed to ensure bores are not overdrawn at times of campus peak instantaneous demands. The best way to manage this is on a building-by-building basis by designing the system with an averaging tank (and pump where required).

Where the project provides for rainwater harvesting, the make-up to the storage tank shall be by bore water as a primary option. Where available, recycled water mains shall be preferred over potable water as the make up supply.

The bore water supply meter to the building should be 25mm to restrict the tank make-up flow rate and the tank inflow rate should be restricted to 2L/sec by use of a standard "Universal" float valve. Check with the Mechanical Engineer to establish maximum demand for the cooling system. Where the non-potable requirements of the building cannot be met by a 25mm meter, a larger meter must be approved in writing by EM Engineering. EM Engineering shall be requested to provide guidance with respect to availability of bore water and treated bore water supply rates and pressures prior to any detailed design being carried out.

Irrigation flow rates shall be designed based on planting need. Typically, lawn area shall be provided with 27mm per week precipitation and garden areas 23mm per week, scheduled to operate within the allotted night-time period which will be provided by EM Engineering once the irrigated areas are known. Maximum station flow rate shall be 1.5L/sec with only one station operating at any one time. Stations will be designed to operate for 1 or more 20-minute periods to achieve the required precipitation rate.

Maximum permitted flow rate from UNSW's internal bore water mains is 2.0 litres/sec for treated bore water and 2.0 litres/sec for raw bore water. Higher flowrates maybe available on request to UNSW EM Engineering.

(For UNSW pump requirements, refer to Section: Drinking (Potable) Water – 'Pump-Requirements for all Pressurised Water Systems' and 'Make-up Pumps to Elevated Storage Tanks')

E.1.14.2. Pipe Material

Generally stainless steel welded or press fit pipework shall be used for building bore water reticulation. PVC-C schedule 80 or Copper tube may be used subject to approval from EM Engineering only. This is due to the low pH and possible long-term corrosive effects of the raw bore water reducing the economic life of the copper piping. However, older existing toilet flushing systems shall remain as copper until refurbished.

UNSW upper campus is generally provided with Treated Bore water where pH correction has been modified to suite the broader range of metallic pipe materials.

All new buildings generally, are to be set up to use **treated raw bore water** (unless notified otherwise) and use poly pipework coloured "purple lilac" as the means of reticulation. In ground piping including 80mm ID and above nominal diameter shall be Purple Lilac MDPE SDR11 - Pipework up to and including 65mm ID shall be purple lilac MDPE SDR11.

Where new pipework is to be installed within buildings, pipelines shall be either:

Grade 316 x 1.6mm thick stainless steel seamless tube in accordance with DIN 1988, with press fit joints as supplied by Viega, or Blucher Australia. Joints shall be Mapress press fittings with NBR Nitrile rubber seals, or lilac coloured HDPE or Polypropylene PN16 or above to suit test pressures. (Note: Cross-linked polyethylene will not be approved).

Refer to PIPEWORK & MATERIALS for Pipe Installation.

E.1.14.3. Pipe Installation below Ground

Non-potable water service shall be laid 300mm clear of parallel potable water service – this includes irrigation pipework.

All non-potable buried pipes shall be banded or coated "purple lilac".

Underground warning tape shall be buried 300mm below the surface of the trench, directly over the centre-line of the entire pipe route.

Identification tape shall be (lilac) at least 75mm wide stating NON-POTABLE or RECLAIMED BORE WATER.

Insulated trace wire is required in accordance with E.1.6.4.

E.1.14.4. Connections

Main connections to each building, irrigation system or facility shall be at the site ring main. Each connection shall include an isolating valve and a pulse-type water meter as directed by EM Engineering.

E.1.14.5. Backflow Prevention

The bore water system is a non-potable water supply and as such does not require additional devices to be fitted, with the exception of the following:

Direct supply to laboratory outlets via a ValvCheq DC03 Double Check Valve.

Direct connection to potable supply for dual supplies via ValvCheq DC03 Double Check Valve. (Note: Potable supply shall be protected using a ValvCheq RP03 RPZD)

Direct feed to chemicals (Not permitted)

It should be protected from contamination wherever possible.

E.1.14.6. Isolation Valves

Refer to: HYDRAULIC SERVICES - Potable Water, Service Isolation Valves and Fitting Isolation Valves.

E.1.14.7. Water Meter

As a minimum, provide a single 20mm main building meter and a single 32mm irrigation meter. Both meters shall be Elster PSM meters provided with a pulse output cable connected to the high pulse rate side of the meter ready for connection to the UNSW site EMACS metering system. Where the non-potable requirements of the

building cannot be met by a 20mm meter, a larger meter must be approved in writing by EM Engineering.

Sub-meters shall be installed on all water consuming plant and equipment which is likely to use more than 20% of the total building average day demand. Such users may include: cooling towers, laboratory non-potable water, irrigation, toilet flushing tanks and pure water treatment plants.

Refer also to: *HYDRAULIC SERVICES - Potable Water, Water Meter*

E.1.15. RAINWATER HARVESTING

E.1.16.1. Rainwater Reuse Generally

Rainwater harvesting is generally not required at UNSW's Kensington campus, along with other sub-campuses which have a supply of bore water.

Where bore water is not available, rainwater harvesting should be considered for WC flushing, cooling tower makeup and irrigation such as Canberra campus

E.1.16. IRRIGATION WATER SERVICE

E.1.16.1. Irrigation Water Generally

For all works of irrigation downstream of the water service

Refer to: ***LANDSCAPING – Irrigation.***

Requirements below relate to provision of water to the irrigation system.

E.1.16.2. Water Supply

All irrigation shall be supplied from the site bore water non-potable system. In exceptional circumstances, connection to potable water may be permitted where approved in writing by EM Engineering. Provide ball-type service valve at the connection and install water meter as directed by EM Engineering.

E.1.16.3. Pipework

Supply from Bore water main to Control Valve: For pipework up to 80mm, use black Polyethylene Class PN12 or greater with lilac stripe or Lilac Class 16 PVC (above ground only).

Where potable water is supplied, use Copper Type B.

E.1.16.4. Backflow Prevention

The irrigation system is a non-potable water supply and as such does not require additional devices to be fitted, with the exception of the following:

Where supply is from bore water and fertilizer injection is installed, a testable ValvCheq Double Check Valve (DC03) Assembly shall be installed. Where supply is from potable water supply, a testable ValvCheq Reduced Pressure Zone Device (RP03) Assembly shall be installed.

It should be protected from contamination wherever possible.

E.1.16.5. Isolation valves

Provide isolation ball valves on each branch at tee and upstream of each solenoid valve. Valves shall be premium range Philmac (Black base with blue handle and unions)

E.1.16.6. Valve Boxes

Valve boxes shall be buried with lid approx. 10-20mm below turf level (for lawn areas) and 10-20mm above soil level (for garden areas). Use large boxes to house isolating ball and solenoid valve installations. Where necessary, use two boxes for ease of access.

E.1.16.7. Wiring

Underground wiring shall be multi-core multi-strand type, taped to the underside of the irrigation pipe where possible. Above ground wiring shall be installed inside electrical conduit. Contractor to size control wiring to minimise voltage drop hence ensuring that solenoid valves operate satisfactorily.

E.1.16.8. Bore Water Hose taps

Hose taps under surface boxes shall be special upturned, ball valve tap and Lock-shield key. Irrigation boxes shall have lilac-coloured lid to identify it as bore water. Support box on 80mm thick concrete pad. Provide Unistrut support with clamp under pipe just behind special valve and fix Unistrut to concrete slab to prevent tap from being pulled out of box. Bore water hose taps shall be 20mm lilac-coloured lockshield with reverse thread outlet.

Hose tap risers shall be 25mm copper pipe, fixed to 75x50 hardwood or treated pine post buried 500mm into 300 x 300 compacted gravel road base. Tap connection shall be 650mm above finished ground level.

Provide sign 140 X 170 approx. On aluminium backing, brass screw-fixed to post or rivet to lid, with the standard pictogram and the following wording:

Do Not Drink

Refer to Diagram: EME 0007 H Bore Water Tap Standard Detail at the end of this Section E.1

E.1.17. NATURAL GAS

E.1.17.1. Basis of Design

Design the system on the basis of the latest NCC and AS5601. Any variation from this standard shall be marked accordingly on the contract design drawings, for which the design was based. Such information shall include: Gas demand calculation, pressure loss in pipework, pressure at building.

E.1.17.2. Authority Inspection

All designs shall be pre-approved, inspected and certified by the gas supply authority (e.g. Jemena) prior to being put into service. Review of the proposed service shall be undertaken by UNSW EM Engineering.

E.1.17.3. Pipework

Selection of pipe materials must conform to AS5601 and must be suited for test pressures of 500kPa.

Buried pipes outside buildings: - Nylon, polyethylene (min SDR rating for HDPE of SDR17) or Copper. Denso or polyethylene sleeve copper pipes where passing through concrete structures or contaminated ground.

Buried pipes inside buildings: - Not permitted.

Above ground: Copper tube Type B. All joints are to be 15% silver soldiered. Compression (or crimp) type fittings shall not be used without prior written approval of UNSW EM Engineering.

E.1.17.4. Isolation

General
Submit a proposed gas isolation shutdown to UNSW EM Engineering a minimum of five (5) working days before the proposed shutdown. Failure to submit the shutdown notice will result in the shutdown not proceeding.

Room Isolations
Where uncontrolled gas outlets such as Bunsen burners or kitchen appliances are installed, provide a press button emergency gas shut off system with key controlled start-up switch similar to Gas Guard by System Control Engineering Model GG1. The emergency press button shall be near to the main entrance to the Lab or kitchen and provided with appropriate signage. Final location of the press button shall be agreed with UNSW EM Engineering.

Install the solenoid valve assembly as close as possible to the main manual shut-off valve prior to any take offs.

Building Isolations
Manual point of entry to each building: Provide wall-mounted manual shut-off valve at the point of entry to each building. The valve shall be accessible and external to each building. A durable and permanent sign shall be provided in a prominent position adjacent to the valve. The sign with black lettering 25mm high on yellow background is to include the following wording: “GAS VALVE”.

Boilers: Emergency valves for all steam and hot water boilers shall be provided. Locate in an accessible position remote to the boiler and clearly identify by the appropriate sign with the following wording: “EMERGENCY GAS VALVE”.

Boiler Plant Rooms, Laboratories & kitchens: Provide “Gas Guard” or “Kromschroeder LSV” safety system with ball isolating valve at assembly inlet and outlet (as supplied by System Control Engineering Pty Ltd). Provide black lettering on yellow sign with instructions for emergency shut-off and resetting.

System 3 Automatic Operation Gas Shutdown
Where a building is provided with fire sprinklers, fire suppression system, and is supplied with natural gas, provide a “System 3” automatic gas shut-off valve assembly

(as supplied by System Control Engineering Pty Ltd) with ball isolating valve at assembly inlet. Mandatory Requirement**, 'System 3'**.

The System 3 system shall activate upon fire sprinkler flow detection or suppression system activation. (Note that water flow shall be used rather than alarm activation to prevent false fire alarms shutting down the gas). Locate in an unobstructed location at the main person entry.

All valves shall be not greater than 1500mm above floor level. Where the valve is mounted inside a cabinet, the cabinet shall not be lockable.

Connect a signal from the System 3 to UNSW Security Cardex alarm system to ensure that resetting of the valve occurs promptly.

Provide the following black on yellow signs:

At building fire indicator panel sign to have the words “GAS SHUTS OFF (insert location such as kitchen or to building) ON FIRE TRIP OR POWER FAILURE - AUTOMATIC SHUT OFF VALVE LOCATED IN (ROOM LOCATION) - TO RESET, FOLLOW INSTRUCTIONS ABOVE SYSTEM 3 VALVE”.

Above System 3 valve, affix to the wall operating and resetting instructions for System 3. On the door(s) leading to the System 3, sign to have the words “GAS VALVE INSIDE”.

E.1.17.5. Markers

Provide surface markers at each change of direction or pipeline end. Markers shall be directional arrows engraved on a brass plate, mounted on a concrete block or in concrete pavement and installed flush with the finished surface.

E.1.17.6. Testing

Test all works to AS5601. Seal the gas system after removing all items of plant or equipment liable to damage at the test pressure. Remedy any defects and retest as required. Testing shall be conducted using a pressurised inert gas or compressed air. If compressed air is to be used for testing a new/existing system, existing isolation valves shall not be relied upon to seal the pipework. Allow to separate the new pipework from the existing, to ensure no air enters the existing gas pipe under test.

E.1.17.7. Control & Isolating Valves

Valves shall be quarter turn ball type (AGA approved). Valves up to 50mm shall be screwed; 65mm and larger shall be flanged.

Below ground valves shall be similar to 'Richards Spherical Ball Valves' and installed under a cast iron surface box.

E.1.17.8. Appliance Control Valves

Gas isolation control for user appliances shall be provided within a readily accessible location. The valve shall be before any flex connector or appliance regulator and be of a spherical stainless steel gas ball valve type. The location shall not be located behind inaccessible ducts, slide out ovens, cabinet draws, shelves, or other location that would require ladders or tools to access. The appliance control valve shall be provided in addition to the “area” control valve.

All UNSW appliance valves are to be provided as “commercial” application (even within residential situation) under AS5601 Clause 6.6.3 and Table 6.6.3 “commercial situation”.

E.1.17.9. Gas Regulators

Low and medium pressure regulators shall be diaphragm type similar to 'Jeavons' as supplied by Systems Control Engineering Pty Ltd unless otherwise approved by EM Engineering. On major supply systems, provide two full capacity regulator installations in parallel so that supply to the building will be maintained during servicing. No by-passes to the regulators are permitted. Where supply is to continuous flow water heaters or Bunsen burners, provide additional step-down regulator to 1.38kPa.

Where Over Pressure Shut Off (OPSO) regulators are required, ensure to locate a minimum of 1.0 metre upstream of any appliance to limit nuisance tripping of the over pressure regulator.

Provide 'Binder' type test point on the inlet and outlet. - Mandatory Requirement, **'Gas Binder Test point’** (See below).

E.1.17.10. Gas Binder (Pete) Test Points

Binder gas test points shall be provided to all locations where (live) gas needs to be proven either by pressure or purging. The Binder test point shall be a standard ¼” or ½” Brass 3mm probe “Pete’s” plug with probe cap. Locate the Pete’s pug (binder point) at either side of the flowing equipment as standard UNSW EM Engineering requirement.

- Regulator test (before & after)
- Meter location (before & after) Including each (all) area tenancy meters.
- Top of the delivery to upper-level secondary appliance regulators (Hot Water Plant Rooms at the top of buildings). Between water heaters.
- OPSO regulators & system shut down systems (before & after).
- Double block & shunt burner valve trains (before & after).
- Mechanical plant regulators & filters (before & after).
- Otherwise, where directed by UNSW EM Engineering under review.

E.1.17.11. Venting

Care should be taken to control gas venting from OPSO valves at regulators. Gas odours are a source of nuisance and if there is any indication that gas will be released in an inhabited area, it should be vented via pipeline to above the roof line and away from air inlet vents and building openings.

E.1.17.12. Gas Meters

Provide pulse type gas meter to each building. The meter is to provide pulse for connection to and be compatible with UNSW EMACS. Sub-meters shall be installed on all major gas consuming plant and equipment which is likely to use more than 20% of the total building average day demand, and where inefficiencies and losses are potentially significant.

Diaphragm meters shall be used for all purposes across campuses due to their accuracy, minimal maintenance and turndown ratios up to 600:1. Size meters for the

minimum probable demand rather than maximum possible to ensure small losses are identified. Where medium pressure supply (100kPa) shall be metered, such meters shall be sized by the meter supplier, as special meters area available for this purpose and the meter will be correctly sized for that pressure.

Meters shall be fitted with Remote Volume Pulser (RVP) and output wiring ready for connection to the site EMACS metering system.

Provide the assembly with upstream filter and regulator to stabilise inlet pressure and downstream regulator with discharge pressure to suit equipment connected.

Rotary meters shall be equal in all respects to Kromschroder or Accutherm International (EMG-EMR) and where proposed for use, shall be submitted to UNSW EM Engineering for approval before installation. Externally located meters shall be housed within weatherproof enclosure where installed outside buildings. Turbine meters shall not be used.

As a guide, meter sizes and their ranges are:

Model 750 – up to 300MJ/hr (8m3/hr)

AL 425 – up to 1,000MJ/hr (25m3/hr)

AL 800 – up to 1,600MJ/hr (45m3/hr)

AL 1000 – up to 2,200MJ/hr (60m3/hr)

AL 1400 – up to 3,000MJ/hr (80m3/hr)

AL 2300 – up to 5,000MJ/hr (130m3/hr)

AL 5000 – up to 11,000MJ/hr (290m3/hr)

(The above capacities assume gas pressure is reduced to 10kPa prior to the meter and based on a pressure loss through the meter of 0.5kPa)

Refer also to Diagrams EME 0015 H Meter Sizing & Selection at the end of this Section E.1

E.1.17.13. Water Heaters

Existing gas fired hot water heaters shall be retained and maintained where existing and in operable condition.

Where new hot water units are required instantaneous electric hot water units shall be installed where there is a requirement for localised hot water to fixtures. Where bulk hot water is required, an assessment shall be made on the need and demand for hot water storage and submitted to UNSW for review and approval.

Provide labelling and insulation of pipework to conform to other parts of this document. For multiple system installations electronic controllers should be used to provide the “lead – lag & alternating start” principle.

For larger projects, UNSW EM Engineering shall be consulted with the possible options for discussion prior to documentation and tender.

E.1.17.14. Tailpipes

Where located in ground, provide 450mm square x 450 deep tailpipe pit similar in construction to stormwater pits.

Where condensation or dust is likely to occur in pipework, particularly at the base of risers in buildings, provide a drain or cleaning point consisting of two ball valves with a short vertical length of pipe, equal in size to main pipe, between the valves. This allows the gas supply shall be isolated and the liquid drained by the lower drain valve.

E.1.18. FIRE HYDRANTS AND HOSE REELS

E.1.18.1. Basis of Design

With the exception of complete new buildings & gross major refurbishments, all fire hydrants and fire hose reels are to be modified, tested and commissioned upon the basis of the level of certification the year the building obtained the Construction Certificate, or was commissioned &/or on the information of the Annual Fire Safety Sheet records as on file within UNSW EM Engineering. In all cases before any annual testing is undertaken, the appropriate standard and year of standard is to be determined by register from UNSW EM Engineering.

All new and major refurbished buildings shall be designed in the basis of the standards as set by current building codes and/or a NSW Fire and Rescue alternative solution. All deviations from the Deemed to Satisfy provisions of the current Building Code of Australia (BCA) shall be approved in writing by UNSW EM Engineering.

Generally, all new buildings hydrants shall be designed to AS2419.1 code requirement and fire hose reels designed to AS2441. The system (where required) shall be complete with booster pump/s installation, with an automatic electric jacking pump. The system shall have an appropriate fire brigade booster valve assembly with dedicated connection/s to the UNSW water main (for Kensington campus) via a testable double check valve and kept separate to sprinkler or house water supplies. Indicate on drawings basis of design of system, including: Design code, flow rates, head loss in pipelines, residual pressure of mains at design flows, pump duties if applicable, height of highest hydrant above ground, available flow rates in main. Alternatively, a combined fire sprinkler and hydrant system in accordance with AS2118.6 will be considered.

E.1.18.2. Fire Block Plans

Before practical completion the contractor shall prepare a draft fire hydrant/sprinkler block plan in the format provided by UNSW EM Engineering. The draft copy shall be submitted to UNSW EM Engineering for review and approval. Any items that require rectification as noted in the UNSW review shall be undertaken by the contractor until finally approved by UNSW EM Engineering. The final approved block plan shall be returned to UNSW in both a DWG & PDF format for final confirmation.

Fire block plans are to contain information relevant to the building and system requirements and be a minimum A3 size. Refer to AS2419.1 for standard display information.

Additional to information as required by the standard, UNSW EM Engineering require the location of any FIP or mimic panel along with a matrix bar code (QR code) to be displayed at the top right-hand corner of the block plan. The minimum size is to be 40mm x 40mm and is to include additional information as follows;

- Basis of Design,
- Construction Certificate,
- BCA year of construction,
- BCA Report,
- Fire Safety Schedule for current and proposed measures,
- Annual Fire Safety Statement,
- Applicable fire standards for all fire protection systems (year of install),
- Fire Engineered Solution, condensed version,
- Copy of 188 approval,
- Copy of 144 approval,
- Block plan for automatic fire detection and alarm system,
- Fire measures for mechanical systems,
- Passive fire systems,
- Plan of fire compartmentalisation,
- Plan showing emergency exit doors,
- Any other relevant fire related measures,
- Occupation Certificate.

QR Code Example

Upon approval, the contractor shall arrange with UNSW approved supplier, Cunneen Signs to produce the block plan/s in accordance with UNSW EM block plan format, refer EME 0018 H Fire Hydrant Block plan & EME 0018 H Fire Sprinkler Block plan in section E.2 of this specification. Contractor is to take delivery and install block plan in compliant and agreed locations. Cunneen Signs can be contacted on 02 9637 9400, sales@cunneen.com.au or www.cunneensigns.com.au

E.1.18.3. Kensington Campus Water Mains

UNSW Kensington Campus maintains a combined site fire/water reticulation system that is metered at the boundaries through three (3) connections to the Sydney Water infrastructure (two in High St and one in Botany Street). Each connection has a testable double check valve for backflow protection.

UNSW EM Engineering is the ONLY source of Pressure Statements (FIRE FLOWS) for development works on the UNSW Kensington campus. NOTE that the maximum combined fire flow that will be provided for any development at the UNSW Kensington Campus is 40 litres per second (at a pressure determined by UNSW EM Engineering).

On-site fire flow tests or pressure statements obtained from Sydney Water in relation to design flows and pressures at the Kensington Campus will not be accepted.

E.1.18.4. Pipework

Pipework shall be galvanised mild steel where above ground, inside, and outside a building. In-ground, pipework shall be either ductile iron, or HDPE (red stripe, SDR11, PN16) or MDPE (red stripe, SDR11, PN16) or AS1432 Copper tube. All materials that are to be used for fire services shall be capable of sustaining 1700kPA under test conditions.

Light gauge steel galvanised pipes (or "Fire Light") will **not be permitted** to be used on UNSW sites.

Galvanised pipes for tank make-up water, whether potable or non-potable, shall not be used.

All copper, steel and small-bore pipelines shall be capable of withstanding working pressures in accordance with the pipe manufacturer's requirement (note annealed Copper may be less) of up to:

- *1700kPa for non-boosted pipelines*
- *2100kPa for boosted and pumped pipelines*

Static testing

- CA16 – 1962 to Ord 70 -1993 Max Static test of installation – 975kPa
- AS2419.1 to Max Static test of installation – 1700kPa.

Flanges shall be a minimum Table E pressure rated for pipework over 80mm diameter and MUST be rated for the higher test pressures as previously specified.

External dedicated fire mains pipework shall be kept as short as possible and preferably no longer than 50m to ensure fire mains are not used for domestic purpose or cross-connected to the campus combined fire / domestic town system.

E.1.18.5. Existing Hose Reels

Where hose reels shall be retained by UNSW, the contractor shall be responsible for their removal and return to the UNSW store in undamaged condition. Where hose reels shall be reused, the Contractor shall maintain their condition as at the time of contract. The Contractor shall repair or replace hose reels damaged during his contract.

E.1.18.6. Hose Reel Isolation Valve

For the purposes of supplying hose reels, the UNSW Kensington campus water supply is a fully metered supply (building meters shall be disregarded for the purposes of hose reels isolation). Therefore, hose reel supplies may be taken off the hydrant service. Isolation valves must be ball valves, clearly marked in accordance with the Standards and UNSW requirements. They must be located in a prominent and readily accessible position.

In other locations, hose reel supplies shall be supplied by a separate service within the building fed from the discharge side of the water meter immediately after the meter

and before the domestic supply stop valve. Provide locked ball isolating valve on hose reel supply.

E.1.18.7. Hose Reels

UNSW Kensington campus maintains a combined site fire/water reticulation system that is metered at the boundaries. The installation of fire hose reels supplied off the fire hydrant system is therefore permitted.

Provide all hose reels with 36m hoses, any other lengths shall be sent to EM Engineering for approval. Provide instruction panel, setting out operation instructions, fixed permanently to front of each fire hose reel.

E.1.18.8. Fire Hose Reel Pump

Must be capable of running at least two hose reel units (full flow) Ensure the system can provide a constant pressure system at the most disadvantaged FHR a discharging flow of not less than 1.26L with residual pressure at the hose reel of 250kPa, construction similar to multi-stage electric pump. Include suction and discharge pressure gauges. Provide pressure tank with 15L nominal capacity, butyl liner, modified non-return valve for slow filling and air valve. Provide complete unit on galvanised mild steel.

E.1.18.9. Hydrant Systems Design

Systems shall be complete with an independent system connection to the UNSW combined fire domestic water main, with AS3500.1.4 compliant back flow devices, and include a suitable booster valve and where pressure compliance requires, a booster pump installation. For existing buildings constructed up to 1996, any system upgrades and/or “voluntary fire orders upgrades” shall generally upgraded to the current Australian Standard. If the existing hydrant pipework is suspected or deemed to be susceptible to damage due to test and new operating pressures, the pipe system may need to be replaced. Consult with UNSW EM Engineering for guidance.

All external fire hydrants that are required to provide external protection to new buildings, shall comply with AS2419.1 requirement of running pressure of 700kPa and shall be boosted from the building’s fixed fire pump and booster.

Water supplied to boosters that incorporate internal pumps shall be arranged “in parallel” in all cases in accordance with AS2419.1 Clause & Figure 7.5. Boosters in relay are to be avoided in existing buildings or system upgrades.

Fire hydrant protection for buildings adjacent to newly developed buildings shall be maintained. New building designs shall consider the fire protection requirements of adjacent existing buildings and at the completion of the project the hydraulic services designer shall provide UNSW with a written statement confirming the fire hydrant protection to the adjacent building has been maintained.

E.1.18.10. Hydrants

External hydrants: (Pillar Hydrants) are to be brass construction standard pattern Double head 65mm landing valves on 100mm GMS. Pipe and fittings of which, shall have an internal and external galvanizing coating of minimum of 300 g/m^2. Above

ground hydrant piping shall be constructed of steel pipe in accordance with AS1074 and shall be—

(a) Medium weight DN 80 (minimum 4.0mm wall thickness) for Victaulic or flanged connections;
(b) Medium weight above DN 80 (minimum 4.5mm wall thickness) for Victaulic or flanged connections;
(c) Heavy weight pipe for DN 100 and above (minimum 5.4mm wall thickness in sizes) for screwed or threaded connections.

Extra light & Light Gauge Galvanised Mild Steel (GMS) is NOT permitted.

GMS Pipe shall be provided for standpipe with 65mm landing valves and brass cap provided. GMS shall not be buried. Turn down all landing valve outlets to 30° to the ground and provide 100 thick x 450 square concrete pad around standpipe. Top surface shall be level with finished ground level. All pipe within or that pass through structural concrete shall be pre- wrapped with Denso tape and approved overwrap to isolate from the concrete. Install concrete thrust anchor blocks at all tee and bends where not flanged jointed.

Internal hydrants: GMS is to be installed internally for fire hydrants. Copper Tube shall not be installed internally within the building. All Landing Valves are to be right angled type single brass 65mm landing valve with integral Storz coupling and cap.

Provide a dual head double hydrant at roof level (where practicable) in an accessible and convenient location for periodic UNSW flow testing of the hydrant system (Up to 20L/sec flow rates). Ensure that the roof drainage is capable of receiving the fire test water without causing flooding to the building.

Refer to Clause E.1.7.6 and apply to the UNSW requirement to maintain "Service Double Landing Valves" for flush down, sterilisation and testing and shall generally comply with Hydrant Code AS2419.1 Clause 8.10.

Victaulic couplings shall be Factory Mutual (FM) approved and tested to 2100kPa min. The couplings shall be high pressure rated to withstand the 5-year 1700kPa pressure tests.

E.1.18.11. Hydrant Booster Valve

All new UNSW development building complexes shall be provided with one single booster response location arrangement for each of the individual fire services in accordance with AS2419.1 Hydrants. The location for the booster/s shall be large enough to contain booster arrangements for fire services such as hydrant, sprinkler installations within the single area. The booster stand shall be located in accordance with Hydrant Code AS2419.1 Clause 7.3.

Hydrant booster valve shall be in parallel and not in series with the fixed hydrant booster pump to prevent boost pressures being experienced by the pump and associated flexible connections. This will also prevent the pump being destroyed during boosting.

GMS pipework shall not be used prior to the supply hydrant standpipe. Each booster shall have a ValvCheq double check valve fitted before the feed hydrant standpipe and a single swing check valve and gate valve between the feed hydrant standpipe and booster inlets. Fabricate the assembly in GMS pipework with flanged or Victaulic joints. Provide 100mm glycerine-filled pressure gauge, drain tap, Storz couplings and caps. Drain tap shall be capped ball valve to prevent accidental depressurisation.

Provide and mount a block plan separately to the booster to the exact details of the UNSW standard hydrant/sprinkler Block Plan. Refer to Estate Management Signage Officer for advice.

Refer to Diagram EME 0037 H Fire Hydrant Booster Requirements at the end of this Section E.1

E.1.18.12. Hydrant Pumps

The fire system pump rooms, internal and external, shall comply with the AS2419.1 Hydrant and the NCC/BCA. The installation shall include for pressure/flow pumping equipment as necessary for compliance

In addition to the above, design shall incorporate only one pump site for the entire complex containing all the required fire pumps and equipment.

In all new buildings, locate the hydrant pump so that it is arranged in parallel with, and not pressurised by, the hydrant booster valve. Refer to AS2419 and above clause E.1.19.11. Prior to the acceptance by UNSW EM Engineering of the fire pumps the contractors shall provide to UNSW EM Engineering full pump manufacturer's details, the proposed plan, location, egress, pump system dynamic flow calculations, proposed pump duties and pump curves with a complete system schematic diagram and shall be submitted for approval to UNSW EM Engineering prior to ordering.

Note: To assure the quality of all pump and driver assemblies, the manufacture of the pumps, shall carry out pressure and flow testing for all pumps, prior to delivery in compliance with the requirements of AS2941 and/or a recognized Australian Quality Assurance Program, curve selection shall be capable of providing compliance to AS2941 and provide performance curves of 130% flow at not less than 80% duty on the same system duty with formal certification for all pumps to UNSW after commissioning.

Refer to Diagram EME 0037 H Fire Hydrant Booster Requirements at the end of this Section E.1

The pump unit is to be provided as a minimum a complete unit on a galvanised steel frame inertia block, including the main pump unit coupled to a diesel motor, a jacking pump, a pressure vessel, a fuel tank, controls, circulation pipework and valves, and all other required appurtenances.

Electric fire pumps shall be considered as well, meeting the requirements of AS2419.1.

Cooling system shall be heat exchanger type. Radiator type cooling systems will NOT be accepted. End suction pump coupling shroud shall be manufactured in 304 stainless-steel. Isolation valves are to be provided for pump suction and discharge

from fixed pipework with high-pressure flexible connectors. Fixed hydrant pump shall be arranged in parallel with the fire brigade boosted supply (Mandatory Requirement). Where this cannot be achieved and subject to written approval of UNSW EM Engineering, the pump shall be installed in strict accordance with the requirements of AS2419.

Main Pump: Generally, for new buildings the fire flow test shall be in accordance with the NCC and AS2419.1. For older building upgrades or partial building refurbishments the minimum pump duty shall be determined through discussion with UNSW EM Engineering. UNSW EM Engineering will then confirm the duty in writing before the pumps can be ordered. Tests shall be (life) tests assessed from suitable most disadvantaged Hydrant locations selected by UNSW EM Engineering to suit the location.

Fire hydrant 'run' signal shall be connected to the Fire Monitoring System (CARDEX) as well as the building FIP to ensure the hydrant pump is turned off in the event of a false actuation.

Hydrant Jacking Pump: Similar to fire hose reel pump but with duty of 1.3L/sec. and capable of supplying at least two hose reels fully open at the same time without initiating the hydrant pump operation. Duties shall not be less than 1.3 L/s and must sustain an even control pressure within the hydrant system.

E.1.18.13. Hydrant System Testing.

The fire hydrant systems testing at UNSW shall be carried out in accordance with the following test sequence:

Pump System Tests – AS2941 – Pump curve to be provided. Compulsory for all systems where pumps are installed.

1. The manufacturer shall supply a factory benchmark pump characteristic curve calculated from the data obtained before the test is conducted in addition supply a schedule of all readings taken during the test including those readings taken on the compression-ignition engine.

2. Appendix F of AS2941 provides for examples of typical performance test data sheets. All performance tests shall be conducted on a test rig complying with the requirements of AS2417 Grade 2 tests of test rig instrumentation, shall be regularly calibrated and certified as current by an accredited test laboratory.

3. Confirmation in writing means that test results and other information required by the Standard are recorded on a certificate and witnessed by UNSW EM Engineering.

4. The fire hydrant system shall be designed and installed to withstand the 5-year 1700kPa pressure tests.

5. Check diesel operation signal interface with FIP.

E.1.19. FIRE SPRINKLERS

E.1.19.1. Basis of Design

Indicate on drawings basis of design of system, including: design code, flow rates, head loss in pipelines, residual pressure of mains at design flows, pump duties if applicable, height of highest sprinkler above ground, available flow rates in water supply main.

Where the consulting engineer proposes a combined fire sprinkler and fire hydrant system in accordance with AS2118.6, EM Engineering is to be consulted for approval.

E.1.19.2. Kensington Campus Water Mains

UNSW Kensington Campus maintains a combined site fire/water reticulation system that is metered at the boundaries through three (3) connections to the Sydney Water infrastructure (two in High St and one in Botany Street). Each connection has a testable double check valve for backflow protection.

UNSW EM Engineering is the ONLY source of Pressure Statements (FIRE FLOWS) for development works on the UNSW Kensington campus. NOTE that the maximum combined fire flow that will be provided for any development at the UNSW Kensington Campus is 40 litres per second (at a pressure determined by UNSW EM Engineering). On-site fire flow tests or pressure statements obtained from Sydney Water in relation to design flows and pressures at the Kensington Campus will not be accepted.

E.1.19.3. General

All new sprinkler systems shall comply with AS2118 unless otherwise approved by EM Engineering. All system components shall comply with AS4118, and pump sets shall comply with AS2941. The system (where required) shall be complete with booster pump/s installation, with an automatic electric Jacking Pump. The system shall have an appropriate fire brigade booster valve assembly with dedicated connection/s to the UNSW water main (separate to house water supplies) via a testable double check valve.

Where sprinkler piping is exposed to corrosion or rainfall, piping shall be heavy gauge galvanised pipe and fittings.

Make allowance for scouring and draining test water to stormwater system at full system flow. Provide block plan in accordance with AS2419 and UNSW Design Specification Standard.

It is UNSW's experience that fire engineered solutions and the associated logic become lost and difficult to manage for annual fire certification. It is for this reason that ANY fire engineered solutions shall be approved in writing by UNSW EM Engineering (before being considered).

Any proposed Engineering Solutions shall be submitted to UNSW EM Engineering on the basis of the submission has been peer reviewed and supported by at least TWO independent registered fire engineering companies.

E.1.19.4. Roof Sprinkler Tanks for Buildings over 25 m "Effective Height"

Kensington Specific: UNSW has a mandatory requirement for a dual (redundant) water supply for all high-rise buildings on the Kensington Campus in accordance with BCA

Specification E1D4. The typical configuration will incorporate a roof top tank of a minimum of 25kL with infill, to supply water by gravity to the sprinkler system with full bypass around to fire pumps and a low-level mains feed supply to the building from the combined water/fire main reticulation. UNSW may require separate hydrant (incoming supply & booster) and separate sprinkler service reticulations for all Sprinkler Hazard Categories. Note: AS2118.6 combined hydrant and sprinkler system is permitted to be installed on the campus in accordance with AS2118.6, EM Engineering is to be consulted for approval.

E.1.19.5. Water Main Connection

The fire sprinkler and fire hydrant water main connections shall be individual connections to the UNSW water main except where a combined fire sprinkler and fire hydrant system in accordance with AS2118.6 is proposed. Each connection shall have an isolation valve on the building branch and isolation valves on each side of the building connection (within the UNSW water main).

E.1.19.6. Sprinkler Booster Valve

Modified proprietary type similar to Dixon, Quell or Fire Quip types, fitted with pressure gauge, drain tap, Storz couplings and caps. Drain tap shall be capped ball valve to prevent accidental depressurization. Provide ValvCheq DC03 double check valves instead of the single check valve usually provided.

Refer to Drawing: EME 0037 H – Hydrant Booster.

E.1.19.7. Sprinkler Hazard Classifications

Generally, hazard classifications shall be specified in accordance with AS2118.1, however, for all new sprinkler system installations and refurbishments, the minimum level of protection for University buildings shall be specified as Ordinary Hazard Group 1, as defined in AS2118.1.

The following specific areas within University buildings shall have the minimum hazard classifications of:

- **Light Hazard – Concealed ceiling voids, offices – As per AS2118.1, 70kPa from the 6 most disadvantaged sprinklers for standard coverage.**
- **Ordinary Hazard Group 1 –physical laboratories, lecture rooms, and lecture theatrettes – 60L/min within the design area specified by AS21181.**
- **Ordinary Hazard Group 2 –chemical laboratories, lecture theatres, Storage Sheds -60L/min within the design area specified by AS21181.**
- **Ordinary Hazard Group 3 – libraries and museums - 60L/min within the design area specified by AS21181.**

Where the quantity of combustible storage is excessive in terms of volume and height and the combustibility of those fuels is high and where the rate of heat release of fuels is high such as bulk storage of flammable and combustible liquids additional precautions shall be taken in compliance with the requirements of AS1940. Note that some flammable and combustible liquids used on campus have other physical and

chemical properties that may require additional precautions and specialist advice should be sought for the fire protection in those cases.

E.1.20. FIRE EXTINGUISHERS

The hydraulic/fire services design shall include the selection and placement of portable fire extinguishers as required for the complete project. The extinguishers shall be of a type suitable for the occupancy and use of the area.

The extinguishers shall be located and fixed in a position to conform with AS2444, NCC and local fire authority i.e. Fire & Rescue NSW, where the requirements exceed those set out in AS2444. The extinguishers and fire blankets shall have standard identification signs etc, as required by AS2444.

E.1.21. MEDICAL/SPECIALIST GAS SERVICE

Refer to the E.1.1 Hydraulic and Fire Services Lab Standard for further information.

E.1.22. PUMPS & CONTROL EQUIPMENT (GENERAL)

E.1.22.1. Generally

All pumping units are to include for control cabinets, mounting brackets, overload switches, control switches and other items of equipment necessary to complete the installation. The main electrical wiring shall be brought up to the control panel by the Electrical Services Contractor. Connect to wiring and complete the electrical installation from control panel to pumps and from control cabinet to level switches. Allow for all necessary conduits, electric wiring to comply with the supply Authorities requirements.

E.1.22.2. Pumps

Material used for pumps and associated equipment shall be first quality and constructed to provide ample margin of safety under all possible circumstances to which they may be subjected under all contingencies of service. Select materials suitable for their application to resist corrosion and provide adequate mechanical performance. Comply with all relevant Australian Standards. Pumps shall be stable in operation from zero quantity up to full discharge at zero head and shall not cause the motor to be overloaded or the rated current to be exceeded under any conditions. Provide a shaft to resist the maximum combined bearing and torsion developed through the whole range of operation. Give special consideration to the design of bearings and thrust and to the liberal rating of the various parts.

E.1.22.3. Electric Motors

Motors shall be of continuous maximum rating squirrel cage motors and when operated at rated voltage shall have a starting torque of not less than 150% full load torque and a starting current of not less than 6 times full load current. Motors shall be enclosed, ventilated, protected, drip proof, squirrel cage induction type, unless specified otherwise, and have a continuous rating not less than 120% of the estimated pump kW. Pump shaft horsepower shall not exceed the rated power to the motor at its specified speeds. Mount pump and motor on common base plate accurately located to enable it to be removed and re-fitted without disturbing the alignment to the shafts or the pipe connections.

E.1.22.4. Brief Drawings & Date for Pumps

Provide a complete specification describing the materials and construction of the pumps. Drawings to indicate sections through pump connections, drawing of base plate, isolation mounting and other items necessary for the installation before proceeding with installation of pumps.

E.1.22.5. Conditions of Pumping

Supply a chart showing characteristics curve through zero discharge up to discharge at zero head.

- Pump output curve.
- Pump kW power curve.
- Pump efficiency curve.

Over all unit efficiency pumps guarantee the performance of the pumping plant in accordance with the curve submitted with a plus or minus tolerance of 2%

E.1.22.6. Control Panels

Supply and fix control panels necessary for the pumping units. Provide suitable access and terminal connection for wiring by electrical contractor. Panels to operate pumping and alarm equipment as described in the specification. Allow to connect to adjacent electrical supply and provide a complete wiring between control panels and pumps and control panels and level control switches. Provide sequence selector switches, relays, warning lights, circuit breakers thermal overloads and other items of equipment necessary to meet the approval of the supply authority and requirements of installation. Panels shall be lockable, dust and spray proof and constructed with 1.6mm steel finished in baked enamel with lockable door.

Pump control panels shall be connected to the BMS system for monitoring and maintenance.

Infrastructure or Building Critical Pump Panels

Panel to be a wall mounted IP66 metal enclosure RAL7035 with a Vision 1210 colour 12.1" OPLC panel to ensure consistency across the campus.

The panel is to contain the following:

- through door lockable panel isolation,
- surge protection,
- individual circuit protection for each pump,
- 24V DC power supply (to be used for control wiring),
- panel to conform Form 1 minimum,
- running and fault indication for each pump, (this can be shown on the OPLC),
- common alarm flashing light to display any pump fault,
- Provide wiring diagram in plastic sealed envelope with each panel.

The OPLC will have the following functionality:

- display of each HYDROVAR displays (pressure, set point pump status, speed),
- ability to adjust main parameters,
- On/off/remote control buttons for each pump,

- Display of suction tank level (if required),
- Modbus over Ethernet for communication to BMS, providing registers for each pump run/each pump fail/each pump remote control & tank level (if required).

Building Pump Panels

Panel to be a wall mounted IP66 metal enclosure RAL7035. The panel is to contain the following:

- through door lockable panel isolation,
- surge protection,
- individual circuit protection for each pump,
- 24V DC power supply (to be used for control wiring),
- panel to conform form 1 minimum,
- on/off/remote control selector switches for each pump,
- running and fault indication for each pump,
- common alarm flashing light to display any pump fault,
- Provide wiring diagram in plastic sealed envelope with each panel.
- 0-10V DC or 4-20mA communication to BMS, providing registers for each pump run/each pump fail/each pump remote control.

E.1.22.7. As Built Drawings

Provide drawings indicating maintenance items, nature and thickness of all joint materials, type of gland packing, clearance of dimensions of all parts subject to wear. The plant will not be accepted until the as built drawings have been supplied.

E.1.22.8. Testing

Arrange for testing of complete pumping units in the presence of EM Engineering. The pressure tests shall be applied at a pressure equal to 1600 kPa or two times the working pressure whichever is required by the Regulatory Authority. The test pressure shall be maintained for a minimum period of 24 hours.

Items of plant and equipment liable to damage at the test pressure to be applied shall not be connected while the pressure tests are being carried out. Record the performance of tests carried out on pumps, prime movers and pressure gauges and submit to EM Engineering before applying for the Certificate of Practical Completion.

Any defect in the pumping plant performance or efficiency due to any cause whatsoever shall be made good without additional expense. Maintain the pumping units in proper working order during the maintenance period. Provide all calibrated testing instruments and other apparatus necessary for testing. After the initial test to prove the technical performance guaranteed for the plant, the plant is to be then tested under working conditions. Pumping plant with a capacity less than the specified quantity against the maximum head due to pipeline characteristics or other causes, may be rejected.

E.1.23. FIXTURES, FAUCETS AND TAPS

E.1.23.1. General

All shall be first quality and of one manufacturer. Written warranties on workmanship and materials of at least 1 year required for each unit. All units shall be subject to inspection by EM Engineering. All shall be vandal-proof.

Flowrate for domestic and laboratory sinks and basins not to exceed 6L/min for hot water and 6L/min for cold water. (Cleaners' sinks excluded) or the WELs ratings targeted by the building's ESD strategy.

Flowrate for showers not to exceed 8L/min for hot water and 8L/min for cold water with the combined flow not exceeding 9L/min. Shower roses shall be AAA or 3-star WELS rated.

WCs are to be minimum 4-star WELS rated.

E.1.23.2. Drinking Fountain

Free standing Zip or equal refrigerated drinking fountain.

E.1.23.3. Toilet Pans, Cisterns and Flush Valves

New multi-storey buildings shall be provided with either a gravity flusherette tank system using flush valves or bore water mains-supplied 'Water Wafer' cisterns.

Do not convert existing flusherette systems to cisterns without written approval from UNSW EM Engineering.

Where treated bore water is available, it shall be used for toilet flushing with manual drinking water standby supply. Stand-alone installations that do not have access to a flusherette system; provide cisterns, supplied with either treated bore water or drinking water.

WC suites shall be commercial grade with 5-year Warranty. W.C pan bases are to have a 100mm outlet. Seat shall be closed front type, suitable for top fixing. Cisterns shall be Caroma 'Invisi' dual flush/single flush or equal, fitted to discharge pipe with 'Keeseal' type concealed flush pipe connection. Include internal overflow. Cistern installation shall be detailed to ensure stop tap will not interfere with servicing any component

Accessible suites: Caroma 'Leda' vitreous china 4.5 litre full flush/ 3 litre half flush type with proprietary "Round Care" or raised button. Seat shall be single flap with institutional hinge. Pans shall be specially manufactured and stamped for use by accessible persons and installed 800mm (min) distance from the front of the pan to finished wall surface and seat height to comply with AS1428.

E.1.23.4. Toilet Flushing Tanks for Buildings over 25 Metres high

Conventional design requires a separate flushing water break tank for toilet flushing purposes. Combined non potable water/flushing water tanks are NOT permitted on UNSW campus unless approved by UNSW EM.

- All Buildings which are 25 metres in height shall be provided with a dedicated toilet flushing water storage tank, separate to all other storages or supplies.
- Where alternate water supplies are available of suitable quality, the dedicated storage shall be supplied by both water supplies with potable water being used only to make up the bottom 30% of the tanks capacity and supplied via its own fill valve separate and independent to the alternate supply. UNSW approve the Apex "pump buddy", as a simple fill solution.
- The alternate supply (bore water) shall be automatically filled via a regulated float valve up to "full "capacity.
- Water storage air gap requirements including all other aspects for the tank shall be designed to meet AS3500.1.

E.1.23.5. Basins

Install with front edge 825mm above finished floor. Vitreous china wall basin with heavy duty concealed bracket as supplied with basin and generally without overflow.

For general ablutions provide one only cold water Enware (or approved equal) Time Flow press button pillar tap within basins factory set to 7 seconds.

The minimum size of waste traps for basins shall be 40mm, with a 40mm plug/waste.

For accessible persons' use in access toilets:

a) Use lever action with maximum mixed flow rate of 4.5L/min.

b) Install with front edge height above finished floor to comply with the Code. Basin to have CP brass plug and washer and supply with warm water using a thermostatic mixing valve.

c) Maximum temperature 43.5°C.

E.1.23.6. Urinals

Stainless Steel trough urinals are only permitted in buildings where treated bore water is available. Flushing devise for trough urinals shall be Pubco manually operated. Wall hung urinals shall be low flow flushing type, with manually operated flushing from bore water or treated bore water supply only.

The UNSW is in a transition from waterless urinals to low flow urinals, to this the Caroma Cube CleanFlush 0.8L Electronic Urinal with GermGard is suitable. The water supply is to be strictly connected to the treated bore water or alternately connected to the existing flusherette supply system.

Horizontal waste line discharge pipework shall incorporate a 2.5% minimum fall (or grade of 1:40). Oversize pipework where space permits (65mm minimum size for 2 urinals). 90-degree changes of direction shall be affected with 2 x 45-degree bends only.

Waterless urinals shall not be used unless specifically approved for use by UNSW EM Engineering.

E.1.23.7. Cleaner's Sink

Shall be either white vitreous china similar to Caroma or stainless-steel 304 similar to Clark with 600mm upstand and CP trap.

E.1.23.8. Showers

Provide separate floor waste and recess taps to each shower recess. Shower rose shall be minimum WELS 3-star Rated (as specified in fitting flow rates) finished in CP brass or as specified, set 1750mm above finished floor.

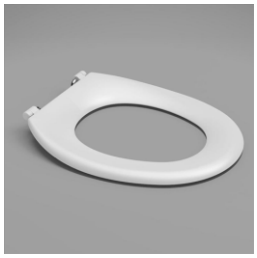
For showers located within Access toilets, ensure handheld showers cannot be extended into adjacent fixtures causing a submerged inlet.

E.1.23.9. Sinks

Shall be stainless steel grade 304 with satin finish and fitted with stainless steel plugs and washers.

E.1.23.10. Sanitary Fixture Schedule

ITEM	DESCRIPTION	IMAGE
Basin – General	**Basin** Caroma Care 600 Wall Basin White Size: 600 x 445 Wall Hung The built-in trap may not be appropriate for each basin. Other options are Concorde and Luna.	
Basin – Accessible	**Accessible Basin** Caroma Opal 720 Wall Basin White Size: 720 x 450 Wall Hung Caroma Care 600 can also work.	
Basin Mixer Access & Mobility	**Caroma Nordic Care Mixer** Bright Chrome – Single hole basin Mixer Product Code: 90965C5A WELS 5 Star Rated	
Kitchen Sink Mixer	**Enware Oras Vega** – Sink Mixer chrome plated. WELS 5 Star rating (5.2lpm)	

Basin Mixer Self-Closing	**Enware-Delabie Time Flow Basin Pillar Tap** – Push Button Bright Chrome Finish Produdct Code: TFC745P [7 Second] WELS 6 Star Rated	
WC with Concealed Cistern	**Pan:** Luna Cleanflush Wall Faced Back Inlet Pan **Cistern:** Invisi 6/4.5 Dual Flush In-wall 4 Star Cistern **Access & Flush Plate:** Invisi II Round Dual Flush Plate and Buttons Satin Stainless Steel **Seat:** Caroma Pedigree II Seat	
Accessible WC with Concealed Cistern	**Pan & Cistern:** Caroma Care 800 Cleanflush Wall Faced BI Pan **Access & Flush Plate:** Caroma Invisi Series II Care Dual Flush Plate & Raised Care Buttons Satin Stainless Steel	
Ambulant WC Suite	**Pan & Cistern:** Caroma Care 660 Ambulant Cleanflush Wall Faced BE Suite with Single Flap Seat White with GermGard	
WC Seat	**Seat** Caroma Pedigree II Seat with Soft Close Generally White is preferred – With Reference to any project Architect schedule. Product Code: 320040W	
Accessible WC Seat	**Seat** Caravelle Care Single Flap Seat Colour is to be selected in compliance with AS1428.1 Clause 12.2.3 that requires a 30% contrasting colour against the wall & floor colours – Generally White is preferred.	

Backrest:
Caroma Backrest curved Arm.

Ambulant WC with Concealed Cistern

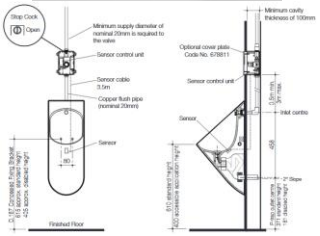
Pan & Cistern:
Caroma Liano Cleanflush – Easy Height Wall Faced Back Inlet Pan with Invisi In Wall 6/4.5 Dual Flush with designer button range compliant for Disable User and double flap seat.

WC Concealed Cistern

Caroma
Invisi In Wall 6/4.5 Dual Flush with designer button range compliant for Disable User.
Product Code: Dual 237003

Urinal – Wall Hung

Urinal Pan:
Caroma CleanFlush 0.8L Electronic Urinal (with GermGard) with SS spreader cap.
WELS 6-star rating
Product Code: 678820W



Cleaners Sink

Cleaners Sink
Clark – 316 Stainless Steel Model Y5100 570W x 500dx 180
With heavy duty bucket grate in stainless steel.
NOTE: Requires two Y5904 brackets or set of legs Y591 532 x 472 x 202 Wall mounted, with front legs, hinged grate

Cleaners Sink Tap Sets
Enware – CS Bib Taps (H&C) with F.L 50mm CP Wall Extension. Wels 3 Star Rating
Finish – Bright Chrome.
Product Code: CS321F (Jumper).

Shower Sets

Showers
Enware Shower Sets (Common) – CS Standard

recess SBA Taps (H&C) with SP263 Anti-Vandal Handles. WELS 3 Star Rating.

Rose Enware – 15mm BSP CP Standard 100mm Rose on Uni Shower Arm.

Finish – Bright Chrome.
Product Code: CS349F (Jumper)

Shower – Care (Assist)
Enware – Tap – Oras Vega Shower Mixer.
Finish – Bright Chrome.
Product Code: SLM608 (Assist).

Enware – Rose & Rail – 15mm BSP CP Handheld Handle with spiral Hose, with 900mm Stainless Steel Grab Rail Shower unit. Wels 3 Star Rating
Finish – Bright Chrome.

Product Code: SGR023CS (Assist)

E.1.23.11. Hose Taps

Refer to Potable Water and Bore Water for detailed requirements and labelling.

All hose taps shall be key operated.

Hand keys over to EM Engineering before practical completion.

E.1.24. BUILDING AUTOMATION & CONTROL SYSTEM AND ALARMS (BACS)

All equipment fault and level alarms shall be relayed back to security. This would normally be done via the Honeywell CSS system.

The Hydraulics Services Contractor shall allow for the following BACS associated items where applicable:

1. Fire hydrant pump – run and fault alarms;
2. Fire sprinkler pump – run and fault alarms;
3. Sump pump – run and fault alarms;
4. Water meter analogue output with graphed flow rate in litres per second, recording daily usage in kilolitres, and collection of historical data;
5. Water pump – run and fault alarms;
6. Rainwater/ non-potable water pumps – run and fault alarms;
7. Bore water meter analogue output with graphed flow rate in litres per second, recording daily usage in kilolitres, and collection of historical data;

8. Bore water pump – run and fault alarms;
9. Fire services tank – high and low water level alarms;
10. Domestic water tank (potable, bore or rainwater) – high and low water level alarms;
11. Natural gas meter analogue output with graphed flow rate in litres per second, recording daily usage in kilolitres, and collection of historical data;
12. Natural gas system 3 valve closed status;

E.1.25. STUDENT HOUSING SPECIAL REQUIREMENTS

E.1.25.1. Bore Water Use

Bore water shall be used for all irrigation, toilet flushing and external hose taps. All bore water shall be metered with separate sub-meters for internal building use and irrigation. Water meter sizes shall be as follows to limit peak demand flow rates.

Building uses: 20mm connected to campus wide BMS (larger water meters need to be approved by UNSW EM Engineering)

Irrigation: 32mm connected to campus wide BMS

E.1.25.2. Toilet Flushing

Flushing shall be by either dual flush cisterns or dual flush flush-valves similar to Pubco. Cisterns shall be fed from roof-mounted flush tanks or direct from bore water main. Flush valves shall be fed only from roof-mounted flush tanks. Flush tanks shall hold at least 50% of average day demand for toilet flushing, with filling rate of 0.5L/sec (max). All toilet cisterns and flushing devices shall be fitted with a local appliance fixture isolation valve that will free removal of the cistern whilst maintaining the supply to other local fixtures.

E.1.25.3. Hand Basins and Showers

Provide all domestic ablutions with hand basins supplied with warm and cold water regulated by tapware with WELS rating of 5. Minimum requirement for hot water temperature control shall be **Enware Aquablend 1500**. Under no circumstances will tempering valves be permitted. Maximum run for warm water pipelines shall be 10m to prevent excessive water loss. Showers shall be WELS rating 3 star in accordance with AS/NZS 6400.

E.1.25.4. Soil Waste

Cleaning eyes (inspection openings) for pipeline maintenance and inspection shall be provided at every section of pipe for all gravity pipelines.

Locate inspection openings every 30m, at the base of every vertical dropper, (including downpipe droppers) and at each fixture outlet and at each junction and change in direction.

Provide clear-outs to permit internal cleaning and clearing of blockages to the whole of the reticulation system. Extend risers up to the finished floor or surface, terminating

under a heavy-duty inspection box. Inspection boxes shall be screw fixed, brass where located internally and cast iron externally.

For specific requirements refer Appendix A - Section C, Sanitary Plumbing and Drainage Systems of the Plumbing Code of Australia.

Direct rodding access shall be provided to one or more water closet pans by providing a 100 mm chrome plated inspection shaft brought up to floor level directly next to the WC pan.

E.1.26. MAIN SERVICES TUNNEL

E.1.26.1. General

The main services tunnel runs generally east-west from Valentine Annex to Science Rd. It is a restricted access space, which has specific requirements for placement and types of services and methods of installation. The following conditions must be met by any works or service connections to the tunnel.

E.1.26.2. Access

Special conditions apply for entry and work permits, which shall be determined from UNSW EM Engineering. Give notice when applying for access into Services Tunnel

E.1.26.3. Pipe Locations

Refer to the cross sections for details of installation and cross-over locations. No pipes shall penetrate the tunnel roof. All wall penetrations shall be mechanically sealed with bolted weep flanges where below the water table. All other penetrations shall be watertight.

Where conduits are connected to the tunnel, they shall be graded away from the tunnel wall to a self-draining scour point to prevent entry of seepage via the conduits.

Refer to Diagram EME 0016 H Tunnel Cross Section at the end of this Section E.1

E.1.26.4. Additional Services

No additional services or extension of existing services shall be introduced without explicit permission of UNSW EM Engineering and an accompanying risk assessment.

Existing nitrogen pipeline dedicated to the Photovoltaic Laboratory and the former Photovoltaic Laboratory shall not be interfered with for any reason. Other nitrogen and oxygen pipelines shall be continuous welded without any valves within the tunnel.

Natural gas joints shall be brazed wherever possible. Screwed joints shall be kept to a minimum. No regulators or venting shall be installed within the tunnel. No joints shall be within 300mm of oxygen pipeline on vertical risers and no longitudinal natural gas services shall be located within 300mm of the oxygen pipeline.

E.1.26.5. Electrical Hazard Zones

All drainage sumps up to floor level are Class 1 Zone 2 (AS3000) rated, requiring explosion rated cabling and sump pump motors up to and including the local pump isolation switch.

Steel shielding is installed on tunnel roof and wall near grid H14. This must remain intact to protect electromagnet interference with adjacent electron microscope.

E.1.26.6. Structural Issues

Where services tunnel walls are sprayed concrete, pipelines or fittings shall be fixed to those walls by bracing from the roof and the floor. Bracing shall not be fixed to the walls. All framing and bracing members shall be kept clear of the wall and floor surfaces using synthetic spacers.

Where galvanised steel vertical supports are located within side drains, they shall be raised with 25mm high stainless-steel spacers. All floor fixings shall be corrosion resistant stainless steel.

E.1.26.7. Tunnel Drainage

Additional drainage pumps installed in tunnel extensions shall be connected to the central drainage pump control cubicle in the G14 Robert Webster entrance for power supply, pump control and alarm monitoring. Pumps shall be identical to existing submersible pump models (NP750T) and be of 415V (0.75kW) 3 phase motors.

Discharge shall be at least 50mm pressure pipe with non-return valve both at the pump and at the discharge pit located outside the tunnel to prevent drainage of stormwater back into the tunnel. Direct discharging pump out flows towards the outlet of receiving pit.

SECTION E.2 SUPPORTING DIAGRAMS

EME 0001 H Checklist for Consultant/Designers

EME 0002 H Asset Registration Form

EME 0003 H Non-Potable Tank Detail

EME 0004 H Thrust Blocks

EME 0005 H Laboratory Service Valve Compartment

EME 0006 H Site Backflow

EME 0007 H Bore Water Tap

EME 0008 H Recessed Tundish

EME 0009 H Laboratory Equipment Cooling

EME 0010 H Laboratory Reverse Osmosis System

EME 0012 H Stormwater Management Plan

EME 0013 H Stormwater Diversion Structures

EME 0014 H Basket Arrester

EME 0015 H Gas Meter Sizing and Selection

EME 0016 H Services Tunnel Cross Section

EME 0017 H Buried Valve

EME 0018 H Fire Hydrant Block Plan

EME 0019 H Fire Sprinkler Block Plan

EME 0020 H Fire Brigade Booster Arrangement

EME 0021 H Valve Selection Table

EME 0022 H P&ID Trade Waste Treatment