THE UNIVERSITY OF NEWCASTLE AUSTRALIA

The University of Newcastle

Infrastructure and Facilities Services

Project Briefing Document

Hydraulic Services

Guiding Principles

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Revision Summary	
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1 PURPOSE

The IFS Project Briefing Document Hydraulic Services Guiding Principles sets out the University of Newcastle's minimum requirements for the design, construction and maintenance of plumbing, drainage, stormwater, water, and gas services. It ensures new and refurbished systems are energy efficient, fit-for-purpose, made from durable good- quality materials, contain no or minimal environmentally harmful substances, and are cost efficient to operate and maintain.

Applicable requirements documented in Workplace Health and Safety legislation, Disability Discrimination legislation, State Environmental Planning legislation, Commonwealth and State legislation, National Construction Codes (NCC), the Building Code of Australia (BCA) and Australian and New Zealand Standards (AS/NZS) are the minimum and mandatory compliance requirements.

Where any ambiguity exists between this standard and the aforementioned mandatory requirements then:

a. the highest performance requirements must apply
b. applicable requirements must follow this order of precedence:
    i. Workplace Health and Safety legislation
    ii. Disability Discrimination legislation
    iii. State Environmental Planning and Assessment legislation
    iv. All other Commonwealth and State legislation
    v. NCC, BCA and PCA
    vi. AS/NZS
    vii. This standard and other University of Newcastle standards

Applicable standards listed in Section 12: References

2 SCOPE

These standards describe the minimum requirements for the design, construction, and maintenance of all hydraulic services throughout all buildings owned, operated, and managed by the University of Newcastle.

The standards apply to all planners, project managers, consultants, contractors, sub-contractors, tenants, managing agents and University staff involved in the design, construction and maintenance of existing, new, and proposed University buildings and facilities.

All hydraulic systems products and services provided or specified by designers, consultants, staff, and contractors must conform to this standard.

Where specific applications are not explicitly covered or ambiguity exists, the intent of the design standard must be satisfied. In such cases a return design brief must be provided for review and approval by the issuer of this standard or their appointed delegate who must have relevant technical competence in the subject matter. Additional more stringent requirements may apply on a project- specific basis dependent upon risk management and insurance requirements.

Any deviation from this standard must be approved by University of Newcastle engineering staff prior to completion.

The standard provides:

a. A reference document to enable consistency with the design and engineering objectives
b. Details of the minimum performance requirements for Planning, Architectural Design, and maintenance.

c. Support of the University Vision for the built environment and best practice.
d. The Standard addresses key objectives
    i. Quality design which responds, enhances, and complements the environment
    ii. Appreciation of the heritage context and cultural history of the campuses
    iii. Value for money in all aspects of the project
    iv. The design of low maintenance buildings and environments
    v. Longevity of construction approach to design
    vi. Standardization of key flashing and ancillary details
    vii. Flexible design, to future proof building usage for expansion or adaption to new uses
    viii. Safety in design

3 GLOSSARY OF TERMS

AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
ASTM	American Society for Testing and Materials
BCA	Building Code of Australia
BEP	Best Environmental Practice
BMS	Building Management System
BS EN	British Standard European Norm
IFS	Infrastructure & Facilities Services
DCP	Development Control Plans
DI	De-Ionised
DICL	Ductile Iron Cement Lined
DWP	Design Worldwide Partnership
EMS	Energy Monitoring System
ESD	Emergency Shut Down
FBE	Fusion Bonded Epoxy
FFL	Finished Floor Level
FRC	Fibre Reinforced Cement
GFA	Gross Floor Area
HDPE	High-Density Polyethylene
HVAC	Heating Ventilation and Air Conditioning
HWC	Hunter Water Corporation
HWU	Hot Water Unit
NCC	National Construction Code
OSD	On-Site Detection
PCA	Plumbing Code of Australia
PE	Polyethylene
PEX	Crosslinked Polyethylene
RMS	Roads & Maritime Services
RO	Reverse Osmosis
RPZD	Reduced Pressure Zone Device
SAA	Standards Association of Australia
SK	Surrogate Key
SUI	Subsurface Utility Information
SV	Stop Valve

TIG	Tungsten Inert Gas
TMV	Thermostatic Mixing Valve
UON	University of Newcastle
UPVC	Un-plasticised Poly Vinyl Chloride
WELS	Water Efficiency Labelling and Standards
WEMP	Water Efficiency Management Plan
WHS	Work Health & Safety
WSUD	Water Sensitive Urban Design

4 AUTHORITIES & RESPONSIBILITIES

This standard is issued by IFS. It is approved and approved by the Operations Manager, IFS. The IFS Operations Team are responsible for maintaining the standards and keeping it up to date. The Standard must be reviewed biennially.

As the University of Newcastle operates campuses over several regions, the local water authorities required to be engaged differ for each campus. As such, when this document refers to the local water authority, this must be interpreted in the context of the campus that is undergoing works. A table of which water authority is responsible for each campus has been included in the appendices.

5 TECHNICAL REQUIREMENTS

5.1 DESIGN AND DOCUMENTATION

5.1.1 Design Approach

The University expects consultants and contractors to provide designs that meet the project briefs. The following are priorities that consultants and contractors are aware of and consider in their designs:

a. Take a long-term balanced view of capital costs, energy costs, maintenance costs and longevity
b. As educational and research both progress at rapid rates, usage of buildings and areas within buildings can change a number of times within the life of a building, systems must be designed to be adaptable for such changes
c. Ensure that plant and equipment is designed with access and visual impact in mind
d. New University buildings are required to meet GBCA 5&6 Star standards so additional design input is required in order to achieve this performance and calculations/attendance at sustainability and ESD meetings. The University of Newcastle also has a requirement to HWC to improve site water efficiency at its Callaghan campus via the WEMP.

5.1.2 Design Inputs and Processes

The University expects consultants and contractors to proactively inform, advise and contribute to the design process. In particular the following aspects:

a. Building Physics - provide advice to the project team, including other design team members that would improve the inherent building performance, which may lead to reductions in both capital and energy costs. This may initially take the form of simple advice relating to existing infrastructure capacity and location, which may affect the siting of the building, and subsequently backed up by modelling or similar methods. The process may take a number of iterative steps. The consultant or designer is expected to advise, contribute and if necessary, lead such processes.

b. Planning and architecture – Provide advice on the appropriate location of plant rooms and reticulation strategy to assist in both the planning of the building and the facilitation of better maintenance in the future. Such advice must be provided in the early stage of the design and planning process so that this is taken into consideration of the architect's design, such that it can be incorporated into his planning. Late advice will lead to poor location of plant and lack of maintenance access, thus a building of poor quality that will suffer from either poor or lack of maintenance and high operational costs to the University. All plant is to be planned to be housed in plantrooms or under protective roofs regardless of whether equipment may be external rated due to short life expectancy of externally housed equipment.

c. The University of Newcastle – Provide advice on the availability of options, assist in assessing the advantages and disadvantages, provide analysis of life cycle costs and life expectancies, offer recommendations, and assist in making decisions.

5.1.3 Engineering Process

Depending on the scale of the project, the reviews of the following may need to be undertaken in detail:

- the capacity-capability of the existing system to be modified
- the site services supplying the facility
- the site supply point from the utility authority

The University expects consultants and contractors to be fully qualified, experienced, and capable of carrying out all engineering design, calculations, equipment selection and construction quality checks.

In selecting equipment, the University expects consultants and designers to select products and system configurations of proven and reliable quality.

In the designing of all systems, the University expects consultants and designers to follow good industry practice.

5.1.4 Equipment Selection and Sizing

In selecting equipment, the University expects consultants and contractors to select products of proven and reliable quality, with reputable support and after sales service. Products which have not had a support agreement in place for a minimum of 10 years in the nearest Australian capital city and proven performance with relevant references will not be considered.

Products which are of closed systems and proprietary in nature, thus locking the University into exclusive dependence of one manufacturer must be avoided and only used if there are no other options.

The provision of 20% spare capacity for future use must be provided when designing and sizing all hydraulic services infrastructure, pipework, and equipment. In making such considerations careful analysis of spare capacity against the application of diversity and balance must be considered.

The preferred equipment list is detailed in appendix 1. Deviation from this list must be approved in writing by IFS Engineering Staff before the acceptance of the design.

5.2 DESIGN AND CONSTRUCT CONTRACTS

5.2.1 General

This section outlines the extent of the services to be provided by the contractor under a Design and Construct contract.

The contractor shall be fully responsible for the complete design of the hydraulic services installations, including the selection, sizes and quantity of equipment, and shall provide calculations and drawings and other documentation as necessary to demonstrate conformance with the design parameters, industry practice, IFS requirements, codes, regulations and standards. This includes all calculations required to confirm that existing infrastructure is sufficient to supply the proposed systems and equipment installed under the project.

The contractor shall allow to fully co-ordinate the documentation with the Architect, Structural Engineer, and all other services consultants / contractors.

5.2.2 Calculations

As part of the contractor's design, it is expected that the following design calculations as a minimum are produced for review by IFS for approval prior to finalising design:

a. Cold water supply calculations for potable, non-potable, fire, and rainwater reuse, inclusive of mechanical services and irrigation water supply requirements. For new buildings and major refurbishments, this shall include water balance calculations for the purpose of sizing rainwater harvesting storage tanks.
b. Hot water supply calculations
c. Sanitary plumbing and drainage calculations
d. Stormwater drainage calculations, inclusive of roof and in ground drainage, overflows, rainwater harvesting, on site detention, permitted site discharge and water quality
e. Sub-soil drainage calculations
f. Gas supply calculations
g. Equipment selections based on the overall capacities calculated
h. Pipe sizing calculations
i. All other calculations necessary to illustrate equipment reticulation and components have been selected fully in accordance with the project requirements and this specification.

5.2.3 Drawings & Documentation

The contractor shall provide design, construction, and as-built drawings, which may be either design drawings produced by the contractor or shop drawings produced by equipment manufacturers.

The contractor is responsible for producing all design and as-built documentation, including, but not limited to:

a. Concept Design documentation (as required).
b. Detailed Design documentation, including:
    i. Layout drawings
    ii. Details
    iii. Schematics
    iv. Design certification
    v. Equipment details
    vi. Testing / commissioning procedures
c. Workshop drawings, including drawings for the purpose of system manufacture
d. As Built drawings, including detailed drawings demonstrating the as installed system
e. Operations and Maintenance manuals.
f. Training manuals

All design documentation shall be approved by IFS prior to any works progressing onsite.

Workshop, As-Built drawings, and O&M manuals shall be submitted for review prior to final sign off. Complete details of what is required are detailed in the document "UON Project Handover Guideline v.1.5" which is part of the UON Handover Pack.

The naming of files must follow the convention shown in Figure 1 below. Further information on this can be found in the document "UON-DSS-001 CAD - BIM Drafting and Document Standards Ver 2.1"

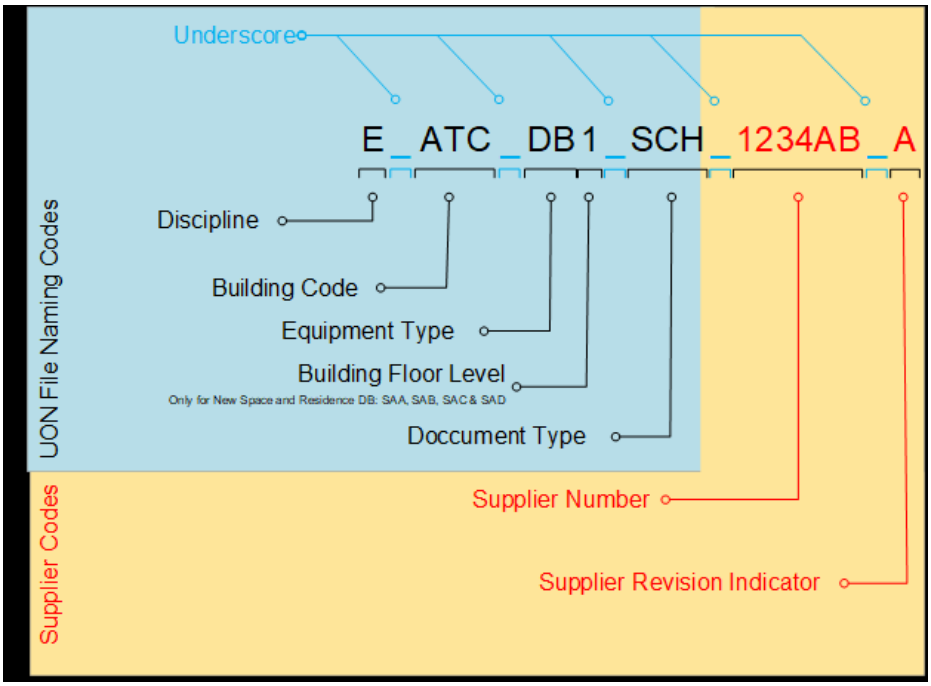

Figure 1- File Naming Convention

5.2.4 Technical Submittals

Technical submittals shall be provided with the full technical and spatial requirements of each proposed plant item. The technical submissions shall include, where applicable, but not be limited to:

a. Certified shop drawings of each item complete with sectional weights and point loads.
b. Certified noise levels from each plant item.
c. Electrical requirements including starting current, running current, operational voltage, power consumption, recommended protection devices, wiring diagrams, connection, and terminals details. Also detail of how cables are terminated to the plant item and earthing requirements shall be provided.
d. Pump Curves as applicable.
e. Equipment flow rates, pressure drops and utilities requirements
f. Recommended spares schedules and projected future availability (to ensure that redundant components are not used)
g. Requirements for specialist tools to maintain the plant item.
h. Maintenance zones and requirements including weights of any replaceable components.
i. Manufacturer's recommendations for installation including ventilation and thermal requirements.
j. Confirmation of product lifespan assuming maintained to manufacturers recommendations.
k. Where equipment model numbers / references are stated these are indicative only and the Contractor MUST ensure the selected plant fully complies with the standard
l. Documentation to indicate equipment complies with Australian Standards

5.3 COLD WATER SERVICES

5.3.1 General

The water supply network serving the University of Newcastle campuses are often a complex arrangement of local water authority owned and University owned infrastructure. During the design development phase of the project the consultant/contractor must determine the water supply demand requirements for the project and determine if the existing infrastructure is capable of meeting the project requirements.

The consultant/contractor must allow to investigate and obtain all available details of the existing infrastructure, including the location and survey of underground services, as required. Where existing information required for the design development is not available, the project team must arrange further investigative works.

Pressure/flow enquiries must be submitted to the local water authority, as required for the project, and all fees and charges applicable for this information must be allowed for. Where the water supply asset is owned by the University of Newcastle, network diagrams must be requested from IFS and testing of the water supply to obtain available pressure /flow details must be arranged by the project team.

Where new connections to the existing water supply infrastructure are required, the consultant/contractor must provide an application for connection to either the local water authority provider or IFS, dependent upon which party owns the asset. Any new connections shall be designed to allow for future proofing and improve redundancy of the existing infrastructure which may require additional zoning isolation valves etc.

5.3.2 Design and Installation Criteria

The following general design and installation criteria for cold water services must be adopted by the consultant/contractor for all projects.

Item	Cold Water Services Criteria
a. Water Main Connections & Valve Pits	i. Provide an underground valve at each connection point to the utility provider and University water supply mains. ii. Provide underground valves on University ring mains at not greater than 100m spacing's to allow shutdown of sections of the ring main. iii. For all underground valves, provide a 300mm square cast iron surface box with hinged cover permanently marked "SV" or "Water" set flush with the adjacent ground surfaces. Where multiple valves are installed on a ring main isolation point triple valve, they shall be installed with a block plan to clearly show function iv. Surface boxes must be concreted to a 150mm pipe riser extending from the valve and housing the valve extension spindle v. Surface boxes installed in soft landscaping must be provided with a concrete minimum 150mm surround. vi. All in ground valves must be clockwise closing vii. Valve pit lids for non-vehicle areas shall be aluminium checker plate with handles and supported to withstand pedestrian loads viii. Valve pits should typically be installed outside roadways ix. Valve pits inside road areas shall include heavy duty gatic type pit lids including valve tool access points

Item	Cold Water Services Criteria
b. Isolation Points	i. Provide individual water service isolation valves where each water service enters a building. ii. Isolation valves and connecting pipework must be arranged so as not to interfere with services isolation of the adjacent buildings. iii. Isolation valves must be provided on each floor immediately adjacent to each water supply riser connection point on each floor. iv. Provide separate isolation valves for all water supplies to each individual laboratory. Isolation valves must be located outside of each laboratory near the main entry to each laboratory. v. Isolation valves must be installed upstream of each group of hot and cold-water fixtures located within an individual room, including a single isolation valve to each bench group of valves so as only to impact individual benches during maintenance. vi. All water service isolation valves must be located in positions not easily accessible to the general public, but easily accessible for maintenance purposes, i.e., located in a locked service cabinet at maximum height of 1500mm above floor level. vii. Access to all isolation valves must be clearly identified with traffolyte signage or approved equivalent. viii. All replaceable local equipment shall include a wall isolation point – toilet cisterns/basins/chilled-boiling water units/dishwashers etc.
c. Water Filtration – Incoming Supply	i. Provide dual automatic backwash filters with stainless steel screens to all main incoming supplies. ii. Automatic backwash cleaning to be provided by set timer and pressure differential control iii. Manual backwash facility to be provided at filter iv. No interruption to water supply to occur during backwash cycle v. Filtration on incoming supply to be not greater than 50 microns. vi. Install a by-pass pipework arrangement around the dual filter assembly
d. Water Tanks	i. Panel tanks must be installed on raised supporting beams allowing access to visually inspect the underside of the base of the tank. ii. A minimum clear distance of 500mm around each wall of the panel tank must be provided to allow maintenance and inspection of the tank walls. iii. Access ladders and lockable access covers to allow internal tank inspection and cleaning must be provided. iv. Analogue tank water level indicators that indicate 0-100% must be installed.
e. Operating Pressure	i. 280-350 kPa ii. Pressure reduction must be used to control maximum water pressures
f. Hot & Cold Water/ Pipeline Velocity	Maximum 1.5 m/s
g. PH Correction	Maintain pH between 6.5 and 7.5 where pH is required to be controlled.

Item	Cold Water Services Criteria
h. DI and RO Water Filtration and Quality	i. Project Manager must specify the quality and quantity of DI and RO water where required for laboratory usage. ii. Proposed DI and RO water supply equipment must be submitted to IFS for approval complete with manufacturer's maintenance requirements and budget costing over the life cycle of the equipment. iii. DI and RO pipe systems must be provided with valving to allow individual floors to be shut down without affecting the entire building. iv. Pipework dead legs on DI and RO pipe systems will not be accepted.
i. Backflow Prevention Devices	i. Each individual University site/building must be deemed a separate property for the purposes of containment protection and must be installed with individual dual backflow prevention devices at the main water supply connection point to each site/building, in order to achieve building containment and to ensure that annual testing does not interrupt the water supply to the site/building being served by the device ii. Containment protection for all University buildings must be deemed high hazard. iii. Zone and individual protection devices must be installed within each building to suit the relevant hazards contained. iv. Zone containment for all wet laboratories, animal houses, green houses, and areas with similar use, must be deemed high hazard v. All backflow prevention devices must be located to allow clearance as per AS3550.
j. External Fire Hydrants	i. Connected to external water supply infrastructure only via a branch line. ii. If connected downstream of a building Brigade Booster Connection be provided with signage indicating "Attack Hydrant". iii. Water supply to each external hydrant must be provided with sluice valve installed in a valve pit complete with cast iron box and hinged cover permanently marked "SV" or "Water" to indicate water service. Some will be feed hydrants and fed from a CW main or a site boosted FW main. iv. Must be a twin hydrant arrangement. v. For more information refer to the IFS Fire System Specification.
k. Boiling/Chilled Water Units	i. Filtered boiling and chilled water units must be provided in all designated tea making areas. ii. Boiling and chilled water taps must be installed in the sink with the boiling/chilled water unit installed in an accessible position in a cupboard directly below the sink.

Item	Cold Water Services Criteria
l. Hose Taps	i. Brass hose taps with a 20mm screwed outlet must be installed for cleaning purposes in open courtyards, balconies, external dining, and entertaining areas. ii. All plantrooms, chiller and cooling towers and accessible roof areas must be provided with brass hose taps with a 20mm screwed outlet to allow hose down and cleaning floors, roofs, and gutters. iii. Each bathroom must be provided with a chrome plated hose tap with a 15mm screwed outlet to allow placement of a cleaner's bucket underneath (min 450mm above from FFL). A floor waste must be located directly below outlet of this tap where possible. iv. Vacuum break devices must be installed to hose taps in zone protected areas and those installed in external areas. v. Quarter turn taps are not permitted to be installed. vi. All hose taps must be provided with vandal proof spindles. vii. Backflow prevention must be installed on hose taps installed in hazardous environments as necessary to comply with AS3500 and local water authority requirements.
m. Safety Showers / Eye Wash	i. All wet laboratories must be provided with emergency safety showers and eye wash facilities with a 32mm minimum potable cold water supply as per manufacturer's instructions. ii. Each safety shower/eye wash facility must be provided with an independent isolation valve. iii. All eyewash stations must be connected to the sanitary plumbing system. Floor wastes shall be provided for safety showers. iv. Tempered water shall be provided to all eye wash and safety showers to allow safe use of items for extended periods.

Item	Cold Water Services Criteria
n. Urinals and Cisterns	i. Flushing requirements for all urinals must be inline type with urine sensing flush control mechanism, or similar, for best practice water conservation. ii. For all new and refurbished bathrooms, water supply pipework must be installed to facilitate the potential for future rainwater re-use and /or centralised grey water reticulation systems. iii. This requires pipework serving urinal and cistern flushing systems to be installed independently of pipework serving hand basins, showers and other general drinking and potable water fixtures. iv. In new buildings where rainwater re-use and/or grey water system is not proposed, this pipework must be installed throughout the facility and fed from the main hydraulic services plantroom containing metering, backflow prevention and/or pumping equipment for the potable water supply to the building. v. A pulse water meter must be installed on the urinal/cistern water supply pipework at the main connection point to the potable cold-water supply. vi. In existing buildings, where this pipework is installed for future connection to a rainwater re-use and/or grey water system, the separated water supply pipework must be installed with a separate isolation valve provided on each floor immediately adjacent to each water supply riser connection point. vii. Pipework installed to meet these requirements must be provided with approved identification to indicate recycled water.
o. Building Management System (BMS)	The following water supply equipment must be connected and monitored by the BMS in real time: i. All water supply pumps (potable/non-potable/rainwater re-use/hot water recirculating, etc) – run/fault alarms and mains and supply pressures. ii. Hot water plant – temperature/fault alarms iii. Rainwater re-use water treatment plant and equipment including UV filtration – rainwater re-use tank level 0-100% iv. In some instances, the control of the CW pumps shall be done by the BMS rather than local control v. Automatic backwash filters vi. Solar HW – preheat temperature/fault alarms
p. Energy Monitoring System (EMS)	All new water meters installed shall be connected and monitored by the EMS to log and display water consumption details in maximum 15-minute intervals.

Item	Cold Water Services Criteria
q. Lab Process Water	Where process water is required in laboratories for cooling of equipment, the supply must meet the requirements of the Project Briefing Document - Environmentally Sustainable Design. Mains water is not to be run to waste for cooling applications.
r. Water Stations	For new buildings and buildings undergoing significant refurbishment, water stations must be installed to meet the requirements of the Project Briefing Document - Environmentally Sustainable Design.

5.3.3 Water Segregation and Backflow Prevention

Existing buildings may contain a variety of water services, including potable, non-potable, de-ionised, reverse osmosis, and rainwater re-use systems. The consultant/contractor is responsible for ensuring that the correct supply is provided to each fitting and fixture and to ensure that water supplies remain totally segregated.

Water segregation comprising separate potable and non-potable, cold and hot water supplies, must be provided within the following areas:

a. Wet Laboratories - all types and ratings
b. Animal Houses

All non-potable supplies including pipework and tapware must be clearly identified using standard pipe marking labels and tapware signage.

The following design and installation criteria for water segregation must be applied to all projects involving laboratories and animal houses:

Item	Water Segregation Criteria
a. Non-Potable Water Supply	i. Non-potable water supplies for all laboratory buildings must generally be designed as centralised systems serving the entire building. ii. For new laboratory buildings, provision of a centralised non-potable water supply via a registered break tank is preferred, however has to be provided alternatively via double RPZ. iii. In existing buildings containing laboratories, the consultant/contractor must connect to the existing non-potable water supply serving the building.
b. Laboratory Water Supply (PC1, PC2, PC3 & PC4)	i. Separate supplies for potable cold water, potable hot water, non-potable cold water and non-potable hot water must be provided to each laboratory. ii. Each supply must be provided with accessible isolation valves located outside of the laboratory facility to allow individual shutdown of each supply.

Item	Water Segregation Criteria
c. Laboratory Backflow Protection (PC2, PC3 & PC4)	i. Each individual laboratory rated as PC2 and above must be provided with 4 off individual RPZDs serving potable cold water, potable hot water, non-potable cold water & non-potable hot water. ii. RPZDs must be installed in a stainless-steel cabinet located outside of the PC rated area to enable servicing without entering the laboratory facility. iii. The door to the cabinet containing the RPZDs must be fitted with a hinged and lockable glass or Perspex viewing panel. iv. The cabinet must be provided with a 50mm diameter drain at the base of the enclosure. v. Pipework supplying each device must be labelled pipe markers indicating water service type, vi. The cabinet must be provided with a traffolyte label indicating the lab name and room number(s) that the devices are protecting.
d. Laboratory Hand Basin	Supplied with potable cold water and potable warm water (hand washing).
e. Laboratory Benches	Supplied with non-potable cold and non-potable hot water supply (laboratory work and equipment) including isolation valve for groups of valves on each bench.
f. Emergency Shower/Eye Wash Facilities	Supplied with tempered potable water.
g. Animal Houses	i. Supplied with potable cold-water supply for animal drinking and hand washing. ii. Supplied with separate potable warm water supply for hand washing. iii. Supplied with separate non-potable hot and non-potable cold-water supplies.

5.3.4 Water Metering

Each building must be provided with its own local water authority meter and/or University owned sub-meter assembly. All meters must be rated for revenue billing in commercial applications in addition to being suitable for monitoring of complex distribution water supply networks.

All meter and sub-meter assemblies installed must be “smart meter” type with multiple pulsed outputs for increased real time data to provide water management information. These meter assemblies must be compatible for connection to the EMS via a set of voltage free contacts and include 2m pulse input cabling from meter head to termination point for connection to pulse input module provided by either electrical or mechanical trade.

Meters must be suitable for measuring bulk flows of cold water, hot water, and rainwater, dependent upon usage.

Sub-meter assemblies must be installed within the building to measure water supplies for the following systems/areas:

a. Mechanical HVAC plant (including cooling Towers, evaporative Condensers, heating boilers, etc) with separate meters for each major use.
b. Steam Boilers
c. Centralised Potable Hot Water Systems
d. Centralised Non-potable Water Systems
e. Rainwater Reuse Systems that quantify the volume of re-use water consumed by each facility
f. Backup Potable Supply to Rainwater Reuse System
g. Irrigation Systems
h. Spaces proposed for tenancy leasing agreements
i. Any equipment that utilises more than 50kL of water a month

Where meter assemblies are connected directly to the local water authority network, the contractor must make application to and pay for all fees for the local water authority to supply a new meter assembly.

Water meters must be installed in fully accessible positions to allow for easy reading and servicing from either side of the meter, including a bypass where supply is critical. Meters are not to be installed in ceiling spaces and need to be viewable from standing at floor level. Individual isolation valves must be provided for each water meter assembly.

The consultant/contractor must coordinate the location, meter type and data output with other building services consultants/contractors to ensure the installed meters are fully compatible with the EMS.

Hydraulic trade is responsible for the supply and installation of meters, pulse equipment, and a 2m cable ready for termination by electrical/BMS/mechanical trade. Electrical/BMS/mechanical trade is responsible for the supply and installation of cable from the meter termination point to the pulse acquisition device and communications device connecting to the facility data network, ready for software configuration by specialist third party. The specialist third party provider for undertaking updates to the University of Newcastle's private EMS server is Circutor Power Studio Deluxe Scada – Energy Systems and Services – Sydney. All additional meters shall be configured equally to the existing configuration, with building level meters displayed at campus plan level and then detailed service meters displayed at a faculty level. Alarms for night-time and high flow daytime rates shall be configured and nominated meter value data exported to the University of Newcastle's Envisi external vendor Utilities Management System.

All water meters and sub-meters must be connected to the EMS. Allowance for modifications to, EMS programming, including meter hierarchy must be included for all new meters and sub-meters.

5.3.5 Equipment and Materials

All materials supplied and installed must be approved by the local authority have the respective Australian Standard's mark and manufacturer's SAA licence number.

All materials must be first quality and the best of their respective kinds. Second quality or inferior materials must be rejected. All costs associated with replacement of rejected materials must be the contractor's responsibility.

The following materials must be specified and installed.

Item	Cold Water Services Equipment & Materials
a. Pipework Above Ground	i. Copper Type B in accordance with AS 1432 (pipe) AS 3688 (fittings) ii. Stainless Steel 316 min 2mm in accordance with ASTM A269-02a / BS EN 10312 iii. High density cross-linked polyethylene (PEX) pipe on branch pipework to bathroom and kitchen fixtures downstream of branch isolation valves supplying the fixtures. iv. Pipework B-Press fittings have been utilised successfully. Termination of all pipework must be made using pipework fittings and end caps. v. The use of alternative non-metallic water supply pipes in above ground locations will not be accepted without prior approval from IFS.
b. Pipework Below Ground	i. The IFS Standard Permit to Work Form must be submitted and approved by IFS prior to installing or repairing any pipework located below ground. ii. Ductile Iron Cement Lined (DICL) must be replaced with HDPE where possible. HDPE indication stripe shall match service type – Blue for CW, Red for FW, Yellow for natural gas. iii. Copper Type B in accordance with AS 1432 (pipe) AS 3688 (fittings), for pipes equal to or less than 100mm diameter. iv. PE Pressure Pipe with minimum pressure class PN16 and compound PE100, in accordance with AS 4130, for pipes greater than 100mm diameter. v. All metallic pipes installed underground must be installed in green polyethylene sleeve protection bag. vi. Underground pipe warning tape and trace wire must be installed adjacent to all underground non-metallic pipes for the full length of the pipe. vii. Warning tape is to be made of durable plastic with a minimum width of 300mm and colour to match AS1345. viii. Line marking identification plates must be installed at pipework changes in direction and at 50m intervals. Identification plates shall indicate the service type, flow direction, depth, and diameter. Identification plates shall be brass, epoxy resin screw set flush with the surrounding surface. For services in soft landscaping a concrete fixing block must be provided. ix. The use of alternative non-metallic pipe in underground locations will not be accepted without prior approval from IFS. x. Underground pipework at depths greater than 1m is to be raised up at all valve locations to above ground or to pit depth to allow the operation of valves. xi. Pressure reducing valves/isolation valves or other major equipment housed above ground is to be housed with supporting struts, including screening, locks to prevent inadvertent operation and block plans to show where the components fit into the broader system operation.

Item	Cold Water Services Equipment & Materials
c. Copper Tube Joints	i. Silver soldered joints for all pipe sizes. ii. Viega Propress or equivalent compression fittings for copper pipe sizes equal to or less than 65mm diameter using specialised pressing tools in accordance with the manufacturer's instructions, for above ground applications only iii. 15% silver solder for chilled and hot water lines iv. Minimum 6mm lapped joints v. Joints must be made from preformed copper tees. Site or factory fabricated copper tee joints are not permitted vi. The use of alternative compression press fittings will not be accepted without prior approval from IFS.
d. Ductile Iron Cement Lined Pipe/Joints	i. DICL installed below ground must be spigot and socket connections with rubber ring joints. ii. DICL may be installed where the pipework exits and enters below ground. Flanged connections and joints must be provided on all DICL pipe installed above ground. iii. Anchored in accordance with local authority and manufacturer's instructions. iv. All DICL fittings must be cement lined /FBE coated. v. Gibault joints must be long sleeve with stainless steel rods, nuts, and washers. vi. All mechanical fastened flange joints below ground shall be installed with stainless steel bolts and wrapped with Denso tape to protect from degradation.
e. Stainless Steel Pipe Joints	Butt jointed, TIG welded and passivated after welding. Victaulic joined galvanised steel pipework is to be used for FW applications.
f. Cross-linked Polyethylene (PEX) Pipe/Joints	i. The use of PEX pipe is only approved for 15-25mm sizes (equivalent to the internal bore of copper tube) ii. Use of PEX pipe as riser's pipework, main horizontal feeds, and plantroom areas, is not permitted iii. Pipes must be jointed using brass compression fittings and specialised tools in accordance with the manufacturer's instructions. iv. PEX pipe colours shall match the water service type, i.e., cold water – platinum, hot/warm water – red, rainwater – green, recycled water - lilac v. PEX pipe to be REHAU or approved equivalent

Item	Cold Water Services Equipment & Materials
g. PE Pipe/Joints	i. PE pipe joints shall be formed by butt or electro fusion welding ii. PE fittings with minimum pressure class PN16 in accordance with AS4129 must only be used. iii. Installers performing welding of PE pipe need to demonstrate experience and training with the weld type proposed iv. Automated welding machines that provide a report of all performed welds shall only be used and copies of each weld must be provided as part of the project deliverables v. Pipe marking colour to match service type, i.e. potable water – blue, fire services – red, rainwater – green, recycled water – lilac. vi. All PE pressure pipe must be submitted for IFS approval with full details of proposed installation, including size, location, depth, jointing method, excavation and backfilling or alternative installation details
h. Unions	i. Bronze heavy pattern three-piece bull nose taper type ii. Where a tap connector type union is used it must be either type silver soldered to the piece or a loose nut used in conjunction with a stop formed tube
i. Valves Above Ground	i. 25mm or less – brass or chrome plated stop valve ii. 50mm or less – non-rising spindle pattern, with clockwise closing, screwed type with a union fitted to the outlet side iii. 80mm or less – bronze flanged iv. 100mm or greater – rising spindle flanged cast iron with bronze trim except where installed for hot water reticulation in which case the valve construction must be flanged bronze v. Must be located in easily accessible positions for ease of maintenance at a maximum height of 1500mm above the floor vi. Lever operated ball or lugged style butterfly valves
j. Valves Below Ground	i. 100mm diameter and greater must be gate valves ii. Flanged body ends, bolted cover and fusion bonded epoxy coated internally and externally iii. Resilient seated iv. Non-rising spindle pattern v. Class 16, working pressure 1600kpa vi. Fitted with key cap vii. Clockwise closing viii. Provided with a surface box ix. Manufactured in accordance with AS 2638.1-2002

Item	Cold Water Services Equipment & Materials
k. Reduced Pressure Zone Device (RPZD) Valves	i. Devices must be installed complete with unions of appropriate size on the inlet & outlet sides of device/s so that water supply can be isolated facilitating easy removal of device/s ii. Devices must be supported so that inlet & outlet pipe work is not supporting devices iii. Backflow devices requiring a drain line must be provided with a 50mm minimum connected drain line iv. Up to and including 50mm diameter must be screwed type v. Greater than 50mm diameter must be flanged type vi. RPZD Valves to be Pentair Valvecheq Figure RP-03 or approved equivalent
l. Double Check Valves	i. Fire services water supplies must be provided with a double check valve with a check bypass water meter prior to the booster valve assembly. ii. Double check valves must be Pentair Valvecheq Figure DCDA03 or approved equivalent
m. Cold Water Pump Sets	i. High efficiency pumps with variable speed drives. ii. A minimum dual pump system arrangement must be installed with a duty and standby and auto changeover every 12 hours. iii. Certified for potable water use to AS4020. iv. Supplied by a pump manufacturer as a complete packaged system mounted on a base with manifold, valves, and control panel. v. Pump control panels shall provide auto/off/manual switches for each pump and a main isolation switch for the controller with traffolyte labelling indicating electrical supply details. vi. Pump controllers shall provide indicator lights for each pump indicating power on, pump run, pump fail. These shall be provided with a local user interface screen indicating system operating parameters. vii. Pressure gauges to be installed on the inlet and outlet of each pump. viii. Enable removal of one pump while the other is in operation. ix. Monitor run/fault/speed of each pump as well as mains and supply water pressure by BMS. x. All cold water pump-sets must be Grundfos type, or approved equivalent. xi. Include binder test points at inlets and outlets. xii. For site supply pumps, monitoring via the BMS shall include instantaneous flow rate ultrasonic meters.
n. Flexible Connections	i. Braided stainless steel bellow type not less than 4 pipe diameters long. ii. Nylon cord reinforced rubber shall be installed on all pump suction and discharge connections. iii. Maximum deflection on each flexible connection must not exceed 5 degrees.

Item	Cold Water Services Equipment & Materials
o. Basin and Sink Connections	i. Mini cistern cocks and chrome plated cover plates for both hot and cold connections must be located at the wall under each fixture ii. Exposed pipework must be chrome plated

5.4 HOT WATER SERVICES

5.4.1 General

Hot water may not be required to be supplied to all amenities. Disabled/shower/parent rooms will typically be supplied with hot water, however general amenities may only be provided with cold water.

The consultant/contractor must ensure the most efficient hot water supply is designed and installed to suit the building operations and demand. Gas boosted solar hot water systems must be installed where sufficient northern roof solar access is available. Where solar access is not achievable, mains pressure gas fired hot water systems must be installed. Life cycle analysis and costing must be performed to determine the most viable hot water supply for each project. Heat pump systems and electric hot water units must only be used where the above listed options are not viable and may be necessary to achieve green star requirements. These types of systems must be submitted to IFS for approval.

Centralised recirculating hot water installations must be installed to ensure continuity of hot water supply temperatures at each outlet. Systems must be designed with multiple units to ensure efficiency and system redundancy is maintained. A minimum of 20% spare capacity above the maximum hot water demand must be provided for all hot water installations. Recirculating pumps must be thermostatically controlled to limit unnecessary operation. Duty and standby hot water pumps must be installed to allow system redundancy. Balancing valves must be installed on the hot water return circuit to control the hot water return temperature to a minimum of 60C.

All hot water installations must comply with the energy efficiency measures listed in the National Construction Code and to suit the requirements of the University of Newcastle Sustainability Framework document and must incorporate adequate controls to avoid the likelihood of the growth of legionella bacteria.

Hot water system calculations must be provided for approval to confirm the design assumptions used in calculating the hot water plant capacity and recovery rate. Energy calculations shall also be included in the assessment of the hot water plant to ensure the most efficient system is selected.

Heat and energy loss must be minimised by installing adequate insulation on all hot water supply pipework and by locating hot water units in the vicinity of areas with the greatest demand.

All hot water units and storage tanks must be installed at floor level in accessible locations with sufficient space to enable maintenance and/or removal and replacement of each individual unit.

Copper safe trays complete with drainage pipework must be installed under all hot water units. Overflow/relief valves must discharge to tundishes connected directly to a drainage connection point, not to the copper safe tray. Under bench hot water may be deemed most suitable rather than a facility wide distribution.

5.4.2 Design and Installation Criteria

The following general design and installation criteria for domestic hot water services must be adopted by the consultant/contractor for all projects.

Item	Hot Water Services Criteria
a. Potable Hot Water Delivery Temperatures	i. Minimum 65^{0}C storage at hot water plant ii. Minimum 60^{0}C return water temperature iii. 42^{0}C to accessible bathrooms & shower amenities iv. 45^{0}C to staff bathrooms & shower amenities v. 50^{0}C to student accommodation amenities, kitchens, and kitchenettes vi. 50^{0}C to staff kitchens, kitchenettes, and cleaners' sinks vii. 60^{0}C to commercial kitchens viii. 60^{0}C non-potable supply to wet laboratory sinks (where hot water has been identified as required) ix. Bathrooms and amenities must have thermostatic mixing valves or tempering valves installed to ensure the water temperature supplied to all fixtures complies with all statutory and NSW Health requirements
b. Student/Public Bathrooms	Hot/warm water supplies are generally not provided to handwash basins in student/public bathrooms
c. Non-Potable Laboratory Hot Water	i. The requirement for provision of non-potable hot water supplies to wet laboratories shall be minimised. ii. Where provided, non-potable hot water supply to all laboratories must be independent from the potable hot water supply to the remainder of the building and/or provided with high hazard zone backflow prevention. iii. The cold-water supply inlet to any individual non-potable hot water unit serving a laboratory must be downstream of a backflow prevention device with a lockable valve to provide isolation and zone containment protection. iv. Individual non-potable hot water units serving isolated laboratories must generally be continuous flow type. Where the size and/or the hot water demand of the laboratory does not permit the use of continuous flow systems, alternatives must be submitted for approval.
d. Operating Pressure	i. Maximum 350kPa ii. Minimum 250kPa
e. Dead legs	i. Maximum hot water dead leg allowable is 10 metres. ii. Maximum warm water dead leg allowable is 5 metres.

Item	Hot Water Services Criteria
f. Insulation	i. All hot water pipes must be installed with extruded flexible closed cell insulation in accordance with AS4426. ii. Insulation must generally be of the sealed tube or hard drawn pre-lagged type. iii. Split and taped insulation or zippered/press type insulation is not acceptable iv. Vapour barrier consisting of reinforced aluminium foil laminate must cover the insulation material with a minimum overlap of 50mm at each longitudinal joint. v. The insulation must be pulled around bends in one piece. Where this is not possible and at tees the insulation must be mitred and neatly taped with 50mm wide PVC tape of similar colour to the insulation. vi. Wood blocks must be provided at each pipe bracket. vii. For hot water pipework exposed to weather, anodised aluminium sheathing must be installed over the insulation in a single piece with a 40mm overlap. The lap must face down and must be secured by pop rivets at 100mm spacing's.

5.4.3 Equipment and Materials

All hot water plant and equipment installed must be suitable for commercial applications and must be provided with sufficient capacity and rating required to serve the system demand.

Item	Hot Water Services Equipment & Materials
a. Hot Water Heaters	i. Continuous flow commercial water heaters with storage cylinders are preferred for all new hot water installations. ii. Where mains pressure hot water heaters and storage vessels are installed, they must be complete with all necessary stop, check, drain and pressure relief valves necessary to complete the installation. iii. All hot water units must be heavy duty suitable for commercial applications. iv. All hot water units must Rheem or Rinnai type, or approved equivalent. v. All hot water system must be provided with a temperature gauge on the supply to the field (flow) and for recirculating systems on the return at the plant. vi. Where more than 2x the standard HWU are required to meet the load of student accommodation, larger commercial grade equipment shall be used in tandem to maintain the robustness and reliability of the installation.

Item	Hot Water Services Equipment & Materials
b. Solar Collectors	i. Where solar collectors are proposed to be installed, assessment of the structure and fixing methods must be submitted for approval. ii. Safe access for maintenance must be provided to all solar hot water panels. iii. Solar hot water panels must be Rheem or Rinnai type, or approved equivalent. iv. A bypass around solar systems shall be provided to allow maintenance of panels whilst maintaining flow to HWS.
c. Pressure Reducing Valve	i. Installed in the cold-water supply pipework to each hot water heater. ii. Set at 500kPa.
d. Insulation	i. Minimum 25mm thickness. ii. Similar or equal to Thermotec or Aeroflex. iii. Mineral wool or fibre glass insulation will not be accepted.
e. Safe Trays	0.6mm copper sheet as per AS3500.4
f. Gas Flue Pipes	i. Individual flue pipes must be installed to each hot water unit. ii. Each flue pipe must be terminated with a flue cowl. iii. Flues are to be terminated at least 0.5m away from building fabric or any overhanging element to prevent flue gas condensing on adjacent concrete slab/building elements. iv. Condensing water heaters shall include dilution for acidic condensate. v. Segmented flue shall be designed and appropriately sealed so as to drain without leakage of condensing flue gases to the internals of the facility.

Item	Hot Water Services Equipment & Materials
g. Hot Water Circulating Pumps	i. Dual pump system must be installed with a duty and standby arrangement and auto changeover every 12 hours ii. Certified for potable water use to AS4020 iii. Supplied by a pump manufacturer as a complete packaged system mounted on a base with manifold, valves, and control panel iv. Pump control panels shall provide auto/off/manual switches for each pump and a main isolation switch for the controller with traffolyte labelling indicating electrical supply details v. Pump controllers shall provide indicator lights for each pump indicating power on, pump run, pump fail. These shall be provided with a local user interface screen indicating system operating parameters. vi. Pressure gauges to be installed on the inlet and outlet of each pump vii. Enable removal of one pump while the other is in operation viii. Monitor run/fault/speed of each pump as well as mains and supply water pressure by BMS. ix. All hot water circulating pumps must be Grundfos type, or approved equivalent x. Include binder test points at inlets and outlets. xi. For site supply pumps, monitoring via the BMS shall include instantaneous flow rate ultrasonic meters.
h. Pipework	As per domestic cold-water services
i. Tempering Valves	i. Tempering valves preferred for student accommodation facilities ii. Tempering valves must be located at a maximum height above floor of 1500mm and readily accessible for ease of maintenance without the need to climb ladders or scaffolding iii. RMC Heatguard type or approved equivalent
j. Thermostatic Mixing Valves (TMV's)	i. TMV's to be placed in a lockable stainless-steel box, recessed and clear of obstructions. ii. TMV's must be located at a maximum height above floor of 1500mm and readily accessible for ease of maintenance or testing without the need to climb ladders or scaffolding. iii. Each TMV must be labelled with a traffolyte label stating valve number and room number(s) the device is supplying warm water to. iv. Where installed to serve laboratories, must be located outside of each laboratory near the main entry to each laboratory. v. Provide a traffolyte label on the box cover indicating "Thermostatic Mixing Valve – this valve requires regular servicing by a qualified person" vi. Enware Aquablend or approved equivalent

5.5 RAINWATER HARVESTING AND WATER RE-USE

5.5.1 General

For 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 the University of Newcastle Sustainability Framework document.

5.5.2 Design and Installation Criteria

Rainwater re-use systems must collect rainwater from building roofs only 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. Fire system annular test water may be piped to the re-use tank; however, fire system drainage pipework must not be piped to the re-use tank due to the contaminants within the fire system pipework.

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. Access for maintenance must be provided to all first flush systems.

Rainwater tanks must be suitably sized to suit the demand of the rainwater being re-used throughout the system, the size of the roof area use to capture rainwater and the Bureau of Meteorology rainfall statistics for the local area. Rainwater harvesting and re-use calculations must be submitted for approval to support the system design, as per the Sustainability Framework document. The tank capacity must be suitable to store major rain events with rainfall rates of 100mm/hr.

Rainwater must be treated prior to re-use and piped to a dedicated rainwater re-use pipework system. The rainwater treatment plant must be an automated/timed system and 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 guidelines, regulations and standards applicable for the treatment and re-use of water.

Metering to measure the quantity of rainwater re-used must be installed.

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 an appropriate air gap, be protected using RPZDs and be sub-metered. The potable water supply must also be piped and valved to allow the rainwater re-use tank and water treatment plant to be fully bypassed and served only by the domestic cold-water supply.

Prior to the rainwater re-use system being brought into service, the re-use tank must be thoroughly flushed out with clean water and fully sterilised. In addition to the University witnessing this process, the consultant/contractor must provide documentary evidence confirming the provision of this process.

Internal access to rainwater storage tanks must be provided to allow for cleaning. Vehicle access must also be provided to allow the tank to be pumped out by a vacuum pump truck. 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.

A stormwater bypass arrangement shall be provided to allow for periods of rainwater re-use tank maintenance.

Rainwater re-use may be used for the following functions, subject to University approval:

a. Irrigation

b. Urinal & Cistern Flushing

C. Cooling Tower Water

5.5.3 Equipment and Materials

All equipment, materials and fixtures installed in rainwater harvesting and re-use applications must be approved for use in such systems.

Item	Rainwater Harvesting & Water Re-use Equipment & Materials
a. Tank	i. Rainwater re-use tanks must be 316 stainless steel modular panel type tanks or reinforced concrete type tanks. ii. Panel tanks must be installed on raised supporting beams allowing access to visually inspect the underside of the base of the tank. iii. A minimum clear distance of 500mm around each wall of the panel tank must be provided to allowance maintenance and inspection of the tank walls. iv. Access ladders and lockable access covers to allow internal tank inspection and cleaning must be provided. v. Confined space signage must be provided. vi. Tank water level indicators must be installed. vii. Tank filling valves must be Philmac servo type or approved equal. viii. Bladder or liner tanks will not be accepted.
b. Filtration/Treatment Plant	i. Supplied by a water filtration/treatment plant manufacturer as a complete automated system to suit the proposed rainwater reuse function. ii. Proposed water filtration plant and equipment must be submitted to IFS for approval complete with manufacturer's maintenance requirements and budget costing over the life cycle of the equipment. iii. Monitored by the BMS to provide appropriate alarms for high pressure differential and equipment failure.
c. Pipework	i. The use of PE and PEX plastic piping systems for rainwater re-use is preferred. ii. For further details relating to PE and PEX piping and jointing systems, refer to cold water services equipment and materials. iii. Provided with an approved green continuous plastic sleeving. iv. Pipework is to be Lilac in colour to depict rainwater re-use.
d. Metering	Monitoring is to be captured via the EMS to measure the quantity of rainwater re-use.

5.6 SANITARY PLUMBING AND SEWER DRAINAGE

5.6.1 General

The sewer and trade waste drainage network serving the University of Newcastle campuses are often a complex arrangement of local water authority owned infrastructure and University owned infrastructure. During the design development phase of the project the consultant/contractor must determine the sewer and trade waste demand requirements for the project and determine if the existing infrastructure is capable of meeting the project requirements.

The consultant/contractor must allow to investigate and obtain all available details of the existing sewer and trade waste infrastructure applicable to the project, including the location and survey of underground services, dilution pits, silt arrestors, etc, as required. This includes obtaining details of the existing local water

authority Trade Waste Agreement. Where existing information required for the design development is not available, the project team must arrange further investigative works.

Due to the age of the University of Newcastle in-ground infrastructure, it may be a requirement of major refurbishment and new projects to replace existing aged (clay pipe type sewer) with new infrastructure due to failure of the existing pipework systems.

Where new or modified connections to the existing sewer infrastructure are required for the project works, the consultant/contractor must provide an application for connection to either the local water authority or University of Newcastle, dependent upon which party owns the asset. Where required, this must include an application to modify the existing local water authority Trade Waste Agreement to accommodate the revised discharge trade waste into the local water authority sewer.

All sanitary and trade waste discharged to sewer must meet the requirements of the local water authority. Trade waste and dilution pit locations may be required to be relocated due to objectionable odours and/or serviceability.

5.6.2 Design and Installation Criteria

The following general design and installation criteria for sewer/trade waste/sanitary plumbing and drainage must be adopted by the consultant/contractor for all projects.

Item	Sanitary Plumbing & Sewer Drainage Criteria
a. Sewer/Trade Waste Access Chambers and Pits	i. Pits and inspection chambers must be constructed of precast or cast in situ concrete to suit the local water authority requirements. ii. Pits must be fitted with gas tight access covers compatible with gatic lifting keys or approved equivalent methods of lifting. iii. Pit covers must be of Class D rating wherever accessible to any vehicle movement and Class C in all other locations. iv. Pit cover identification plates must be installed on all pit's lids. Identification plates shall indicate the service type (i.e. sewer waste, lab waste, grease arrestor, dilution pit, sewer pump, etc), flow direction, depth, asset number, and downstream diameter. Identification plates shall be brass, epoxy resin screw set flush with the pit cover. v. Where a pit is identified as a confined space, pit covers shall be provided with standard confined space signage vi. Pit covers that accommodate infill paving are acceptable provided the edge of the frame and the cover are each a minimum of 5mm thick with the cast elements extending to the surface of the paving. vii. Covers that utilise edge plates attached to the cast lid to enclose infill paving as the interface between the cover and the frame are not acceptable. viii. Access ladders or step irons must be provided where access to the pit or chamber is required for maintenance purposes ix. Cover lifting keys must be provided. x. Pits or access chambers must be installed at each change in direction of all sewer pipework.

Item	Sanitary Plumbing & Sewer Drainage Criteria
b. Gravity & Pumped Drainage	i. Gravity sanitary plumbing and sewer drainage must be provided for all buildings. ii. Where the depths of fixtures prevent gravity drainage connections to existing infrastructure, pumped drainage may need to be considered. iii. All pumped drainage solutions must be submitted to IFS for approval with sufficient information demonstrating that gravity drainage cannot be achieved. iv. All laboratory sanitary drainage pipework shall be HDPE and include stainless steel-copper pipework for high temperature drains and cooling/dilution pits as required.
c. Sizing	i. All toilet pans minimum 100mm ii. The sanitary plumbing and drainage system must be sized in accordance AS3500, based on fixture loading units with a diversity factor and 20% spare capacity for future loading
d. Venting	i. Modified venting system using relief, group and branch vents must be installed for combined soil and waste stacks. ii. Air Admittance Valves (AAV's) must not be installed on any sanitary drainage and trade waste drainage pipework. iii. Vent exhaust locations are to be kept away from air intakes and extend a minimum of 3m above facility roofs to prevent entrainment in cross wind flows to air intake locations.
e. Drainage Pipework	i. All underground sewer and trade waste drainage must be of minimum nominal size of 100mm. ii. Drainage pipes must be installed in straight runs, with even falls and grades and connections made to prevent pooling and blockages iii. All in ground drainage pipework must be provided with accessible clear-outs and/or pits/access chambers to accommodate general maintenance. iv. Connections between different materials must be mechanical bolted gland joints, using neoprene ring gaskets, or threaded connections. v. Flexible neoprene/rubber connections with worm drive clips must not be accepted. vi. For existing buildings, new pipe work material must match the existing pipe.
f. Stacks	i. Pipework must be concealed in accessible plumbing ducts and ceiling spaces. ii. Access panels to stacks must be adequately sized to enable maintenance to be performed within the shaft. iii. Building wall/ceiling access panels shall be provided to all sewer stack access points.

Item	Sanitary Plumbing & Sewer Drainage Criteria
g. Floor Wastes	i. Floor wastes must be installed in cleaners' rooms, toilets, washrooms, showers, plantrooms and first aid rooms ii. Floor waste grates must be 100mm minimum internal diameter with removable chrome plated brass grate. iii. Floor waste gullies in toilet areas must not be charged from a hose cock.
h. Laboratory Floor Wastes	No open floor wastes are to be provided to rooms and areas classified as wet laboratories.
i. Inspection Openings (I/O's) & Clear-outs (C/O's)	All I/O's and C/O's must be minimum 100mm diameter and installed: i. At the connection to either the University or local water authority sewer infrastructure. ii. Externally adjacent to the building on each branch line entering the building iii. At intervals not exceeding 30m iv. On the downstream and upstream end where any existing drain passes under a building v. Where any new section of drain is connected to an existing drain including a cut into the main line vi. At all junctions and all changes of direction vii. At the base of each stack viii. At each main connection point to the stack at each level of the building ix. All I/O's and C/O's must be fully accessible and where installed in ground, provided with a flush airtight cap installed at the finished surface level. Where installed in soft landscaped surface they must be installed with a 150mm concrete surround. x. Chrome plated airtight C/O caps must be provided within each bathroom at the finished floor level at the start of each drainage line.
j. Trade Waste Drainage	i. Dedicated trade waste drainage must be provided for all commercial and industrial activities as determined by the local water authority, e.g. laboratories, food preparation areas, arts/ceramics studios, mechanical workshops, etc. ii. Existing infrastructure must be fully reviewed prior to increasing trade waste discharges to pre-treatment equipment

Item	Sanitary Plumbing & Sewer Drainage Criteria
k. Trade Waste Pre-Treatment	i. Minimum trade waste pre-treatment requirements are determined by the local water authority. These include local water authority approved pre- treatment equipment for grease traps, dilution pits, bucket traps, basket arrestors, sediment pits, general purpose pits, plaster traps and oil separators ii. The consultant/contractor must determine with the project user group and stakeholders, the detail and quantity of the trade waste discharge in order to determine the size and type of trade waste pre-treatment required for the project. iii. All trade waste pre-treatment equipment must be submitted for approval prior to installation. iv. For ease of service, and replacement, trade waste pre-treatment equipment is preferred to be installed in above ground locations v. For longevity and ease of cleaning, grease traps are preferred to be constructed of polyethylene materials. vi. Additional pre-treatment may be required for specialised laboratories to enable laboratory certification. vii. Specialised requirements for treatment and storage of radioactive liquid waste must be discussed and agreed with the University radiation safety officer, IFS, and the local water authority.
l. Condensate Drainage	i. Separate condensate drainage pipework must be installed for each item of mechanical plant producing condensate. ii. Installed with continuous fall to termination point. iii. Insulated and labelled to termination point. iv. Minimum 25mm diameter. v. Installed in an accessible position. vi. Drainage to external landscape and hardstand areas must be terminated over a gully. vii. Drainage to internal/roof areas must be terminated via a tundish of appropriate size, connected above the water seal of a waste trap and installed 50mm minimum above surcharge point e.g. basin/sink. viii. Condensate recovery to the rainwater re-use system is to be considered for cost effectiveness at the design stage. ix. In-wall tundishes shall be provided for in-ceiling concealed mechanical equipment with a flip lid viewing panel to confirm condensate flow and air gap.
m. HWU Relief Valve Drainage	Hot water unit temperature and pressure relief valve termination point must be via a tundish.

Item	Sanitary Plumbing & Sewer Drainage Criteria
n. Building Management System (BMS)	The following sanitary plumbing and drainage equipment must be connected and monitored by the BMS in real time: i. Sewerage Pumps – run/fault alarms, speed, current. ii. Sewerage Pit – high level alarm & low-level alarm. iii. Site sewerage pumps shall include a 0-100% level and flow rate monitoring.

5.6.3 Equipment and Materials

All equipment, materials and fixtures installed in sanitary plumbing and sewer drainage must where applicable, be approved for use by the local water authority.

Item	Sanitary Plumbing & Sewer Drainage Equipment & Materials
a. Gravity Sanitary Plumbing and Sewer Drainage Pipe Above/Below Ground	i. The IFS Standard Permit to Work Form must be submitted and approved by IFS prior to installing or repairing any pipework located below ground. ii. Best Environmental Practice (BEP) certified UPVC, Class DWV in accordance with AS1260, AS2032 (pipe) & AS3789 (jointing), for pipes equal to and less than 300mm internal diameter and installed no more than 3m deep. iii. Copper Type B in accordance with AS 1432 (pipe) and AS 3688 (fittings), for 2m downstream from hot water units, steam boilers and wherever wastewater may be discharged at above 60^0C. iv. Vitrified Clay Pipes installed in accordance with AS 1741 and approved by the local water authority, for pipe installed greater than 3m deep. v. The pressure class of drainage pipework, jointing methods and pit cover design must be considered in relation to the depth that the pipe is installed to vi. Underground pipe warning tape and trace wire must be installed adjacent to all underground pipes for the full length of the pipe vii. Warning tape is to be made of durable plastic with a minimum width of 300mm and colour to match AS1345 viii. Line marking identification plates must be installed at pipework changes in direction and at 50m intervals. Identification plates shall indicate the service type, flow direction, depth, and diameter. Identification plates shall be brass, epoxy resin screw set flush with the surrounding surface. For services in soft landscaping a concrete fixing block must be provided.
b. Stacks installed external to a building	Copper Type B in accordance with AS 1432 (pipe) and AS 3688 (fittings)
c. Stacks and vents serving toilet areas and internal to a building	Best Environmental Practice (BEP) certified UPVC, Class DWV in accordance with AS1260, AS2032 (pipe) & AS3789 (jointing)

Item	Sanitary Plumbing & Sewer Drainage Equipment & Materials
d. Stacks, vents and drainage for laboratories and trade waste	i. HDPE Pipe and Fittings in accordance with AS4401 (pipe) AS2033 (jointing) and manufacturer's instruction ii. Jointed using butt welding, electric welding sleeves or socket connections with plug in and expansion couplings iii. Geberit or approved equivalent
e. Pumped Drainage	Pressure pipe suitable for proposed pressures
f. Vent pipes installed external to a building	Copper Type D in accordance with AS1432 (pipe) and AS3688 (fittings)
g. Roof penetrations	Install flashing and/or back trays to all pipe penetrations through roofs.
h. Clear outs/Flushing Points	PVC bolted trap screws with brass lid of appropriate size as per manufacturer's instructions
i. Sewage Pumps	i. Sewage pumps must be grinder type pumps installed in pits ii. Dual pump system must be installed with a duty and standby arrangement and auto changeover every 12 hours iii. Supplied by a pump manufacturer as a packaged system complete with control panel iv. Enable removal of one pump while the other is in operation v. Guide rails and lifting devices must be installed in situ to allow the easy removal of the pump from the pit and replacement vi. The pumps must be connected to the BMS to provide monitoring of the status of the pumps and to provide a high-level alarm. vii. An alarm bell must operate on a fault and high-level alarm. The alarm bell must be located in a public area. x. Sewage pumps and control panels must be Grundfos or equivalent as approved by IFS Engineering Staff. xi. Pump control panels shall provide auto/off/manual switches for each pump and a main isolation switch for the controller with traffolyte labelling indicating electrical supply details xii. Pump controllers shall provide indicator lights for each pump indicating power on, pump run, pump fail, high level alarm

5.7 STORMWATER AND SUBSOIL DRAINAGE

5.7.1 General

The stormwater drainage network serving the University of Newcastle campuses are often a complex arrangement of local water authority, Council, Roads & Maritime Services (RMS) and University owned infrastructure. During the design development phase of the project the consultant/contractor must determine the stormwater demand requirements for the project and determine if the existing infrastructure is capable of meeting the project requirements.

The consultant/contractor must allow to investigate and obtain all available details of the existing stormwater infrastructure applicable to the project, including the location and survey of underground

services, on site detention tanks, as required. Where existing information required for the design development is not available, the project team must arrange further investigative works.

Where new or modified connections to the existing stormwater infrastructure are required for the project works, the consultant/contractor must provide an application for connection to whichever party owns the asset.

All stormwater and sub-soil discharges must comply with water quality and discharge rates, in accordance with the local water authority, Local Council DCP for water and flood management, and NSW EPA requirements. Erosion and sediment control plans must be adopted for all new developments and refurbishment projects which affect stormwater runoff.

WSUD principles must be considered for all new buildings and public domain redevelopments in accordance with the University of Newcastle Sustainability Framework document. Rainwater capture and reuse is also to be a major consideration of all new projects.

Overland flow paths, flood mitigation measures and communal on-site detention strategies must be assessed and incorporated as part of all new developments.

Further details regarding roof drainage requirements can be obtained from the IFS Roofing and Guttering Standards.

5.7.2 Design and Installation Criteria

A combination of adequate drainage, tanking and waterproof membranes must be designed and installed to remove the possibility of stormwater and groundwater ingress to all buildings from roofs, gutters, balconies, planter boxes, overland flow paths and seepage.

The following general design and installation criteria for stormwater and sub-soil drainage must be adopted by the consultant/contractor for all projects.

Item	Stormwater & Subsoil Drainage Criteria
a. Roof & Balcony Drainage	i. Downpipes and box gutters sized to drain a 1% AEP storm event. ii. Eaves gutters sized to drain a 5% AEP storm event. iii. Roof and box gutter overflows suitable to relieve runoff from a 200-year average recurrence interval (ARI) storm event. iv. Box gutters are to be avoided. v. Gutters are to include overflows of sufficient size to cater for the full drainage rate of roof plumbing at 1 in 100yr rainfall rates. vi. Preference is for no gutter and spoon drains at ground level OR spoon gutter at roof with major downpipes. vii. Downpipes are not to be concealed within wall structures so that any downpipe leakage/overflow/failure does not allow water ingress to the facility. viii. Failure of any component of the roof drainage system shall be fail safe and drain outside of the facility.

Item	Stormwater & Subsoil Drainage Criteria
b. Stormwater Drainage	i. External stormwater drainage network in areas with sufficient overland flow paths must be sized to drain a 5% AEP storm event ii. External stormwater drainage network in areas with trapped low points with no overland flow paths must be sized to drain a 1% AEP storm event iii. Drainage lines must be laid at a minimum grade of 1%
c. Gravity & Pumped Drainage	i. Gravity roof and balcony drainage must be provided for all buildings ii. Stormwater drainage must not be pumped under any circumstances iii. Where the locations of water capture prevent gravity drainage connections to existing infrastructure, such as sub-soil and seepage drainage connections, pumped drainage may need to be considered iv. All pumped drainage solutions must be submitted to IFS for approval with sufficient information demonstrating that gravity drainage cannot be achieved.
d. Stormwater Access Chambers and Pits	i. Pits and inspection chambers must be constructed of precast or cast in situ concrete to suit the local water authority requirements. ii. Pits must be fitted with access covers compatible with gatic lifting keys, or approved equivalent methods of lifting iii. Covers must be of Class D rating wherever accessible to any vehicle movement and Class C in all other locations. iv. Pit cover identification plates must be installed on all pit's lids. Identification plates shall indicate the service type (i.e. stormwater, sub-soil, seepage, etc), flow direction, depth, and downstream diameter. Identification plates shall be brass, epoxy resin screw set flush with the pit cover. v. Where a pit is identified as a confined space, pit covers shall be provided with standard confined space signage vi. Pit covers that accommodate infill paving are acceptable provided the edge of the frame and the cover are each a minimum of 5mm thick with the cast elements extending to the surface of the paving. vii. Covers that utilise edge plates attached to the cast lid to enclose infill paving as the interface between the cover and the frame are not acceptable. viii. Access ladders or step irons must be provided where access to the pit or chamber is required for maintenance purposes ix. Cover lifting keys must be provided. x. Pits or access chambers must be installed at each change in direction of all stormwater pipework.

Item	Stormwater & Subsoil Drainage Criteria
e. Drainage Pipework	i. All above ground stormwater drainage must be of minimum nominal size of 100mm. ii. All below ground drainage pipework must be of minimum of nominal size of 150mm. iii. Drainage pipes must be installed straight runs with even falls and grades and connections made to prevent pooling and blockages iv. All roof plumbing incorporating close coupling joints must be statically tested. v. Inspection openings must be installed on or below any junction or bend greater than 85^0.
f. Syphonic Drainage	Syphonic drainage will generally not be accepted. Where proposed: i. Syphonic drainage can only be considered on flat roofs with adequate rainheads ii. Syphonic drainage systems must be designed, installed, commissioned, and certified by an approved specialist syphonic drainage contractor, similar or equivalent to Syfon Systems. iii. Syphonic rainwater outlets must be made of robust materials, suitable for the installed location. iv. Outlets must incorporate leaf guards to restrict the entry of debris into the system without restricting the flow. v. Proposed syphonic drainage system must be submitted to IFS for approval complete with manufacturer's warranty and maintenance requirements and budget costing over the life cycle of the equipment.
g. Subsoil/Seepage Drainage	i. Installed below all slabs on ground, at the base of all retaining walls and for all stormwater pits ii. Subsoil/seepage water quality must be sampled to determine if the water quality is suitable to drain to stormwater or requires water treatment. iii. Dish drains with adequate falls and outlets must be installed adjacent to all piled walls to capture subsoil/seepage water iv. Capped flushing points must be provided for all subsoil and seepage drainage systems at the end of each pipe, at 30m spacing and at changes in directions
h. Inspection Openings (I/O's) and Clear-outs (C/O's)	I/O's and C/O's must be a minimum of 100mm diameter provided at every junction, bend, change of direction and at the base of all downpipes immediately above where the downpipe penetrates the ground or slab on ground

5.7.3 Equipment and Materials

All equipment and materials installed in stormwater and sub-soil drainage must where applicable, be approved for use by the relevant local water authority as outlined in appendix 2.

Item	Stormwater and Subsoil Drainage Equipment & Materials
a. Stormwater Drainage Pipework Below Ground	i. The IFS Standard Permit to Work Form must be submitted and approved by IFS prior to installing or repairing any pipework located below ground. ii. Best Environmental Practice (BEP) certified UPVC, Class DWV in accordance with AS1260, AS2032 (pipe) & AS3789 (jointing), for pipes less than 300mm internal diameter and installed no more than 2.5m deep to the invert of the pipe iii. Class 4 Precast Reinforced Concrete Pipes with rubber ring joints in accordance with AS1342, for pipes equal to or greater than 300mm internal diameter or installed greater than 2.5m deep to the invert of the pipe iv. Class 4 Fibre Reinforced Cement Pipe (FRC) with rubber ring joints to suit AS4139, and AS3725, for pipes with internal diameters between 300mm & 600mm and installed greater than 2.5m deep to the invert of the pipe v. The pressure class of drainage pipework, jointing methods and pit cover design must be considered in relation to the hydraulic grade line and depth that the pipe is installed to. vi. Underground pipe warning tape and trace wire must be installed adjacent to all underground pipes for the full length of the pipe vii. Warning tape is to be made of durable plastic with a minimum width of 300mm and colour to match AS1345 viii. Line marking identification plates must be installed at pipework changes in direction and at 50m intervals. Identification plates shall indicate the service type, flow direction, depth, and diameter. Identification plates shall be brass, epoxy resin screw set flush with the surrounding surface. For services in soft landscaping a concrete fixing block must be provided.
b. Internal Gravity Stormwater Downpipes	i. Best Environmental Practice (BEP) certified UPVC, Class DWV in accordance with AS1260, AS2032 (pipe) & AS3789 (jointing) ii. HDPE Pipe and Fittings in accordance with AS4130 (pipe) AS2033 (jointing) and manufacturer's instruction
c. External Gravity Stormwater Downpipes	Stainless steel Colourbond downpipes in accordance with AS1432 (pipe) and AS3688 (fittings). Architectural and aesthetic choice will typically drive selection. Preference is for painted PVC, Colourbond and consideration needs to be given to the environment of the installation (e.g. corrosion protection in coastal locations)

Item	Stormwater and Subsoil Drainage Equipment & Materials
d. Syphonic Drainage Pipework	i. HDPE Pipe and Fittings in accordance with AS4130 (pipe) AS2033 (jointing) and manufacturer's instruction ii. Jointed using butt welding, electric welding sleeves or socket connections with plug in and expansion couplings iii. All pipe and fittings must be verified by the approved specialist syphonic drainage contractor
e. Subsoil Drainage Pipework	i. Factory slotted HDPE, minimum 100 diameter SN8 class, similar or equal to Vinidex Draincoil, for installation to a maximum depth of 2 metres ii. Best Environmental Practice (BEP) certified UPVC, factory slotted, minimum 100 diameter, in accordance with AS1260, AS2032 (pipe) & AS3789 (jointing) iii. Installed on geotextile fabric with 150mm surround of 25mm blue metal aggregate. iv. Subsoil drainage pipework must be installed with a filtersock v. Joined with solvent cement joints
f. Pumped Drainage Rising Mains	Pressure pipe suitable for proposed pressures
g. Inground Stormwater Structures	i. Stormwater pits, kerb entry pits, sumps and grated drains must be precast or cast in situ concrete. ii. Access ladders or step irons must be provided where access to the pit or chamber is required for maintenance purposes iii. Frames, covers and gratings for pits, sumps and drains must be provided to suit Class D duties. iv. Cover lifting keys must be provided. v. On site detention tanks shall not contain any maintainable filters or equipment associated with water quality control measures, other than the trash screen on the OSD discharge pipe. vi. Preferred structures to achieve water quality control measures include pit screens and filtration, GPT's and Humes Jellyfish. vii. WSUD structures to achieve water quality control measures include bio retention swales and rainwater gardens

Item	Stormwater and Subsoil Drainage Equipment & Materials
h. Subsoil Pumps	i. Subsoil pumps must be submersible type installed in pits ii. Dual pump system must be installed with a duty and standby arrangement and auto changeover every 12 hours iii. Supplied by a pump manufacturer as a packaged system complete with control panel iv. Enable removal of one pump while the other is in operation v. Guide rails and lifting devices must be installed in situ to allow the easy removal of the pump from the pit and replacement vi. The pumps must be connected to the BMS to provide monitoring of the status of the pumps and to provide a high-level alarm. vii. An alarm bell must operate on a fault and high-level alarm. The alarm bell must be located in a public area. viii. Subsoil pumps and control panels must be Grundfos or approved equivalent. ix. Pump control panels shall provide auto/off/manual switches for each pump and a main isolation switch for the controller with traffolyte labelling indicating electrical supply details x. Pump controllers shall provide indicator lights for each pump indicating power on, pump run, pump fail, high level alarm
i. Grated Drains	i. Made of robust materials suitable for the installed location ii. Grating sizes and materials must be assessed to maximise drainage potential but eliminate WHS issues relating to slips, trips and falls. iii. Grates must be fixed in position to reduce potential vandalism but must enable easy removal via a key or tool to allow maintenance and replacement. iv. Grates in high pedestrian areas shall be heel guard type. v. Grates in all roads and cycle paths shall be bicycle safe type
j. Rainwater Outlets (RO's)	i. Circular RO's to be minimum 260mm diameter ii. Square RO's to be minimum 200mm square iii. All RO's to be provided with guards to prevent the ingress of litter, gravel, and leaves.

5.8 NATURAL GAS SERVICES

5.8.1 General

During the design development phase of the project the consultant/contractor must determine the gas supply demand requirements for the project and determine if the existing infrastructure is capable of meeting the project requirements

The consultant/contractor must allow to investigate and obtain all available details of the existing infrastructure, including the location and survey of underground services, as required. Gas supply enquiries must be submitted to the University, and the nominated gas retailer, as required for the project, and all fees and charges applicable for this information must be allowed for. Where existing information required for the design development is not available, the project team must arrange further investigative works.

New Projects may be planned as gas free to improve Green Star rating.

Where new connections to the existing gas supply infrastructure are required, the consultant/contractor must confirm details of the proposed consumption for all gas appliances being installed under the project works in conjunction with assessing the metering pressure available. These details must be submitted to Jemena and the University to ensure the incoming gas service, meter/sub-meter and regulator assembly is capable of providing the required consumption.

Where new gas regulators, gas meters or sub-meter assemblies are required to be installed under the project, the consultant/contractor must pay all costs associated with the supply and installation of the equipment as required for the project works.

5.8.2 Design and Installation Criteria

The natural gas service must be designed and installed to suit the requirements of the University of Newcastle and Jemena.

The following general design and installation criteria for natural gas services must be adopted by the consultant/contractor for all projects.

Item	Natural Gas Services Criteria
a. Gas Pressure	i. High and medium pressure gas supply must not be installed internally within a building without prior approval from IFS. ii. Under and over pressure shut off regulators must be installed to suit Jemena requirements to reduce high pressure to low pressure gas supplies. iii. Vent pipes from gas regulators must be installed and terminated in locations approved by Jemena.
b. Gas Supply Metering	i. High and medium pressure gas metering assemblies must be installed externally to the building in accordance with Jemena requirements. ii. Each building must have its own University low pressure gas sub-meter assembly iii. Gas meters are typically diaphragm type meters. iv. Connection to the EMS for all gas metering is to be provided v. All gas meters connected to EMS must be assessed as either hazardous or non-hazardous for electrical installations, by an accredited hazardous area assessor. Written classification of each hazard assessment must be provided prior to connection to the EMS. vi. All gas meters assessed as hazardous must be provided with intrinsically safe devices in accordance with Jemena requirements vii. All gas meters connected to the EMS by mains powered devices shall include an intrinsically safe barrier supplied by the electrical/BMS/EMS/mechanical trade.
c. Service Isolation	i. Provide individual gas service isolation points that enable isolation of each gas supply to each building. ii. Isolation points must not interfere with the provision of gas services to adjoining buildings

Item	Natural Gas Services Criteria
d. Laboratory Isolation	i. Provide isolation valves for all gas supplies to each laboratory. ii. Isolation points are to be located at the entry to the laboratory and be clearly labelled. iii. All teaching laboratories are to be fitted with a master isolation switch for gas supplies. Contact the University of Newcastle for further details
e. Purging	All gas pipework must be purged with nitrogen in accordance with the Authorities requirements
f. Gas Heaters Appliances	i. All gas appliances other than cooktops and ovens must be flued to the outside of building. ii. All gas appliances must be provided with flame supervision devices
g. Cooktops	Gas cooktops and ovens must include flame supervision devices on each burner
h. Automatic Gas Shutdown Devices	i. Automatic gas shutdown devices connected to fire alarm systems must not be provided unless required by statutory requirements ii. The provision of flame supervision devices on all gas appliances is proposed to remove requirements for automatic gas shutdown in fire mode iii. Where these devices are required by code, they must include UPS backup and alarm to BMS in trip state

5.8.3 Gas Metering

Each building must be provided with its own Jemena meter and/or University owned sub-meter assembly. All meters must be rated for revenue billing in commercial applications in addition to being suitable for monitoring of complex gas supply networks.

All meter and sub-meter assemblies installed must be “smart meter” type with multiple pulsed outputs for increased real time data to provide water management information. These meter assemblies must be compatible for connection to the EMS via a set of voltage free contacts.

Meters must be suitable for measuring bulk flows of natural gas.

Sub-meter assemblies must be installed within the building to measure gas supplies for the following systems/areas:

a. Centralised Potable Hot Water Systems
b. Centralised Non-potable Hot Water Systems
c. Heating Hot Water Boilers and Humidification/Dehumidification Equipment
d. Steam Boilers
e. Laboratory Supplies
f. Commercial Kitchens/Communal Kitchens in Student Accommodation facilities
g. Spaces proposed for tenancy leasing agreements

Where meter assemblies are connected directly to the Jemena gas supply network, the contractor must make application to and pay for all fees for Jemena to supply a new meter assembly. Where a Jemena meter is installed, a private meter is to be installed on the facility side and monitored by the EMS.

Gas meters must be installed in fully accessible positions to allow for easy reading and servicing. Individual isolation valves must be provided for each gas meter assembly.

The consultant/contractor must coordinate the location, meter type and data output with other building services consultants/contractors to ensure the installed meters are fully compatible with the EMS and adequate communication network connection points have been provided.

All new gas meters and sub-meters must be connected to the EMS. Allowance for modifications to, EMS programming, including meter hierarchy must be included for all new meters and sub-meters.

5.8.4 Equipment and Materials

All equipment and materials installed in natural gas systems must where applicable, be approved for use by UoN and Jemena.

Item	Natural Gas Equipment & Materials
a. Pipework Above Ground	i. Copper Type B in accordance with AS 1432 (pipe) AS 3688 (fittings) ii. The use of non-metallic gas supply pipe in above ground locations will not be accepted.
b. Pipework Below Ground	i. The IFS Standard Permit to Work Form must be submitted and approved by IFS prior to installing or repairing any pipework located below ground. ii. Copper Type B in accordance with AS 1432 (pipe) AS 3688 (fittings) iii. Nylon tube in accordance with AS2944.1 (pipe) and AS 2944.2 (fittings), Class 400 iv. To suit pressure and service in accordance with AS 5601-2010 and Jemena Network Operating Rules v. All metallic pipes installed underground must be installed in green polyethylene sleeve protection bag vi. Underground pipe warning tape and trace wire must be installed adjacent to all underground pipes for the full length of the pipe vii. Warning tape is to be made of durable plastic with a minimum width of 300mm and colour to match AS1345 viii. Line marking identification plates must be installed at pipework changes in direction and at 50m intervals. Identification plates shall indicate the service type, flow direction, depth, and diameter. Identification plates shall be brass, epoxy resin screw set flush with the surrounding surface. For services in soft landscaping a concrete fixing block must be provided. ix. The use of alternative non-metallic pipe in underground locations will not be accepted without prior approval from IFS.

Item	Natural Gas Equipment & Materials
c. Copper Jointing	i. Silver soldered joints for all pipe sizes. ii. Viega Propress G compression fittings for copper pipe sizes equal to or less than 65mm diameter using specialised pressing tools in accordance with the manufacturer's instructions, for above ground applications only iii. High pressure system 15% silver solder iv. Medium/Low pressure systems 5% silver solder for other services v. Minimum 6mm lapped joints vi. Joints must be made from preformed copper tees. Site or factory fabricated copper tee joints are not permitted vii. The use of alternative compression press fittings will not be accepted without prior approval from IFS.
d. Nylon Tube Jointing	Adhesive joints as per manufacturers requirements
e. Exposed Pipework Valves and Fittings	Must be chrome plated wherever they are exposed outside of plant areas.
f. Gas Valves	i. Spherical ball type in accordance with AS4617 ii. Up to and including 50mm diameter must be screwed type iii. Above 50mm diameter must be flanged type
g. Flues	i. Stainless steel flue pipes must be installed to all gas appliances with flues ii. Flue cowls must be installed to all flues

5.9 SANITARY FIXTURES, TAPWARE AND ASSOCIATED EQUIPMENT

5.9.1 General

All sanitary fixtures and tapware installed must incorporate a high level of water efficiency. Water saving devices must include aerated tap fittings, water flow restriction devices, dual flush toilets, low flush urinals and high efficiency showerheads.

Fixtures and tapware installed must be low maintenance with a design life expectancy of 25 years.

All fixtures, tapware and appliances are to have the Watermark approved certification and be provided with full product support, including spare parts and technical assistance, within the local area.

The requirements for sanitary fixtures, tapware and associated equipment must be read in conjunction with the architectural room data sheets. Where inconsistencies between the equipment specified in the room data sheets and the requirements of this standard exist, the requirements of this standard shall take precedence.

5.9.2 Equipment and Materials

All materials must be first quality and the best of their respective kinds. Second quality or inferior materials must be rejected. All costs associated with replacement of rejected materials must be the contractor's responsibility.

The following materials must be specified and installed.

Item	Sanitary Fixtures, Tapware and Associated Equipment and Materials
a. Toilet Suites (Cistern, Pan & Seat)	i. Close-coupled or wall faced design with exposed cistern. ii. 4.5/3 litre dual flush system with a minimum WELS 4 Star Rating. iii. Cisterns must be fitted with a vandal resistant conversion kit allowing the lid to be locked onto the cistern. iv. Cisterns must be accessible for maintenance by way of an accessible void. v. In-wall concealed cisterns are to be avoided, but if utilised they shall include a minimum of 400mm x 400mm access and a stainless-steel cover plate for servicing. vi. Compliant for use with rainwater re-use systems. vii. Gravity flush cisterns shall typically be utilised. If mains flush cisterns are required due to high volume of use and refill rate, then special consideration needs to be given to device locations (control valves etc) for ease of maintenance and serviceability. viii. White in colour. ix. Seat must be vandal resistant. x. Similar or equal to Caroma Caravelle 2000. xi. Silicon sealant to be provided around the pan and cistern in a colour to match the surrounding tiles. xii. Pans to be sufficiently fixed to prevent substantial movement.
b. Accessible Toilet Suite (Cistern, Pan and Seat)	i. Dual flush and have a minimum WELS 4 Star Rating ii. Compliant for use with rainwater re-use systems iii. White in colour. iv. Compliant with AS 1428.1 v. Similar or equal to Caroma Care 400
c. Urinal Suite	i. Minimum WELS 6 Star Rating ii. Smart demand urine sensing flushing system iii. Where sensor flushing controls and power supply units are located within walls or inaccessible ducts, a screwed, minimum 400mm x 400mm, stainless-steel panel must be provided adjacent to the urinal to enable access for maintenance and replacement iv. Compliant for use with rainwater re-use systems v. White in colour vi. Ceramic in material vii. Waterless urinals will not be accepted viii. Similar or equal to Caroma Cube 0.8L Electronic Activation Urinal Suite
d. Concealed Cisterns	i. Where concealed cisterns are proposed to be installed within walls or inaccessible ducts, a screwed stainless-steel panel (min 400mm x 400mm) must be provided above the pan or urinal to enable direct access to the cistern for maintenance and replacement ii. Cisterns must not be mounted in ceiling spaces iii. Cisterns must be accessible for maintenance by way of an accessible void

Item	Sanitary Fixtures, Tapware and Associated Equipment and Materials
e. Flusherette Valves	i. 4.5/3 litre dual flush system with a minimum WELS 4 Star Rating ii. Where flusherette valves are proposed to be installed within walls or inaccessible ducts, a screwed stainless-steel panel (min 400mm x 400mm) must be provided above the pan or urinal to enable direct access to the valve for maintenance and replacement. iii. Similar or equal to Puce concealed dual flush valve
f. Basins	i. Single taphole ii. Ceramic in material iii. Overflow as standard
g. Accessible Basins	i. Refer to basin's details above ii. Compliant with AS 1428.1
h. Cleaners Sink	i. Ceramic in material ii. Nominal size of 575mm x 435mm iii. Fitted with heavy chrome plated brass hinged grating iv. Installed directly below wall mounted hot and cold taps v. Similar or equal to Caroma Cleaners Sink
i. Tapware	i. Minimum WELS 5 Star Rating ii. Water outlets must be of the aerated type iii. Valves are to be of jumper type iv. Bright chrome plated only v. In high use public/student use areas, cold water push button timed operation tapware must be installed to all basins vi. In staff areas hot and cold water must be supplied via mixer tapware to all basins, kitchens and tea making facilities vii. Electronic sensor taps will not be accepted for general use.
j. Accessible Tapware	i. Refer to tapware details above ii. Compliant with AS 1428.1
k. Shower Facilities	i. WELS 3 Star Rating (>6l/min but <7.5l/min) ii. Shower facilities must be provided for each building greater than 1000^2m GFA. iii. The number of shower facilities provided must be on a sliding scale determined by the number of bicycle storage facilities required under statutory planning regulations and the University of Newcastle Sustainability Framework document.
l. Laboratory Sinks	i. Stainless steel 316 acid resistant. ii. The university Project Manager to liaise with client on plug and waste needs

Item	Sanitary Fixtures, Tapware and Associated Equipment and Materials
m. Laboratory Tapware	All laboratory basins and sinks are to be provided with: i. Lever/elbow action tapware for hot and cold-water supplies ii. Electronic sensor taps will only be accepted in high risk laboratory areas such as PC2 and radiation facilities or similar iii. Electronic sensor tapware must be battery operated (with long life battery, i.e. > 2 years) or rechargeable type. iv. Sensors for all electronic tapware must be adjusted so that the tap only operates water flow when hands are placed directly under the spout.
n. Safety Showers/Eye Wash	i. Combined hand operated stainless-steel safety shower/eyewash facilities must generally be installed. ii. All combined safety shower/eyewash facilities must be complete with an adequately sized and positioned bowl to capture and drain the water when the eyewash is in use. iii. Floor wastes shall be provided under all safety showers. iv. Where laboratory layouts do not allow combined safety shower/eyewash to be installed, an adequately sized handwash basin must be installed under the eyewash to capture the water when in use. v. Tempered water shall be provided to all eye wash and safety showers. vi. A recessed stop valve must be provided to each safety shower/eyewash facility to enable isolation of the individual unit without affecting the potable water supply to other fixtures. vii. All safety shower/eye wash systems must be Enware, or approved equivalent
o. Combined Boiling/ Chilled Water Units	i. Each kitchen/tea making facility must be provided with a combined boiling/chilled water unit. ii. The tap supplying the boiling/chilled water must be located over a sink. iii. The under-sink control cabinet must be located within one metre of the tap, it must be adequately ventilated and provided with sufficient clearance around all sides of the cabinet.
p. Dishwashing and Washing Machines	i. Minimum WELS 5 Star Rating ii. Have anti flood technology in order to prevent water damage of premises
q. Hand Driers	i. Hand driers must be installed in all student/public bathrooms.

5.10 EQUIPMENT LABELLING AND IDENTIFICATION

5.10.1 Below Ground Services

All underground services to have marking tape of correct distances above pipework complying with relevant Australian Standards for that service. Where the service is non-metallic, provide a tape incorporating locating wire.

An independent trace wire is to be provided for all underground non-metallic pipework installed adjacent to the pipe. The trace wire is to be a minimum of 2.5mm^2 diameter, insulated electric cabling, and rising up and attached to pipework above ground so as to allow easy identification and use by cable location contractors. These are also to be run though pits to allow for additional connection locations.

5.10.2 Above Ground Services

All pipework must be labelled with adhesive pipe markers indicating pipe contents or system type and directional arrows indicating flow. Markers must be installed at a minimum of every five metres. Labelling must not be restricted only to close proximity of access panel openings.

Covered/louvred enclosures shall be provided to minimise aesthetic impact of major service items housed above ground.

5.10.3 Asset Labelling and Barcoding

Equipment must be provided with asset labels and bar codes. Asset numbers will be determined by IFS to ensure that they are unique to the university asset database. Equipment that require this include but are not limited to:

- Backflow Prevention Devices
- Control Panels
- Thermostatic Mixing Valves
- Tempering Valves
- Domestic hot water units
- Ultra Violet Sterilisation Systems
- Dishwashers
- Drinking Water Units
- Emergency Showers & Eyewash stations
- Natural Gas Valve Safety Isolation Trip Systems
- Urinal Flushing Systems
- Hot water generators
- Ice Machines
- Motor Control Centre Boards
- Metering devices
- Sewer Pumps
- Potable boiling &/or chilled water units
- Stoves
- Tanks
- Cold water boost pumps

Complete assetting procedures are detailed in the document “UON Project Handover Guideline v.1.5” which is part of the UON Handover Pack.

5.11 PIPEWORK INSTALLATION

5.11.1 Below Ground Pipework

All pipework and services installed below ground must be fully surveyed and documented in accordance with the details required for Quality Level A, as per AS5488-2019 – Classification of Subsurface Utility Information (SUI).

The IFS Standard Permit to Work Form must be submitted and approved by IFS prior to installing or repairing any pipework located below ground.

For further details and requirements of all pipe installations below ground, please refer to the IFS Excavation Guidelines.

CCTV recordings of below ground sewer, stormwater and sub-soil drainage pipework and structures, including pits, reflux valves, detention tanks, gross pollutant traps, jellyfish, etc, must be provided prior to practical completion.

5.11.2 Above Ground Pipework

All pipe work chased into masonry walls must not cross any movement joint and must be provided with sufficient insulation so that expansion and contraction can take place without damage to pipe work or to the surrounding element and its surface finish.

5.11.3 Pipe Supports and Fastening

Spacing of pipework supports must be installed to suit:

a. AS3500.1. Table 5.2 Spacing of Brackets and Clips
b. AS3500.2 2003. Table 9.1 Maximum Spacing of Brackets, Clips and Hangers.
c. AS3500.4 Heated Water Services
d. every 2 metres for pipework greater than or equal to 100mm in diameter
e. located to separately support valves within pipework of 200mm or greater.
f. pipe manufacturers requirements

Inlet and outlet pipework serving pumps and other hydraulic equipment must not be used to support the equipment. All equipment must be adequately supported independently of the inlet and outlet pipework supports.

Materials for pipework supports must be as follows.

Item	Support Type
Channels	Use purpose made galvanised mild steel channel equal to Unistrut or approved equivalent, complete with purpose made fittings. Provide plastic end caps on exposed brackets.
Insulation Barrier	Use purpose made wooden block barriers between steel clamps and copper / steel / PVC-U pipes.
Fasteners	Galvanised bolts, nuts, and washers of adequate size,

Pipe Hangers rod diameters must be as follows:

Pipe Diameter (mm)	Rod Diameter (mm)
15-25	8
32-50	10
65-100	15
150-200	20
225-450	25

Heater supports to be Baytak type, or approved equivalent, of appropriate size.

Masonry fixings must be Dynabolt type, or approved equivalent, expanding type or chemical anchors, installed in accordance with manufacturer's instructions.

Timber fixings must be stainless steel coach screws. Use of explosive type fixings must not be permitted.

5.11.4 Core Holes and Sleeves

Details of all proposed core holes in floors, walls, beams, and columns must be checked and approved by a structural engineer prior to coring the hole.

All pipework passing through a core hole or masonry/concrete wall or floor must be provided with a 0.6 mm thickness sheet copper sleeve having a grooved and seamed joint. Sleeves must be cylindrical having a diameter to provide a 25mm gap all around the pipe passing through the sleeve. Alternatively, copper tubing may be used as the sleeve if a 25mm gap around the pipe can be achieved. Each pipe passing through the sleeve must be positioned centrally in the sleeve to ensure the annular space between the pipe sleeve is equal and round.

Fire rating of all pipework penetration must be installed to comply with all statutory requirements. For further information regarding fire rating of pipe penetrations, refer to the IFS Fire System Specification.

5.11.5 Corrosion Protection and Finishes

All surfaces exposed or susceptible to corrosion will be suitably painted, including external surfaces of all machinery, apparatus, equipment, fittings, tanks, vessels, and services including supports, hangers, and brackets.

Ferrous metal exposed to the atmosphere or in humid conditions is to be hot dip galvanised having a minimum coating thickness 0.1mm. Hot dip galvanising must be carried out after all welding, cutting, drilling and swarf removal has been completed. The university will not accept cold galvanising process.

All metallic pipework with supports of an alternate material (e.g. copper pipe / galvanised steel supports) shall include isolation/insulation rubber to separate the dissimilar metals and not support corrosion. Plastic dipped saddles shall be used, painted only is not acceptable.

Surfaces that must not be painted include:

a. All fibreglass and plastic surfaces.
b. Chrome plated and stainless-steel surfaces.
c. Bearing surfaces, slides, adjusting screws and any surface that is required to be unpainted for the correct operation or adjustment of the equipment.
d. Flexible duct connections to plant, rubber or canvas hoses, flexible rubber mountings and any other non-metallic flexible connections.
e. Piping where installed in ceilings, trenches, underfloor, and similar concealed spaces mustnot be painted throughout their entire length but must be labelled with identification bands. However, steel piping installed in damp conditions in any of the above must be hot dip galvanised.
f. Bare copper tanks.
g. Motor and equipment nameplates.
h. Hot water or, convection heaters, unit heaters, etc, are to be pre-finished with Colorbond, powder coated or equivalent, otherwise painted to gloss finish of selected colour or colours to match the surroundings.

5.11.6 Acoustic Performance of Hydraulic Pipework

All hydraulic services must comply with the acoustic requirements of NCC through a combination of treatment to building elements and system pipework.

Acoustic treatment of all hydraulic services requires assessment and certification from a qualified Acoustic Engineer.

6 COMMISSIONING

Comprehensive pre-commissioning, commissioning and quality monitoring must be specified by the consultant/designer. A project specific commissioning plan is to be developed and provided to the University for review and approval. Detailed testing and commissioning records must be provided for each system and each component as appropriate. All such records must be witnessed and verified by the project consultant/head contractor. Project hand over inspection and testing plans (ITP's) must be developed by the consultant/contractor to allow the system to be handed over to the University.

7 SAFETY IN DESIGN

The contractor must consider risk during the design. A design safety report must be submitted to the relevant IFS Project Manager for every design project. Contractors must confirm, so far as it is reasonably practicable, that the structure is without risks to health and safety.

Design risks must be considered for the asset lifecycle covering construction, operational and maintenance, refurbishments, and decommissioning.

The design safety report must include the following:

a. Description of design element.
b. Description of potential risks and hazards associated with the design element.
c. A low/medium/high risk assessment considering likelihood and consequence.
d. Proposed measures to eliminate risks where practicable.
e. Control measures to mitigate and manage design risks.
f. Nominating responsibilities for managing the design risks.

This may be provided as a design risk register where appropriate and must include results of any calculations, testing and analysis etc.

8 DOCUMENTATION AND RECORDS

All documentation must be provided by the consultant/contractor in both electronic and hard copy formats and approved by the University.

8.1 DESIGN DOCUMENTATOION

Prior to commencing construction of new or refurbishment projects, the consultant/contractor must fully investigate and document the requirements for each hydraulic services system required to be installed, altered, or modified as part of the project works.

This must include:

a. Return Brief defining the systems proposed and any deviations from this standard.
b. Calculations to be provided on the sizing of the pipe work. Future allowances are to be included in these calculations\sizing.
c. Calculations & selections on the proposed equipment.
d. Budget calculations.

e. Provision of Design Certification of each essential fire safety measure.
f. Requests for all variations to this Standard submitted in writing
g. Complete the Design & Construct checklist

8.2 COMPLETION DOCUMENTATION

At the completion of all projects, the following documentation must be provided for each hydraulic services system installed or altered as part of the project works:

a. O&M manual(s)
b. As-built drawings (including schematics)
c. Asset schedules and labelling (as per the Asset Identification and Labelling Standard)
d. Commissioning test results and certificates of compliance for the following:
    i. All plumbing, drainage, gas fitting and LPG work.
    ii. Fire collars and penetrations
    iii. Stormwater drainage
    iv. Backflow prevention devices
    v. Thermostatic Mixing Vales
    vi. Pressure and Flow tests
    vii. Rainwater tanks
    viii. Boost pumps
    ix. Hot water systems
    x. Gas equipment
    xi. Safety showers/eye wash
    xii. Tempering valves and thermostatic maxing valves
    xiii. Solar pre-heat systems
    xiv. Backflow prevention devices
    xv. Fire water boost pumps
e. Product manufacturer specific information
f. Fully surveyed and documented underground services drawings depicting all as built water, drainage and gas pipework and services, to suit Quality Level A information, in accordance with AS5488-2013 Classification of Subsurface Utility Information (SUI)
g. CCTV Recording - provide on completion of all drainage lines a CCTV video complete with mark-up drawings relating to CCTV tape, i.e.: drawing to relate to sequence of taping (e.g. Run # 1: Pan 6 to Main Line, Run #2: Main Line to Junction, compass directions etc and as directed).
h. Warranty schedules for all major items of equipment, including but not limited to tanks, storage vessels, pumps, HWU's, solar panels, water filtration plant, sanitary fixtures, tapware, grease traps, gross pollutant traps, etc.
i. Maintenance requirements for all items of equipment
j. Building User Guide
k. Supply authority completion forms and inspection records
l. Installers Statutory certificates

9 OPERATIONS

9.1 MATERIALS AND EQUIPMENT SELECTION

Only new materials, equipment and components will be installed, and these must be of good quality, fit for purpose and selected to minimise life-cycle costs and maximise efficiency. All products must be supported locally and internationally by factory trained service networks. All spare parts must be available ex-stock factory for a period of 10 years from purchase date. Equipment and materials that are obsolete, discontinued, about to be discontinued or superseded, must not be installed.

Uniformity of the type of materials must be consistent throughout all individual installations and must match, or be fully compatible, with the existing equipment.

Details of all major items of hydraulic services equipment proposed to be installed during new or refurbishment projects must be submitted to IFS for approval prior to installation. This will include, but is not limited to pipe material selection, pumps, water storage tanks, pits, hot water plant, syphonic drainage systems, rainwater re-use filtration systems and sanitary fixtures and tapware.

Identification of a proprietary item of equipment will not necessarily imply exclusive preference for the item identified but indicates a deemed-to-comply item and provides the baseline of quality, function, and performance. It will be at the discretion of the University of Newcastle as to whether alternatives will be considered and adequately detailed information will be required to prove equivalence with nominated products.

9.2 SERVICE ACCESS REQUIREMENTS

The following servicing and access requirements must be provided:

a. Position all equipment and arrange access provisions at equipment, to optimise future maintenance and repairs.
b. Service access doors and panels must be hinged and lockable with a University plantroom surrogate key (SK). Lift off panels with screw fixings are not acceptable.
c. The University will not accept major plant within ceiling spaces and plant in tight spaces. Plant that is located in ceiling space must have free and easy access. This includes ability to service and replace system without reaching around or over columns, beams, cable trays, pipe work, lights, and duct work
d. All motors are to be provided with isolators within 3 meters distance from motor. Isolators must be labelled with details of the source of electrical supply (DB/CB).
e. A plus 20% additional dimension access allowance is to be provided for above the manufacturers access requirements
f. Major plant located above 3m height will have permanent stair/ladder access provisions with permanent workable platform
g. Trip hazards to be identified and painted in yellow
h. Electrical hazards must be identified and labelled appropriately
i. Confined spaces to be noted and appropriate signage applied
j. Fixed switchable lights are to be provided in all areas where essential fire safety measures are installed
k. Access to plant and equipment must comply with all WHS regulations

9.3 REDUNDANT EQUIPMENT

All redundant hydraulic services systems and equipment and associated services (power, water, drainage, etc) must be removed as part of the project. Building surfaces and finishes must be made good wherever redundant services are removed. Where a service is unable to be removed appropriate tags and labelling shall be installed to indicate the service is redundant.

9.4 INTERRUPTION TO HYDRAULIC SERVICES

Interruption to hydraulic services must be planned to minimise disruption to existing services and University operations.

Where hydraulic services shutdowns are proposed, contractors must arrange to provide temporary connections to ensure operational areas of the University are not unduly affected. In cases where temporary connections cannot be achieved, shutdowns must occur outside of University operating hours.

Hot tapping and pipe freezing of University hydraulic service infrastructure will not be accepted unless authorised by IFS.

10 AUTHORISATION OF VARIATIONS

Project managers, consultants, contractors, commissioning agents and facilities maintenance personnel must ensure compliance with these requirements is achieved.

Variations to this standard must only be considered where:

a. the University Standard's requirement cannot physically or technically be achieved.
b. the alternative solution delivers demonstrated and proven superior performance for the same capital and life cycle cost or better.

Consultants and contractors must identify and justify requirements of the standard that do not apply to the project or which need to be varied. The issuer of this standard or their delegated authority must review and consider requirements of stakeholders from clients, projects, and facilities management before deciding whether to approve variations. Their formal sign-off is required for acceptance of any non-compliances and departures from this standard's requirements.

11 QUALITY CONTROL

11.1 DESIGN STANDARD COMPLIANCE

Compliance with requirements of this standard must be checked throughout the design, construction and commissioning phases of projects by IFS' services consultant. Any issues or deviations from this standard must be reviewed and approved in writing by the issuer of this standard.

Competent IFS consultants and representatives must check compliance with this standard during design reviews and formal site inspections. Any non-conformances with requirements of this standard must be documented and provided to the IFS Project Manager for issue to contractors and their consultants.

Project Managers must maintain a formal register of non-conformances and manage close out of outstanding non-conformances. Contractors and their consultants issued with non-conformances must take appropriate corrective actions. The IFS Project Manager must ensure:

proposed corrective actions are implemented

close out of non-conformances in relation to this standard is formally approved and signed off by the author of the standard or their delegate

11.2 DESIGN STANDARD CERTIFICATION

Contractors and consultants must certify compliance to the design standard at each of the following project phases:

a. Design and Documentation
b. Tender
c. Construction

Notwithstanding IFS' internal quality control processes, contractors and their consultants must implement their own robust quality assurance and control procedures to ensure compliance with requirements of this standard.

11.3 CONSTRUCTION COMPLIANCE

Consultants and contractors are expected to include check sheets for each system component detailing each item that needs to be checked, tested, and verified during the installation process. Such check sheets must be completed and verified by the project consultant/contractors, including the identification of any defects and the closing out of such defects.

11.4 ACCEPTANCE

The University will only accept projects as complete when all of the above have been carried out, submitted, and verified.

12 REFERENCES

Design, documentation, and installation utilising these standards is to incorporate the requirements of the following Authorities, and all associated Legislation, Regulations, Codes, Rules, Guidelines and Australian Standard requirements:

a. National Construction Code
b. National Plumbing Code
c. NSW Environmental Planning & Assessment Act & Regulation
d. NSW Plumbing and Drainage Act & Regulation
e. Work Health & Safety Act & Regulations
f. All University of Newcastle Standards
g. University of Newcastle Sustainability Framework Document
h. Office of Gene Technology Regulator (OGTR) Guidelines
i. Department of Primary Industries
j. Department of Fair Trading
k. Work Cover Authority
l. Environmental Protection Authority
m. The Local Water Authority
n. Jemena Limited
o. Department of Planning and Infrastructure
p. Local Council Authority

q. NSW Department of Health
r. Roads and Maritime Services
s. AS/NZS 3500 Plumbing and Drainage
t. AS5601 Gas Installations
u. AS3814 Industrial and Commercial Gas Fire Appliances
v. AS4032 Thermostatic Mixing Valves
w. AS5488 Classification of Subsurface Utility Information (SUI)
x. Australian Rainfall and Runoff (ARR) published by Engineers Australia
y. WSA 02-2002 Sewerage Code of Australia
z. WSA 03-2011 Water Supply Code of Australia
aa. WSA 10-2011 Sub-Metering Code of Practice V1.1
bb. WSA 12-2013 Meter Selection and Installation Code of Practice

The above details are not an exhaustive list of the relevant requirements. The consultant/contractor must incorporate all relevant standards and Authorities requirements into project specific design, documentation, and installation.

13 ACKNOWLEDGEMENTS

The University of Newcastle would like to acknowledge and thank the University of Sydney for their assistance in the development of this document.

14 ATTACHMENTS

ATTACHMENT 1 Preferred Equipment List

ATTACHMENT 2 Design and Construct Checklist for Consultants

ATTACHMENT 3 Table of Local Water Authorities

ATTACHMENT 1 PREFERRED EQUIPMENT LIST

Equipment Type	Pre-approved Make
BMS	Siemens
Cold Water Pumpset	Grundfos
Double Check Valves	Pentair Valvecheq Figure DCDA03 / Febco 850
Gas meters	Elster / Krom Schroeder / Email / FMG
Heater Supports	Baytak
Hot Water circulating pumps	Grundfos
Hot water units	Rinnai / Rheem
Laboratory Tapware	Enware
Masonry Fixings	Dynabolt
Multistage pumps	Grundfos
PEX Pipe	REHAU / AusPex
RPZD Valves	Pentair Valvecheq Figure RP-03 / Febco 860
Safety Shower/Eye Wash Systems	Enware
Sewage Pumps & Control Panels	Grundfos
Signage	Traffolyte
Solar hot water panels	Rinnai / Rheem
Subsoil Pumps & Control Panels	Grundfos
Tank Filling Valves	Philmac servo type
Tempering Valves	RMC Heatguard / TOMSON
VSD	Danfoss / ABB HVAC range
Water meters	Elster / Davies Kent
Water temperature control	Enware thermostatic mixing valves

ATTACHMENT 2 DESIGN AND CONSTRUCT CHECKLIST FOR CONSULTANTS

Design and Construct List

The following is a list of hydraulic documents which IFS require the building service consultant and contractors to provide as part of their package.

This is a guide for the consultant/contractor to ensure they meet minimum design components in all projects. These documents will be reviewed by the relevant IFS Services Engineer or their delegate during the design phases.

This list does not alleviate the building services consultant's responsibility to design to the IFS Design standards.

Design Input - Provided by all Hydraulic Services Consultants on all Projects		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6		
Item Required	**Detail of the Design Item to be Completed**	**Project Planning and Assessment**	**Approved Project Initiation**	**Design and Documentation**	**Tender**	**Construction**	**Post Construction and DLP**	**Compliance Achieved**	**Building Services Consultant Comments**
Application for connection to hydraulic services infrastructure for new or increased water, gas, sewer, and stormwater supply requirements.	Application to be made to either Hunter Water, Local Council or University of Newcastle (determined by ownership). Application must be approved by the asset owner prior to design being finalised.		x					Yes / No or N/A	
Specifications (Where applicable)	Complete a hydraulics specification for the project. Include schedules for all major items of equipment including pumps, tanks, hot water plant, water filtration, trade waste equipment, fixtures, fittings, and material types.			x				Yes / No or N/A	
Plan Layout Drawings	Design drawings in AutoCAD (and Revit 3D or GIS model where applicable) format including plans, schematics, and detail drawings.			x		x		Yes / No or N/A	
Room Spatial Allowances for Hydraulic Equipment	Confirm all equipment proposed will fit within the room/riser/ceiling spaces with sufficient access for maintenance and egress.			x		x		Yes / No or N/A	
BMS & EMS Connections	Complete a schedule for points and control and functional descriptions for all Hydraulic Services equipment connected to BMS and EMS.			x		x		Yes / No or N/A	
Pipework sizing	Calculations to be provided on the sizing of for all hydraulic services pipework, including water, gas, sewer, and stormwater. Future allowances are to be included in these calculations/sizing.			x		x		Yes / No or N/A	
Equipment sizing	Calculations & selections to be provided for all proposed equipment including tanks, pumps, hot water plant, rainwater reuse, stormwater management, meters, trade waste equipment			x		x			
Supply of statutory design certifications and certification of compliance to the University standards and other relevant standards.	Complete the design certificate in line with the relevant standards and requirements including NCC, Australian Standards, Fire Engineering Report, IFS Standards			x	x	x		Yes / No or N/A	
Safety in Design Documentation	Provide a Safety in Design document for review and approval by the Services Engineer.			x	x	x	x	Yes / No or N/A	
Asset List	Proposed final asset list to be submitted for approval					x		Yes / No or N/A	
Inspection, testing and maintenance	Confirm all inspection, testing and preventive maintenance to be performed during DLP together with proposed dates when the tasks will be performed						x	Yes / No or N/A	

ATTACHMENT 3 TABLE OF LOCAL WATER AUTHORITIES

CAMPUS	WATER AUTHORITY	CONTACT INFORMATION	
• Callaghan	N/A		
• Newcastle City Precinct • Hunter Medical Research Institute • John Hunter Hospital Site • Maitland • Mater • Mayfield • Wallsend Hospital • Williamtown	Hunter Water	Website: Email: Phone: Street Address: Postal Address: Fax:	https://www.hunterwater.com.au/ enquiries@hunterwater.com.au 1300 657 657 36 Honeysuckle Drive Newcastle NSW 2300 PO Box 5171 Hunter Region Mail Centre NSW 2310 +61 2 4979 9711
• Gosford • Ourimbah • Wyong	Central Coast Council	Website: Email: Email: Phone: Street Address Gosford: Postal Address Gosford: Street Address Wyong: Postal Address Wyong:	https://www.centralcoast.nsw.gov.au/ ask@centralcoast.nsw.gov.au gwcwater@wyong.nsw.gov.au 1300 463 954 49 Mann Street Gosford NSW 2250 PO Box 21 Gosford NSW 2250 2 Hely Street Wyong NSW 2259 PO Box 20 Wyong NSW 2259
• Sydney	Sydney Water	Website: Phone: Phone interstate: Street Address: Postal Address: Fax:	https://www.sydneywater.com.au/ 13 20 92 1300 143 734 1 Smith Street Parramatta NSW 2150 PO Box 399 Parramatta NSW 2124 1300 362 092
• Tamworth • Moree	WaterNSW	Website: Email: Phone: Street Address Tamworth: Postal Address Tamworth:	https://www.waternsw.com.au/ Customer.Helpdesk@waternsw.com.au 1300 662 077 33-35 Gunnedah Rd Tamworth NSW 2340 PO Box 1251 Tamworth NSW 2340

CAMPUS	WATER AUTHORITY	CONTACT INFORMATION	
		Street Address Moree: Postal Address Moree:	66 - 68 Frome Street Moree NSW 2400 PO Box 486 Moree NSW 2400
• Taree	MidCoast Council	Website: Email: Phone: Street Address: Postal Address:	https://www.midcoast.nsw.gov.au/Water-Services council@midcoastwater.com.au 02 7955 7777 2 Pulteney Street Taree 2430 PO Box 482 Taree 2430
• Coffs Harbour	Coffs Harbour City Council	Website: Email: Phone: Street Address:	https://www.coffsharbour.nsw.gov.au/ coffs.council@chcc.nsw.gov.au 02 6648 4000 cnr Coff & Castle Streets Coffs Harbour NSW 2450
• Port Macquarie	Port Macquarie-Hastings Council	Website: Email: Phone: Street Address: Postal Address: Fax:	https://www.pmhc.nsw.gov.au/Services/Water council@pmhc.nsw.gov.au (02) 6581 8111 17 Burrawan Street Port Macquarie NSW 2444 PO Box 84, Port Macquarie NSW 2444 (02) 6581 8123
• Muswellbrook	Muswellbrook Shire Council	Website: Email: Phone: Street Address: Postal Address:	https://www.muswellbrook.nsw.gov.au/ council@muswellbrook.nsw.gov.au (02) 6549 3700 157 Maitland Street, Muswellbrook NSW 2333 PO Box 122, Muswellbrook NSW 2333