SECTION 24

HYDRAULIC SERVICES

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Version	Date	Authors	Summary of Changes
1	9 April 2013	Multitech for JCU	First Edition
2	30 September 2013	Manager, Infrastructure Services	Revised with JCU comments

24.0 HYDRAULIC SERVICES

24.1 INTENT OF THE JAMES COOK UNVERSITY DESIGN GUIDELINES

James Cook University was established to pursue and encourage study and research, especially in subjects of importance to the people of the tropics. James Cook University is Queensland's second oldest university and through its research, graduates and industry links, is a major driver of economic growth and social change in northern Queensland.

Staff and students of JCU use its unique locations to conduct nationally significant and internationally-recognised research in areas such as marine sciences, biodiversity, tropical ecology and environments, global warming, tourism and in tropical medicine and public health care in underserved populations. Its network of specialist centres, institutes and research stations span a wide geographic area from marine islands to the outback and the students come from many backgrounds, promoting a rich cultural and experiential diversity on campus.

These design guidelines have been developed to ensure that projects delivered by JCU comply with the University's vision, are appropriate for the unique tropical environments and incorporate the lessons learnt from previous projects. The Deputy Director – Planning and Development is responsible to ensure these Design Guidelines achieve the best design outcomes for JCU.

24.2 COMPLIANCE AND APPROVALS

24.2.1 Compliance Requirements

All design and works are to comply with the latest versions of all Australian National, Queensland State, legislation and standards, as well as local council/authority requirements. Further details are provided in Section 24.5

All other sections of these Guidelines are to be read for completeness as this document has been developed as a section of a suite of documents.

Where there is a discrepancy between requirements, legislation and regulation to take precedent over these Guidelines.

24.2.2 Non-Conformance Approvals

All project team members (for example Consultants, D&C Contractors, Principal Consultants, Internal/External project managers, subcontractors etc.) are responsible for delivering the project in accordance with the project brief, these guidelines, user group information and other contractual documents.

Where there are sound engineering reasons to deviate from these documents, a written non-conformance request is to be submitted to the Deputy Director – Planning and Development via the JCU Project Manager.

This could apply when the project involve aspects, scope, technologies, locations or other applications that are not specifically briefed or covered by the Design Guidelines, the non-conformance request will include clear information on:

- Technical Aspect that is not covered
- A range of options to address the issue
- Time and costs implications for each option
- Effect of the aspect on the design and on other trades
- Effects on users, maintenance, access, life of plant, energy efficiency, cost

- Effects on future re-allocation of the space / system etc.
- Recommended solution to the issue

A Non-Conformance register is to be maintained by the Consultant and the details of each request plus the outcome are to be recorded.

24.2.3 Design Approvals

Irrespective of directions received from JCU, the Consultant remains fully responsible for the design solution developed.

All designs done for and on behalf of JCU require RPEQ certification, unless approved by the Manager, Infrastructure Services via the JCU Project Manager.

Form 15 Design Certification, and where required, approval from the local Regulatory Authority and QFRS is to be obtained. QFRS is to be consulted though the design process for fire related requirements.

24.2.4 NCC Version to Apply

Confirm with JCU's Project Manager which version of NCC (Building Codes of Australia) that is applicable to the works.

24.2.5 Site Infrastructure Connection Approvals

The Manager, Infrastructure Services is responsible for approving the Hydraulic Services Application (which is to be prepared and submitted to the Local Authority by the Hydraulic Design Consultant) on behalf of JCU, PRIOR to that submission.

Furthermore, the Manager, Infrastructure Services is responsible for approval of all connections to JCU's existing infrastructure, including water mains, fire and sewer infrastructure. A single request (per hydraulic system) to connect to the JCU site infrastructure is to be sent to the Manager, Infrastructure Services, at least 3 working days before the connection is required. This request shall contain the following information;

From the RPEQ Design Engineer:

- Mains Water Flow (l/s)
- Building Fire Water Flow Demand (l/s)
- Building Peak Stormwater Water Flow Discharge (l/s) (Q100)
- Building Peak Sewer/Sanitary Water Flow Discharge - fixture units and l/s
- Building Peak Trade Waste Flow Discharge (l/s)
- Building Peak Hot Water Flow Demand (l/s)
- Water supply network analysis with the above water demand and fire flow modelled.
- Site sewerage PWWF modelling with proposed development added
- 24 hr Systems Mains Water Flow Demand (l/s)
- As built drawing of ALL surveyed in ground pipework, pits and connection points.
- Certificate of Design Compliance

From the commission team:

- Hydraulic Services Commissioning Plan for all systems
- Certificate of Installation Compliance for all systems (Form 16)
- Water quality test result (pre-connection clean)
- Water pressure test results for mains and fire water
- System commissioning and test results in compliance with legislation and codes

24.3 DESIGN PROCESS REQUIREMENTS

24.3.1 Roles and Responsibilities

The University does not wish to be separated from the design process, regardless of whether the project is traditionally delivered, delivered through Managing Contractor, D&C contractor or other.

24.3.1.1 Traditional Delivery

Where traditional delivery is chosen, the framework may be through a Principal Consultant (such as an Architect or Project Manager), or direct to JCU.

The Principal Consultant is to arrange workshops with the JCU Deputy Director – Planning and Development, Manager, Infrastructure Services, Manager, Asset Strategy and Maintenance and other technical staff as directed by these managers from initiation of schematic design.

24.3.1.2 Managing Contractor Framework

Arrange workshops and information issues throughout the design process with the JCU Deputy Director – Planning and Development, Manager, Infrastructure Services, Manager, Asset Strategy and Maintenance and other technical staff as directed by these managers (through the Managing Contractor and JCU's Project Manager.).

24.3.1.3 Communication Arrangements

All communication with JCU is to be via the JCU Project Manager. Minutes of any design review meetings etc. are to be provided to all participants via the JCU Project Manager.

24.3.2 Interfaces with Other Disciplines

Ensure that all works necessary for the complete installation and successful operation are advised to other consultants and specified as interface with other engineering disciplines, professions or specialists.

Ensure that information required to accurately design the services is obtained from other consultants as required. Additional information is available in section 24.5.3

24.3.3 Schematic Design (SD) Report / Design Review

The Schematic Design (SD) report will give a high level understanding to JCU of the requirements for the project.

24.3.3.1 Report Content

- The drawing numbers and revisions the SD report is based upon e.g. Architectural, As Installed drawings, Landscape, Survey, Civil etc.
- A detailed list of the hydraulic scope of works for the project
- A detailed list of the applicable standards, regulations and local authority requirements that the project has to conform to

- Where existing plant is being utilised, whether this plant is being used, replaced, refurbished etc. with indication of associated issues and costs.
- A high level description of the method of servicing the various spaces in the project
- List of Ecological Sustainable Development (ESD) opportunities
- Non-Conformance Register listing any deviations from Legislation, Standards, Codes, Guidelines or Project Brief.
- List of Assumptions, Boundaries (battery limits or tie-in points) and Specific Exclusions
- Proposed Drawing Register and Deliverables List
- Layout drawings showing existing site conditions for all services, any interfaces, connections and easements with existing services and structures, including proposed services corridor/trenches, depths, flow direction and invert levels of existing services within the site.
- Results of any Flow and Pressure testing on water main/s adjacent to the site and any requirements for pumps and tanks to supplement the mains water supply
- A detailed description of the sanitary plumbing and drainage systems including types of materials and plumbing systems to be used i.e. single stack, drainage, elevated pipework etc.
- A detailed description of any trade waste plumbing and drainage required for the project including any required pre-treatment devices including findings from consultation with the local trade waste officer and what their requirements will be for the project
- A detailed description of the roof & storm water drainage design for the project including interfacing with the civil infrastructure
- A detailed description of any rain water harvesting including pre-treatment devices
- A drawing proving that the drainage systems proposed will work i.e. showing invert levels from the furthermost points to the connection points can be made on a standard grade and without having to have a reduced grade on any section of drain
- Design intent for drainage other than in stable ground i.e. drains in highly reactive ground
- Report on the cold drinking and non-drinking water service including site connections, metering, backflow prevention, insulation, signage etc.
- Report on the design intent for the hot drinking and non-drinking water services including type of hot water generation, tempering, insulation, description of flow and returns etc.
- Provide a description of the warm water design intent including the required temperatures under the relevant standards
- Itemise requirements for fire hydrant coverage together with intended fire main system design including any required booster pumps/water storage tanks
- Provide a detailed description of the design intent for any reticulated LP or Natural gas for the project including storage requirements, safety equipment, labelling etc.
- Detail the labelling and identification requirements for the project
- Investment Decision Report including Cost (Capex and Opex) and Schedule estimates, Lifecycle costs and indicating any areas of risk to the project delivery. This document to be resubmitted based on feedback from the SD review and approved by the JCU Deputy Director – Planning and Development prior to commencement of Detailed Design.
- Where option analysis was included, a recommendation on the option to take forward with supporting information/decision criteria.
- Outcomes and recommendations for safety in design, and design risk assessment workshops particularly responding to (or addressing) design elements which affect fire safety.

- List of proposed design development activities/milestone schedule and deliverables

24.3.3.2 Submission Format

This information is to be submitted to the JCU Project Manager as an A4 colour PDF file with A3 drawing attachments, in hard and electronic format. The Consultant may be requested to deliver a presentation (in person or via VC) to JCU stakeholders and decision makers.

24.3.3.3 Design Review

Submit SD drawings / report and non-conformance register to JCU's Project Manager in full size hard copies (1) and on CD for a full design review in accordance with the project schedule, allow a minimum of 2 weeks for design review.

Inform the JCU's Project Manager as soon as possible if the drawings are going to be delayed for any reason.

Following receipt of the design review comments from JCU, respond formally with

- Acknowledgement that changes will be actioned, and
- List any areas where the design review comments require additional discussion and proposed manner of resolution.

24.3.4 Developed Design / Universities' Review Report Requirements

The DD report will provide more detail on the design for the accepted option and design approaches.

24.3.4.1 Report Content

- Full return brief for the hydraulic services
- The drawing numbers and revisions the DD report is based upon e.g. Architectural, As Installed drawings, Landscape, Survey, Civil etc.
- Provide detailed information of all existing site services, their re-use, refurbishment, relocation or removal
- Provide detailed information of all existing site services and easements including depths and invert levels of existing services within the vicinity of the project and how the consultant intends on dealing with any potential clashes i.e. diverting existing services.
- In each case options investigated, reasons or supporting information for design choices,
- Statement on how the existing services will be impacted by these additional loads and specify any required upgrades
- ESD Opportunities Register
- Updated Non-Conformance Register listing any deviations from codes, standards, legislation, guidelines or project brief.
- Updated Assumptions, Boundaries (battery limits or tie-in points) and Specific Exclusions
- Final Equipment List with sizes/specifications
- Drawing Register and Deliverables list
- A detailed description of the sanitary plumbing and drainage design including the materials and plumbing systems to be used
- A detailed description of the trade waste plumbing and drainage design required for the project including any required pre-treatment devices
- A detailed description of the roof & storm water drainage design for the project including interfacing with the civil infrastructure

- A detailed description of any rain water harvesting including pre-treatment devices
- Detailed description of drainage design for installation in other then in stable ground i.e. drains in highly reactive ground
- Report on the cold drinking and non-drinking water service design including site connections, metering, backflow prevention, insulation, signage etc.
- Report on the design for the hot drinking and non-drinking water services including type of hot water generation, tempering, insulation, description of flow and returns etc.
- Provide a detailed description of the warm water design including the required temperatures under the relevant standards
- Provide a detailed description and gas pipe sizing calculations of the design for any reticulated LP or Natural gas for the project including storage requirements, safety equipment, labelling etc.
- Detail the labelling and identification requirements for the project
- All IFC drawings and design calculations
- Updated site water schematic, showing positions of all new valves
- Updated stormwater drainage drawing
- Updated and finalised Investment Decision Report including Cost (Capex and Opex) and Schedule estimates, Lifecycle costs (and whole of life costs) indicating any areas of risk to the project delivery. This document to be resubmitted based on feedback from the DD review and approved by the JCU Deputy Director – Planning and Development prior to commencement of Construction.
- Updated outcomes and recommendations for safety in design, and design risk assessment workshops.
- Finalised recommendations for preventative maintenance and list of critical spares on proposed equipment.
- Risk Matrix for design methodology (i.e. n+1 redundancy systems)
- Areas of risk to the project during construction and commissioning
- List of construction activities/milestone schedule and deliverables, including construction and commissioning hold point/inspection/witness/approvals.

24.3.4.2 Submission Format

This information is to be submitted to the JCU Project Manager as an A4 colour PDF file with A3 drawing attachments, in hard and electronic format. The Consultant may be requested to deliver a presentation (in person or via VC) to JCU stakeholders and decision makers.

24.3.4.3 Supporting Documentation

- Maximum 1:500 site services drawings – e.g. mains water, showing tie-in points to existing
- Maximum 1:500 site services drawings
- Maximum 1:100 Floor & Roof Plans. Separate water and drainage plans required.
- Maximum 1:50 inserts on Floor and Roof plans
- Maximum 1:50 Details
- Diagrammatic water plans
- Diagrammatic sanitary and trade waste drainage if above ground

24.3.4.4 Design Review

Submit DD drawings / report and non-conformance register to JCU's Project Manager in full size hard copies (1) and on CD for a full design review in accordance with the project

schedule, allow a minimum of 2 weeks for design review.

Inform the JCU's Project Manager as soon as possible if the drawings are going to be delayed for any reason.

Following receipt of the design review comments from JCU, respond formally with

- Acknowledgement that changes will be actioned, and
- List any areas where the design review comments require additional discussion and proposed manner of resolution.

24.3.4.5 Developed Design JCU RPEQ Certification Schedule

This table shall be completed by the DD Design Engineer as below, or as modified by the Manager, Infrastructure Services, and submitted for confirmation.

Project		
Project Number		
Date		
Company		
RPEQ Design Engineer		
RPEQ Licence Number		
Building Area	sqm	
Calculated Building Peak Mains Water Flow	l/s	
Calculated Building Peak Fire Water Flow	l/s	
Calculated Building Peak Stormwater Flow (Q100)	l/s	
Calculated Building Peak Sewer/Sanitary Water Flow	l/s	
Calculated Building Peak Trade Waste Flow	l/s	
Calculated Building Peak Hot Water Flow /Demand storage/recovery	l/s	
Calculated 24 hr Systems Peak Mains Water Flow Demand	l/s	
Hydraulic Services Estimated Capital Investment (ex GST)	$	
Total number of Pumps	No. Off	
Total number of Filters	No. Off	
Total number of Hose Taps	No. Off	
Total number of Valves	No. Off	
Total number of Gully Traps	No. Off	
Total number of Trade Waste Pre-treatment stations	No. Off	
Total number of Hydrants	No. Off	
Total number of Hose Reels	No. Off	
Any other plant and equipment requiring routine inspections or as listed under 24.2.5	No. Off	
	Manager Infrastructure Services	
Schematic Design & Report Approved	YES / NO	
Developed Design & Report Approved	YES / NO	
Construction Documentation Approved	YES / NO	
All specific design elements are included in the design	YES / NO	
Does the investment decision in SD Report include Life Cycle Costing	YES / NO	

24.3.5 Contract Documents Requirements

24.3.5.1 Specification Requirements

A concise, project specific specification shall be produced that

- Clearly identifies the scope of works
- Clearly identifies the project nature
- Clearly identifies Interfaces with other disciplines
- Calls into effect the requirements of codes, standards, legislation etc.
- Calls into effect the requirements of these guidelines
- Does not contain excessive or spurious references to unrelated projects or unrequired works.
- Includes all performance requirements
- Includes schedules of all equipment requirements, capacities etc.
- Requires relevant price breakup information from the contractor
- Requires contractor confirmation of equipment, scope, documentation etc.
- Calls up required service, maintenance details etc. in an acceptable Operating and Maintenance Manual format complete with preventative maintenance schedules.

24.3.5.2 Drawing and Documentation requirements

Both Issued for Tender (IFT) and Issued for Construction (IFC) drawing and documentation will be required.

Drawings shall conform to section 34. Ensure:

- Use JCU Title block and include JCU Drawing Number (obtain from JCU Drawing register)
- All fonts and colours to be legible at A3 print colour or black and white
- Use Australian English throughout all documents
- Clearly identifies the scope of works
- Are clear and legible and easily read
- Provide sections, elevations and the like to indicate heights, etc. Generally a minimum of two sections shall be provided for any project to enable the contractor to determine the work heights, co-ordination etc.
- Provide details for specific items such as pumps, hot water systems, meter assemblies, trade waste pre-treatment devices etc.
- Details on connections to all infrastructure
- Maximum 1:500 existing site services drawings
- Maximum 1:500 proposed site services drawings
- Single line diagrams
- Commissioning and testing plans and protocols including notification of any outages

24.3.5.3 Number of Copies

Unless briefed / agreed otherwise, the contract documents shall be provided in electronic (.pdf and native (.dwg)) format and in hard copy as follows:

- Three full sized hardcopies of all drawings
- Three bound copies of specifications in A4

24.3.6 Handover Requirements

24.3.6.1 Requirements for Commissioning

The hydraulic engineer will provide a detailed set out of the methodology for commissioning to be completed by the contractor in the draft hydraulic specification prior to tender.

Testing and commissioning of all hydraulic systems shall be witnessed and signed off by an independent testing authority not associated with the hydraulic contractor.

Testing is to be done to AS3500/AS2419 and AS2118 and other mandatory standards.

The commissioning section of the hydraulic specification shall include:

- The methodology for the comprehensive commissioning of hydraulic equipment and systems that will ensure that the as-designed performance, functionality and reliability of the hydraulic equipment and systems are proven and documented prior to project "practical completion".
- The requirement to provide all commissioning data and test results for the hydraulic installation at least 7 days prior to witness testing by JCU Manager, Infrastructure Services for review by the JCU appointed Consultant hydraulic engineer.
- Cause & effect matrix for the equipment & system being operated including hydraulic system interface relevant to other systems.
- Pre-start and start-up check sheets
- Provide Form 16 and any other certification required for the works.

24.3.6.2 Witnessing

Following commissioning, undertake a witness inspection of the operation of the hydraulic systems. Ensure the JCU appointed Consultant hydraulic engineer and Manager, Infrastructure Services, or representative are in attendance.

As a minimum, prove to their satisfaction:

- The hot water systems are installed and operating as designed
- Warm water temperatures are correct
- Laboratory gas shutdown controls function correctly
- Fire mode operation of systems
- Pump Duty / Standby operation and changeover
- Controls operation. Prove operation by amending set-points etc and observing operation. Prove alarm functionality.
- Sample 10-20% of WC flushing

Rectify any defects identified. Should re-inspection be required, the cost of consultants reinspections will be deleted from the contract sum.

24.3.6.3 Records to be provided

Within 3 weeks of Practical completion provide

- All commissioning data as finalised
- Defects lists signed out and complete
- Certification of any Fire Penetrations etc.
- Commissioning sheets for any specialised equipment e.g. Thermostatic Mixing Valves, Reduced Pressure Zone Devices, Fire Hose Reels, Fire Hydrants and all booster pumps.

24.3.6.4 Defects Liability

The Defects Liability period shall be a minimum of 12 months from the date of Practical completion or acceptance of the systems by the Manager, Infrastructure Services or Manager, Asset Strategy and Maintenance. Longer periods of warranty for key/critical equipment may be required, this should be tested on a project specific basis.

During this period the contractor must attend to and rectify all faults, defects etc. at their cost including all parts, labour, commissioning and associated costs. Should an item repeatedly fail during this period, JCU may require warranty in relation to that item to apply from the date of latest repair / replacement.

24.3.6.5 Maintenance Requirements

All construction/ installation contracts shall allow for the performance of regular preventive maintenance of the works during the period of the defects liability period inclusive of all consumables.

Such maintenance shall be in accordance with the manufacturer's instructions and the requirements of AS 1851, Work Health and Safety Act and Regulations, Standards or other applicable regulations, legislation, or codes of practice.

~~S~~afety systems shall be maintained and recorded as a minimum to relevant requirements (e.g. AS1851).

24.3.6.6 Operating and Maintenance Manuals

Operating and maintenance manuals must be issued as Preliminary prior to Practical Completion. Any amendments must be made and manuals issued within three weeks of Practical completion. Manuals must include as a minimum:

- Concise English description of the installation as a whole
- Concise English description of the each system
- Concise English description of the Fire Mode Operation of systems
- Equipment list for all hydraulic equipment and systems
- Supplier / Support list for all hydraulic equipment
- Manufacturer's Literature for all hydraulic equipment
- List of recommended critical spares
- List of Contractors and Subcontractors
- List of As-Constructed drawings
- All related services drawings
- All finalised commissioning data
- Form 16
- Recommended Service and Maintenance procedures
- Final certification from the Local Authority and QFRS
- Service and Maintenance Schedule
- Fault finding and reporting procedures
- Emergency Contacts
- All test results as finalised
- Defects lists signed out and complete. All warranties included.
- Certification of any Fire Penetrations etc.
- Updated planned and preventative maintenance schedules and design calculations

Provide THREE hard copies of all manuals and "As Constructed" drawings plus electronic (.pdf and native (.dwg)) copies of all documents and drawings.

Consultants shall provide a statement that maintenance manuals and as constructed drawings are correct to the best of their knowledge.

24.4 HYDRAULIC SERVICES DESIGN AND EQUIPMENT REQUIREMENTS

24.4.1 Design for project and future

A holistic approach shall be taken to any new or refurbishment design and the effect on the existing campus services and buildings shall be well understood.

All designs must consider how the project specific requirements and any additional areas served by systems serving the project areas (e.g. mains water reticulation etc.) will impact on the existing services, possible future fitouts / reworking of the project area, and future expansion such as master plan items, items advised etc. These impacts are to be clearly articulated in the design documentation.

Generally allow for 10-20% expansion in load within the infrastructure serving major projects, stand alone buildings and the like. This expansion capability must be provided in:

- Drinking and non-drinking water pipe mains and main branches (typically with additional blanked valves at strategic locations)
- Pumps
- Control panels (generally provide spare space for an additional 10% controls or 1 whole controller – whichever is greater)
- Riser spaces – pay particular attention to both space and accessibility. Minimise risk where necessary by providing spare ducts etc.
- Specialist infrastructure should be considered on a case by case basis e.g. RO water.

All exposed pipe work is to be chrome plated. All hydraulic penetrations in building fabric to be finished with chrome wall or floor flanges and the penetration shall achieve the required fire rating for that part of the building. Water and gas services in buildings located within structural concrete slabs are to be designed to be fully retrievable.

24.4.2 Design for Tropical Areas

JCU's campuses are located in a tropical environment. Particular care is required to ensure necessary measures are taken to prevent the formation of condensate on external or internal surfaces such as air conditioning units, pipework, ductwork, registers, ceilings, walls, windows etc. The design must specifically deter the growth of mould

In particular, ensure that cold bridges are avoided. Ensure that water and drainage pipes from conditioned, cold spaces or that carry cold fluids traversing through ambient air are insulated as necessary to prevent condensation.

The design team shall work together to minimise moisture migration into buildings which can lead to adverse effects and lower energy efficiency of air conditioning system (eg: no louver type windows are to be provided to air conditioned spaces). Provide advice to other members of the design team regarding the location and requirement for vapour barriers, insulation requirements for building elements relating to the hydraulic services requirements.

24.4.3 Design for Cyclone Prone Areas

JCU's campuses are located in a cyclone prone environment. Particular care is required to ensure necessary measures are taken to ensure that all plant, equipment etc. (particularly external plant) is securely fixed, of suitably rated cyclone area construction and constructed in a manner to withstand such events.

24.4.4 Corrosion Prevention and Protection

JCU's campuses are generally located in coastal areas. The prevention of corrosion must be considered in the design. Plant should be located under cover (preferably in plantrooms). Exposed plant should be avoided.

External items should be constructed of non-corroding elements (PVC / Stainless steel etc). Fixings should be stainless steel. Dissimilar metals should be electrically separated.

Pay particular attention to elements such as switchboards, control panels etc which should be stainless steel where exposed to weather.

Identify additional service recommendations to mitigate or minimise corrosion where the particulars of the installation may produce corrosion in the installation.

24.4.5 Equipment Quality and Support

All equipment and components shall have a proven track record of operation in Queensland and be of high quality and reliability, readily available, with a Queensland based agent for service / spare parts, with sufficient stock of spares to support JCU's operation.

Critical Spares requirements shall be listed in Operating and Maintenance Manuals.

24.4.6 Design for Maintenance

Ongoing service and maintenance must be facilitated in the installation. Measures at least will provide minimum service access spaces, easily workable arrangements, clear unencumbered walkways of minimum 1200mm.

In all cases mandatory clear access for electrical switchboards and the like is to be provided.

Where roof areas must be accessed for maintenance, suitable stairs, walkways, railings, fall protection measures etc., are to be provided. Take reasonable steps to minimise the amount of equipment etc., requiring servicing from roof areas.

24.4.7 AQIS / OGTR / Authorities

Where AQIS / OGTR / Federal Drug Administration or other requirements apply, the designer must fully address these requirements, and provide all information to allow JCU to inform these bodies and pass certification.

24.4.8 Arrangement of Services

Take particular care with arrangement of services and ensure full co-ordination of the project. Some particular requirements are as follows:

- The separation of pipes and location of pipes in relation to electrical services shall be such that the risk of damage from the contents of the plumbing, or from condensation etc. associated therewith, shall not be a possibility.

- Water or drainage shall not be installed above electrical equipment, communications and data racks, computer equipment and the like.
- Water or drainage shall not be installed within switch rooms or electrical risers.

24.4.9 Locating Existing Services

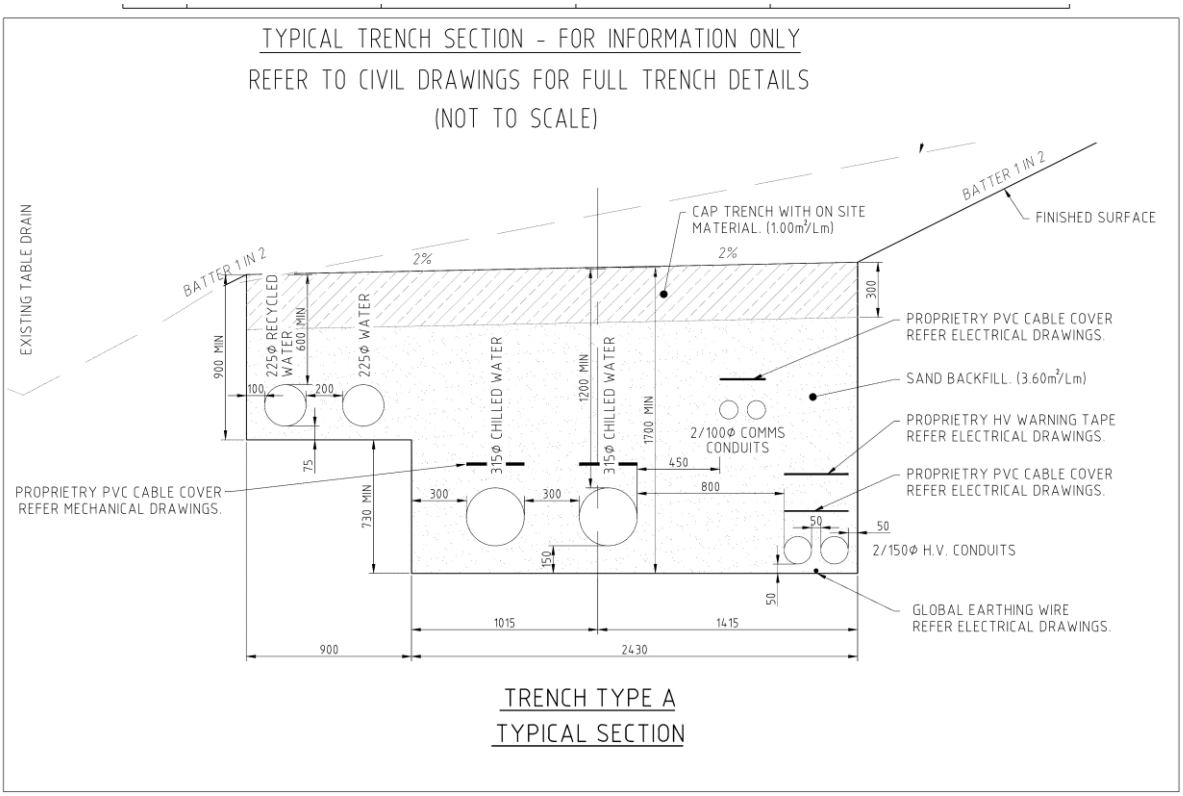
All existing services for the project shall be identified and confirmed onsite in accordance with the requirements identified through JCU's Permit to Work system.

24.4.10 Services Trench

The design shall provide for the connection to existing drinking, non-drinking water and sewer infrastructure within the site. Co-ordination with civil, electrical, communications, wet fire and mechanical services will be required to ensure that where ever possible common trenching of services is achieved.

All inground services shall have traceable identification tape installed above the service. All inground services shall be co-ordinated and common trenched where possible. All inground services shall be designed to suit the soil conditions as described by the geotechnical engineer.

Refer typical JCU common services trench detail below.



CONDUIT DEPTHS:
HV CONDUITS SHALL HAVE 1200mm COVER.
COMMUNICATIONS CONDUITS SHALL HAVE 450mm COVER.

24.4.11 Safety in Design

Safety in design must be incorporated into the design of all new plant, buildings etc. In addition to legislated and briefed requirements, work closely with JCU Project Manager and keep the Deputy Director – Planning and Development, Manager, Infrastructure Services and Manager, Asset Strategy and Maintenance fully informed of installation, service and maintenance and access requirements.

Particular care must be taken to ensure that safe installation and service is inherent in the design. Generally any requirement for the use of Personal Protective Equipment (PPE) or protective measures (fall restraint systems etc.) should be avoided by design.

24.4.12 Laboratory Hydraulic Services

Laboratories should contain appropriate laboratory sinks, emergency deluge showers, emergency eye washes and separate hand washing basins. The hand wash basins will require drinking cold and warm water and be located near the entry/exit points of the Laboratory. The emergency deluge showers, emergency eye washes will require drinking water connections and be within 10 seconds reach for any individual. The emergency deluge showers shall be connected to a minimum 25mm drinking water service.

Height adjustable Laboratory sinks may be required to provide access. Height adjustable Laboratory sinks will require watermarked approved flexible connections long enough to suit the joinery movement. In some instances where corrosive chemical exposure is likely, the use of porcelain bowl sinks may be necessary.

Special water systems (such as deionised, demineralised, reverse osmosis or purified) where required should be accurately defined in terms of demand and water quality. Laboratories may provide their own water treatment/purification systems which may require pre-treated water, UV sterilisation, carbon filtration, storage tanks/vessels, recirculation pumps, special piping and avoidance of dead legs, and special metal-free tapware. Systems may be either stand-alone or recirculating depending on quality and quantity.

Enquire of the nature of liquid wastes to be produced in the Laboratory and determine in consultation with the local authority whether dilution, neutralisation or holding may be required for the application.

24.4.13 Sanitary Drainage

The design shall allow for all drainage to be feed to the campus infrastructure via gravity at normal grades and in accordance with the local authority's requirements. Reduced grade drains are to be avoided at all times. If reduced grades are required, approval must be obtained from JCU's Deputy Director – Planning and Development at time of SD and confirmed at each milestone.

Sewer lifting stations are to be avoided at all times. If a lifting station is required then permission must be sort from JCU's Deputy Director – Planning and Development at time of SD and confirmed at each milestone.

Pipe Materials shall suit the conditions of the wastewater (temperature, trade waste etc.)

Inspection chambers shall be installed in accordance with Local Authority requirements with cast iron gas tight chamber covers stamped 'SAN'.

Sanitary risers will have a test gate and expansion joint at the base on each floor in an accessible position. Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

24.4.14 Trade Waste Drainage

The design shall allow for all trade waste drainage to be fed via gravity to the site infrastructure after being treated to the local authority's requirements through proprietary pre-treatment device. Reduced grade drains are to be avoided at all times. If reduced grades are required, approval must be obtained from the Deputy Director – Planning and Development at time of SD and confirmed at each milestone.

Trade Waste lifting stations are to be avoided at all times. If a lifting station is required then permission must be sort from the Deputy Director – Planning and Development at time of SD and confirmed at each milestone.

Trade Waste risers will have a test gate and expansion joint at the base on each floor in an accessible position. Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

24.4.15 Waste Water Treatment and Re-use

The treatment of any waste water for re-use is to be submitted to the Deputy Director – Planning and Development for approval.

24.4.16 Roof & Roof Access

A safe permanent means of access to the roof shall be provided and shall fall under the Architectural design. This would include safety hook on points and safety guide wires for use during maintenance of the roof and roof drainage systems. The preferred pitch of the roof is 5-7 degrees. If any of these items have not been addressed in the Architectural design the hydraulic engineer shall bring this to the attention of the Deputy Director – Planning and Development at time of SD and confirmed at each milestone.

24.4.17 Roof Drainage

Box gutters and concealed eaves gutters are NOT permitted. All roof drainage systems are to be fabricated from marine grade stainless steel including roof gutters and downpipes.

The Eaves Gutters shall be sized to a 1:20 year Average Return Interval (ARI) and the sole of eaves gutters are to be a minimum 200mm wide and must allow ease of access into the gutter for cleaning. The back and stop ends of the eaves gutter is to be a minimum 30mm higher than the front of the eaves gutter. The minimum size of a downpipe shall be 150 mm. Leaf guard is not to be installed on gutters. The roof drainage system is to be designed to withstand cyclonic conditions and add a 10% safety margin to the final calculations for sizing.

Down pipes within building elements will have a test gate and expansion joint at the base in an accessible position and will be hydrostatically tested. Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

Document that safety guide wires shall be provided complying in all respects to Work Health and Safety legislation and there is to be no access to roof without a safety plan being prepared and a copy submitted for approval, in accordance with JCU's Permit to Work procedure, the Manager, Asset Strategy and Maintenance.

24.4.18 Rain Water Tanks

Rain water harvesting and a wet system of tank fill are not preferred by James Cook University. If required, the rain water tanks will be connected to non-trafficable roof tops, be insect and vermin proof and be sized relative to the catchment area and rainfall data for the area where they will installed. Provide rain water tank sizing calculations in the SD and DD reports.

A permanent means to exclude leaf litter and debris from entering the tank will be required this could be in the form of leaf excluding rain heads or sieves on the inlet to the tanks.

Underground tanks shall be avoided but if required or approved by University, they shall be designed by a structural engineer, have reflux valves fitted to the outlets, have bolt down gatic access lids

positioned over the inlets and outlets of the tank and be positioned so that a vacuum truck can access it to clean the bottom of the tank.

24.4.19 Storm Water Drainage

External down pipes are to discharge over storm water inlet pits where not connected to a rain water harvesting tank.

Down pipes are to discharge over minimum 450x450 inlet pits with a minimum depth of 4 times the diameter down pipe discharging over it. Specify stainless steel or hot dipped galvanised heel guard grates on all storm water inlet pits. The outlet of the downpipe is to be a minimum 150mm above the grate, for ease of clearing, and be angled so that the discharge, no matter how minor, discharges over the grate of the pit. Co-ordination with the site drainage and landscape architect will need to be demonstrated during the all stages of the design.

All stormwater drainage shall be a minimum 150mm internal diameter.

24.4.20 Clear Outs

Clear outs will be provided as per the standards and provided every 30m and at changes of direction of all drainage systems. Clear outs will be chrome plated brass and will have concrete surrounds in soft landscaped areas and will be 100mm above the surrounding surface.

Clear outs will be provided adjacent to every Water Closet (WC) on ground floor in an accessible position to enable clear access to drainage system.

24.4.21 Drainage in other than Stable Ground

All drainage in unstable ground is to be protected from excessive soil movement and will be required to be designed & certified by a suitably qualified/registered engineer. The hydraulic engineer is to document in the SD and DD reports the results and recommendations from the Geotechnical Engineer on the soil conditions.

24.4.22 Drinking Water

Back-flow prevention devices to AS 3500 shall be fitted to all buildings and to supply lines to Laboratories. Water metering shall be provided for all new buildings, or when carrying out alterations and/or extensions to buildings without metering.

Drinking water will be connected to site water infrastructure and sized to meet the maximum demand of the building. The water will pass through an above ground digital full flow meter assembly connected to the University's BMS. The meter signal shall be readable via the university's intranet. The meter assembly will include an appropriate backflow device have a full flow bypass under the meter assembly and means of disconnection to service/replace the meter, strainer & backflow valve as required.

The water pressure will be limited as per the standards and also to individual equipment as per the manufacturer's instructions.

The water is to be designed so that each floor, group of fixtures and individual fixtures can be isolated with a tested gate valve which is located in an accessible position not more than 1500mm above Finished Floor Level (FFL). This will enable maintenance to be carried out and new branch lines to be installed without having to shut the water down to entire buildings.

Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

Inground Cold water services shall be Class B copper tubing up to 100mm, above 100mm shall be minimum class 18 uPVC blue brute. All above ground water services to be installed in Class B copper tube. All exposed pipework shall be chrome plated.

Each fixture is to have its own isolation valve for maintenance.

24.4.23 Non-Drinking Water

The non-drinking water will be connected to a non-drinking water supply and sized to meet the maximum demand of the building. The water will pass through an above ground digital full flow meter assembly connected to the University's BMS. The meter signal shall be readable via the university's intranet. The meter assembly will include an appropriate backflow device have a full flow bypass under the meter assembly and means of disconnection to service/replace the meter, strainer & backflow valve as required.

The non-drinking water pressure will be limited as per the standards and also to individual equipment as per the manufacturer's instructions. Any non drinking outlets will be signed appropriately.

The non-drinking water design is to be designed so that each floor, group of fixtures and individual fixtures can be isolated with a tested gate valve which is located in an accessible position not more than 1500mm above Finished Floor Level (FFL). This will enable maintenance to be carried out and new branch lines to be installed without having to shut the non-drinking water down to entire buildings. Provide details of the required signage at the point of discharge of non-drinking water points.

Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

Each fixture is to have its own isolation valve for maintenance.

Inground Cold Water service pipe shall be compatible with the quality of the non-drinking water supply.

24.4.24 Drinking and Non-Drinking Hot Water

The preferred method of generating hot water is with solar or heat pump. Heat pumps are not permitted to be installed inside a building or enclosure. Permission must be sought from Deputy Director – Planning and Development on type of water heater at time of SD and confirmed at each milestone.

Where multiple hot water systems are required they shall designed to the standards and manufacturers requirements. The consultant's drawings shall include details of how the hot water systems are to be manifolded together and balanced.

In instances of wait times for hot water of more than 15 seconds a balanced flow and return system is to be designed for the building.

Instantaneous hot water units can be utilised in instances of a fixture requiring hot water that is remote from the buildings hot water systems and to eliminate the need for excessive runs.

All hot water storage tanks inside a building are to be provided with a drained copper safe tray. All hot water pipes, valves and equipment is to be insulated as per the Australian Standards. Allow for sufficient space around the unit for removal of elements and above the unit for the withdrawal of anodes.

The hot water design is to be designed so that each floor, group of fixtures and individual fixtures can be isolated with a tested gate valve which is located in an accessible position not more than

1500mm above Finished Floor Level (FFL). This will enable maintenance to be carried out and new branch lines to be installed without having to shut the non-drinking water down to entire buildings. Each fixture is to have its own isolation valve for maintenance, quarter turn valves are not permitted. Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

Install a backflow device with the required level of protection to the hot water service to fixtures requiring non-drinking hot water. Provide details of the required signage at the point of discharge.

Gas fired hot water units shall be mains pressure storage units in single or multiple installations.

Quick Recovery or Boiling Water Units to single isolated applications such as tea preparation stations, may be provided by the use of a under sink mounted quick recovery unit.

24.4.25 LPG / Natural Gas Services

Gas services shall be Natural Gas or Liquefied Petroleum Gas. The gas services engineer shall provide the pipe sizing calculations in the DD report and allow for future expansion of the reticulated gas system by a minimum of 20%. All joints in the reticulated gas system shall be silver soldered with a minimum 15% silver solder and pipe work is to be concealed from view. Where the pipe-work is visible it shall be protected from mechanical damage and be chromed plated.

Provide in the design a keypad operated Room Gas Control Keypad Panel adjacent to the normal entry/exit door so that the gas cut-out emergency button may be activated when exiting in an emergency situation. The control panel is to be connected to gas sniffers suited and located to the particular gas being used within the room, which will shut down the gas in the event of a leak.

The gas design is to be designed so that each floor, group of fixtures and individual fixtures can be isolated with a tested gas ball valve which is located in an accessible position not more than 1500mm above Finished Floor Level (FFL). This will enable maintenance to be carried out and new branch lines to be installed without having to shut the gas down to entire buildings.

Access panels are to be nominated on the hydraulic plans and co-ordinated with the Architect.

Where LP gas cylinders are to be installed allow for following as a minimum:

- Double cylinder installation connected in parallel;
- Provide a secure mesh or vented enclosure to cylinders with lockable gates;
- Locate as close as possible to high usage rooms and in close proximity to service road for ease of access for bottle replacement or in situ filling;
- Locate on a concrete plinth at level above adjacent garden beds;
- Provide hard paving access to the LP gas cylinders;
- Provide hazardous material signage;

24.4.26 Noise & Vibration Control

Design the Hydraulic systems to eliminate transmission of noise and vibration from hydraulic equipment to the building structure, spaces and users.

Reciprocating or rotating equipment shall be isolated from structure and other systems by vibration isolators. Where necessary seismic restraint type shall be used.

Pipework shall not be rigidly mounted to building structure. Ensure that hangers are arranged to accommodate thermal expansion, transient loads and conditions whilst maintaining isolation.

Penetrations shall incorporate sealing methods (whether they be acoustically rated, fire rated, weather rated etc) that do not provide a vibration bridge from services to structure.

24.4.27 Design Sound Levels for Spaces

Ensure noise levels comply with the following. Review the arrangement of the hydraulic plant and equipment and advise in DD of any areas where noise will exceed the following levels:

SPACE	Sound Power in dBA
Offices (enclosed)	37
Open Plan Offices, Administration spaces etc, Post graduate areas,	37
Teaching rooms	37
Accommodation rooms	32
Lecture Theatre / Auditoria	32
Library	40
Video Conferencing Areas	32
Corridors, Lobbies, Foyers	45
Laboratories etc	40
Outside	5 dB above ambient @ 10 Meters

All pipework shall be isolated from spring-mounted equipment by flexible pipework with a flexibility to match the deflection of the equipment spring mountings. Expansion and vibration in pipework shall be taken up by appropriately designed and approved changes of direction or expansion loops.

Take particular care to avoid tonal components, whistles, rattles etc. Avoid intrusive noises such as machinery start and stop characteristics. Generally allow VSD or soft starting.

24.4.28 Insulation

In all cases pipe insulation is to comply with the requirements of the NCC latest edition Section J for thermal properties for the relevant climate zone.

24.4.29 Plant Rooms and Equipment Locations

Generally plantrooms and the like shall not be located immediately bordering noise sensitive spaces (e.g. plant room backing on conference rooms and the like). Wherever possible, plant-rooms shall be stacked above one another in multistorey buildings. The below are the minimum requirements:

- Service Access to be shown
- Plant room drawings must include service clearance zones, travel paths for maintenance and the like.
- Provision for expansion
- Provision for cleaning and maintenance
- Plant room lighting
- External Plant Deck lighting

24.4.30 Interfaces with BMS

Allow for in the design all required interfaces from hydraulic equipment & control panels to JCU's BMS, as specified in JCU Design Guideline Section 23. This includes:

- All Water Meters
- Pumps – signals for pump run/stop, pump fail & high/low level alarms
- Gas – signals from gas control panels for gas on/off & emergency shut down

24.4.31 Metering

Water metering will be provided to all new buildings or to buildings undergoing refurbishment or extensions. The meters shall be an electric digital full flow meter and be capable to be connected to JCU's BMS as per JCU Design Guideline Section 23.

Sub-meters will be provided for the following:

- All tenancies
- Inlet supply and discharge of cooling towers
- Irrigation systems
- Rain water pump outlets connected to fixtures
- Inlet supply and outlet supplies to water polishing plant i.e. Reverse Osmosis
- Trade Waste Discharge

24.4.32 Hot Water Pumps

Hot water circulating pumps shall be provided in hot water flow and return loops to minimise dead legs. The hot water circulating pump shall be installed on the return hot water loop. Pumps shall be "in line" model with isolation valves either side of the pump to facilitate replacement or maintenance. Pump casings shall be bronze with bronze impellers and mechanical seals. Hot water circulating pumps shall be controlled by a thermostat in the return line. A time clock shall be provided to the power source of the pump and set to the operating hours of the building it serves. Visually accessible temperature devices are to be provided on the upstream and downstream sides of the circulation pump to enable monitoring of the systems operational temperature, also to allow the correct adjustment to the circulation pump. Where the system is required to provide larger volumes of circulated hot water an intelligent logic controller is to be specified.

24.4.33 Water Filters

Shall be as approved by Deputy Director – Planning and Development.

24.4.34 Valves

All valves are to be DR Brass, Stainless steel equal approved by the Manager, Infrastructure Services. All valves are to display either their water mark or Australian standard approval. Control valves shall be provided on all hot and cold supply to all individual fixtures.

All valves 25 mm and greater to be install with barrel unions with class D flanges.

Thermostatic Mixing Valves (TMV) shall be approved by the Deputy Director – Planning and Development. Set to requirements of AS 3500.

Control valves are to be tested gate vales, Brass or Stainless steel and installed a minimum of 1500mm above finished floor level. Control valve shall be provided so as to isolate fixtures, groups of fixtures and individual floors of buildings.

Pressure limiting valves shall be provided to ensure individual fixtures have a maximum pressure of 500Kpa or a lesser pressure if required to comply with manufacturer's instructions.

24.4.35 Hose Taps

Hose taps to be DR Brass vandal proof, with jumper valve and key type displaying water mark or Australian standards marking.

24.4.36 Tundishes

Tundishes to be stainless steel sized to comply with AS 3500 with a minimum size of 100mm and shall be trapped where required.

24.4.37 Gully Traps

All gully traps are to have a non-mechanical permanent method of charging/priming.

Gullies unable to be charged by a fixture shall have their water seal protected by a priming device e.g. The priming device shall connect to the nearest WC flush pipe and run under slab in 6mm copper tube to connect to the FWG above the water seal. The copper tube is to be encased in denso wrapping.

Floor waste gullies shall have chrome plated brass or stainless steel screwed grates set flush with the floor finish surface. All floor wastes in concrete floor slabs shall have puddle flanges. All floor wastes shall be regularly charged via a basin, condensate drain or a non-mechanical priming system – a hose tap will not suffice.

24.4.38 Trade Waste Pre-Treatment

The requirements of the local authority shall be assessed and communicated to the Manager, Infrastructure Services at time of SD and confirmed at each milestone.

Grease traps will be required for all greasy waste lines and also be installed prior to oily water pre-treatment by an oil water separator. Grease traps are to comply with Local Authority requirements.

All above ground trade waste pre-treatment devices shall be fit for purpose and made of marine grade stainless steel and preferably under cover or inside plant rooms.

20mm Anti-vandal Hose taps with the required backflow will be positioned within 6m of trade waste devices for cleaning purposes.

GITs installed above ground shall be installed on a minimum of 100mm concrete plinth designed by a structural engineer. Bollards are to be provided if required to protect from vehicular traffic or mechanical damage.

Oil/Water separators are to above ground type manufactured from stainless steel and install under cover within a bunded area.

Other than treatment to comply with trade waster requirements waste water shall not be treated including grey water.

24.4.39 Backflow Prevention

Back flow prevention devices shall be fitted to all buildings and to supply lines connected to fixtures and fittings requiring back flow prevention e.g. non-drinking water to a Laboratory, supply to a hose tap adjacent a grease trap.

The back flow device shall be rated according to the relevant hazard level it is protecting the water supply from. Barrel unions are to be fitted either side of the back flow device to facilitate the ease of maintenance or replacement. The minimum size of a drain or tundish for a back flow valve shall be 100mm.

Back flow devices shall not be fitted anywhere on a building where it may cause damage to the building, a slip hazard or become a nuisance. The discharge from drain hole is to be easily visible from buildings, pathways or roads adjacent the installation.

All ported backflow prevention devices shall be provided with a Tundish sized to AS3500 but in no case smaller than 100mm.

All backflow prevention valves located externally shall be in vandal proof.

24.4.40 Fire Sprinkler Services

This information is given in Section 29, Wet Fire Services, of these Design Guidelines. Section 29 is to read in conjunction with this section (Section 24).

24.4.41 Fire Extinguishers

Selection and location of fire extinguishers shall conform to AS 2444.

24.4.42 Booster Pumps

Pump type to be submitted to Manager, Infrastructure Services, for approval. Pumps are to be designed as two identical pump sets manifolded together with details of valve trains, pressure vessels and rated to supply flows complying with relevant Australian standard for the particular installation. Pumps are to be installed on a minimum of 100mm plinths with anti-vibration mounts the connections are to be, flexible and anti-vibration. Pumps are to be located in weatherproof ventilated structures and are to be designed with allowance for access, maintenance and replacement. Generally the pumps duty will be Duty Call - Duty, Standby – Duty, Duty – Duty Stop. Pumps are to be clearly marked with manufacturer and duty pressure and flows.

Fire protection pump sets to comply with all required standards (AS2941, AS2118)

24.4.43 Fire Hydrants

Determine extent of required fire hydrants system to NCC and AS2419/AS2941 in association with the Architect and the Building Certifier. Hydrant systems are to be D.T.S in accordance with NCC only.

The SD report shall itemise requirements for fire hydrant coverage together with intended fire main system design including any required booster pumps/water storage tanks.

Approval from the Deputy Director – Planning and Development is required at SD prior to proceeding to DD.

Fire hydrant systems shall be designed to ensure that the system performance shall be sufficient to supply the flow and pressures at the applicable number of most remote hydrants for the building in accordance with AS2419.1 and QFRS requirements.

Authority requirements for all wet fire services over and above the requirements of the relevant Australian Standards must be adhered to following consultation with the relevant QFRS building assessment officer and included in the DD report.

Unless otherwise specified by the Deputy Director – Planning and Development, hydrant systems shall be 'wet pipe' systems.

The water supply design for fire hydrant services shall be provided via a dedicated water service to the building isolated by double check valves located in an accessible approved position.

Hyena Hydraulic calculations shall be included in the SD and DD reports and reviewed by the University prior to systems installation.

All fire hydrant service designs shall specify that before commencing any installations, Fire Services Contractors shall provide evidence to the Deputy Director – Planning and Development that they are duly registered with the Fire Protection Contractors Registration Board of Queensland, and have such licences as required by State legislation.

Fire hydrant service designs shall ensure a full site campus water mains flow and pressure test specific to the project site is obtained prior to the design of any wet fire service. Flow and pressure testing results must be verified by the installing contractor prior to the commencement of works.

Consideration shall also be made within the system design for the protection of any 'Open Yard' in accordance with the requirements of AS2419.1

Designs shall include anti-tamper/vandal proof device shall be fitted to all hydrant stand pipe and landing valves hydrants accessible to the public to ensure unwanted operation of the service.

The design shall specify that all stand pipes and any inground steel services are to be lagged with double wrapped denzo tape to a minimum 150mm above the surrounding finished surface level to stop any potential corrosion.

Where designs include fire hydrant enclosures consideration must be made for clear identification.

All fire hydrant designs shall allow for the provision of required block plans as engraved traffolyte type at least A2 (594 x 420mm) in size as a minimum.

All fire hydrant service design shall specify the requirements for the system performance test in accordance with the commissioning requirements of AS2419 in the presence of the Manager, Infrastructure Services, or representative, and provide all testing results to the Manager, Infrastructure Services prior to inspection and approval by the QFRS. Following the completion of the performance testing the QFRS Community Safety Inspection Officers will conduct their proving tests as a process in the final certification of the systems.

All fire hydrant service design shall specify that fire hydrants services are to be certified and tagged by a certified fire services equipment installer.

Where designs include internal hydrants allowance must be made for the inclusion of a safe discharge point (Fire Test Drain) for the testing of the two most disadvantaged fire hydrants. All discharge points shall be fitted with the required number of 65mm round thread 'Type 6' QRFS compliant female couplings and shall be designed to discharge to the Stormwater drainage system.

Where available, fire hydrant services shall be designed such that all routine test and maintenance 'waste' water is recycled within the service or captured with the possibility of re-use by other permissible services.

Wet fire services shall be designed such that preventative maintenance can be carried out in accordance with AS1851. Consideration shall be given to the availability of system consumables, replacement pipe, fittings, valves and any other item required.

Fire hydrant design shall call for the installing contractor to provide 3 hardcover maintenance manuals with all technical information, maintenance and testing programs, all warranties and hard copies of drawings.

The fire hydrant service design shall include the provision for a Fire Service Key required for all door locks and key switches and shall be keyed to the 003 fire service key only.

All above-ground hydrant valves shall be designed as Galvin, Dixon Fire or Tyco supplied, installation of other equipment of equal or superior standard shall only be used after the approval of the Deputy Director – Planning and Development has been obtained.

Any in-ground spring type hydrants shall be of the A.W.E. (Associated Water Equipment) 'Maxi Flow' nylon coated type.

The fire hydrant design shall include only 'POTTER' pressure switches, installation of other equipment of equal or superior standard shall only be used after the approval of the Deputy Director – Planning and Development has been obtained.

24.4.44 Fire Hose Reels

Determine extent of required fire hose reels to NCC and AS 1221 and AS 2441 in association with the Architect and the Building Certifier.

The sketch design shall itemise requirements for fire hose reel requirements and location of the fire hose reels within the building.

Approval from the Deputy Director – Planning and Development is required at SD prior to proceeding onto design documentation.

Fire Hose Reels are to be 36 Metres in length. System design coverage shall be provided where required in accordance with Specification E1.5 of the NCC and AS2441.

All Hose reels are to be designed with a tested Gate Valve fitted to allow the removal of the fire hose reel for servicing and or replacement.

Extended swivel arms shall be allowed for with the design where hose reels are installed inside recessed areas, inside cupboards or cabinets.

Where fire hose reels are to be exposed to direct sunlight and weather and not otherwise housed in a suitable enclosure designs should include a purpose built cabinet/cupboard to be provided. Floor mounting brackets shall be utilised only where other forms of mounting/support are not available.

Where provided all fire hose reel cabinets and enclosures shall be designed to include visible signage in accordance with the requirements of AS2441.

Only brass screw nozzles shall be specified.

Fire hose reel designs shall ensure that only 'Quell' Selector type, Wormalds Model 92-482P or Fire Master (Tyco) 'Exelgard' fire hose reels shall be installed, installation of other equipment/reels of equal or superior standard shall only be used after the approval of the Deputy Director – Planning and Development has been obtained.

24.4.45 Fire Pump / Pumproom Design Guidance

24.4.45.1 Access

Pumps rooms and contained plant and equipment must be designed such that access for both operation and maintenance is available without obstruction.

24.4.45.2 Location

The location and design of fire pump room installations shall be approved by the Deputy Director – Planning and Development, Building Surveyor and the QFRS prior to design finalisation.

24.4.45.3 Duty

Pump duties shall be designed such that the available flow and pressure of the pump shall be at least 20% greater than the system duty flow and pressure requirements to allow for pump redundancy.

24.4.45.4 Maintenance & Testing

Provision must be made within the design of the fire pump rooms for ongoing testing & maintenance with consideration being given to available power sources, lighting and drainage.

24.4.45.5 Equipment

All large ticket fire pumps shall be designed as compression ignition type 'Kelair', 'Prime Pumps' or 'Southern Cross' supplied, installation of other equipment of equal or superior standard shall only be used after the approval of the Deputy Director – Planning and Development has been obtained.

Pressures relief valves shall be included within the design for all pumps and system pipework.
All pumps systems shall be designed with mechanical seals only.
All pressure gauge inclusions shall be designed with an isolation valve to enable service or replacement of the gauge.

24.4.45.6 Notification

The consultant shall design all fire pumps installations fitted with a 'Pump-Run' and 'Pump-Fail' audible and visual notification and be external to the fire pumproom in a visible location. The prior notification signals shall also interface with both the BMS and security services.

24.4.46 Booster Assemblies

Where required, hydrant booster designs shall meet the requirements of AS 2419.1/2/3.

Within the wet fire services design the location, colour and design of fire booster installations shall be approved by the Deputy Director – Planning and Development, Building Surveyor and the QFRS prior to design finalisation.

Masonry construction is preferred to metal cabinets with wet fire services design.

24.4.47 Identification of Equipment / Services

Confirm the plant numbering sequence with JCU Deputy Director – Planning and Development prior to Contract Documentation. Prefix equipment with building number.

Equipment Labels shall be 3 layer laminated plastic coloured to Australian standards fixed by stainless steel screws (approved adhesive fixings may be used to plastic accessories). Labels shall be sized to suite the importance and application and must be uniform for similar items. Minimum letter size is to be 3mm and 0.3mm line thickness.

Labelling shall be provided to all items to give clear indication of direction of flow and service purpose. Labels shall be colour coded to comply with AS1318.

Underground pipe work shall have traceable warning tape place 75mm above the pipework, colour coded, magnetic and be printed with the identification of the contents of the pipe and/or conduits and direction of flow. Warning tape is to be manufactured from polypropylene with 316 stainless steel trace wire imbedded to enable location detection complying with AS2648. The width of the marking tap shall be equal to the diameter of pipe it is protecting up to 400mm.

Above ground pipework identification shall be in accordance with AS1345 to identify piping, conduit and ducts.

24.5 USEFUL INFORMATION

24.5.1 National and State Legislation / Standards / Codes

As a minimum, the latest revisions or version of

- National Construction Code (revision as determined above)
- All applicable standards
- Queensland Development Codes
- Environmental Protection Act, Regulations
- Work Health and Safety Act
- JCU requirements as the local electricity provider
- QLD Electrical Safety Act and Regulations
- QLD Plumbing and Waste Water Code
- The Plumbing Code of Australia
- The Plumbing and Drainage Act
- The Plumbing and Drainage Regulations
- The Standard Plumbing and Drainage Regulations
- Local Authority's Plumbing and Drainage Department
- Local Authority's Trade Waste Department
- JCU requirements as the local infrastructure owners
- QFRS
- These Design Guidelines

- JCU Policies and Procedures
- Any other regulation or local authority requirements applicable to the works

24.5.2 Trade Specific Standards

AS/NZS 3500.1	Water service
AS/NZS 3500.2	Sanitary plumbing and drainage
AS/NZS 3500.3	Stormwater drainage
AS/NZS 3500.4	Heated water service
AS 2118	Automatic Fire Sprinkler Systems
AS 2419.1	Fire Hydrants
AS 2441.1	Fire Hose Reels
AS 2941	Fixed Fire Protection Installations – Pumpset Systems
AS/NZS 5601	Gas Installation
AS/NZS 1260	Sanitary drainage & vent fittings
AS 1273	Stormwater drainage fittings
AS 1530	Fire Stops
AS 2129	Flanges for pipes values & fittings
AS 2528	Bolts & nuts for flanges
AS/NZS 4087	Metallic flanges for water works
AS/NZS 1167	Silver or copper phosphorous brazing alloys
AS/NZS 3718	Copper alloy screw-down pattern taps
AS 1628	Metallic gate, globe and non-return valves
AS 2638	Gate valves for waterworks purposes
AS 1345	Identification of the contents of pipes, conduits and ducts
AS 1431	Copper tubes for plumbing, gasfitting and drainage applications
AS 1432	Copper tubes for plumbing, gas fitting and drainage applications
AS/NZS 4680	Hot-dipped galvanizing
AS/NZS 4792	Hot-dipped galvanizing
AS 1055	Acoustics - Description and measurement of environment noise
AS 1170.4	Minimum design loads on structures
AS 1210	Pressure vessels
AS 1318	Industrial safety colour code
AS 1530	Methods of fire tests on building materials, components and structures
AS 1657	Fixed platforms, walkways, stairways and ladders — Design, construction and installation
AS 1775	Low voltage switchgear and control gear
AS 1851	Maintenance of fire protection systems and equipment
AS2107	Acoustics — Recommended design sound levels and reverberation times for building interiors
AS2243	Safety in Laboratories (all parts)
AS2982	Laboratory Design and Construction
AS 3000	SAA Wiring Rules
AS 3653	Boilers – Safety, Management, Combustion and other ancillary equipment
AS 3666	Air-handling and water systems of buildings - Microbial control
AS 4041	Australian Standard Pressure Piping
AS 4426	Thermal insulation of pipework, ductwork and equipment - Selection, installation and finish
AS 60079	Electrical apparatus for explosive gas atmospheres

Regardless of the above, any applicable standard is to be considered in the design. The term “AS” shall also refer to “AS/NZS”.

24.5.3 Interfaces

Further to 24.3.2, as a minimum:

24.5.3.1 Architectural Services

- Plant room sizing (plan and height)
- Gross floor area sizes
- Roof type and pitch
- Duct and pipe special requirements and proposed zones
- Rising levels, finished surface levels & finished floor levels
- Riser spaces
- Access panel sizes and locations
- Service clearances
- Penetrations & fire collars
- Location of fire walls, doors, shutters etc
- Bunding requirements
- Clarification of building elements insulation
- Roof drainage systems including location of downpipes and overflows
- Location of bollards
- Location & dimensions of bulkheads
- Location of drainage points in, on or around the building e.g. drain outlet under mat at doors
- Preferred location of meter assemblies, booster assemblies, fire pump rooms and fire water tanks
- Location of rain water tanks
- Location of termination of vents and exhausts

24.5.3.2 Landscape Architectural Services

- Location of special features and drainage/water requirements e.g. sand pits, planter boxes etc
- Location of external hose taps
- Location of irrigation take off points
- Irrigation flows and pressure requirements
- Location of required drainage points with in soft and hard landscaping
- Arborist's requirements for location of inground services

24.5.3.3 Mechanical Engineering

- Requirements for condensate drains, waste and overflow from mechanical equipment
- Requirements, location and size of tundishes
- Types and temperature of discharges from mechanical equipment
- Requirements and location for plant room drains for mechanical equipment
- Requirements and location of water supplies to mechanical equipment

24.5.3.4 Electrical Engineering

- Requirements for supplies (location, termination, size, phases) to all hydraulic equipment
- Requirements for FIP interfaces & fire alarm indication
- Requirements for plant room, fire pump room and external plant deck lighting and service power points
- Requirements for data points for connection to BMS controls e.g. water meters
- Requirements for all gas safety equipment and interface with BMS
- Requirements for fire pumps and equipment and interface with FIP including audible and visual alarms

24.5.3.5 Acoustic Engineering

- Obtain the Acoustic report if relevant and address requirements for hydraulics
- Provide information of sound power / pressure & vibration and nature of devices
- Confirm internal and external noise constraints and design thereto

24.5.3.6 Structural Engineering

- Location of plant including masses, any additional special items such as dynamic load etc
- Size and mass of exhaust flues, requirements for stays and guy wire fixing points
- Special fixings as may be required
- Location of penetrations
- Location, depth and width of footings for co-ordination with drainage
- Sag points in concrete roof decks to position drains
- Requirements for drainage in, under and around basements
- Requirements for above or below ground tanks i.e. trafficable lid on a rain water tank
- Requirements for tanks located within or on the structure and weights
- Advice regarding any potential hydraulic uplift

24.5.3.7 Civil Engineering

- Location & invert levels of interfaces with civil storm water, infrastructure
- Location & size of civil storm water inlet pits and gross pollutant traps
- Location & size of civil detention tanks, basins or swales
- Requirements for drainage in, under and around basements
- Requirements for above or below ground tanks
- Advice regarding any potential hydraulic uplift
- Location of the extent of storm water discharge points
- Demarcation points between civil and hydraulic engineering

24.5.3.8 Geotechnical Engineering

- Location and types of soil conditions i.e. highly reactive
- Location, type & flow rates of sources of any ground water i.e. sea water, springs
- Recommendations on drainage systems for soil conditions
- Location of any acid sulphate soils
- Location of any contaminated soils

24.5.3.9 Hazardous Areas Design

- Review the Hazardous Area Classification for the space and address any hydraulic equipment Requirements e.g. location of electric hot water units
- Where required, arrange for electrical design for Hazardous Areas
- Where potentially flammable or explosive liquids, gases, vapours or dusts are advised, advise the Deputy Director – Planning and Development of such presence and confirm whether a Hazardous Area Classification is required