Standard

Departmental Network Infrastructure Procedures & Standards

CM: 21/709204
Implementation Date: 15th May 2022
Version: 4

Audience

Department-wide
External

- Project managers
- Electrical Designers/Engineers
- Builders
- ICT Cabling Contractors

Purpose

The Departmental Network Infrastructure Procedures & Standards (DNIPS) sets the minimum requirements to which all network cabling and supporting infrastructure is designed, installed, labelled, planned, documented, selected, tested, certified, warranted and completed within the Queensland Department of Education (DoE). The standard reflects the mandated responsibility of DoE as dictated by the Queensland Governments' ICT cabling infrastructure policy.

Overview

The Departmental Network Infrastructure Procedures & Standards (DNIPS) achieves the following;

- Ensures that ICT cabling infrastructure and components within DoE are selected and installed to a consistent level.
- Delivers a practical working specification intended to ensure the Information Communication Technology (ICT) infrastructure remains functional throughout the product's relevant life cycle; as defined by international standards and the manufacturers own requirements
- The installation environment on DoE sites is considered to be hostile in respect to malicious damage; this document mandates additional installation practices to minimise the potentiality of damage and further protect the ICT Infrastructure throughout its life cycle.
- Acknowledges DoE's unique duty of care for students and staff by placing an emphasis on prevention of injury resulting from physical interference with, or mechanical damage to, ICT Infrastructure deliberate or otherwise.

DNIPS was developed in accordance with, and is mandated by, the following:

- Queensland Government ICT Cabling Infrastructure Policy
- Queensland Government ICT Cabling Infrastructure Standard

Scope

Departmental Network Infrastructure Procedures & Standards (DNIPS) governs all ICT cabling infrastructure activities and works carried out on all accommodation and properties occupied by DoE including existing and newly built premises and state schools. These requirements are additional to all other relevant international, national and state standards, legislation, regulations and manufacturer's installation and warranty requirements.

Handling of Exceptions

Where a proposed implementation is not consistent with the requirements in this standard, this ***SHALL*** require prior approval for exception from the DoE Information and Technologies Branch (ITB) Design Authority.

1. All exception requests ***shall*** be made in the design phase of the project via a completed standard exception form.
2. All exception approvals ***shall*** only apply to the location and scope for which it is requested and permission ***shall*** be recorded in the detailed ICT cabling design documentation.
3. Approvals ***shall not*** be used on any other project, site or location.
4. All exception ***shall*** be recorded in a register

Requests to deviate from the Queensland Government ICT Cabling Infrastructure Standard or regulatory compliance requirements ***shall not*** be accepted. Any questions or clarification relating to ICT cabling in DoE environments or the contents of this document should be directed to:

DoE Information and Technologies Branch Design Authority, Email: network.design@qed.qld.gov.au

Categories of Requirements

This standard contains mandatory requirements as well as recommendations for best practice. The use of the word "***shall***" defines a mandatory requirement. The use of the words "***shall not***" defined a prohibited activity.

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1. Order of Precedence of Standards

Under the Queensland Government Enterprise Architecture (QGEA) Framework, decisions on any conflicting information should be governed by reference to the following in descending rank order:

1. Relevant Australian Government Legislation and Regulation (e.g. Telecommunications Act 1997 (the Act), AS/CA S008 and AS/CA S009) etc.
2. Relevant Queensland Government Legislation and Regulation (e.g. Queensland Workplace Health and Safety regulations) etc.
3. Relevant Australian Standards to be found in the CCM Package-2007: Communications Cabling Manual (Volumes 1 & 2)
4. Queensland Government Enterprise Architecture - ICT cabling infrastructure technical standard https://www.qgcio.qld.gov.au/documents/ict-cabling-infrastructure-technical-standard
5. Departmental Network Infrastructure Processes and Standard (DNIPS) - this document
6. Cabling systems manufacturers design, installation and warranty requirements

2. Important Information for ICT Cabling Designers and Installers

2.1. Mandatory Requirements

All works carried out within the DoE ICT infrastructure environment are mandated by the order of precedence of federal, state and QLD DoE standards. Adherence to the standards and specifications within this document is mandatory – exceptions may only be sought in accordance with the formal exception process and all approvals ***shall*** be obtained in writing prior to undertaking any sites works. Any questions or clarifications related to ICT cabling in DoE environments or the contents of this document should be directed to DoE Information and Technologies Branch Design Authority at: network.design@qed.qld.gov.au
The information contained within this standard is applicable to all ICT cabling installation within DoE sites regardless of size or complexity.

2.2. Definitions - Installation Types

2.2.1. Simple Installations

A simple ICT cabling installation within the DoE environment is constrained as follows:

a. The installation ***shall not*** involve the installation of a new telecommunications cabinet
b. The installation ***shall not*** involve the installation of optic fibre cabling
c. The installation ***shall not*** involve the installation of cabling to support wireless network equipment

2.2.2. Complex Installation

A complex ICT cabling installation is any installation not defined as simple, per the previous definition.
Complex installations ***shall*** utilise the services of a qualified ICT cabling designer to ensure the design complies with installation standards and regulation. A qualified project manager ***shall*** provide physical installation oversight to ensure compliance.
Design and specification documentation including plans (site and building), cabinet layouts, etc. for complex cabling works performed within the DoE environment ***shall*** be submitted to the DoE ITB Design Authority for endorsement prior to installation.

2.2.3. Passive Installations

Passive installations include all ICT cabling elements constructed or installed to provide a functional physical network for the interconnection of active network devices.

2.2.4. Active Installations

Active installations refer to the fitting/mounting of network active devices including, but not limited to,

a. Network routers and switches
b. Wireless network equipment
c. Server equipment

2.2.5. Other IP Connected Equipment Installations

Other IP connected equipment includes all Ethernet based equipment and systems connecting via the passive ICT cabling infrastructure. This includes, but is not limited to,

a. Closed Circuit Television (CCTV)
b. Security
c. Public Address (PA)
d. Audio/Video Streaming

All such equipment and systems ***shall*** be compliant to the applicable ACMA technical standards.

2.3. ICT Cabling Working party Stakeholders Engagement

All provisioning of ICT cabling ***shall*** include a design component to ensure that any proposed ICT cabling works have explicitly had consultation with, and input from the appropriate “working party” representatives, taking into account future growth expectations and specific user requirements at the relevant DoE facility.
Primarily, the “working party” engagement model aims to embed fit for purpose quality assurance mechanisms into the provisioning of ICT infrastructure. This ensures the Department’s facilities are underpinning the capabilities of the Department’s managed operating environment and promoting delivery of DoE’s broader educational strategy and learning outcomes for both staff and students.
The working party ***shall*** incorporate representation from the listed representatives in the following matrix, based on the installation type defined previously;

Working Party Representation Matrix (Minimum Mandatory Requirements)		
Stakeholder Representation	**Scope of Works**	
	Simple	**Complex**
School/Site Representative (Principal, BSM, etc)	Required	Required
DoE Regional Representative (RTM, RST, etc)	Required	Required
DoE ISB ICT Procurement (Manager/Coordinator)	Required	Required
DoE ITB Design Authority (Network Design)	*Not Required*	Required
External Project Management (where present)	*Not Required*	Required
Any Principal Architecture Consultant (where present)	*Not Required*	Required
Any Electrical/Mechanical Engineer (where present)	*Not Required*	Required

The working party ***shall*** complete the relevant section of the ICT Cabling Design Acceptance form, formally acknowledging they have been consulted throughout the design process and have been supplied with the required supporting design material.

2.4. Warranty and Site Certification

It's a requirement when DoE undergoes ICT cabling infrastructure activities, works ***SHALL*** conform to the warranty and site certification requirements of the Queensland Government ICT Cabling Infrastructure Standard, addressing the following areas:

- the minimum level of warranty and site certifications for cabling infrastructure
- the use of a single manufacturer for copper and optical fibre cabling systems
- conditions for when multiple manufacturers are permitted for copper and fibre cabling systems

For ease of maintenance, and to ensure the integrity of site certification and warranty, DoE prefers a single manufacturer solution on each campus; where all ICT cabling components are of the same manufacturer throughout the site.
Departures from the above may fall into the following categories;

a. Where a site already has an existing mix of distinct manufacturer product throughout a single building. In this instance, the DoE ICT Cabling Design authority ***shall*** be notified and will arbitrate on an appropriate solution.
b. Where a site already has an existing mix of distinct manufacturer product across a number of separate buildings (with a specific manufacturer constituting the entirety of the cabling within a building). In this instance manufacturer No.1 in building 'A' ***shall*** continue to be utilised for that specific building, and manufacturer No.2 in building 'B' ***shall*** continue to be utilised for that specific building; and so on.

In both these instances the manufacturer of the components to be installed ***shall*** provide confirmation before works begin that the appropriate site certification and warranty will be honoured on both the existing and any new cabling.
All ICT cabling components ***shall*** be manufactured by the certifying manufacturer.

2.4.1. Certified Installers

A Certified Installer (CI) is an organisation holding a commercial agreement with a certifying ICT cable manufacturer to apply a warranty/certification to a completed ICT cabling system. CI companies employ technicians accredited by the manufacturer in the practices involved in installing and testing the ICT cabling systems of that manufacturer. CI companies ***shall*** be familiar with the QITC (Queensland Information Technology Contracting) framework.

2.4.2. Accredited Installer

Accredited Installers (AI) are employees of CI companies who hold an Open Cablers Registration, with competencies for Structured Cabling and Optical Fibre, and have attended a certified installation training course with the certifying manufacturer and have received a certificate of completion. A Letter or Statement of Attendance is not acceptable as certification by a manufacturer.
The minimum number of Accredited Installers engaged on the installation of ICT cabling on a DoE site ***shall*** be 50% of the CI personnel actively engaged on site during the installation of the ICT cabling.
Accredited Installers ***shall*** be the holder of a valid working with children Blue Card.

2.4.3. Installer - Other

Personnel actively involved in the installation of ICT cabling on DoE sites who are not CI's ***shall*** only perform ICT cabling installation works under the direct supervision of a CI. It is not sufficient that a CI is on site without direct supervision of non-CI personnel. It is expected that a CI ***shall*** be within the facility or area of works performing direct supervision of non-CI personnel.
Installers ***shall*** be the holder of a valid working with children Blue Card.

2.5. Guidance for Brownfield Sites (Existing School Sites)

To ensure clarity regarding the application of this standard as it pertains to existing DoE sites the following ***shall*** be considered by designers and installers of ICT infrastructure.

2.5.1. Asbestos

All works on DoE Facilities are to be carried out in accordance with the requirements and conditions listed in the "Working on Department of Education (DoE) Facilities" document available from https://education.qld.gov.au/about/Documents/working-on-doe-facilities.pdf.

All work involving asbestos containing material or material suspected of containing asbestos ***shall*** require a Work Area Access Permit. Failure to obtain a Work Area Access Permit will result in removal from site and further action may result in accordance with DoE Asbestos Management policy and procedures (https://education.qld.gov.au/about-us/reporting-data-research/reporting/asbestos-management/policy-and-procedures/policy)

2.5.2. Heritage Listing

The works ***shall*** include consideration of any building heritage listing with information from the Queensland Heritage Register: https://www.qld.gov.au/environment/land/heritage/register.

A copy of the details from the Heritage Council register for a DoE site can be viewed on the abovementioned web site.

For heritage buildings the works ***shall*** include delivery to the Queensland Heritage Council of plans detailing the work to be performed in or on the listed building, including all ICT cabling. Compliance to the requirements of the Queensland Heritage Council for installation of ICT cabling Infrastructure ***shall*** form part of the works.

2.5.3. Existing Cabling

In the case where a brownfield site undergoes the upgrade or new installation of an ICT system or service, such as wireless access points or closed-circuit television systems, cabling contractors and designers are permitted to use existing cabling to facilitate network connectivity only where ***all*** the following conditions are met;

a. The existing cabling is at minimum Class D with support for Gigabit Ethernet
b. The existing ICT cabling is 'fit-for-purpose, as deemed by DoE Network Design; relevant to the system or service installed and the required operational outcomes and business requirements.
c. The existing ICT cabling satisfies Field Testing Requirements specified in Section *4 Field Testing of Cable*
d. Reuse of existing cabling does not breach any relevant Australian legislation, standards or codes

The following documentation is required by the Department of Education Information and Technologies Branch to assist in determining if existing cabling can be used or if new cabling is required:

a. A design or scope of works which clearly indicates the proposed ICT deliverables
b. Test results produced from Field Testing Requirements specified in Section *4 Field Testing of Cable*.

2.5.4. Existing Telecommunications Cabinet Relocation/Upgrade

Where it is necessary to relocate a cabinet the existing cabling terminated within the cabinet ***shall*** be assessed for replacement against the criteria established in section 2.5.3 Existing Cabling. Where the existing cabling meets this criteria but does not have spare slack available to reach the new cabinet location, the use of a consolidation point may be permitted. Refer to section *7.9 Consolidation Points* for details.

Where the existing cabinet has less than 500mm depth from the rear of the cabinet to the inside of the cabinet door, it ***shall*** be replaced with a minimum 700mm deep cabinet.

2.5.5. Telecommunication Equipment Rooms

For refurbishments or other building modifications that will significantly impact the building's ICT cabling, ICT capabilities and ICT services, telecommunication equipment rooms ***shall*** comply with the specification for new buildings in regards to data cabinet/equipment access and security.

For the purpose of this section, refurbishments or other building modifications will significantly impact a building's ICT cabling or ICT capabilities and services when one or more of the following conditions are met:

a. A new ICT system or service is to be installed within a building (Interactive whiteboards, wireless network equipment, etc.) which results in a requirement to expand the capacity of an existing telecommunications cabinet.
b. As a result of planned works, a building's data cabinet is relocated and the bulk of existing ICT cabling is required to be re-terminated or replaced.

2.5.6. Defect and non-compliance Reporting

Where installation contractors, certified by the ICT cabling manufacturer, are installing additional cabling onto an existing certified installation and existing installation practices are found which are in breach of the "Wiring Rules", or the mandatory provisions of this cabling standard, these ***shall*** be reported to the DoE PM/PC/RST for further action. Where the installation practices are in breach of the "Wiring Rules" the installation contractor ***shall*** complete a Telecommunications Cabling Advice 2 (TCA2) for the breach and submit this to the DoE PM/PC/RST along with photographs of the breach.

Where the non-compliance poses an immediate risk to either personal safety or to the network, the installation contractor ***shall*** advise the department immediately.

2.6. Practical Completion and Site Mandatory Documentation

Unless otherwise specified, the Contractor ***shall***, within five (5) working days of practical completion of the cabling at a site, provide to the Project Manager, site representative and the ITB Design Authority the following documentation;

a. Telecommunications customer cabling advice Form (TCA1)
b. Documentation produced as a result of field testing as per section- *4 Field Testing of Cable*
c. DoE ICT Works Completion Advice Form
d. DoE ICT Cabling Design Acceptance Form
e. DoE ICT Cabling Completion Acceptance Form

Unless otherwise specified, the Contractor ***shall***, within ten (10) working days of Practical Completion of the cabling at a site, provide to the Structured Cable System (SCS) manufacturer, in accordance with the warranty requirements, all the necessary documentation to enable issuing of the manufacturer's Performance Warranty directly to the School.

2.7. Audit and Inspection of Cabling Work

An independent ICT cabling post installation audit is conducted where deemed necessary by DoE to ensure the installation complies with the requirements of the Australian regulations, standards, vendor installation practices and the DNIPS cabling standard.

Personnel engaged in the post installation auditing of installed ICT cabling ***shall*** meet the following criteria:

a. Be an ACMA Open Registered installer with competencies for Structured Cabling and Optic Fibre
b. Be a qualified electrician in the State of Queensland
c. Be a BICSI Registered Communications Distribution Designer (RCDD)
d. Have a documented minimum of five (5) years of ICT cabling audit experience within an environment similar to DoE
e. Have demonstrated working knowledge of the DNIPS and the AS/CA S009 "Wiring Rules"
f. Hold a completed training certificate from the Structured Cabling System (SCS) vendor/manufacturer for the installed SCS product

Information relating to the inspection of ICT Cabling Infrastructure ***shall*** be provided in Portable Document Format (PDF) and include

a. Date(s) of the inspection
b. Name, Company, and contact details of the inspector
c. Full name and address of the inspection site
d. Remedial action taken in the event of a failed inspection

Where supplementary documentation is provided in digital format, such as photographs, video recordings, etc, this ***shall*** be organised in a hierarchical tree where each building has its own subfolder under the Site Folder

3. ICT Cabling Design Requirements

3.1. ICT Cabling Topology

A hierarchical star topology is mandated by DoE for all fibre and copper ICT infrastructure at DoE sites. DoE manages over 1400 networks state-wide, for that reason the need for standardisation far outweighs the most economical solution.

3.2. ICT Backbone Cabling

ICT Backbone cabling ***shall*** consist of a minimum 12 core OS2 Single Mode Optical Fibre (SMOF) cable originating from the Centre of Network (CoN) to each network connected building on campus. Each ICT Backbone cable segment ***shall*** be continuous, without joints, from the Centre of Network to each connected building except where one of the following is true;

a. An outdoor rated fibre cable of flammable construction is to be installed internally through fire penetrations within a multistorey building in breach of AS/CA S009, or
b. An existing cable of 12 core single mode fibre type does not have available cable slack to accommodate relocation of the current termination point.

In either of the above situations a fibre joint may be permissible with endorsement of the DoE ICT Cabling Design Authority. Refer to section *6.5. Fibre Optic Joints* for more detail.

3.3. ICT Horizontal Cabling System

All ICT horizontal cabling ***shall*** originate from an approved ICT cabinet located within each network connected building on campus. All new ICT horizontal cabling ***shall*** be continuous without joints. The performance standard of the cabling ***shall*** be specified in the ICT cabling design documentation.

The minimum standard of ICT Horizontal Cabling ***shall*** be Class EA as defined in AS/NZS ISO/IEC 11801.1 and referenced in the Queensland Government Enterprise Architecture - ICT cabling infrastructure technical standard.

3.4. Centre of Network (Network Hub)

The Centre of Network is the main distribution point for the campus network backbone cabling and houses the site's core network equipment. The Centre of Network may also house horizontal cabling terminations for the building in which it is located. All new Centre of Network data cabinets ***shall*** be 45 RU in size with a depth of 1100mm.

3.5. Edge Buildings (Network Host)

Edge buildings are connected directly to the Centre of Network via optical fibre cable and contain Network equipment and a Horizontal Cabling System that support the edge building only. All new buildings ***shall*** be connected to the Centre of Network with 12 core Single-Mode Optical Fibre (SMOF). Typical edge buildings can be serviced by cabinets varying in size from 18RU through to 45RU

3.6. ICT Cabling Facilities

3.6.1. Telecommunication Equipment Rooms

All equipment room designs ***shall*** be specified in detail, and be clearly illustrated in the ICT cabling design documentation for the site. Details ***shall*** include, but are not limited to the following:

a. Room dimensions
b. Room layout diagrams, including
    1. Cabinet locations
    2. Cabinet clearances
c. Entry heights and widths
d. Ceiling heights
e. Cabinet sizes
f. Cabinet layouts
g. Room electrical services, and
h. CD/MDF and/or any BD/IDF

Design guidance for equipment rooms ***shall*** be taken from AS/NZS 3084 with respect to minimum size to suit the campus and also the minimum services required for the space to function as the Centre of Network.

All equipment rooms ***shall*** be "fit for purpose" and suitably sized to accommodate any ICT infrastructure necessary to facilitate the delivery of any immediate business requirements and the anticipated future ICT requirements articulated by the project "working party" stakeholders.

Equipment rooms ***shall*** comply with the following specifications:

a. Be secured with suitable locks, or electronic access controls
b. The room ***shall not*** have windows of any type
c. Provides a ceiling-height of no less than 2600mm, with any access doors providing a minimum of 2400mm in height and 1000mm in width
d. Provides a minimum lighting-level of 500Lx @ 1.0m AFFL in all areas of the room and 200Lx incidental where the light meter is held @ 90º to the horizontal plane as detailed in AS/NZS 14763.2
e. Provides adequate dedicated power-outlets for the type of cabinet being installed
f. Provides a minimum of two (2) dual power-outlets per cabinet (1x front + 1x rear) for service-personnel, to a maximum of

two dual power-outlets (2x front + 2x rear).

g. Provides a minimum front clearance of 1500mm from the fore-most dimension (front) of any cabinet in medium and large type equipment rooms (refer to Appendices B and C).
h. Provides a minimum front clearance of 1000mm and 1100mm from the fore-most dimension (front) of any cabinet in small and closet type equipment rooms respectively (refer to Appendices A and D).
i. Provides a minimum rear clearance of 900mm from the rear-most dimension (rear) of any cabinet
j. Provides a minimum side clearance of 900mm from at least one (1) side of any cabinet, or suite of cabinets, to the wall or other obstruction and a minimum of 300mm clearance to any obstruction on the other side
k. For all new buildings, includes a dedicated space allocation for at least one (1) additional cabinet, while still complying to the side-clearance provisions (item j) above
l. Provides adequate clearance as per AS/CA S009 for any collocated MDF/CD infrastructure.

3.6.2. Telecommunication Equipment Rooms Accessible from the Exterior of a Building

Where access to a Telecommunications Equipment Room is via the exterior of a building the following ***shall*** be applicable:

a. Doors ***shall*** be solid construction; hollow core construction doors ***shall not*** be installed.
b. Doors ***shall*** be weather and dust sealed.
c. Doors ***shall*** have heavy duty anti-tamper hinges.
d. Locks ***shall*** be internal lever action handle, four point dead bolt lock and openable from inside at all times.
e. Additional ventilation/air conditioning ***shall*** be considered to ensure the room maintains a suitable ambient temperature.

3.6.3. Dedicated Telecommunication Equipment Rooms - Centre of Network

In addition to the specifications identified in 3.6.1. Telecommunication Equipment Rooms of this document, Centre of Network equipment rooms ***shall*** also comply with the following specifications:

a. 24/7 air conditioning
b. Patch cord hangers ***shall*** be provided and installed
c. Refer to Appendix C for sample dimensions of a large equipment room

3.6.4. Dedicated Telecommunication Equipment Rooms - Edge Buildings

In addition to the specifications identified in 3.6.1. Telecommunication Equipment Rooms of this document, edge building equipment rooms ***shall*** also comply with the following specifications:

a. 24/7 air conditioning, or
b. Thermostatically controlled exhaust fan rated for 24/7 operation.
c. Refer to Appendices A-D for sample dimensions of equipment rooms

Designers ***shall*** consider and reference building/room circulation and year round ambient temperatures when determining if air-conditioning is not required for edge buildings.

3.6.5. Dedicated Telecommunication Equipment Closet

Where there is insufficient space to provide a dedicated room for ICT infrastructure purposes and the future scalability expectations are confirmed by the project “working party” stakeholders as being minimal, with particular reference to Halls, Tuckshops and Janitor/Grounds Sheds, a suitable space ***shall*** be allocated that provides the following:

a. Adequate space for a suitably sized, fully enclosed and lockable cabinet
b. The cabinet ***shall*** be located in a position that provides a minimum of 900mm clear unobstructed access to both the front and rear of the cabinet
c. A minimum of 300mm clearance to both sides of the cabinet from any obstruction
d. A minimum ceiling clearance of at least 100mm from the top of the cabinet
e. A minimum lighting-level of 500Lx @ 1.0m AFFL and 200Lx incidental where the light meter is held @ 90º to the horizontal plane as detailed in AS/NZS 14763.2
f. Suitable cable access to comply with the installation requirements of the certifying manufacturer
g. Adequate dedicated power-outlets as detailed in the specific cabinet-requirements for the cabinet being installed
h. A minimum of two (2) dual power-outlets per cabinet (1x front + 1x rear) for service-personnel
i. A fully enclosed cable pathway of minimum 100mm X 100mm rigid PVC or metallic ducting from the cabinet to the enclosed ceiling cavity. Where the cabinet is located in a student accessible area the duct ***shall*** be metal and the lid ***shall*** be secured with anti-tamper screws. Where the duct rises vertically more than 2000mm additional cable supports ***shall*** be installed within the duct to provide adequate long-term support to the ICT cabling
j. Provides adequate clearance as per AS/CA S009 for any collocated MDF/CD infrastructure

Refer to Appendix D for sample dimensions of a dedicated telecommunications equipment closet.

3.6.6. Unenclosed Telecommunication Space

For any existing building that explicitly presents no alternative location for ICT infrastructure purposes (i.e., Brownfield), and the future scalability expectations have been confirmed by the project “working party” stakeholders as being minimal, a suitable unenclosed space may be utilised.

A suitable unenclosed space ***shall*** comply with the following specifications

a. Adequate space for a suitably sized, fully enclosed and lockable cabinet
b. A minimum front clearance of 1500mm from the fore-most dimension (front) of any cabinet

c. A minimum rear clearance of 900mm from the rear-most dimension (rear) of any cabinet
d. A minimum side clearance of 900mm from at least one (1) side, of any cabinet, or bay of cabinets
e. A minimum ceiling clearance of at least 100mm from the top of the cabinet
f. Suitable cable access to comply with the installation requirements of the certifying manufacturer
g. Adequate dedicated power-outlets as detailed in the specific cabinet-requirements for the cabinet being installed
h. A minimum of two (2) dual power-outlets per cabinet (1x front + 1x rear) for service-personnel
i. A fully enclosed cable pathway of minimum 100mm X 100mm rigid PVC or metallic ducting from the cabinet to the enclosed ceiling cavity. Where the cabinet is located in a student accessible area the duct ***shall*** be metal and the lid ***shall*** be secured with anti-tamper screws. Where the duct rises vertically more than 2000mm additional cable supports ***shall*** be installed within the duct to provide adequate long term support to the ICT cabling
j. Provides adequate clearance as per AS/CA S009 for any collocated MDF/CD infrastructure.

Refer to Appendix E for sample dimensions of an unenclosed telecommunications equipment space.

3.7. Telecommunications Cabinets

3.7.1. Centre of Network Equipment Cabinet

Centre of Network Equipment Cabinets ***shall*** meet the following specifications:

a. 45RU High
b. Minimum 800mm wide
c. Minimum 1100mm deep to allow for rack mounted server equipment
d. Cabinet rails ***shall*** be recessed 150mm from the front with rear rails mounted 500mm from the front rails
e. Contain three (3) fixed front/rear mounted shelves for a 45RU cabinet
f. Contain a minimum of one (1) 450mm wide internal cable tray for the support of installed cabling
g. Minimum 10 outlet power rail with 15A captive plug
h. Horizontal cabling cabinets ***shall*** service a maximum of 336 telecommunications outlets
i. Where more than one cabinet is installed into the Centre of Network the cabinets ***shall*** all be identical in size and manufacture and ***shall*** be joined as a suite using the cabinet manufacturer's baying kits.
j. Fitted with an integral earth termination stud on each structural element of the cabinet
k. Where a shielded cabling solution is installed the cabinet ***shall*** contain an earth termination bar with a minimum of 24 termination holes for individual earth terminations for patch panels and network active equipment.
l. Cabinets shall be secured to the floor with appropriate anchors suitable for the floor surface

Requirements for doors and side panels will be detailed in the site-specific detailed design. If doors and side panels are specified they ***shall*** be ventilated. Cabinet doors ***shall*** be ventilated to a minimum of 80%. If the cabinets are enclosed they ***shall*** be fitted with a thermostatically controlled exhaust fan unit from the cabinet manufacturer with the thermostat set to 26 Degrees Celsius.

3.7.2. Standard Telecommunications Cabinet

The Telecommunications Cabinets of edge buildings that are not of relocatable/temporary type ***shall*** meet the following specifications:

a. Service a maximum of 336 telecommunications outlets
b. Minimum 45RU high
c. Minimum 800mm wide
d. Minimum 800mm deep
e. Cabinet rails ***shall*** be recessed 150mm from the front with rear rails mounted 500mm from the front rails
f. Contain two (2) fixed front/rear mounted shelves for a 39RU cabinet
g. Contain three (3) fixed front/rear mounted shelves for a 45RU cabinet
h. Minimum 10 outlet power rail with 10A captive plug
i. ***Shall*** be fitted with an integral earth termination stud on each structural element of the cabinet
j. Where a shielded cabling solution is installed the cabinet ***shall*** contain an earth termination bar with a minimum of 24 termination holes for individual earth terminations for patch panels and network active equipment.
k. Cabinets shall be secured to the floor with appropriate anchors suitable for the floor surface

Requirements for doors and side panels ***shall*** be detailed in the site specific detailed design.
Where a telecommunications cabinet is located outside of a Telecommunications Room the cabinet ***shall*** be fully enclosed with all doors and side panels secured with #92268 locks. Cabinet doors ***shall*** be ventilated to a minimum of 80%. The cabinet ***shall*** be fitted with a thermostatically controlled exhaust fan unit from the cabinet manufacturer with the thermostat set to 26 Degree Celsius.

3.7.3. Two Classroom Relocatable Building Telecommunications Cabinet

The telecommunications Cabinets of relocatable buildings with two or less classrooms ***shall*** meet the following specifications:

a. Service a maximum of 48 telecommunications outlets
b. Minimum 12RU (600mm) high wall mounted and fully enclosed with ventilated side panels
c. Minimum 600mm wide
d. Minimum 700mm deep
e. Cabinet rails ***shall*** be recessed 150mm from the front
f. Contain one (1) 450mmD cantilever shelf

g. Minimum six (6) outlet power rail with 10A standard plug
h. Lockable front door
i. Cabinets ***shall*** be mounted 150mm below ceiling
j. Where staff/students are able to access the area under a cabinet the cabinet ***shall*** be mounted 2000mm AFFL to the underside of the cabinet
k. ***Shall*** be fitted with an integral earth termination stud on each structural element of the cabinet
l. Where a shielded cabling solution is installed the cabinet ***shall*** contain an earth termination bar with a minimum of 9 termination holes for individual earth terminations for patch panels and network active equipment.
m. Where wall mounted cabinets are mounted onto non-structural walls a supplementary backing board of minimum 12mm thick structural plywood painted white ***shall*** be supplied and fitted to the wall prior to the mounting of the cabinet. The backing board ***shall*** be at minimum 300mm larger than the cabinet in all dimensions. The backing board ***shall*** be secured to at least two (2) wall studs by minimum of six (6) anchors. The exclusive use of "liquid nails" type products for the mounting of the backing board is prohibited without the use of supplementary anchors.

3.8. Telecommunications Cabinet Layout

3.8.1. New Sites Centre of Network Cabinet Layout

All Centre of Network equipment cabinets ***shall*** be laid out as detailed in Appendix F.

3.8.2. Existing Sites Centre of Network Cabinet Layout

Where possible all fibre optic termination enclosures ***shall*** be located within one zone of the cabinet as per the new site's layout. Placement of termination enclosures amongst horizontal cabling terminations should be avoided wherever possible.

3.8.3. Edge Building Telecommunications Cabinet Layout

All standard edge building cabinets ***shall*** be laid out as detailed in Appendix G.

3.8.4. Two Classroom Relocatable Building Telecommunications Cabinet Layout

All wall mounted telecommunications cabinets ***shall*** be laid out as detailed in Appendix H.

4. Field Testing of Cable

Testing of all ICT cabling installations is mandatory to demonstrate compliance to the required standards and Class of cabling.
The testing process ***shall*** comply with the following standards:

a. AS/NZS ISO/IEC 11801-1 for compliance to the Class of performance
b. IEC 61935-1 for copper testing methodology
c. AS/NZS 14763.3 for optical fibre testing methodology

A quality plan compliant to AS/NZS 14763.2 Clause 6.1 ***shall*** be provided for all testing on DoE sites. Quality plans ***shall***, as a minimum, detail the qualifications of the personnel performing the test, equipment utilised, calibration status, applicable test standard and methodology as well as manufacturer specific information from the installation.
All personnel actively involved in field testing of ICT cabling ***shall*** be certified by the test equipment manufacturer.

4.1. Copper Testing

Testing of the installed copper ICT cabling infrastructure ***shall*** comply with the following requirements:

a. Testing ***shall*** be completed in accordance with the AS/NZS 14763.2 Quality Plan provided
b. Installation personnel responsible for the performance of the testing process ***shall*** be the holder of test equipment manufacturer certification in the use of the test equipment (Fluke Networks CCTT or similar). Evidence of certification ***shall*** be supplied with project handover documentation
c. Test equipment used ***shall*** be calibrated and certificates of calibration currency ***shall*** be submitted with all test results
d. Test equipment ***shall*** be minimum standard Level IV as per IEC 61935-1
e. Only permanent link testing ***shall*** be performed
f. Test equipment ***shall*** only use proprietary test leads supplied by the test equipment manufacturer
g. Test "head" test counts ***shall not*** exceed the maximum number of test insertions as recommended by the test equipment manufacturer
h. Test equipment ***shall*** be set to metric measurements
i. Test results ***shall*** be supplied in the test equipment software's native format. A copy of the test results summary ***shall*** also be provided in Portable Document Format (pdf). Text files ***shall not*** be submitted
j. Test results files containing marginal *pass or fail results ***shall not*** be submitted
k. Test results ***shall*** indicate the full TO identification sequence including the Site Code
l. Submitted test files ***shall*** be submitted with each building having its own subfolder under the Site Folder in a hierarchical tree

4.2. Optic Fibre Testing

Testing of the installed optic fibre ICT cabling infrastructure ***shall*** comply with the following requirements:

4.2.1. Light Source Power Meter (LSPM)

a. Testing ***shall*** be completed in accordance with the AS/NZS 14763.2 Quality Plan provided
b. Installation personnel responsible for the performance of the testing process ***shall*** be the holder of test equipment manufacturer certification in the use of the test equipment (Fluke Networks CCTT or similar). Evidence of certification ***shall*** be supplied with project handover documentation
c. Test equipment used ***shall*** be calibrated and certificates of calibration currency ***shall*** be submitted with all test results
d. Light Source Power Meter (LSPM) testing ***shall*** be performed using the one test cord reference model detailed in AS/NZS 14763.3 Appendix E
e. Only reference connected test cords ***shall*** be used
f. Testing ***shall*** be performed at both operating wavelengths applicable to the grade of optic fibre installed and in both directions
g. LSPM test result labels ***shall*** indicate the source FOBOT ID, the destination FOBOT ID and the core number. The source FOBOT ID ***shall*** be the FOBOT at the Centre of Network cabinet
h. Test equipment ***shall*** be set to metric measurements
i. Test results ***shall*** be supplied in the test equipment software's native format. Text or Portable Document Format (pdf) files ***shall not*** be submitted

4.2.2. Optical Time Domain Reflectometer (OTDR)

All installed optic fibre links exceeding 100m ***shall*** be tested with an OTDR.

a. Testing ***shall*** be completed in accordance with the AS/NZS 14763.2 Quality Plan provided
b. Test equipment used ***shall*** be calibrated and certificates of calibration currency ***shall*** be submitted with all test results
c. OTDR testing ***shall*** be performed using launch and tail test cords with reference grade connectors
d. OTDR testing ***shall*** be performed at both operating wavelengths for the grade of optic fibre installed in one direction only
e. Test results ***shall*** be supplied in the test equipment software's native format. Text or Portable Document Format (pdf) files ***shall not*** be submitted
f. Trace data ***shall*** be submitted in *.sor format. The installer ***shall*** provide to DoE a copy of viewing software capable of viewing the native trace data.

5. ICT Cabling System Installation Requirements

5.1. Cabling Systems

The cabling and pathway installation procedures and standards contained within this document ***shall*** apply to the installation of structured cabling systems.
In addition, they ***shall*** also apply to any structured (telecommunications) cabling required to support the following systems:

a. Audio Visual Systems
b. Interactive White Boards
c. Projectors
d. Bell and PA systems
e. CCTV surveillance systems
f. Monitoring systems
g. Access Control Systems
h. Security systems
i. Other Network IP/Ethernet based solutions

The connection of the above systems to a structured cabling system is restricted by the voltage limits detailed in AS/CA S009. Systems operating at a voltage in excess of 60Vd.c. or 42.4Va.c. peak ***shall not*** be connected to any structured cabling system.

ICT cable constructed of copper clad aluminium conductors ***shall not*** be installed.

5.2. General ICT Cable Installation Practices

ICT Cable elements are highly engineered and require adherence to specific installation practices to ensure the performance class of the system is maintained through the life of the warranty.

The following installation requirements are mandatory and ***shall*** be followed.

5.2.1. ICT Cable Installation Practices - Copper

The following ***shall*** be adhered to when hauling copper cables through cable pathways:

a. The Contractor ***shall*** inspect the cabling path prior to hauling the cable
b. The contractor ***shall*** ensure that the pathway conforms to the minimum bend radius of the cable to be installed and that the conduit bends do not impact on the maximum hauling tension for that cable
c. The Contractor ***shall*** ensure that the maximum hauling tension of the cable is not exceeded during installation. The maximum hauling tension for soft annealed copper multi pair cables is 11kg
d. When hauling the cable the load ***shall*** be applied to all elements of the copper cable
e. Where a mechanical advantage is required to pull-in the cable, specialised external cable grips and stockings with swivel attachments fitted ***shall*** be utilised in conjunction with the cable's load bearing strength members
f. Motorised winches and motor vehicles ***shall not*** be used to pull-in cables

5.2.2. ICT Cable Installation Practices - Optical Fibre

a. The following ***shall*** be adhered to when hauling optic fibre cables through cable pathways:
b. The Contractor ***shall*** inspect the cabling path prior to hauling the cable. The contractor ***shall*** ensure that the pathway conforms to the minimum bend radius of the cable to be installed and that the conduit bends do not impact on the maximum hauling tension for that cable. The minimum bend radius during hauling of any optical fibre cables is 20 X the outside diameter of the cable
c. The Contractor ***shall*** ensure that the maximum hauling tension of the cable is not exceeded during installation. The maximum hauling tension for light duty riser (indoor) optical fibre cables is 22kg. Outside Plant (loose tube) optical fibre cables have a maximum hauling tension of 280kg
d. When hauling the cable the load ***shall*** be applied to central strength member AND the outside sheath simultaneously
e. Where a mechanical advantage is required to pull-in the cable, specialised external cable grips and stockings with swivel attachments fitted ***shall*** be utilised in conjunction with the cable's load bearing strength members
f. Motorised winches and motor vehicles ***shall not*** be used to pull-in cables

5.2.3. Lubricating Cabling

a. The following ***shall*** apply to the lubricating of cables during hauling:
b. A suitable lubricant ***shall*** be used where a single person applying reasonable effort without mechanical advantage is unable to haul the cable without exceeding the manufacturer's short term (installation) hauling tension of the cable through either empty or occupied conduits
c. Where cable lubricants are required they ***shall*** be approved by the certifying manufacturer for use on that cable sheath. Petroleum based lubricants ***shall not*** be used under any circumstance

6. Backbone Cabling Systems

6.1. Fibre Optic Backbone

All new fibre optic backbone cables ***shall*** originate from the Centre of Network and be continuous to the connected building/cabinet without intermediate joints unless the conditions for joining are met, as stipulated in section *6.5 Fibre Optic Joints*

6.2. Fibre Optic Terminations

Fibre optic connectors ***shall*** be used as follows:

a. LC connectors ***shall*** be used on all optical fibre backbone cables
b. All connectors ***shall*** be duplex configuration
c. All optic fibre links ***shall*** be terminated with a pair wise crossover

6.2.1. Fibre Optic Terminations Practices

Fibre optic terminations ***shall*** be as follows:

a. Fibre optic cores ***shall*** only be terminated by means of fusion splicing factory manufactured pigtails onto each core. Direct termination of installed fibre optic cabling and mechanical splicing is not permissible
b. Fibre optic terminations ***shall*** be housed within 1RU FOBOT enclosures containing not more than 48 terminated cores. Connectors ***shall*** be housed in duplex through adaptors (couplers) to match the connector termination
c. Where more than one cable is terminated within a FOBOT the terminated cores ***shall*** be laid in sequential order from left to right as viewed from the front
d. Terminated cores ***shall*** be fitted to the through adaptors in the FOBOT in a pair wise crossover where core one at the Centre of Network is core two at the edge cabinet
e. FOBOT enclosures ***shall*** have a compliant LASER radiation warning label fitted to the FOBOT front panel, this label ***shall*** be visible with the cabinet door open
f. The through adaptors ***shall*** be physically secured to the FOBOT enclosure front panel
g. Pigtails ***shall*** be a minimum length of 1 metre
h. Cleaved using a mechanical cleaver equivalent to a Fujikura CT-30 cleaver
i. Spliced using a Fujikura FSM 50 or equivalent fusion splicer
j. Fibre optic material safety practices ***shall*** be observed with respect to the proper disposal of fibre optic sharps
k. The Contractor ***shall*** observe all safety requirements with respect to chemicals used in the process of terminating fibre optic cables

6.2.2. Fibre Optic Break Out Termination Enclosures

FOBOTs ***shall*** be provided as follows:

a. 19” rack mountable, fully enclosed with removable lid
b. Spare through adaptor slots ***shall*** be covered with dust covers
c. Located within the cabinet as per the cabinet layout drawing
d. Each termination enclosure ***shall*** be capable of housing at least twenty four (24) duplex LC through adaptors
e. The FOBOT ***shall*** only contain through adaptors equal to the number of cores terminated. Spare slots ***shall*** be covered as per item c)
f. Fibre adapters ***shall*** be fitted with a dust caps at the completion of the fibre termination
g. LC through adapters for OS2 single mode optical fibre ***shall*** be blue
h. Cabinet FOBOTs ***shall*** be fitted with internal optical fibre guides for storage of slack fibre
i. Optical fibre ***shall*** be secured where it enters the enclosure. The central strength member of the fibre cable ***shall*** be mechanically secured to a post within the FOBOT enclosure
j. Optical fibre cable entry points ***shall*** be fitted with compression lands to protect the optical fibre where it enters the enclosure and ***shall*** be sealed to prevent the entry of vermin
k. Only one (1) cable ***shall*** be installed within a single compression gland
l. FOBOT ***shall*** be labelled as detailed in section *11 Labelling of ICT Infrastructure*

6.3. Fibre Optic Cable

School sites in Queensland have a variety of fibre optic technologies installed.
New fibre optic cable ***shall*** be supplied as follows:

a. Wired from the Centre of Network in a star topology
b. All new fibre optic cabling ***shall*** be minimum12-core OS2 Single-Mode
c. All fibre optic cores ***shall*** be terminated at both ends with LC-Duplex connectors
d. Indoor cable ***shall*** be 900µm tight-buffered optical fibre with an Aramid yarn (stranded Kevlar) strength member within a PVC or LSZH jacket. Indoor rated fibre optic cable ***shall not*** be installed in an underground/outdoor environment
e. Outdoor fibre optic cable ***shall*** be loose tube constructed, filled with water blocking gel and have a nylon jacket over polyethylene sheath and contain a glass reinforced polymer central strength member
f. Indoor single mode optical fibre ***shall*** have a yellow sheath
g. Loose Tube optical fibre ***shall*** have a blue sheath and the type of optical fibre ***shall*** be printed on the sheath
h. 2 metres of cable slack ***shall*** be provided at each end of a cable run

i. Fibre optic cables ***shall*** be secured within the cabinet with hook and loop style cable ties (Velcro™ or similar)
j. Sufficient spare cable ***shall*** be provided within the Fibre Optic Break-Out Termination (FOBOT) enclosure to allow for re-termination of the cable without the need to remove additional outer jacket
k. All cables installed outdoors ***shall*** be installed within a conduit
l. All outdoor rated cables installed indoors ***shall*** be enclosed within a PVC conduit from the point of entry to the building to the cabinet housing the cable termination enclosure
m. Where the fibre is run through an external conduit and pit system, the contractor ***shall*** provide a further minimum 2 metres of cable looped within the first pit located closest to the data cabinet or originating end, and a further minimum of 2 metres looped within the final pit before the termination point

6.4. Composite Optical Fibre/DC Power Cable

Where a network service is required in a location remote from a connected building, consideration ***shall*** be given to the use of an optical fibre solution that can provide power to the connected device. Where a composite optical fibre/DC power cable solution is proposed it ***shall*** meet the following criteria:

a. The cable ***shall*** be a compliant outdoor construction cable
b. The cable ***shall*** be a composite construction cable with both the optical fibre and power supply cabling within the same cable construction
c. The cable ***shall*** be fit for purpose to suit the installation

Preference will be given to a powered optical fibre solution which includes a far end termination system including an integral media convertor housed within a suitable vandal resistant metal enclosure.

Where a composite optical fibre solution is installed the following installation practices ***shall*** be followed:

6.4.1. Installation through existing indoor ICT cabling pathways:

The powered optical fibre cable ***shall*** be readily identified with a micro etched acrylic label at each accessible location with a label identifying the cable as a composite optical fibre cable

6.4.2. Installation through existing underground ICT cabling pathways:

The powered optical fibre cable ***shall*** be readily identified at each accessible location with a micro etched acrylic label identifying the cable as a composite optical fibre cable

6.4.3. Installation through existing underground electrical pathways:

Where a composite optical fibre cable is installed through an existing underground electrical conduits system the cable ***shall*** be installed within a spare conduit
Where a spare conduit is not available the composite optical fibre cable ***shall*** be installed within a compliant sub-duct within the electrical conduit system. The sub-ducting ***shall*** be continuous from point of entry to point of exit of the electrical conduit system. At each pit location the cable and sub-duct ***shall*** be secured to the side wall of the pit and clearly labelled with a suitable outdoor rated labelling identifying the cable and its originating cabinet identifier. As a minimum the label ***shall*** be a suitable micro etched acrylic material or etched stainless steel secured to the cable with stainless steel cable ties.

6.5. Fibre Optic Joints

For all new fibre optic connections any fibre optics joints ***shall*** be documented in the detailed design and electrical specification. Joining of fibre cables ***shall*** only be permitted when one of the following site-specific conditions is met;

1. Where the pathway of a new fibre optic cable traverses from an external/outdoor location to a building's interior, passes through a certified fire barrier and the originating cable type is of flammable construction; or
2. Where an existing Single Mode Optical Fibre will be disturbed as part of building works, trenching, relocation of a data cabinet or other planned works and the existing fibre cable length cannot accommodate re-termination at the original or new location.

In the above scenarios, a transition joint ***shall*** be created within a suitable enclosure. The enclosure ***shall*** be located at the cable entry point to the building in a secure, weatherproof and UV protected location to enable the continuation of indoor rated non-flammable type fibre optic cable within the building in accordance with AS/CA S009. Where a secure, weatherproof and UV protected location cannot be established, the enclosure ***shall*** have a minimum IP56 rating.
In addition to splicing practices outlined in section *6.2.1. Fibre Optic Terminations Practices* the following criteria ***shall*** be met when creating a fibre optic joint;

a. The fibre cables ***shall*** be joined by means of Fusion Splice. Mechanical splices ***shall not*** be used.
b. Both fibre optic cables ***shall*** be minimum 12 core OS2 SMOF.
c. All cores ***shall*** be joined.
d. The joined connection ***shall*** be tested with OTDR.
e. The insertion loss of each splice ***shall not*** exceed 0.1 dB.
f. Manufacturers Certification ***shall*** apply to the complete end-to-end fibre connection, including joint.
g. Joints and joint enclosures ***shall not*** be located within communication pits.
h. Only one joint between two end fibre termination points ***shall*** be allowed.

i. A joined fibre connection ***shall not*** exit a building to an exterior/outdoor location once it has been transitioned to indoor rated type fibre optic cable.
j. Fibre joints ***shall*** be labelled and identified on the as built drawings.
a. Fibre joint enclosure ***shall*** be labelled as detailed in section *11 Labelling of ICT Infrastructure*

6.6. Fibre Optic Patch Cords

Fibre optic patch cords ***shall*** be provided as follows:

a. With a minimum length of 2.0m
b. Duplex patch cords ***shall*** be provided in varying lengths (not shorter than 2.0m) so as to avoid congestion of the patch panel with leads of excess length. The quantity and length of fibre optic patch cords to be supplied will be specified in the detailed design
c. Optic fibre patch cords ***shall*** match the existing installation.
d. The DoE ISB ICT Procurement Officer will nominate the patch cord connector type to fit the active network equipment
e. Fibre optic patch leads ***shall*** be duplex hybrid construction and fitted with the appropriate connectors at the FOBOT and as appropriate for the active equipment at the other end
f. Fibre optic patch leads ***shall*** be supplied as crossover leads
g. OM1 - Multimode optical fibre patch cords ***shall*** have an orange sheath
h. OM3 - Multimode optical fibre patch cords ***shall*** have an aqua sheath
i. OS2 - Single mode optical fibre patch cords ***shall*** have a yellow sheath

6.7. Voice Grade Backbone Telecommunications Cabling

Where copper backbone cabling is necessary to support connection to a site's PABX, the pair count and requirements ***shall*** be identified by the consulting engineer/electrician and specified in the detailed design. When specified, a minimum of 10 pair cable ***shall*** be installed from the Main Distribution Frame to each connected building.
Where required voice grade copper cabling ***shall*** be provided as follows:

a. External voice grade 0.64mm2, gel-filled, UTP outdoor rated cabling ***shall*** be installed
b. This ***shall*** be installed from the campus distributor to the building distributor as specified in the detailed design
c. Voice grade cabling ***shall*** be terminated onto IDC frames at both ends. Terminations ***shall*** be onto 10 pair disconnect IDC blocks mounted onto stainless steel backmount frames. Profil® style backmount systems ***shall not*** be used. The back mount frames ***shall*** be earthed in accordance with the requirements of AS/CA S009
d. Overvoltage protection ***shall*** be fitted to protect all incoming carrier cable pairs
e. Overvoltage protection ***shall*** be fitted to cables directly connected to the PBX Test Point Frame
f. Lightning projection ***shall*** be Critec SLP10K2/SPL1K2 or functional equivalent
g. The sizing (pair count) of the voice grade cable ***shall*** be based on the services required with an initial 50% spare capacity
h. All voice grade cable pairs ***shall*** be terminated, tested and recorded in a suitable record back at each termination location
i. All outdoor rated voice grade cables installed indoors ***shall*** be enclosed within a PVC conduit from the point of entry to the building to the point of termination
j. At the edge termination a suitable indoor rated voice tie cable ***shall*** be installed from the IDC termination frame and ***shall*** be terminated onto a suitable patch panels dedicated to voice services and labelled as such. The cable pair count ***shall*** match the pair count specified in the detailed design. All services ***shall*** present as one pair per port on the patch panel unless specified otherwise in the detailed design.

6.8. Indoor Type (Voice) Inter Building Cabling

Where inter building voice tie cables are installed in a manner classified as indoor for the purposes of AS/CA S009 the following installation practices ***shall*** apply:

a. Tie cables ***shall*** be installed wholly within a suitable enclosure as a minimum PVC communications conduit
b. Tie cables ***shall*** originate from the PABX Test Point Frame and ***shall*** be terminated onto 10 pair disconnect modules
c. At the edge building termination the voice grade tie cable ***shall*** be terminated onto a 24 port patch panels dedicated to voice services and labelled as such. The cable pair count ***shall*** match the pair count specified in the detailed design. All services ***shall*** present as one pair per port on the patch panel unless specified otherwise in the detailed design.

6.9. Earth Potential Rise

The Contractor ***shall*** ensure that the telecommunications cabling on site complies with the requirements of AS/CA S009 with respect to Earth Potential Rise.

7. Horizontal Subsystems

The horizontal subsystem ***shall*** comply with all performance elements of the AS/NZS 11801 Standards. All new links ***shall*** be continuous from the patch panel to the telecommunications outlet. Joints in horizontal cabling ***shall not*** be installed.

7.1. Class of Service

All horizontal subsystem links and channels (new, replacement and supplementary) ***shall*** be of Class EA utilising Category 6A components throughout.

As products and standards evolve, a higher class of service is anticipated to be introduced into ICT cabling standards and subsequent designs. At the approval of the DoE ITB Design Authority new definitions of class of service with compliant product available for installation may be considered as part of the works.

7.2. Patch Panels

Patch panels ***shall*** be provided as follows:

a. Patch panel terminations ***shall*** be Insulation Displacement Connectors (IDC) type and ***shall*** be T568A sequence wiring fitted with colour coded wiring guides to assist in visual inspection and identification
b. Patch panels ***shall*** be provided with integrated rear cable management units to support the incoming ICT cabling. Where integrated support is not available then an alternative form of cable support ***shall*** be provided
c. Patch panels ***shall*** have provision for the fixing of circuit designation labels
d. Only 24 port patch panels ***shall*** be installed for Class EA and above ICT cabling
e. Patch panels ***shall*** be installed and mounted to allow ready access to the UTP/IDC terminations of individual sockets without the removal of the patch panel from the rack or disturbing adjacent sockets
f. The patch panels Category ***shall*** match the Category of ICT cabling installed
g. Patch panels ***shall*** be labelled as detailed in section *11 Labelling of ICT Infrastructure*

7.3. Twisted Pair Copper Cable

The UTP copper network ***shall*** be installed as follows:

a. Wired in a star topology from the building data room/closet
b. Cable ***shall*** have surface printing on the outer sheath to indicate the performance, and to comply with the requirements of the "labelling notice" contained in Handbook 243. Handbook 243 is a component document in the Communications Cabling Manual (CCM)
c. Cable slack ***shall*** be provided to enable at least (4) four re-terminations at the telecommunications outlet. The additional cable ***shall*** be accommodated in the pathway, raceway or ducting space outside the outlet mounting enclosure
d. A 2000mm loop of spare cable ***shall*** be stored at the cabinet end to permit future relocations of the cabinet or reconfiguration of the cabinet layout.
e. An additional 1000mm of spare cable ***shall*** be stored on the cable tray or catenary wire for future relocation or re-termination of the cable. The cable ***shall*** be looped back on a cable tray or stored as a goose neck and tied to the catenary wire using hook and loop cable ties (Velcro™ or similar)
f. Where 12RU data cabinets are used, the mandatory cable loops may be left coiled in the ceiling space adequately supported by the catenary wire or cable tray
g. Where the cabinet is wall mounted, in addition to the 2000mm loop at the cabinet end, sufficient additional cable ***shall*** be looped to permit the future upgrade of the wall mounted cabinet to a floor mounted cabinet
h. Where totally sealed conduit is used to the TO, provision for spare cable ***shall*** be made at the data cabinet or rack end only

7.4. Cabling Installation Requirements

All ICT cabling work undertaken ***shall*** comply with the following:

a. All cable runs ***shall*** be continuous between the patch panel and TO termination points
b. All ICT cabling ***shall*** be enclosed, surface cabling ***shall not*** be installed
c. All ICT cables ***shall*** be routed a minimum of 300mm away from fluorescent lighting fixtures and devices incorporating inductive motors. Where 300mm clearance is not possible a suitable method of screening the copper cable ***shall*** be used
d. All ICT cabling ***shall*** be separated from LV cabling by a minimum of 150mm to minimise interference except when there is a permanent metallic barrier between the cables and that barrier is connected to a protective earth (as required by AS/CA S009:2013)
e. All ICT cabling ***shall*** be fully supported by independent cable support systems. Cabling ***shall not*** be laid onto other services or ceiling surfaces
f. All cabling ***shall*** be secured to support structures/systems with hook and loop style cable ties (Velcro™ or similar)
g. Cabling installed onto wall surfaces ***shall*** be enclosed in compliant conduit
h. Cabling installed through penetrations ***shall*** be suitably protected by bushing or conduit sleeves
i. Where penetrations are made through building elements they ***shall*** be sized to provide a minimum of 20% spare capacity except where the pathway passes through a fire rated partition

7.5. Telecommunication Outlets

Telecommunication outlets (TOs) ***shall*** be provided as follows:

a. Besides outlets for wall mounted telephones or CCTV cameras, telecommunications outlets ***shall*** be dual.
b. Locations requiring more than one (1) dual TO ***shall*** have multiple dual TOs installed to meet the requirements.
c. TOs ***shall*** be shuttered.
d. TOs ***shall*** be mounted in standard pattern faceplates and ***shall*** be equivalent to Clipsal No 32VH series. Decorator faceplate with removable facia or surrounds ***shall not*** be installed
e. TO wall plates ***shall*** be mounted 500mm minimum AFFL or as otherwise nominated within detailed specification documentation.
f. Where ICT cabling is installed within the wall cavity TO faceplates ***shall*** be flush mounted to the wall surface.
g. Wall plates or mounting blocks ***shall*** be firmly attached to the structure.
h. Wall plates ***shall*** be white. Black Wall plates may be permitted in areas deemed functionally appropriate, such as stage areas and auditoriums.
i. Wall plates ***shall*** have concealed fixing and cover screws.
j. TOs ***shall*** implement T568A sequence wiring and be fitted with colour coded wiring guides to assist in visual inspection.
k. TOs ***shall*** be provided with insulation displacement connectors (IDC) for termination of the UTP and be provided with integrated strain relief.
l. TOs ***shall*** remain securely held in place to the wall plate when the wall plate is physically removed from its mounting.
m. TOs ***shall not*** be mounted with the keyway at the top. All TOs on a single faceplate ***shall*** be oriented the same way. DoE preference is to have the keyway oriented to the bottom in all locations, exceptions to this orientation are where the wall cavity is too ***shall***ow to allow for the required bend radius of the cable installed.
n. TOs mounted in a high dust environment or exposed ***shall*** be mounted in an enclosure to prevent the ingress of dust or moisture. The entry of the cable into the enclosure ***shall*** use correctly sized glands, and cable entry ***shall*** be at the bottom.
o. TOs which are installed external to a building, ***shall*** be installed within a lockable enclosure with an IP protection rating of at least IP56.
p. TO/LV separation ***shall*** be a minimum of 150mm distance between the closest pin of the LV socket-outlet and the edge of the RJ45 socket, this is to be measured on the front surface side of the face plate. This measurement ***shall*** be made (regardless of orientation of the wall plates), between the closest pin of the LV socket-outlet and the edge of the RJ45. Refer to Appendix A23

7.6. TOs for Wireless Access Points

Wireless access points (WAPs) ***shall*** be installed in locations specifically nominated as the result of a wireless survey or design process.

7.6.1. Wall Mounting

a. Dual TOs to service wall mounted WAPs ***shall*** be located on a standard faceplate (landscape orientation) with the RJ-45 sockets in the faceplate 300mm below ceiling level. TOs ***shall*** be located between 2400mm and 2700mm AFFL on a fixed, permanent wall surface.

7.6.2. Ceiling Mounting

a. Dual TOs to service ceiling mounted WAPs ***shall*** be located on a standard faceplate on a permanent surface on or in the ceiling, central to the area. In the case of suspended ceilings, the TOs ***shall*** be located on the surface of a solid ceiling or a beam adjacent to the designated access point location.
b. TOs ***shall not*** be located on a ceiling tile or other suspended, floating or removable surface or structure
c. Easy and proximate access to the TOs ***shall*** be provided from the designed WAP location.
d. Where data outlets are installed above a suspended ceiling, their location ***shall*** be permanently marked on the ceiling visible with a TO identifier and clearly identified on the “As Built” drawing. A micro-etched acrylic label with “WAP TO Above” ***shall*** be placed on the main ceiling grid section at the nearest possible location to the TO.

7.6.3. Spare TO Cabling for WAPs

a. At each WAP TO location an additional 3.0m of spare cable ***shall*** be secured to the cable pathway adjacent to the WAP TO location to allow for relocation of the TO to suit future WAP installations.
b. TOs ***shall*** be located adjacent to the WAP mounting such that the cable connecting to WAP is not more than 1.0m in length.

7.7. Dedicated Wall Phone Outlet Installation

Dedicated TOs for wall mounted phones ***shall*** be provided as follows:

a. Use a standard pattern wall mount phone faceplate. The faceplate ***shall*** be capable of mounting a keystone style telecommunications outlet termination.
b. Wall phone telecommunications outlets ***shall*** be of the same manufacture as the certifying manufacturer.
c. Wall phone cabling ***shall*** be concealed within the wall cavity where possible and the TO faceplate flush mounted to the wall surface.
d. Where flush mounting is not possible rigid conduit ***shall*** be used to complete the cable pathway. Conduit installation ***shall*** comply with all requirements of this specification.

e. Height of the wall outlet ***shall*** be minimum 1200mm AFFL.
f. Orientation of the faceplate ***shall*** be vertical with the TO keyway at the bottom and contacts at the top.
g. TO locations for wall mounted telephones ***shall*** be designed to accommodate accessibility and obstruction to the ingress/egress of a room or area.
h. TO locations ***shall*** have a minimum of 300mm clearance in all directions to allow for unobstructed installation of the wall mounted phone.
i. Install wall mounted TOs away from sinks, vibration and high traffic areas (e.g. 450mm minimum from nearest door frame).

Refer to Appendices W, X & Y, for wall phone installation details

7.8. Recessed Floor Boxes

Recessed floor boxes ***shall not*** be installed without approval by the DoE design authority. Where a recessed floor box is approved to be installed the approved model type ***shall*** be included in the electrical specification and detailed design documentation.

7.9. Service Columns

Flexible suspended "umbilical" style service risers ***shall not*** be installed on DoE sites:
Service columns ***shall*** meet the following requirements:

a. Only full height service columns ***shall*** be installed on DoE sites. Half height floor or ceiling mounted bollards ***shall not*** be installed.
b. Service columns ***shall*** have physical dimensions suitable for the installation of the Class of cabling. They ***shall*** have internal segregation barriers between LV electrical cabling and terminations and the ICT cabling zone.
c. Service columns ***shall*** be minimum 80mm X 80mm to ensure the minimum bend radius of the installed ICT cabling is maintained.

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7.10. Consolidation Points

Consolidation points ***shall*** only be installed where approved by the DoE design authority as follows:

a. Consolidation points ***shall*** only be utilised where an existing cabinet is being relocated.
b. ICT Cabling consolidation points ***shall*** be of the same manufacturer as the installed ICT cabling.
c. Consolidations point installations ***shall*** ensure that a minimum of 15m of ICT cabling is installed between the Consolidation Point and the patch panel terminations in accordance with the requirements of the AS/NZS 11801 standards. Installed cabling ***shall*** be adequately supported in accordance with this standard.
d. Where possible the consolidation point should be mounted above the ceiling.
e. Consolidation points ***shall*** be mounted on a backing board consisting of minimum 15mm structural plywood painted white.
f. The backing board ***shall*** be mounted onto a building structural element or brackets suitable for the purpose.
g. If the consolidation point is to be mounted below the ceiling surface in an accessible area the consolidation point ***shall*** be enclosed in a secure enclosure to prevent incidental access or damage.
h. Consolidation points ***shall*** be labelled and identified on the as built drawings.

7.11. Patch Cords

Patch cords ***shall*** be provided as follows:

a. One patch cord and one work area cord ***shall*** be provided for each installed Telecommunication Outlet
b. The patch cords and work area cords ***shall*** be supplied by the installing contractor
c. Patch cords ***shall*** be "factory assembled", ACMA compliant and certified by the ICT cabling manufacturer for the Class of cabling installed
d. Patch cords ***shall*** be stranded copper
e. Patch cords ***shall*** be supplied in different lengths of 1m, 2m and 3m to reduce slack on the patch panel. Exact quantities of lead lengths to be supplied ***shall*** be specified in the detailed design
f. Work area patch cords ***shall*** be provided in 2m, 3m and 5m lengths. Exact quantities of lead lengths to be supplied ***shall*** be specified in the detailed design
g. Work area patch cords ***shall*** not exceed 5 metres in length.
h. Patch cords ***shall*** be designated by the colour indicated in the following table:

Circuit Type	Colour code
PBX and POTS Voice	GREEN
Data	BLUE
IP Telephony	BLUE
Wireless Network	YELLOW
CCTV	ORANGE
Cross Over Leads	RED

i. Patch cord colours and quantities ***shall*** be specified in the detailed design
j. Traditional telephone "fly-leads" of flat ribbon manufacture provided with handsets and should not be considered as part of the

design requirement for ICT cabling

k. Telephone hand set leads ***shall*** be supplied with 8 way modular (RJ45) plugs where they are to be connected to ICT cabling. Insertion of smaller 6 way and 4 way plugs damages the Telecommunications Outlets

7.12. Minimum Provision of Telecommunication Outlets for School Spaces

Refer to Appendix FF for required TO allocations per space. These are the minimum mandatory amounts for the spaces listed. These allocations ***shall not*** prevent the specification of additional outlets should they be required as an outcome of the detailed design or by request of the school/customer.

Allocation of additional high set data outlets for wireless access points ***shall*** form part of the detailed design with consideration to the amount of students and staff utilising a space. All learning and staff work areas ***shall*** have wireless networking coverage.

For high technology spaces, such as Robotics Labs, Audio/Visual Editing Labs and Computer labs, additional outlets ***shall*** be allocated on a per device (non-mobile) basis and ***shall*** form part of the detailed design and specification.

8. ICT Cable Pathways

All installed cables ***shall*** be supported and/or enclosed using cable trays, catenary wire supports, conduit or ducting. ICT Cabling ***shall not*** be exposed in any manner to human intervention. Where possible, ICT Cabling ***shall*** be installed within the hollow wall cavity.
The following sections detail the specific requirements for the various types of ICT cable pathways at DoE sites.

8.1. Earthing of Pathways

All metallic elements of the ICT cabling installation ***shall*** be connected to a protective earth.

8.2. Rigid PVC Duct

Rigid PVC duct ***shall not*** be installed on DoE sites without written approval of the DoE ITB Design Authority.

8.3. Cable Pathway Prohibitions

The following ICT Cable pathways are prohibited in the DoE environment:

a. Aerial cabling of any type between buildings
b. Use of relocatable buildings as a thoroughfare for backbone cabling to downstream buildings
c. Open cable trays under buildings or covered walkways
d. Light duty conduit of any type
e. Rigid PVC surface ducting in any student accessible areas
f. Soft wall flexible electrical conduit
g. Flexible steel conduit of any type
h. Rigid PVC conduit exposed to direct UV radiation

8.4. Cable Tray

Horizontal cable trays ***shall*** be installed in all locations where there are more than twenty-four (24) ICT cables being run together in the same general direction within a concealed building cavity (e.g. ceiling).
Cable tray ***shall*** be provided as follows:

a. Cable trays ***shall*** be of metallic construction, either folded sheet metal or weldmesh basket
b. Supplied with corrosion protection equivalent to hot dip galvanising
c. Only manufacturer fittings ***shall*** be used in the assembly of the cable tray system
d. Cable tray fill ratios ***shall*** be as per certifying cable manufacturers specifications
e. At the completion of the initial installation, a minimum of 25% of the capacity ***shall*** remain for future expansion
f. Cable trays ***shall*** be at least 1mm thick and wide enough to meet the minimum capacity + spare with a minimum internal depth of at least 50mm with all sides rolled or folded
g. Cable trays ***shall*** have surface support for the cabling at intervals not exceeding 100mm
h. Cable tray bends, tees and joining pieces, covers and cable retainers ***shall*** be manufactured to suit the minimum bend radius of the installed cables
i. Cable trays ***shall not*** be installed in any areas that are unenclosed or accessible by students and staff
j. Ceiling mounted trays ***shall*** be supported by cantilever or trapezium style support brackets
k. Cable trays ***shall*** only be secured to building structural elements
l. All vertically mounted cable trays ***shall*** be fixed to the building structure for the entire length of installation as per the manufacturers specification for the anticipated load over the life of the tray
m. Where cable trays are installed vertically between levels of a building and are not housed in a riser cupboard they ***shall*** be fully covered with a galvanised sheet metal top hat section for the entire length of the exposure. Where exposed the top hat sections ***shall*** be secured with tamper resistant fixings

8.5. Conduit - General

8.5.1. Surface Mounted Conduit

Conduits installed in above ground situations ***shall*** be installed as follows:

a. Surface mounted conduits ***shall*** be minimum medium duty construction and comply with AS 2053
b. All joins in PVC conduit ***shall*** be glued with an appropriate PVC bonding agent equivalent to Clipsal 240 series Jointing Cement
c. Continuous runs of conduit ***shall*** have a pull box installed every 30m
d. Flexible or slip expansion joints ***shall*** be installed every 12m
e. Expansion joints ***shall*** be protected by means of over-saddling with double sided saddles of the next larger size than the conduit installed. Saddles ***shall not*** impede on the operation of the expansion joint
f. Pull boxes ***shall*** be installed after two bends of 90 degrees
g. Pull or transition boxes ***shall not*** be used as a change of direction. Refer to Appendix A10 for correct change of direction technique

8.5.2. Mechanical Protection and Support for Conduit

The installing contractor ***shall*** provide adequate mechanical protection and support for all ICT conduit and enclosures that are mounted within 2400mm in any direction of;

a. an accessible floor area
b. access platform
c. stairs
d. stair landing
e. standard floor
f. ground level
g. any other location where it is reasonable to expect equipment, wiring or enclosures may be interfered with.

8.6. Conduit - Indoor

PVC communications conduit ***shall*** be installed in all locations where ICT cabling cannot be installed within a building cavity. Surface conduit installed indoors ***shall*** the following requirements:

a. Conduit ***shall*** be "communications" conduit white in colour
b. Conduit ***shall*** be secured to the fixed building surface with double sided saddles
c. Double sided saddles ***shall*** be corrosion protected equivalent to hot dipped galvanising
d. Conduits <40mmØ ***shall*** have saddle spacing at 300mm intervals.
e. Conduits 40mmØ and larger ***shall*** have saddles at 500mm intervals
f. Saddles ***shall*** be placed within 50mm of all bends
g. Spring clip saddles ***shall*** only be used to secure conduit to structures at a height above 4000mm
h. Conduit bends ***shall*** meet the hauling bend radius of the cables being installed
i. Conduit fill ***shall not*** exceed the maximum quantity as per the manufacturer's specifications to a maximum fill of 80% for horizontal cabling and 60% for backbone cabling
j. Conduits ***shall*** be installed flush to the mounting surface. The maximum allowable gap between the conduit and a mounting surface at any point ***shall not*** exceed 12mm
k. Any conduits not installed flush to mounting surface with a gap exceeding 12mm ***shall*** have suitable packing installed to reduce the gap and prevent hand holds. Refer to Appendix K
l. Pull boxes ***shall*** be installed at 30m intervals in continuous runs
m. Expansion joints ***shall*** be installed at 12m intervals on continuous runs
n. The use of flexible medium duty corrugated conduit ***shall*** be kept to a minimum
o. Inspection Tees and elbows ***shall not*** be used for ICT cabling installations. These fittings do not meet the minimum bend radius requirements for ICT cables of any Category

8.7. Conduit - Outdoor

All outdoor ICT cabling ***shall*** be enclosed in conduit and the following ***shall*** apply:

8.7.1. Covered Walkway Conduit

The installing contractor ***shall*** determine the suitability of the covered walkway as a conduit support pathway. Where the walkway is unsuitable the contractor ***shall*** advise the DoE representative and an alternative pathway will be determined.

PVC conduit ***shall*** only be installed on the underside of a covered walkway

a. PVC conduit <40mm in diameter ***shall*** be saddled with double sided saddles at intervals no greater than 300mm. Saddles ***shall*** have corrosion protection equivalent to hot dip galvanising
b. PVC conduit 40mm or greater in diameter ***shall*** be secured with double sided saddles at intervals no greater than 500mm. Saddles ***shall*** have corrosion protection equivalent to hot dip galvanising
c. Saddles ***shall*** be installed within 50mm of any conduit bend
d. Large radius bends ***shall*** have a saddle installed at the mid-point of the bend
e. The use of flexible medium duty corrugated conduit on walkways will be kept to a minimum. An example of acceptable use is the installation of conduit over multiple changes in height in a short distance such as around structural posts and beams. The pathway ***shall*** revert to rigid conduit as soon as practicable after the change in direction
f. Where conduit is installed over obstructions the conduit ***shall*** be blocked between the structure and the conduit to prevent a hand hold. Blocking is required where the gap exceeds 12mm
g. Where a pathway conduit passes a building that is not currently connected to the network a transition box ***shall*** be installed at an appropriate location to facilitate a connection to the building in the future without damage to the pathway

Refer to Appendix J for installation detail requirements.

8.7.2. Underground Conduit

Conduits installed in underground situations ***shall*** be installed as follows:

a. ICT cabling ***shall not*** be direct buried
b. Underground conduits ***shall*** be heavy duty construction and comply with AS 2053
c. Only rigid PVC conduit labelled and identified as “Communications” ***shall*** be installed underground. Communications conduits ***shall*** be white
d. Metal conduit ***shall not*** be installed underground
e. Inspection pits ***shall*** be installed at intervals not exceeding 50m
f. Inspection pits ***shall*** be installed adjacent to any change of direction in the underground conduit
g. All underground conduits systems ***shall*** have a draw rope installed at the completion of installation. The draw rope ***shall*** be UV resistant, non-corrosive and be equivalent to 6mm polypropylene with a minimum breaking strain of 600kgs.

Refer Appendices Q, R, S, & T for instructional diagrams relating to underground conduit installation.

Underground conduit systems ***shall*** meet the following additional installation practices:

a. Main trunk routes ***shall*** be constructed of minimum 100mmØ conduits ensuring that the initial installation capacity does not exceed 40%
b. Sub trunk routes ***shall*** be minimum 50mmØ conduit ensuring that the initial installation capacity does not exceed 40%
c. The minimum underground conduit installed to any building ***shall*** be 50mmØ
d. 90 degree bends of any radius ***shall not*** be installed in an underground conduit system except immediately adjacent to an inspection pit
e. Large radius bends installed mid-stream in a conduit ***shall not*** exceed 60 degrees
f. No more than 180 degree of bends ***shall*** be installed between inspection pits. Only bends 45 degree and greater ***shall*** be calculated to reach 180 degree
g. Large radius bends ***shall*** be installed at the building entry point and rise continuously into the building or to a transition box mounted on the building structure
h. The maximum vertical unsupported rise of a conduit ***shall not*** exceed 1200mm
i. For the vertical rise from underground to the building, the conduit ***shall*** be supported with a suitable structure fit for the purpose. Over-sleeving with steel pipe is recommended. Alternatively a suitable fit for purpose support structure ***shall*** be constructed, hot dipped galvanised steel materials ***shall*** be used as a minimum
j. Building entry conduits from underground to building ***shall not*** be exposed to UV radiation. A compliant hot dipped galvanised top hat section ***shall*** be installed
k. Vertical rising conduits ***shall not*** be exposed to direct or indirect mechanical damage. The conduit ***shall*** be protected as detailed in this standard

8.7.3. Walkway to Building or Other Structure Transition - <1200mm

Conduit risers between walkways and buildings/structures ***shall*** be ‘J’ type and ***shall*** be galvanised steel conduit. These ***shall*** be manufactured on site. The transition box ***shall*** be secured to the end of the walkway.

Where a covered walkway does not physically adjoin a building and the distance between walkway and building is less than 1200mm the following installation practices may be applied:

a. A self-supporting galvanised steel conduit ***shall*** be installed between the walkway and the building
b. The conduit ***shall*** originate from a transition box on the walkway and extend across the gap to the building and terminate in another transition box mounted on the underside of the soffit.
c. The maximum vertical rise from the walkway to the building soffit ***shall not*** exceed 700mm
d. If the vertical rise exceeds 700mm but is less than 1200mm the maximum horizontal distance ***shall*** be reduced to 700mm
e. No more than 2000mm of steel conduit ***shall*** be installed when meeting these requirements
f. All bends in the steel conduit ***shall*** be manufactured on site. Cast galvanised iron bends ***shall not*** be used at any time.

Refer to Appendices L, M, & N for installation diagrams

8.7.4. Walkway to Building or Other Structure Transition >1200mm

Where a covered walkway does not physically adjoin a building/structure and the distance between walkway and building/structure is greater than 1200mm the following installation practices may be applied:

a. Self-supporting conduit ***shall not*** be installed
b. A galvanised steel support structure ***shall*** be provided to support the conduit installed between the walkway and the building/structure. At a minimum the support structure ***shall*** be constructed from hot dip galvanised Unistrut™ or functional equivalent. The metal ***shall*** measure 40mm X 40mm and the structure ***shall*** be constructed as per the manufacturer’s installation instructions and ***shall*** be fit for the purpose intended
c. The conduit ***shall*** originate from a transition box on the walkway and extend across the gap to the building and terminate in another transition box mounted on the underside of the soffit.
d. The conduit ***shall*** be secured to the support structure by means of galvanised double sided saddles or stainless steel straps or stainless steel worm drive clamps
e. Where the support structure exceeds 2000m in length structural drawings ***shall*** be submitted for engineering approval prior to the installation. Written approval from the DoE ITB Design Authority will be obtained prior to the installation of the support structure. Where approval is declined the pathway will be installed via compliant underground conduit installation

f. All bends in the steel conduit ***shall*** be manufactured on site. Cast galvanised iron bends ***shall not*** be used at any time

Refer to Appendices L, M, & N for installation diagrams.

8.7.5. Transition Boxes

Transition boxes ***shall*** meet the following installation requirements:

a. Transition boxes ***shall*** be a minimum 100mm X 100mm X 75mm deep for conduits up to 32mmØ
b. Transition boxes for conduits >32mmØ ***shall*** be 200mm X 100mm X 75mm deep
c. Boxes ***shall*** be minimum IP56 in construction and protection rating
d. Boxes ***shall*** be made from UV stabilised material
e. Boxes ***shall*** have a lid secured by a minimum of four vandal resistant screws
f. Boxes ***shall*** be sized to ensure the minimum bend radius of the installed cabling is not compromised during hauling
g. Where applicable the transition box ***shall*** have threaded conduit entries for the placement of plain to screw conduit adaptors
h. Where the conduit size exceeds the size of the standard threaded entries a suitable plain to screw adaptor ***shall*** be fitted to facilitate the entry of the conduit to the box

Refer to Appendix I for installation detail.

8.7.6. Conduits Cast into Concrete

Where conduits are cast into structural concrete they ***shall*** meet the following requirements:

a. Conduits ***shall*** be white communications conduits
b. Conduits ***shall not*** be installed immediately adjacent to LV electrical conduits within the slab
c. Where conduits rise vertically above the concrete they ***shall*** terminate at least 50mm above the concrete surface to prevent the ingress of fluids
d. Conduits ***shall*** be effectively sealed prior to concrete pour to prevent the entry of concrete into the conduits
e. Conduits ***shall*** be cleaned prior to the installation of cabling
f. Conduit routes ***shall*** be indicated on the “As Built” documentation
g. The installation contractor ***shall*** confirm with the certifying cable manufacturer that the installation of cabling within cast conduits is acceptable for the purposes of warranty and support.

8.8. Building Entry Conduits

Building entry conduits ***shall*** comply with the following minimum requirements. The contractor ***shall*** refer to the detailed design documentation for specific building requirements.

8.8.1. Relocatable/Temporary Buildings and Buildings Elevated Above Ground Level

The building entry conduit to a relocatable building or buildings elevated above ground level ***shall*** comply with the following requirements:

a. A minimum 32mmØ PVC conduit rising up to the under floor space
b. Concrete base ***shall*** be poured around conduit, when conduit emerges under a building
c. The joint ***shall*** be protected by encasing in concrete to a minimum depth of 250mm and 6 times the diameter of the conduit
d. Conduit which extends above ground more than 1200mm vertically ***shall*** be further supported by enclosure in a galvanised pipe sleeve or top hat and attached to the building vertical piers for support
e. Where it is necessary to join PVC and Galvanised Steel (GS) conduit leading to building entry points or the underneath of modular buildings, the joint ***shall*** be located as close as practical to ground level and in a vertical run
f. Where steel conduit is joined to PVC conduit the joint will provide a minimum 50mm overlap with the bond being made with industrial adhesive
g. The joint formed between the underground PVC and above ground steel conduit ***shall*** be secured with an industrial strength adhesive to the manufacturer’s specifications
h. The steel/PVC joint ***shall*** be additionally protected by encasing in concrete

8.8.2. Small Edge Buildings

The building entry conduit to a small classroom building (four or less classrooms) ***shall*** comply with the following requirements:

a. Be a minimum 32mmØ PVC conduit ensuring that there is a minimum of 60% spare capacity after initial installation of backbone cabling
b. Where 60% spare capacity cannot be achieved the building entry conduit ***shall*** be increased to 50mmØ PVC conduit
c. Be installed in accordance with the preceding requirements regarding exposed conduits and mechanical protection

8.8.3. Medium & Large Edge Buildings

The building entry conduit to medium and large classroom buildings (greater than four classrooms) ***shall*** comply with the following requirements:

a. Be a minimum 50mmØ PVC conduit ensuring that there is a minimum of 60% spare capacity after initial installation of backbone cabling
b. Where 60% spare capacity cannot be achieved the building entry conduit ***shall*** be increased to 100mmØ PVC conduit
c. Be installed in accordance with the preceding requirements regarding exposed conduits and mechanical protection

8.8.4. Centre of Network Building

The building entry conduit to the Centre of Network building ***shall*** comply with the following requirements:

a. Be a minimum of two 100mmØ PVC conduit ensuring that there is a minimum of 60% spare capacity after initial installation of backbone cabling
b. Where 60% spare capacity cannot be achieved the building entry conduit quantity ***shall*** be increased meet the requirement
c. Be installed in accordance with the preceding requirements regarding exposed conduits and mechanical protection

8.9. Catenary Wire Cable Support Systems

Indoor catenary wire ***shall*** be provided as follows:

a. The maximum number of 4-pair cables permitted on any single indoor catenary wire ***shall*** be 24 or lower if nominated as a requirement by the cabling system manufacturer
b. Catenary wire ***shall*** be galvanised steel rope or seven strand galvanised steel wire with a minimum diameter of 2.0mm, suitably anchored and supported to the ceiling slab or building structural elements and tensioned by way of turnbuckles or tensioning callipers and self-locking (Gripple® or similar) wire joiners. Where seven strand wire is used the catenary wire ***shall*** be secured with "D" shackles at both ends. Anchors used for the securing of catenary wire supports ***shall*** provide a minimum bend radius of 6.0mm and not have sharp edges at the wire contact interface. The use of wire rope thimbles is recommended for the securing of steel wire rope systems.
c. Under-floor Catenary wire ***shall*** be suitably anchored to the floor and supported by either the fixed raised floor pedestals or by dedicated stand-offs and tensioned by way of turnbuckles or tensioning callipers and self-locking wire joiners
d. Under floor catenary wire ***shall not*** be installed in accessible areas
e. Where cables traverse areas above fixed architectural ceilings with limited or no access, the use of conduit secured to a catenary wire, or suitably saddled to the ceiling joists ***shall*** be provided. As a minimum a single spare 50mmØ communications ***shall*** be installed at each pathway location for future cabling access. The conduit ***shall*** have a suitable draw rope installed
f. Catenary wire ***shall*** be supported by jack chain or similar at intervals of 3000mm to prevent excessive sag
g. Where cables are bundled together on the catenary wire, minimum width 25mm, VelcroTM or similar hook and loop style cable ties ***shall*** be used around cables
h. Where cables leave a catenary wire support, they ***shall*** be supported over their entire length in either PVC ridged conduit and/or flexible conduit and/or an additional catenary where the distance exceeds 2.0m. The conduit ***shall*** be fastened to the catenary and then at every change of direction
i. Earthing catenary wires ***shall*** be via a 2 screw tunnel type earth connector in lieu of the Brass line clamp. A connector equivalent to a Clipsal 563/2 ***shall*** be used to connect the protective earth wire to the catenary wire

8.10. Perimeter Ducting

Modular perimeter ducting ***shall*** meet the following minimum requirements:

a. Perimeter ducting ***shall*** be of metallic construction
b. Perimeter ducting ***shall not*** have a loose fitted lid system,
c. Perimeter ducting ***shall*** have a lid requiring the use of a tool for removal
d. Perimeter ducting ***shall*** be equivalent to Moduline TALPlus or ECD Systems EL series duct with a clip on lid
e. Perimeter ducting ***shall*** have outlets mounted on the centre line of the duct
f. Perimeter ducting ***shall*** be a minimum size of 150mm H X 50mm deep
g. Perimeter ducting ***shall*** be segregated internally for LV power and ICT cabling
h. Electrical and telecommunications outlets ***shall*** be mounted in duct kits manufactured for the purpose
i. Perimeter ducting ***shall*** be installed at a minimum 500mm AFFL to prevent incidental damage to the installed outlets

8.11. Trenching

The following details the minimum requirements for underground trenching on DoE sites.

Trenches ***shall*** comply with the following:

a. Prior to commencement of trenching the installation contractor ***shall*** ensure that all existing underground services in the proposed area have been located and identified
b. The contractor ***shall*** comply with all WH&S mandatory requirements in establishing the site
c. All ICT conduits ***shall*** be buried at a minimum depth of 500mm to the top of the conduit
d. All conduits ***shall*** be laid on a bed of sand a minimum of 100mm deep
e. 100mm of sand ***shall*** be laid over the installed conduits and compacted
f. 200mm of clean fill ***shall*** be laid over the sand and compacted
g. AS 2648 Part 1, compliant telecommunications marker tape complete with metallic detection strip ***shall*** be laid over the compacted fill 300mm above the installed conduit/s
h. Backfill the remainder of the trench with clean fill and compact such that the ground does not settle excessively
i. Reinstate the ground level to original condition

Where trenches dissect concrete or bitumen pathways or driveways a competent civil contractor shall reinstate the surfaces to the satisfaction of the DoE PM/PC/RST and nominated school representative.

8.12. Inspection Pits

The following requirements refer to the supply and installation of inspection pits for underground conduit installations.
Inspection pits ***shall*** meet the following minimum requirements:

a. Inspection pits ***shall*** be a minimum of size P3 (equivalent to BVCI Part #124020) for pits located at the point of entry to a building to allow for the storage of 2m of loose tube OSP fibre optic cable
b. Inspection pits ***shall*** be a minimum of size P2 (equivalent to BVCI Part #124015) for pits located mid run where OSP fibre optic cables pass through without storage. P2 pits ***shall*** only be used with a maximum conduit size of 50mmØ
c. Inspection pits located at the Centre of Network building ***shall*** be a minimum of size P4 for a maximum of 2 X 100mmØ conduits. For sites requiring more than 2 X 100mmØ conduits the building entry pit at the Centre of Network ***shall*** be a minimum size P6 (equivalent to BVCI Part #124040)
d. Inspection pits ***shall*** be fitted with lids suitable for the environment into which the pit is installed. As a minimum pit lids will require the use of a tool/lifter for removal with a preference for lockable lids
e. Pit lids ***shall*** be imprinted with the word “Communications”
f. Standard construction “P” type pits ***shall not*** be installed in areas trafficable by vehicles. It is preferred that inspection pits are not installed in trafficable areas, where this is unavoidable approval ***shall*** be sought from the DoE Project Manager prior to installation and the pits ***shall*** be poured concrete “Gattic” style pits with cast iron concrete infill lids
g. Inspection pits installed in grassed areas ***shall*** have a concrete collar fitted flush to ground level. Collars can be pre-cast concrete (equivalent to BVCI pre-cast collars) or can be cast on site. Where cast on site the collar ***shall*** contain steel reinforcing and ***shall*** be 100mm wide all round and have an effective depth of 150mm. The cast on site collars ***shall*** be pinned to the inspection pit with hot dipped galvanised pins from the pit rim into the poured concrete

Refer Appendix T

8.13. ICT Cable Road Crossings

8.13.1. Trenching

ICT backbone cabling that crosses under trafficable roads ***shall*** comply with the following minimum requirements:

a. All approvals, including local government, ***shall*** be provided by the installation contractor prior to the commencement of all trenching works
b. Road crossing conduits ***shall*** be AS 2053 compliant heavy duty rigid PVC white communications conduit
c. Road crossing conduits ***shall*** be minimum 100mmØ
d. Road crossing conduits ***shall*** extend 2000mm from the kerbs
e. Minimum size P4 inspection pits ***shall*** be installed either side of the road crossing
f. The number of road crossing conduits ***shall*** be confirmed with the DoE PM/PC/RST prior to installation
g. Conduits ***shall*** be buried a minimum of 600mm below finished road level to the top of the conduit
h. Conduits ***shall*** be laid on a bed of compacted sand 100mm deep
i. 100mm of compacted sand ***shall*** be installed immediately over the conduits
j. The remainder of the trench ***shall*** be backfilled and comply with civil road construction methods with respect to ground compaction and fill material
k. The finished road surface ***shall*** match existing
l. Where ICT cabling conduits are installed in the public domain the pathway system ***shall*** be registered with 1100 Dial Before You Dig

8.13.2. Under-Bore

Cables under Roadways which are installed with the use of under boring ***shall*** be provided as follows:

a. All approvals, including local government, ***shall*** be provided by the installation contractor before the works commence
b. Conduit installed ***shall*** include multiple 50mm conduit with communication pits at each end of the under bore entry and exit path way

8.14. Innerducts (Sub Cabling Enclosures)

Inner duct installation ***shall*** only proceed with the written approval of the DoE ITB Design Authority. Inner duct installation is the installation of an additional conduit pathway within a larger conduit pathway of another service such as LV electrical.
Inner duct installation ***shall*** comply with the following minimum requirements:

a. Inner ducts ***shall not*** be installed into the conduit system of a HV electrical system or other service classified as a hazardous service (flammable gas or liquid)
b. The maximum number of inner ducts allowed in any section of main enclosure ***shall*** be one (1) unless otherwise directed by the PM
c. Be compliant to AS/CA S009 and form a compliant barrier
d. Where possible the inner duct ***shall*** be installed into an available empty conduit
e. When within an LV electrical enclosure, the inner duct ***shall*** pass through the main enclosure and any associated pits and fittings unbroken, except where the main enclosure, pits and fittings are fitted with a non-removable and durable barrier that provides effective segregation of the different cabling systems

8.15. Pathway Cable Fill Rates

The following fill rates ***shall*** be considered in the design and planning process and incorporated in design documentation:

8.15.1. Backbone conduit cable fill rates

The maximum initial installation fill rate for any backbone conduit cable pathway is 40%. The maximum allowable fill rate for a backbone conduit cable pathway is 60%, once 60% fill has been achieved the pathway is deemed to be full and no additional cabling ***shall*** be installed into that conduit pathway.

The accepted industry practice of 100% fill of any cable pathway is 50% cable + 50% air by volume. The following formula is the accepted method of calculating fill:

CSA of pathway divided by CSA of cable divided by 2 = 100% fill

CSA = Cross Sectional Area (πr2 for circular pathways and cables)

The installing contractor ***shall*** confirm the O/D of the cable with the certifying manufacturer and is responsible for calculating the maximum fill capacity of all pathways.

8.15.2. Horizontal conduit cable fill rates

The maximum allowable fill rate for horizontal copper conduits is 80%. When calculating the conduit for an installation consideration should be given to future ICT cabling requirements and a maximum fill rate on initial installation should be 60%.

Refer Appendix U

8.16. Building Works and Penetrations

Where it is not practical or safe to utilise existing supporting structures new support structures ***shall*** be installed to the relevant Australian Standards and Codes.

8.17. Fire Stopping

The accredited installer ***shall*** ensure all penetrations for the ICT cabling works through fire rated walls/partitions or structure that break the integrity of an established fire zone are fire-stopped as per the requirements of the Building Code of Australia (BCA) and re-certified. Where there is a fire zone breach that is not part of the works for fire stopping, the accredited installer ***shall not***ify the DoE FPO (project manager/coordinator) or builder for rectification and again upon completion of the rectification.

8.18. Sealing of Penetrations

Penetrations ***shall*** be sealed as follows:

a. All penetrations made or provided in or through building walls, floors and ceilings ***shall*** be sealed with a suitable gap sealing compound suitable for the environment. External grade sealants ***shall*** be used for all penetrations in exterior walls and soffits.
b. Ensure that all penetrations through external walls are made weatherproof including the installation of flashing and/or rain hoods to prevent the entry of rain, seepage, etc.
c. Ensure that all penetrations through external walls are sealed to prevent the ingress of vermin

8.19. Paint and Corrosion Protection

Where metallic elements are provided as part of the installation they ***shall*** be painted to match the surface to which they have been fitted unless instructed otherwise by the DoE PM/PC/RST.

Painting and corrosion protection ***shall*** be provided as follows:

a. Provide corrosion protection and the painting treatment of all metal enclosures, threads, brackets, supports, cable trays and ladders, weather shields, etc. being supplied and/or installed as part of the ICT cabling works
b. Paint ***shall*** be equivalent to a cold galvanising preparation or ***shall*** match the main paint specification of the particular area where works are undertaken
c. Provide restoration to the original finish (or a matched equivalent) of paintwork to enclosures, structures, equipment and accessories
d. Where no special painting procedure is specified or required, all metal surfaces ***shall*** be wire brushed (or equivalent) to remove all traces of rust, scale or grease, and prime coated with one coat of an approved rust inhibiting paint (as per the Australian Standard AS/NZS 2312:2002, "Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings"). The finishing coats, including colour and type of paint, ***shall*** be nominated by the PM

Cut ends of all metal work ***shall*** be treated with a cold

9. External Wireless Access

9.1. External Wireless Access Point Installation

Where a Wireless Access Point (WAP) is required to be installed on the exterior of a building the following installation requirements ***shall*** be met:

a. The entire WAP/TO installation ***shall*** be mounted a minimum of 3000mm above finished surface level.
b. The WAP/TO ***shall*** be enclosed within a minimum IP54 rated enclosure mounted under a soffit or similar weatherproof cover.
c. The enclosure ***shall*** be the following minimum dimensions:
    1. 300mmW
    2. 250mmH
d. 250mmD, this depth is the minimum to allow for the rotation of the WAP mount
e. The enclosure ***shall*** be constructed of a UV stabilised polymer or glass reinforced resin material. Metal enclosures ***shall not*** be used
f. The enclosure ***shall*** be mounted to the building surface with four (4) fixings suitable for the surface. Fixings ***shall*** be minimum M8
g. The enclosure ***shall*** include a backmount panel for equipment mounting
h. The enclosure ***shall*** be lockable if fitted with a hinged lid, the lock ***shall*** utilise an L&F 92268 key. If the enclosure has a lid retained by screws, the screws ***shall*** be marine grade (316) stainless steel anti-tamper.
i. The installed TO ***shall*** meet the requirements of the certifying vendor with respect to outlet rating
j. The enclosure ***shall*** be fitted with a 25mm long M6 stainless steel earth stud. The earth stud ***shall*** be fitted to the enclosure backmount panel. The incoming protective earth cable ***shall*** be secured to the earth stud at the rear of the backmount panel, a crown washer or similar anti-vibration nut ***shall*** be used to secure the earth stud. A spare crown washer/anti-vibration nut ***shall*** be left in the enclosure for the termination of the protective earth to the WAP antenna
k. A 6mm2 protective earth cable ***shall*** be installed from the CET in the building telecommunications room direct to the WAP enclosure. It is not acceptable to connect this protective earth to the nearest pathway connection.
l. All protective earth terminations at the WAP enclosure ***shall*** be fixed by a suitable crimp style lug
m. Where the ICT cabling penetrates the external wall of the building structure the cabling ***shall*** be installed within a 32mmØ PVC conduit and the penetrations sealed with a suitable sealant fit for the purpose of preventing the ingress of moisture and vermin. The conduit ***shall*** be sealed with a re-enterable compound after the cable installation. The conduit ***shall*** only penetrate through the rear of the enclosure, it ***shall not*** penetrate the enclosure backplane, this is to allow the earth cable to be installed behind the backplane to the earth stud

Refer Appendices CC & DD

9.2. External Wireless Antenna Installation

Where an external wireless access point antenna is required the following installation requirements ***shall*** be met:

a. External antenna brackets ***shall*** be hot dipped galvanised steel
b. Antenna brackets ***shall*** have a minimum of two (2) mounting holes
c. Antenna brackets ***shall*** be mounted to building structural elements with minimum M10 marine grade (316) stainless steel fixings. It is not sufficient to secure an antenna bracket to a facia or barge board without securing to a structural roof element (truss frame)
d. Antenna brackets up to 1200mm high can be installed without bracing
e. Antenna brackets greater than 1200mm high ***shall*** be braced in two (2) directions
f. From the wireless antenna a continuous connection cable ***shall*** be installed from the antenna through the wall to the wireless access point
g. The connecting cable ***shall*** have a drip loop installed in the cable run immediately prior to the entry point to the building to prevent the ingress of moisture. The drip loop ***shall*** be secured flat to the wall surface
h. Where the ICT cabling penetrates the external wall of the building structure the cabling ***shall*** be installed within a 25mmØ PVC conduit and the penetrations sealed with a suitable sealant fit for the purpose to prevent the ingress of moisture and vermin. The conduit ***shall*** be sealed with a re-enterable compound after the cable installation. The conduit ***shall*** be installed with a slight downward slope to the exterior of the building to prevent the ingress of moisture should the sealing compound fail
i. At the location of the wireless access point to which the antenna will be connected a suitable over voltage protection module ***shall*** be installed between the antenna and the access point. A 6mm2 protective earth ***shall*** be installed from the building CET and connected directly to the over voltage protection module

Refer Appendix EE

10. Specific Application of Pathways

The purpose of this section is to outline the provision of cabling for specific applications, such as furniture and Interactive White Boards. All ICT data cabling is required to comply in all respects with Australian Cabling Rules and relevant DoE standards (including separation of power and data cabling and the surface mounting of outlets). It should be clearly understood that all cabling, power socket outlets and data outlets ***shall*** be fixed to permanent structures.

10.1. Furniture Cable Pathways

10.1.1. Fixed Modular Workstation Furniture

Modular furniture ***shall*** only be used in Staffrooms, Administration areas and Business Education areas. Modular workstation blade assemblies ***shall*** be secured to the building structure (floor or walls).

Where furniture is fixed to a wall or other permanent structure, the following ***shall*** apply:

a. All cabling ***shall*** be fully enclosed, concealed, protected and supported
b. The TOs ***shall*** be affixed to the position of the work area device or computer workstation
c. All TOs ***shall*** be mounted above the bench
d. All TOs ***shall*** be mounted so that they are physically secure
e. The work area cords ***shall*** have a maximum length of 3 metres subject to permanent link length and ***shall not*** pose a WH&S risk of tripping

10.1.2. Moveable Loose Furniture

Where furniture is moveable or capable of being moved the following ***shall*** apply:

a. All cabling, including work area cords, ***shall*** be fully enclosed, concealed, protected and supported
b. The outlets ***shall*** be affixed to the wall or permanent structure, or service pole only
c. The TOs ***shall*** be connected to the equipment by work area cords
d. The work area cords ***shall*** have a maximum length of 3 metres subject to permanent link length and ***shall not*** pose a WH&S risk of tripping

10.1.3. Circular Furniture

Circular furniture, such as those used in libraries etc., ***shall*** be serviced by a centrally located full height service pole.

11. Labelling of ICT Infrastructure

All elements of the ICT Cabling system ***shall*** be labelled and where specified uniquely identified as detailed in the following:

11.1. ICT Cabinets

a. Each installed ICT cabinet ***shall*** have a unique identifier affixed to the front of the cabinet.
b. The label ***shall*** be a minimum 25mm high with text measuring 20mm high.
c. The label ***shall*** be machine generated micro etched acrylic. Tape labels ***shall not*** be used
d. Labels ***shall*** be affixed to the cabinet with industrial double sided tape. Foam type tapes ***shall not*** be used
e. Alternatively labels can be riveted to the cabinet
f. A LASER radiation warning label ***shall*** be fitted to the front of the Cabinet door

11.2. Fibre Installations

11.2.1. FOBOTS

a. A LASER radiation warning label ***shall*** be fitted to the FOBOT face
b. Manufacturer labelling indicating the Category of product represented
c. FOBOTs ***shall*** be uniquely identified from the upper most installed item down the cabinet, inclusive of Patch Panels The identifier ***shall*** be a capitalised alpha (A, B, C, etc.) symbol affixed to the right hand side of the patch panel
d. FOBOTs ***shall*** display labelling to reflect the origin of the optic fibre cable terminated therein. (e.g. 01-A-01-12, being a cable originating from cabinet 01, FOBOT “A”, ports 01-12)
e. FOBOT ports ***shall*** be labelled to reflect the pair-wise termination sequence of the course
f. Labelling ***shall*** be machine printed black lettering on white printed and permanent labels
g. Labelling ***shall*** use Arial lettering style
h. Labelling tape ***shall*** be at least 20mm with maximum font size possible

11.2.2. Fibre Joint Enclosure

a. A LASER radiation warning label ***shall*** be fitted to the enclosure face
b. The enclosure ***shall*** be labelled to reflect the end termination points of the optic fibre cables joined therein. (e.g. 01-B-13-24 to 10-A-01-12, being a cable originating from cabinet 01, FOBOT “B”, ports 13-24 running to cabinet 10, FOBOT “A”, ports 01-12).
c. The label ***shall*** be an outdoor grade label, machine printed and self-laminating. Alternatively embossed metal label systems may be used

11.2.3. Cabling

a. Each installed optic fibre link ***shall*** be labelled as the cable enters the FOBOT enclosure inside the ICT cabinet
b. The label ***shall*** clearly indicate the origin and destination of the cable using the Cabinet ID and the FOBOT ID
c. The label ***shall*** be machine printed with text sized to be capable of being read at a distance of 1000mm
d. Optic fibre cables ***shall*** be identified in all underground inspection pits. The label ***shall*** be an outdoor grade label, machine printed and self-laminating. Alternatively embossed metal label systems may be used

11.2.4. ICT Cabling Sub-ducted Pathway

When ICT cabling is subducted through LV electrical pit and pipe pathways the following label:

a. A LASER etched stainless steel label secured to the subducting with stainless steel ties. The label ***shall*** be secured to the subduct in all locations where the subduct is accessible and collocated with LV electrical services or within the LV electrical pathway system.
b. The label ***shall*** state the following “ICT Cabling Installation – Contact IT Admin”

11.3. Copper Installations

11.3.1. Patch Panels

a. Manufacturer labelling indicating the Category of product represented
b. Patch panels and FOBOTs ***shall*** be uniquely identified from the upper most installed item down the cabinet. inclusive of FOBOTS. The identifier ***shall*** be a capitalised alpha (A, B, C, etc.) symbol affixed to the right hand side of the patch panel
c. Patch panels ***shall*** display numbering to all ports 01-24
d. Labelling ***shall*** be machine printed black lettering on white printed and permanent labels
e. Labelling ***shall*** use Arial lettering style
f. Labelling tape ***shall*** be at least 20mm with maximum font size possible

11.3.2. Telecommunications Outlets

a. All telecommunications outlets ***shall*** be uniquely identified
b. TOs ***shall*** be labelled using identification studs equivalent to IPA studs for moves, adds and changes only
c. For new construction works TO faceplate ***shall*** be machine/LASER engraved; IPA studs ***shall not*** be used. Minimum

font size of 6mm in Arial Bold

d. The faceplate ***shall*** contain source identification of the cabinet and patch panel of origin of the ICT cabling. This ***shall*** be located to the top of the faceplate
e. Each installed TO ***shall*** be identified with its patch panel termination number immediately above the TO
f. Where a TO is located above a suspended tile grid ceiling system a label ***shall*** be affixed to the ceiling grid immediately below the TO. The label ***shall*** indicate the TO ID on the label and wording similar to TO above. The label ***shall*** be 20mm wide black writing on a white background. Font size ***shall*** allow for two (2) lines of 6mm high text on the label. Label ***shall*** be machine generated micro etched acrylic, tape labels ***shall not*** be used. The label ***shall*** be secured in place by means of double-sided adhesive tape covering 100% of the label surface

Refer to Appendix BB

11.3.3. Cabling

a. Each installed copper ICT cable ***shall*** be labelled behind the patch panel and the faceplate
b. The label ***shall*** be machine printed with text sized to be capable of being read at a distance of 1000mm
c. Cable labels ***shall*** be of the self-laminating type.
d. The label ***shall*** contain the same information as that on the TO faceplate
e. Alternatively the TNA Industries Job Management System may be used

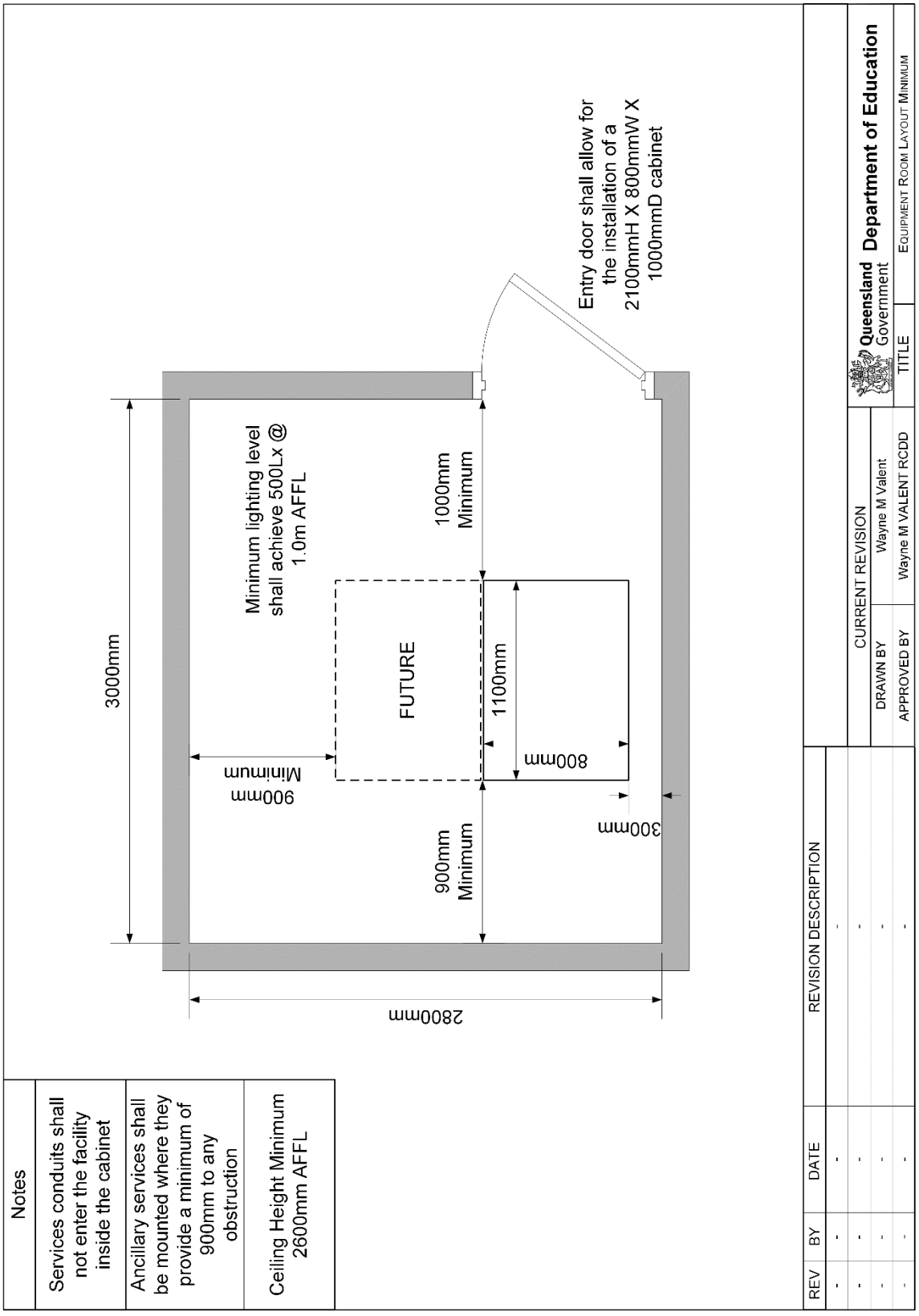
12. Glossary

Acronym	Meaning
8P8C	8 Position 8 Conductor modular plug. Referred to in the industry as RJ45
AI	Accredited Installer
ACM	Asbestos Containing Material
ACMA	Australian Communications and Media Authority
AFFL	Above Finished (or Fixed) Floor Level
APs	Access Points
AS	Australian Standard
BCA	Building Code of Australia
BD	Building Distributor
BEMIR	Building Environment Materials Information Register
BEP	Building Entry Point
CAD	Computer Aided Design
CCTV	Closed Circuit Television
CD	Campus Distributor (see also MDF)
CI	Certified Installation Company
CM	Contract Manager
CON	Centre of Network
CP	Consolidation Point
DBYD	Dial Before You Dig now called Dial1100
DGPO	Dual General Purpose Outlet. Previously used term, now known as dual (power) socket-outlet
DNIPS	Departmental Network Infrastructure Procedures and Standards
DoE	Department of Education
DoE PQP	Department of Education 78113 Pre-Qualified Partner arrangement
.dwg	CAD Drawing File format
EC	Electrical Consultant
EPR	Earth Potential Rise
FD	Floor Distributor
.flw	FLW file is a Fluke Linkware Database. Fluke Linkware is a cable test management software
FOBOT	Fibre Optic Break Out Termination enclosure
F/UTP	Foil over Unshielded Twisted Pair. Typical construction of Category 6_A ICT cable
CWPPD	Capital Works Program Portfolio Delivery (DoE)
GPO	General Purpose Outlet. Previously used term, now known as (power) socket-outlet
GS	Galvanised Steel
HDG	Hot Dipped Galvanising
HV	High Voltage, greater than 430VAC
ICT	Information and Communications Technology
IDC	Insulation Displacement Connector
IP	Internet Protocol
IPA Stud	IPA stud, a brand of electrical permanent identification marker
ISD	Infrastructure Services Division (DoE)
ITB	Information and Technologies Branch (DoE)
LC	A Small Form Factor optic fibre connector developed by Lucent

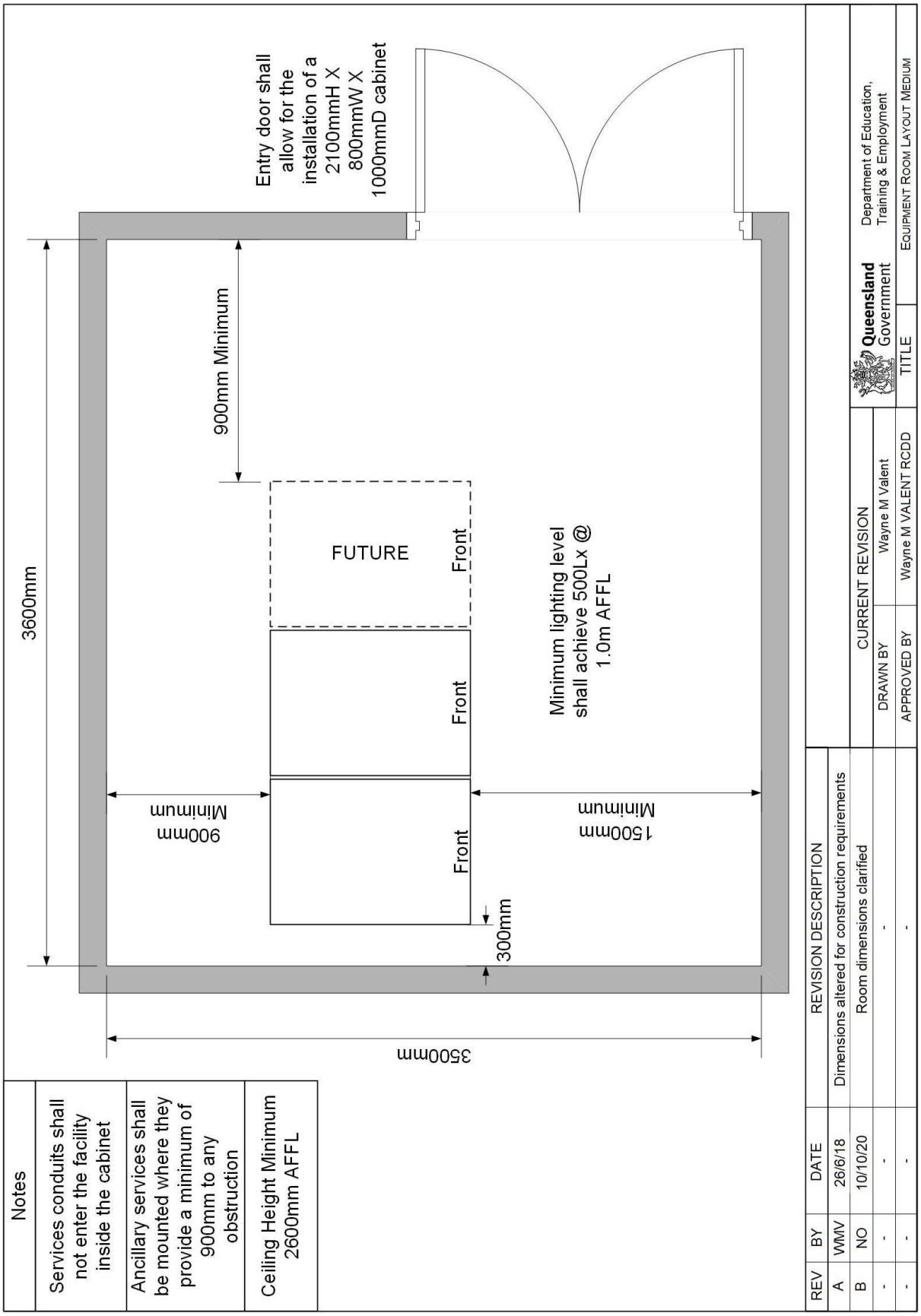
Acronym	Meaning
LDB	Low Density Board usually containing friable asbestos
LV	Low Voltage, less than 430VAC
MDF	Main Distribution Frame (see also CD)
MMOF	Multi-Mode Optical Fibre
MUTO	Multi-User Telecommunications Outlet
OM1	62.5µm multimode optical fibre 200MHz.km
OM3	50µm multimode optical fibre 1500MHz.km
OS2	9µm single mode optical fibre grade OS2
PABX	Private Automatic Branch Exchange
PBX	Private Branch Exchange
PC	Practical Completion
.pdf	Portable Document Format
PFC	Powered Fibre Cable
PM	Project Manager
PoE	Power Over Ethernet
PVC	Polyvinyl Chloride
QGEA	Queensland Government Enterprise Architecture
RCDD	Registered Communication Distribution Designer
RJ	Registered Jack
RJ-45	Refer to 8P8C
RST	Regional Systems Technician (DoE)
RTM	Regional Technology Manager (DoE)
RU	Rack Unit, the unit of measurement is 44.25mm
SC	Subscriber Connector (optical fibre)
SCS	Structured Cable System
ScTP	Screened Twisted Pair
SFF	Small Form Factor
SMOF	Single Mode Optical Fibre Grade OS2
SOW	Scope of Works
ST	Straight Tip (Bayonet) Fibre Optic Connector
STP	Shielded Twisted Pair
TCA-1	Telecommunications Cabling Advice form #1 - installation completion form
TCA-2	Telecommunications Cabling Advice form #2 - for reporting of non-direct installation defects
TO	Telecommunications Outlet
UPVC	Un-plasticised Polyvinyl Chloride
UTP	Unshielded Twisted Pair
Velcro™	A proprietary form of Hook & Loop fastener/cable tie
VoIP	Voice over IP
WAAP	Work Area Access Permit
WAP	Wireless Access Point
WH&S	Workplace Health and Safety

13. Appendices

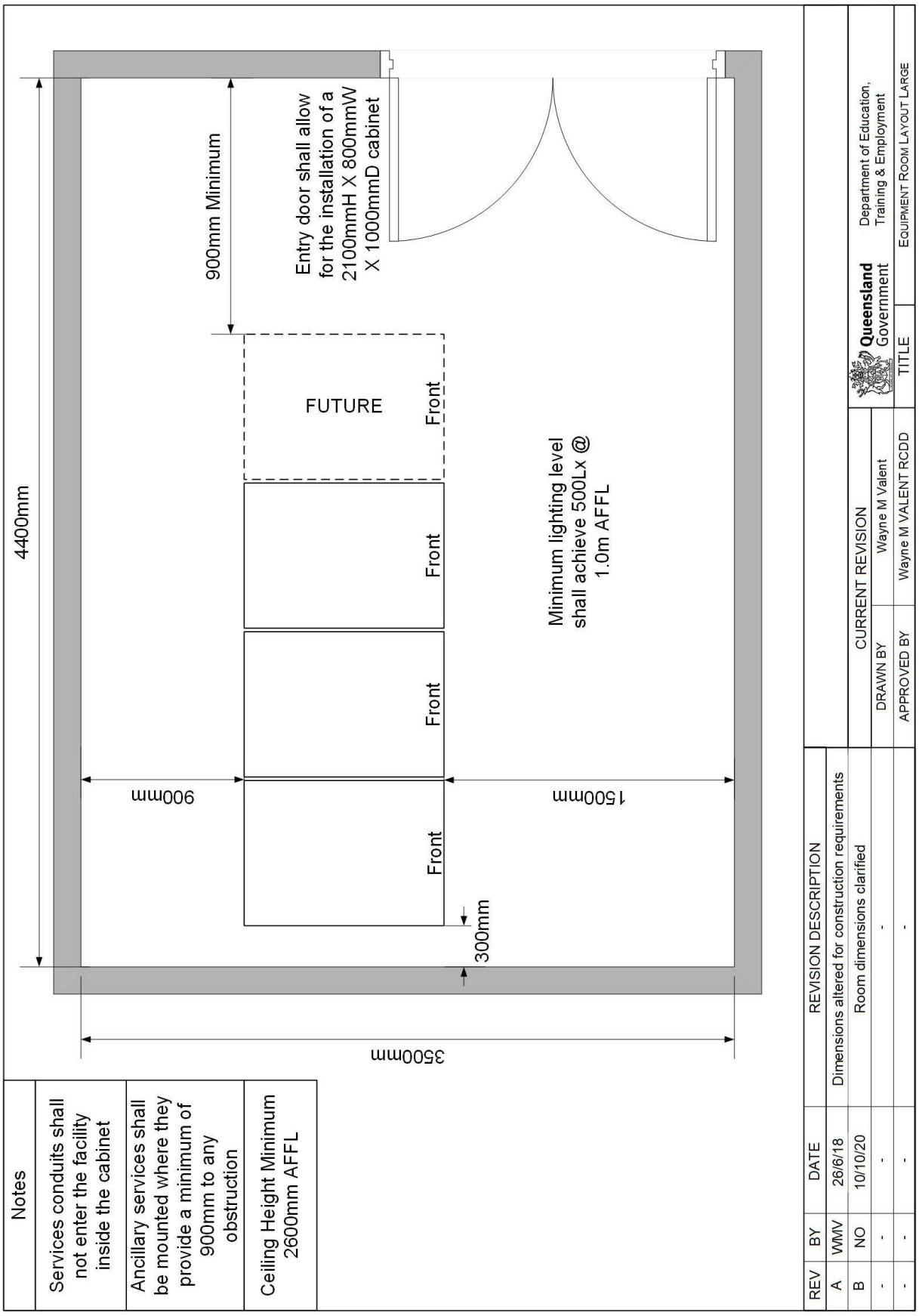
A Equipment Room Layout Minimum



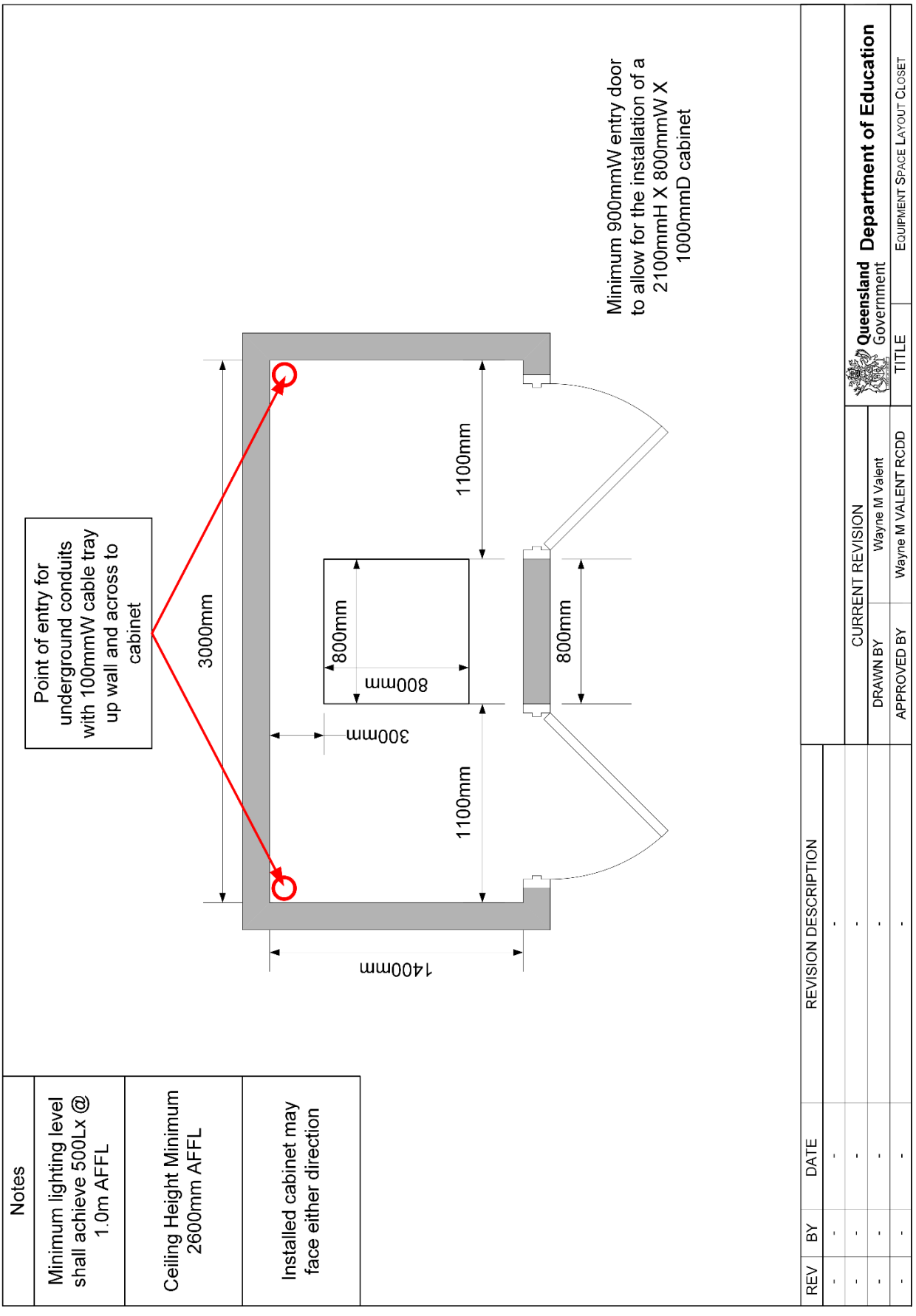
B Equipment Room Layout Medium



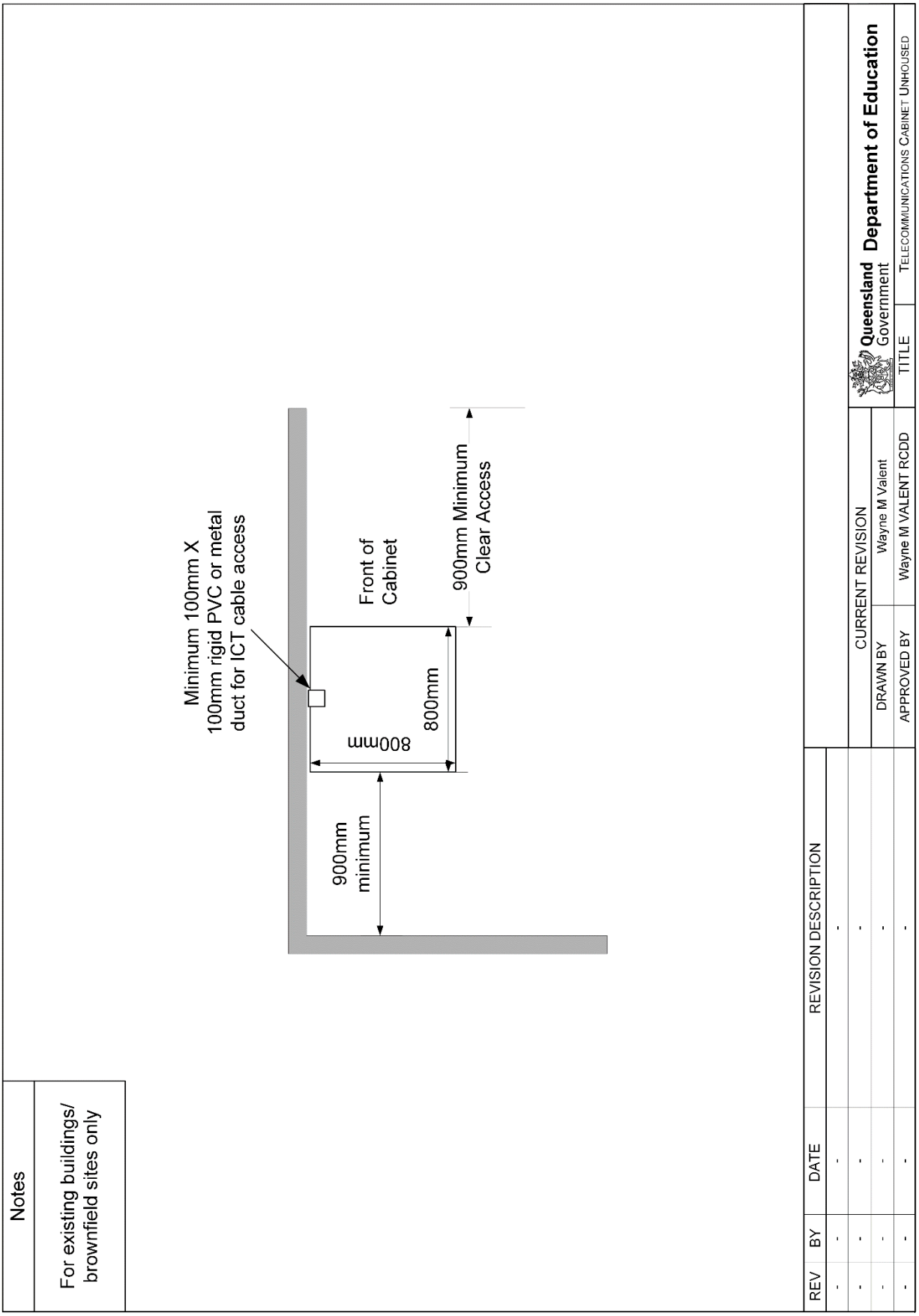
C Equipment Room Layout Large



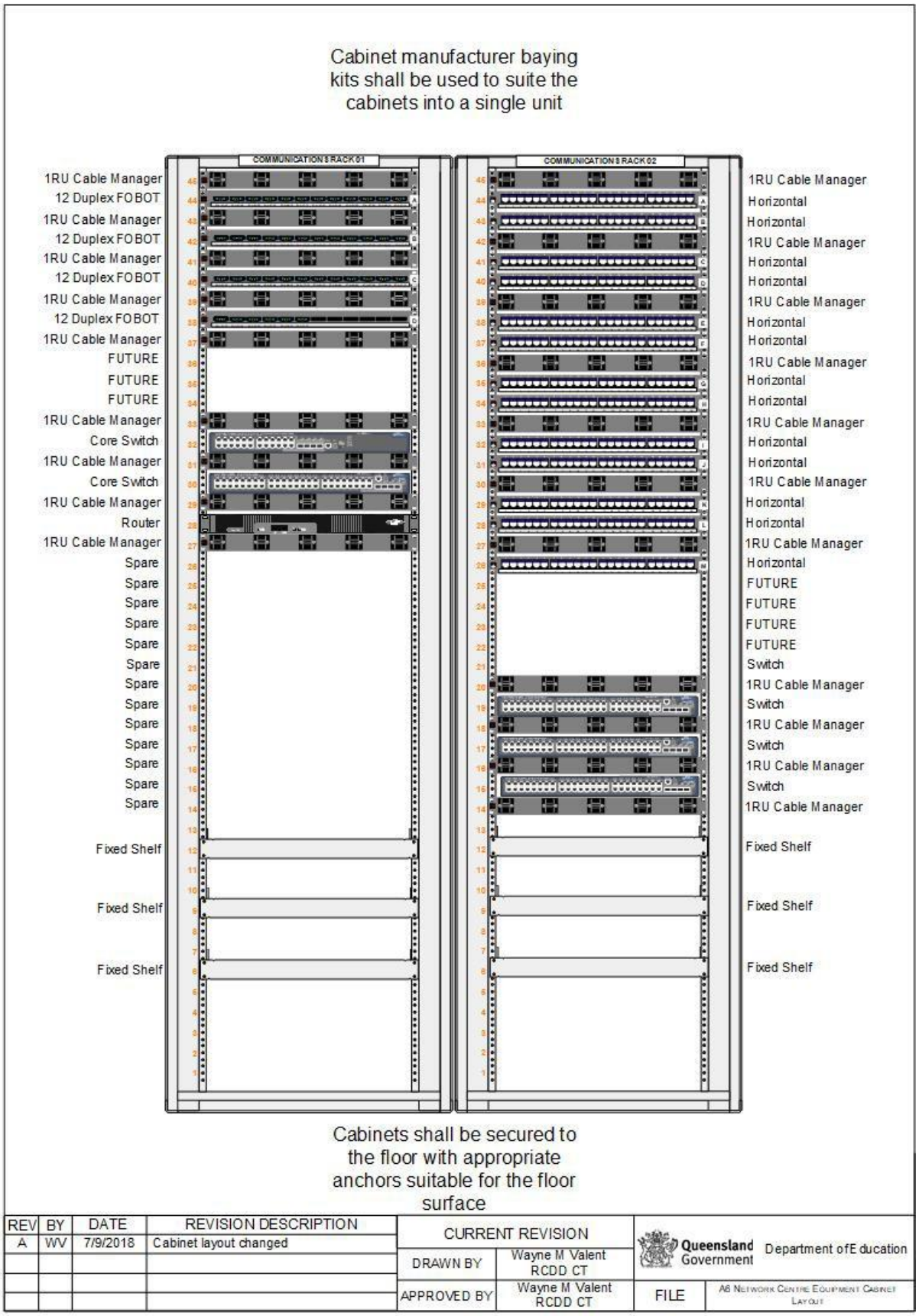
D Equipment Room Layout Closet



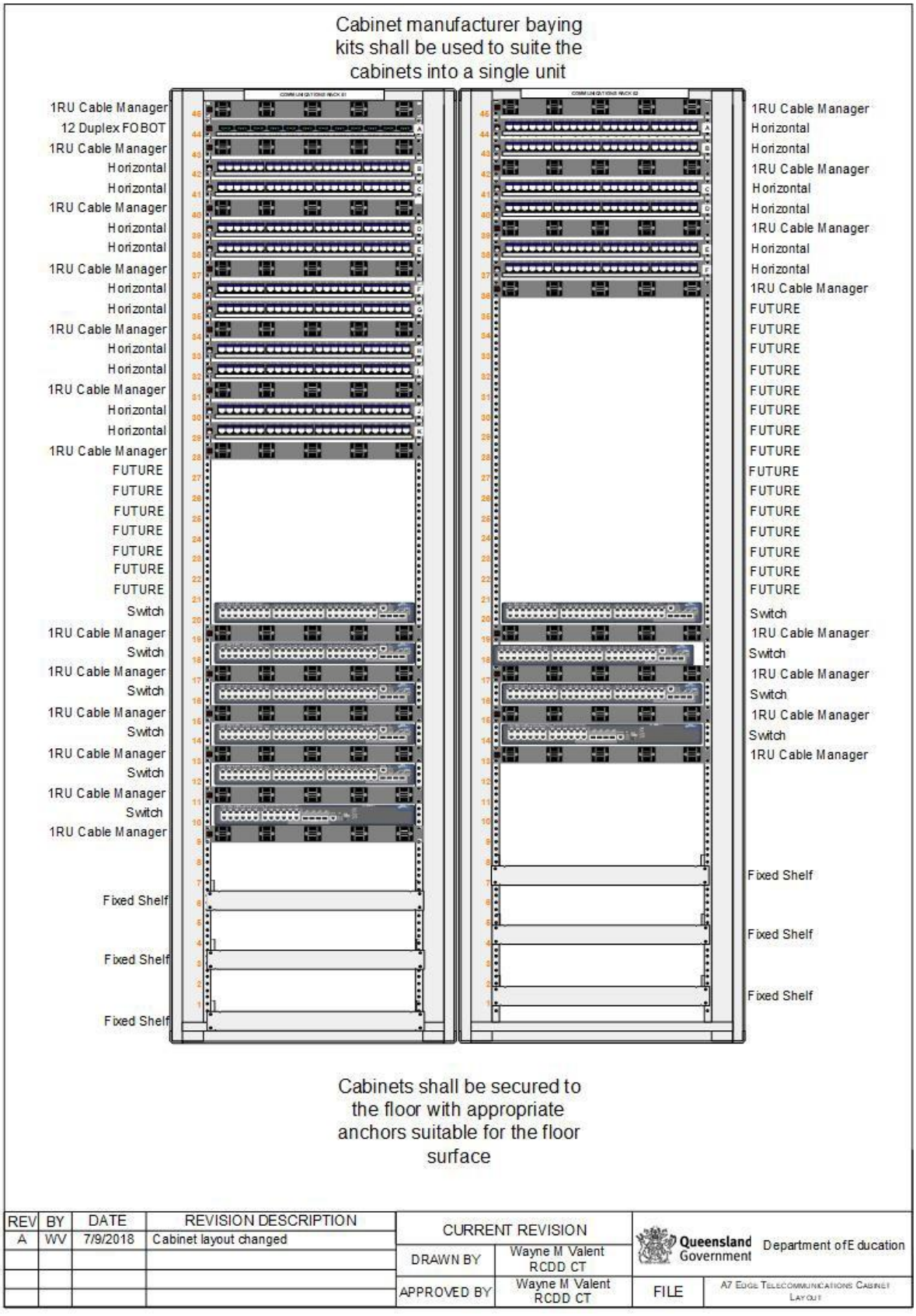
E Minimum Space Requirements for Enclosed Lockable Cabinet



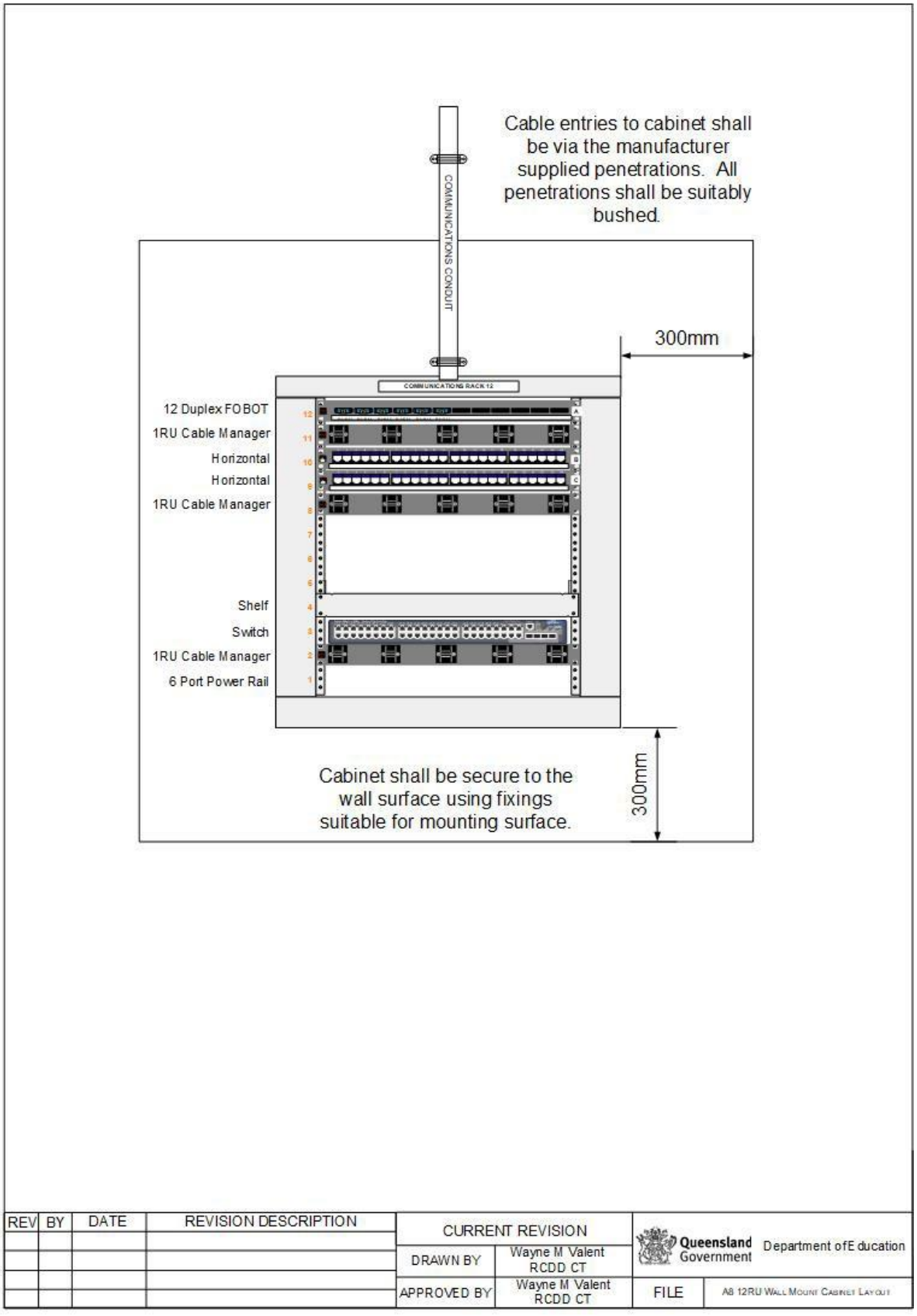
F Typical Network Centre Cabinet Layout



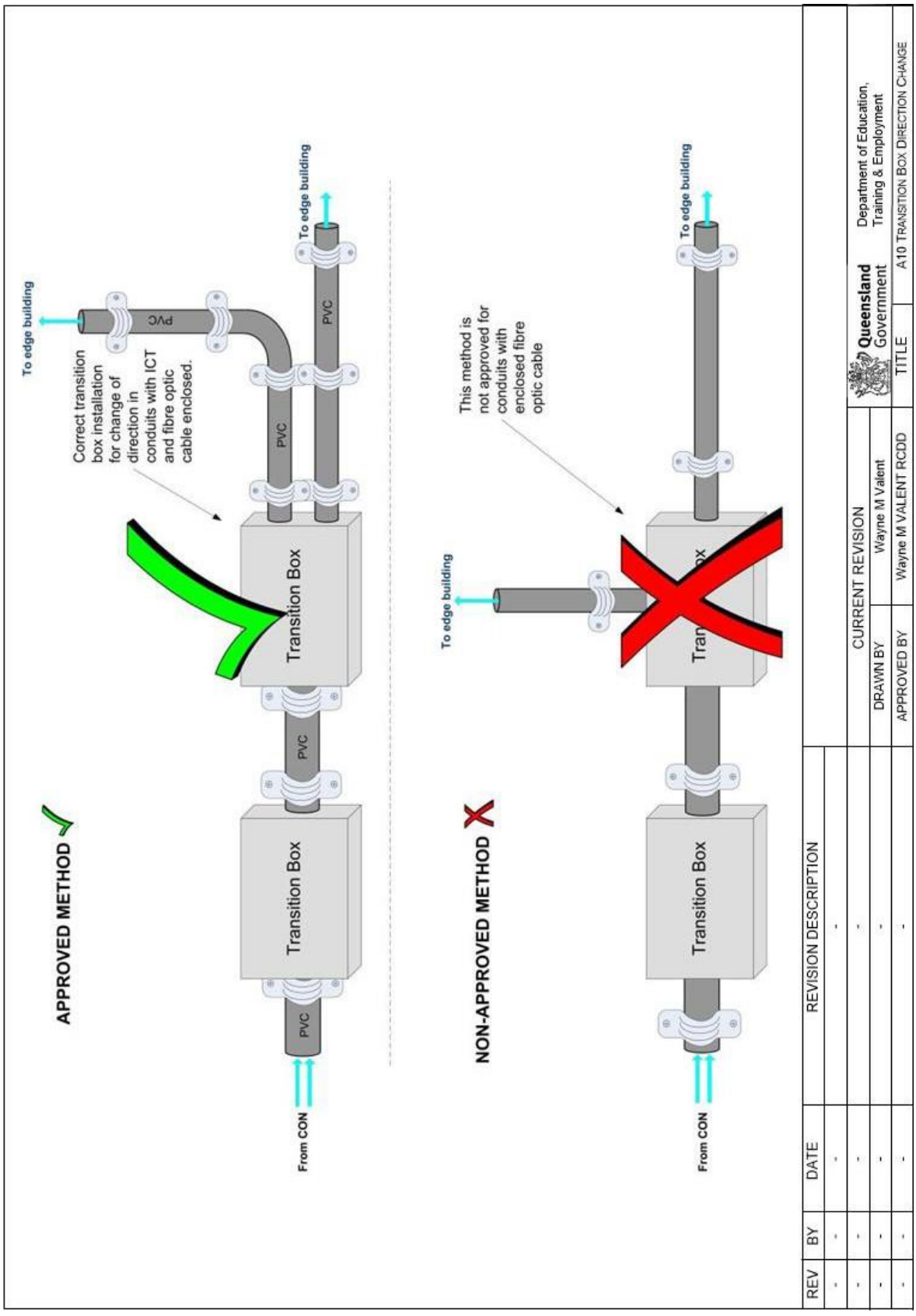
G Typical Edge Building Cabinet Layout



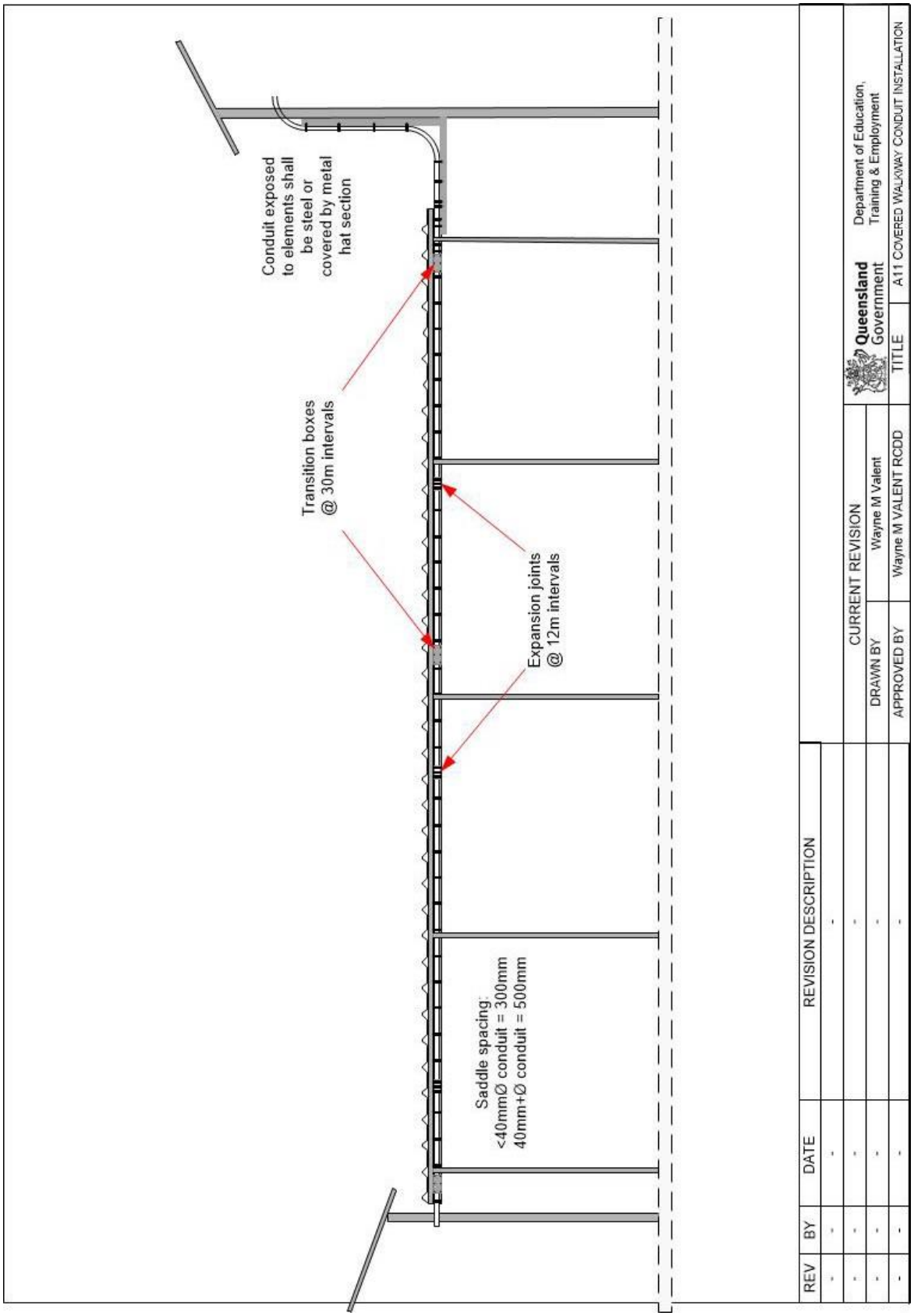
H Typical Wall Mount Cabinet Layout



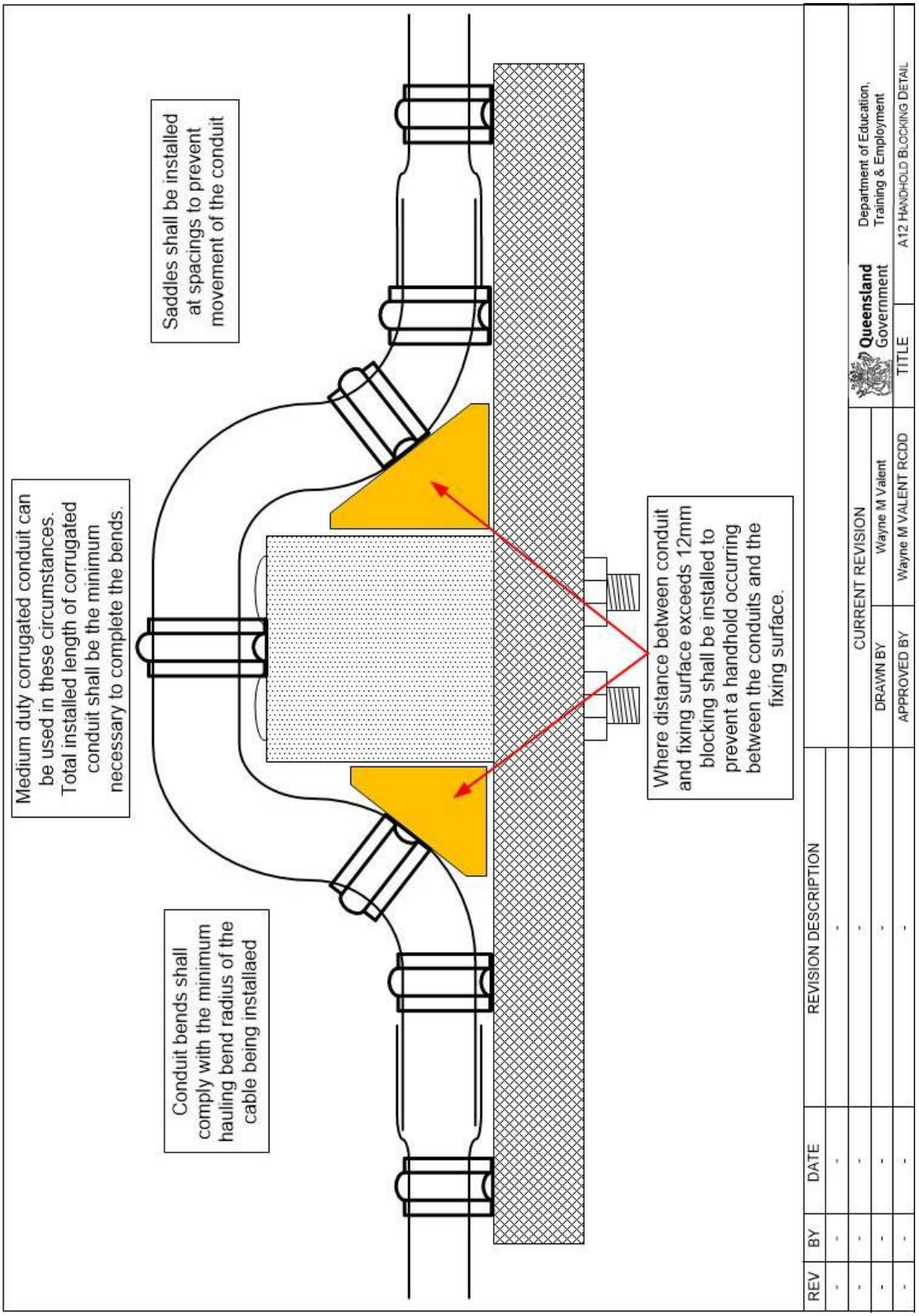
I Transition Box Conduit Directional Change



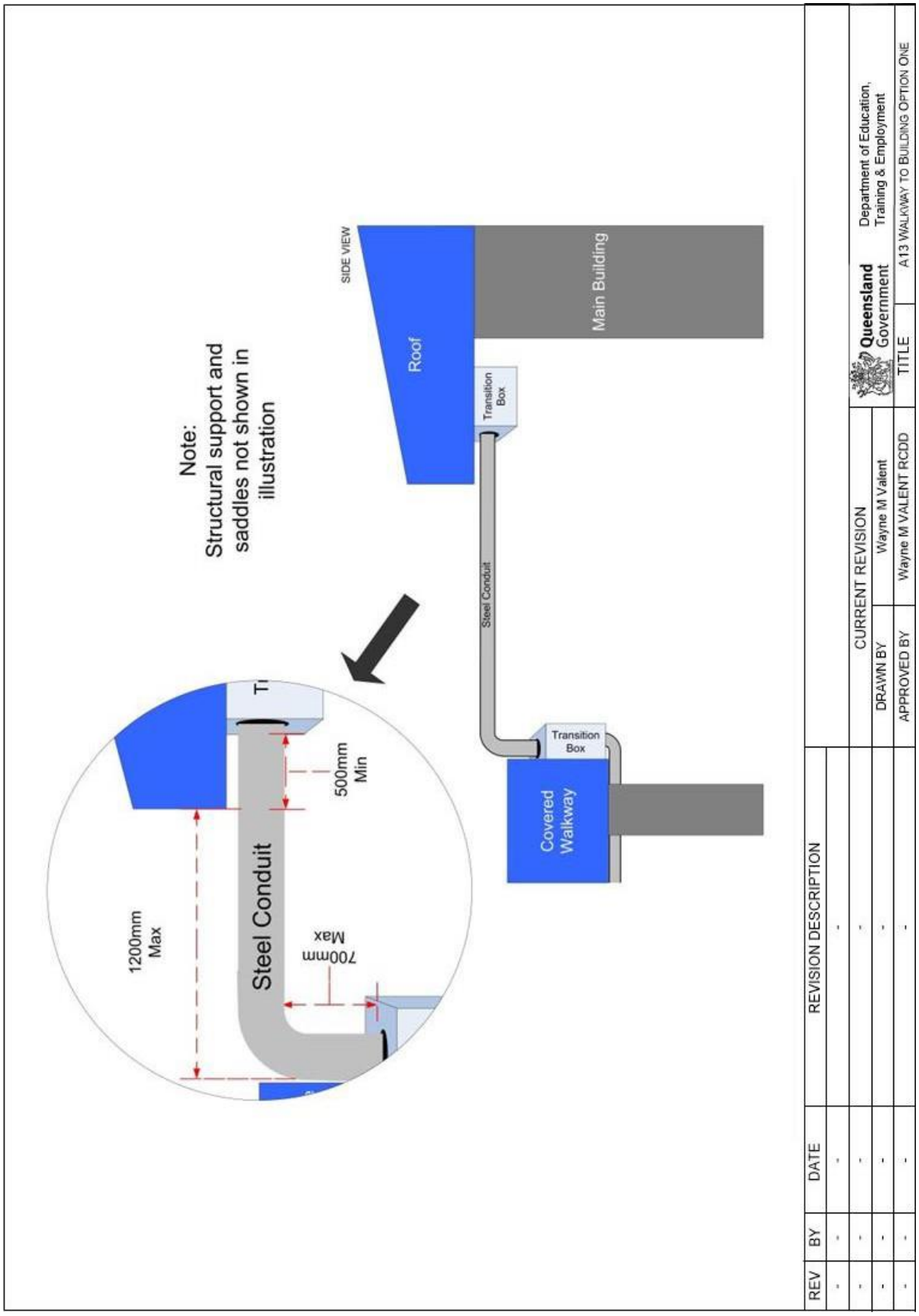
J Minimum Surface Conduit Requirements



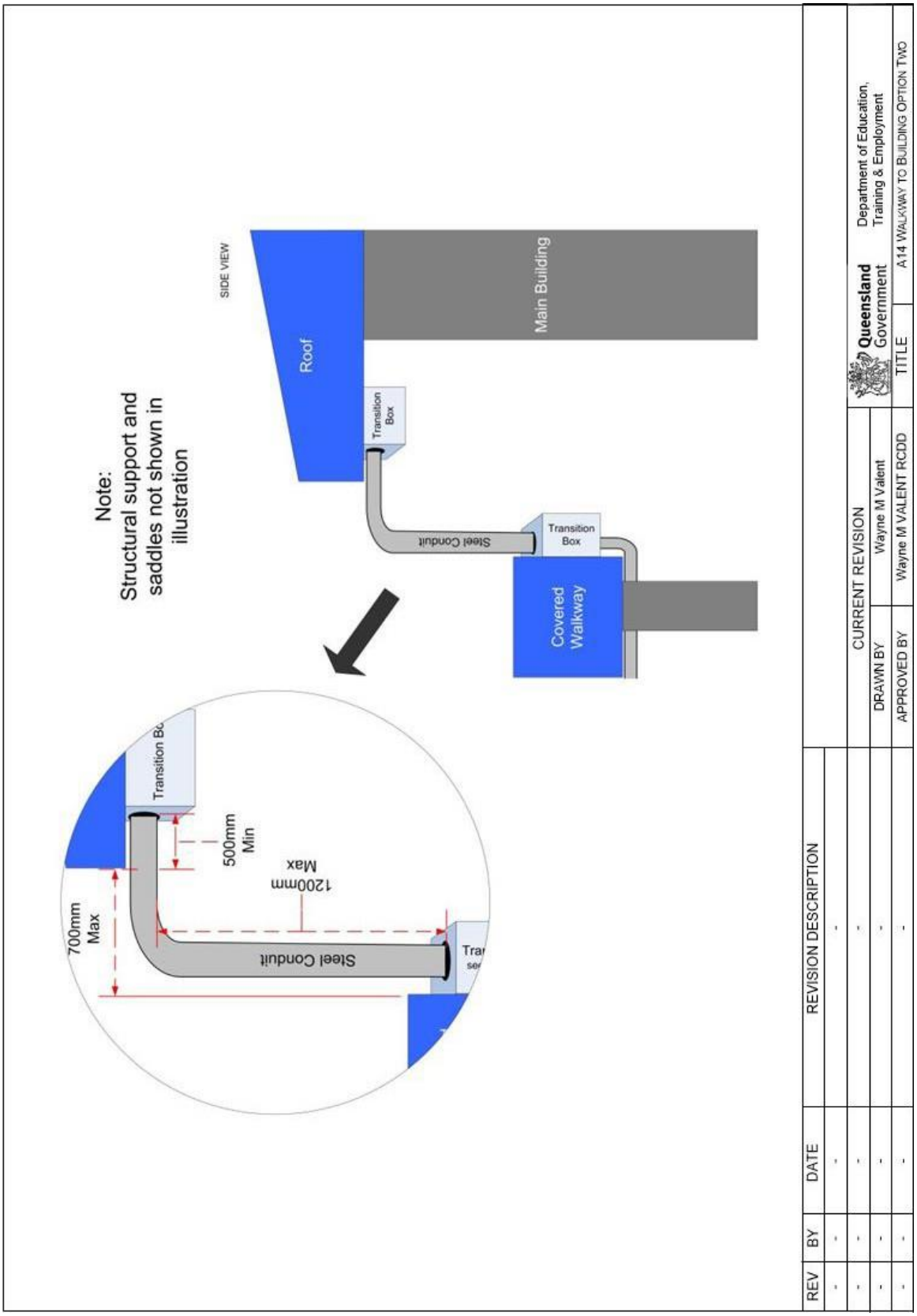
K Hand Hold Blocking Detail



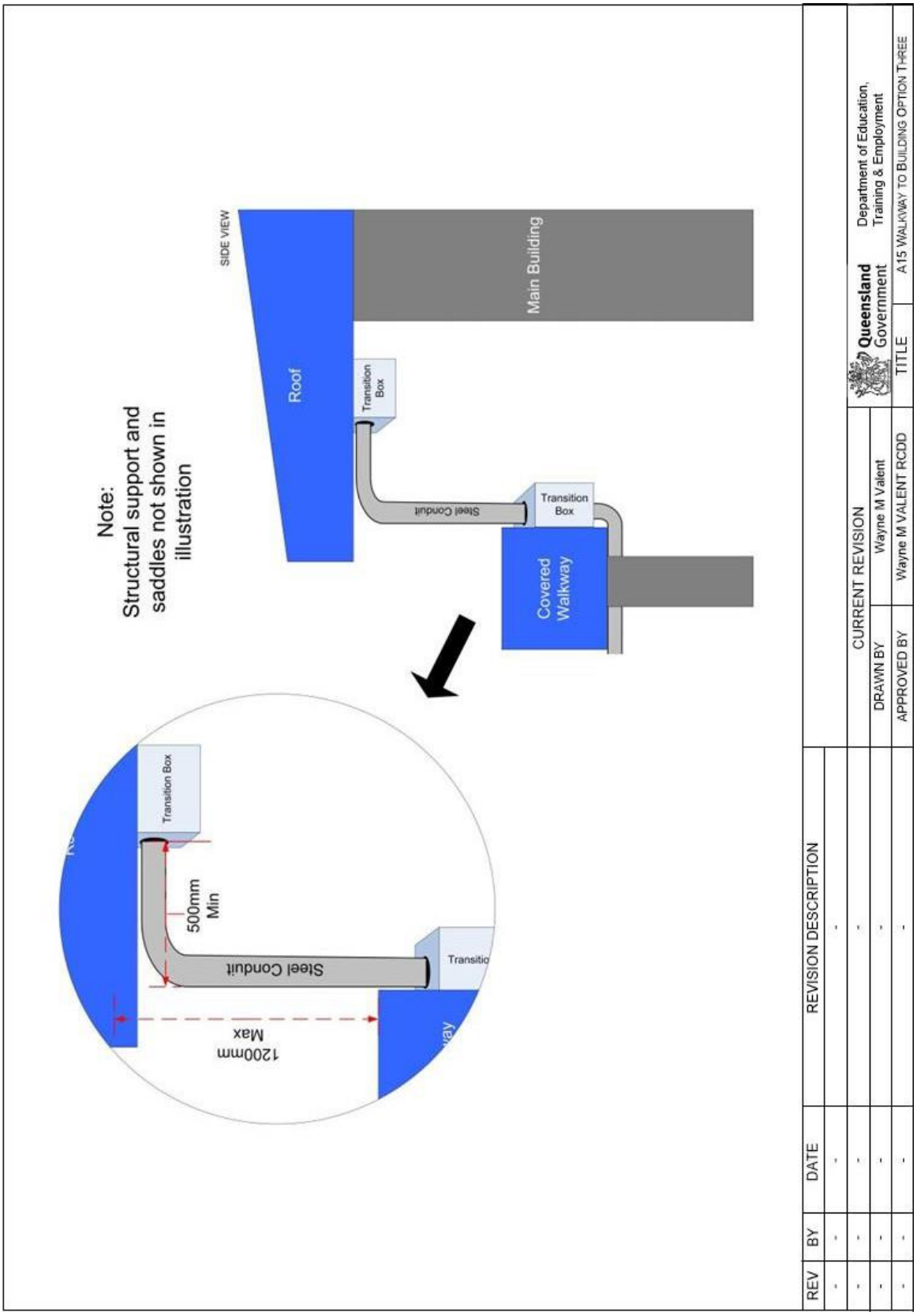
L Walkway – Building/Other Structure Conduit Transition Option One



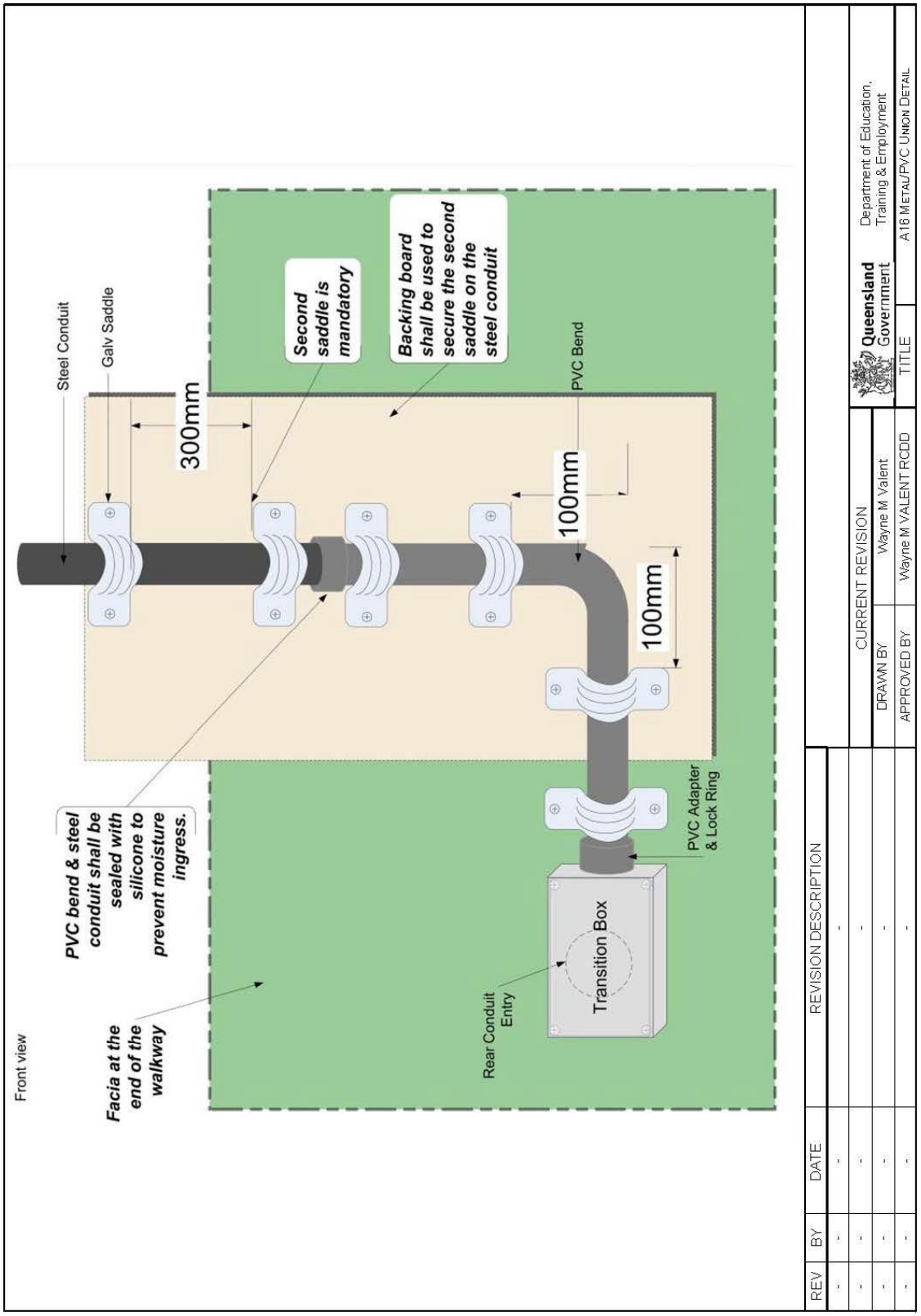
M Walkway – Building/Other Structure Conduit Transition Option Two



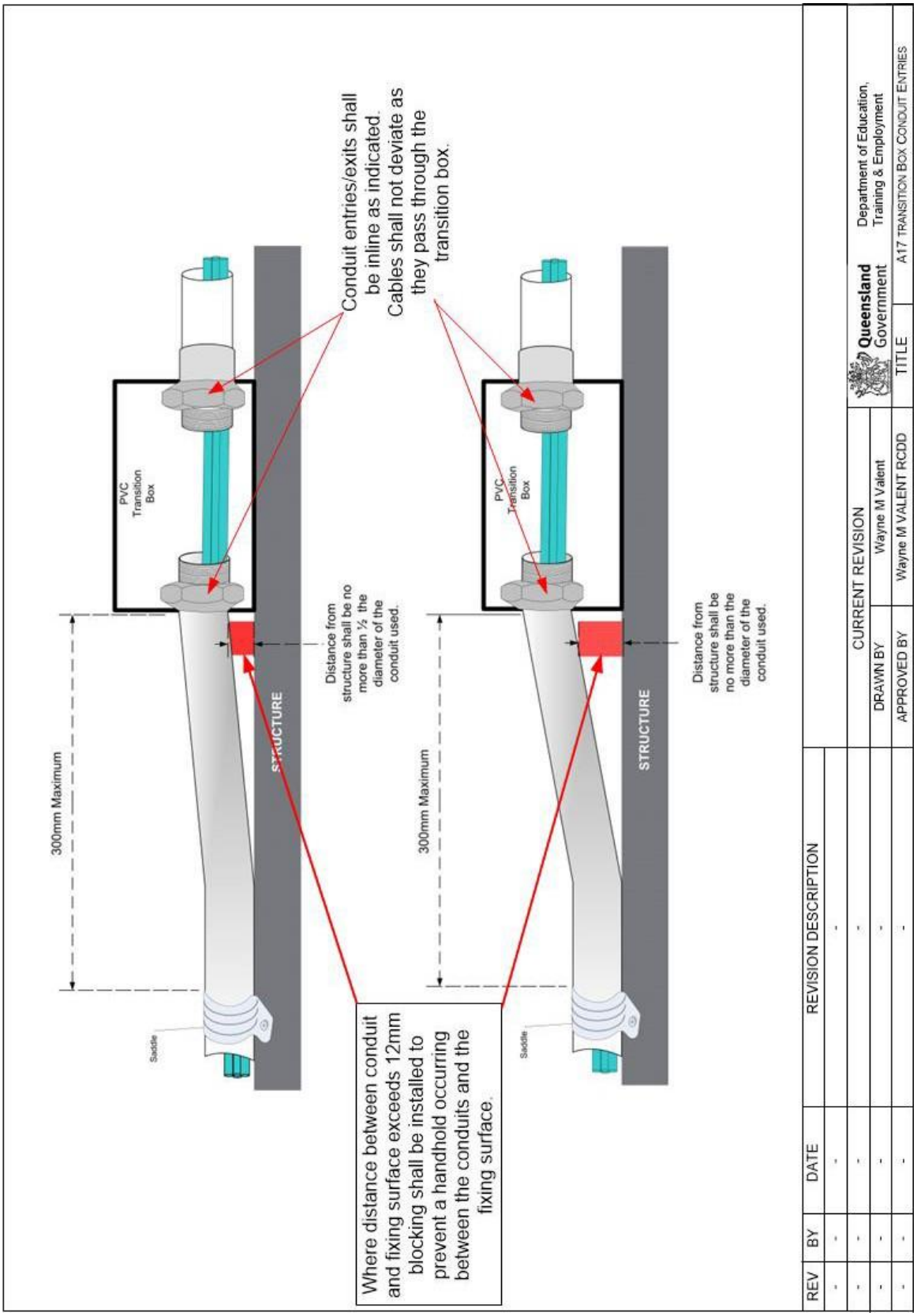
N Walkway – Building/Other Structure Conduit Transition Option Three



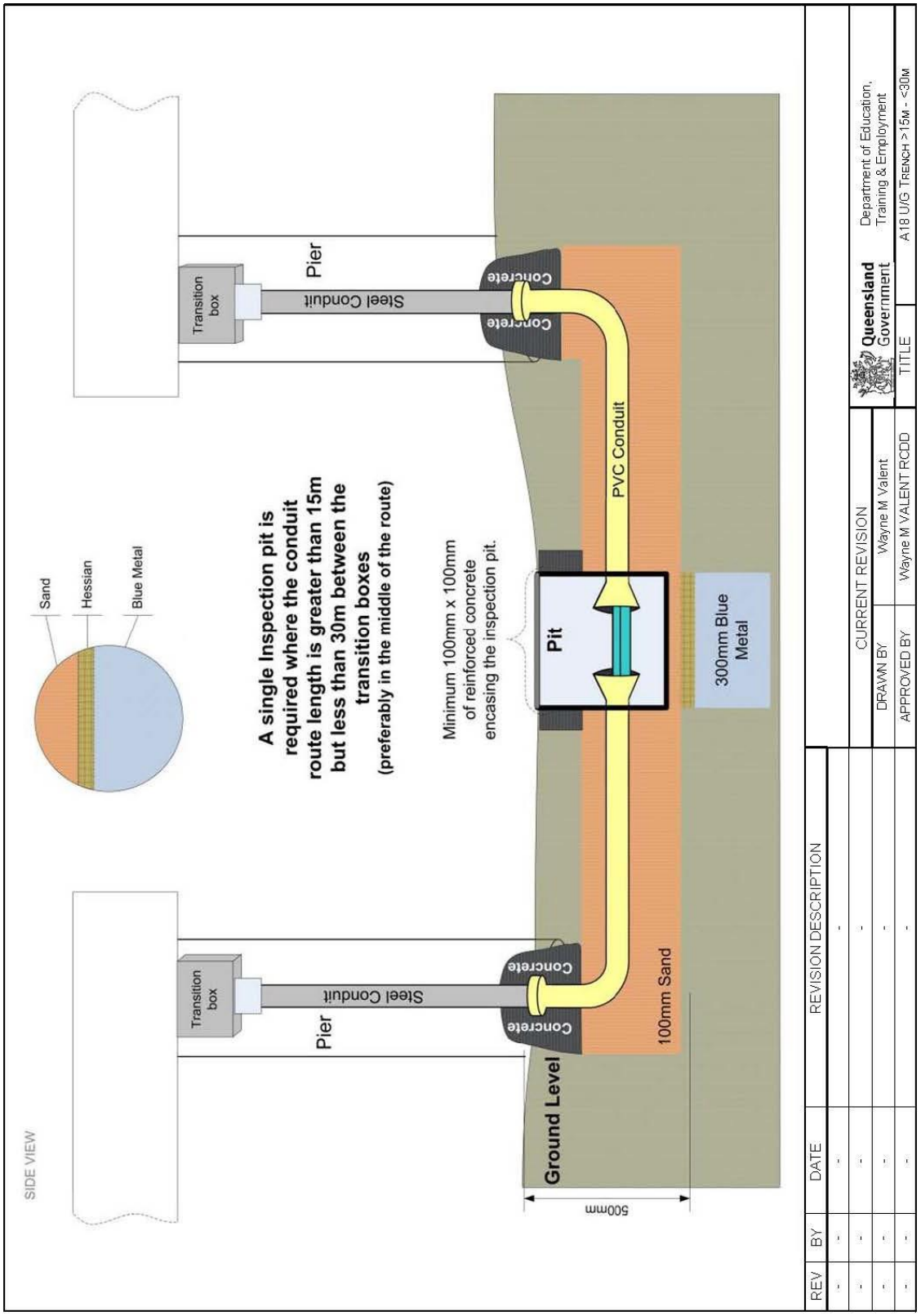
O Metal/PVC Union Detail



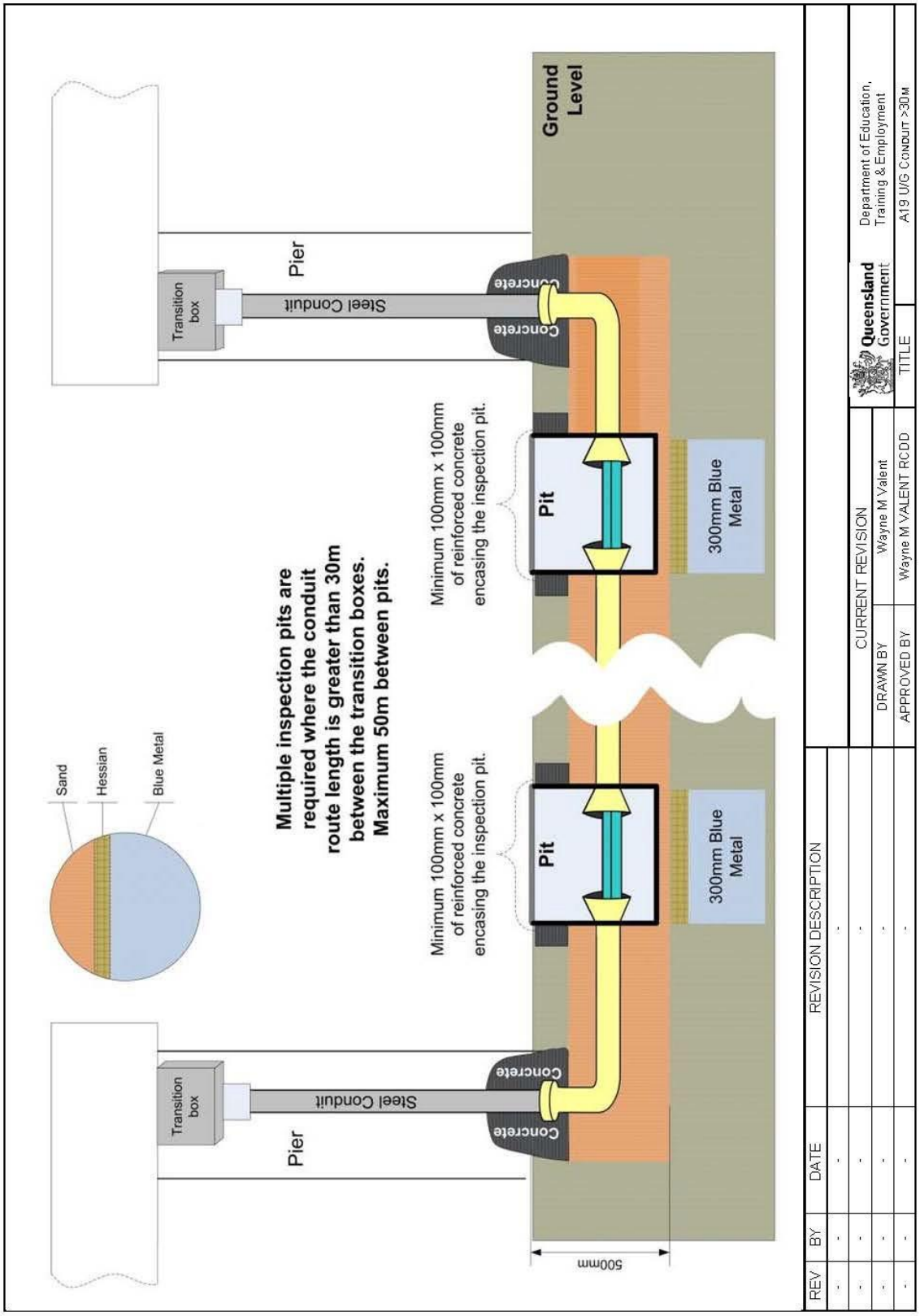
P Transition Box Conduit Entry Detail



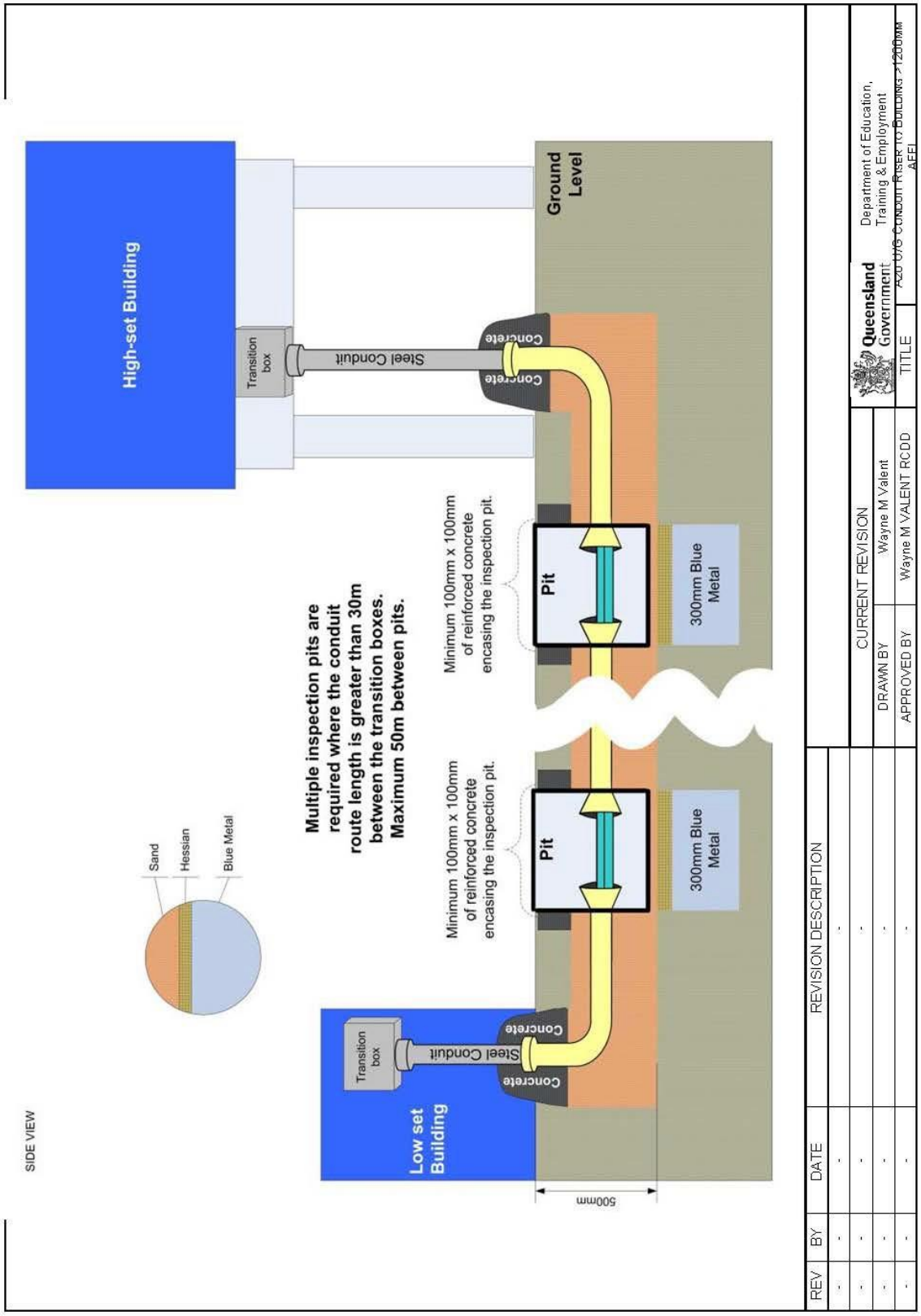
Q Trench Detail One



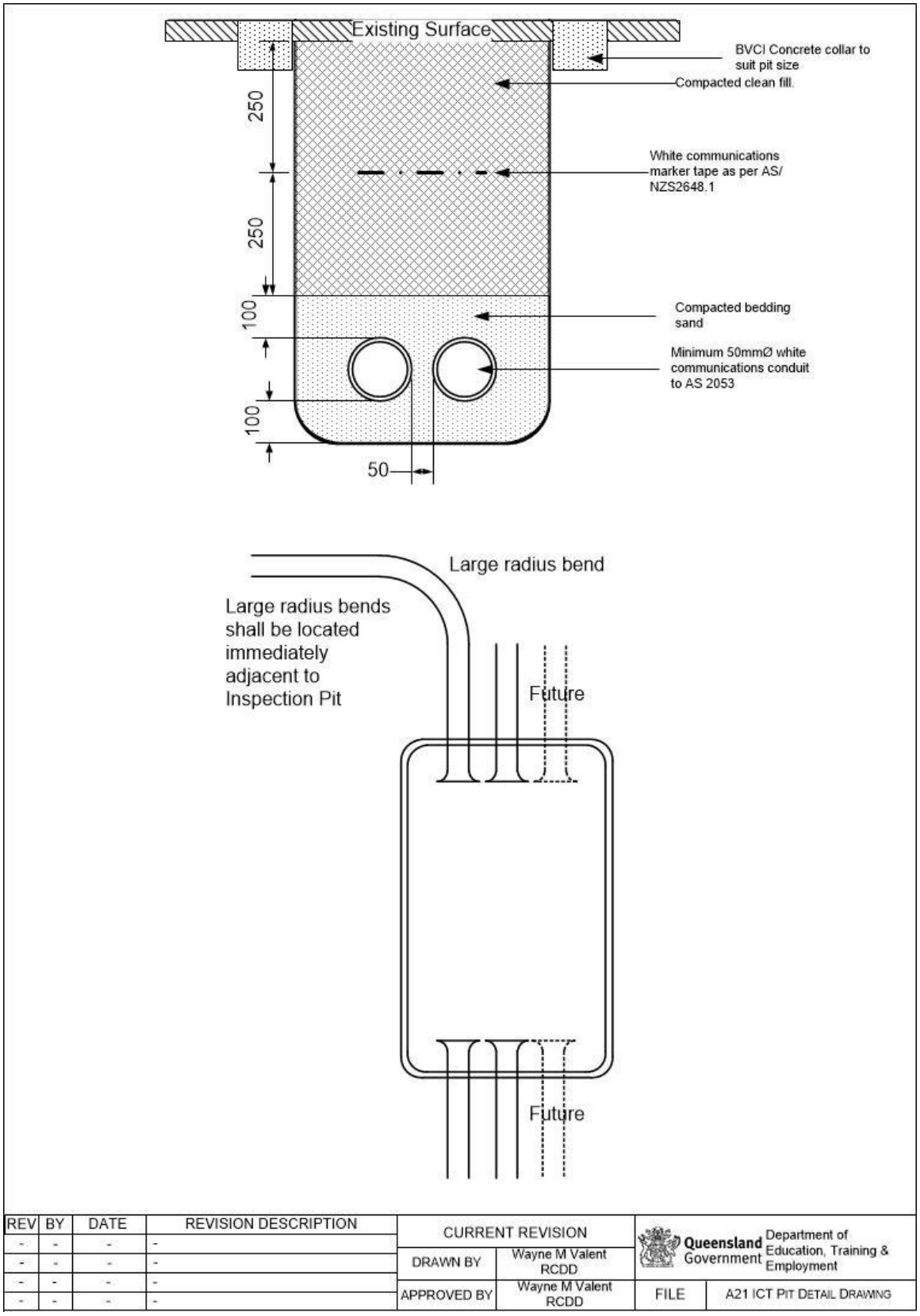
R Trench Detail Two



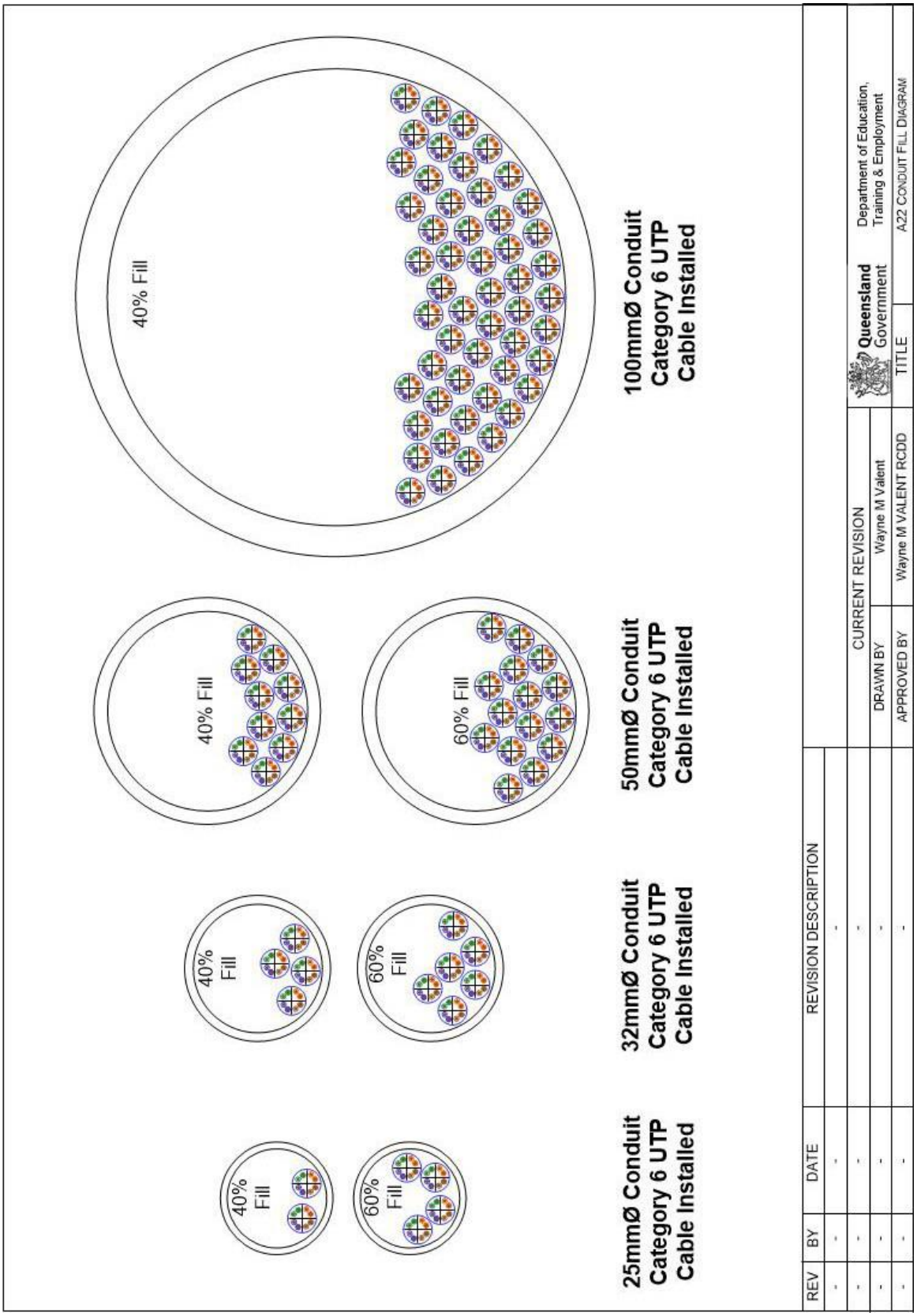
S Trench Detail Three



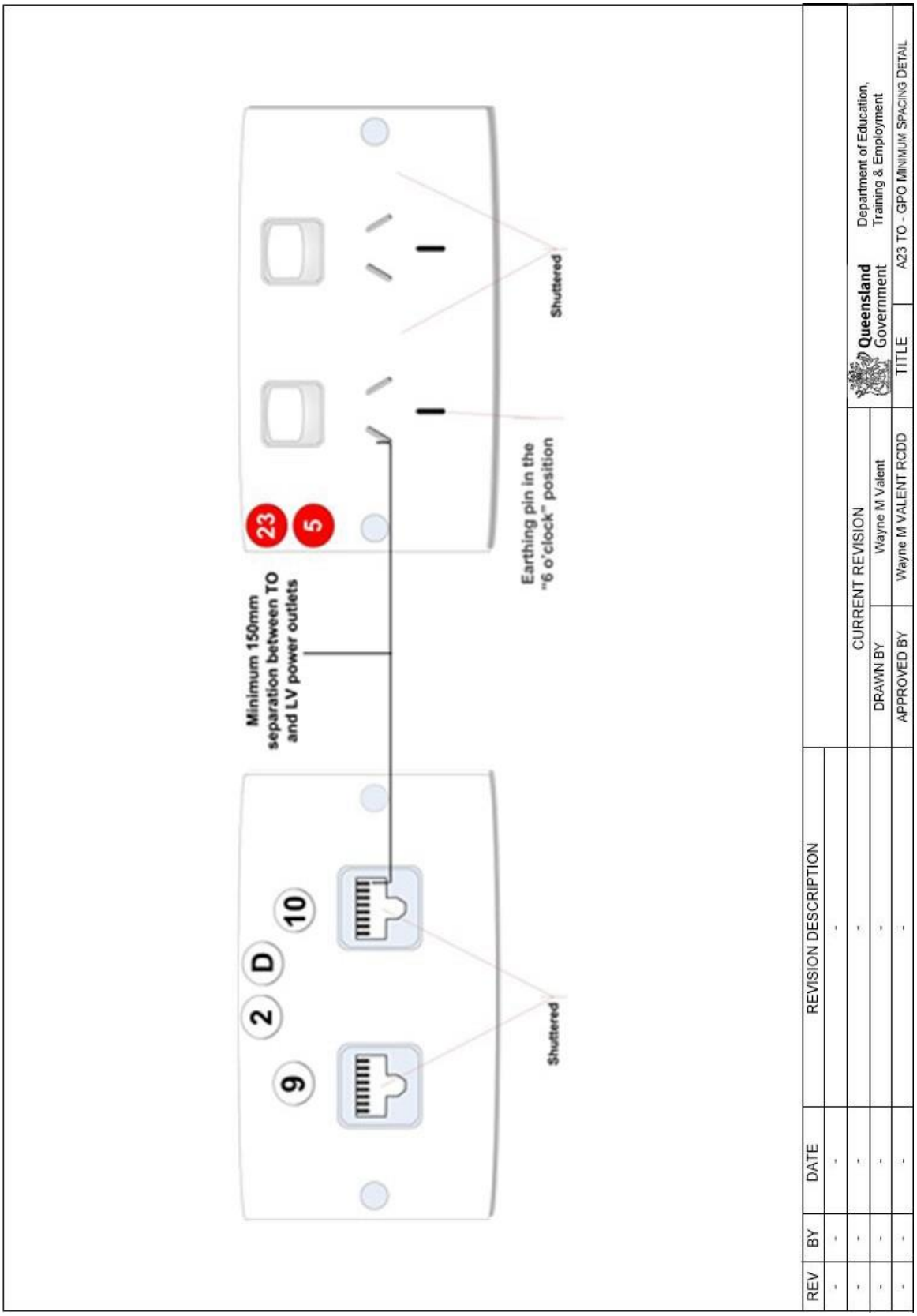
T Pit Detail Drawing



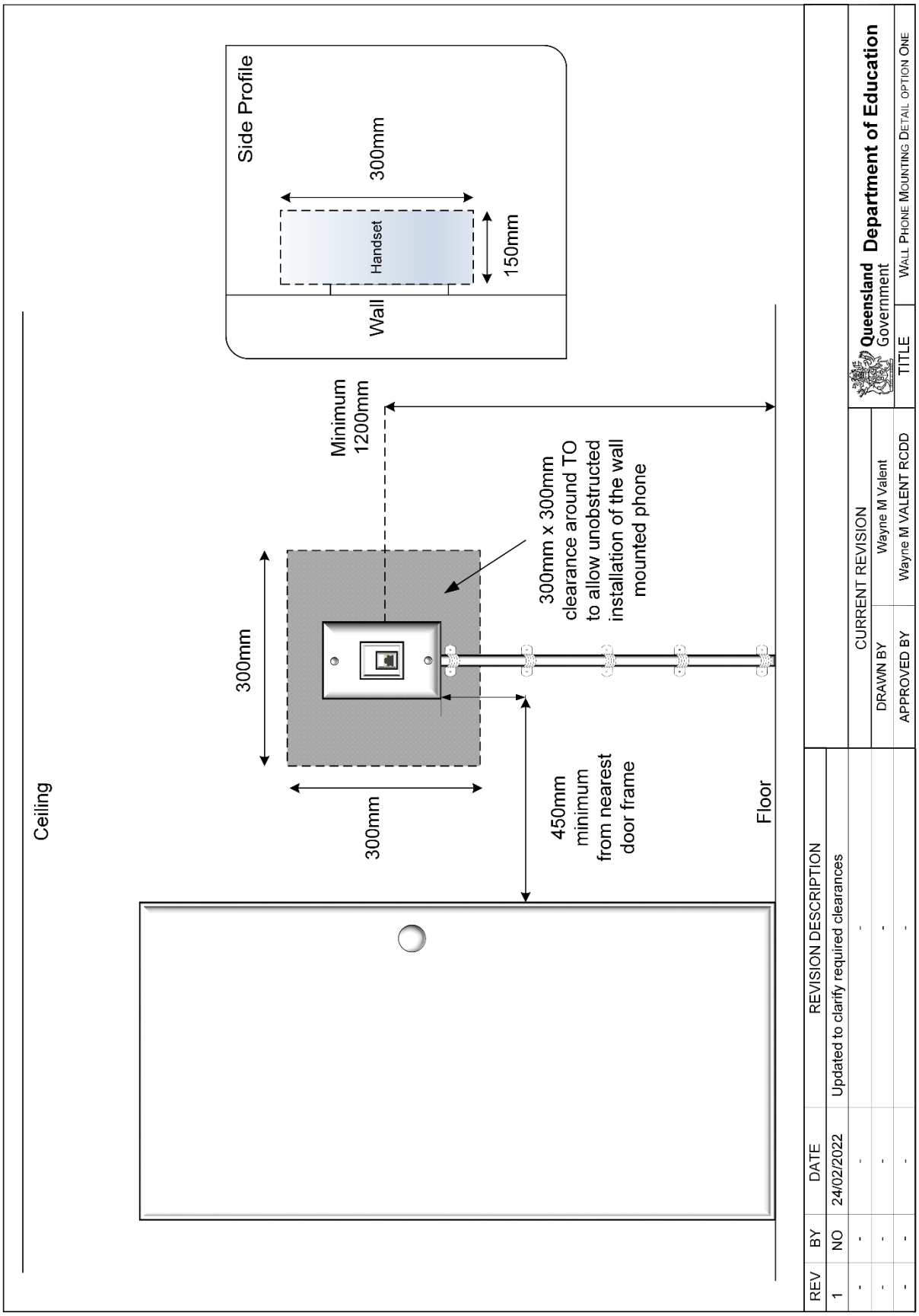
U Conduit Fill Diagram



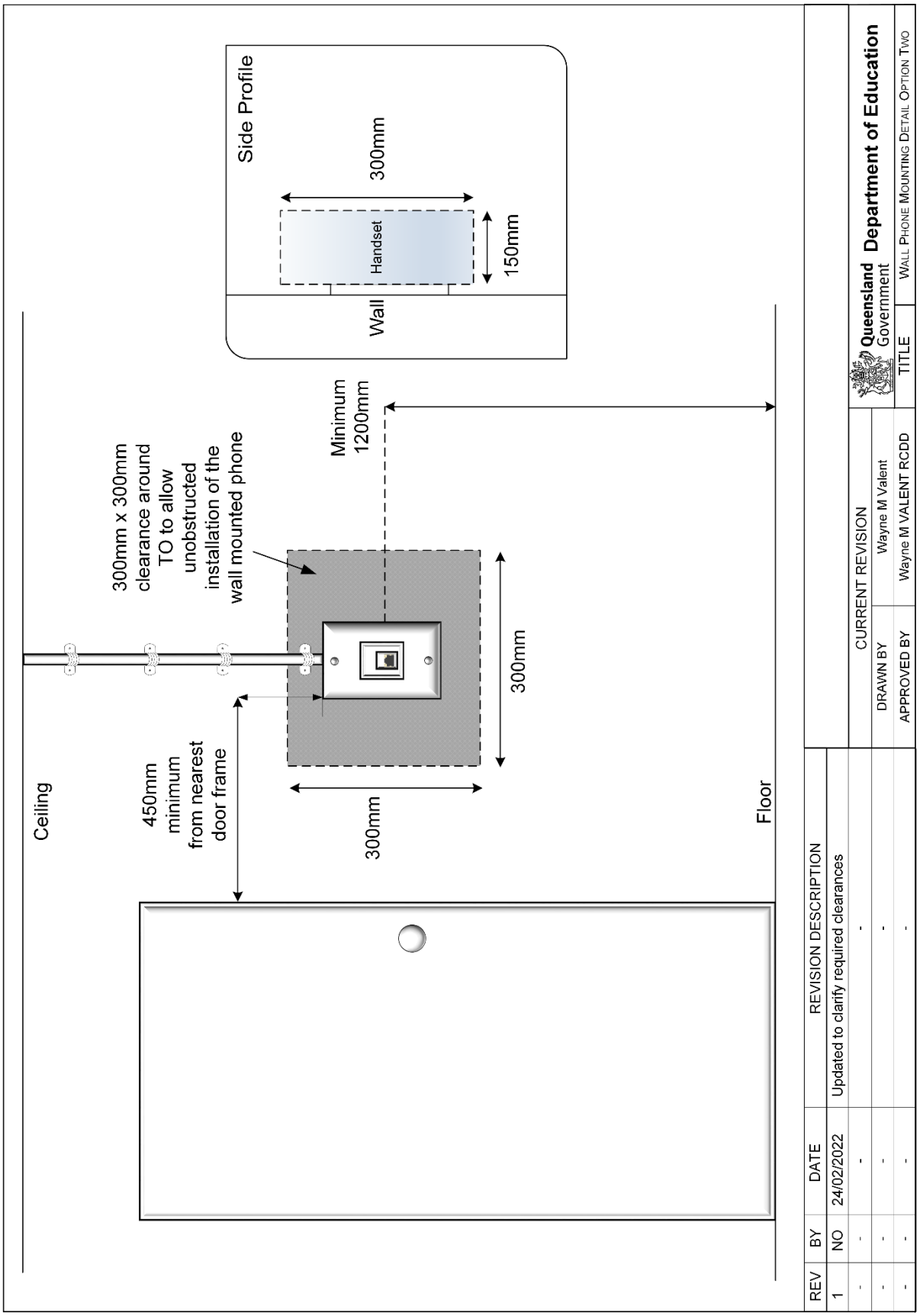
V TO - GPO Spacing Detail



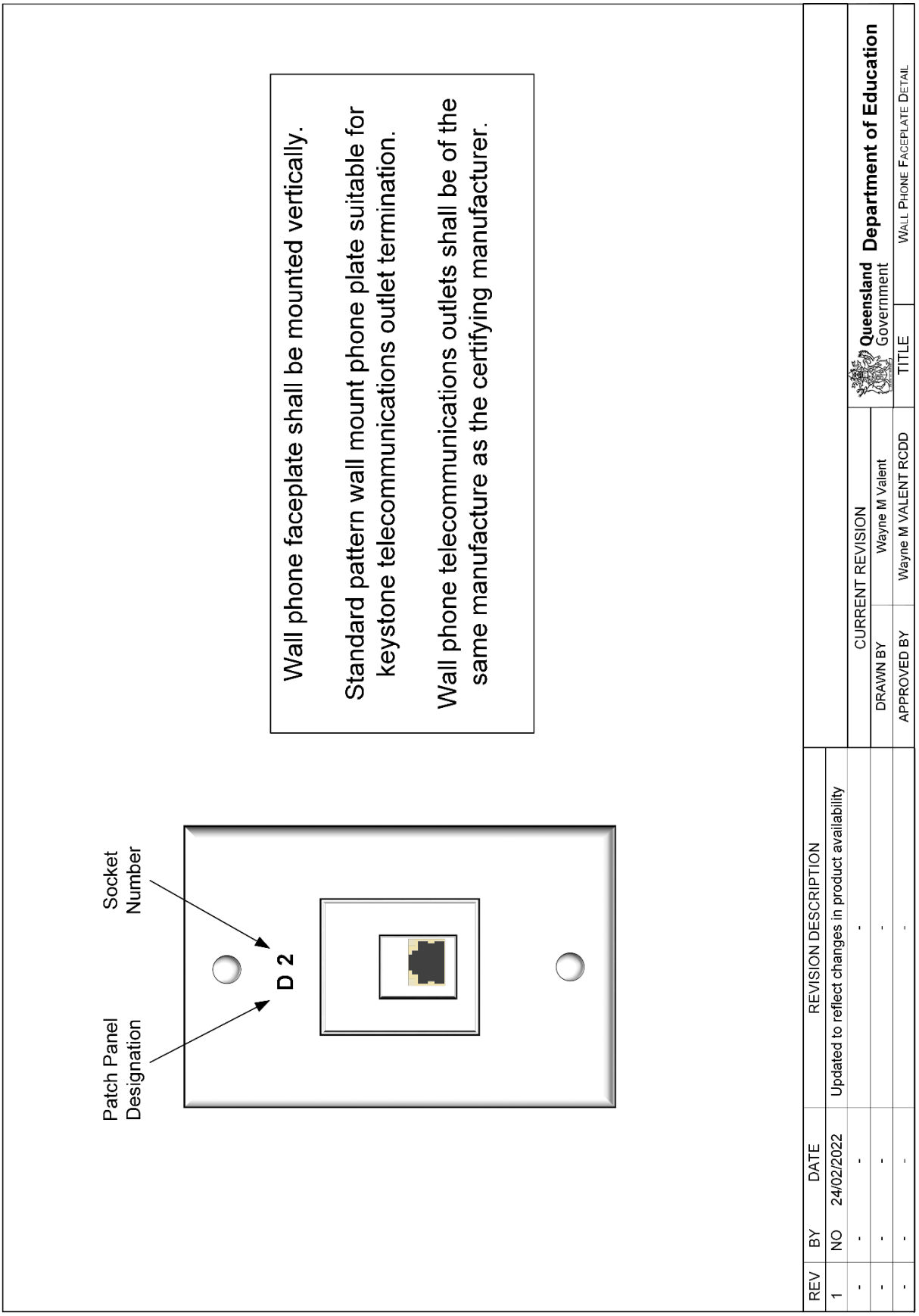
W Wall Phone Mounting Detail Option One



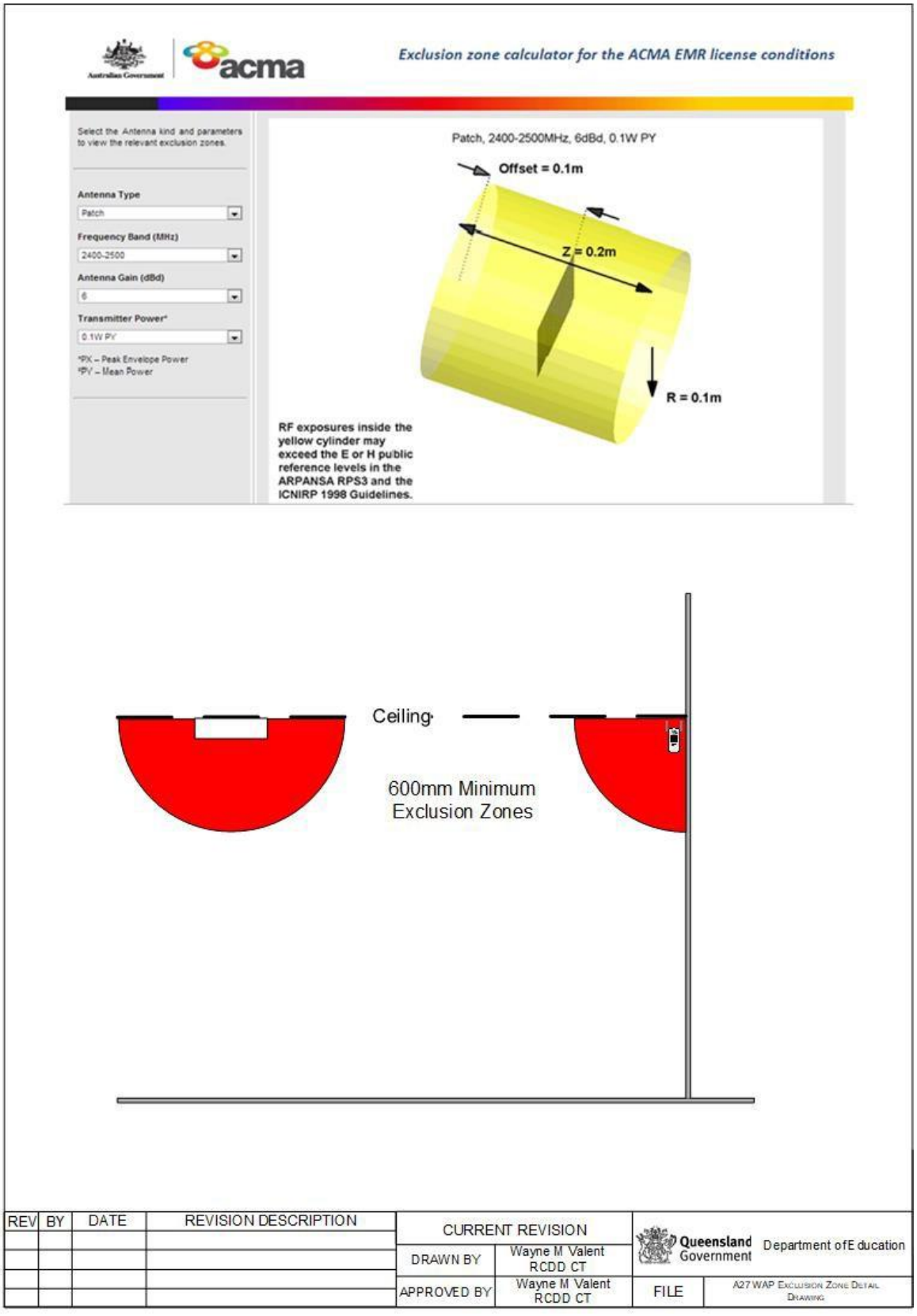
X Wall Phone Mounting Detail Option Two



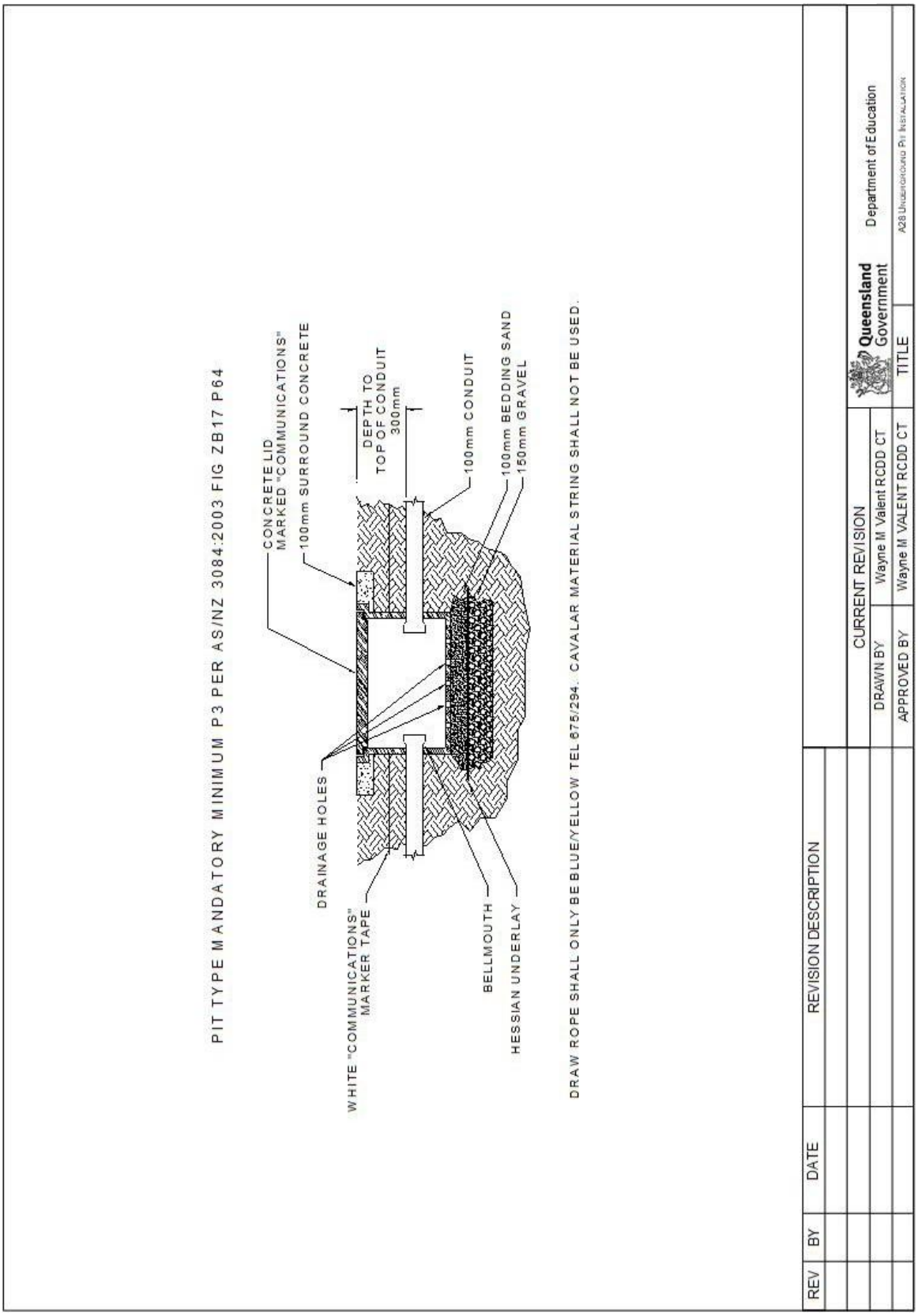
Y Wall Phone Labelling Detail



Z Wireless Access Point Exclusion Zone

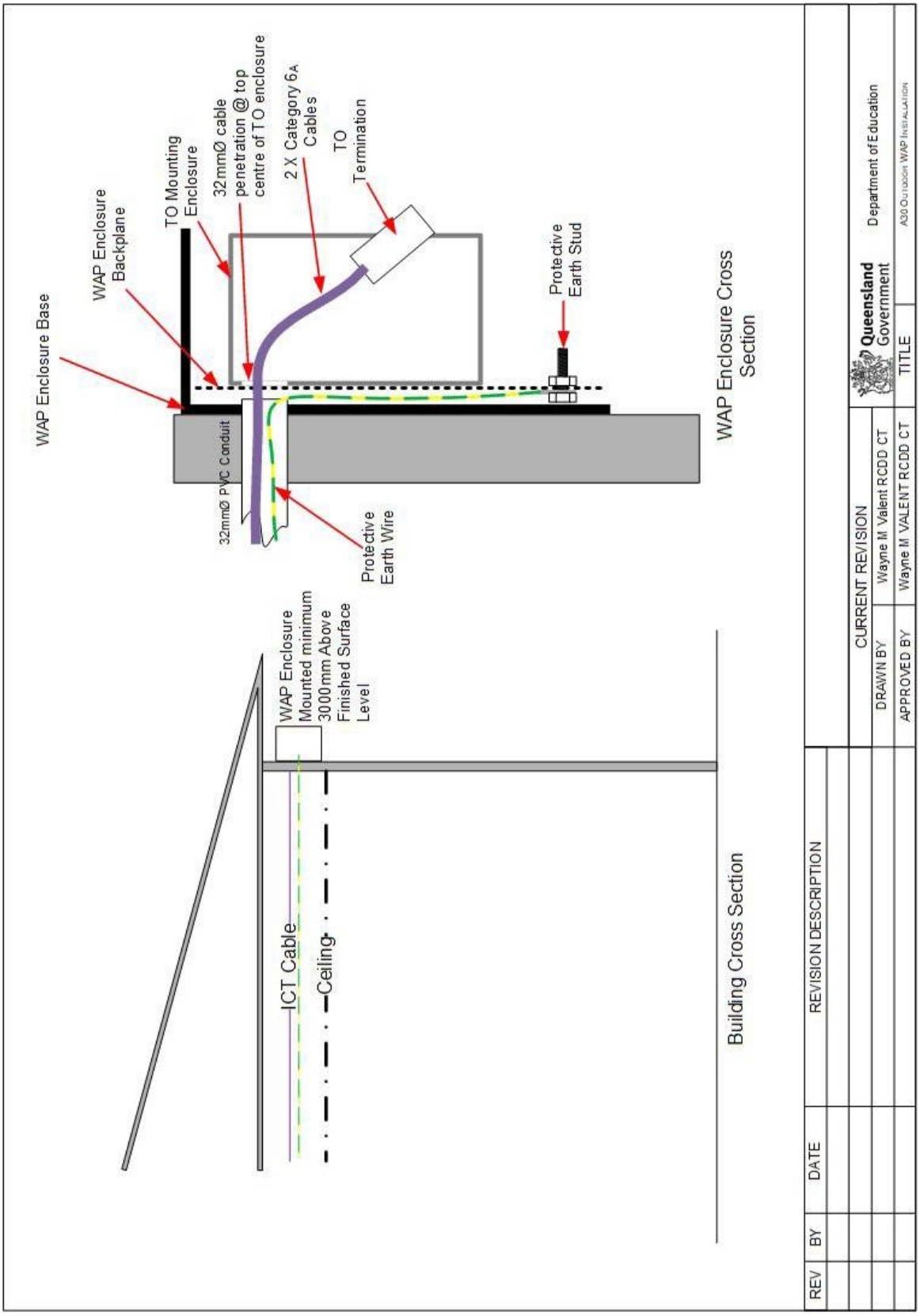


AA Underground Pit Installation

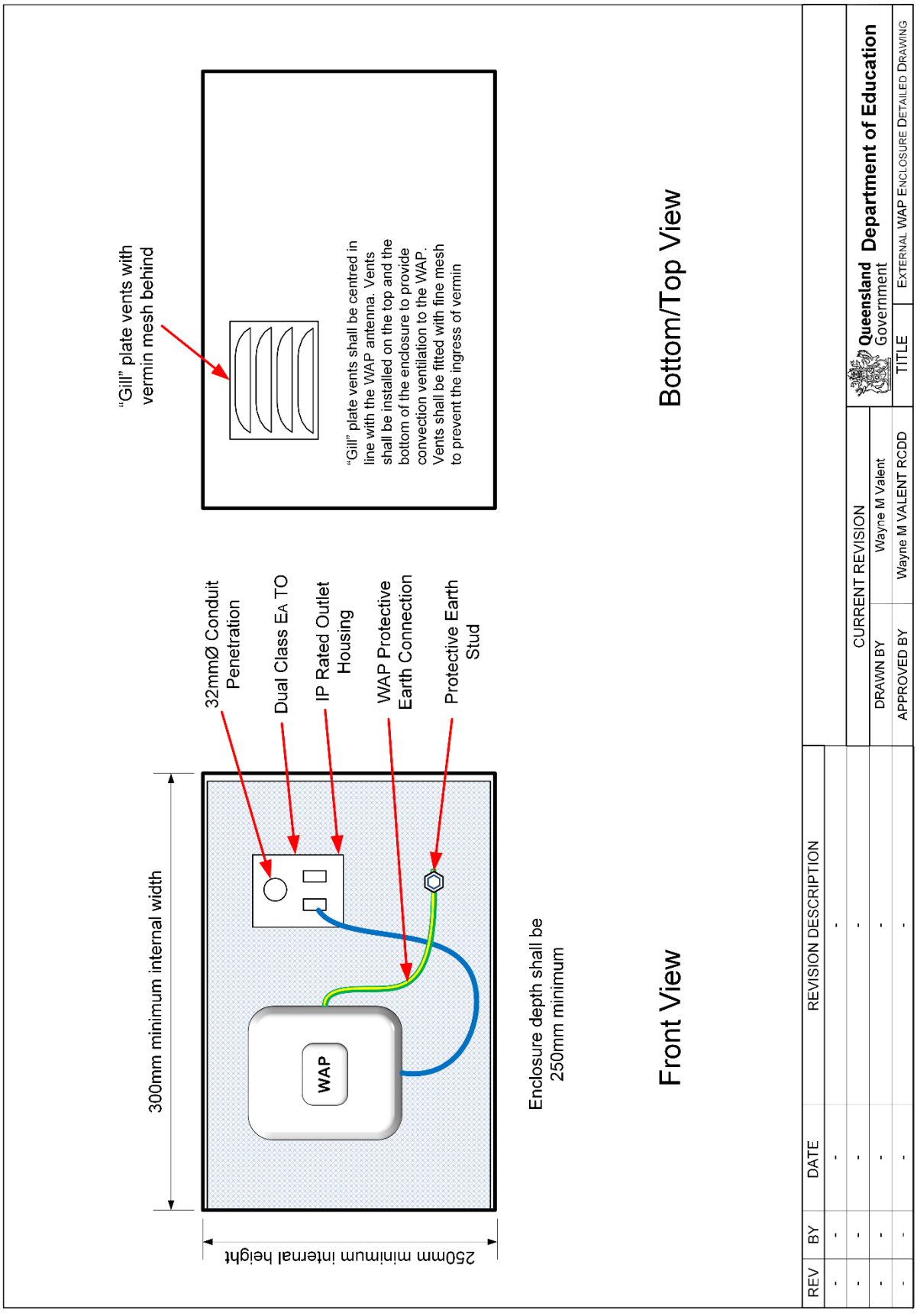


BB Faceplate Labelling Minimum Standard

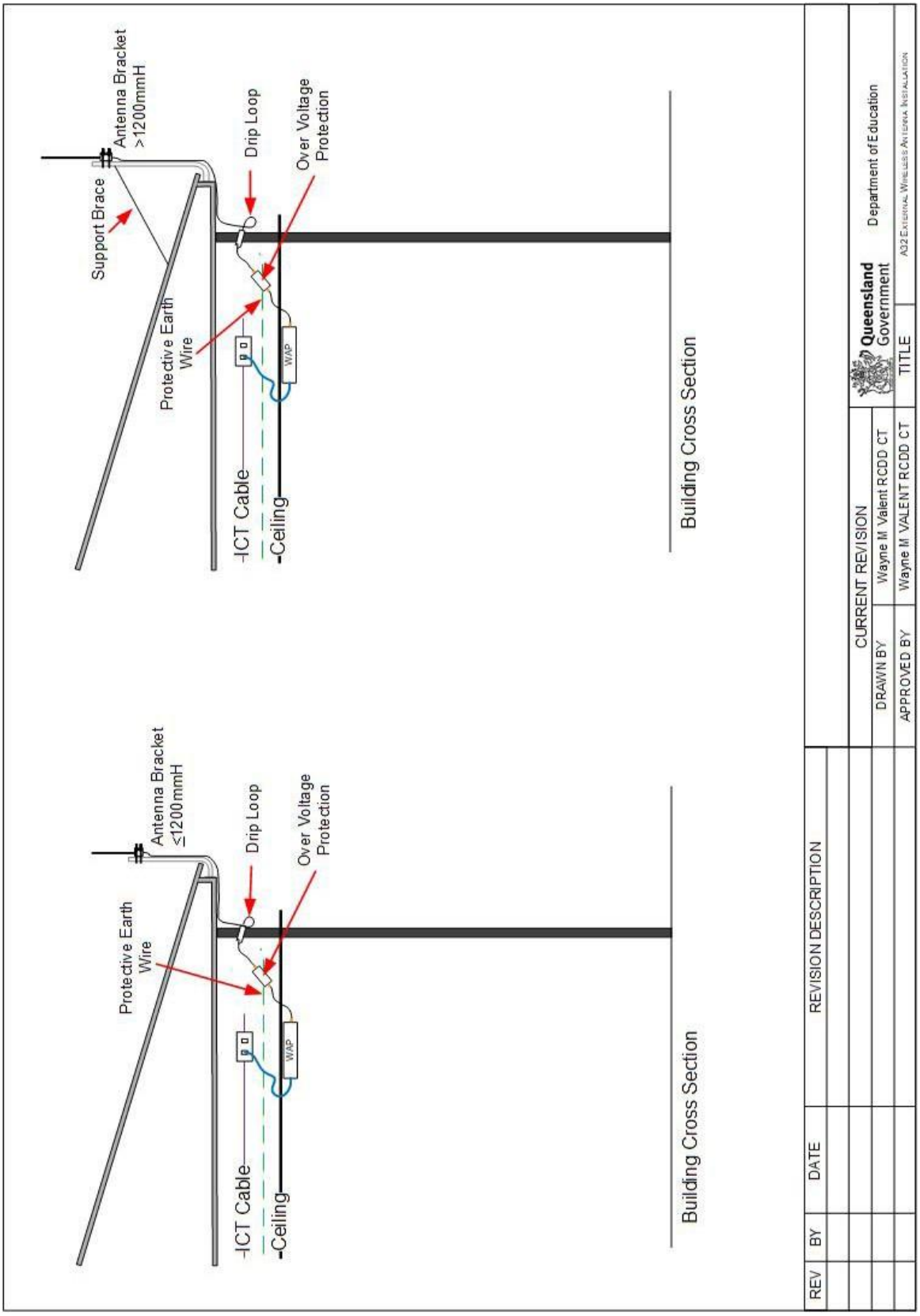
CC Outdoor WAP Installation



DD External WAP Enclosure Detail Drawing



EE External Wireless Antenna Installation



FF Minimum Provision of Telecommunication Outlets for School Spaces

DoE Building	Type of space	Minimum allocations per space
General Learning Building (inclusive of Prep, Primary, Secondary and Special)	Learning Areas (inclusive of Science, Music and Home Economics)	4 x Distributed dual data outlet to allow for flexible space configuration (preference of 1 per wall) 1 x Additional dual data outlet for the teaching wall (location to be discussed with school/IT staff) 1 x Ceiling mounted dual data outlet for wireless networking (centrally located) 1 x Wall mounted dual data outlet for IWB/projector/apple TV/ smart TV (location to be discussed with school/IT staff, with consideration to the device that will be deployed) 1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff)
	Staff Areas	1 x Dual data outlet per staff member using the space 1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff) 1 x Ceiling mounted dual data outlet for wireless networking per 30 staff members (centrally located)
	Resource Preparation/Store	2 x Dual data outlet on opposite sides of the room
Administration Building	Office (principal, Deputy Principal, Business Manager , Visiting Specialist, etc)	2 x Dual data outlet on opposite sides of the room
	Meeting/ conference room	2 x Dual data outlet on opposite sides of the room 1 x Ceiling mounted dual data outlet for wireless networking (centrally located) 1 x wall mounted dual data outlet for IWB/projector/apple TV/ smart TV (location to be discussed with school/IT staff, with consideration to the device that will be deployed)
	Reception/ Corporate Services	3 x Distributed dual data outlet to allow for flexible space configuration 1x Additional dual data outlet per staff member using the space 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Resource/ Reprographics & Student Payments	4 x Distributed dual data outlet to allow for flexible space configuration 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Casualty Room	1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff)
Canteen and Retail Centre	Servery and Preparation Area	2 x Dual data outlets for POS and EFTPOS 1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff) 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Office	1 x Dual data outlet
	Uniform store	2 x Dual data outlet on opposite sides of the room
Information Services Centre/Resource Centre/ Library	Information Service Desk and Display	2 x Dual data outlet 1 x Wall mounted dual data outlet for IWB/projector/apple TV/ smart TV (location to be discussed with school/IT staff, with consideration to the device that will be deployed) 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Self Service Area	3 x Dual data outlet
	Staff Work Room	3 x Distributed dual data outlet to allow for flexible space configuration 1x Additional dual data outlet per staff member using the space 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Office – Manager Information Services	2 x Dual data outlet on opposite sides of the room

DoE Building	Type of space	Minimum allocations per space
	Catalogue Area	6 x Distributed dual data outlet to allow for flexible space configuration 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Collection Area/Multi Media Area	12 x Distributed dual data outlet to allow for flexible space configuration 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Video/Audio Studio and Computer Labs	3 x Dual data outlet 1 x Wall mounted dual data outlet for IWB/projector/apple TV/ smart TV (location to be discussed with school/IT staff, with consideration to the device that will be deployed) 1 x Ceiling mounted dual data outlet for wireless networking (centrally located) 1 x Additional dual data outlet per device to be used in the space
Multipurpose Sports Centre	Sports Court	4 x Wall mounted dual data outlet (2400mm AFFL)for wireless networking located around the perimeter
	Sports Science/ Kinesiology Laboratory	4 x Distributed dual data outlet to allow for flexible space configuration (preference of 1 per wall) 1 x Additional dual data outlet for the teaching wall (location to be discussed with school/IT staff) 1 x Ceiling mounted dual data outlet for wireless networking (centrally located) 1 x Wall mounted dual data outlet for IWB/projector/apple TV/ smart TV (location to be discussed with school/IT staff, with consideration to the device that will be deployed) 1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff)
	HOD Office	2 x Dual data outlet on opposite sides of the room
	Office/ Staff Room	3 x Distributed dual data outlet to allow for flexible space configuration 1x Additional dual data outlet per staff member using the space 1 x Ceiling mounted dual data outlet for wireless networking (centrally located)
	Kiosk/ Servery	1 x Dual data outlet 1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff)
Performing Arts Centre	Dance Studio / Performance Stage	4 x Distributed dual data outlet to allow for flexible space configuration 1 x Wall mounted dual data outlet (2400mm AFFL)for wireless networking
	Drama GLA (includes tiered retractable seating)	4 x Distributed dual data outlet to allow for flexible space configuration 1 x Wall mounted dual data outlet (2400mm AFFL)for wireless networking 1 x Wall mounted dual data outlet for IWB/projector/apple TV/ smart TV (location to be discussed with school/IT staff, with consideration to the device that will be deployed)
	HOD Office	2 x Dual data outlet on opposite sides of the room
	Dressing / Make up Area	1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff)
	Box Office / Kiosk	1 x Dual data outlet 1 x Wall mounted single data outlet for telephony (1500mm AFFL, location to be discussed with school/IT staff)
	Bio Box	2 x Dual data outlet

14. Related Standards

- Queensland Government ICT Cabling Infrastructure Standard
- AS/NZS ISO/IEC 11801.1 Information technology - Generic cabling for customer premises - General requirements
- AS 11801.2 Information technology - Generic cabling for customer premises - Office premises
- AS 11801.3 Information technology - Generic cabling for customer premises - Industrial premises
- AS 30129:2018 Information technology - Telecommunications bonding networks for buildings and other structures
- AS/NZS3084:2017 Telecommunications installations Telecommunications pathways and spaces for commercial buildings
- AS/NZS ISO/IEC 14763.2:2014 Information technology Implementation and operation of customer premises cabling - Planning and installation
- AS/NZS 14763.3 Information technology – Implementation and operation of customer premises cabling - Testing of optical fibre cabling
- AS/NZS 3084 Telecommunications installations - Telecommunications pathways and spaces for commercial buildings
- AS/NZS 2053.1 Conduits and fittings for electrical installations - General requirements
- AS/NZS 2648.1 Underground marking tape Non-detectable tape
- AS/NZS 2312.2 Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings - Hot dip galvanizing
- IEC 61935-1:2019 Specification for the testing of balanced and coaxial information technology cabling - Installed balanced cabling as specified in ISO/IEC 11801-1 and related standards
- IEC 61935-2:2010: Testing of balanced and coaxial communication cabling - Part 2: cords as specified in ISO/IEC 11801 and related standards
- AS/NZS 3085.1:2004 Telecommunications Installations - Administration of communications cabling systems – Basic requirements
- RFC 2119 Key words for use in RFCs to Indicate Requirement Levels
- AS/CA S009 – Installation requirements for customer cabling (wiring rules)
- AS/CA S008 - Telecommunications Technical Standard - requirements for customer cabling products

Supporting Documentation and Websites

- Queensland Information Technology Contracting (QITC) framework
- DoE ICT Cabling Design Acceptance Form
- DoE ICT Cabling Completion Acceptance Form

Contact

For further information, please contact:

ICT Support Services Network Design

- email: network.design@qed.qld.gov.au

Review Date

Next Review Date: 1 July 2023

Superseded Versions

Standard Title	Version	Publication Availability	Key Changes	Superseded by
DETE - Network Infrastructure Procedures & Standards DNIPS Part B (Technical Standard)	V3.0	Internal & External	Merged into single standard and updated to approved standards format	Departmental Network Infrastructure Procedures & Standards (DNIPS) v4.0
DETE - Network Infrastructure Procedures & Standards DNIPS Part A (Policy)	V3.0	Internal & External	Merged into single standard and updated to approved standards format	Departmental Network Infrastructure Procedures & Standards (DNIPS) v4.0

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