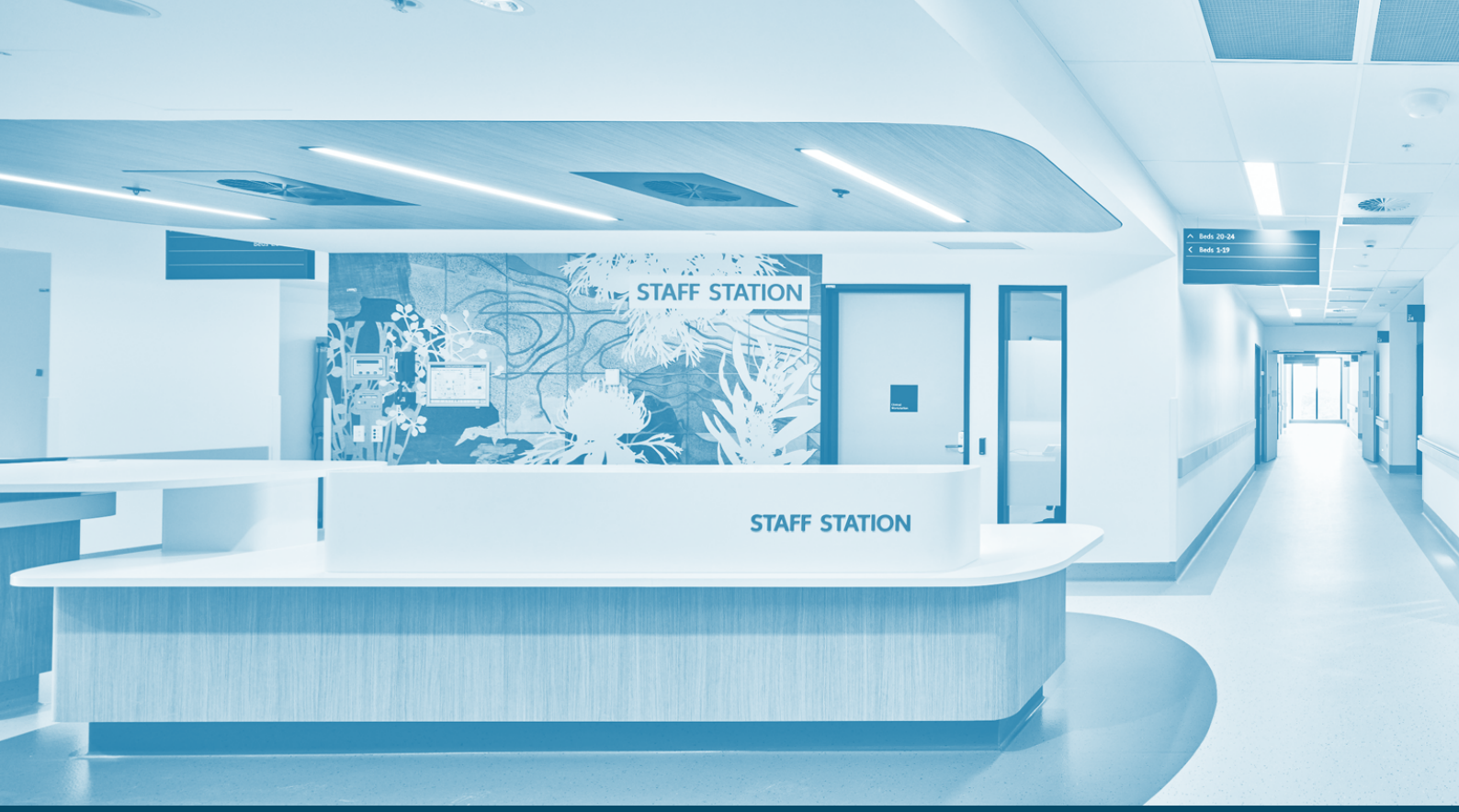

Australasian Health Facility Guidelines

HPU 170 Cardiac Investigation Unit

Health Facility Briefing, Planning and Design

August 2026

Version **4.0**

AHIA australasian health infrastructure alliance
AusHFG Australasian Health Facility Guidelines

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Australasian Health Facility Guidelines

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Image cover: Nepean Hospital NSW, NSW Health Infrastructure

Cultural Acknowledgement and Terminology

The Australasian Health Facility Guidelines (AusHFG) are developed in collaboration with stakeholders across Australia and Aotearoa, New Zealand.

Acknowledgement of Country

We acknowledge the Aboriginal people and Torres Strait Islander People as traditional owners and continuing custodians of the land throughout Australia and the Torres Strait Islands.

We acknowledge their connection to land, sea, sky and community and pay respects to Elders past and present.

Acknowledgement of Te Tiriti o Waitangi

Te Tiriti o Waitangi obligations have been considered when developing the AusHFG resources.

Terminology and Language in the AusHFG

Throughout the AusHFG resources, the term ‘Indigenous Peoples’ is used to refer to both the Aboriginal and Torres Strait Islander Peoples of Australia and Māori of Aotearoa, New Zealand. Where references to specific cultural requirements or examples are described, the terms ‘Aboriginal and Torres Strait Islander Peoples’ and ‘Māori’ are used specifically. The AusHFG respect the right of Indigenous Peoples to describe their own cultural identities which may include these or other terms, including particular sovereign peoples or traditional place names.

Contents

Acronyms

Acronym	Definition
ABP	Ambulatory Blood Pressure
AHIA	Australasian Health Infrastructure Alliance
ARPANSA	Australian Radiology Protection and Nuclear Safety Agency
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
AusHFG	Australasian Health Facility Guidelines
CCL	Cardiac Catheterisation Laboratory
CCU	Cardiac Care Unit
CIED	Cardiac Implantable Electronic Device
CIU	Cardiac Investigation Unit
CSANZ	Cardiac Society of Australia and New Zealand
CT	Computed Tomography
CTCA	Computed Tomography Coronary Angiography
DSE	Dobutamine Exercise Echocardiography
ECG	Electrocardiography
ED	Emergency Department
EP	Electrophysiology
ESE	Exercise Stress Echocardiography
HPU	Health Planning Unit
ICD	Implantable Cardiac Defibrillator
ICM	Iodinated Contrast Media
ICT	Information Communications and Technology
ICU	Intensive Care Unit
IPC	Infection Prevention and Control
MRI	Magnetic Resonance Imaging
PCI	Percutaneous Coronary Intervention
RFA	Radiofrequency Ablation
RMD	Reusable Medical Device
SC	Standard Component
SC-D	Standard Component - Derived
TOE	Trans-Oesophageal Echocardiography
TTE	Transthoracic Echocardiography

1 Introduction

1.1 Preamble

The Australasian Health Facility Guidelines (AusHFG) (www.healthfacilityguidelines.com.au) are freely available resources for health services and project teams across Australia and New Zealand to support better planning, design, procurement and management of health facilities.

The AusHFG are an initiative of the Australasian Health Infrastructure Alliance (AHIA), a cross-jurisdictional collaboration of all health authorities across Australia and New Zealand. Part A of the AusHFG provides further information relating to the purpose, structure and use of these resources. It is acknowledged that the application of the AusHFG varies between jurisdictions across Australia and New Zealand.

This document is intended for new-build projects; however, refurbishment projects should adhere to these guidelines as far as is possible. It is acknowledged that meeting the recommended spatial allocation may not be achievable in a refurbishment project.

This Health Planning Unit (HPU) has been developed by the Australasian Health Infrastructure Alliance (AHIA). This revision has been informed by an extensive consultation process that was completed in 2026.

1.2 Introduction

1.2.1 General

HPU 170 outlines the specific requirements for the planning and design of a Cardiac Investigation Unit (CIU) and incorporates cardiac catheter laboratories (CCLs) and cardiac diagnostics. The document should be read in conjunction with the Australasian Health Facility Guidelines (AusHFG) generic requirements described in:

- Part A: Introduction and Instructions for Use
- Part B: Section 80: General Requirements
- Part B: Section 90: Standard Components, Room Data and Room Layout Sheets
- Part C: Design for Access, Mobility, Safety and Security
- Part D: Infection Prevention and Control
- Pandemic Preparedness - Health Infrastructure Planning & Design Guidance.

Other relevant AusHFG HPUs include:

- HPU 260 Cardiac Care Unit
- HPU 270 Day Surgery / Procedure Unit.
- HPU 340 Inpatient Accommodation Unit, e.g. for general cardiology inpatient units
- HPU 360 Intensive Care Unit, where the Cardiac Care Unit may be a component of an Intensive Care Unit
- HPU 520 Operating Unit, for requirements relating to cardiac surgery.

Paediatric services and facilities are excluded from this guideline. Paediatric studies are longer in duration and more complex, frequently requiring two physicians per study. It is particularly important that infants and all patients with complex congenital heart disease be catheterised only in centres with active paediatric cardiac surgical programs.

1.3 Policy Framework

Prior to undertaking a project, planners and project personnel are encouraged to familiarise themselves with relevant State and Territory specific policies, along with the following publication:

- Cardiac Society of Australia and New Zealand, 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI).

1.4 Description

1.4.1 Definition of a Cardiac Investigation Unit

A Cardiac Investigations Unit (CIU) provides the facilities, equipment, and support necessary to deliver comprehensive cardiac diagnostic, investigative and/or interventional services to both inpatients and outpatients.

CIUs range in scope from small outpatient diagnostic services and specialist cardiac outpatient clinics to larger, more complex unit based on the designated level of function and role of the healthcare facility. These advanced units are equipped to perform specialised investigations and procedures, including those undertaken within cardiac catheterisation laboratories.

1.4.2 Range of Services

This HPU addresses the following components of a cardiac investigation service primarily for secondary and tertiary healthcare facilities, although some components may be provided in smaller hospitals:

- cardiac catheter laboratories (CCLs)
- cardiac diagnostic services:
  - echocardiography including transthoracic echocardiography (TTE) and trans-oesophageal (TOE)
  - electrocardiogram (ECG)
  - stress testing, including exercise stress testing (EST), exercise stress echocardiography (ESE) and pharmacological stress echocardiography e.g. dobutamine stress echocardiography (DSE)
  - Holter monitoring
  - ambulatory blood pressure monitoring
  - cardiac implantable electronic device (CIED) interrogations, including in-person and remote monitoring
  - tilt table testing (not commonly provided but may be considered where clinically justified)
- computed tomography coronary angiography (CTCA) – usually part of Medical Imaging although highly accessed by cardiology
- transcatheter aortic valve implantation (TAVI) – usually performed at larger CIUs.

Depending on the facility, some of these services may be incorporated into general ambulatory or outpatient services rather than being delivered through a dedicated CIU.

Although not typically part of the CIU, some facilities may also provide and co-locate the following services:

- cardiac device home monitoring services
- specialist cardiac outpatient clinics.

Cardiac Care Units (CCU) and general cardiology inpatient services are covered in other HPUs as noted in Section 1.2.1 General.

This HPU includes general diagnostic and interventional CCLs, as well as electrophysiology (EP) laboratories used to treat complex arrhythmias. Interventional CCLs are used for a range of structural heart interventions, including TAVI/aortic valve replacements, mitral valve repairs and atrial septal defect repairs. These highly specialised interventions may also be performed in a hybrid operating theatre located within an operating theatre suite; hybrid operating theatres are not included in the scope of this HPU. Project teams will need to refer to HPU 520 Operating Unit.

1.4.3 Model of Care

Cardiac investigation services are part of an overall cardiology model of care. Prior to commencing a planning and design process, the future cardiology models of care across the full care continuum must be defined. This includes confirmation of the clinical pathway for managing Acute Coronary Syndrome to ensure that the future design supports a seamless patient journey with access to timely, high quality and coordinated patient care.

Key considerations relating to the models of care are noted below, acknowledging that not all components below will be provided in every facility but will be available via a networked service:

- Implementation of early triage of myocardial infarction whereby ambulance services undertake a 12-lead ECG meets criteria for reperfusion or urgent coronary angiography/angioplasty and if it requires urgent angioplasty within a specialist centre. The ambulance transfer may bypass the emergency department which has implications for the location of and access to the CCLs.
- Establishment of dedicated chest pain evaluation/assessment services with direct access to appropriate cardiac diagnostic equipment and staff skilled in cardiac care who can initiate treatment protocols. These are commonly being established either as a zone within a CIU or adjacent to the emergency unit.
- Access to medical imaging modalities including CTCA and MRI. Cardiac CT commonly requires the administration of medications for heart rate reduction and coronary vasodilation therefore appropriately credentialed clinical staff must be present. Cardiovascular Magnetic Resonance (CMR) protocols may be modified during image acquisition by medical officers to achieve diagnostically adequate imaging.
- Use of remote, home cardiac monitoring for chronic patients in the community.
- Increasing use of telemedicine to support patient care.
- Provision of specialist outpatient services, e.g. heart failure and rapid access clinics.
- Increasing demand for interventional electrophysiology with complex arrhythmias such as atrial fibrillation, complex atrial tachycardia and ischaemic ventricular tachycardia now able to be treated with three-dimensional mapping.
- Converging of the disciplines of cardiology and cardiac surgery for structural procedures such as mitral valve repair, and repair of patent ductus arteriosus.

CCLs and cardiac diagnostic services are accessed by both inpatients and outpatients. Most inpatients will be transferred to the cardiac diagnostic services unit unless they are too unwell to travel, e.g. patients in CCU, ICU and ED resuscitation bays.

These critical care units will have some diagnostic equipment on the unit, e.g. ECG, or alternatively a mobile machine will be taken to the patient, e.g. for TOEs. The use of mobile machines should be minimised given the sensitivity of the machines and staff work, health and safety considerations.

Access to holding and recovery bays is required for CCL procedures, TOEs and direct current cardioversion (DCCV).

A brief description of a range of procedures that may be undertaken within a CIU is presented in the Appendix 7.1 Description of Cardiac Investigation Services.

2 Planning

2.1 Operational Models

2.1.1 Operational Service Models

Cardiac Catheter Laboratories (CCL)

Depending on the role and function of the service, CCLs may be:

- a dedicated component of a cardiac precinct
- a component of an interventional imaging suite in a medical imaging unit
- an extension of an 'interventional floor' incorporating operating theatres and CCLs.

The advantages and disadvantages of these operational models are summarised below. The preferred model also needs to take into consideration the proposed location of ICU, CCU, ED and other cardiology services to ensure optimal patient flows.

Cardiac Catheter Laboratories Location	Advantages	Disadvantages
Cardiac Precinct	• rapid patient transfer to and from CCU • opportunity to share holding and recovery areas with TOE and other cardiac investigation services • direct access to additional staff skilled in cardiac care • greater opportunities for integration and collaboration across cardiology staff.	• less direct access to specialist anaesthetic support depending on funded session allocated to CCL • less direct access to operating theatre in the event that open cardiac surgery is required and is available • reduced opportunity for synergies with other interventional services relating to stock control.
Interventional Imaging Suite	• opportunity to share holding and recovery areas with other interventional imaging services • synergies relating to stock control • synergies with radiation safety and protection planning, medical imaging technicians and equipment management programs • access and proximity to imaging equipment/facilities and resources.	• the distance between the CCL and the CCU may be greater than if the CCL were located within a dedicated cardiac precinct • less direct access to operating theatre in the event that open cardiac surgery is required • less direct access to specialist anaesthetic support • less opportunity for collaboration with other specialist cardiac staff • restricted access to suite due to competing services requiring infrastructure.
Interventional Suite with Operating Theatres (only relevant in facilities where cardiac surgery is provided)	• direct access to anaesthetic support, recovery and other associated support areas 24/7 • rapid access in the event that open cardiac surgery is required.	• greater travel distance between CCU and the CCLs • recovery areas still require specialist cardiac staff who have less opportunity for collaboration with other cardiac team members • impact to sterile zone.

Cardiac Diagnostic Unit

Cardiac diagnostic services may be provided:

- as part of a fully integrated CIU or cardiac precinct
- as part of a clinical measurement unit (that may also include facilities for diagnostic neurology and respiratory function testing, including spirometry)

- as part of an outpatient/ambulatory care unit (depending on the range of tests to be provided).

Cardiac Specialist Outpatient Clinics

Cardiac clinics may be provided as:

- dedicated consulting rooms in a cardiac precinct
- consulting rooms in a clinical measurement unit (usually shared with other disciplines)
- a general outpatient/ambulatory care unit.

Provision of cardiac clinics should be based on throughput and endorsed clinical service planning.

2.1.2 Service Profile

The range and quantum of services required will be determined by the Clinical Services Plan and will align with the level of service to be provided.

Although it may be possible for a CCL to function well in an institution without a cardiac surgery program, such laboratories will only offer limited services. A formal arrangement is required between the laboratory and a healthcare facility with cardiac surgery capacity. The Cardiac Society of Australia and New Zealand notes that coronary interventional procedures are preferably performed in hospitals with on-site surgical support. However, centres without on-site surgical backup can provide coronary interventional procedures in accordance with standards set out in the Cardiac Society of Australia and New Zealand, 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI) including Guidelines on Performance of Procedures in Rural Sites'.

2.1.3 Staffing Models

Staffing levels will vary for each unit, depending on the size of the unit, clinical case load, operational policies, required staff skill mix and level of supervision required.

The staff establishment may include (on a permanent and visiting basis) the following disciplines:

- cardiologists (specialists, registrars and residents)
- radiographers
- cardiac physiologists
- cardiac sonographers
- nursing staff
- unit or service manager
- administrative staff
- allied health professionals
- education and research staff where applicable
- support staff including patient transport
- students.

The staff establishment should be developed early in the planning process in order to inform the range of staff work areas and amenities that will be required.

2.1.4 Education, Training and Research

The approach to staff education, training and research for the unit and the overall hospital will inform the extent of associated facilities required, both within and external to the CIU.

This may include:

- some education, training and meeting spaces provided locally
- videoconferencing facilities
- simulation capability, e.g. for advanced life support and sonography

- support for research protocols
- specialist research laboratories may be provided in tertiary facilities
- staff work areas for those engaged in education and research
- support for students.

2.2 Operational Policies

2.2.1 General

Operational policies have a major impact upon the planning and design and capital and recurrent costs of health facilities.

Project teams should review their design proposals with these in mind and be able to demonstrate that the capital and recurrent cost implications of proposed operational policies have been fully considered. Operational policies may have hospital-wide application or be unit specific. A list of general operational policies that may apply can be found in Part B: Section 80 General Requirements.

2.2.2 Hours of Operation

The unit will generally operate during business hours with after-hours emergency access to CCLs and echocardiography services, particularly in tertiary facilities, however after-hours services are also increasingly being provided in selected regional areas. Consideration should be given to extended recovery area hours to facilitate late discharges and a reduction in the requirement for patient admission post-procedures.

A range of other after-hours services may also be available, e.g. rapid chest pain clinics, access to CTCA and urgent pacemaker or defibrillator checks.

2.2.3 Cardiac Arrest and Resuscitation

Cardiac services and associated tests present a higher than usual likelihood of cardiac arrest, and resuscitation equipment should always be immediately accessible.

An electrophysiology or implantable electronic device laboratory should contain, or have access to, two external cardiac defibrillators, as multiple use during procedures increases the incidence of equipment failure. One cardiac defibrillator should be located within the CCL and another close by. An anaesthetic machine should be readily available from the CCL, should emergency situations progress to interventional procedures.

In diagnostic rooms, such as those for echocardiography and stress testing, the room size should be sufficient to allow access to a patient in the event of cardiac arrest without requiring the major movement of equipment.

2.2.4 Electrocardiogram (ECG)

In addition to ECGs routinely undertaken on its own patients (outpatients, inpatients, day patients), the cardiology service is frequently responsible for ECG requests for other inpatients throughout the healthcare facility, usually excluding emergency unit and intensive care units. Cardiac physiologists may use machines stored in individual units or take an ECG machine to the patient from a central store. Facilities to store this equipment will be required.

Information technology should enable ECG recordings to be available anywhere, at any time, within the healthcare facility.

Consideration will therefore need to be given to:

- units that undertake their own ECG using their own equipment
- the number of mobile ECG units for general hospital use and storage locations
- after-hours arrangements
- telemedicine capacity
- information technology systems that enable uploading and downloading of ECGs for centralised reporting and telemedicine capability.

2.2.5 Management of Bariatric Patients

Problems with the quality of the images may preclude overweight or obese patients from treatment or investigations in the CCLs. However, currently available tables are capable of supporting a total weight including patient and on-table equipment, e.g. injectors, of up to 250-300 kilograms depending on the vendor.

In the CCLs, space restricts effective use of hoists. Ceiling hoists may not be possible due to the C-Arm and other ceiling-mounted equipment. In areas where space constraints have already been risk-assessed and a ceiling-mounted hoist is still being considered, there are also IPC considerations that require risk assessment, such as the cleaning of lifting tracks and reusable lifting slings in sterile environments. However, manual handling of bariatric patients can generally be achieved with the use of inflatable transfer mattresses or portable lifting equipment.

For other diagnostic rooms, consideration should be given to the weight capacity of plinths, examination couches and stress testing equipment.

2.2.6 Pathology

Point of care pathology testing is routinely required for CCLs. The associated equipment may be provided within the unit or be easily accessible within adjoining units, such as the CCU or ICU.

Ready access to a pneumatic tube system (PTS) assists with the rapid or urgent assessment of pathology specimens.

2.2.7 Anaesthetic Services

Most patients accessing CCLs are managed with local anaesthetic. Coronary angiography is provided under local anaesthetic and may require conscious sedation. PCI is performed under local anaesthetic with conscious sedation. Project teams should consult jurisdictional requirements and future directions in models of care, as there has been an increase in anaesthetic team-led sedation compared to clinician-led sedation (e.g. sedation administered by the TOE clinician) which may affect infrastructure requirements such as storage for anaesthetic equipment and supplies. Some units may also continue to use a non-anaesthetic model where there is lack of access to anaesthetics.

Some of the more complex procedures, such as CIED or cardiac ablation, are performed under general or local anaesthetic. Some jurisdictions recommends that anaesthetic support is provided for high-risk PCI, emergency STEMI with shock and mechanical ventilation support for cardiac device implantation.

Patients requiring general anaesthetic are usually induced within the laboratory. Project teams should refer to local jurisdictional requirements regarding access to anaesthetic services.

2.2.8 Patient Recovery and Discharge Management

Patients require close observation for a minimum of three to four hours following angiography, and four to six hours following PCI. Inpatients will return to their own unit. Options for recovery of day patients include:

- recovery area in the CCL
- CCU or cardiac inpatient unit
- extended day only (23 hour) unit, with cardiac monitoring capability.

In some facilities, based on model of care, patients recover in the catheterisation laboratories during the first stage before being transferred to the recovery area. This will influence the number of stage 1 recovery bays noted in the SOA for 5.4 Patient Holding and Recovery.

Once stable, patients referred from other hospitals may be transported back to the referring institution, transferred to another healthcare facility with access to appropriate monitoring, or may be discharged home. However, overnight beds should be available for patients from geographically isolated areas who may not be able to return home immediately or following complications.

For the first 24 hours following angiography, day patients should remain within an accessible distance of a service that is able to manage relatively common complications. They also need to be accompanied by a responsible adult to and from the facility.

Access to recovery areas is also required following TOE procedures. Patient recovery time for this procedure is typically two hours.

Holding bays for patients awaiting their procedure should be flexibly used with recovery bays. The recommended number of recovery bays per CCL and TOE room is included in Section 5 Schedule of Accommodation. The capacity requirements for pre-procedure patient holding bays will depend on local operational arrangements noting that access to pre-procedure holding bays for inpatients can increase the efficiency of the unit, however the staffing requirements to provide oversight of these patients requires consideration.

2.2.9 Reprocessing of Reusable Medical Devices (RMDs)

TOE probes and ultrasound transducers are classified as reusable medical devices (RMDs) and are commonly reprocessed within the unit; however, facilities may access a centralised reprocessing service. As probes are high-value items, where transport is required, appropriate handling and transfer procedures should be implemented to minimise the risk of damage. A common arrangement is to provide a reprocessing room directly accessible from the TOE room where probes are reprocessed using an automated and closed high level disinfection unit. Where feasible, also consider opportunities for economies of scale by sharing the reprocessing area with related services e.g., CCL or endoscopy.

Ultrasound transducers used for TTEs that do not come into contact with blood or non-intact skin are classified as non-critical medical devices and require low-level disinfection (LLD) or intermediate disinfection before and after each use based on IPC risk assessment. These are heat-sensitive items and need to be disinfected using disposable disinfectant cleaning wipes or low-temperature chemical sterilising or disinfecting agents, or other approved automated systems. This may be performed at the point of care or in a separate room with unidirectional dirty to clean workflows.

TOE probes which come into contact with mucous membranes and TTE transducers that come into contact with blood or non-intact skin during procedures are considered semi-critical due to the high risk of potential contamination. These probes and transducers are reprocessed by cleaning followed by a high-level disinfection (HLD) method. Given their delicate construction, these are frequently reprocessed at the point of care within the CIU, rather than being sent to a central sterilizing services unit (SSU).

When considering reprocessing to occur within the unit, it should align with the standardised infection prevention and control strategies for ultrasound practice across Australia and New Zealand in the Guidelines for Reprocessing Ultrasound Transducers: 2026. The designated space must also comply with the requirements outlined in AS 5369 *Reprocessing of reusable medical devices and other devices in health and non-health related facilities*, including:

- providing a dedicated area or room that is separate to the patient/clinical treatment area or room
- meeting the requirements for environmental control, effective segregation of clean and dirty activities, unidirectional workflows and facility fixtures and finishes (this should be informed by a process map or flow diagram to minimise the risk of cross contamination)
- access to appropriate hand hygiene facilities, including clinical hand basins (Type B)
- sufficient space to store accessories, chemicals and documentation
- surface finishes are smooth, non-porous and easily cleaned
- systems for the identification and traceability of the point of use reprocessing
- storage facilities for reprocessed probes/transducers that protect them from the risk of contamination
- high level disinfection systems should be provided with reference to TGA requirements and included on the Australian Register of Therapeutic Goods (ARTG) or New Zealand Medicines and Medical Devices Safety Authority (Medsafe).

Refer to AusHFG HPU 190 Sterilizing Services and Endoscope Reprocessing Units and HPU 440 Medical Imaging Unit Section 4.2.5 Ultrasound Reprocessing Room for additional information.

2.2.10 Telemedicine

Telemedicine links between community centres, ambulance units, emergency departments, cardiac units and the cardiology clinicians' homes may considerably enhance the early diagnosis and ongoing treatment of patients.

Patients residing in rural or remote areas, as well as health services covering extensive geographical regions, benefit from telemedicine. This approach enables patients to access cardiac services and support - such as remote cardiac monitoring and post-procedure review - without the need to travel long distances to metropolitan hospitals. In certain cases, patients may benefit from sitting with a clinical staff member in the telemedicine area to facilitate a more effective and engaging discussion with the clinician or specialist.

Telemedicine may also be used to facilitate clinician-to-clinician collaboration, making it essential to incorporate remote support capabilities - including appropriate interfaces and supporting hardware and software - early in the planning and design of the CIU.

Information technology infrastructure needs to support the communication of high-resolution images and videos for a range of services including echocardiography services, CCLs and CTCA. This will include the provision of live two-way, uninterrupted video and audio transmissions between facilities to support telemedicine services and education and training.

2.3 Planning Models and Functional Relationships

2.3.1 Unit Location and External Functional Relationships

The most appropriate location for the CIU will depend on the range of services to be provided, the anticipated volume of inpatient and outpatient activity and the preferred operational model as previously described.

Consideration should be given to outpatient volumes with regard to ease of access for patients and vertical access to clinics if the cardiac precinct is not on a ground floor. 'Easy' relationship reflects the need for convenient and minimally complicated access between services.

The CIU must not act as a thoroughfare to other parts of the healthcare facility.

Direct access (rapid non-public horizontal or vertical adjacency) from the emergency unit, ambulance access and helipad (where applicable) to the CCLs is essential for the rapid transfer of emergency patients. The achievement of 'direct' relationship between the services above are essential to ensure that care requirements, particularly relating to critical care events, can be optimally met.

Direct access is also required between the CCLs and Operating Theatres, ICU, CCU and day only recovery services (depending on the operational model for day only patients).

Ready access is required to and from cardiac diagnostic services and:

- chest pain assessment service (if provided and located elsewhere in the facility)
- medical imaging particularly chest x-rays and cardiac capable CT and MRI (where provided)
- nuclear medicine (particularly for stress testing)
- PET Unit (cardiac positron emission tomography) - tertiary facilities
- biomedical engineering services.

A 'ready' relationship reflects the requirement for proximal (but not adjacent) access due to a potentially high volume of patient transfers, ease of access for staff moving between services and transfer of mobile imaging equipment, maintenance equipment and supplies.

For some facilities satellite cardiac echocardiography services may be required depending on the distance between the CIU and clinical units.

Linkages to cardiac surgery occur at several operational levels including clinical decision-making regarding patients requiring cardiac surgery; joint research projects; and joint management of patients in the postoperative phase including rehabilitation.

Refer to Sections 2.1.1 Operational Service Models and 3.7 Safety and Security for further information.

2.3.2 Unit Configuration and Internal Functional Relationship

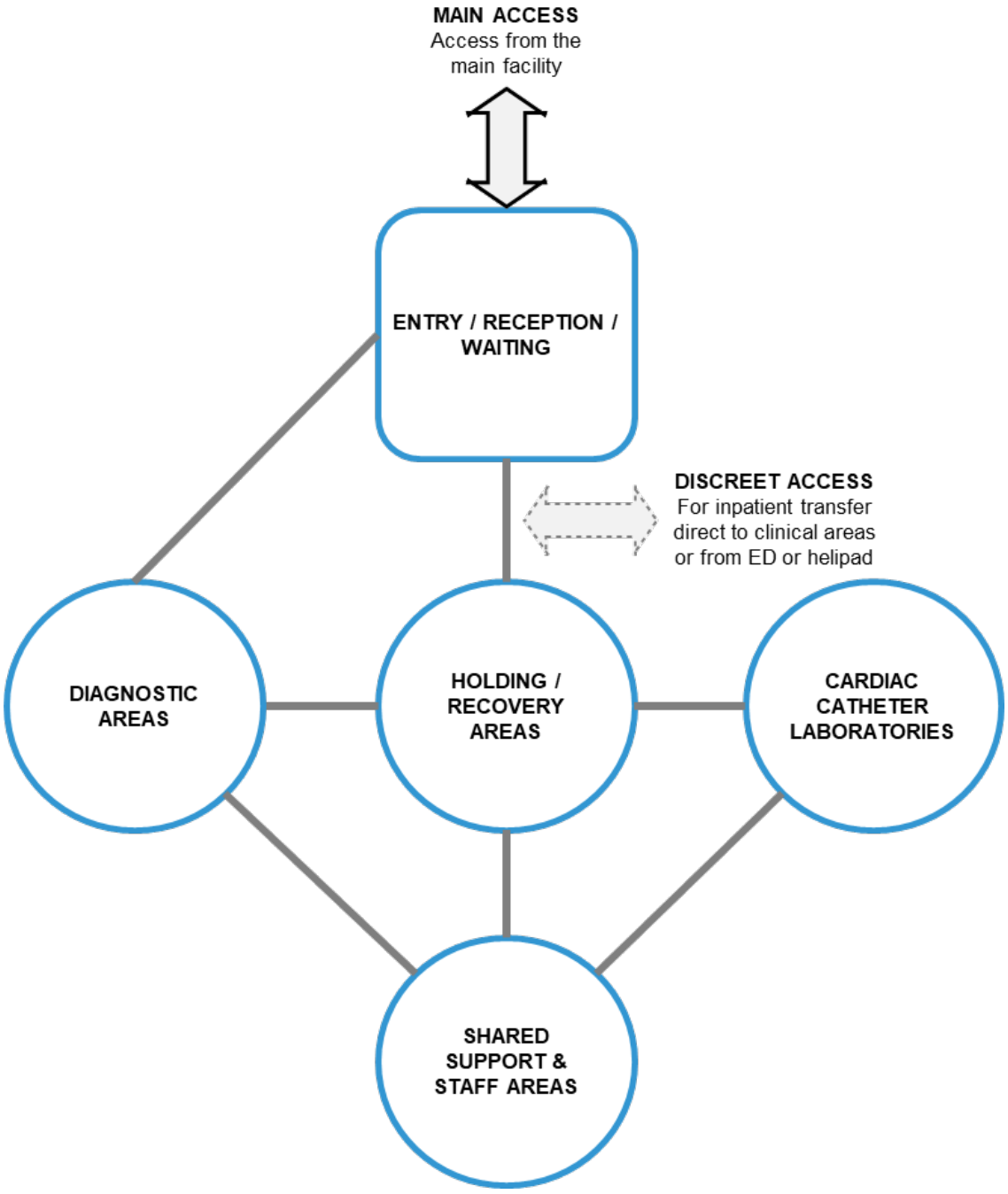
The less complex and more frequently used diagnostic and clinic rooms should be located close to the unit entry, reception and waiting area. The CCLs should be more discretely located.

The main public access to the unit should be separate to inpatient transfers in and out of the unit and access for 'back of house' support services.

Project teams should obtain specialist advice to identify and manage electromagnetic interference (EMI) risks. Early coordination and appropriate facility planning may reduce the need for shielding or other physical mitigation measures.

Pacemaker and ICD clinics should not be located in an area where high radiofrequency interference may affect new devices using wireless technology. Expert advice should be obtained.

2.3.3 Functional Relationships



2.4 Functional Areas

2.4.1 Unit Functional Zones

The CIU will consist of the following functional zones that may or may not be co-located, depending on operational policies, service delineation and relationships to other services:

- entry, reception and waiting area
- cardiac diagnostic services
- cardiac catheter laboratory areas
- patient holding and recovery
- staff work areas and amenities, including education, training and research.

2.4.2 Entry, Reception and Waiting

The reception and waiting area may be a shared area for all aspects of the CIU. It should provide easy access to both the diagnostic services and CCLs and provide access to public and accessible amenities.

A separate reception/waiting area may be required for the CCLs if it is not co-located with the cardiac diagnostic services, however opportunities to share with other co-located services should be considered.

2.4.3 Cardiac Diagnostic Services

The range and quantum of cardiac diagnostic services provided will be guided by clinical services planning and may include the following:

- consult rooms that can be flexibly equipped to provide outpatient ECGs, Holter/ambulatory blood pressure (ABP) monitor applications and general cardiology clinics
- a dedicated ECG, Holter and ABP room in units where the throughputs are high which cannot be efficiently accommodated within a flexible-use consultation space
- a designated clinic room to support the follow up and interrogation of pacemakers and ICDs, including remote CIED monitoring which may be accommodated in a separate clinic room
- stress testing rooms that may be flexibly used for EST and ESE testing, and pharmacological stress echocardiography
- tilt table testing rooms (not commonly provided but may be considered where clinically justified)
- TTE rooms
- TOE rooms, that are commonly also flexibly used to provide TTE services.

Access to recovery bays with clinical staff oversight is essential to support TOE services. Patients are typically recovered for two hours following the procedure.

Consultations to determine the need for an implantable loop recorder (ILR) are generally undertaken within cardiac diagnostic services; however, insertion is typically performed in a procedure room, electrophysiology laboratory, or dedicated day surgery unit.

2.4.4 Cardiac Catheter Laboratories (CCL)

The number and type of CCLs will be informed by clinical services planning. Each laboratory will require a co-located control room. Shared control rooms are possible; however, they are not recommended due to the operational impact of the number of staff to be accommodated and associated noise generated. Associated equipment rooms will also be provided with the CCLs. These should be separate to the labs to allow maintenance personnel to access the rooms without accessing the laboratory.

Access to consult rooms will be required for pre-admission interviews, consents, pre-procedure examinations and post angiogram reviews. Patients will need to change prior to and following the procedure and some patients will require access to a shower prior to the procedure.

A range of support areas are required including storage for lead aprons, sterile stock, medications, contrasts, consumables and equipment, as well as viewing and reporting workstations.

2.4.5 Staff Work Areas and Amenities

Staff work areas and meeting rooms will generally be co-located in a zone that is accessible only by staff. These may be provided as part of an integrated cardiac precinct. The number and type of work areas to be provided will be dependent on the staff establishment and the relevant jurisdictional office accommodation policy. This will require consideration of work areas to support remote cardiac monitoring services.

Staff amenities will also be co-located with the CIU and accessible only by staff. Depending on the size of the unit, some staff toilets may be located near treatment areas so that travel is reduced. The staff room should be located in close proximity to the CCLs for direct access by staff in the event of a clinical emergency and when preparing/waiting for cases, particularly after hours.

Provision for research may be justified depending on the defined role and function of the service.

3 Design

Refer to the following AHIA Project Resource for overarching design guidance including:

- Design Guidance: Medical Services Panels and Pendants
- Design Guidance: Doors
- Key Sustainability Guidance

3.1 Access

3.1.1 Internal

Access is required for patients on beds, trolleys and wheelchairs in all diagnostic and treatment areas. The CCLs will be designed to enable access by beds and trolleys, including for ICU and emergency department patients with associated equipment. The bed areas should facilitate unhindered access to the patient in the event of a cardiac arrest.

Consider lift and stairs staff access where CIU services and cardiac inpatient units spans more than one floor of the facility.

3.1.2 External

There should be easy access to the unit from the main entry for outpatients and a defined point of access for non-urgent patients.

In the case of an emergency, after-hours access for authorised staff will be required for performance of a procedure or to gain access to equipment. Swipe card entry at access points should be considered as they provide more secure, cost-effective access control.

Also refer to Part C: Design for Access, Mobility, Safety and Security.

3.2 Parking

A sheltered vehicle drop-off area and disabled parking will be required for outpatients whose mobility may be severely compromised and for non-emergency patients arriving by ambulance, e.g. from nursing homes, etc.

Refer to AusHFG Part C for considerations relating to parking.

3.3 Disaster Planning and Major Incident Management

The planning team will consider the role of the unit in any local, regional or state-wide disaster management plans.

Each unit will have operational plans and policies in place detailing the response to a range of internal and external emergency situations.

For further information refer to:

- Part C: Design for Access, Mobility, Safety and Security
- Part B: Section 80 General Requirements.

3.4 Infection Prevention and Control

The following aspects of planning and design contribute to the implementation of effective infection prevention and control (IPC) measures and are relevant within the context of this HPU:

- hand hygiene facilities
- air handling systems

- isolation rooms (if applicable)
- linen handling
- separation of ‘clean’ and ‘dirty’ workflows
- storage (sterile and bulk)
- waste management
- surface finishes.

Refer to AusHFG Part D: Infection Prevention and Control, AusHFG standard components and individual jurisdictional policies and guidelines.

3.5 Environmental Considerations

3.5.1 Acoustics

Acoustic privacy will be required in consulting and testing rooms, and in any rooms where confidential information is discussed. Conversations between staff/clinicians and patients who are in curtained holding/recovery bays should be operationally managed to maintain confidentiality – such as booking a consult room for detailed conversations.

Minimisation of sound transfer between clinical spaces will reduce staff error from miscommunication and disruptions and increase patient safety particularly in control rooms.

Dedicated control rooms for each cardiac laboratory are recommended. Shared or combined control rooms serving multiple laboratories should be avoided, as simultaneous staff instructions via microphones can create acoustic interference, increasing the risk of reduced communication clarity and misinterpretation. Acoustic treatment between CCL and control room is also essential.

3.5.2 Vibration

The planning, design, and siting of a CIU should incorporate appropriate vibration control measures, recognising the sensitivity of cardiac diagnostic and interventional equipment to both continuous and intermittent structure-borne and floor-borne vibration.

Vibration sources may arise from internal building services, adjacent clinical functions, plant and equipment, or external environmental influences, and should be appropriately assessed during the design phase.

The CIU should be designed and constructed to ensure that vibration does not adversely impact:

- diagnostic image quality
- procedural accuracy and clinical safety
- reliability and integrity of haemodynamic measurements
- the operation, calibration, and service life of cardiac imaging and interventional equipment.

Vibration performance criteria should be determined in accordance with equipment manufacturer requirements and relevant standards, and should be integrated into structural, architectural, and building services design to support optimal clinical safety and diagnostic performance.

3.5.3 Natural Light and Views

Access to natural light and quality external views supports wellbeing for building occupants. External windows are desirable in regularly occupied spaces such as waiting areas, holding and recovery areas, and staff lounges, but are generally not recommended in diagnostic rooms.

Where sunlight may cause glare, operable blinds with low visual light transmission should be provided. In spaces without access to natural light, daylight-mimicking lighting systems, such as circadian or adjustable RGBW lighting, may be considered.

Where access to natural light or external views is limited, calming, nature based or abstract artwork may also be used to mitigate the absence of visual connection to the outdoors.

3.5.4 Privacy

To ensure patient privacy, change rooms should be located adjacent to diagnostic rooms so that the patient does not cross public areas to access testing rooms, and are not open to view when doors are opened.

Acoustic and visual privacy considerations are essential in areas where ECGs are performed, Holter or ABP monitors are fitted, and in recovery zones - particularly when these spaces rely on curtained bays rather than enclosed rooms.

Artwork and visual treatments may be incorporated in change rooms and recovery areas to enhance dignity and reduce patient distress, provided required levels of visual observation and privacy are maintained.

3.5.5 Interior Considerations

Interior décor includes furnishings, style, colour, textures, ambience, perception and identity. Pleasant interior décor can help to prevent an institutional atmosphere; however, cleaning, infection control, fire safety, patient care and patient perceptions of a professional environment should always be considered.

Some colours, particularly the bold primaries and green should be avoided in areas where clinical observation occurs. Such colours may prevent the accurate assessment of skin tones, e.g. yellow for jaundice, blue for cyanosis and red for flushing.

A calming non-threatening environment is desirable using colours that do not mask skin colours.

Additional information on lighting requirements relevant to minimising interior colour interference with clinical assessment is provided in Section 3.10.3 Electrical Services and Lighting.

Consideration may be given to ceiling art and murals. Calming, non-threatening artwork may be incorporated within interior environments, provided colours, content and placement do not interfere with clinical observation of skin tone, patient safety or IPC requirements.

Biophilic design principles should be adopted for interior design as they have proven benefits for mental and physical health including reduced stress, quicker recovery times, and improved staff retention.

Where inclusion of internal planting is not feasible due to IPC or other operational requirements, images, tones, and patterns of nature may be incorporated into the interior design.

3.5.6 Arts Integration

Visual art should be integrated throughout the CIU and considered from early planning stages, with artwork selected in consultation with clinical staff and consumers. Visual art should be integrated into reception and waiting areas to promote patient and carer wellbeing and to help reduce anticipatory anxiety before cardiac investigations and procedures. The use of arts-based visual health communication and calming imagery can further support health literacy and alleviate stress during waiting periods.

Subtle, clinically appropriate artwork may be incorporated in diagnostic rooms used for lengthy or physically demanding investigations, provided it does not interfere with equipment, workflow or emergency access.

Soothing artwork, including ceiling based or line of sight pieces, should be incorporated in patient holding and recovery areas to support comfort during extended post-procedure recovery.

Other areas which may benefit from artwork are telemedicine rooms and other staff-only work areas to support comfort, wellbeing and stress reduction in high acuity cardiac environments.

Refer to the AusHFG Arts in Health Framework and Culturally Sensitive Planning and Design for further guidance on arts and culture integration from early planning.

3.5.7 Signage and Wayfinding

Signage and wayfinding should be clear and intuitive for all users (patients, visitors and staff) regardless of mobility and health status. Visual cues or artwork may be integrated alongside compliant signage to support intuitive wayfinding and reduce cognitive load for cardiac patients.

Refer to:

- Part C: Design for Access, Mobility, Safety and Security

- Jurisdictional guidance such as Department of Health, NSW, 2022, Wayfinding for Health Facilities.

3.6 Space Standards and Components

3.6.1 Accessibility and Mobility

In Australia, the facility must comply with the Commonwealth Disability and Discrimination Act (DDA) and the following standards where applicable:

- Disability (Access to Premises – Buildings) Standard 2010
- Australian National Construction Code
- AS1428.1 - 2010 Design for access and mobility.

In New Zealand, comply with *NZS 4121: Design for access and mobility: Buildings and Associated Facilities*, New Zealand Building Code and any other applicable statutory and advisory requirements.

3.6.2 Building Elements

Building elements include walls, floors, ceilings, doors, windows and corridors and are addressed in detail in AusHFG Part C: Design for Access, Mobility, Safety and Security.

Ceilings in the CCLs should be three metres high at a minimum. The ceiling and the slab above should be capable of supporting the weight of ceiling-mounted systems. This may include the gantry for catheter equipment, imaging equipment, monitors, radiation protection device, ceiling mounted pendants, theatre light, room lighting, patient lifting device, and air-conditioning, etc. Special attention is required in co-ordination of all ceiling fixed services. The floor and supporting slab should be designed to accommodate the load requirements of any floor-mounted equipment.

Ensure that doorways are sufficiently wide and high enough to permit the manoeuvring of beds, wheelchairs, trolleys and equipment without risk of damage or manual handling risks. Planning and design should consider door and travel pathway clearances as well as floor loading that allow the safe removal and replacement of manageable components of disassembled, non-functional MME, without requiring structural modification of lead lined and fire-rated walls.

Good visibility for the operators from the control room to the procedure room is essential to support a high level of communication between the clinicians and the equipment operators during all procedures, particularly in EP laboratories.

Audio communication facilities including microphone should be provided to support communications between the laboratory and the control room.

3.7 Safety and Security

3.7.1 Safety

The unit must provide a safe and secure environment for patient and staff.

A safety audit comprising of a risk analysis of potential hazards should be undertaken at every stage of the planning and design process of the unit.

Appropriate access to duress and emergency call systems is essential and the design of the unit must support efficient and safe staff workflows with no entrapment or concealment points.

Radiation safety guidelines require the use of ‘X-ray in Use’ illuminated signs over the doors leading into the CCL. Safety in relation to storage and transport of hazardous wastes including radioactive wastes needs to be considered.

Also refer to disability standards to ensure safety requirements are adhered to for people with mobility, auditory and visual disabilities.

3.7.2 Security

Access control systems will be needed to ensure that only authorised people will have access to restricted areas of the unit. Duress points may also be needed at staff stations and receptions.

Patient and visitor escorted access only will be provided beyond the waiting area.

The design will need to consider that staff may work out of hours and will access CCLs and echocardiography services including recovery areas and staff amenities after hours.

Refer to individual jurisdiction guidelines and to Part C: Section 6 Security.

3.8 Finishes

3.8.1 General

Finishes in this context refer to walls, floors, windows and ceilings. Refer to the following references for further information:

- AusHFG Part C: Design for Access, Mobility, Safety and Security
- AusHFG Part D: Infection Prevention and Control.

3.8.2 Floor Finishes

The selection of floor finishes should be appropriate to the function of the space and take into account manual handling issues, including the impact of the flooring on push and pull forces for wheeled equipment.

Consider acoustic performance, slip resistance, consequences of patient falls, infection prevention and control, movement of beds and trolleys, maintenance and cleaning protocols. The flooring selected should be non-reflective and adequate to avoid the potential for slips, trips and falls to occur.

3.8.3 Wall Finishes

Adequate wall and corner protection should be provided to areas that will be regularly subjected to damage. Particular attention should be given to areas where bed or trolley movement occurs such as corridors, bed head walls, treatment areas, equipment and linen trolley bays.

3.8.4 Ceiling Finishes

Ceiling finishes should be selected with regard to appearance, cleaning, infection prevention and control, acoustics and access to services.

3.9 Fixtures, Fittings and Equipment

3.9.1 Definition

The Room Data and Room Layout Sheets in the AusHFG define the required fixtures, fittings and equipment. Refer to:

- Part C: Design for Access, Mobility, Safety and Security
- AusHFG Standard Components for CIU specific rooms.

3.10 Building Service Requirements

3.10.1 General

In addition to topics addressed below, project teams should also refer to the following:

- AusHFG Part C: Design for Access, Mobility, Safety and Security
- AusHFG External Resources: Engineering and Building Services - refer to this for relevant jurisdictional references relating to engineering services guidelines

- AusHFG Standard Components for CIU specific rooms.

Project teams planning CCL facilities should also consult the relevant jurisdiction-specific guidance listed in the AusHFG External Resources – Engineering and Building Services to ensure full compliance with local requirements.

3.10.2 Air Handling Systems

Air conditioning should be provided to the entire department to provide heating, cooling and ventilation to meet the temperature and outside air needs of the spaces. In some regions active humidity control may also be required. Air conditioning plant should wherever possible be located within a plant room. The plant should be programmed to operate during the hours of occupation with overrides based on agreed local control interface to meet out of hours emergency use requirements.

The outside air and exhaust ventilation provisions should meet the requirements as set out in the NCC (or NZBC for NZ facilities), however, refer to applicable jurisdictional guideline to address outside air and exhaust air requirements specifically for CIUs.

Cardiac investigations and procedures are becoming increasingly complex and invasive. Consequently, the air handling systems in interventional CCLs should include the provision of high-efficiency particulate air (HEPA) filtration, increased air change rates, and appropriately designed laminar airflow systems delivering adequate air velocity over the procedural table and a defined clean zone. The design should also ensure effective air dilution while accommodating the spatial and functional constraints imposed by large, fixed imaging and interventional equipment.

For CIUs involving surgical and intravascular procedures, such as cardiac catheterisation units, consider delivery of supply air at high level via ceiling diffusers to minimise recirculation of potentially contaminated air from adjacent areas, and to provide the cleanest practicable air supply over the procedure zone. Diffusers should be located as close as practical above the procedure area to promote airflow from clean to less clean zones within the room. The HVAC system should be designed to maintain an appropriate pressure cascade so that airflow is directed from cleaner to less clean areas, supporting infection prevention and control objectives.

High-voltage X-ray generators are decreasing in size, however; they still produce large amounts of heat and are best managed in a separate room with separate air conditioning plant and controls.

Individual temperature controls may be provided in the CCLs with local override functionality to the central control system like BMS. Temperature control requirements to be finalised with project team including staff and other members of the project team.

For CIUs where nitrous oxide is used for anaesthetic procedures, low-level return or exhaust grilles should be provided to reduce the risk of nitrous oxide accumulation and spread. Also refer to 3.10.5 Medical Gases for additional information.

3.10.3 Electrical Services and Lighting

It is essential that services such as emergency lighting, telephones, duress alarm systems (including the central computer) and electronic locks are connected to the emergency power supply.

Equipment and engineering services should be provided with UPS and emergency power supplies in accordance with local jurisdiction requirements and specific to the facility's needs. Cardiac catheter equipment will require an uninterruptible power supply (UPS) and an emergency supply, as detailed in the AusHFG standard components relating to CCLs.

While AS/NZS 3003 *Electrical Installations – Patient Areas* does not explicitly classify CCL control rooms as cardiac-protected areas, it does outline considerations that may warrant the application of cardiac protection measures beyond designated patient areas (i.e. CCL). In particular, the standard highlights the need to assess whether extended area classification is appropriate. This assessment should consider factors such as the proximity and physical connection between the control room and the adjacent CCL (including access distance and configuration), as well as the type and use of medical equipment within the control room that supports procedural activities. As the control room door may open directly into the CCL, incorporate cardiac protection from the early planning stages and refine this, as required, during design development. Refer also

to relevant jurisdictional engineering guidelines for requirements relating to designated cardiac-protected electrical areas and associated wiring.

Provide lighting that achieves appropriate illuminance levels and high colour-rendering fidelity to support accurate clinical observation. Lighting should avoid the use of coloured or tinted light sources that may distort the assessment of skin tone, in accordance with healthcare lighting guidelines that emphasise visual clarity, colour accuracy, and suitability for clinical examination areas. Lighting that is capable of being dimmed to improve the reporting environment and screen visibility is required in the following areas:

- control room
- reporting rooms
- CCLs
- stress test room (for ESE or DSE)
- TTE/TOE room
- analysis rooms.

Refer to the AusHFG standard components for cardiac diagnostic services and CCLs for further detail regarding lighting requirements.

3.10.4 Information and Communication Technology

Information and Communication Technology (ICT) are key enablers to optimise patient care and to ensure efficient and effective patient information and image management. ICT systems necessary to support clinical and operational requirements should be assessed during the planning and design process to ensure an appropriate level of capability is provided that also supports future flexibility. Given cardiac services are high uses of ICT and rely on the seamless transmission of images and videos between facilities and service areas to support clinical care and education, it is essential that appropriate ICT infrastructure and resources are provided to support the service. Close collaboration with the local information technology department and clinicians is recommended.

Key considerations will include:

- video and teleconferencing capability with appropriate bandwidth to stream cases from CCLs without interruption
- picture archiving and communication system (PACS) and storage for digital archives (may be a local or facility-wide system)
- data capture (other than images)
- back-up storage
- wireless technology
- Wi-Fi connectivity is required to enable real-time image upload for point-of-care ultrasound and TOE when equipment is used across the facility. It is also beneficial for education, research and training.
- voice/data (telephones and computers)
- support for remote cardiac monitoring and reporting
- radiology or patient information systems (RIS), EMR, diagnostic reporting stations and monitors.
- remote or robotic systems will require planning and additional adjacent facilities in accordance with manufacturers recommendations
- audio visual, web network access to view angiograms
- closed circuit television (CCTV) surveillance if indicated
- patient, staff and emergency call systems.

3.10.5 Medical Gases

Reticulated piped services should be provided for the following medical gases where required:

- oxygen

- medical air
- suction
- nitrous oxide (optional for reticulated piped services, see below).

Other gases such as compressed air may also be required for equipment.

Full anaesthetic capability including nitrous oxide and scavenge is required within the CCLs.

Similar to operating theatres and emergency departments, the use of nitrous oxide is declining in CIU due to a range of clinical and environmental concerns. Reticulated systems have been found to increase leakage of nitrous oxide (a potent greenhouse gas) to atmosphere, can increase facility operating costs and potentially expose staff to nitrous oxide.

Reticulated nitrous oxide and associated scavenge outlets are not mandatory for any healthcare service and point of care cylinders can meet clinical requirements for the majority of healthcare facilities.

Where found to be clinically necessary, the provision of nitrous oxide via piped outlets or via cylinder is to be determined at a project level, based on an assessment of expected clinical need and associated risk assessment, particularly for services with high utilisation. The associated cost impacts should be considered including the storage and management of cylinders.

Due consideration must be given to a range of operational and planning factors including:

- monitoring and measurement of usage
- management of leakage
- Work Health and Safety (WHS) requirements relating to the use of cylinders
- approach to the provision of scavenge where cylinders are used
- appropriate storage for cylinders
- movement, access pathways, and operational management of cylinders where local storage is not provided including safety when transporting cylinders via vertical transport (i.e. lifts)
- security of gas sources given its potential for inappropriate use.

Refer to the AusHFG Standard Components for specific CIU rooms.

3.10.6 Radiation and Radiation Safety

CCLs require radiation shielding. For all issues related to radiation shielding and safety, refer to: Safety Guide for Radiation Protection in Diagnostic and Interventional Radiology (RPS 14.1, ARPANSA, 2008).

The radiation protection assessment will specify the type, location and amount of radiation protection required, according to final equipment selection and layout. Radiation protection requirements should be incorporated early in the planning of the CCL and reflected in the final specifications and building plans to ensure appropriate infrastructure is provided without compromising the functionality or operational efficiency of rooms where radiation protection is required.

Consider adequate radiation lead apron accessibility and storage for emergency attendance e.g. ICU and other non-CCL staff who do not own or have alternative access to lead aprons.

When planning for radiation protection infrastructure, technologies that eliminate the need for staff to wear lead aprons may be considered. While some local jurisdictional guidelines may not yet reflect advancements in alternative radiation protection devices, these options can significantly improve staff comfort and workflow.

If floor-mounted radiation safety systems are being considered, ensure adequate storage space is planned, as these units are typically large and bulky. For ceiling-mounted systems, assess the structural capacity of the slab to support the significant weight of the equipment.

The incorporation of ‘no lead apron’ technologies, whether mobile or ceiling-mounted, should be considered in the context of overall room planning and functional performance. Careful assessment is required to manage the potential impact on equipment clearances, including the risk of collisions with C-arm systems or other

ceiling-mounted services, as well as the introduction of trip hazards. These considerations are particularly relevant in rooms in emergency scenarios where rapid staff movement is required.

Projects exploring alternatives to traditional radiation practices should engage a qualified radiation safety consultant. Claims about new equipment, such as internal shielding or reduced radiation doses, must be verified, and all setups should align with relevant jurisdictional requirements. Project teams should also consider health service provider-specific radiation shielding guidelines, where available, as these may include more detailed requirements.

4 Components of the Unit

4.1 Standard Components

Rooms/spaces are defined as:

- standard components (SC) which refer to rooms/spaces for which room data sheets, room layout sheets (drawings) and textual description have been developed
- standard components – derived rooms (SC-D) are rooms, based on a SC but they vary in size. In these instances, the standard component will form the broad room 'brief' and room size, and contents will be scaled to meet the service requirement
- non-standard components which are unique rooms that are usually service-specific and not common.

The standard component types are listed in the attached Schedule of Accommodation.

The current Standard Components can be found at
www.healthfacilityguidelines.com.au/standardcomponents

4.2 Non-Standard Components

Non-standard components are unit-specific and provided in accordance with specific operational policies and service demand.

Non-Standard components for this unit include:

- ECG / ABP / Holter Monitoring Room
- Cardiac Implantable Electronic Device (CIED Clinic)
- Store - Contrast Media

4.2.1 ECG / ABP / Holter Monitoring Room

Description and Function

An ECG / ABP / Holter Monitoring Room is a dedicated space for conducting cardiac and blood pressure assessments. It is used to perform electrocardiogram (ECG) tests and to fit patients with wearable devices such as Holter monitors and ambulatory blood pressure (ABP) monitors. These devices record continuous/ambulatory data over a 24- to 72-hour period, or a more extended event monitoring, enabling comprehensive evaluation of heart rhythm and blood pressure patterns prior to cardiologist review.

The room may also be used to have the electrodes and wearable devices removed after the monitoring period.

Location and Relationships

The room may be part of a dedicated cardiac clinic. A separate analysis room should be ideally provided adjacent to this room.

Considerations

The space may be provided as multiple open bays or rooms.

Acoustic and visual privacy should be considered when planning and designing this room.

4.2.2 Cardiac Implantable Electronic Device (CIED) Clinic

Description and Function

This room is for the follow up and interrogation of CIED for inpatients (typically performed bedside) and outpatients. Note that devices are not inserted in this room. This room may also be utilised for remote CIED monitoring if not provided its own dedicated room.

The multiple vendor specific programmers are used for checking CIEDs. Each weigh between fifteen and twenty kilograms and therefore require a sturdy bench top at a height for easy use, with appropriate GPO access. Consider more lightweight portable programmers for use when visiting inpatients.

Location and Relationships

The room may be part of a dedicated cardiac diagnostic unit or cardiac clinic. Patients who are in bed in an inpatient unit will remain in their current location; staff will attend to them at the bedside rather than bringing them into this room.

Considerations

The following should be considered:

- this room generally needs body protection; however, the project team should undertake a risk assessment for other activities performed in this room and refer to AS/NZS 3003 activity-based classifications for body- or cardiac-protection requirements
- oxygen and suction
- patient recliner chair to sit on during the CIED check
- fail safe phones or external link to cardiac support
- workstation with two computers - one for electronic medical records (EMR) and one for the reporting system - and three monitors. This includes twin monitors to test pacemakers with different device programmers.
- benches at an appropriate height to prevent staff neck and back injury if staff have to continually lift and move programming machines
- trolley for moving programmers
- storage cupboard for approximately six programmers from each vendor to be stored vertically
- Type B hand wash basin.

4.2.3 Store – Contrast Media

Description and Function

This room/space is designated for the storage of iodinated contrast media (ICM) for CIU with high patient volume in the CCLs. ICM is a critical imaging agent containing iodine, administered via injection into blood vessels to enhance visualisation of vascular structures, cardiac anatomy, and potential blockages during angiography or other imaging procedures. Prior to administration, ICM is typically warmed to body temperature (approximately 37°C) using a dedicated contrast media warmer.

The room should include designated storage cupboards or shelving for ICM and administration consumables.

If ICM is to be prepared in this room, it should also include:

- a preparation bench
- a contrast media warmer
- appropriate bins for the safe disposal of wastes in compliance with national or jurisdictional regulatory requirements
- immediate access to hand hygiene facilities.

The cardiac diagnostic unit may also utilise imaging agents/contrast for echocardiography which may be stored in this room. Echocardiography contrast requires a preparation bench, temperature monitored drug refrigerator and agitator.

Location and Relationships

If the room is used for ICM preparation, it should be located in close proximity to the CCLs for efficient workflow. This room may be shared with other imaging modalities if CIU is co-located with other imaging rooms or cardiac diagnostic unit.

Considerations

ICM must be stored below 25°C or 30°C (as per manufacturer's instructions), protected from light and secondary radiation sources.

Depending on jurisdictional policies, ICM may be stored within the Medication Room or Clean Store if a dedicated Store - Contrast Media is not provided. Designated cupboards/shelving is recommended if ICM is stored in the Medication Room or Clean Store.

Where the store/preparation area is shared between CCL and cardiac diagnostic unit (for echocardiography contrast), confirm jurisdictional requirements to ensure compliance with safety and regulatory standards for all modalities, adopting the highest applicable standard where necessary.

Refer to The Royal Australian and New Zealand College of Radiologists. Iodinated Contrast Media Guideline V2.3 for further information.

5 Schedule of Accommodation

A schedule of accommodation is shown below and lists generic spaces for this HPU. Quantities and sizes of spaces will need to be determined in response to the service needs of the specific unit

The 'Room / Space' column describes each room or space within the unit. Some rooms are identified as 'Standard Components' (SC) or as having a corresponding room which can be derived from a SC, i.e. 'Standard Components – Derived' (SC-D). The 'SC / SC-D / NS' column identifies these rooms and relevant room codes and names are provided. All other rooms are non-standard (NS) and will need to be briefed using relevant functional and operational information provided in this HPU.

In some cases, Room / Spaces are described as:

- '**Optional**'. Inclusion will be dependent on a range of factors such as operational policies or clinical services planning.
- '**Alternative Option**'. Inclusion is considered as an alternative to another Room / Space.
- '**Quantity is service dependent**'. Quantity will be determined by the model of care, service profile, or operational requirements.
- '**Quantity is planning dependent**'. Quantity will be determined during planning, considering accessibility, functional relationships, and opportunities for efficient space allocation.

The schedule of accommodation below assumes the provision of an integrated cardiac investigations unit, including both cardiac diagnostic services and CCLs.

For alternative operational models, e.g. where CCLs are included as part of an interventional suite, co-located with operating theatres, opportunities to share support areas should also be explored.

5.1 Entry, Reception and Waiting Areas

Room Code	Room Name	SC / SC-D / NS	Qty	m^2	Comments
WAIT-20	Waiting	SC	1	20	Area recommendation is indicative and will depend on the number of services sharing the waiting area and number of people to be accommodated. 1.2m^2 recommended per seat, 1.5m^2 per wheelchair space. Consider infrastructure requirements for patient self-registration and access to education/health promotion resources.
WCPU	Toilet - Public	SC	2	3	May be shared with co-located services.
WCAC	Toilet - Accessible	SC	1	6	May be shared with co-located services.
RECP-15	Reception	SC	1	15	Size will depend on number of services being supported. Adjust area if staff are supporting both outpatient/ diagnostic and interventional areas.
BMFD-3	Bay - Multifunction Device	SC	1	3	
Discounted Circulation			**25%**		

5.2 Cardiac Diagnostic Areas

The number of cardiac diagnostic clinical spaces below is indicative only. The range and quantum of services will need to be determined on a project-by-project basis in line with the Clinical Services Plan and the defined role and function of the service.

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
CONS	Consult Room	SC	2	12	May be flexibly used for ECG, Holter/ambulatory BP application, general consultations. Number of rooms will depend on projected activity assuming optimal utilisation.
BHWS-B	Bay - Handwashing, Type B	SC		1	**Quantity is planning dependent.** Access to a handwash basin nearby will be required, e.g. corridor where not provided in Consult Rooms or other diagnostic rooms. Qty to facilitate ease of access. Assume one basin between four rooms in early planning and assess opportunities for a more efficient allocation during schematic design.
CONS	ECG / ABP / Holter Monitoring Room	SC-D	1	12	**Optional** as dedicated ECG / ABP / Holter Monitoring Room. Number of rooms will depend on projected activity assuming optimal utilisation. Ideally separate from Analysis Room. May be flexibly used as a Consult Room. Use CONS as a starting point.
REPR	Analysis Room - Ambulatory Monitoring	SC-D	1	12	Height adjustable desks to support 2-3 computers. Provide ECG, Holter and ABP device storage when not in use. May use Reporting Room as a starting point.
	Cardiac Implantable Electronic Device (CIED) Clinic	NS	1	15	Includes dedicated write up area and storage for programmers for different pacemakers.
STRT	Stress Testing	SC	1	20	Includes resuscitation trolley. Number of rooms will depend on projected activity. Pharmacological stress echocardiography may also be undertaken in a TOE room given a treadmill is not required.
CHPT	Change Cubicle - Patient	SC	1	2	
CHPT-AC	Change Cubicle - Patient, Accessible	SC	1	4.5	
ULTR-PR	Echocardiography - Transthoracic (TTE)	SC-D	2	20	For TTEs. Suitable for combined outpatient and inpatient cardiac diagnostic areas where cardiac ultrasound activities are undertaken. Number of rooms will depend on projected activity and case mix. Can be 16m² if dedicated for ambulant outpatient/ diagnostic activities only (refer to ULTR as starting point).
ECHO-TOE	Echocardiography - Transoesophageal (TOE)	SC	1	26	For TOEs. May be flexibly used for TTEs also. Note recovery areas included with cath lab SOA below as an assumed integrated recovery zone.
	Reprocessing Room - High Level Disinfection, Cardiac Diagnostics	NS	1	12	**Alternative Option.** For reprocessing of TOE probes and ultrasound transducers (TTE). Ensure dirty to clean flow. Consider opportunities for economies of scale by sharing the reprocessing area with related services e.g., CCL, Endoscopy, where appropriate.
	Reprocessing Room - High Level Disinfection, Ultrasound	NS	1	7	**Alternative Option**. Provide in lieu of TOE/TTE Reprocessing Room for units where TOE is not performed. Ensure dirty to clean flow.
REPR	Reporting Room - Echocardiography	SC	1	12	For up to 4 people.
SSTN-10	Staff Station	SC-D	1	12	For write-up function for non-consultant staff.
MED-14	Medication Room	SC-D	1	8	May be provided as a combined Clean Store / Medication Room depending on local jurisdictional

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
					policies. Media storage/prep may be located in this room based on jurisdictional policy.
CLN-10	Clean Store	SC-D	1	8	May be provided as a combined Clean Store / Medication Room depending on local jurisdictional policies. Media storage/prep may be located in this room based on jurisdictional policy.
DTUR-S	Dirty Utility-Sub	SC	1	8	May be shared with adjacent service.
BRES	Bay - Resuscitation Trolley	SC	1	1.5	
BLIN	Bay - Linen	SC	1	2	
BMEQ	Bay - Mobile Equipment	SC	1	4	
STEQ-20	Store - Equipment	SC-D	1	16	Storage of mobile units, requires power and data. Area will depend on scope of service and no. of mobile units to be accommodated.
BWC	Trolley / Wheelchair Park	SC	1	4	May be used to store outpatient trolleys when rooms are used for inpatients. Area requirement will depend on size of unit.
Discounted Circulation			**32%**		

5.3 Cardiac Catheter Laboratory Areas

It is assumed that the reception and waiting areas are shared with a co-located service, e.g. cardiac diagnostic services, interventional imaging suite or operating theatres.

The schedule of accommodation below assumes the provision of two interventional CCLs and one EP laboratory. The number and type of laboratories will need to be determined on a project-by-project basis and will be informed by clinical services planning.

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
CONS	Consult Room	SC	2	12	For examinations, post angiogram review, operator reviews, pre-admission interviews, consents etc. Also needs to accommodate a carer.
BHWS-B	Bay - Handwashing, Type B	SC		1	Access to a handwash basin nearby will be required, e.g. corridor where not provided in Consult Rooms or other diagnostic rooms. Qty to facilitate ease of access. Assume one basin between four rooms in early planning and assess opportunities for a more efficient allocation during schematic design).
CLAB-I	Catheter Laboratory - Interventional	SC	2	55	Assumes single plane imaging equipment. Additional 5m² if biplane imaging equipment is required which is more commonly used for paediatrics. Adjust area to reflect project-specific higher-density procedural environment.
CLAB-EP	Catheter Laboratory - Electrophysiology Studies	SC	1	60	May have single or biplane imaging equipment. Adjust area to reflect project-specific higher-density procedural environment.
CLCR-I	Control Room - Catheter Laboratory, Interventional	SC	2	14	1 control room per cath lab recommended.

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
CLCR-EP	Control Room - Catheter Laboratory, Electrophysiology Studies	SC	1	17	Required if electrophysiology studies or CIED implantations are to be performed in the cath lab. Multiple staff will stand and sit in this area. Located ideally at head or foot of bed not at the side for maximum patient and procedure visibility.
	Equipment Room - Catheter Laboratory, Interventional	NS	2	10	For storage of vendor computer cabinets. Adjust the size of the room to suit specific requirements of equipment selection.
	Equipment Room - Catheter Laboratory, Electrophysiology Studies	NS	1	12	For storage of vendor computer cabinets, additional required for EP labs. Adjust the size of the room to suit specific requirements of equipment selection.
B-SCRUB	Bay - Scrub	SC	3	4	Includes gowning requirements. May be shared between 2 labs.
	Bay - Lead Aprons	NS	3	1	One per laboratory; may be shared between rooms. To be located for ease of donning prior to accessing the procedure room.
BBW	Bay - Blanket / Fluid Warmer	SC	1	1	
BMEQ	Bay - Mobile Equipment	SC	1	4	Minor equipment e.g. IV poles, commodes, wheelchairs.
	Store - Sterile Stock		1	36	12m² per lab.
	Store - Contrast Media	NS	1	5	**Optional.** Dedicated contrast media storage for CIU with high patient volume in the cath lab or echo requiring contrast. Media storage/prep may be located in other areas such as Medication Room or Clean Store based on jurisdictional policy.
STEQ-20	Store - Equipment	SC-D	1	24	8m² per lab. For large equipment when not required in cath labs such as balloon pumps.
STGN	Store - General	SC-D	1	8	For storage of non-sterile bulk items/boxes.
CLNUP	Clean-up Room	SC-D	1	10	
REPR	Reporting Room	SC-D	1	18	1 workstation per lab assumed, however this will depend on the staffing profile. May be shared with cardiac diagnostic services if co-located.
DISP-10	Disposal Room	SC	1	10	Large volume of packaging waste. May be shared with co-located service. Size requirements for a Disposal Room will be dependent on a department's estimated waste output, the frequency of waste collection and local operational policies for waste management that may dictate the number of waste streams and minimum bin sizes.
CLRM	Cleaner's Room	SC	1	5	
Discounted Circulation			**32%**		

5.4 Patient Holding and Recovery

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
CHPT	Change Cubicle - Patient	SC	2	2	1 change space per lab.
CHPT-AC	Change Cubicle - Patient, Accessible	SC	1	4.5	1 change space per lab.
	Bay - Property, Patient	NS	1	2	

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
PT-RS1	Patient Bay - Recovery, Stage 1	SC		9	**Quantity is service dependent.** For pre and post procedure holding and recovery. Locate to provide ease of access to lockers. The allocation and number of recovery bays should be determined based on the proposed model of care and relevant jurisdictional and project-specific requirements. As a guide: **Stage 1 Recovery Bays:** base on the proposed model of care, particularly the proportion of patients recovering from procedures performed under GA and whether immediate post-procedure recovery is undertaken within the CCL or in a dedicated Stage 1 Recovery area. **Stage 2/3 Recovery Bays** (including discharge lounge recliners): assume 3 bays per CCL and 1 - 2 bays per TOE room in early planning, depending on anticipated activity levels and patient throughput.
PT-HOLD-B	Patient Bay - Holding / Recovery Stage 2	SC		9	
	Patient Bay - Discharge Lounge	NS		4	
WCPT	Toilet - Patient	SC	2	4	
WCAC	Toilet - Accessible	SC	1	6	
ENS-ACC	Shower / Toilet - Accessible	SC	1	7	Close access from the stress testing room and cath labs.
SSTN-14	Staff Station	SC	1	14	Includes central monitoring.
MED-14	Medication Room	SC-D	1	8	Shared with cath lab zone. May be provided as a combined Clean Store / Medication Room depending on local jurisdictional policies.
CLN-10	Clean Store	SC-D	1	8	Shared with cath lab zone. May be provided as a combined Clean Store / Medication Room depending on local jurisdictional policies.
BHWS-B	Bay - Handwashing, Type B	SC	4	1	1 between 4 bays.
BPATH	Bay - Pathology Point of Care Testing (POCT)	SC	1	3	Accessible from cath lab and recovery zones.
BPTS	Bay - Pneumatic Tube	SC	1	1	
BBW	Bay - Blanket / Fluid Warmer	SC	1	1	
BRES	Bay - Resuscitation	SC	1	1.5	
BLIN	Bay - Linen	SC	1	2	
BMEQ	Bay - Mobile Equipment	SC	1	4	
BBEV	Bay Beverage	SC	1	4	
DTUR-S	Dirty Utility - Sub	SC	1	8	
Discounted Circulation			**32%**		

5.5 Staff Work Areas and Amenities

The range and quantum of staff work areas and amenities, and associated area requirements, will depend on the staff establishment required for the unit.

Room Code	Room Name	SC / SC-D / NS	Qty	m²	Comments
OFF-1P-9	Office - Single Person	SC		9	**Quantity is service dependent.** Number will depend on staff profile and local jurisdictional policies.
OFF-WS	Office - Workstation	SC		4.5	**Quantity is service dependent.** To support home monitoring service. Number of workstations will depend on staff establishment.
MEET-15	Meeting Room	SC	1	15	Number and size will depend on requirements of unit. May be shared with adjacent service. Will require audio-visual equipment.
SRM-15	Staff Room	SC-D	1	18	Area requirement will depend on the staff establishment. Refer to standard components for capacity requirements. Shared staff room for small units. Depending on the size of service, additional beverage bays may be needed to support staff near to where they work.
WCST	Toilet - Staff	SC	2	3	Number will suit FTE and be located in staff areas but also close to patient care rooms. Access to accessible toilet required.
CHST-10 CHST-35	Change Room - Staff	SC-D	1	30	Indicative only; peak access periods need to be assessed; separation of overall area allocation into male and female and support for all gender/gender neutral facilities needed is in line with local policies. Includes toilets, showers, lockers; size depends on the staffing per shift.
Discounted Circulation			**25%**		

6 References

- Australasian Health Infrastructure Alliance (AHIA), 2016, AusHFG Part A: Introduction and Instructions for Use, St Leonards, Australia.
- Australasian Health Infrastructure Alliance (AHIA), 2016, AusHFG Part B: Health Facility Briefing and Planning, St Leonards, Australia.
- Australasian Health Infrastructure Alliance (AHIA), 2018, AusHFG Part C: Design for Access, Mobility, Safety and Security, Sydney, St Leonards, Australia.
- Australasian Health Infrastructure Alliance (AHIA), 2025, AusHFG Part D: Infection Prevention and Control, St Leonards, Australia.
- Australasian Health Facility Guidelines (AHIA), 2018, HPU 260 HPU 260 Cardiac Care (Inpatient) Unit, St Leonards Australia.
- Australasian Health Facility Guidelines (AHIA), 2023, AusHFG Arts and Culture – Arts in Health Framework, St Leonards, Australia.
- Australasian Health Facility Guidelines (AHIA), 2024, AusHFG Arts and Culture – Culturally Sensitive Planning and Design, St Leonards, Australia.
- Australasian Health Facility Guidelines (AHIA), 2024, AusHFG External Resources – Key Sustainability Guidance, St Leonards, Australia.
- Australasian Health Infrastructure Alliance (AHIA), 2023, AusHFG External Resources – AusHFG Pandemic Preparedness - Health Infrastructure Planning & Design Guidance, St Leonards, Australia.
- Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2008, Radiation Protection Series No. 14 Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation, Australian Government.
- Cardiac Society of Australia and New Zealand (CSANZ), 2012, Guidelines for Ambulatory Electrocardiographic Monitoring.
- Cardiac Society of Australia and New Zealand (CSANZ), 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI).
- Freedman, B and Colquhoun, D, 2014, Clinical Exercise Stress Testing in Adults, The Cardiac Society of Australia and New Zealand, Sydney, NSW
- New Zealand Standards, 2001, NZS 4121: 2001 Design for access and mobility: Buildings and Associated Facilities.
- NSW Health Infrastructure, 2022, Wayfinding for Healthcare Facilities, Second Edition, NSW Government.
- Peters, N, Juraja, M, Isles, N, et al., Guidelines for Reprocessing Ultrasound Transducers: 2026, Australasian Journal of Ultrasound in Medicine 29, no. 2.
- Standards Australia, AS 1428.1:2021, Part 1: General requirements for access - New building work, Sydney, Australia.
- Standards Australia, 2023, AS 5369:2023, Reprocessing of reusable medical devices and other devices in health and non-health related facilities, Sydney, Australia.
- Standards Australia, 2018, AS/NZS 3003:2018 Electrical Installations - Patient Areas, Sydney, Australia.
- The Royal Australian and New Zealand College of Radiologists, 2018, Iodinated Contrast Media Guideline V2.3, Sydney, Australia.

7 Appendix

7.1 Description of Cardiac Investigation Services

7.1.1 Cardiac Catheterisation / Coronary Angiography

Cardiac catheterisation or coronary angiography (the terms are used interchangeably) is an invasive diagnostic procedure undertaken to detect the presence of disease in valves, blood vessels and both left and right-side heart chambers. It detects whether coronary arteries are narrowed or blocked.

The procedure is performed under local anaesthetic and may require conscious sedation. It involves the insertion of a catheter into an artery via a sheath threaded over a guide wire. Angiography and PCI (described below) are performed through the femoral artery and increasingly the radial or ulnar artery. A radio-opaque liquid contrast is injected through the catheter and digital images are taken. The procedure reveals if any of the coronary arteries are narrowed (stenosis) or blocked (plaque, clots).

The procedure routinely takes 20-30 minutes; however, it may be longer depending on the nature of the study. A three to four-hour period of observation post procedure is required prior to discharge. The procedure may advance to an interventional procedure such as balloon angioplasty or stent insertion.

7.1.2 Percutaneous Coronary Intervention (PCI)

Also known as angioplasty; Percutaneous Transluminal Coronary Angiography (PTCA); or Balloon Angioplasty.

An interventional procedure whereby an occluded coronary artery (or arteries) is dilated by means of a balloon catheter, in order to restore blood supply to heart muscle. It is performed under conscious sedation and local anaesthesia. At the same time a stent may be inserted that supports the occluded artery and maintains patency. The procedure takes approximately 90 minutes. CCLs should have direct access to intra-aortic balloon pump therapy to support critically ill patients when required.

The Cardiac Society of Australia and New Zealand notes that coronary interventional procedures are preferably performed in hospitals with on-site surgical support. However, the Society believes that centres without on-site surgical backup can provide coronary interventional procedures in accordance with standards set out in Cardiac Society of Australia and New Zealand, 2016 'Guidelines on Support Facilities for Coronary Angiography and Percutaneous Coronary Intervention (PCI) including Guidelines on Performance of Procedures in Rural Sites.'

7.1.3 Electrophysiology (EP) Studies and Radiofrequency Ablation (RFA)

Electrophysiology (EP) studies are performed to assess and diagnose cardiac arrhythmias and conduction disorders and to evaluate the effect of drug therapy. Complex arrhythmias and atrial fibrillation are assessed using three-dimensional (3D) mapping technologies.

The procedure involves inserting a catheter attached to electric monitoring electrodes into a vein, usually in the groin or neck, and threading the catheter wire into the heart. Once the catheter reaches the heart, electrodes at its tip gather data and a variety of electrical measurements are taken. This data pinpoints the location of the abnormal electrical site and if amenable to treatment, RFA (destruction of tissue) or medical therapy may be used to treat the arrhythmias.

Some patients may require an override pacemaker or automatic implantable cardiac defibrillator inserted as part of the treatment of an arrhythmia.

Provisions for echocardiography, pacing, defibrillation, and resuscitation should be immediately available.

7.1.4 Pacemakers and Implantable Cardiac Defibrillators

Pacemakers may be temporary or permanent and are used to treat cardiac rhythm irregularities. Temporary pacing systems are used for a short period of time (days or weeks) and the pacing wire is external. All cardiac units (secondary and tertiary) should have the capacity for temporary pacemaker insertion. Permanent pacemakers are inserted under the skin under general or local anaesthetic and under sterile conditions in an environment that meets operating theatre standards. Pacemaker implantation is often performed in the same

room where EP studies are conducted. An implantable loop recorder (ILR) is a diagnostic device used to monitor cardiac rhythms and may be inserted to assess the need for a pacemaker. This procedure is typically carried out under local anaesthetic in a CCL or a procedure/operating room.

Implantable cardiac defibrillator (ICD) similarly controls irregular heart rhythms but additionally deliver electrical currents and provide a safety net against ventricular fibrillation and cardiac arrest. ICDs are inserted under general or local anaesthetic with conscious sedation to ensure no discomfort to the patient at time of insertion.

7.1.5 Echocardiography

Also known as a cardiac ultrasound, echocardiography uses standard ultrasound techniques to produce two-dimensional (2D) images of the heart chambers, valves and surrounding blood vessels. The latest systems now employ three-dimensional (3D) real-time imaging.

Transthoracic echocardiography (TTE) is a non-invasive procedure using a transducer passed over the chest wall to gain two-dimensional pictures of the heart and surrounds.

Transoesophageal echocardiography (TOE) is an invasive procedure where the transducer is inserted into the oesophagus under conscious or general sedation (to reduce discomfort and the gag reflex) and provides more comprehensive images than can be achieved by simple TTE.

A stress echocardiogram is a two-stage diagnostic examination used to assess cardiac function at rest and under stress. It supports the evaluation of coronary artery disease and provides information on cardiac valve function and intracardiac and pulmonary pressures. Cardiac stress is typically induced through exercise using a treadmill or stationary bicycle. Where patients are unable to exercise, pharmacological stress (e.g. dobutamine) may be used. Echocardiographic images are acquired at baseline and during and/or immediately following stress. This test typically takes one hour.

7.1.6 Exercise Stress Testing

Exercise stress testing is undertaken by a range of clinical specialties to assess functional capacity. In Cardiology, stress testing is performed on patients with known or suspected coronary artery disease to assess cardiac function under exercise conditions with the patient attached to ECG leads that record heart activity. It is usually undertaken on a motorised treadmill and less commonly on an exercise bicycle.

There is a small but definite risk of an adverse event during this procedure (arrhythmias, chest pain and cardiac arrest) and the room in which the tests are performed needs to be adequate to cope with complications. In the event of cardiac arrest, there needs to be space in the room to lay the patient on the ground and initiate CPR, and a resuscitation trolley and defibrillator needs to be immediately accessible.

The cardiac stress testing room may be used for ECG or exercise stress echocardiography as well as pharmacological stress testing. This is a diagnostic procedure in which cardiovascular stress is induced by pharmacologic agents for patients with decreased functional capacity or who cannot exercise. Pharmacologic stress testing is also commonly provided in a TOE room given a treadmill is not required. It is essential that a defibrillator/resuscitation trolley is located in close proximity.

Refer to Safety and Performance Guidelines for Clinical Exercise Stress Testing (Freedman and Colquhoun, 2014). This document represents the views of the Cardiac Society of Australia and New Zealand (CSANZ).

7.1.7 Ambulatory Monitoring

Holter monitoring records a continuous ECG usually over a 24-48-hour period while the patient is performing his usual daily activities. Monitoring can be used to:

- analyse the heart rhythm
- detect problems missed in a regular ECG
- evaluate chest pain
- check activity after a heart attack
- check the effectiveness of medications.

Electrodes are attached to the chest and then wired to a small digital recorder on a belt or shoulder strap. A wireless model is also now available.

Event monitor is another form of wearable device worn for up to 30 days or longer to record cardiac electrical activity when symptoms are experienced by the patient.

Refer to Guidelines for Ambulatory Electrocardiographic Monitoring (CSANZ, 2012). This document represents the views of the Cardiac Society of Australia and New Zealand (Cardiac Society of Australia and New Zealand 2009).

Ambulatory blood pressure monitoring can also be carried out. For this, the patient wears a cuff that inflates at regular intervals, and a small monitor records the blood pressure.

7.1.8 Tilt Table Testing

Tilt Table Testing is used for the investigation of syncope of suspected cardiothoracic origin. The procedure involves blood pressure and ECG monitoring while a patient is lying on a table that is then moved from a horizontal to a vertical position.

While tilt table testing remains clinically valid and useful in selected cases, its routine use has declined in many CIU settings. This reflects advances in ambulatory monitoring, such as Holter monitoring, the availability of more targeted diagnostic tools for arrhythmias and autonomic dysfunction, and a greater emphasis on clinical history and physical examination. Accordingly, this room is not included in the SOA for this HPU but may be provided in a designated or multipurpose room where clinically justified.