

EVIDENCE BASED DESIGN FOR ECIB**RECIPIENT**

Facilities Development Governance Group (FDGG)

PRESENTATION DATE

TBA

PRESENTED BY

Dr Katherine Tse, Healthcare Design Fellow, i3
Dr Robyn Whittaker, Public Health Physician, i3

Endorsed by:

- Jasmx
- Patient Experience Team
- Ideal Ward Leapfrog Project
- Institute for Innovation and Improvement (i3)
- W2025 Design Group

PROPOSAL AT A GLANCE

WDHB has completed concept design for the Elective Capacity Inpatient Beds (ECIB) project extension of Elective Surgical Centre (ESC). The aim of this project is to extend theatre and inpatient capacity and support a new endoscopy suite.

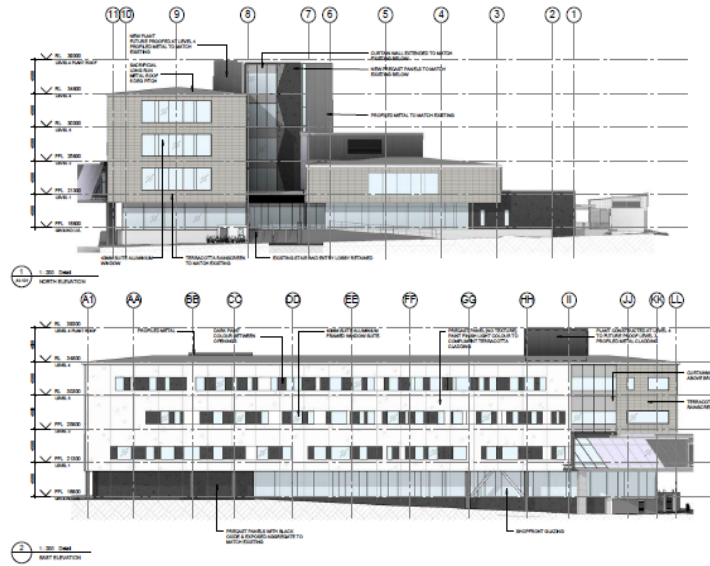
The dimensions of the proposed floor plates poses design challenges which will have implications on function, clinical workflow and patient safety. Furthermore, risk assessment and stringent planning is required to ensure that during the construction the impacts on patient and staff particularly in the Cullen Ward are minimised.

We propose that Evidence Based Design (EBD) is fundamental in providing innovative support for these challenges to be addressed.

This proposal aims to:

- Outline the ECIB project
- Highlight the effects facility construction and design has on user safety and experience
- Apply evidence based design literature as testimony for the provision of investment into design solutions
- Waitemata 2025 Design Group acknowledge the issues as important to prioritise and support innovative design solutions to be incorporated into ECIB
- Provide i3, Patient Experience, Leapfrog Programme with a mandate to research with Jasmax and other vendors to evaluate and research healthcare evidence based design
- Create a culture change and leadership within Waitemata DHB with support from Waitemata 2025 Design Group towards a human centered approach to facility design
- Provide our community with innovative facilities which place patient and staff safety and experience at the forefront of design, whilst delivering a built environment that is fit for purpose and flexible for future needs

BACKGROUND

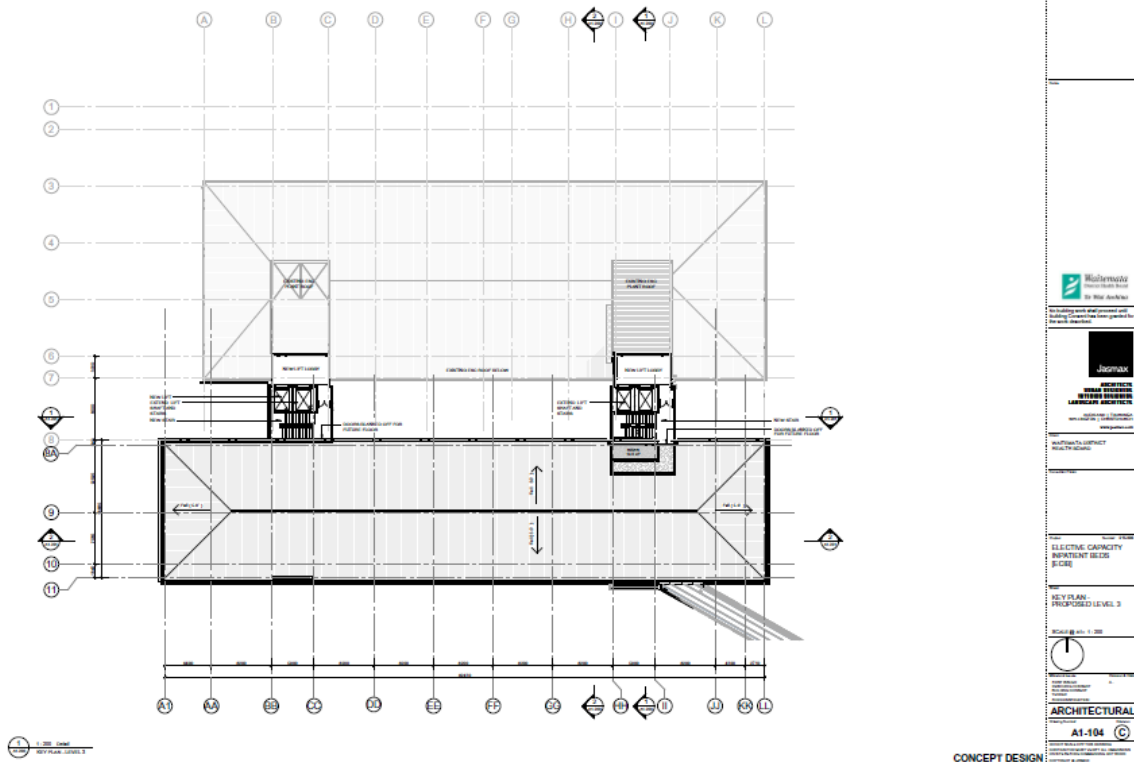


ELECTIVE CAPACITY INPATIENT BEDS [ECIB]

FOUR STOREY ELEVATION DESIGN - NORTH AND EAST

SK-522 REV
REVISED BY: J. SMITH
DATE: 18/06/2018





The Elective Capacity and Inpatient Beds (ECIB) is a project which aims to deliver an extension to the current ESC building. The appointed project Architect is Jasmx. This currently involves a four-floor extension onto the east aspect of ESC. The floor plates of the upper two floors have an internal length of 82.4m by 18.2m width, providing a space which is long and narrow. The dimensions, shape and location are dictated by the available site area that exist between the current ESC building and North Shore Hospital Road.

While the ground level (identified for a theatre extension) and level 1 (identified for an endoscopy extension) concept designs are complete, level 2 and 3 accommodating the inpatient ward requires innovative design solutions to ensure the ward meets Waitemata DHB design principals and facilitates achievement of our strategic direction of “best care for everyone”.

The two inpatient wards will accommodate 30 patients. The current concept design includes 10 single rooms, 6 double rooms and two “flexi” four bedded rooms. These “flexi rooms” are a four bedded room which will have a central partition which divides the room in half. To our knowledge these rooms have not been created in New Zealand.

In order to meet our goals for this build and remain true to our two priorities of better outcomes and enhanced patient experience we must consider the following design features and ensure these are investigated and evaluated.

ISSUES AT A GLANCE

Six issues are listed below citing affected Waitemata DHB design principles and Ideal Ward recommendations, plus possible design solutions to mitigate these. Possible areas for further research and investigation are included.

Noise + Sleep and Nature + View are examined in finer detail further in this paper.

1. NOISE + SLEEP	
Reasoning	<p>Noise is a common cause of poor inpatient sleep and a major complaint. Noise levels and reverberation a large cause of poor sleep – multiple causes eg. equipment, alarms, hard surfaces</p> <p>The ward currently contains 10 single occupancy rooms, 6 double occupancy and two four-bedded “flexi” rooms.</p> <p>Construction noise and vibration has been an issue with development projects at WDHB in the past.</p>
Design Principles, Ideal Ward	<p>Enhanced patient and whanau experience</p> <p>Increased noise due to low proportion of single rooms; does not meet Ideal Ward recommendations</p>
Suspected outcomes if concerns not addressed	<p>Poor sleep prolonging recovery, patient complaints, poor patient experience.</p> <p>Poor sleep is linked a to negatively effect on cardiovascular physiology (including raising blood pressure and heart rate), neuroendocrine homeostasis and inflammatory state.¹²³⁴.</p> <p>Noise pollution affecting staff concentration, communication and productivity.</p>
Design Innovations	<p>Acoustic separation between spaces and acoustic absorption within spaces to be developed with an Acoustic Engineer and/or Sleep Fellow.</p> <p>Co-design project with Patient Experience team and consumers to ensure good sleep hygiene and provision of a supportive environment for quality sleep.</p> <p>Formal Post Occupancy Evaluation (POE) of ratios of beds/room vs. length of stay, patient experience, noise levels</p>

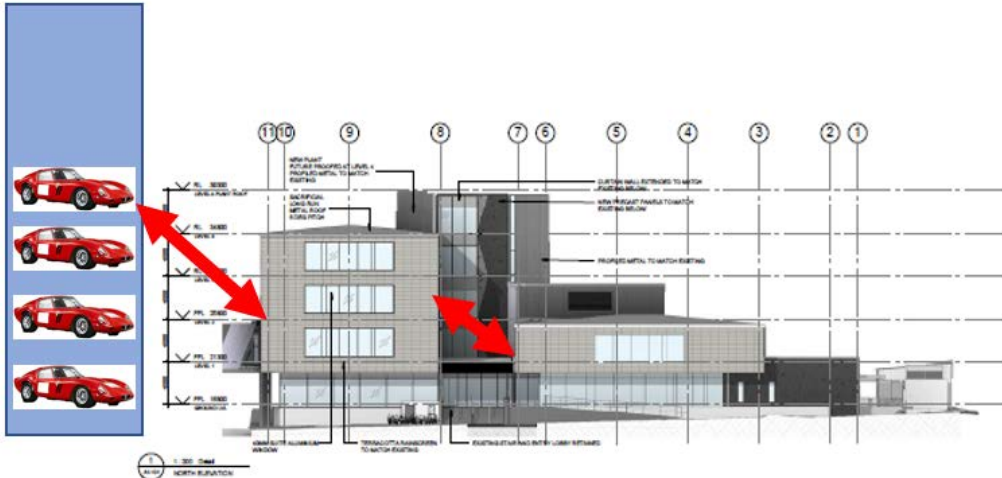
2. NATURE + VIEW

¹ Beccuti, G. Pannain, S. 2011. Sleep and Obesity, *Curr Opin Clin Nutr Metab Care*, 14(4), 402-412

² Faraut, B. Boudjeltia, K. Vanhamme, L. et al. 2012 Immune, inflammatory and cardiovascular consequences of sleep restriction and recovery, *Sleep Medicine Reviews*, 16, 137- 149

³ Hsu, S. Ko, W. Liao, W. et al. 2010 Associations of exposure to noise with physiological and psychological outcomes among post- cardiac surgery patients in ICUs, *Clinic*, 65(10), 985-989

⁴ Levy, P. Bonsignore, M. Eclél, J. 2009 Sleep, sleep-disordered breathing and metabolic consequences, *Eur Resp J*, 34, 243-260

Reasoning	<p>The west aspect of ECIB overlooks ESC's Cullen ward thus incurs issues with privacy. The east aspect of ECIB overlooks the public carpark causing issues with a lack of view and privacy. Growing body of evidence which shows the link between sunlight, view and nature with decreased length of stay⁵, decreased requirement for moderate to strong analgesia⁶.</p> 
Design Principles, Ideal Ward	<p>Enhanced patient and whanau experience Health promoting environments</p>
Suspected outcomes if concerns not addressed	<p>Reduced view and privacy issues from Cullen Ward. Patient privacy issues from carpark looking into ward. Decreased patient wellbeing, experience and outcomes such as increased length of stay, increased analgesia requirements and associated side effects.</p>
Design Innovations	<p>Green wall on public carpark for privacy and enhanced view Green courtyard containing shrubs and tall planting providing visual privacy between Cullen Ward and level 2 ECIB and improved outlook for both new and existing buildings Treatments for internal glass walls/windows resembling nature</p>

3. LINE OF SIGHT + DISTANCE WALKED

Reasoning	<p>Long and narrow ward requires a long corridor with increased distances between staff stations and patients</p>
Design Principles and Ideal Ward	<p>Low impact and high efficiency – this design does not support high efficiency; however this is due to the property available for the extension</p>
Suspected outcomes if concerns not addressed	<p>Poor visibility affecting patient safety, particularly with falls and unwell patients. Poor patient experience due to feelings of isolation if distant from staff and other patients. Distance to amenities being a barrier for patient independence Long travel distances for staff, particularly on night shift</p>

⁵ Gbjl, K. Madsen, H. Svendsen, S. et al. 2016 Depressed Patients Hospitalized in Southeast-facing rooms are discharged earlier than patients in Northwest-facing rooms, *Neuropsychobiology*, 74, 193-201

⁶ Ulrich, R. 1984, View Through a Window May Influence Recovery from Surgery, *Science*, 224, 420-421

Design Innovations	<p>Internal windows and glazed doors to allow for easier visibility through internal structures and into patient rooms.</p> <p>Virtual Reality to ensure glass is adequate for staff to visualise patients.</p> <p>Placement of public areas promoting patient independence eg accessible lounges and kitchens</p> <p>Post occupancy evaluation of glass – evaluating benefits and lessons learnt</p>
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4. FLEXI-ROOMS	
Reasoning	<p>Proposed flexi 4bedded rooms which have not been trialled in NZ, uncertainty over efficacy of these rooms</p> <p>Potential for change in patient cohort accommodated in these rooms in the future.</p>
Design Principles, Ideal Ward	<p>Flexible and future-focused</p>
Suspected outcomes if concerns not addressed	<p>A lack of knowledge of flexi rooms could lead to poor selection of flexi-room materials reducing usability, not meeting infection control requirements, not enhancing privacy or patient sleep</p>
Design Innovations	<p>Investigation into suitable operable walls to enable flexibility – how effective are these, what materials, impact on sleep/light/visibility/infection control</p> <p>Considering appropriate building materials for potential future uses of ward space</p> <p>Mock ups and simulations with material samples which can be re-used in situ.</p> <p>Site visits if another case is found to have flexi-rooms</p>

5. MECHANICAL EQUIPMENT ROOM	
Reasoning	<p>Placement of mechanical plant – initial concept design had this partially on the patient ward which uses space available for patient care. Unclear where this will be placed now that the extra level 3 has been added.</p>
Design Principles, Ideal Ward	<p>Flexible and future-focused</p> <p>Health promoting environments</p>
Suspected outcomes if concerns not addressed	<p>Reduced available footprint for clinical space if mechanical plant remains on the ward floorplate -results in reduction of single rooms, smaller patient rooms, less space for communal areas including space for post-operative rehabilitation</p>
Design Innovations	<p>Transparency over placement of this plant and reasoning for it's location including long term feasibility</p> <p>Involvement of consumers in design process in a move towards human centered design.</p>

6. WELCOMING ENVIRONMENT	
Reasoning	<p>Improved patient experience by providing welcoming environments that are intuitive to navigate and provide comfort.</p> <p>Patient feedback indicates that being welcoming and friendly is the most single important driver of a positive patient experience. This is critical to the achievement of our Board’s priorities to “enhance patient experience and achieve better outcomes⁷”.</p>
Design Principles, Ideal Ward	<p>Health promoting environments.</p> <p>Enhanced patient and whanau experience</p>
Suspected outcomes if concerns not addressed	<p>Poor patient experience, poor whanau experience due to uninviting environments and poor wayfinding</p>
Design Innovations	<p>Clear and obvious wayfinding incorporating colour, natural materials such as wood and texture to inform users of space and direction.</p> <p>Good use of external windows providing orientation.</p> <p>Use of modular furniture, flexible equipment that provides comfort and privacy</p>
	 <p><i>PLN group modular furniture, flexible and sound absorbing for communal spaces</i></p>

⁷ <http://www.waitematadhb.govt.nz/about-us/board-priorities/>



Consistent, clear wayfinding at Guy's Cancer Center, London. Floor levels clearly coloured externally and internally including incorporation in lift shaft



L: Clear identification of lift buttons



Furniture providing privacy, colour themed floor

FOCUSED ISSUES + EVIDENCE BASED DESIGN

Evidence Based Design (EBD) is a four-level evidence based process in which a designer, together with an informed client, makes decisions based on best information available from research and project evaluations. The concept takes cues from Evidence Based Medicine (EBM)⁸:

1. Evaluate evidence from scientific literature and the link between physical environment and health outcomes
2. Hypothesis creation based on evidence
3. Measure the results of the design innovation
4. Publically share results

Clinically we would expect medications to be prescribed only if they are proven to provide a benefit. The same could be applied to design – as a DHB we should support evidence which correlates the benefits of well-

⁸ Viets E., Lessons from evidence-based medicine: what healthcare designers can learn from the medical field, Health Environments Research & Design Journal, 2009 (2) 2, 73-87

designed environments to patient outcomes. Furthermore, WDHB should be evaluating their facilities from multiple disciplines including direct users formally by the likes of a Post Occupancy Evaluation (POE) on the fitness for purpose of facilities after refurbishments or developments. Lessons learnt from the design and construction processes should be utilised to continuously improve design, particularly as the DHB continues to develop its facilities.

The following two issues have been well investigated and support from the Waitemata 2025 Design Group is requested to ensure investment in design that achieves our priorities for enhanced patient experience and better outcomes.

1. NOISE AND SLEEP

Noise during construction

Construction noise and vibration pollution is a risk which needs to be stringently assessed and managed. This includes hours of construction, duration, appropriate and feasible timelines.

At Waitemata DHB during construction several, sudden decants of ICU and SCBU at North Shore Hospital have caused major disruption to care of intensive care patients and neonates.

In 2015 during the construction of Hine Ora ward, ICU was majorly affected by construction noise and vibration. The noise and vibration levels of the drilling works into ICU's ceiling caused occupational issues with staff who could not concentrate. Haemo-filtration units were not operable due to incompatibility with building vibration and dust accumulation onto consumables required the decant of these to secondary storage in CSSD. Dr Jonathan Casement, Clinical Director of ICU stated his personal decibel reader measured 120dB –of which Workforce NZ suggests protective hearing equipment is required once a maximum exposure of 5 seconds/day is reached⁹. The decision was made to decant ICU/HDU to Lakeview Cardiology centre in March 2015 for an estimated 3 weeks, however this became 12 weeks.

In 2016 SCBU was decanted twice during the refurbishment of Operating Theatre 1 below. The charge nurse manager of SCBU stated they were not involved in the construction risk assessment “as vibration was thought to go down and not up”. During drilling into concrete slabs on 8th July 2016, neonates in SCBU became agitated, desaturated and required oxygen. Staff and family had to “shout to be heard”. A decant was planned to transfer SCBU into PACU for one weekend. Once SCBU returned to the original premises scheduled floor slab drilling was consolidated to the hours of 6-8am and 6-8pm Monday – Friday only. Despite this, a second decant was required this time into HDU for five weeks. A lack of space for neonatal equipment in HDU meant that some equipment had to remain in SCBU, resulting in reduced efficiency and fragmented resource allocation.

In theatre, Dr Mike Rogers HOD General Surgery commented that he had to stop a bowel resection due to construction noise affecting his concentration.

Discussion with multiple parties affected by construction vibration and noise led to a common theme that communication is key – between construction/facilities and a nominated clinical staff member, and patients.

These are three recent examples of the effects of construction on the most vulnerable patient cohorts in Waitemata DHB. It is known construction pollution has historically had a major impact on patient care and

⁹ Worksafe New Zealand Factsheet: Noise Levels created by common construction tools
<http://construction.worksafe.govt.nz/assets/resources/WSNZ-1311-Construction-Machinery-Fact-Sheet-v5.pdf>

staff ability to deliver care and WDHB should ensure this is considered as a risk and contingency in place should construction have an effect on patient and staff safety.

Discussions between project managers, health and safety consultant and Facilities have been held discussing the risks for the ECIB project with possible strategies to mitigate risk. This will need further planning if the ECIB project is accepted by Treasury.

Noise during occupancy

Poor sleep is a common complaint, although there are multifactorial causes for this noise is a common factor which can be mitigated. Sleep is vital for physiological recovery, endocrine regulation and deprivation has been linked to enhanced inflammatory state^{1,2,3,4}. An acoustic study from the University of Auckland¹⁰ conducted on Ward 7 NSH (Acute Orthopaedics) in April 2017 showed the day and night decibel readings were consistently louder than WHO and Australasian Standards. Interviews with patients revealed common causes for this cohort was noise from equipment, other patients particularly in shared rooms, staff noise and inadequate curtains.

Improving patient sleep is a WDHB priority and is evident from the Sleep Program which has been in action for two years. The ECIB project has the opportunity to work with the Sleep Program group and address a registered organisational risk, while placing patients at the centre of care.

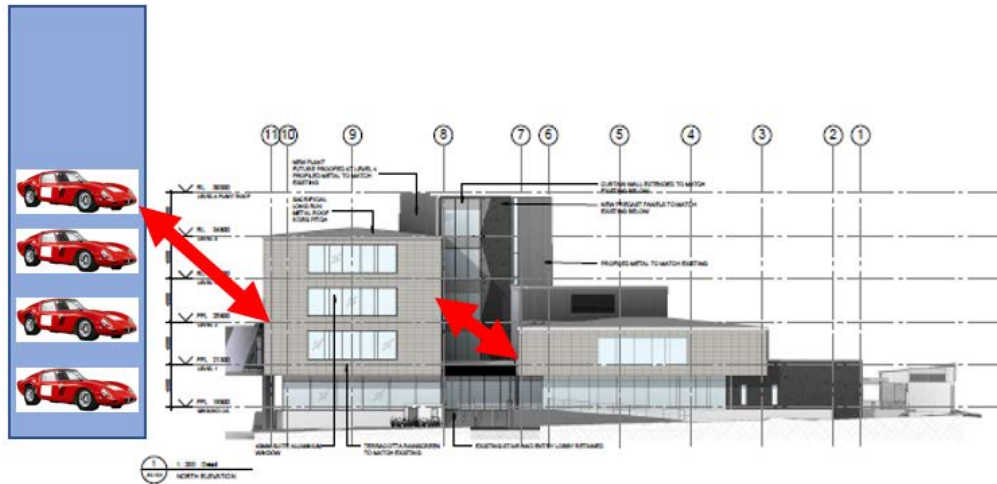
Innovations include:

- Services: acoustic engineer expertise – both during construction and for internal design
- Furnishings: Using sound absorbing materials, glass to provide acoustic sheltering but also provide visibility, sound absorbing patient curtains, acoustic panels on ceilings or walls, soft furnishings, reducing reverberance
- Co-designing with Sleep Program to ensure patient sleep considered throughout design process, optimising and improving patient experience and safety
- Demonstrating a consumer focused culture

2. NATURE AND VIEWS

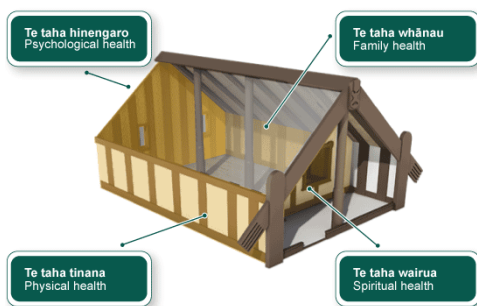
There are two main areas of ECIB in which privacy and view are compromised. The west aspect of ECIB overlooks ESC's Cullen Ward – with the main issue with ECIB ward patients being able to see into the Cullen Ward. Jasmox have proposed a green courtyard providing visual privacy and improved outlook for both new and existing buildings. The second area is the east aspect of ECIB which is overlooking the public carpark – this carpark having partial screen cover and the rest open for view into the ward. The use of greenery can provide both privacy, a therapeutic green space and enhanced patient experience with nature and views – improving patient and staff satisfaction.

¹⁰ University of Auckland, Acoustic Sound Study Ward 7 North Shore Hospital



The link between nature and improved health outcomes is known. Research in Denmark showed people living more than 1km from a green space were more likely to be obese and less likely to exercise rigorously than those living closer than 300m¹¹. Those living within 300m of green spaces report better self-perceived health and mental health¹² and increased positive emotions. Although hospital is a different context, the value of green space and a view is increasingly being investigated and appreciated. This is an area in which WDHB could contribute by implementing and researching the benefits of view and green space on patient experience and outcomes.

Furthermore as a DHB, we need to consider not only the western model of health but also the Maori Whare Tapa Wha. This encompasses four walls of a whare of which are constituents of health and wellbeing. Whanau (family), Hinengaro (mental health), Tinana (Physical health) and Wairua (spiritual health). A qualitative study interviewing Maori healers found a common theme that Maori identity was linked to the earth by a sense of belonging to the land, being part of the land and being bonded together with the land¹³. The access to a garden, or at least a view of nature supports this model.



Nature can also be used to provide privacy for the courtyard between Cullen Ward and the new ECIB wards. This could be designed by a landscape architect considering growth and maintenance of such greenery.

¹¹ Toftager, M et al. (2011) Distance to green space and physical activity: a Danish national representative survey. *J Phys Act Health*, 8 (6), 741–749

¹² Triguero-Mas, M et al. (2015) Natural outdoor environments and mental and physical health: Relationships and mechanisms. *Environmental International*, 22, 35–41

¹³ Mark, G. Lyons, A. 2010 Maori healers’ views on wellbeing: the importance of mind, body, spirit, family and land, *Social Science and Medicine*, 10, 1756-1764



Green Screen House / Hideo Kumaki Architect Office

Furthermore, there is increasing demand for buildings to be “green” in both commercial and residential sectors. This is yet to become common in New Zealand health facilities in which there is only one hospital (Forte Health, Christchurch) which has been GreenStar rated with a 4 star accreditation.



Green Hospital render, Tokyo, Kengo Kuma



New Green Wall on Children's Library Spain, / Jose Maria Chofre

Within the ECIB space itself, simulated nature can also be incorporated via window films, artwork and if used on large scales can act as wayfinding for patients and whanau.





Innovations include:

- Green wall between car park and east ECIB
- Green courtyard between west ECIB and Cullen Ward
- Nature depicting window and wall treatments
- Consideration of sustainable materials and systems such as rain water harvesting for toilets, specific low volatile organic compound paints and adhesives
- Formal evaluation of patient experience and outcomes

EXPECTED OUTCOMES WITH EBD

Short term:

- Ensure patient safety, experience and positive health outcomes remain at the forefront of this project
- Real world demonstration of the Core Design Principles and Ideal Ward research within a Waitemata DHB facilities development, potentially providing an exemplar ward for innovative future hospital facilities design features nationally
- An innovative structured research based ward design approach in New Zealand
- Contributing to the growing breadth of data-driven and evidence based design in New Zealand

Long term:

- Allowing for flexibility when refurbishment is required for changing demographics and models of care
- Evidence based design providing recommendations and information to guide future design at Waitemata DHB

REQUEST FOR FDGG

- Endorse i3, Leapfrog, Facilities and Patient Experience groups to be involved in an evidence based design approach to the ECIB project if/once approved
- Endorse the use of external interested parties in this field such as academic institutions, researchers, New Zealand Health Design Council, Jasmax in sharing expertise and knowledge
- Work with Well Foundation and other external supporters for funding on extra costs in trialling, evaluating and implementing options
- Endorse the trial of testing various solutions as appropriate, running pilots/simulations/evaluations of products and solutions
- Share information with other DHB's and contribute to Evidence Based Design.
- Support escalation of this paper to appropriate groups at WDHB as required