Garvan, St Vincents

Garvan St. Vincent's Cancer Centre

ESD Project Application Report

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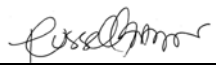
		Signature			
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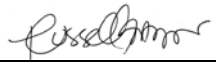
		Signature			
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1 Introduction

Arup has been commissioned by both the Garvan Institute of Medical research and St Vincent's and Mater Health Sydney to provide an Ecologically Sustainable Development (ESD) strategy for the new Garvan St. Vincent's Cancer Centre (GSVCC) located in the St Vincent's Research Precinct on Victoria Street, Darlinghurst, Sydney. The proposed GSVCC site is on Victoria Street, between Burton and Liverpool streets, in the Darlinghurst neighbourhood.

This document describes the key features of the ESD strategy for the purposes of the Project Application submission.

The building is a new twelve (12) storey medical facility and provides four (4) levels of basement car parking. The building generally comprises consultation areas and research laboratories. Research laboratories are to be designed to PC2 levels, although the client will decide upon timing and/or application of certification at a later stage.

The project will meet national and international standards for sustainable building performance and operation appropriate to the building function, whilst giving consideration to whole of life costs and the project's capital budget.

2 Summary Response to the Director-General's Requirements

►ESD Principles include the investigation of national and international rating tool guidelines to measure sustainability and definition of a sustainability plan, the reduction of energy consumption, water conservation, bio-diversity, and carbon reduction.

►Water-sensitive Urban Design Measures include proposals for rainwater capture, storage, and reuse; water-efficient tapware; green roofs to reduce stormwater runoff; and low or no-water irrigation.

►Energy Efficiency initiatives include proposals for efficient equipment selections, high-performance façade materials, and the investigation of solar photovoltaics.

►Materials initiatives will include the reduction of Volatile Organic Compounds to improve indoor air quality and to reduce the release of known carcinogens into the biosphere.

Further details on specific initiatives are provided within the body of this report.

3 Report Scope

This report is written in response to the Department of Planning Director-General's Requirements for the Project Application for the Garvan St. Vincent's Cancer Centre.

4 Ecologically Sustainable Development Principles

Ecologically sustainable development aims to sustain and conserve natural resources through *'using, conserving and enhancing the communities' resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased'* (Commonwealth Government of Australia, 1990).

The principles of ecologically sustainable development will be an integral consideration throughout the process of developing the GSVCC and assessing its benefits and impacts. In addition, the preparation and exhibition of the environmental assessment in itself contributes to the consideration of the principles of ecologically sustainable development.

5 Garvan and St. Vincent's in the Sydney Context

The *Sustainable Sydney 2030 City of Sydney Strategic Plan* (SS2030) is a comprehensive document produced by the City to address global climate change and resource scarcity as it

affects the core of Sydney, including the Darlinghurst neighbourhood. The GSVCC is located within the St. Vincent's campus, which represents one of the largest energy and water demands in the central urban area. As an institution with a mission of providing essential health care and medical research for Sydney residents and all Australians, the GSVCC and St. Vincent's will respond to the planning and design strategies outlined by the SS2030 Plan where those strategies are appropriate to the project.

It should be noted that the SS2030 Plan contains a significant amount of governance strategies that pertain to how the City of Sydney addresses sustainability. It is not a design guideline, but rather a high-level planning document meant to be used by the City to prioritise planning issues, with particular focus on the CBD. Thus, its application to a project like the GSVCC is relatively limited. However, the GSVCC's commitment to sustainability and best practice laboratory design has translated into a number of initiatives that correspond in spirit to the goals of the SS2030 Plan:

TARGET 1
By 2030, the City will reduce greenhouse gas emissions by 50% compared to 1990 levels, and by 70% compared to 1990 levels by 2050.

The GSVCC seeks to reduce greenhouse gas emissions by increasing energy efficiency through a building management system, heating water using solar panels, using auto closing sash fume cupboards, providing extensive electrical metering of major loads, installing efficient ventilation systems and controls that respond to air quality sensors, and purchasing at least 20% of its electricity through a GreenPower contract.

Further detail is provided in section 8.

TARGET 2
By 2030, the City will have the capacity to meet up to 100% of its energy demand and 10% of its water supply.

The GSVCC will includes a rainwater harvesting system to supply non-potable water to the building's irrigation, toilets, and cooling towers in order to reduce potable water consumption. The building will also include highly efficient tapware, extensive water metering, and an innovative condensate reuse system.

TARGET 5
By 2030, the City will contain at least 465,000 jobs with an increased share in sectors that reflect the City's specialisations, namely finance, advanced business services, education, creative industries and tourism.

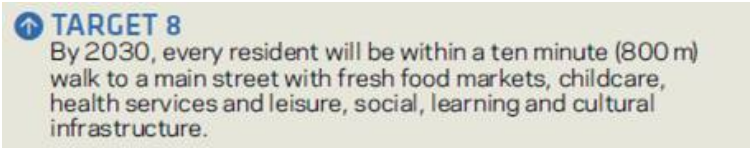
The GSVCC will bring additional jobs to the Darlinghurst precinct, providing a range of educational opportunities in advanced medical research.

TARGET 6
By 2030, the use of public transport for travel to work by City Centre workers will increase to 80% and the use of non private vehicles by City residents for work trips will increase to 80%.

The GSVCC will incorporate a number of alternative transportation strategies, including preferred parking for car pool, small cars, and alternative-fuel vehicles. Infrastructure will also be designed into the car park as "future proofing" for the anticipated installation of electric car charging stations when available. The GSVCC is also located near major public

transportation corridors along Oxford Street and in Kings Cross, as well as developing bicycle routes along Williams Street. By locating the building in this transport nexus, the GSVCC will strengthen these networks and further move the city away from a reliance on private cars. The GSVCC's lobby will also include an environmental informatics display that will include public transport information for visitors and building occupants, to encourage behavioural change toward sustainable transport use.

The GSVCC includes nearly 40 secure bicycle storage spaces, as well as changing facilities to accommodate employees.



The GSVCC's location ensures that occupants will have access by foot, without need of a car, to social and commercial amenities during the work day.

5.1 SS2030 Plan and GSVCC Synergies

In addition to the main over-arching targets of the SS2030 Plan, there are several other targets that apply directly to the GSVCC development that are not previously addressed. These are outlined below:

5.1.1 Education

SS2030: The SS2030 Plan refers to the Garvan Institute as a "world-class education institution" that should be "encouraged to play a greater role in the economic life of the precincts and communities in which [it] resides."

GSVCC Initiatives: An attractive, new, high-performance, green research laboratory building will attract world-class research staff to the GSVCC and the Darlinghurst neighbourhood, as well as significantly improving health care amenities for cancer patients undergoing treatment and evaluation.

5.1.2 Stormwater

SS2030: The SS2030 Plan views water as "celebrated and retained for re-use."

GSVCC Initiatives: The GSVCC's rainwater harvesting system will capture and reuse water for irrigation, toilet flushing, and cooling tower make-up. In addition, the GSVCC has committed to eliminating the use of copper solders in the stormwater system in order to prevent copper contamination of public stormwater systems and, ultimately, Sydney Harbour.

6 Occupant and Community Benefit

High-performance green buildings have been shown to increase the productivity of staff and to contribute to better health for occupants. As a medical research and Healthcare institution, the GSVCC has committed to implementing strategies that will lead to positive behavioural change with building occupants and visitors:

Environmental Informatics: As a part of its atrium lobby, the GSVCC will include a digital means of conveying real-time building performance, staff events, transportation information, and environmental lifestyle advice. Such systems are not only "community bulletin boards"

for events and communications, they are a way to slowly raise consciousness about how we interact with the built environment and how our decisions lead to resource consumption.

Building User Guides: Staff and occupants of the GSVCC will receive a building user guide once they move in, to explain how the building is meant to operate, what facilities are provided for their use, and how they can improve the performance of the building through their own choices, such as with lighting and ventilation systems.

Transport: The GSVCC will include bicycle parking for staff, change facilities, and infrastructure for electric vehicle charging stations. The transport section below includes more information on these initiatives.

7 ESD Process

The GSVCC project will incorporate sustainability principles into the integrated design process for the project. This process includes stakeholder feedback and workshops, the review and benchmarking of national and international sustainable design rating tools for use as guidelines, and ultimately the development of a Sustainability Design Plan to set goals and track accomplishments.

7.1 ESD Workshop and Sustainability Design Plan

An ESD workshop was held on 9 March 2009 to identify the key goals of the project. The following is a list of the key priorities identified during that workshop:

- Commissioning, monitoring and maintenance.
- Design longevity.
- The ability to attract world-class researchers.
- Integrated services/structure/architecture.
- Energy minimisation.
- A building that delights all of its stakeholders: users, public, financial sponsors alike.
- Innovation: improving on current best practice by looking at the challenge in a new way.
- Air-conditioning and ventilation efficiency.
- Campus model: shared space such as cafes, break-out spaces and meeting rooms.
- Community benefits: gives back to the community through research and energy production.

7.2 Benchmarking and Compliance Requirements

This development, while part of a larger facility, will be primarily a research centre containing laboratory and office space, as well as clinical care, retail and car park spaces. Currently a wide selection of ‘green design’ rating tools exist for commercial, retail, residential and healthcare developments, with less information available for laboratory spaces. The approach to benchmarking this project is to identify the most relevant rating tools to healthcare and laboratory spaces and apply the concepts where applicable. The following tools are investigated:

7.2.1 Green Star Health Care

The Green Star rating schemes are voluntary holistic sustainable design rating tools which have been set up and are managed by the Green Building Council of Australia. These tools

are used to guide the design process, and address a wide spectrum of environmental performance measures dealing with social, economic, and environmental issues.
The Green Star Health Care Pilot tool has target performance levels in the general areas of water, waste, IEQ, management, energy, emission and transport and with specific targets for medical equipment and trade waste pollution.

Currently the GSVCCC will be comprised of Class 5, 8 and 9b spaces to the BCA. While there are individual Green Star tools which rate these BCA classifications, they all have required area proportions which are not met by the GSVCCC. As such the project does not qualify as a health care facility as defined by the GBCA and consequently the design team cannot pursue a formal green star health rating for this project.

7.2.2 LEED Health Care

The United States Green Building Council produces a suite of tools called LEED, which is a third-party certification program and an internationally accepted benchmark for the design, construction and operation of high-performance green buildings. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. The LEED program includes a specific health care system that mostly addresses acute care hospital design, however there are many worthwhile credits and benchmarks included in the program. For the GSVCC project, however, LEED is considered within the context of two other relevant tools—the Green Guide to Health Care and LABS 21—explained below. Since the LEED tool does not address laboratory buildings, the GSVCC design team will not pursue a formal certification.

Appendix A lists the various recommendations of the LEED, in conjunction with the other tools mentioned and reports the application to the GSVCC project.

7.2.2.1 Green Guide to Health Care

The Green Guide to Health Care is a voluntary, self-certifying metric toolkit of best practices used to guide and evaluate progress towards high-performance healing environments.

The tool was developed in collaboration with LEED by health care design and industry experts. Many of the concepts outlined in this tool translate well to the GSVCC. The goal of providing superior indoor air quality, a fundamental requirement for health care facilities, by eliminating most carcinogenic indoor emissions is one that is particularly appropriate for a world-class cancer research centre. Again, because this tool does not specifically address laboratory buildings, a formal certification will not be pursued.

Appendix A lists the various recommendations of the Green Guide to Healthcare, in conjunction with the other tools mentioned and reports the application to the GSVCC project.

7.2.2.2 Labs 21

The most comprehensive lab benchmarking program underway—Laboratories for the 21st Century (www.labs21century.gov)—is in the United States, although many international projects have relied on the program. A joint venture between the U.S. Government's Department of Energy and the Environmental Protection Agency and recently expanded to the U.K., the Labs21 program has collected information on hundreds of new laboratory buildings in public, private, and institutional sectors to create a benchmarking database for a variety of metrics. The energy metrics are based on the American Society of Heating, Refrigerating, and Air Conditioning Engineer's Standard 90.1-2004 Energy Efficiency in Buildings (ASHRAE 90.1).

The approach to lab design contained within Labs21 will allow the design team to set realistic energy benchmarks to an agreed set of perimeters, providing a design target that can be measured against throughout the design phase. It has been determined that the

GSVCC cannot participate as a Labs21 pilot, since it's a foreign project, but the Labs21 program can still be used as a guideline for design.

Appendix A lists the various recommendations of Labs 21, in conjunction with the other tools mentioned and reports the application to the GSVCC project. The GSVCC project is targeting the top 25% of performance when measured against benchmark labs in the Labs 21 program.

7.2.3 NABERS Energy

The NABERS Energy program, formerly known as the Australian Building Greenhouse Rating (ABGR), is widely recognised for energy emissions rating. It was born from the perceived need to encourage existing buildings to reduce their energy-related impact on the environment. The scheme rates a building's Green House Gas (GHG) emissions, which lead to global warming compared to other buildings.

Currently NABERs provides rating schemes for commercial, residential, retail buildings and hotels and is developing a tool for health care. However, achieving a NABERs rating for the GSVCC will not be a key goal for this project. The design team will track the progress of the NABERS health care tool as it is developed and otherwise strive to incorporate NABER's key goal of reducing operation energy consumption as a fundamental design target if possible.

7.2.4 TS-II

The NSW Government and NSW Health developed the *Engineering Services and Sustainable Development Guidelines Technical Series TS11* to address the design and construction process of public health care facilities in NSW. These guidelines address a full range of services, including mechanical, electrical, hydraulics, and communications, as well as including an overview of good sustainable design practice. These guidelines refer to other documents, as well, such as the Environmental Performance Guide for Buildings (EPGB).

The key objectives of TS11 are to design a building that results in the following:

- Comfortable and healthy indoor environment (in terms of thermal comfort, visual comfort and indoor air quality)
- Minimised non-renewable resource consumption (e.g. energy, water) and environmental impacts (e.g. greenhouse, other air and water emissions, solid waste)
- Cost-effectiveness over its whole life cycle.

These objectives will inform the ESD design of the building. One of the key requirements of TS11 is to establish early on and consistently report the ESD objectives throughout the design process. The *Sustainability Design Plan* will be consistently updated throughout design to reflect the goals, decisions, technical details, and analysis as developed by all members of the client, design, and construction teams.

7.2.5 Building Code of Australia – Section J

Section J of the Building Code of Australia is concerned with energy efficiency of buildings. Minimum performance requirements have been set in regards to building fabric gain, external glazing, building sealing, air movement, HVAC systems, lighting and power, hot water supply and access for maintenance.

Section J is a minimum performance target for standard buildings. The GSVCC is aiming to be a best practice sustainable building and will exceed the requirements for Part J.

7.2.6 Sustainability Design Plan and Design Integration

Due to the nature of the GSVCC, no single rating scheme will be appropriate. As such the previously mentioned rating schemes have been investigated and the most applicable and

beneficial targets and strategies have been identified. This collection of targets and strategies will then become the basis against which the design process will be measured. These targets are summarised in section 8.

This system will be tracked as part of the *Sustainability Design Plan*, which will follow the integrated design process involving the architects, consultants, contractors, and client groups as required as part of true project integration and collaboration.

8 Resource Consumption

The driving force behind 'building green' is the need to minimise resource consumption. A number of strategies will be investigated in the context of the GSVCC which will help to reduce the building's resource consumption.

8.1 Energy Efficient Design

Energy efficiency will be a key design target for the GSVCC. Laboratory spaces are extremely energy intensive spaces due to their high ventilation requirements and equipment loads. By designing the building to be more energy efficient, the end result will be a more cost efficient building to operate especially in light of the likely increase in energy costs. A two pronged approach will be taken to reducing the energy consumption of the building.

8.1.1 Energy Reduction Strategies

Reducing the energy requirement of the building by using the most efficient equipment available is a fundamental approach for the sustainable design of the GSVCC. The design of the GSVCC will target the top 25% of performance when measured against benchmark labs in the Labs21 program. The design will pursue this by incorporating daylighting and solar gain reduction initiatives, active ventilation control via air quality sensing, as well as through passive ventilation where appropriate.

In order to reduce energy loads, the design will implement the following initiatives:

- **General:**
  - An integrated building management system for systems controls.
  - Occupancy sensors for lighting throughout the building
  - High-performance façade materials with external shading devices to reduce solar cooling demand by 40% at peak condition and even greater at non peak times.
  - Good insulation that exceeds Section J requirements
  - Where not restrained by future extension impacts, a green roof will be provided to improve insulation and thermal mass.
- **Central atrium:**
  - Tempered spill air from adjacent spaces.
  - Tempered control of atrium conditions, focussing on passive measures where feasible. Currently phase change material is being considered for the atrium structure to minmise supplemental mechanical cooling requirements. Heat recovery from exhaust from the labs is also being considered.
  - Maximise daylighting to reduce electrical lighting energy consumption
  - Exterior sun shading to reduce solar gain and daylight glare
  - Potential for mixed-mode or tempered supply air
- **Office areas:**

- Low temperature Variable Air Volume (VAV) ventilation system to minimise fan energy compared with traditional VAV design.
- Daylight optimisation for enclosed perimeter offices.
- Minimal and high-efficiency lighting, coupled with task lighting
- Exposed structure to reduce material use and activate thermal mass to reduce mechanical cooling requirements.
- Mixed-mode ventilation is being considered for meeting rooms.

- **Laboratory spaces:**
  - Maximise daylighting within the performance constraints of the laboratory's environmental tolerance
  - Efficient ventilation systems and control
  - Proposed automatic sash closers on fume hoods to save energy through reducing conditioned air lost to the fume cupboard ventilation system when sashes are left raised.
  - Innovative air quality monitoring systems to manage supply air and conserve energy via reducing air change rates when air quality and temperature is maintained. This initiative is expected to provide significant energy savings.
  - Right sizing of laboratory electrical loads. The project team are undertaking actual monitoring of the existing facility to ensure electrical capacities and cooling capacities are not oversized for the application.

8.1.2 Renewable Energy

The design will provide a solar thermal hot water system on the roof of the GSVCC to reduce energy demand by using the sun's energy to pre-heat water for use in the building. A standard solar thermal module system will be selected with full back up hot water provision from a gas system.

A green power contract will be specified for the building requiring a minimum of 25% of the building's energy requirements are met by a green power producer (excluding hydro power). This will be an ongoing management process.

8.1.3 Energy-efficient Equipment and Controls

The project will target specifying and select all new equipment so that it meets current best practice for energy efficiency. For appliances, products supplied with the Energy Star or TESAW labels will be used, where possible and appropriate. These should mostly be within 1 Star of the best available appliance on the market based on Australian Government standards.

Car park ventilation energy consumption will be reduced through the use of variable speed drives (VSD) and carbon monoxide sensors. The use of occupancy sensors to reduce lighting and fan use will also be investigated during detailed design to further reduce energy use.

Systems containing refrigerants will be housed in a moderately air-tight containers and the design team will investigate the use of a refrigerant leak detection system at all critical points. In such a system, upon alarm, factory-installed standard refrigerant recovery systems will ensure no leakage occurs.

8.1.4 Environmental and Energy Modelling

Two models are being developed to help inform decisions about how to best provide cooling and reduce energy consumption in the GSVCC:

Computational Fluid Dynamic Model: This model is being undertaken for the atrium to identify the potential for air stratification and heat build-up that could lead to poor indoor environmental quality. This model will be used to test alternative strategies for passively or efficiently reducing heat gain in the atrium, while maximising daylighting and openness.

Passive measures to reduce cooling demand in the atrium are being considered and these include potentially the use of phase change material within the atrium structure to increase the activation of thermal mass, and also heat recovery from laboratory exhaust.

A second model will be performed on a typical laboratory space to identify any possible improvements to how the air flow will function with fume hoods operating. This model will assess Air Change Effectiveness (ACE) as defined by AS1668.2 and will target levels stipulated by Green Star for typical building spaces as a minimum performance standard.

Energy Model: A full energy model is being developed that will give the project a realistic baseline for energy performance of all proposed systems in the GSVCC. The energy model will be used to test alternative design strategies that could lead to further energy improvement. This model will also allow the GSVCC to be compared to other laboratory project energy benchmarks to guide the project in its sustainability approach.

8.1.5 Metering

Metering of major electrical loads will be specified in order to improve performance over time. The project will incorporate a commissioning and building tuning plan into the building's design, construction, and operation.

Meters will be included for all energy usages exceeding 100kVa in line with standard Green Star requirements. These meters will be linked to the building management system and results displayed publicly using building informatics.

8.1.6 Energy-efficient Lighting Strategies

It is proposed that the GSVCC will use occupancy sensors and high-efficiency lighting. The design will not, where ever possible, use incandescent or halogen lamps and instead design with T5 fluorescent fixtures in offices, labs and conference rooms. The design will use LED light fixtures where possible to extend lamp life and reduce re-lamping costs and waste. For corridors, the design will use high-efficiency fixtures with maximum on-centre spacing to reduce energy use and will avoid using purely decorative luminaires or light sources with poor efficacy.

The GSVCC will be designed to take advantage of maximum daylight, while avoiding glare and thermal comfort issues. Design analysis has indicated the proposed shading screen for the façade will reduce blind use to control sunlight glare by between 30-50%, which translates into better daylighting and access to views for building occupants.

Lighting levels will be designed to meet and not exceed the levels stipulated in AS1680.2 in this way no energy will be wasted on unneeded lighting. Individual offices and consulting rooms will all have their own lighting zones and in open plan areas lighting zones will not exceed 100 m^2. High-frequency ballasts (at least 32,000 Hertz) for fluorescent light fixtures will be specified.

8.1.7 Dark Sky Lighting Requirements

The project will attend to diurnal patterns and biodiversity by minimising dark sky issues by installing low cut-off luminaires that direct light on surfaces and not toward the sky. The team will also design site lighting in accordance with Australian Standard 4282-1997 (*Control of Obtrusive Effects of Outdoor Lighting*) and, where possible, ensure that at least

95 percent of outdoor spaces do not exceed the minimum requirements of AS1158 for illuminance levels.

8.2 Water-Sensitive Urban Design Measures

Water consumption is always a key focus of sustainable developments in Australia – one of the driest continents in the world. As such, the project will seek to reduce potable water consumption as much as possible using a variety of methods:

Rainwater Capture: The project has included a rainwater capture system that collects water from the GSVCC roof and stores it in a tank for reuse for toilet flushing, irrigation purposes, and cooling tower water make-up. This will significantly reduce the potable water consumption of the building. A 50,000 L rainwater tank will be located in the roof plant room and is expected to store approximately 1,160,000 L annually. This rainwater will cover between 10% and 15% of the building's annual non-potable water requirements.

Water Efficiency: The GSVCC will use water-efficient tap ware based on the Water Services Association of Australia's National Water Conservation Rating and Labelling Scheme. A minimum of rating of 5 stars for taps, 4 stars for WCs and 6 stars for urinals will be required for the building. Water use for irrigation and recycled water will be metered for the building and site.

Fire System Water Consumption Minimisation and Capture: A bypass valve and a storage tank, sized to house the total quantity of water expelled during a single test which would be expected to be in the order of 10 m^3, will be included in the design of the fire water system such that testing any water used for testing will be able to be salvaged and reused on site.

Water Monitoring: Water meters will be installed, in line with standard green star requirements for, for all large-scale water uses including cooling towers, hot water services, and kitchen facilities. These meters will be linked back to the BMS. In addition to metering large scale water use, each individual laboratory will be monitored as well.

Condensate Water Reuse: The design will incorporated an innovative conservation system on air handling units on the roof that will collect condensate water and reuse it in either the cooling towers or as additional water into the rainwater storage tank. This condensate water is normally fed into the stormwater system. This initiative will contribute to further reduce potable water use in the GSVCC.

Condensate reuse will result in approximately 270L of icy cool water being diverted from the drain. While not an enormous quantity of water, this is approximately equivalent to the water used by an average one unit apartment in Sydney.

Targeted Water Reduction: Using the water meter data, a baseline will be set for the building's water consumption and strategies will be considered to reduce consumption by 20% over an agreed period.

Process Water Metering: Meters will be provided at each laboratory to gauge water use and identify those labs that are using excessive amounts of water. These metered approaches have been shown to help a building's maintenance staff identify wastage and improve overall water conservation.

Stormwater: Consideration will be given that all stormwater leaving the site will be treated in accordance with the *Urban Stormwater Best Practice Environmental Management Guidelines* (CSIRO 1999) and *Australian Runoff Quality, A Guide to Water Sensitive Urban Design* (Engineers Australia, 2006), for all 1-in-20-year storm events. This may require the use of sand filters or other such devices, mainly targeted for the plaza proposed on the ground level between the existing Garvan Institute to the south, the Victor Chang building to the east, and the GSVCC.

8.3 Micro-Climates

The project has incorporated a number of options that will improve the overall environmental quality of the built environment in and around the GSVCC:

Green Roof: Where not subject to future building extension restrictions, a green roof will be installed. This is to be provided on the roof of the meeting space on Level 07. This type of roof improves bio-diversity on the site, provides some reduction the heat island effect that contributes to increased air-conditioning use during peak summer months, and reduces the site's peak stormwater runoff.

This roof will be a green roof approximately 15 cm in depth comprised of native draught resistant species.

8.4 Commissioning

One of the key objectives for the GSVCC is to include building commissioning and tuning, beginning as part of the integrated design process and following through into building operation. Commissioning will occur for all major systems, such as mechanical, hydraulics, and controls.

An independent commissioning agent will be employed to overview the design process and well as post occupancy building tuning which will occur over a minimum of a heating and a cooling period.

8.5 Materials, Recycling and Waste Disposal

The material strategy for the GSVCC will target the minimisation of the use of all products with harmful, carcinogenic emissions such as VOCs, formaldehyde, and chromium. Lists of all known carcinogens have been compiled from sources such as the United States National Toxicology Program, the World Health Organisation and the U.S. and Australian Environmental Protection Agencies. These lists will inform the material selection process where possible. In general, the following areas and principles will be considered when making material selections:

- Minimisation, reuse and recycling
- Embodied energy
- Transportation
- Carcinogens used in manufacturing
- Carcinogens emitted once created

Specifically:

- The GSVCC project is targeting 60% reduction in PVC by cost.
- The use of mercury will be reduced on the project by specifying that all fluorescent lamps should be low-mercury, and that other lamps and thermostats should not contain mercury.
- materials containing lead and cadmium will not, wherever possible, be specified for the project.
- The project will specify non-copper solders for stormwater systems, and to specify alternatives to copper for asphalt shingles, gutters, and cladding.

The following priorities be followed when selecting materials:

- The project will aim to specify materials which do not emit formaldehyde or carcinogens when installed.

- The project will aim to specify materials which do not expose the manufacturers to formaldehyde or carcinogens.

- The project will aim to specify materials which do not contribute dioxins or carcinogens to the environment.

Improving the ecological value of the site will also be a key target of the site with the construction of a green roof garden.

The GSVCC has committed to reduce its dependence on incinerating its medical waste by working with waste contractors to implement more sustainable strategies once the building is in operation.

Refrigerants: All refrigerants used within the building's HVAC system will be specified to have an Ozone Depletion Potential (ODP) of zero. The Global Warming Potential (GWP) of all refrigerants will be clearly stated and displayed to make future replacement possible should a zero GWP option become available.

8.6 Transport

Since the GSVCC will be located in central Sydney with easy access to a number of major transport hubs such as Victoria road, Oxford Street and Kings Cross train station, the project stands to gain from a relatively low energy expenditure tied to the transport of its occupants and visitors. The site is also surrounded by residential areas with Elizabeth Bay, Edgecliff, Paddington and Darlinghurst all within one kilometre or the site, as such it could be reasonably expected that a large portion of employees and visitors would be in the position to walk and cycle to the building (see Figure 7.5 below).

The following initiatives will be implemented as ways in which to reduce the transport footprint of the building:

- Bicycle racks for staff and visitors
- Cyclist changing facilities including showers
- Small car parking spaces to encourage more fuel efficient cars
- Infrastructure for electric car charging points
- Dedicated car share parking spaces

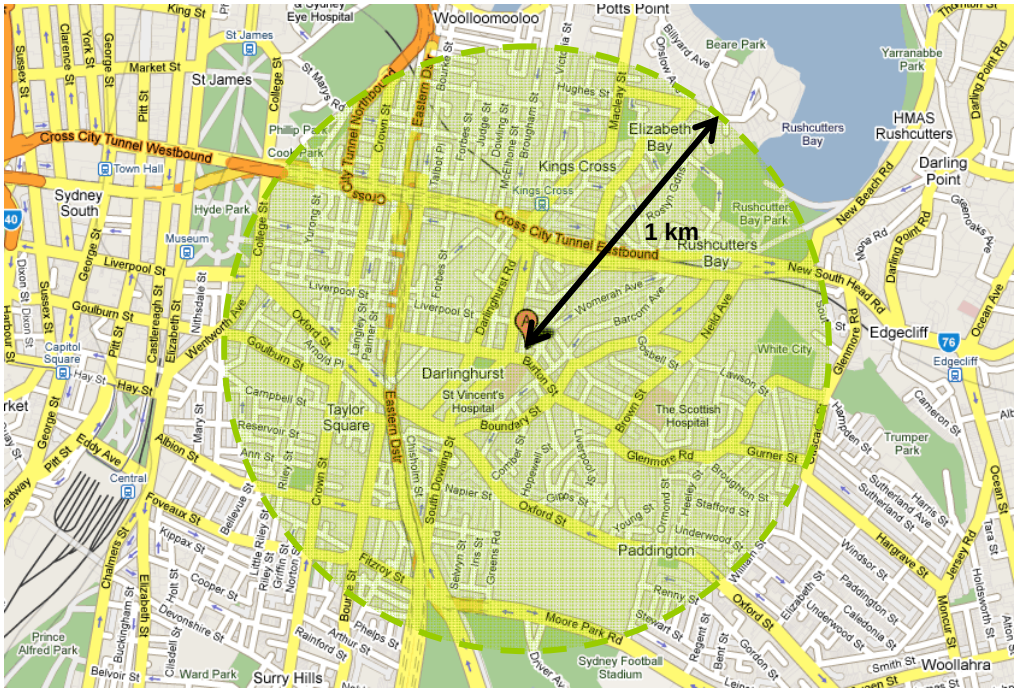


Figure 7.5 A 1-kilometre radius from the proposed site extends into some of Sydney's densest neighbourhoods, thereby increasing the likelihood that visitors and occupants of the building will walk or ride their bikes (Courtesy Google Maps).

In addition to providing infrastructure to allow more sustainable transport to and from the site, the proposed building informatics system will be used to feed back information on local transport options to the staff. An area of the building's intranet site will also be dedicated to green transport with all the required information being easily located in one place.

Appendix A

Rating Scheme Comparison

The following table is presented for information only. It represents the design targets and research which have been used to inform the design of the GSVCC.

KEY:

APPLICABLE:	STRETCH:	NOT APPLICABLE / NOT ACHIEVABLE:
Initiatives which have been categorised as 'applicable' are those which are either wholly or partially applicable to the GSVCC. These initiatives have all been addressed by the design of the GSVCC and it can be reasonably assumed that were the building to be rated by the relevant tool it would achieve at least some of the available points for that credit.	Initiatives which have been identified as 'stretch' initiatives are those which are currently being explored by the design team for application to the project. The majority of these credits are unlikely to be achieved due to the nature of the building.	Initiatives which have been identified as 'not applicable/not achievable' have not been included in the design of the building either because the intent of the credit is not suitable to the function of the GSVCC or because the requirements of the credit are simply unachievable given the building location and layout.

9/10/2009

	Green Star Healthcare Pilot		Green Guide to Healthcare		LEED Healthcare		LABS 21		GARVAN Rating Scheme	
	Green Star Accredited Professional	2			LEED Accredited Professional	1	LEED Accredited Professional	1	1	**Accredited Professional:** The purpose of this credit is to encourage projects to include a team member with experience in green building who can assist with the integration of sustainable building practices. Arup's ESD team has already been appointed to fill this role in addition to which we have a Green Star accredited professional and a LEED accredited professional already working on the project.
			Integrative project planning and approach - Define an integrated design team, including representation from all end user stakeholders. Individuals may perform more than one role for the team; ie, the architect may also be the space programmer or the administrator may also manage the capital budget.		Integrative project planning and approach - Define an integrated design team, including representation from all end user stakeholders. Individuals may perform more than one role for the team; ie, the architect may also be the space programmer or the administrator may also manage the capital budget.	1	Integrative project planning and approach - Define an integrated design team, including representation from all end user stakeholders. Individuals may perform more than one role for the team; ie, the architect may also be the space programmer or the administrator may also manage the capital budget.	1	2	**Integrated design approach:** This credit is to encourage collaborative design. A multi-discipline team has already been appointed. This credit required a design workshop to be held which includes ALL end use stakeholders and the minutes of this to be documented (other options also exist). (GGHC)
			Health Mission Statement - Establish human health as a fundamental evaluative criterion for building design, construction, and operational strategies.						3	**Health Mission Statement:** Establish a mission statement and document this within the design intent document. (GGHC)
	Commissioning - Clauses	2	Building commissioning - guarantee basic building system commissioning	PR	Building commissioning - guarantee basic building system commissioning	PR	Building commissioning - guarantee basic building system commissioning	PR	4	**Building commissioning:** Tune all energy systems and document tuning process.
	Commissioning - Building Tuning	1	Measurement and Verification - ongoing building tuning.	1	Measurement and verification - provide long term monitoring.	1	Measurement and verification - provide long term monitoring.	1	5	**Building tuning:** Ongoing building tuning to be performed by the building owner with the key mechanical engineer involved in the process. A report to be completed after a full year of tuning. (GS)
	Commissioning - Commissioning Agent	1	Enhance Commissioning - assign a commissioning agent to oversee the whole building process.	1	Enhance Commissioning - assign a commissioning agent to oversee the whole building process plus provide commissioning for the entire building envelope.	2	Enhance Commissioning - assign a commissioning agent to oversee the whole building process plus provide commissioning for the entire building envelope.	2	6	**Commissioning Agent:** Assign an independent commissioning agent to give advice to the building owner and design team as well as monitor and verify all building systems (GS)
	Building Users Guide	1							7	**Building Users Guide:** Compile a building users guide. (GS)
	Environmental Management	2	Construction Environmental Management Plan (EMP) - establish a construction environmental management plan.	1	Construction Environmental Management Plan (EMP) - establish a construction environmental management plan.	1	Construction Environmental Management Plan (EMP) - establish a construction environmental management plan.	1	8	**Construction environmental management plan:** Construction team to compile an EMP and have a valid ISO management system. (GS)
	Waste Management	2	Construction waste - divert up to 75% of waste from land fill	2	Construction waste - divert up to 75% of waste from land fill	2	Construction waste - divert up to 75% of waste from land fill	2	9	**Construction waste management plan:** Compile a plan to divert 80% of construction waste from landfill.
			Utilities and Emission Controls - minimise construction transport noise, vibrations and emissions.						10	**Utilities and Emissions Control:** Reduce the impact of the construction process - details outlined.
	Construction Indoor Air Quality Plan	3	Construction EQ management - Reduce indoor air quality problems resulting from the construction or renovation process in order to help sustain the comfort and wellbeing of construction workers and building occupants.	1	Construction EQ management - Reduce indoor air quality problems resulting from the construction or renovation process in order to help sustain the comfort and wellbeing of construction workers and building occupants.	1	Construction EQ management - Reduce indoor air quality problems resulting from the construction or renovation process in order to help sustain the comfort and wellbeing of construction workers and building occupants.	1	11	**Construction indoor air quality plan:** Reduce indoor air quality problems resulting from the construction process.
			Pre-occupancy EQ management - building flush out or indoor air testing.	1					12	**Pre-occupancy indoor air quality plan:** Flush out and other measures to improve indoor air quality. (GGHC)
	Building Management Systems	1							13	**Building Management System:** Include a building management system. (GS)
							Safety and Risk management - meet all standards and generally accepted guidelines for outdoor protection of workers and general public from airborne hazards.	1	14	**Safety and Risk management:** Meet all standards and generally accepted guidelines for outdoor protection of workers and general public from airborne hazards. (LABS 21)
							Safety and Risk Management - prevent releases of hazardous chemicals and other pollutants to sanitary sewer using containment and engineering controls.		15	**Safety and Risk Management:** Prevent releases of hazardous chemicals and other pollutants to sanitary sewer using containment and engineering controls. (LABS 21)
							Chemical resource management - develop and action plan to eliminate, minimize, substitute, recycle and dispose of harmful chemicals safely.		16	**Chemical resource management:** Develop and action plan to eliminate, minimize, substitute, recycle and dispose of harmful chemicals safely. (LABS 21)

Management

Category	Green Star Healthcare Pilot		Green Guide to Healthcare		LEED Healthcare		LABS 21		No.	GARVAN Rating Scheme
							Exterior door notification system - provide an explicit notification system for all doors leading directly from pressure-controlled lab spaces to the outside.	1	17	**Exterior door notification system:** Provide an explicit notification system for all doors leading directly from pressure-controlled lab spaces to the outside. (LABS 21)
IEQ	Ventilation Rates	3	Outdoor air delivery monitoring - provide sufficient outdoor air and include CO2 sensors.	PR	Outdoor air delivery monitoring - Provide capacity for ventilation system monitoring to help sustain occupant comfort and wellbeing.	1	Outdoor air delivery monitoring - Provide capacity for ventilation system monitoring to help sustain occupant comfort and wellbeing.	1	18	**Ventilation Rates:** Use CO2 rates to control airflow.
	Air Change Effectiveness	2					Indoor environment safety - optimise indoor airflow based on CFD or physical modelling. Commission fume hoods. Design all alarm systems in the lab to be inherently self identifying and failsafe.		19	**Indoor environment safety**: Optimise indoor airflow based on CFD or physical modelling. Commission fume hoods. Design all alarm systems in the lab to be inherently self identifying and failsafe. (LABS 21)
	Carbon Dioxide and VOC Monitoring and Control	1							20	**CO2 and VOC monitoring:** Include VOC and CO2 monitoring systems which are linked back to the building management system or provide 100% outside air. (GS)
	Daylighting	3	Daylight - Diagnostic and Treatment Areas: Configure the building floorplate to provide an increased percentage of daylit area above the 'square-root base' percentage daylit area of a hypothetical square floorplate of equal area to the building floorplate to achieve 1, 2 or 3 credits: 6% (1 point), 12% (2 points), 18% (3 points).	3	Daylight - Diagnostic and Treatment Areas: Configure the building floorplate to provide an increased percentage of daylit area up to 3 points are available.	3	Daylight - Diagnostic and Treatment Areas: Configure the building floorplate to provide an increased percentage of daylit area up to 3 points are available.	3	21	**Daylight maximisation:** Daylight levels will be maximised for the buidling but due to constraints regarding lab requirements none of the targets outlines here would be met.
	External Views	2	Views - In multi-bed inpatient rooms, ensure that both patients have visual connection to the outdoors, AND provide a window direct to the outdoors from 75% of regularly occupied staff work spaces and non-inpatient-room spaces. Provide a window direct to the outdoors from 90% of regularly occupied staff work spaces and non-inpatient-room spaces.	2	Views - In multi-bed inpatient rooms, ensure that both patients have visual connection to the outdoors, AND provide a window direct to the outdoors from 75% of regularly occupied staff work spaces and non-inpatient-room spaces. Provide a window direct to the outdoors from 90% of regularly occupied staff work spaces and non-inpatient-room spaces.	2	Views - In multi-bed inpatient rooms, ensure that both patients have visual connection to the outdoors, AND provide a window direct to the outdoors from 75% of regularly occupied staff work spaces and non-inpatient-room spaces. Provide a window direct to the outdoors from 90% of regularly occupied staff work spaces and non-inpatient-room spaces.	2	22	**Views:** External views will be maximised for the buidling but due to constraints regarding lab requirements none of the targets outlines here would be met.
	Daylight Glare Control	1			Daylight quantity - for 75% of areas outlined above a DF of between 2% and 25% is achieved.		Daylight quantity - for 75% of areas outlined above a DF of between 2% and 25% is achieved.		23	**Daylight Quantity:** Daylight will be maximised for the buidling but due to constraints regarding lab requirements none of the targets outlines here would be met.
	High Frequency Ballasts	1							24	**High Frequency Ballasts:** Install high-frequency ballasts for 95% of the OFA (GS)
	Electric Lighting Levels	1							25	**Electric Lighting Levels:** Achieve no more than the light levels stipulated in AS/NZS 1668.2 for 95% of the OFA.(GS)
	Thermal Comfort - PMV between +/-0.5 for 98% of operating hours.	2	Thermal comfort - Agree to implement a thermal comfort survey of building occupants (patients and staff) within a period of six to 18 months after occupancy. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of the respondents in each group are dissatisfied with thermal comfort in the building.	1	Thermal comfort - Agree to implement a thermal comfort survey of building occupants (patients and staff) within a period of six to 18 months after occupancy. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of the respondents in each group are dissatisfied with thermal comfort in the building.	1	Thermal comfort - Agree to implement a thermal comfort survey of building occupants (patients and staff) within a period of six to 18 months after occupancy. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of the respondents in each group are dissatisfied with thermal comfort in the building.	1	26	**Thermal Comfort:** Undertake a thermal comfort assessment of the design with a PMV target of +/-0.5 for controlled space. (Undergo a thermal comfort survey of the building 6-18 months after occupancy).
	Comfort Control - provide individual HVAC and lighting controls for 80% of administration areas.	2	Controllability of systems - thermal comfort. Provide individual temperature and air flow controls for 50% of staff.	1	Controllability of systems - thermal comfort. Provide individual temperature and air flow controls for 50% of staff.	1	Controllability of systems - thermal comfort. Provide a minimum of one operable window and one lighting control zone per 200 SF for all occupied areas within 15 feet of the perimeter - pressure controlled laboratory spaces are exempt from the window requirement.	1	27	**Comfort Control:** Provide individual comfort controls for 50% of staff OR provide on operable window and one lighting control for every 20m2 zone within 5 m of the perimeter.
	Asbestos	1	Hazardous material removal - survey the site and remove or encapsulate any identified hazardous material.	1	Hazardous material removal - survey the site and remove or encapsulate any identified hazardous material.	1	Hazardous material removal - survey the site and remove or encapsulate any identified hazardous material.	1	28	**Hazardous material removal:** Survey the site and remove or encapsulate any identified hazardous material.
	Internal Noise Levels - building services noise in line with AS/NZS 2107:2000	1	Acoustic environment - meet and exceed 2006 AIA/AHA Draft Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities for internal noise levels and vibrations.	1	Acoustic environment - meet and exceed 2006 AIA/AHA Draft Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities for internal noise levels and vibrations.	1	Acoustic environment - meet and exceed 2006 AIA/AHA Draft Interim Sound and Vibration Design Guidelines for Hospital and Healthcare Facilities for internal noise levels and vibrations.	1	29	**Internal Noise Levels:** Building services noise in line with AS/NZS 2107:2000
	Volatile Organic Compounds	4	Low emitting materials - specify low VOC materials for wall, floor and ceiling finishes.	3	Low emitting materials - specify low VOC materials for wall, floor and ceiling finishes.	3	Low emitting materials - specify low VOC materials for wall, floor and ceiling finishes.	3	30	**Low emitting materials:** Specify low VOC materials for wall, floor and ceiling finishes.
	Formaldehyde Minimisation	1	Low emitting materials - specify no formaldehyde composite wood products.	1	Low emitting materials - specify no formaldehyde composite wood products.	1	Low emitting materials - specify no formaldehyde composite wood products.	1	31	**Low emitting materials:** Specify no formaldehyde composite wood products.
			Low emitting materials - specify furniture with low VOC etc emissions.	1					32	**Low emitting materials:** Specify furniture with low VOC etc emissions.
			Low emitting materials - specify external surfaces which do not emit harmful substances during construction.	1					33	**Low emitting materials:** Specify external surfaces which do not emit harmful substances during construction.
	Mould Prevention	1							34	**Mould Prevention:** Relative humidity to remains below 60% in the space and 80% in the ductwork or the building is naturally ventilated. (GS)
	Exhaust Riser	1	Chemical and pollutant source control - minimise cross contamination of internal hazardous materials.	1	Chemical and pollutant source control - minimise cross contamination of internal hazardous materials.	1	Chemical and pollutant source control - minimise cross contamination of internal hazardous materials.	1	35	**Exhaust Riser:** The need to exhaust pollutants will be met by the design of the HVAC system.

		Green Star Healthcare Pilot		Green Guide to Healthcare		LEED Healthcare		LABS 21			GARVAN Rating Scheme
		Air Distribution System	1							36	**Air Distribution System:** Ductwork to have adequate access to all HVAC components AND all ductwork is clean in accordance with National Air Duct Cleaners Associations ACR 2006 standard. (GS)
		Outdoor Pollutant Source Control	1	Chemical and pollutant source control - minimise outdoor pollutants from coming inside.	1	Chemical and pollutant source control - minimise outdoor pollutants from coming inside.	1	Chemical and pollutant source control - minimise outdoor pollutants from coming inside.	1	37	**Outdoor pollutant Source:** Locations of HVAC intakes satisfy requirements for minimum distances from roads etc OR a risk assessment by an air quality expert confirms acceptable air quality. (GS)
		Places of Respite	1	Connection to the natural world - provide places of respite which have a direct view of the outside world.	1					38	**Connection to the natural world:** This is a requirement intended specifically for healthcare facilities.
				Minimum indoor air quality - satisfy ASHRAE requirements for indoor air quality	PR	Minimum indoor air quality - satisfy ASHRAE requirements for indoor air quality	PR	Minimum indoor air quality - satisfy ASHRAE requirements for indoor air quality	PR	39	**Minimum indoor air quality:** Satisfy ASHRAE requirements for indoor air quality
								Assess minimum ventilation requirements - determine minimum ventilation requirements in laboratories based on user needs and H&S protection and energy consumption.	1	40	**Assess minimum ventilation requirements:** Determine minimum ventilation requirements in laboratories based on user needs and H&S protection and energy consumption.
								Laboratory ventilation - ensure that minimum requirements of ANSI Z9.5 are met.		41	**Laboratory ventilation:** Ensure that minimum requirements of ANSI Z9.5 are met.
				Environmental tobacco smoke control - prohibit smoking within the building and limit any outdoor smoking areas to over 50 m from entries and exits.	1	Environmental tobacco smoke control - prohibit smoking within the building and limit any outdoor smoking areas to over 50 m from entries and exits.	1	Environmental tobacco smoke control - prohibit smoking within the building and limit any outdoor smoking areas to over 50 m from entries and exits.	1	42	**Environmental tobacco smoke control:** It is illegal to smoke inside publicly accessable buildings in Australia and as such this credit is moot.
				Natural ventilation - provide natural ventilation to all areas allowed by code.	1					43	**Natural ventilation:** Achieving an entirely naturally ventilated building can not be achieved with the site constraints of this building.
				Lighting and circadian rhythms - Reinforce natural circadian rhythms (sleep/wake patterns) in patients and daytime staff, and promote alertness in both day-shift and night-shift staff. In patient sleeping or holding areas, establish lighting and lighting control design solutions that allow for variation in day and night lighting characteristics as outlined in the Credit Goals. In staff areas, establish lighting to support work	1					44	**Lighting and circadian rhythms:** This is a requirements specifically designed for healthcare facilities where people work during the night as well as during the day - this is not he case for this building.
	Energy	Energy Improvement	15	Minimum energy performance - perform an energy model and establish the minimum benchmark for the building as per ASHRAE standards	PR	Minimum energy performance - perform an energy model and establish the minimum benchmark for the building as per ASHRAE standards	PR	Minimum energy performance - perform an energy model and establish the minimum benchmark for the building as per ASHRAE standards AND comply with Labs21 Laboratory Modelling Guidelines.	PR	45	**Minimum energy performance:** Perform an energy model and establish the minimum benchmark for the building as per ASHRAE standards AND comply with Labs21 Laboratory Modelling Guidelines.
				Optimise Energy Performance - improve building energy performance by up to 42% when compared against base case.	10	Optimise Energy Performance - improve building energy performance by up to 42% when compared against base case.	10	Optimise Energy Performance - improve design energy cost by up to 50% when compared against base case.	10	46	**Optimise Energy Performance:** Improve design energy cost by up to 42%.
				Onsite Renewable Energy - provide up to 0.15W for each square meter of the building.	3	Onsite renewable energy - provide 1 or 3% of building's energy use with onsite renewables.	2	Onsite renewable energy - provide2, 5 or 10% of building's energy use with onsite renewables.	3	47	**Onsite renewable energy:** Provide2, 5 or 10% of building's energy use with onsite renewables. (LABS 21)
				Green power - provide up to 100% of the building's energy supply from renewable resources.	4	Green Power - provide at least 25% of the building's energy demands by green power	1	Green Power - provide at least 25% of the building's energy demands by green power	1	48	**Green Power:** Provide at least 25% of the building's energy demands by green power
								Energy supply efficiency - reduce energy source efficiency by up to 50%.	5	49	**Energy supply efficiency:** Reduce energy source efficiency by up to 50%.
		Car Park Ventilation	3							50	**Car park Ventilation:** 50% of car park is naturally ventilated and fans have a variable speed drive.
		Electrical Sub-Metering	1							51	**Electrical Sub metering:** Sub-metering provided for all substantive uses in the building. (GS)
		Lighting Zoning and Control	1	Controllability of systems - lighting. Provide individual controls to 90% of occupants.	1	Controllability of systems - lighting. Provide individual controls to 90% of occupants.	1	Controllability of systems - lighting. Provide individual controls to 90% of occupants.	1	52	**Light zoning and control:** Switches for all individual and enclosed spaces, a master switch for each functional space and switches are clearly labelled.
		High Efficacy External Lighting	1							53	**High Efficacy External Lighting:** All external lighting has a light source efficacy of at least 50lumans/watt, 95% of all external lighting meets AS1158 illumination levels and are connected to daylight sensors. (GS)
		Peak Energy Demand Reduction	2							54	**Peak Energy Demand Reduction:** This could only be achieved through the use of cogeneration which was deemed to be not suitable for this building.

Category	Green Star Healthcare Pilot		Green Guide to Healthcare		LEED Healthcare		LABS 21		No.	GARVAN Rating Scheme
	Medical Equipment Efficiency	2	Equipment efficiency - Calculate 75% of the equipment purchased for the project (based on number of units) according to either Energy Star® qualified or sit in the top 25th percentile of lowest energy consumption for that class of equipment.	1	Equipment energy efficiency - At least 50%, by rated power, of medical equipment purchased for the project shall be among the 25th percentile of lowest energy consumers for that class of equipment. Equipment shall be compared based on their continuous (or "standby") mode electrical energy consumption.	1	Equipment energy efficiency - top 25th percentile for 75% or new class 1 and 2 equipment and at least 30% of all class 1 and 2 equipment.	1	55	**Equipment Efficiency:** Equipment to be in the top 25th percentile for 75% of new class 1 and 2 equipment and at least 30% of all class 1 and 2 equipment. (LABS 21)
							Right-size laboratory equipment load - measure base usage of equipment electrical loads in a comparable lab space and design based on these loads. Design electrical dist. System to provide for metering.	1	56	**Right-size laboratory equipment load:** Measure base usage of equipment electrical loads in a comparable lab space and design based on these loads. Design electrical dist. System to provide for metering. (LABS 21)
	Stairs	1							57	**Stairs:** Stairs are available to the public, are highly visible, are located within 5m of primary lifts or in a central location and are fully open to the interior on at least one side OR 25% of wall area is external glazing OR each level of stairs has a DF of 3.5% at floor level. (GS)
Transport	Provision of Car Parking	2	Parking Capacity - provide minimum parking.	1	Parking Capacity - provide minimum parking.	1	Parking Capacity - provide minimum parking.	1	58	**Parking Capacity:** Provide either the absolute minimum required parking spaces OR 50% of maximum allowed parking space.
	Fuel Efficient Transport - Design 25% of all parking spaces for small cars and/or mopeds AND parking spaces enough for 5% of peak staff numbers are provided for car share schemes and/or hybrid etc cars.	2	Fuel efficient transport - Provide either: low emitting and fuel efficient vehicles for 3% of peak building day shift OR preferred parking for fuel efficient vehicles for 5% of parking capacity of site OR install alternative fuel refuelling stations for 3% of total parking capacity.	1	Fuel efficient transport - Provide either: low emitting and fuel efficient vehicles for 3% of peak building day shift OR preferred parking for fuel efficient vehicles for 5% of parking capacity of site OR install alternative fuel refuelling stations for 3% of total parking capacity.	1	Fuel efficient transport - Provide either: low emitting and fuel efficient vehicles for 3% of peak building day shift OR preferred parking for fuel efficient vehicles for 5% of parking capacity of site OR install alternative fuel refuelling stations for 3% of total parking capacity.	1	59	**Fuel efficient Transport:** Design 25% of all parking spaces for small cars and/or mopeds AND parking spaces enough for 5% of peak staff numbers are provided for car share schemes and/or hybrid etc cars - future-proof for electric charging stations. (GS)
	Cyclist Facilities - provide a locker and rack for 10% of building staff and showers for 1% in addition provide one visitor parking space per four practitioners within 10m of entry.	3	Bicycle storage and changing rooms - provide cyclist facilities for 3% of peak staff occupancy and showers for 0.5% of peak staff occupancy.	1	Bicycle storage and changing rooms - provide cyclist facilities for 5% of peak staff occupancy and showers for 0.5% of peak staff occupancy.	1	Bicycle storage and changing rooms - provide cyclist facilities for 5% of peak staff occupancy and showers for 0.5% of peak staff occupancy.	1	60	**Cyclist Facilities:** Provide a locker and rack for 10% of building staff and showers for 1% in addition provide one visitor parking space per four practitioners within 10m of entry. (GS)
	Proximity to Public Transport	5	Public Transport Access - select a site with access to existing or planned public transport.	1	Public Transport Access - select a site with access to existing or planned public transport.	1	Public Transport Access - select a site with access to existing or planned public transport.	1	61	**Public Transport Access:** Select a site with sufficient access to public transport.
	Pedestrian Routes	1							62	**Pedestrian Routes:** Not applicable to such a small site - this credit is for large hospital complexes.
			Structured parking - provide structured parking for 50% of spaces (minimum of 100 spaces required).						63	**Structured Parking:** Not applicable for such a small car park - no benefit.
Water	Occupant Amenity Potable Water Efficiency	6	Potable water use reduction - sensor operators and low flo fittings	2	Potable water use reduction - sensor operators and low flo fittings	1	Potable water use reduction - sensor operators and low flo fittings	1	64	**Potable water reduction:** Reduce potable water consumption by x% as compared against a similar building.
	Water Meters	1							65	**Water Meters:** Install water meters for all large scale water uses on site. (GS)
	Landscape Irrigation Water Efficiency	2	Landscaping water use - no potable water or no irrigation	1	Landscaping water use - no potable water or no irrigation	1	Landscaping water use - no potable water or no irrigation	1	66	**Landscape Water:** Use no potable water for irrigation or have no irrigation systems. (LEED)
	Cooling Tower Water Consumption	4	Process water reduction - reduce cooling tower blow down by 20% and no potable water in other fixtures etc	1	Process water reduction - reduce cooling tower blow down by 20% and no potable water in other fixtures etc PLUS specific	1	Process water reduction - reduce cooling tower blow down by 20% and no potable water in other fixtures etc PLUS specific	1	67	**Cooling tower water consumption**
	Fire System Water Consumption	1							68	**Fire System Water Consumption:** Sufficient temporary storage exists for 80% of all fire test water for reuse on site OR a system exists for the recovery of water for use off-site OR the fire system does not expel any water for testing. (GS)
	Potable Water Use for Equipment Cooling	1	Potable water use for equipment cooling - no potable water to be used for once through cooling for medical equipment	PR	Potable water use for equipment cooling - no potable water to be used for once through cooling for medical equipment	PR	Reduce potable water use for equipment cooling - no potable water to be used for once through cooling for medical equipment. Unless it is needed as direct contact process water.	PR	69	**Reduce potable water use for equipment cooling:** No potable water to be used for once through cooling for medical equipment. Unless it is needed as direct contact process water.
			Process water reduction - capture condensation or use non-potable water for all water systems	1					70	**Process Water Reduction:** Capture condensate for reuse or use non-potable water for all water based cooling systems.
					Stormwater management - Implement a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff from 90% of the average annual rainfall1 using acceptable best management practices (BMPs).	1	Stormwater management - Implement a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff from 90% of the average annual rainfall1 using acceptable best management practices (BMPs).	1	71	**Stormwater management:** Implement a stormwater management plan that reduces impervious cover, promotes infiltration, and captures and treats the stormwater runoff from 90% of the average annual rainfall1 using acceptable best management practices (BMPs). (LABS 21)

		Green Star Healthcare Pilot		Green Guide to Healthcare		LEED Healthcare		LABS 21			GARVAN Rating Scheme
								Process water efficiency - install water meters, establish baseline, initiate strategies to reduce water consumption by 20%, document progress.	2	72	**Process water efficiency:** Install water meters, establish baseline, initiate strategies to reduce water consumption by 20%, document progress.
	Materials	Recycling Waste Storage	1	Storage and collection of recyclables	PR	Storage and collection of recyclables	PR	Storage and collection of recyclables	PR	74	**Storage and Collection of Recyclables:** Provide sufficient space on site for the storage and collection of recyclable waste.
				Mercury elimination - specify that lights are to have low, or no, mercury levels.	PR	Mercury elimination - specify that lights are to have low, or no, mercury levels.	PR	Mercury elimination - specify that lights are to have low, or no, mercury levels.	PR	75	**Mercury elimination:** Specify that lights are to have low, or no, mercury levels.
		Reuse of Façade	2	Building reuse - maintain up to 80% of existing floors, walls and roof.	2	Building reuse - maintain up to 80% of existing floors, walls and roof.	2	Building reuse - maintain up to 80% of existing floors, walls and roof.	2	76	**Building Reuse:** This credit has never been as possibility due to the layout, and structural integrety of the buildings currently on site.
		Reuse of Structure	3	Building reuse - maintain 50% of interior non-structural elements.	1	Building reuse - maintain 50% of interior non-structural elements.	1	Building reuse - maintain 50% of interior non-structural elements.	1	77	
		Recycled-Content Products & Materials	2	Sustainably sourced materials - up to 50% of materials to be sourced sustainably e.g. recycled, renewable, re-used or harvested and manufactured within 500 km.	5	Sustainably sourced materials - up to 50% of materials to be sourced sustainably e.g. recycled, renewable, re-used or harvested and manufactured within 500 km.	5	Sustainably sourced materials - up to 50% of materials to be sourced sustainably e.g. recycled, renewable, re-used or harvested and manufactured within 500 km.	5	78	
		Recycled Content of Concrete	3							79	**Sustainably sourced materials:** Up to 50% of materials to be sourced sustainably e.g. recycled, renewable, re-used or harvested and manufactured within 500 km. (LEED)
		Recycled Content of Steel	2							80	
		PVC Minimisation	2							81	
		Sustainable Timber	2							82	
		Flooring	3							83	**Flooring:** Use materials which have a reduced environmental impact as defined by the calculator. (GS)
		Ceilings, Walls & Partitions	2							84	**Ceiling, Walls and Partitions:** Use materials which have a reduced environmental impact as defined by the calculator. (GS)
		Joinery	1							85	**Joinery:** Use materials for fixed joinery which have a reduced environmental impact as defined by the calculator. (GS)
		Loose Furniture	4	Furniture and medical furnishings: 20% of furniture is reused, recycled or salvaged. 40% of furniture contains no PBTs or complies with the EU ROH on hexavalent chrome. 40% of furniture is locally sourced or transported with minimum packaging.	3	Furniture and medical furnishings: 20% of furniture is reused, recycled or salvaged. 40% of furniture contains no PBTs or complies with the EU ROH on hexavalent chrome. 40% of furniture is locally sourced or transported with minimum packaging.	3	Furniture and medical furnishings: 20% of furniture is reused, recycled or salvaged. 40% of furniture contains no PBTs or complies with the EU ROH on hexavalent chrome. 40% of furniture is locally sourced or transported with minimum packaging.	3	86	**Furniture and medical furnishings:** 20% of furniture is reused, recycled or salvaged. 40% of furniture contains no PBTs or complies with the EU ROH on hexavalent chrome. 40% of furniture is locally sourced or transported with minimum packaging. (LEED)
		Design for Disassembly	1	Resource use - design for flexibility and durability.	5	Resource use - design for flexibility and durability.	1	Resource use - design for flexibility and durability.	1	87	**Resource use:** Design for flexibility and durability.
				PBT elimination - Reduce the release of Persistent Bioaccumulative Toxic chemicals (PBTs) associated with the life cycle of building materials. Dioxins, mercury and lead and cadmium.	3	PBT elimination - Reduce the release of Persistent Bioaccumulative Toxic chemicals (PBTs) associated with the life cycle of building materials. Dioxins, mercury and lead and cadmium.	3	PBT elimination - Reduce the release of Persistent Bioaccumulative Toxic chemicals (PBTs) associated with the life cycle of building materials. Dioxins, mercury and lead and cadmium.	3	88	**PBT elimination:** Reduce the release of Persistent Bioaccumulative Toxic chemicals (PBTs) associated with the life cycle of building materials. Dioxins, mercury and lead and cadmium.
				Copper reduction - no copper on roof and if using copper pipes thin minimise need to flux on site.	1					89	**Copper reduction:** No copper on roof and if using copper pipes thin minimise need to flux on site. (GGHC)
	Land use and ecology	Ecological Value of Site	PR	Site selection - due not develop sites which are near wetlands or water ways, habitats of threatened species, below the 100 yr flood line etc.	1	Site selection - due not develop sites which are near wetlands or water ways, habitats of threatened species, below the 100 yr flood line etc	1	Site selection - do not develop sites which are near wetlands or water ways, habitats of threatened species, below the 100 yr flood line etc	1	90	**Site selection:** Site selection was dictated by the fact that this buidling is an expansion of an existing facility.
		Reuse of land	1	Development density and community connectivity - construct in existing town centres with access to basic amenities etc	1	Development density and community connectivity - construct in existing town centres with access to basic amenities etc	1	Development density and community connectivity - construct in existing town centres with access to basic amenities etc	1	91	**Development density and community connectivity:** Construct in existing town centres with access to basic amenities etc
		Reclaimed Contaminated Land	2	Brown field redevelopment - build on and remediate contaminated land.	1					92	**Reclaimed Contaminated Land:** The site is not contaminated.
				Brown field redevelopment - build on and remediate contaminated land to residential requirements.	1	Brown field redevelopment - build on and remediate contaminated land to residential requirements.	1	Brown field redevelopment - build on and remediate contaminated land to residential requirements.	1	93	**Reclaimed Contaminated Land:** The site is not contaminated.
				Brown field redevelopment - build on and remediate contaminated land AND establish that there are either no contaminated sites in close proximity OR that preventative measures have been taken to prevent future contamination.	1					94	**Brown field redevelopment:** The site is not contaminated.
		Change of Ecological Value	4	Protect or restore open space or habitat - improve the ecological value of the site. Minimise removal of existing vegetation.	1	Protect or restore open space or habitat - improve the ecological value of the site. Minimise removal of existing vegetation. On Brownfield sites restore 50% of the footprint (excluding building footprint) with native species.	1	Protect or restore open space or habitat - improve the ecological value of the site. Minimise removal of existing vegetation. On Brownfield sites restore 50% of the footprint (excluding building footprint) with native species.	1	95	**Change of Ecological Value:** Improve the ecological value of the site. (GS)
				Protect or restore open space or habitat - improve the ecological value of the site. Minimise removal of existing vegetation AND minimise building footprint as outlined.	1					96	**Change of ecological value:** Improve the ecological value of the site. Minimise removal of existing vegetation AND minimise building footprint as outlined. (GGHC)
		Topsoil & Fill Removal from Site	1							97	**Topsoil & Fill Removal from Site:** Cut and fill is balanced on site with no net import or export of either. (GS)
				Heat island effect - shade surfaces, specify minimum Solar Reflectance Indices, shade parking spaces etc...	2	Heat island effect - shade surfaces, specify minimum Solar Reflectance Indices, shade parking spaces etc...	2	Heat island effect - shade surfaces, specify minimum Solar Reflectance Indices, shade parking spaces etc...	2	98	**Heat island effect:** Shade surfaces, specify minimum Solar Reflectance Indices, shade parking spaces etc. (LEED)

		Green Star Healthcare Pilot		Green Guide to Healthcare		LEED Healthcare		LABS 21		GARVAN Rating Scheme		
				Construction activity pollution prevention - create plan to minimise erosion and sedimentation due to construction	PR	Construction Activity Pollution Prevention - Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities associated with the project	PR	Construction Activity Pollution Prevention - Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities associated with the project	PR	99	**Construction Activity Pollution Prevention:** Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities associated with the project
				Connection to the natural world - provide outside places of respite for staff, visitors and patients	1	Connection to the natural world - provide outside places of respite for staff, visitors and patients	2	Connection to the natural world - provide outside places of respite for staff, visitors and patients	2	100	**Connection to the natural world:** Provide outside places of respite for staff, visitors and patients
	Emissions	Refrigerant ODP	1	Fundamental Refrigeration Management - Zero use of refrigerant CFCs	PR	Fundamental Refrigeration Management - Zero use of refrigerant CFCs	PR	Fundamental Refrigeration Management - Zero use of refrigerant CFCs	PR	101	**Refrigerant Ozone Depletion Potential:** Refrigerants to have an ODP of zero or no refrigerants are to be used. (GS)
		Refrigerant GWP	1			Enhanced refrigeration management - either do not use refrigerants or comply with minimum GWP limits outlined.	1	Enhanced refrigeration management - either do not use refrigerants or comply with minimum GWP limits outlined.	1	102	**Refrigerant Global Warming Potential:** Refrigerants to have a global warming potential of less than 10.
		Light Pollution	1	Light Pollution - do no direct any light up or out of the building.	1	Light Pollution - do no direct any light up or out of the building.	1	Light Pollution - do no direct any light up or out of the building.	1	103	**Light Pollution:** Do not direct any light up or out of the building.
		Watercourse Pollution	2	Stormwater management - create a stormwater management plan which minimises stormwater flow from site.	2	Stormwater management - create a stormwater management plan which minimises stormwater flow from site.	1	Stormwater management - create a stormwater management plan which minimises stormwater flow from site.	1	104	**Watercourse pollution:** Manage stormwater leaving site.
		Airborne Emissions	1	Air pollution - Meet California South Coast Air Quality Management District standards for all products of combustion.	1	Air pollution - Meet California South Coast Air Quality Management District standards for all products of combustion.	1	Air pollution - Meet California South Coast Air Quality Management District standards for all products of combustion.	1	105	**Airborne Emissions:** Exhaust provisions to exceed the requirements of AS2243 and AS2982.
		Refrigerant Recovery	1							106	**Refrigerant Recovery:** Automatic refrigerant pump down.
		Reduced Flow to Sewer	1							107	**Reduced Flow to Sewer:** Due to recycling of water.
		Cooling Towers	4							108	**Cooling Towers:** There will be cooling towers.
		Insulant ODP	1							109	**Insulant ODP:** Thermal insulants avoid the use of ODPs.
		Trade Waste Pollution	1					Hazardous material handling - develop a system to maintain current information about hazardous material types, quantity, location, disposal etc	1	110	**Hazardous material handling:** Develop a system to maintain current information about hazardous material types, quantity, location, disposal etc (LABS 21)
		Refrigerant leak detection	1	Leaks and spills - install oils traps in parking stations and comply with EPS standards for underground fuel storage containers.	1					111	**Refrigerant leak detection:**