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Sydney Church of England Grammar School (Shore)

20 Edward Street North Sydney

Graythwaite Project – Stage 1

Indicative Green Star Assessment

Report Number 610-10157-R1

25 November 2010

Shore Graythwaite Stage 1 Project Application
c/- PD Mayoh Pty Ltd Architects
60 Strathallen Avenue
NORTHBRIDGE NSW 2063

Version: Revision 0

Sydney Church of England Grammar School (Shore)

20 Edward Street North Sydney

Graythwaite Project

Indicative Green Star Assessment

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EXECUTIVE SUMMARY

Heggies Pty Ltd (Heggies) has been commissioned on the Shore Graythwaite Project to provide an Indicative Green Star Rating assessment during the "Project Application" Stage 1 of the proposed expansion of the Graythwaite site, owned by Sydney Church of England Grammar School at 20 Edward Street, North Sydney. Stage 1 comprises of:

- Conservation and refurbishment of the Graythwaite House (the house), Coach House, Tom O'Neill building and associated garden area (the house will not be used for school classes but rather for administrative support and other activities, including perhaps the School archives)
- Drainage and Stormwater improvements, site levelling and landscaping of the site (significantly on the middle and lower terraces)
- Transport, traffic, parking and access improvements to the Graythwaite and Shore sites (spread over Stages 1 to 3)
- Miscellaneous works including site fencing

The Coach House and Tom O'Neill Centre are not eligible for Green Star Rating. It is therefore recommended to rate the Graythwaite House Using Green Star using Office Design V3 rating tool.

Overall, good ESD design features are currently in place for a number of areas, incorporating the following:

- The proposed development is close to good transport nodes with frequent service and facilitates the use of mass transport for work commuting;
- The proposed development will incorporate passive and active energy saving measures such as operable windows to enhance natural ventilation where appropriate;
- The building is naturally ventilated;
- Most building facades are retained;
- Most building structures are retained;
- No refrigerants are used in the project;
- No heat rejection water system is used in the project; and
- All trees are retained and additional landscape is provided.

The following additional recommendations have been made to achieve Four Green Star:

- Line the inside of the roof with a minimum R3.0 insulation;
- A 12 month building tuning period also incorporates quarterly reviews and a final recommissioning;
- Independent commissioning agent;
- Building user guides to provide information on the design features and ensure that they are used efficiently;
- Environmental Management Plan (EMP) in accordance with Section 4 of the NSW Environmental Management System guidelines (1998);
- Lighting system incorporating high frequency ballasts and limiting electric lighting levels to 400 Lux;

EXECUTIVE SUMMARY

- On-site rainwater collection for irrigation and toilet flushing to be constructed in Stage 2 of development;
- External cycling facility;
- Water efficient bathroom and kitchen fittings;
- Low VOC paint, carpet, sealant and adhesives where appropriate;
- Dedicated waste storage area for the separation, collection and recycling of consumables with good access for all building users and for collection by recycling companies; and
- Fitout design is being coordinated with the base building design and construction.

An indicative Green Star rating using the Green Building Council of Australia's (GBCA) Office Rating Tool V3 is conducted to assess the initial ESD measures adopted for the building.

The indicative Four Star Office Rating pointed to an overall weighted score of 55, equivalent to a Four Star Green Star Rating. The initial total weighted score for the development is above the minimum weighted score of 45 for a 4 star "Best Practice" rating.

This report is not a formalised Green Star Assessment but provides comment upon the Green Star categories. Additional documentation will be required to demonstrate compliance under the categories awarded.

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- Conservation and refurbishment of the Graythwaite House (the house), Coach House, Tom O'Neill building and associated garden area (the house will not be used for school classes but rather for administrative support and other activities, including perhaps the School archives)
- Drainage and Stormwater improvements, site levelling and landscaping of the site (significantly on the middle and lower terraces)
- Transport, traffic, parking and access improvements to the Graythwaite and Shore sites (spread over Stages 1 to 3)
- Miscellaneous works including site fencing
- No anticipated increase in student or staff population

The Stage 1 project application is shown in **Figure 1**.

The Director General requested (DGRs Condition 6 dated 27 October 20100) to demonstrate that the Stage 1 development can achieve a minimum 4 Green Star rating, or any other suitably accredited rating scheme. Therefore, this report assesses the Stage 1 development in terms of the Green Star Office Design schemes where appropriate and provides qualitative ESD design advice towards achieving the proposed ratings.

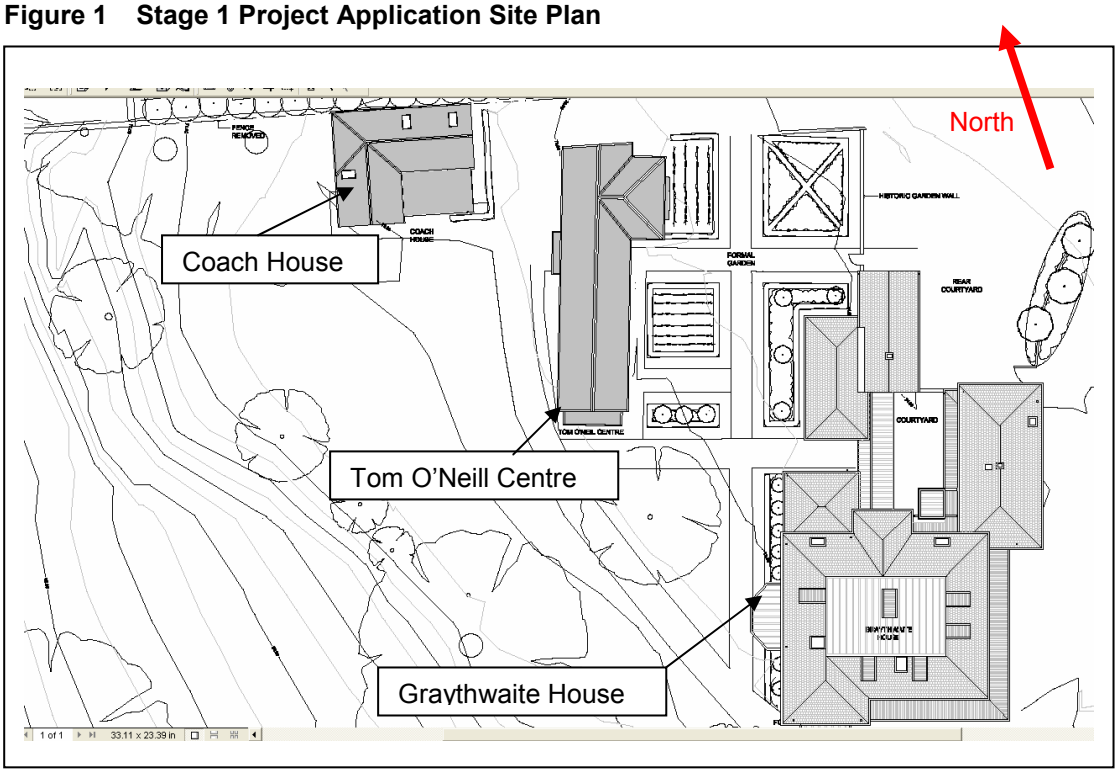
This report further explains the limitations and heritage considerations of the proposed Stage 1 if meeting the 4 Star Green rating or conditional requirement is unachievable.

The following ESD elements have been addressed within this report:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water;
- Materials;
- Land Use & Ecology; and
- Emissions.

The following report will identify the opportunities for the incorporation of principles of ESD into the project.

Figure 1 Stage 1 Project Application Site Plan



2 ECOLOGICAL SUSTAINABLE DESIGN

2.1 Benefits of Adopting ESD Design

It is the intention that ESD building design produces an environment that is both low-impact and high quality. Planning a development that embraces the concepts of ESD will serve to portray the developer and owners of the Graythwaite House re-development as "good corporate citizens". Going green in development is gaining momentum and making a leap to the mainstream. ESD also has the benefit of improved public profile and community relations.

While it is generally accepted that 'Green' buildings may cost more to design, these up-front costs are almost always recoverable in a relatively short period of time as such developments will have lower operational costs. It is noted that generally the first one percent of the cost of a development will determine the next seventy percent. Therefore, by adopting ESD principles from the outset, low-impact developments may be delivered at a fraction of the cost of 'retro-fitting' a development with ESD initiatives. A recent survey of 36 buildings conducted in California indicated that, on average, the cost premium of delivering an ESD building was less than 2% above that of conventional buildings, with cost-neutral buildings being achieved in some instances. Of the 28 office buildings and 8 schools studied that had adopted ESD design initiatives, the following gains were achieved on an annual basis:

- 30% Energy Savings over conventional buildings;
- 30% to 50% Water savings over conventional buildings;
- 50% to 97% Waste cost savings.

With respect to the potential 'additional' costs associated with construction of an ESD building, it is important to address the 'whole-life cost' of a building. Life Cycle Assessment of an average building attributes the following costs over a 40 year lifetime period:

- 11% Construction costs;
- 14% Financing costs;
- 25% Alterations costs; and
- 50% Operational costs

Green buildings that incorporate natural lighting and ventilation and internal energy and water generation are less reliant on external grids and less vulnerable to grid related problems or failures such as brown-outs and black-outs or water shortages. Decreasing a building's reliance on water and energy through incorporation of conservation and management measures, a building is being future proofed against future utility price increases. Organisations that anticipate and adapt rather then react will not be at a competitive disadvantage in the future.

2.2 Green Star Design Parameters

The following section provides comment on design initiatives considered during the concept stage and to be later assessed under the GBCA Green Star rating scheme. Note the following section is not a Green Star Assessment but will provide comment upon the Green Star categories, in addition to energy issues required under National Australian Built Environment Rating System (NABERS).

Green Star is a comprehensive environment quality and resource system for buildings. Green Star evaluates separately the environmental initiatives of design, projects and/or buildings based on a number of criteria, including energy and water efficiency, indoor environment quality and resource conservation.

Green Star was created to:

- Establish a common language and standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Identify building life-cycle impacts;
- Raise awareness of green building benefits;
- Recognise environmental leadership; and
- Transform the built environment to reduce the environmental impact of development.

2.2.1 Project Eligibility for Green Star

To be eligible for Green Star assessment, projects must meet all four provisions of the Green Star Eligibility Criteria detailed below:

- Space Use
  - Buildings with a minimum of 80% of the building's GFA (measured to exclude internal car parks) comprised of space types stated as being able to be assessed by the particular Green Star rating tool.

    The GFA for each building in Stage 1 is summarised in **Table 1** below:

Table 1 GFA Schedule by Building Classes - Stage 1

1. COACH HOUSE			
Class 5:	Offices		61.2
Class 4:	Caretakers flat		66.2
		TOTAL	**127.4**
2. TOM O'NEILL CENTRE			
Class 9b:	Music practice classrooms		119.3
		TOTAL	**119.3**
3. GRAYTHWAITE HOUSE			
Class 9b:	Function room & kitchen		128.5
Class 5:	Offices, meeting rooms & stores		670.97
Class 5:	New link		24
		TOTAL	**823.47**

The following comments are made regarding the green star rating of the development application Stage 1 of the proposed expansion of the Graythwaite site:

- The Coach House is not eligible for Green Star Rating because Class 5 or Class 4 represents less than 80% of the building GFA.
- Tom O'Neill Centre (Class 9B Building) can only be assessed using a Pilot tool for public building.
- It is therefore recommended to rate the Graythwaite House (Class 5 building) using Green Star using Office Design v3 rating tool.

- Spatial Differentiation
  - To meet the Spatial Differentiation criterion, the project must be clearly distinct.
- Conditional Requirements: There are two conditional requirements for Green Star Rating:
  - The project predicted green gashouse gas emission must not exceed 110 kgCo2/m2/annum
  - The building must be a refurbishment or not to be on land of high ecological value.
- Timing of Certification
  - Application for certification can be lodged following the practice completion of the project and the certified rating must be awarded within two years of practice completion.

2.2.2 Green Star Credits and Weightings

Green Star rating tools include nine separate environmental impact categories, which have different weighting attached to each category as seen in **Table 2** below:

Table 2 Green Star Categories and Weightings

Category	Points Available	Weighting Factor
Management	12	10%
Indoor Environment Quality	27	20%
Energy	29	25%
Transport	11	10%
Water	12	12%
Materials	22	10%
Land Use & Ecology	8	8%
Emissions	16	5%
		100%

The categories are divided into credits, each of which addresses an initiative that improves or has the potential to improve a design, project or building's environmental performance. Each credit category has an environmental weighting. The number of points allocated to each issue (eg Daylighting and Noise in Indoor Environment Quality Category) is effectively a weighting between issues within a credit category.

The following section provides comment on preliminary design initiatives considered for the Stage 1 Project Application drawings for Graythwaite Refurbishment and their relevant score under the Green Building Council of Australia's (GBCA) Green Star Office Design V3 rating scheme. Note the following section is not a formalised Green Star Assessment but will provide comment upon the Green Star categories.

3 MANAGEMENT

The Green Star's Management category is to encourage sustainability principles from the earliest stage of design, ie Concept Design Stage. This category helps to reduce greenhouse emissions and energy consumption through adequate commissioning and user guides. It is also to reduce environmental impact during construction activities.

3.1 MAN 1 - ESD Professional

Environmentally sustainable principles are best implemented from the earliest stages of a project, through to the design and construction phases. This is recognised and encouraged through the Green Star rating scheme by awarding points for having at least one Green Star Accredited Professional on the design team.

The Shore Graythwaite Project commissioned Heggies from DA stage to provide detailed ESD design advice throughout the design stage, and will therefore qualify for points under this criterion.

Two points are therefore achieved for MAN - 1.

3.2 MAN 2 - Building Commissioning

It is possible to improve building services performance and energy efficiency by incorporating comprehensive pre-commissioning, commissioning, and quality monitoring into a project. The Green Star compliance criteria recognises this by awarding credit where it is demonstrated that comprehensive pre-commissioning, commissioning, and quality monitoring are contractually required to be performed by the appropriate contractors and trades on site.

The second point available regards the transfer of information and documentation from the design team and contractor to the building owner/manager.

No point is being sought for the Graythwaite House re-development at this stage.

3.3 MAN 3- Building Tuning

Traditionally, building tuning is undertaken in a limited period of time at the end of a project when there is no budget left. Often, building tuning is conducted using ambient climate conditions at the time, and usually with the building unoccupied.

The proposed building tuning period incorporates an all seasons approach to improved energy efficiency and comfort. Credit is given under the Green Star compliance criterion for a building tuning period of 12 months. This ensures that the time and cost of building tuning is accounted for during the design phase. A 12 month building tuning period also incorporates quarterly reviews and a final recommissioning.

Two points are considered possible for the Graythwaite House re-development.

3.4 MAN 4 - Independent Commissioning Agent

One 1 point is awarded if an independent commissioning agent is appointed from schematic design to handover to provide advice to the client and design team and to monitor and verify the commissioning of all building systems (Hydraulic, electrical, and fire suppression systems) used in the project. There is no HVAC system in the Graythwaite House re-development.

The Green Star compliance criterion encourages the appointment of an independent commissioning agent by awarding points for the contractual commissioning of a suitably qualified or experienced agent.

One point is considered possible for the Graythwaite House re-developemt

3.5 MAN 5 - Building User's Guide

The aim of the Building User's Guide Credit is to encourage and recognise the provision of guidance material to enable building users to achieve the environmental performance envisaged by the design team, and to manage future changes that promote efficiency and environmental quality.

Credit is given under the Green Star Compliance criteria for provision of a building users guide given to building users, occupants and tenants' representatives. The building users guide is to provide information on the design features and ensure that they are used efficiently. The user's guide to gain credit must include the following:

- Energy and Environment Strategy.
- Monitoring and Targeting.
- Building Services.
- Transport Facilities.
- Materials and Waste Policy.
- Expansion/Re-fit Considerations.
- References and Further Information.

One point is awarded where a simple easy to use Building User Guide is provided for the Graythwaite House.

One point is considered possible for this project.

3.6 MAN 6 - Environmental Management

Construction has the potential to result in significant environmental disturbance including pollution, construction waste, and water and energy use. The adoption of a formal environmental management system during construction can significantly minimise these impacts. To encourage the adoption of a formal environmental management system the Green Star Compliance criteria awards credit when it can be demonstrated that:

- The contractor adheres to a comprehensive Environmental Management Plan (EMP) for the works in accordance with Section 4 of the NSW Environmental Management System guidelines (1998)
- The contractor has ISO 140001 Environmental Management System accreditation.

Two points are considered possible for Graythwaite House.

3.7 MAN 7- Waste Management

Waste management involves a hierarchy of actions, in the following order:

- Waste Avoidance.
- Waste Minimisation.
- Waste Reuse.
- Waste Recovery and Recycling.
- Waste Disposal.
- The Waste Avoidance and Resource Recovery Act 2001 (which repealed the 1995 Act) require local government to implement strategies to reduce waste generation by avoidance, reuse and recycling.

Historically waste from construction sites have contributed an approximated 40% of all waste going to landfill despite the fact that the majority of it can be considered valuable material to be reused or recycled. Waste management on construction sites is becoming increasingly common. A comprehensive waste management plan is recognised under the Green Star Compliance criteria where weighted credit is awarded for the following:

- 60% of waste (by weight) is re-used or recycled.
- 80% of waste (be weight) is reused or recycled.

For the purposes of obtaining an indicative rating, it has been assumed that the re-development will commit to a diversion of 60% of construction waste from landfill equivalent to one point for MAN 7. It is also assumed that a comprehensive waste management plan will be provided and implemented. Records must be kept by the contractor to demonstrate the actual percentage of waste recycled by weight and these must be reported to the owner quarterly.

It has been assumed that one point is achievable for the Graythwaite House Re-development.

4 INDOOR ENVIRONMENT QUALITY

The Indoor Environment Quality (IEQ) category ensures building and building services are designed and managed to benefit the health and wellbeing of building occupants and visitors.

4.1 IEQ 1 - Ventilation Rates

The intent of this credit is to maximise the use of natural ventilation to the Centre as a whole during favourable climatic conditions, to promote a healthy indoor environment. Increased natural ventilation rates maintain general contaminants (odour, VOCs etc) at lower concentrations than artificially ventilated spaces, improving indoor air quality.

Up to three points are awarded if the minimum outside air provided by the base building services is at rates better than the requirements of AS 1668.2-1991 *The Use of Mechanical ventilation and Air-conditioning in Buildings – Mechanical Ventilation for Acceptable Indoor Air Quality* or if natural ventilation is provided, as follows:

Ventilation System	Green Star Criteria
Mechanically Ventilated Buildings	• 1 point is awarded for a 50% improvement on AS 1668.2-1991; • 2 points are awarded for a 100% improvement on AS 1668.2-1991; and • 3 points are awarded for a 150% improvement on AS 1668.2-1991.
Naturally Ventilated Buildings	Three points are awarded where it is demonstrated that 90% of the GLA and common areas (excluding car park and tenancies that provide their own air) is naturally ventilated in accordance with AS 1668.2-2002.
Mixed Mode Buildings	Both modes of operation must satisfy the relevant mechanical and natural ventilation criteria. The points awarded will be limited to the maximum points awarded under the mechanical ventilation criteria.

It is noted that the Graythwaite House re-development is naturally ventilated and that there are substantial points to be gained through this credit, and attention should be given to this area during the detail design phase of the project.

It is noted that a balance is required between providing adequate fresh air to dilute contaminants and the loss/gain in heat and resulting increased energy consumption associated with artificial heating and cooling requirements. This should be noted in the detail design of the Graythwaite House re-development.

As a guide the following perspective requirements apply for typical commercial buildings with a net floor area per occupant of 15 m^2:

- Minimum area of operable openings into an enclosure equals to 5% of the NLA
- All external openings are proportionally distributed to the floor area
- All internal openings along the air path shall not be less than the total external openings and flow through air does not pass through more than two enclosures and a corridor
- All parts of the enclosure being ventilated shall be within 7 m or within a distance twice the enclosure height of the shortest path between any two natural ventilation openings.

Three points are being sought for the proposed re-development based on the provided architectural drawings AR-D1 2001 – Revision P2 dated March 2010. The project is required to demonstrate that 95% of the NLA is naturally ventilated in accordance with AS1668.2-2002.

4.2 IEQ 2 - Air Change Effectiveness

Air Change Effectiveness (ACE) relates to the efficiency of the supply/outside air distribution through an occupied space. ACE compares the age of the air in the occupied portions of the building to the age of the air if perfect mixing of the ventilation air existed. By increasing the ACE, the impact of indoor air pollutants generated within the occupied space is minimised.

For the ACE credit, two points are awarded where it is demonstrated that:

Ventilation System	Green Star Criteria
Mechanically Ventilated Buildings	The ventilation systems are designed to achieve an ACE of >0.95 when measured in accordance with ASHRAE 129-1997. ACE is to be measured in the breathing zone (nominally 1m from the finished floor level).
Naturally Ventilated Buildings	Demonstrate a distribution and laminar flow pattern for at least 95% of each space in the direction of air flow for not less than 95% of standard hours of occupancy.
Mixed Mode Buildings	Both modes of operation must satisfy the relevant mechanical and natural ventilation criteria, but the requirement for natural ventilation is reduced to 95% of the hours of the predicted natural ventilation operation

It is currently assumed that no point can be achieved for the proposed re-development at this stage.

4.3 IEQ 3 - Carbon Dioxide Monitoring and Control

Elevated carbon dioxide (CO_2) levels are indicative of inadequate ventilation, affecting the quality of air within an enclosed occupied space, and the health of the occupants. CO_2 monitoring systems can detect elevated concentrations of CO_2 and automatically adjust ventilation supply rates before indoor air quality becomes problematic.

Under the Green Star Office Design rating scheme, one point is awarded where it is demonstrated that:

- A CO_2 monitoring system with a minimum of one CO_2 sensor at all return points on each floor (excluding car park) is provided to facilitate continuous monitoring and adjustments of outside air ventilation rates to each individual zone, ensuring independent control of ventilation rates to achieve fresh air requirements; or
- Where systems provide 100% outside air with no re-circulated component; or
- Where the building is naturally ventilated and ventilation rates are directly controlled by occupants.

The Graythwaite House Re-development is naturally ventilated and the ventilation rates are directly controlled by occupants. One point is therefore achievable for IEQ 3.

4.4 IEQ 4 - Daylight

Studies have shown that the increasing reliance on artificial lighting in building design is having a detrimental affect on the health and wellbeing of occupants. Natural lighting, from the sun, is freely available and improves the mindset and health of workers and visitors.

The Daylight credit under Green Star aims to encourage and recognise designs that provide good levels of daylight for building users. One point is awarded where it is demonstrated that 30% of the base building common areas (excluding car park) have a Daylight Factor of at least 2.0% as measured at the floor level under a uniform design sky. Compliance requirements are as follows:

- A Daylight Modelling Report;
- Copies of architectural façade and roof drawings and elevations to show the transparent façade materials;
- Copies of architectural plan drawings clearly showing the areas considered to have a Daylight Factor of ≥ 2.0% within the NLA of each section clearly shown;
- Copies of the sections of the specification where all glazing properties and minimum transmittal levels are nominated; and
- A copy of the site plan in the context of the surrounding area showing heights and location of surrounding buildings and average reflectance for house buildings.

One point is being sought for the Graythwaite House Re-development at this stage.

4.5 IEQ 5 – Daylight Glare Control

One point is awarded where it is demonstrated that glare from daylight is reduced for through any combination of the below:

- Fixed shading devices shade the working plan from direct sun at desk height for 80% of standard working hours. OR
- Blinds or screens are fitted on all glazing and meet the following criteria: eliminate all direct sunlight, controlled with an automatic monitoring system, equipped with a manual override function and have a visual light transmittance of <10%.

No point is being sought for the Graythwaite House Re-development at this stage.

4.6 IEQ 6 – High Frequency Ballasts

The developer is committed to install high frequency ballasts in fluorescent luminaries over a minimum of 95% of the Class 5 offices of Graythwaite House NLA.

One point is therefore achievable for IEQ 6.

4.7 IEQ 7 - Electrical Lighting Level

One point is awarded where the office design has a maintained illuminance level of no more than 400 Lux for 95% of the Class 5 office NLA at the working plan (720 mm AFFL)

It has been assumed that one point is achievable for the Graythwaite House Re-development.

4.8 IEQ 8 - External View

Up to two points are awarded when 80% of the Class 5 NLA has a direct line of sight to the outdoors (one point is awarded for 60% of the NLA). The distance to the nearest vision glazing is to be no more than 8 m. The sight line is to be measured by extending a perpendicular line from the atrium or window. A line at 45 degree can be used at the corner.

Two points are being sought for the proposed re-development based on the provided architectural drawings AR-D1 2001 – Revision P2 dated March 2010.

4.9 IEQ 9 - Thermal Comfort

Buildings are often designed using air temperature design conditions, which is often a poor indicator of how comfortable spaces actually are. The sensation of comfort is based on a number of parameters including air temperature, humidity, air movement, metabolic rates and clothing levels. An example of where someone may feel uncomfortable, despite ambient conditions, is when someone is sitting in direct sunlight, on a 22°C day.

The Thermal Comfort credit aims to encourage projects to design for comfort, rather than temperature. Two points are awarded where it is demonstrated that assessments have been made of thermal comfort levels in the base building common areas (excluding car park) during the design phase and used to evaluate appropriate servicing options.

Where naturally ventilated buildings achieve credit criteria for IEQ 10 “individual comfort control” up to two points are awarded if the acceptability limits of ASHRE standards 55-2004 are achieved during standards operating hours of occupancy for 98% of the year:

- One point for internal temperatures within 80% of Acceptability Limit 1; and
- Two points for internal temperatures within 90% of Acceptability Limit 1

The compliance requirements for this credit include:

- A Thermal Comfort Design Report summarising thermal comfort calculations for the project design;
- Copies of architectural façade and roof drawings and elevations showing façade materials;
- Copies of architectural plan drawings clearly showing each zone assessed for thermal comfort; and
- Copies of the sections of the specification where the thermal properties of materials are nominated.

No point is being sought for IEQ 9 at this stage.

4.10 IEQ 10 – Individual Thermal Comfort Control

For naturally ventilated buildings, individual user control over ventilation openings, no less than 0.75 m^2, is provided as follows:

- One point where openings are provided for every 30 m^2 of the NLA; and
- Two points where openings are provided for every 15 m^2 of the NLA

Two points are being sought for the proposed re-development based on the provided architectural drawings AR-D1 2001 – Revision P2 dated March 2010.

4.11 IEQ 11 - Hazardous Materials

The aim of this credit is to encourage and recognise actions taken to reduce health risks to occupants from the presence of hazardous materials.

The Green Star rating criteria states that it must be demonstrated that a comprehensive hazardous materials survey has been carried out and all identified asbestos has been appropriately removed and disposed of as defined by the relevant environmental and Occupational Health and Safety (OH&S) legislation. For new buildings that have an existing building component of less than 25% of GFA, this credit is 'Not Applicable' and is excluded from the points available.

The Shore Graythwaite project has carried out a comprehensive hazardous materials survey as defined by relevant Environmental and Occupational Health and Safety (OH & S) legislation and one point is therefore achieved by for the Graythwaite House re-development.

Hazardous materials survey and removal procedures whenever were found should be included in the heritage building Environmental Management Plan (EMP).

4.12 IEQ 12 - Internal Noise Levels

Internal noise levels are a significant factor in determining occupant and customer satisfaction and wellbeing. The aim of this credit is to encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level. One point is awarded where the building services noise meets the recommended design sound levels provided in Table 1 of AS/NZS 2107:2000 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors*. An additional point is awarded where the sound levels are between 40-45 dB LAeqT in general offices and 35-40 dB LAeqT in private offices.

The building is naturally ventilated and it is assumed that the above criteria can not be achieved with ventilation openings open. No point is therefore being sought at this stage.

4.13 IEQ 13-15 Materials Selection

People in Australia on average spend over 90% of their lives indoors, and exposure to pollutants can be far greater from breathing indoor air as opposed to outdoor air. Indoor materials selection can play an important role in improving the indoor environment. Three key health areas with indoor pollution minimisation that form part of the Green Star IEQ criteria are:

- Volatile Organic Compounds.
- Formaldehyde.
- Mould.

The following addresses the Green Star criteria for each of these key indoor air pollutants.

4.13.1 IEQ 13 - Volatile Organic Compounds

Volatile organic compounds (VOC) consist primarily of petrochemical solvent type compounds. In buildings, VOCs are commonly emitted from paints, adhesives, carpets, sealants, furniture, cleaning products, office equipment and wood products. Exposure to VOCs can result in symptoms such as eye, nose and skin irritation, headache and lethargy.

The aim of the VOC credit is to encourage and recognise projects that reduce the detrimental impact on occupant health from finishes emitting internal air pollutants. Up to three points are awarded where it is demonstrated that various finishes meet the benchmarks for low VOC content. One point is awarded for each criterion below that is achieved:

- 95% of all painted surfaces are low-VOC paints OR no paint is used;
- All carpets and other floor coverings are low-VOC OR no floor coverings are installed; and/or
- All adhesives and sealants are low-VOC OR no adhesives/sealants are used.

It has been assumed that the above is achievable by the Graythwaite House re-development and 3 points corresponding allocated to the indicative Green Star rating.

4.13.2 IEQ 14 - Formaldehyde Minimisation

Formaldehyde is used widely as an industrial chemical, and as a resin to bind constituent parts together (in particleboards and fibreboards). Formaldehyde resin continues to emit vapour even after it has hardened, and are reported to cause eye, nose and throat irritations, dermatitis, respiratory ailments and increased risk of cancer.

The aim of the formaldehyde minimisation credit is to encourage and recognise projects that reduce the use of formaldehyde composite wood products in order to promote a healthy indoor environment. One point is awarded where it is demonstrated that:

- All composite wood products are low emission formaldehyde;
  OR
- No composite wood products are used.

It has been assumed that the above is achievable by the Graythwaite House re-development and one point corresponding to IEQ-14 is allocated to the indicative Green Star rating.

4.13.3 IEQ 15 - Mould Prevention

Excessive moisture in various building materials and systems can provide a place for mould to grow. Problems may arise when quantities of mould grow beyond usual limits or when particular species are introduced to a building. The most effective way of controlling humidity and moisture problems is to prevent unhealthy mould growth and build up, combined with an effective maintenance program. The GBCA determines the following criteria as a guide to controlling mould in office buildings under the Green Star rating scheme:

- Mechanical ventilation systems should be designed to actively control humidity to be no more that 60% relative humidity in the space and no more than 80% relative humidity in supply ductwork, or
- The building should be fully naturally ventilated.

The Graythwaite House re-development is fully naturally ventilated and one point corresponding allocated to the indicative Green Star rating.

4.13.4 IEQ 16 - Tenant Exhaust Riser

One point is awarded where the building includes a dedicated tenant's exhaust riser with the following characteristics:

- Complies with section 5.7 of AS1668.2-2002;
- Provides no less than 0.2 L/s/m2 for 100 NLA
- Has a capacity of 0.35 L/s/m2 for 100% of the NLA on any individual floor and the exhaust system is not recycled to other enclosure of different use.

No point is being sought for the Graythwaite House re-development at this stage.

5 ENERGY

The Energy category helps reduces greenhouse emissions from operation of the building, and encourages the use of energy more efficiently and reduces peak loads. The six credits in the Energy category are:

- Energy Improvement.
- Electrical Sub-metering.
- Tenancy Sub-metering.
- Office Lighting Power Density.
- Office Lighting Zoning.
- Peak Energy Demand Reduction.

A critical component of the energy design to be considered during preliminary stages is the tuning of the façade to optimise solar access and thereby reduce energy consumption of mechanical services in meeting heating and cooling loads. Careful passive design to optimise solar access will maximise the potential for the tower to attain a higher score during detailed design of mechanical services.

5.1 Ene 1 - Energy Improvement

The aim of the Energy Improvement credit is to encourage and recognise projects that contain design features that help to minimise operational energy consumption and greenhouse gas emissions of the base building over and above the Conditional Requirement. Up to twenty points are awarded where it is demonstrated that there is an improvement in energy efficiency and greenhouse gas emissions above 110 kg/Co_2/m^2/annum.

Heggies anticipate that the Graythwaite House re-development meets the conditional requirement for the Energy and achieves additional points for Ene – 1. To allocate Points for Ene – 1, the following should be provided:

- Energy modelling report in accordance with the Australian Building Green House Rating (ABGR) validation protocol must be provided.
- Extracts from the specifications demonstrating that all the inputs used in the energy simulation are reflected in the current design.

No points are allocated for energy improvement at this stage. This category can be further reviewed when the building services design is progressed.

5.2 Ene 2 - Sub Metering

The use of sub-metering of energy consumption for large consumers and tenancies does not expressly save energy itself, but provides baseline information to monitor trends, identify improvement opportunities and encourage sustainable behaviour. Each meter can be connected to a data logger, which can send usage information via General Packet Radio System (GPRS) technology to the utility provider, the building management system and the tenant. Sub-metering is broken into electrical sub-metering (for major base building services) and tenancy sub-metering.

5.2.1 Electrical Sub Metering

Successful management of energy consumption of large uses within a building allows building managers to fine-tune operational procedures to minimise consumption and compare historical use. Under the Green Star Office Design rating scheme, one point is awarded where it is demonstrated that sub-metering is provided for all substantive (greater than 100 kVa) energy uses within the building and there is a mechanism for monitoring energy consumption data. These uses may include car parks and common areas (lighting and power).

It is expected that all substantive energy uses in the proposed development are below 100 kVa. Such details will be considered when the mechanical and electrical services design is progressed.

It has been assumed that one point is achievable for Ene 2.

5.2.2 Tenancy Sub Metering

Lighting energy consumption in tenancies contributes signification to energy loads of a commercial re-development, and metering can assist in the measurement and management of lighting usage. Under the Green Star Office Design rating scheme, additional point is achieved where

- The point in Section 6.2.1. is achieved; and
- Sub metering is provided separately for lighting and separately for power for each floor; and
- There is an effective mechanism for monitoring energy consumption data from all energy sub-meters.

It is assumed that the additional point for Ene – 2 is not achievable at this stage.

5.3 Ene 3 - Lighting Power Density

Up to three points are awarded where it is demonstrated that the lighting power densities for 95% of the NLA meets the following criteria at 720 mm AFFL with the default maintenance factor of 0.8:

- One point for lighting power density of 2.5 W/m^2 per 100 LUX
- Two points for lighting Power density of 2.0 W/m^2 per 100 LUX; and
- Three points for lighting power density of 1.5 W/m^2 per 100 LUX.

The provision of energy efficiency lighting systems is achievable through:

- Use of electronic ballasts (see also IEQ-6)
- New generation florescent lamps
- Efficient luminaries
- Correct spacing of light fitting
- Lighting control zoning
- Maximising use of daylight with perimeter dimming
- Designing to reasonable light level

A lighting power density of 1.5 W/m^2 per 100 LUX is assumed for the proposed re-development. Three points are therefore allocated to the indicative Green Star rating.

5.4 Ene 4 – Lighting Zoning

One point is awarded where it is demonstrated that:

- All individual spaces have individual switches
- The size of each individual zone does not exceed 100 m^2 for 95% of the NLA

An additional point is awarded where the above point is achieved and it is demonstrated that an individually addressable lighting system is provided for 90% of the NLA.

It is assumed that the Graythwaite house can achieve one point at this stage. The second point can be confirmed when the building services design is progressed.

5.5 Ene 5 - Peak Energy Demand Reduction

Up to two points are awarded where it is demonstrated that energy demand reduction systems are installed to reduce peak demand on electricity infrastructure, as follows:

- 1 point is awarded for 15% reduction; and
- 2 points are awarded for 30% reduction.

Reduction shall be measured against base building peak energy demand calculated without the benefit of the installed reduction systems. This may be achieved by on-site generation or by thermal/energy storage systems, but not by load lopping using the Building Management System (BMS).

No point is being sought for the Graythwaite House at this stage.

6 TRANSPORT

When designing a sustainable re-development, it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging the use of energy efficient public transport that is immediately at hand, reducing car parking facilities, and providing adequate bike storage facilities to minimise the requirement for individual motorised transport.

6.1 Tra 1 - Provision of Car Parking

Transport emissions are one of the largest contributors of greenhouse gas emissions in Australia. This credit aims to encourage the utilisation of alternative and mass transit forms of transport by limiting the availability of private vehicle spaces.

Up to two points are awarded where it can be demonstrated that car parking spaces provided on the site are less than the maximum local planning allowances, as follows:

- 1 point = at least 25% less than the maximum local planning allowances or within 10% of the minimum local planning allowances if only a minimum is stipulated;
- 2 points = at least 50% less than the maximum local planning allowances, or no more than the minimum local planning allowances if only a minimum is stipulated.

Heggies recommend providing carspaces no more than the minimum local planning allowance for the Graythwaite House re-development.

Halcrow Transport report dated November 2010 stated that the Graythwaite site has the potential to accommodate in the order of 25 parked vehicles on the site under existing conditions and that this capacity has existed for some time.

It is proposed that on site parking in the front of the Graythwaite House building will be formalised to retain a total of 6 on site visitor parking spaces and no new staff parking spaces will be provided.

Therefore, 2 points are being sought for this category.

6.2 Tra 2 – Fuel Efficient Transport

The purpose of providing smaller parking spaces (4.3 m by 5 m) is to encourage the use of smaller, more fuel efficient vehicles visiting the Graythwaite House. It is proposed that undersized vehicles with smaller engine capacity, and thus higher fuel efficiency, be given preferential parking allocation, encouraging their uptake and use.

Guidance on small car spaces for off-street parking is given in Australia Standard AS 2890.1-1993 *Parking Facilities, Part 1: Off-street car parking.*

Under the Green Star one point is awarded where:

- A minimum of 80% of all preferred parking spaces are dedicated solely for use by car-pool participants, small carpark, hybrid or other alternative vehicle; and
- A minimum of 10% or 10 parking spaces (whichever is the greater) are designed and labeled for small vehicle4s, in accordance with AS/NZS 2890.1:2004; and
- A minimum of 5% or 5 parking spaces (whichever is the greater) are designed and labeled for mopeds and /or motorbikes in accordance with AS/NZS 2890.1:2004.

No point is being sought for Tra 2 at this stage.

6.3 Tra 3: Cyclist Facilities

Cycling to work and short-trip journeys by bicycle benefits the environment, provides substantial health benefits, and reduces road congestion. Short journeys by car are the most polluting, as a cold car motor pollutes more than a warm motor, as it can take up to five kilometres before pollution control devices (such as catalytic converters) to become effective.

Under the Green Star Office Design rating system, a total of three points are allocated to encourage and recognise building design that promotes the use of bicycles by occupant and visitors by ensuring adequate cyclist facilities are provided. Up to two points are awarded where it is demonstrated that cyclist facilities are provided for building staff, as follows:

- 1 point = 5% of building staff (staff numbers are calculated as one per 15 m^2 of GLA); and
- 2 points = 10% of building staff.

Employee cyclist facilities must include the following:

- Secure bicycle storage (bicycle locker or bicycle rail in a locked compound, one bicycle space per staff member); PLUS
- Accessible showers (one per 10 bicycle spaces provided or part thereof) with adjacent changing facilities; PLUS
- Secure lockers (one for each bicycle space) or equivalent at the changing facility.

For visitor cyclist facilities, an additional point is awarded where it is demonstrated that the above requirements are met and sufficient visitor bicycle parking is signposted, and is provided in an accessible location that is within ten metres of a major public entrance. The criterion for number of visitor bicycle spots required is based on one space per 750 m^2 NLA.

The following recommendations can help achieving 3 points for the Graythwaite House re-development

- Number of Staff: 17 currently to a maximum of 23.
- Number bicycle storages for 23 Staff: 3
- Number of showers: 1
- Number of lockers: 3
- Number of bikes for visitors: 1

It is worth mentioning that showers, changing facilities and bicycle storages are already available on the Shore site near the Graythwaite House Redevelopment.

As per the Green Star-Office Design Technical Manual, it is envisaged that cyclist facilities can be located outside of the main office building with the following additional requirements:

- The cycling facility (storage area, change rooms, showers, etc) must be connected to the building by an all-weather cover.
- The cycling facility must be owned and managed by the same corporate body as the building (i.e. it must not be under separate ownership or title);
- The facility must be located in direct line of sight from a major public entrance of the building and no more than 50 metres away.

It is assumed that the above conditions can be satisfied and three points are considered possible for the Graythwaite House Redevelopment.

6.4 Tra 4: Commuting Public Transport

The locality of a commercial re-development is important in determining modes of travel of staff, consumers and visitors.

The Public Transport Calculator in the Green Star assessment process assesses a development's proximity to public transport based on:

- The type of public transport (train, bus, tram, ferry).
- The walking distance from the building to the stop.
- The frequency of service during peak commuting periods.

The proposed site (see **Figure 2**) has been assessed against the Mass Transport Calculator. The results are shown in **Figure 3**. The re-development is able to achieve 5 points due to its location within north Sydney region (Post Code 2060) and within 500 m (walking distance) of North Sydney train station with four platforms.

Figure 2 Site Location and Locality Map of the Proposed Re-development

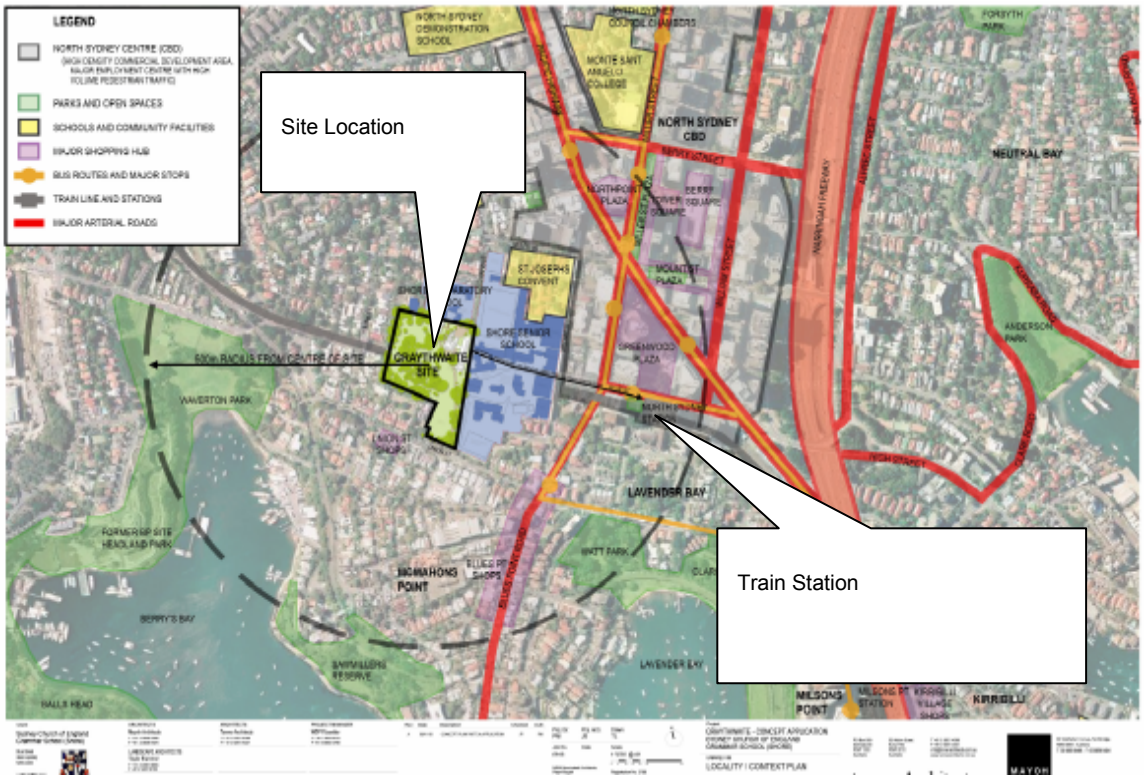
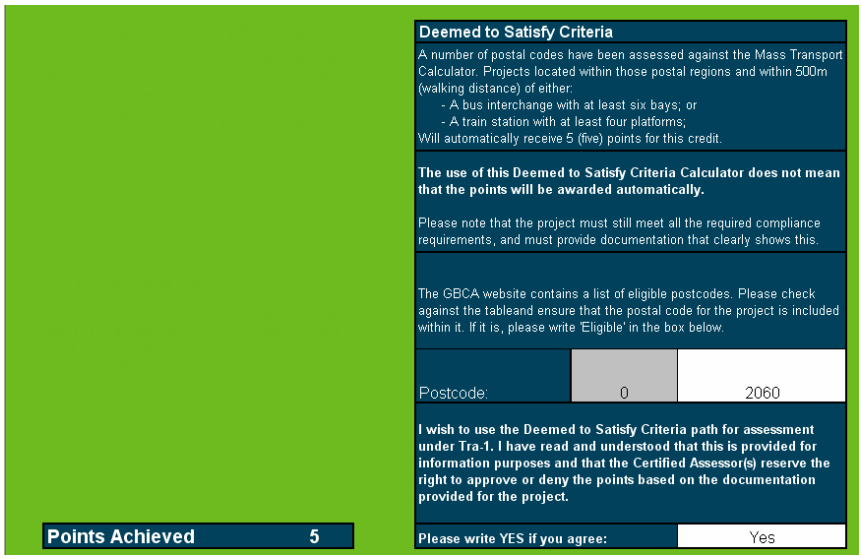


Figure 3 Tra 4 Deemed to Satisfy Green Star Calculator Results for the Graythwaite House Re-development.



Deemed to Satisfy Criteria

A number of postal codes have been assessed against the Mass Transport Calculator. Projects located within those postal regions and within 500m (walking distance) of either:
- A bus interchange with at least six bays; or
- A train station with at least four platforms;

Will automatically receive 5 (five) points for this credit.

The use of this Deemed to Satisfy Criteria Calculator does not mean that the points will be awarded automatically.

Please note that the project must still meet all the required compliance requirements, and must provide documentation that clearly shows this.

The GBCA website contains a list of eligible postcodes. Please check against the tableand ensure that the postal code for the project is included within it. If it is, please write 'Eligible' in the box below.

Postcode:	0	2060

I wish to use the Deemed to Satisfy Criteria path for assessment under Tra-1. I have read and understood that this is provided for information purposes and that the Certified Assessor(s) reserve the right to approve or deny the points based on the documentation provided for the project.

Please write YES if you agree:	Yes

Points Achieved	5

7 WATER

The water category in the Green Star rating scheme is to help minimise water consumption through design of building services, and water conservation management practices.

7.1 Wat 1 - Occupant Amenity Potable Water Efficiency

Water consumption in buildings contributes significantly to water demands in urbanised areas. An audit conducted by Sydney Water determined that, within office buildings, water use is typically broken into to following:

- Amenities – 40%.
- Cooling towers – 30%.
- Irrigation – 5%.
- Waste / leakage – 25%.

This credit aims to encourage and recognise systems that have the potential to reduce the potable water consumption of building occupants, primarily through the use of amenities. The other water use areas are discussed in subsequent sections.

It is proposed to construct a rainwater tank for the proposed re-development to be constructed to the east or west of the Graythwaite House in Stage 2 or Stage 3 of development. Collected roof water could be reused on site for toilet flushing and irrigation.

Up to five points are awarded where it is demonstrated that the predicted potable water consumption for sanitary use within the building has been reduced. The points are determined using the Potable Water Calculator, which takes into account the types and water ratings of fixtures/fittings and any reduction in potable water use through grey water, recycled water, backwater or rainwater reuse systems.

Heggies recommend the following water fixture to reduce the potable water consumption of Graythwaite House occupants

- 100% of toilets in the development are 3 Star water efficient (4 L/Flush).
- 100% of urinals are 3 Star water efficient (2 L/Flush).
- 100% of indoor taps are 4 Star water efficient (7.5 L/min).
- 4 kL storage capacity of rain water tank to be constructed during Stage 2 of the project.

The water calculation was based on the above data and rain fall data shown in the **Figure 4** below (Data obtained from BoM website for Sydney area).

Figure 4 Rainfall Data for Sydney (1929-2010 Statistical Data for Sydney Airport AMO)

Jan.	Feb.	March	April	May	June
94.5	113.9	114.5	104.5	101	120.7
July	**August**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
69.1	67.7	60.8	71.6	79.9	73.4
				Annual Rainfall (mm)	1071.6
				Annual number of rain days >1mm:	81

A total of 5 points was calculated for this credit using the above inputs and the Potable Water Calculator (see **Figure 5**).

Figure 5 Potable Water Calculation for the Graythwaite House Re-development.

	Points Achieved	**5**	
		Gross Floor Area (m^2)	**823**
WCs	**Star Rating**	**Avg L/flush**	**% of WCs**
WCs	3 Star	4	100%
Predicted WC Water Consumption from calculation L/day/m^2			**0.35**
Urinal Flush Controls	**Star Rating**	**Avg L/flush**	**% of urinals**
Two Urinals	3 Star	2	100%
Predicted Urinal Water Consumption from calculation L/day/m^2			**0.13**
Indoor Taps	**Star Rating**	**Avg L/min**	**% of taps**
All Indoor Taps	4 Star	7.5	100%
Showerheads			No
Are there any other recycled water demands in the project? Enter recycled water demand only, disregard potable water use. Reductions in potable water use are awarded in other Water credits in the Green Star tool.			No
RAINWATER HARVESTING			
Are there any rainwater harvesting systems, and if so, do they comply with Local Authority requirements?			Yes
Rainwater collected is used for (please tick appropriate box(es)):			
☑ **Irrigation**		☑ **WC & Urinal Flushing**	
Rainfall collection area to storage tank (m^2)			229

Storage capacity of rainwater tank (kL)						4
Rainwater Run-off Coefficient		Steel roof (> 30 pitch)				0.8
Average monthly rainfall for the building location (mm) **Link to Bureau of Meterology: http://www.bom.gov.au/climate/averages/**						
To obtain the rainfall data and number of rain days for your region, go to the link above and choose your area. Then copy data to all fields.	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**
	94.5	113.9	114.5	104.5	101	120.7
	July	**August**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
	69.1	67.7	60.8	71.6	79.9	73.4
					Annual number of rain days >1mm:	81
Predicted potable water reduction due to rainwater harvesting (L/day/m^2)						0.48
GREYWATER HARVESTING						No
BLACKWATER HARVESTING						No
NET POTABLE WATER CONSUMPTION						**0.19**
POINTS ACHIEVED:						**5**

7.2 Wat 2 - Water Metering

This allows for water sub-meters to be installed on all major water usages in the development to assist in the monitoring and management of consumption.

Under the Green Star Office Design Rating Tool, one point is awarded where it is demonstrated that water meters are installed for all major water uses in the development, including at a minimum:

- Bathroom water consumption;
- Recycled water systems;
- Rainwater collection systems; and;
- Hot water services: and;

There is an effective mechanism for monitoring water consumption data.

No point is being sought for Wat 2 at this stage.

7.3 Wat 3 - Landscape Irrigation Water Efficiency

Irrigation demand is not included in the occupant potable water use as calculated in **Section 7.1**, due to difficulties in setting a benchmark. The aim of this credit is to encourage and recognise the design of systems that aim to reduce the consumption of potable water for landscape irrigation.

Under the Green Star Office rating tool, one point is awarded where it is demonstrated that either 90% of the water requirement for landscape irrigation is sourced from on-site rainwater collection or recycled water, or where a water efficient irrigation system comprising subsoil drip systems and automatic timers with rainwater or soil moisture sensor control override is installed.

In terms of water consumption for landscape irrigation, the landscape architect has confirmed that the existing vegetation will be watered by natural rainfall and through the natural springs on the site. The only area that will require irrigation is the new ornamental garden, between Graythwaite and the Tom O'Neill Centre.

It is recommended that 100% of the water requirement for the new ornamental garden is sourced from the proposed rain water tank. One point is therefore being sought for Wat 3.

7.4 Wat 4: Cooling Tower Water Consumption

The aim of this credit is to encourage and recognise building design that reduces the potential demand on potable water supplies and infrastructure due to water-based building cooling systems.

Up to four points are awarded where the building design demonstrates that potential water consumption is reduced through efficient use of, or avoidance of, evaporative or water cooling tower systems. Two points are awarded where it is demonstrated that:

- The cooling tower water treatment is designed to achieve six or better cycles of concentration for water based cooling systems; or
- The natural ventilation mode of a mixed mode system reduces the HVAC cooling water consumption by at least 50%.

Four points are awarded where it is demonstrated that:

- No cooling towers or evaporative cooling is specified in the design; or
- Cooling systems use 90% non-potable water.

No water based heat rejection systems are provided for the Graythwaite House re-development. Therefore, four points can be achieved for this category.

7.5 WAT 5 - Fire System Water Consumption

Fire protection systems are regularly tested to ensure compliance with statutory requirements, resulting in the discharge of considerable volumes of potable water. The aim of this credit is to encourage and recognise building design that reduces potable water consumption of the building's fire protection and essential water storage systems.

Under the current Green Star rating tool, one point is awarded where it is demonstrated that there is sufficient temporary storage for fire protection system test water and maintenance drain-downs for reuse on-site or where a facility exists for the pump out and recovery of water for use off-site.

It has been assumed that this point is not achievable for the Graythwaite House.

8 MATERIALS

The Materials category in the Green Star rating scheme is designed to minimise resource consumption through material selection, use and re-use initiatives and efficient management practices.

The reuse of materials and selection of sustainable materials are encouraged for the Graythwaite House re-development. Additionally, it is recommended that a commitment is made to maximise the use of local materials for this project. This will reduce the transportation requirements for the materials used on the job, with corresponding embodied energy savings.

8.1 Building Fabric

The existing building materials for the proposed development at Graythwaite House development are tabulated below.

Table 3 Material Section for Proposed Commercial Building

Element	Material type	Detail
External walls	Masonry Construction	No insulation
Windows	Single Glazing	Clear glass
	Internal window covering	Not specified
	External window covering	As per the provided drawings
Ceilings	Plasterboard	
Floor	Mainly Timber. The Kitchen has a concrete floor	
	Covering	Carpet
	Insulation	None
Roof	Sandstone	

Thermal insulation in the outer fabric of the building is important for the control of heat flow through the external fabric to achieve a successful energy efficient design. The insulations in the ceiling/roof and the external walls should minimise heat loss in cold weather and prevent overheating during summers. Insulation for the external walls and for the ceiling and roof at the top level will be finalised during the detailed design stage of the project. The following recommendations are made to improve significantly the thermal performance of the building fabric:

- Line the inside of the roof with a minimum R3.0 insulation.

Considering an energy and thermal comfort point of view, the choice of the glazing systems depends on:

- Limiting the heat gain during summer
- Allowing sufficient solar heat into the building during winter
- Ensuring daylight access so as not to increase the use of artificial lighting

Clear glazing systems are incorporated in the office buildings on the northern, western, eastern and southern sides of the building allowing plenty of natural daylight access and therefore minimising the use of artificial lighting on the office levels.

No recommendations are made to replace the existing glazing system due to heritage considerations of the proposed Graythwaite House re-development.

8.2 Mat 1 - Recycling Waste Storage

Australia's per capita material flows is very high by world standards, generating almost 180 tonnes per person per annum. Waste generated in day to day operations, such as cardboard, plastics, glass bottles, aluminium cans and paper, are commonly recycled. A convenient, purpose-designed storage space ensures that sufficient waste is accumulated before it is collected, and encourages sorting of waste by tenants.

The aim of this credit is to encourage and recognise the inclusion of storage space that facilitates the recycling of resources used to reduce waste going to disposal.

Two points are awarded where it is demonstrated that a dedicated storage area is provided for the separation, collection and recycling of consumables with good access for all building users and customers and for collection by recycling companies. The storage area shall meet the access requirements of "Policy for Waste Minimisation in New Developments". And is located in the same level as the loading dock with a clearly-marked sign-posted and be adequately sized to allow for recycling of, as a minimum, paper, cardboard, glass, plastics, metals, and organic materials.

Heggies recommend providing a recycle waste storage for the proposed re-development. The minimum recyclable storage space must be at least 0.8% of GFA (6.6 m^2) to achieve two points for Mat - 1.

8.3 Mat 2 - Building re-use

The aim of this credit is to encourage and recognise the reuse of existing façades and structure to reduce new material consumption.

Six points are available as follows:

- UP to two points are awarded where a proportion of the total existing façade of the building, by vertical area, is reused:
    - 1 point for re-use of 60%
    - 2 points for re-use of 90%
- Up to four points are awarded where a proportion of the existing major structure, by gross building volume, is reused
    - 2 points for 30% re-use
    - 3 points for 60% re-use
    - 4 points for 90% re-use

The extent of demolition of Graythwaite House is minor, comprising a two-storey toilet block at the rear of the house. The proposed redevelopment re-uses more than 90% of the total existing facades of the building and more than 80% of the existing major structure.

Five points are therefore allocated for this category.

8.4 Mat 3 – Reused Material

One point is awarded where at least 2% of the project's total contract value is represented by reused products/materials. Example of re-used materials includes, but is not limited to bricks, windows, cladding, pre-cast structure.

The credit excludes material specifically addressed by other credit (ie steel, concrete, PVC and timber); neither does it address the re-use of the original building(s) on the site (addressed by Mat 2).

No point is being sought at this stage.

8.5 Mat 4 - Shell and Core Integrated Fitout

Up to two points are awarded where it is demonstrated that the percentage of the NLA of the base building construction or refurbishment is either, 'shell and core' (ie no ceiling, floor finishes or partitions installed) or the fitout is fully integrated with the tenancy fitout works.

Heggies recommend that the fitout design is being coordinated with the base building design and construction.

Two points are being sought for Mat 4 at this stage.

8.6 Mat 5 - Recycled Content of Concrete

Concrete is a significant component in most commercial buildings, forming floors, columns, footings and facades. This credit aims to encourage and recognise the reduction of embodied energy and resource depletion due to the use of concrete.

Up to three points are awarded where it can be demonstrated that the concrete to be used in the building construction or refurbishment has a significant recycled content. One point is awarded where 20% of all aggregate used is recycled aggregate. An additional two points are also awarded, as follows:

- 1 point = 20% of cement used for in-situ concrete and 15% of cement used for pre-cast concrete is replaced with industrial waste product;
- 2 points = 40% of cement used for in-situ concrete and 30% of cement used for pre-cast concrete is replaced with industrial waste product.

It has been assumed that the material cost of new concrete represents less than 1% of the project's contract value. This credit is therefore Not Applicable and is excluded from the points available used to calculated the material category score.

8.7 Mat 6 - Recycled Content of Steel

The aim of this credit is to encourage and recognise the reduction in embodied energy and resource depletion due to the use of recycled steel.

The structural engineers have advised that structural steel with a recycled steel content as part of milling process can be used for the project. However, the manufacturer would have to confirm and/or certify the steel yield stress and other material characteristics. The recycled steel percentage content in steel available in Australia would need to be confirmed by suppliers, but it is understood that currently it would not be greater than 70%. The cost differential of the use of such steel also remains to be confirmed.

It has been assumed that the material cost of new steel represents less than 1% of the project's contract value. This credit is therefore Not Applicable and is excluded from the points available used to calculated the material category score.

8.8 Mat 7 - PVC Minimisation

Poly Vinyl Chloride (PVC) products are used in almost all electrical and data cabling and ducting and for water supply drainage. Buildings account for approximately 60% of PVC use in Australia, and as Australia has limited provisions for the safe recycling of PVC, the minimisation or elimination of PVC in building projects is encouraged through Green Star.

Up to two points are awarded where it is demonstrated that the total PVC content cost for major services elements (pipes, conduits and cables) is reduced by replacing with alternative materials, as follows:

- 1 point = 30% reduction by cost;
- 2 points = 60% reduction by cost.

It has been assumed that the above is achievable by the Graythwaite House re-development and one point corresponding allocated to the indicative Green Star rating.

8.9 Mat 8 - Sustainable Timber

Australia's deforestation rates are amongst the highest in the world. The specification of re-used timber products or timber that has certified environmentally responsible forest management practices can act to reduce rates of deforestation in Australia and globally.

Two points are awarded where it is demonstrated that 95% of all timber and composite timber products used in the base building and construction works are required to be sourced from either one or a combination of the following:

- Post-consumer reused timber; or
- Forest Stewardship Council (FSC) certified timber.

No point is being sought for this category at this stage.

8.10 Mat 9 – Design for Disassembly

One point is awarded where 50% (by area) of the structure framing, roofing, and façade cladding systems are designed for disassembly or 95% of the total façade is designed for disassembly.

No point is being sought for this category at this stage.

8.11 Mat 10 - Dematerialisation

The aim of this credit is to encourage and recognise designs that produce a net reduction in the total amount of material used.

No point is being sought for this category at this stage. One point can be achieved where the following two initiatives are demonstrated:

- The building is fully naturally ventilated
- Mass of underground piping is reduced by 25% for the same functional requirement and material for naturally ventilated building OR

  No piping is used for urinals (ie all urinals are water free).

9 LAND USE AND ECOLOGY

9.1 Ecological Value of the Site

It is a conditional requirement for obtaining a certified Green Star rating that the development site is a refurbished building or is not on land of high ecological value. The aim of this credit is to encourage wherever possible development on land that already has a limited ecological value and discourage the development of ecologically valuable sites.

To fulfill this requirement, it must be demonstrated that the project site is not located on land of high ecological value, including:

- Prime agricultural land; and
- Land within 100 m of a natural wetland.

The Graythwaite House re-development site satisfies both of the above, and therefore satisfies the conditional requirement for a certified Green Star rating.

9.2 Eco 1 - Topsoil and Fill Removal from Site

Topsoil is a valuable and diminishing resource at all scales. Australia in particular has very poor topsoil regeneration rates, and depends heavily on the economic foundation that healthy and nutrient rich soils provide.

The aim of this credit is to encourage and recognise practices that reduce the amount of topsoil and fill removed from development sites. One point is awarded where it is demonstrated that cut and fill requirements are balanced on-site and where there is no exportation of fill or topsoil from the site.

It is most likely that this credit can not be achieved for the proposed development and further assessment will be carried out during the detailed design stage of the project.

9.3 Eco 2 Re-use of Land

The aim of this credit is to encourage and recognise the reuse of land that has previously been developed. One point is awarded where it is demonstrated that at least 75% of the site has been previously built on. Therefore, one point can be achieved for this credit.

The Graythwaite House re-development is a refurbishment project with a minor extension, and therefore one point is allocated for this category.

9.4 Eco 3 - Reclaimed Contaminated Land

Many sites throughout Australia are affected by contamination caused by manufacturing, petrochemical, military, urban and agricultural activities. The development of contaminated sites not only makes available a redundant, formerly developed area, but also makes safe an area that would otherwise be unhealthy for human occupation or use.

The aim of this credit is to encourage and recognise positive actions to use contaminated land that otherwise would not have been developed. Two points are awarded where it is demonstrated that the land prior to development was defined as contaminated and where adequate remedial steps have been taken by the developer to decontaminate or safely encapsulate the site prior to construction.

It is most likely that this credit is 'Not Applicable' for the proposed development and is excluded from the points available for green star rating.

9.5 Eco 4 - Change of Ecological Value

Australia has very distinctive native flora and fauna, many of which are found no where else in the world. Changes to landscape as a result of human activity can destroy habitat and place species at risk of endangerment. The Change of Ecological Value credit aims to encourage and recognise the minimisation of ecological impact from a development and maximise the enhancement of a site for both new and existing buildings.

Up to four points are awarded where it is demonstrated that the ecological value of a development site is either not diminished or is enhanced beyond its previously existing state. No points are available for sites which contain rare, threatened or vulnerable flora and fauna. The points are determined using the Change in Ecology Calculator, which compares the relative ecological value of land use before and after development.

One point is achieved for the proposed development using the included calculator (Refer **Figure 7**).

Figure 6 Existing and Proposed Landscaping for the Graythwaite House Re-development

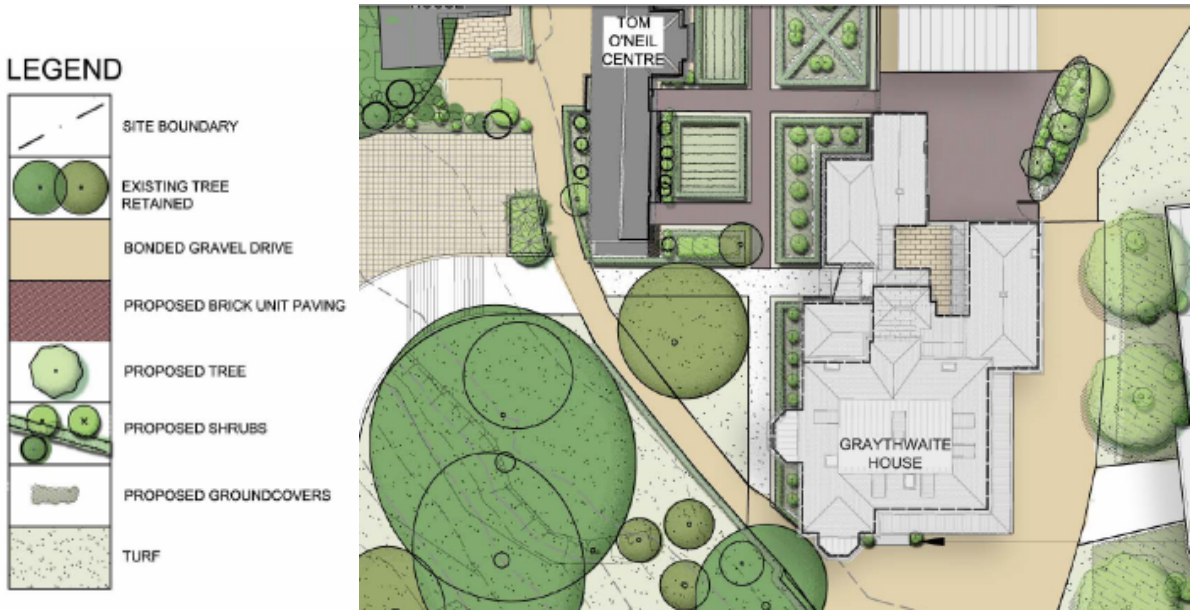


Figure 7 Ecology Value of the Graythwaite Stage 1 Project

Land Type	BEFORE	AFTER
	Land Types Before Construction / m^2	Land Types After Construction / m^2
Building	787	823
Bare Ground	36	6595
Weed Infestations	8750	0
Exotic Garden	18857	18854
Native Garden	7790	7790
Regenerated Native Habitat(< 10 years old)*	0	2155
TOTAL	**36217**	**36127**
ECOLOGICAL DIVERSITY INDEX:	7.04	8.23
CHANGE IN ECOLOGICAL DIVERSITY INDEX	**1.19**	
Points Achieved	**1**	

10 EMISSIONS

The purpose of the Emissions category in the Green Star rating scheme is to ensure that buildings and building services are designed and managed to reduced point source pollution to land, air and water.

10.1 Emi 1 - Refrigerant ODP

Building services, such as refrigeration, have an impact on damage sustained to the ozone layer through the release of chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC). These substances are used as refrigerants and are present in some insulating materials. Ozone Depleting Potential (ODP) provides a measure of the potential for damage that a chemical has relative to that of the refrigerant CFC11. CFC11 has an ODP of one and is the most damaging of the CFCs.

The aim of the Refrigerant ODP credit is to encourage the reduction of potential long-term damage to the Earth's ozone layer through the accidental release to the atmosphere of ozone depleting substances.

One point is available for the Graythwaite House re-development because no refrigerants are used in the project.

10.2 Emi 2 - Refrigerant GWP

The effectiveness of compounds in contributing to global warming on a molecule-by-molecule basis is typically measured relative to carbon dioxide and is referred to as the compound's Global Warming Potential (GWP). This parameter depends primarily on the infrared radiation absorption properties of the gas and its atmospheric lifetime.

The phasing out of CFCs and HCFCs as refrigerants under the Montreal Protocol led to the replacement of these substances with HFCs, which have a high GWP. It is deemed good environmental practice to specify refrigerants with a GWP of below 10 (ie ten times the potential assigned to carbon dioxide as a greenhouse gas). Under the Green Star rating,

Two points are awarded where it is demonstrated that all refrigerants have a GWP of less than 10 or where no refrigerants are used.

Two points can therefore be achieved by the Graythwaite project.

10.3 Emi 3 - Refrigerant Leak Detection

Refrigerant leaks can lead to substantial releases of ozone depleting and greenhouse gases to the atmosphere. Reducing leakages can also have monetary savings to the building owner and/or occupier, as leakages can lead to a 40% loss in efficiency of plant. Detecting and repairing leaks reduces potential damage to the environment and has a direct economic benefit to the building’s occupier.

Under the Green Star rating system for office developments, one point is awarded where it is demonstrated that systems containing refrigerants are contained in a moderately air-tight enclosure, and where a refrigerant leak detection system is specified/installed covering high-risk parts of the plant (evaporator or condenser coils can be omitted). An additional point can be achieved where the project has installed a refrigerant recovery system.

This credit is not applicable for the Graythwaite House re-development.

10.4 Emi 4 - Insulant ODP

Some thermal insulants used in building services (such as refrigerant pipework, ductwork, hot and cold water pipes) are manufactured with blowing agents that contain CFCs or HCFCs. The aim of this credit is to encourage and recognise designs which reduce the potential for long-term damage to the Earth's stratospheric ozone layer from ozone depleting substances used in the manufacture or composition of thermal insulation. One point is awarded where it can be demonstrated that the specification of thermal insulation avoids the use of ozone depleting substances in both manufacture and composition.

No point is being sought for the Graythwaite House project at this stage.

10.5 Emi 5 Watercourse Pollution

In highly urbanised systems, up to 90% of rainfall may flow directly into the storm water system, rather than infiltrate into the surrounding environment. Storm water in Australia receives little, if any, treatment before release to the surrounding environment. Common pollutants in storm water from urban environments include oils and surfactants, litter, suspended solids, nutrients, micro-organisms, toxic organics, and trace metals.

The aim of the watercourse pollution credit under Green Star is to encourage and recognise project design that reduces the potential of pollution in water running off from buildings and hard surfaces to natural watercourses. Two points are awarded where it is demonstrated that stormwater leaving the site, at any time up to a 1-in-20 year storm event, is treated/filtered in accordance with either:

- the Victorian EPA Best Practice Guidelines for Environmental Management for Urban Stormwater; or
- the Australian and New Zealand Environment Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.

Additional point is awarded where a riparian buffer zone that has three separate zones of pollution buffering is installed.

To obtain points it must also be demonstrated that the development does not increase peak storm water flows for rainfall events of up to a 1-in-20 year storm.

No point is being sought at this stage. The points for the Watercourse pollution can be confirmed when the design of the hydraulic and storm water system is progressed.

10.6 Emi 6 - Reduced Flow to Sewer

Wastewater from buildings can significantly contribute to waterway pollution and water wastage. The majority of wastewater is water, which has the potential to be reused, reducing the flow of wastewater to the sewer. The aim of this credit is to encourage and recognise building design that reduces water flows to the municipal sewerage systems for treatment. Up to five points are awarded where it is demonstrated that the design outflows to the sewerage system due to building occupants' usage have been reduced. The number of points is determined using the Sewage Calculator.

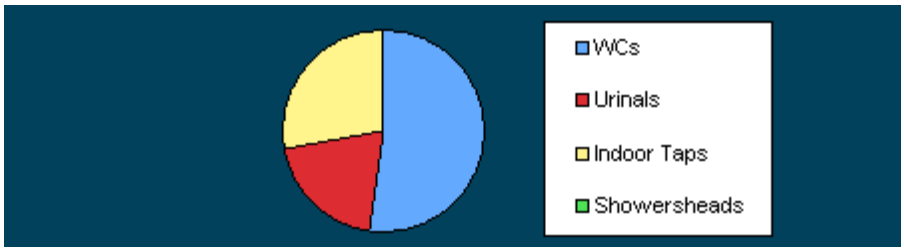
Three points are achieved for the proposed development using the included calculator (Refer **Figure 8**).

Figure 8 Green Star Office Design V3 – Sewerage Calculator

WATER CONSUMPTION DUE TO FITTINGS

The water consumption of the fittings per m^2 is based on assumptions of typical office usage and does not represent actual water consumption in the building.

Predicted Water Consumption from Calculation	L/day/m^2
	0.67



WCs	**0.35**
Urinals	**0.13**
Taps	**0.19**
Showersheads	**0.00**

SEWERAGE REDUCTION DUE TO RECYCLING

Greywater	0.00
Blackwater	0.00

TOTAL REDUCED POTABLE WATER USE	L/day/m^2
Predicted Potable Water Consumption from Fixtures calculation	0.67
Predicted Recycled Water available to Fixtures	0.00
Estimated discharge to sewer (L/day/m^2)	0.19
Points Achieved	**3**

10.7 Emi 7 Light Pollution

Light spilling up into the night sky or onto neighboring properties is a form of pollution, and can disrupt the biological rhythms and navigation of nocturnal species and migratory birds. Additionally, greenhouse gases are released for the purpose of lighting the night sky. The aim of this credit is to encourage and recognise lighting design that reduces pollution from the unnecessary dispersion of light into the night sky and onto neighbouring property. One point is awarded where it is demonstrated that no light beam is directed beyond the site boundaries or upwards without falling directly on a surface with the explicit purpose of illuminating that surface, and where the design complies with AS 4282-1997 Control of the Obtrusive Effects of Outdoor Lighting.

The proposed redevelopment incorporates the following lighting design:

- Drive way lighting
- Security lighting outside ground of the Graythwaite House.

It is most likely that this credit can be achieved for the proposed re-development.

10.8 Emi 8 Legionella (Cooling Towers)

Cooling towers are evaporative coolers used for cooling water to near-ambient temperature. Cooling towers use the evaporation of water to reject heat from the chiller. Warm water in the cooling system is a natural habitat and breeding grounds for micro-organisms, and unclean cooling towers promote growth of potentially infectious bacteria, including *Legionella Pneumophilia*.

The aim of this credit is to encourage and recognise building systems design which eliminates the risk of Legionnaire's Disease from cooling towers. One point is awarded where it is demonstrated that there are no cooling towers serving the building.

No cooling tower will service the proposed building at Graythwaite House re-development. Therefore, one point can be achieved for this credit.

11 SUMMARY OF FINDINGS

Based on the preliminary architectural and building services designs, as well as budgetary expectations, the points allocated to each of the Green Star categories detailed above are summarised in **Table 4**. It should be noted that these point allocated are very preliminary figures, and will only be finalised when detailed design of the development are being carried. These values will provide the owners of the Graythwaite House re-development an overview of the preliminary ESD commitments.

Table 4 Graythwaite House Development – Indicative Green Star Office Rating

Category	Title	Credit No.	Points Available	Points Achieved
Management				
	Green Star Accredited Professional	Man-1	2	2
	Commissioning Clauses	Man-2	2	0
	Building Tuning	Man-3	2	2
	Independent Commissioning Agent	Man-4	1	1
	Building Users' Guide	Man-5	1	1
	Environmental Management	Man-6	2	2
	Waste Management	Man-7	2	1
		TOTAL	12	9
Indoor Environment Quality				
	Ventilation Rates	IEQ - 1	3	3
	Air Change Effectiveness	IEQ - 2	2	0
	Carbon Dioxide Monitoring and Control	IEQ - 3	1	1
	Daylight	IEQ - 4	3	1
	Daylight Glare Control	IEQ - 5	1	0
	High Frequency Ballasts	IEQ - 6	1	1
	Electric Lighting Levels	IEQ - 7	1	1
	External Views	IEQ - 8	2	2
	Thermal Comfort	IEQ - 9	2	0
	Individual Comfort Control	IEQ - 10	2	2
	Hazardous Materials	IEQ - 11	1	1
	Internal Noise Levels	IEQ - 12	2	0
	Volatile Organic Compounds	IEQ - 13	3	3
	Formaldehyde Minimisation	IEQ - 14	1	1
	Mould Prevention	IEQ - 15	1	1
	Tenant Exhaust Riser	IEQ - 16	1	0
		TOTAL	27	17
Energy				
	Conditional Requirement	Ene -	-	-
	Greenhouse Gas Emissions	Ene - 1	20	0
	Energy Sub-metering	Ene - 2	2	1
	Lighting Power Density	Ene - 3	3	3
	Lighting Zoning	Ene - 4	1	1
	Peak Energy Demand Reduction	Ene - 5	2	0
		TOTAL	29	5

Category	Title	Credit No.	Points Available	Points Achieved
Transport				
	Provision of Car Parking	Tra - 1	2	2
	Fuel-Efficient Transport	Tra - 2	1	0
	Cyclist Facilities	Tra - 3	3	3
	Commuting Mass Transport	Tra - 4	5	5
		TOTAL	11	10
Water				
	Occupant Amenity Water	Wat - 1	5	5
	Water Meters	Wat - 2	1	0
	Landscape Irrigation	Wat - 3	1	1
	Heat Rejection Water	Wat - 4	4	4
	Fire System Water Consumption	Wat - 5	1	0
		TOTAL	12	10
Materials				
	Recycling Waste Storage	Mat - 1	2	2
	Building Reuse	Mat - 2	6	5
	Reused Materials	Mat - 3	1	0
	Shell and Core or Integrated Fit-out	Mat - 4	2	2
	Concrete	Mat - 5	0	na
	Steel	Mat - 6	0	na
	PVC Minimisation	Mat - 7	2	1
	Sustainable Timber	Mat - 8	2	0
	Design for Disassembly	Mat - 9	1	0
	Dematerialisation	Mat - 10	1	0
		TOTAL	17	10
Land Use & Ecology				
	Conditional Requirement	Eco -	0	-
	Topsoil	Eco - 1	1	0
	Reuse of Land	Eco - 2	1	1
	Reclaimed Contaminated Land	Eco - 3	0	na
	Change of Ecological Value	Eco - 4	4	1
		TOTAL	6	2
Emissions				
	Refrigerant ODP	Emi - 1	1	1
	Refrigerant GWP	Emi - 2	2	2
	Refrigerant Leaks	Emi - 3	0	na
	Watercourse Pollution	Emi - 5	2	0
	Discharge to Sewer	Emi - 6	5	3
	Light Pollution	Emi - 7	1	1
	Legionella	Emi - 8	1	1
	Insulant ODP	Emi - 4	1	0
		TOTAL	14	8

Total unweighted points = 72
Total weighted points = 55

Once certified this would equate to a Four Star rating

The above analysis points to an overall weighted score of 55, which indicates that the development is *eligible* to apply for a **Four Star Green Star** Certified Rating.

12 SUMMARY AND CONCLUSIONS

Heggies Pty Ltd (Heggies) has been commissioned on the Shore Graythwaite Project to provide a qualitative Ecological Sustainable Design (ESD) assessment during the concept design / development application stage of the proposed expansion of the Graythwaite site, owned by Sydney Church of England Grammar School (Shore) at 20 Edward Street, North Sydney.

Overall, good ESD design features are currently in place for a number of areas, incorporating the following:

- The proposed development is close to good transport nodes with frequent service and facilitates the use of mass transport for work commuting;
- The proposed development will incorporate passive and active energy saving measures such as operable windows to enhance natural ventilation where appropriate;
- The building is naturally ventilated;
- Most building facades are retained;
- Most building structures are retained;
- No refrigerants are used in the project;
- No heat rejection system is used in the project; and
- All trees are retained and additional landscape is provided.

The following additional recommendations have been made to achieve Four Green Star:

- Line the inside of the roof with a minimum R3.0 insulation;
- A 12 month building tuning period also incorporates quarterly reviews and a final recommissioning;
- Independent commissioning agent;
- Building user guides to provide information on the design features and ensure that they are used efficiently;
- Environmental Management Plan (EMP) in accordance with Section 4 of the NSW Environmental Management System guidelines (1998);
- Lighting system incorporating high frequency ballasts and limiting electric lighting levels to 400 Lux;
- On-site rainwater collection for irrigation and toilet flushing to be constructed in Stage 2 of development;
- External cycling facility;
- Water efficient bathroom and kitchen fittings;
- Low VOC paint, carpet, sealant and adhesives where appropriate;
- Dedicated waste storage area for the separation, collection and recycling of consumables with good access for all building users and for collection by recycling companies; and
- Fitout design is being coordinated with the base building design and construction.

An indicative Green Star rating using the Green Building Council of Australia's (GBCA) Office Rating Tool V3 is conducted to assess the initial ESD measures adopted for the building.

The indicative Four Star Office Rating pointed to an overall weighted score of 55, equivalent to a Four Star Green Star Rating. The initial total weighted score for the development is above the minimum weighted score of 45 for a 4 star "Best Practice" rating.

This report is not a formalised Green Star Assessment but provides comment upon the Green Star categories. Additional documentation will be required to demonstrate compliance under the categories awarded.