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Sydney Church of England

Shore Graythwaite Project, Grammar School

Union & Edward Streets North Sydney

Indicative ESD Assessment

Report Number 10-8964-R2

5 October 2011

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

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Sydney Church of England

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Union & Edward Streets North Sydney

Indicative ESD Assessment

PREPARED BY:

SLR Consulting Australia Pty Ltd
2 Lincoln Street Lane Cove NSW 2066 Australia
(PO Box 176 Lane Cove NSW 1595 Australia)
Telephone 61 2 9427 8100 Facsimile 61 2 9427 8200
Email sydney@heggies.com Web www.heggies.com

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EXECUTIVE SUMMARY

SLR Consulting Australia Pty Ltd (SLR Consulting) has been commissioned on the Shore Graythwaite Project to provide a qualitative Ecologically 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 at Union and Edward Streets, North Sydney.

The proposed 2.7 hectares Graythwaite development site is situated between the existing Senior School site and Preparatory School sites in North Sydney. The site is located at the south end of Edward Street and is bounded by Union Street to the south. The site is mostly surrounded by the existing Shore School with some adjoining residential premises.

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

- The proposed development will incorporate passive and active energy saving measures such as operable windows to enhance natural ventilation where appropriate. The proposed development will also incorporate a mechanical ventilation system for selected spaces to provide adequate outside air rates to promote a healthy indoor environment;
- North facing glazing to enhance solar access;
- All corridors (open galleries) are naturally ventilated;
- Retention of most existing trees for the proposed site and provision of additional green walls landscaping for the west building to provide an environmentally friendly contribution to the proposed development.

Opportunities for ESD are limited in respect to the refurbishment of the heritage building whereas all options are available for consideration in the new buildings. The following additional recommendations have been made to improve the sustainability of the heritage building:

- Lighting system incorporating high frequency ballasts;
- On-site rainwater collection; and
- Low VOC paint, carpet, sealant and adhesives where appropriate.

The following additional recommendations have been made to improve significantly the sustainability of the proposed development:

- Line the inside of the roof with a minimum R3.0 insulation;
- Provide external walls insulation with R2.0;
- Incorporate openings to the east and west sides of the basement carpark to enhance natural ventilation;
- Achieve a Daylight Factor (DF) of 2% at desk-height level (720mm AFFL) under a uniform design sky;
- Lighting system incorporating high frequency ballasts;
- Installation of motion sensor lighting in low use basement carpark areas.
- Rainwater tank for irrigation and toilet flushing.
- Water efficient bathroom and kitchen fittings;
- A minimum 4.5 star energy efficient air conditioning systems, if provided;
- Power sub-metering to allow for effective monitoring and management of electricity consumption;

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- Water sub-metering for different uses where appropriate;
- Cyclist parking facilities; and
- Low VOC paint, carpet, sealant and adhesives throughout the building.

A renewable energy option such as Photovoltaic (PV) Solar Cells for the proposed development is considered viable economically. SLR Consulting recommend conducting a detailed study to select, size, cost and conduct a payback analysis for the propose PV system for the site if this option is desired.

Recommendations regarding internal finishes pollutant emission and waste, building management etc. have been made within the body of the report.

The Graythwaite development proposal represents an opportunity for Shore School to demonstrate their commitment to ESD to their school and wider community. A combination of the current design features of the development proposal, along with SLR Consulting additional recommendations will help to achieve significant reductions in the energy and water required by the development both in building and operation. This will also ensure that the educational areas will provide suitable levels of comfort conducive to a healthy and progressive learning environment.

The environmental initiatives of the proposed development will be validated during the DA stage against Green Building Council of Australia (GBCA's) standards in consultation with the School to select an appropriate rating at that time.

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1 INTRODUCTION

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The following ESD elements have been addressed within this report:

- Management;
- Indoor Environment Quality;
- Energy;
- Transport;
- Water; and
- Materials

The following report is prepared based upon architectural drawings A000 to A007, A100 to A104, A150 and A161 Revision G, completed by PD Mayoh and Tanner Architects, dated 16/09/2011.

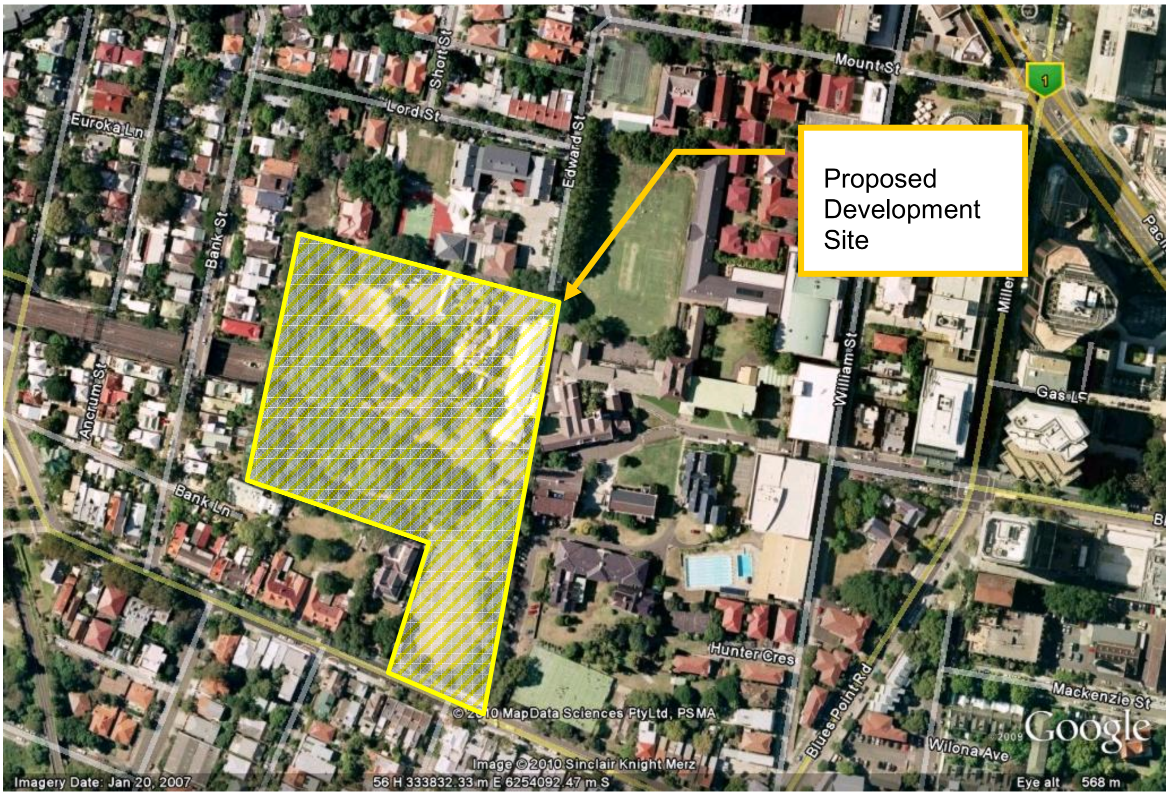
The following report will identify the opportunities for the incorporation of principles of ESD into the project.

2 PROJECT OVERVIEW

2.1 Development Site

The proposed 2.7 hectares Graythwaite development site is situated between the existing Senior School site and Preparatory School sites in North Sydney. The site is located at the south end of Edward Street and is bounded by Union Street to the south. The site is mostly surrounded by the existing Shore School and some adjoining residential premises. **Figure 1** shows an aerial view of the development site.

Figure 1 Development Site Location



Proposed Development Description

The Development Application for the Shore Project at Graythwaite comprises the following:

1. Three stages of development to be completed over 10 to 15 years, comprising:

   <u>Stage 1</u>

   - 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

- Landscape works including advance tree planting, shrub under planting and weed removal along the Western Boundary

Stage 2

- Development of a new building to the north of the house which may be used for education or administration purposes
- Demolition of the Ward building to the east of the house
- Construction of two new buildings to the east of the house for classrooms, teaching or other educational facilities
- Capacity or potential to accommodate approximately 100 students and 10 staff

Stage 3

- Construction of two new buildings to the west of the house for classrooms, teaching or other educational facilities
- Capacity or potential to accommodate approximately 350 students and 35 staff
- Potential demolition of the Tom O'Neill Centre

2. Additional gross floor area (new buildings) of approximately 4,944.4 m^2.

3. Capacity or potential to accommodate approximately 500 students and 50 staff.

The master plan for Stages 1 to 3 (including building footprints/envelopes) would be the subject of an application for Concept Plan approval. Stage 1 works are to be the subject of a Project Application (to be commenced as soon as practicable to ensure that the house is restored as soon as possible). Further Project Applications would be submitted for Stages 2 and 3.

Separate to this Part 3A application, it is planned to seek approval to undertake temporary works to prevent further deterioration of the house.

Figure 2 shows for the proposed concept plan and the proposed buildings.

Figure 2 Proposed Site Plan

3 SITE LAYOUT AND BUILDING DESIGN

3.1 Site Analysis and Layout

A key ESD objective should be to optimise site conditions and minimise energy consumed for cooling and heating loads through proper selection of building orientation and internal layout. The following points are noted with respect to the siting of the proposed development:

It is seen that the proposed west building, where most of the educational spaces will be, is oriented with its long axis running east-west, maximising the north facing façades to the educational spaces. This allows for solar access to all parts of the proposed building and helps to minimize heat gain where sun exposure is heaviest.

The proposed east building is oriented with its long axis running north-south with the glazing facing both east and west to each educational space also allowing for solar access to all parts of the proposed building throughout the day. The large awnings above the glazing facades will minimize high solar heat gains.

3.2 Solar Heat Gain and Shading

One of the objectives of energy conservation is to minimise the heating and cooling requirements of buildings with air conditioning. Sunlight should preferably be able to penetrate the building in winter and be excluded from the building in summer. The following points are noted with respect to the solar access and shading of the proposed development:

Orienting the west building, with its long axis running east-west, maximises the north facing façades to many of the educational spaces. This allows for solar access to those parts of the proposed development and helps to minimize heat gain where sun exposure is heaviest.

The buildings are shaded by the existing large trees. The trees and surrounding buildings (mainly to the west of the proposed buildings) may block a large amount of the summer solar radiation reducing the heat gain in the proposed development throughout the day, year round.

The south orientation of a number of educational spaces in the west building will result in a significant reduction in the summer heat gain and increase in the winter heat loss. Heat losses from the building will be addressed through proper selection of glazing and building material.

The size of the west facing windows of the educational spaces in the east building should be kept to as maximum of 30% of the façade to minimize heat gain where sun exposure is heaviest.

3.3 Landscaping

The proposed development incorporates existing trees which will be retained and protected during the course of any proposed construction work and additional green walls landscaping for the west building to provide an environmentally friendly contribution to the proposed development.

4 ENERGY EFFICIENCY

4.1 Passive Energy Efficiency

Passive energy efficiency refers to the choice of building materials, the placement of external facades and fenestration to effectively utilise solar energy for heating when required, and minimise solar gains when appropriate, thus 'passively' reducing the artificial heating and cooling requirements of the building. While high cooling and heating loads are typical summer and winter months respectively, a good balance of heating and cooling load reduction techniques is required to produce a development with efficient passive design. Well designed buildings will not require artificial heating or cooling.

4.1.1 Natural Ventilation

The most important role of natural ventilation in the context of the educational buildings is to remove accumulated heat gain during overheated periods. In this case, ventilation is intended to achieve predicted rates of volumetric air change. Also important during the summer months is the role of ventilation in directly improving the perception of thermal comfort by occupants of a space. This is achieved when moving air aids the evaporation of perspiration by passing over the skin. As long as there is some air movement, most people will tolerate somewhat higher temperatures.

Heat build-up within educational spaces through daytime summer temperatures can be quickly purged with the availability of suitable breezes at the site.

Department of Planning and NSW Council's *DCP* encourages cross ventilation to be assisted by the building design. Building design should enable ventilation to be controlled, where comfort levels are maintained for the occupants during the summer and winter extremes. Locations of windows and openings within each space are to be suitably in line where possible with each other on opposite sides of the room. It is recommended that building openings be designed such that cross-ventilation is maximised, to minimise heat gain in summer.

Ventilation of buildings is achieved by permanent openings, windows, doors or other devices which have an aggregate opening or openable size of not less than 5% of the floor area of the ventilated room. The provision of ceiling fans for use in summer months is also encouraged.

In terms of air velocity within a room, magnitudes of between 0.2 and 0.7 m/s are generally considered desirable for the provision of so-called comfort ventilation in Sydney climates, with conditions under which higher temperatures are considered acceptable.

The key characteristics of the Sydney Wind Climate relevant to the assessment of the development's wind impact are the two distinct primary wind seasons, which occur in summer and winter/early spring.

- Summer winds occur mainly from the eastern quadrants. While northeast, east and south-easterly winds are the more common prevailing wind direction, southerly winds also occur and provide strong gusts during summer.
- Winter winds occur mainly from the west to northwest, and to a lesser extent the south, and provide the strongest wind gusts during winter.

Natural ventilation has been planned for the following areas in the proposed development:

- Building East Carpark
- Educational Spaces (e.g. Classrooms, Cafeteria and staff rooms)

4.1.1.1 Carpark

The East building two levels carpark being partly above the ground on the south western corner and southern façade can have openings to the outside and be partly ventilated naturally, reducing the use of mechanical ventilation. The carpark entry gate is located on the south façade.

Accordingly, for south and west breezes, the potential openings on the upper basement level are likely to provide a favourable configuration of openings which have both the positive and negative pressures required to promote airflow through the carpark. The existing school buildings on the east of the proposed east building will reduce the effectiveness of the proposed natural ventilation system. In the case of southerly winds, a porous carpark entry gate is recommended to enhance airflow movement in the carpark.

Although natural ventilation will occur with most prevailing wind directions, mechanical exhaust system will be required to maintain sufficient air charge rates and acceptable CO concentration throughout the carpark.

As a part the future project application, detailed assessment utilising numerical modelling such as Computational Fluid dynamics (CFD) modelling will be undertaken to determine need (or otherwise) for mechanical ventilation for the upper basement carpark.

SLR Consulting also recommend providing fresh air to the lower basement carpark through a vertical shaft. The proposed vertical shaft could be located on the East side of the East Building. The mechanical ventilation system can therefore incorporate exhaust fans ONLY. The proposed ventilation shaft can be sized during the DA stage of the project.

4.1.1.2 Educational Spaces

SLR Consulting recommend operable windows on opposite sides of the educational use areas to enhance natural ventilation:

- West building with windows on the north and south facing facades
- East building with windows on the east and west facing facades

Nevertheless, all educational spaces in the development will incorporate passive and active energy saving measures such as operable windows to enhance wind-driven natural ventilation where appropriate.

The design of the west building atrium incorporates fixed horizontal louvres to eliminate views into private residences but maintain outdoor views. SLR Consulting recommend incorporating low and high level louvres in the design of the atrium to enhance natural ventilation and reduce thermal loads during hot summer days.

SLR Consulting recommend consideration of the use of ceiling fans within these spaces; such fans would augment the available wind-induced natural ventilation of these spaces and enhance thermal comfort in summer.

In winter it is important to close off heated areas that need warming. It is recommended that the following initiatives also be incorporated to minimise heat leakage from the building:

- Design detailing of the glazing interface to the window framing system and the provision of adequate sealing in accordance with the Building Code of Australia (BCA).
- Doors leading to hallways, stairwells and non-common use areas provided with draught excluders to limit heat losses during winter months.

Doors located throughout the development in general-use areas, such as access ways to/from the building, fitted with door closers where it is deemed that their opening will have an adverse effect on heat loss during winter.

4.1.2 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.

SLR Consulting recommend achieving a Daylight Factor (DF) of 2% at desk-height level (720 mm AFFL) for the classes under a uniform design sky.

The proposed design incorporates the following:

- A large number of educational spaces in the west building have glazing on the north façade thus achieving high solar access and daylight levels;
- Most of the educational spaces in the east building will have glazing facing both east and west, resulting to daylight access in the morning and afternoon;

The design therefore provides reasonable daylight levels to all educational areas.

SLR Consulting recommend the following initiatives to allow natural daylight access and therefore minimising the use of artificial lighting.

- Implement skylights in the design of all buildings where appropriate.

SLR Consulting also recommend conducting a daylight modeling during detailed design stage of the project to demonstrate daylight factors.

4.2 Operational Energy Efficiency

4.2.1 Air Conditioning and Ventilation System

At this stage the exact heating and cooling units have not been determined. Individual packaged units for a future cafeteria and north building (possible archive store and museum display) can provide superior energy performance when compared with centralised plant.

If individual split systems are chosen, it is commonly recommended that at least a **4.5-Star** energy efficient systems be chosen.

4.2.2 Domestic Hot Water

SLR Consulting recommend installing a solar or gas hot water system with an energy star rating of at least **3.5 Star**.

As natural gas is abundant and more energy efficient than electricity, gas is recommended for hot water in NSW. The sole use of electricity as the energy source for conventional electric water heaters is inefficient because electricity is a secondary source, deriving its energy after burning coal. As coal based systems require expensive handling equipment and specialised pollution control systems, gas water systems are more energy efficient and cheaper.

4.2.3 Appliances

If a future cafeteria is to be fitted with refrigerators, dishwashers and any other appliances should be ensured that all the appliances to be installed by the school are as energy efficient as possible. Energy efficiency of appliances can be determined by their Energy Rating label, which rates them between 1 and 6 -stars, 6 being the most energy efficient. Energy rating labels are compulsory for single phase air conditioners, dishwashers, kitchen taps, etc.

SLR Consulting recommend the installation of appliances with minimum of **3.5 Star** energy rating.

4.2.4 Artificial Lighting

It is recommended that the following lighting features be incorporated into the development to minimise energy consumption due to lighting:

- Maximise use of compact fluorescents and minimise or where possible eliminate the use of halogen down lights, as compact fluorescents are much more efficient than halogen lighting.
- Installation of energy-efficient fluorescent lamps in place of "conventional" fluorescent lamps—for example T8 and T5 (T12s to T8s in developing countries).
- Installation of high frequency electronic ballasts in place of conventional ballasts where possible.
- Lighting Power Control Requirements as per the BCA 2010 Section J Part 6.3.

4.2.5 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.

SLR Consulting recommend sub-metering for all substantive (greater than 100 kVa) energy uses within the proposed development. These uses may include AC units, car parks and common areas (lighting and power).

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

5 BUILDING MATERIALS

Complete energy efficient design aims to reduce the energy consumed by a building over its entire lifecycle. The environmental effects of construction materials and products should be considered over their whole life cycle, and, where feasible and reasonable, construction materials and products should be (but not limited to) selected based on balancing the following criteria:

- Recycle-ability;
- Sustainable sourcing;
- Low embodied energy;
- Low pollution from manufacturing;
- Low transport costs;
- Minimal environmental impact;
- Durability and minimal maintenance;
- Non-hazardous; and
- Eco-labelling and certification.

Embodied energy is the “up front” capital energy investment at the construction stage associated with the building materials and process used in the production of a building. This includes the mining or harvesting of raw materials, processing these materials into housing fabrics, transport for both raw materials and refined products and the preservation of the energy investment through durability.

It is recommended that the use of local materials for this project is maximised where feasible. This will reduce the transportation requirements for the materials used on the job, with corresponding embodied energy savings.

Table 1 Renewable / Recyclable Properties

Material	Embodied Energy	Durability	Re-usability/ Recyclability	Toxicity	Renewable	Polluting
Aluminium	**Very High**	**High**	**High**	**Low**	**No**	**Moderate**
Steel	High	High	High	Generally low	No	Moderate
Concrete	Moderate	Moderate-high	High potential, depends on market	Low	No	Moderate-low
Brick	Moderate	Moderate-high	High potential, depends on market	Low	No	Moderate-low
Wood	Low	Moderate	High	Low	Yes	Low
Glass	Moderate	Moderate	High	Low	No	Low
Carpet	Moderate-high	Low	Moderate, although market very limited	Low	Partially	Moderate-low

Sustainable building design focuses on durability, robustness and adaptive re-use. Materials to be used extensively throughout the development include concrete, steel, glass, aluminium (for all glazing frames) and tiles.

5.1 Building Fabric

5.1.1 Walls

The R-values of common wall systems in Australia, is tabulated below, the higher the R-value, the better the insulation properties of the fabric.

Table 2 R-Value of Typical Wall Systems

Wall type	R-value
Brick Veneer	0.48
Cavity Brick	0.80
Concrete Block	0.48

As seen in **Table 2**, the cavity brick has the highest R-value among the three typical wall systems. While cavity brick is preferred, the subsequent project application design should aim to maximum the overall R-value for the proposed buildings.

5.1.2 Roof

It is proposed to use metal deck or roof tiles construction all new roofs. SLR Consulting recommend R3.0 insulation blanket between the roof and ceiling to reduce the heat gain/loss through the roofs.

5.1.3 The Final Glazing

The following design concepts allowed for low-performance glazing to be used:

- Larger glazing areas facing north with overhangs or external fixed sun shading where appropriate blocking the high summer sun and allowing low winter sun in.
- Minimal west facing glazed areas to reduce low summer sun penetration into the educational spaces.

5.1.4 The Final Floor and Thermal Mass

Concrete slab construction is proposed for all floors throughout the development - concrete has amongst the highest thermal mass capacity of a range of common building products, as presented **Table 3**.

Generally more dense materials have higher mass which has the ability to store heat energy and then release it slowly to the room. This storage effectively smoothes out daily temperature variations within conditioned spaces, with corresponding reductions in both heating and cooling loads.

Table 3 Indicative Thermal Mass Values of Some Common Building and Reference Materials

Material	Thickness (mm)	Thermal Mass ($kJ/m^2.K$)
Dolerite (Rock / Stone)	200	433
10-31 Solid Brick	190	410
Concrete	100	221
Concrete block	90	194
10.01 regular brick	90	151
Clay brick (3.5 kg solid + 0.5 kg mortar)	110	142
Aerated concrete block	100	50
Fibre cement sheet (compressed)	18	32
Wood flooring (hardwood)	19	25
Weatherboard (softwood)	15	16
Fibre cement sheet	6	8
Plasterboard	10	8
Glass	3	6
Expanded polystyrene (EPS-class SL)	50	1.8
Cork	6	1.6
Rockwool (batts)	50	1.5
Fibreglass (batts)	50	0.5
Air	50	0.5

It is worth mentioning that opportunities for ESD are limited in respect to the refurbishment of the heritage building whereas all options are available for consideration in the new building.

6 WATER

Australians use more than one million litres of freshwater per person each year (Green Building Council of Australia 2006).

6.1 Water Fixtures and Fittings

The minimum sustainable standard for water efficient water fixtures and fittings is 3A. To achieve greater than the standard level, the development should consider installing water efficient fixtures and fittings such as:

- 4A flow restricted tapware.
- 4A Dual flush toilets.
- 4A shower heads

If dishwashers are to be installed, it is recommended that appliances with a minimum of 3.0 -star WELS (Water Efficiency Labelling Scheme) rating be selected.

6.2 Alternative Water Supply

In addition to increased water use efficiency, new developments can reduce potable water demand by the building users through the provision of an on-site alternative water supply. There are three principal forms of alternative water supply:

- Reticulation of reclaimed water to the site.
- Rainwater/storm water storage and reuse.
- Grey water storage and reuse.

The above water supply systems can be used for toilet flushing, landscape irrigation and fire services, reducing the demand on potable water supply. SLR Consulting recommend the installation of the rainwater tank in between the west building and Graythwaite House with water collection from the west building and Graythwaite House inclined roofs. The collected rainwater can be used for toilet flushing, laboratories if applicable, fire system water and irrigation.

6.3 Water Metering

To help reduce water consumption, accurate information on usage is required at the building management level. SLR Consulting recommend installing water meters for all major water uses in the development.

6.4 Landscape Irrigation

The proposed development retains most existing landscape and incorporates additional landscaped areas to provide an environmentally friendly contribution to the proposed building. The existing plants and trees are mostly low water usage species and are sustainable on their own.

The additional proposed landscaped design e.g. green walls should focus on using drought resistant species that rely primarily on rainwater for their water needs.

It is understood that, for heritage reasons, the ornamental garden will comprise of some non-drought resistant plants. This garden area will relay on rainwater for their water needs.

7 TRANSPORT

7.1 Provision of Car Parking

Transport emissions are one of the largest contributors of greenhouse gas emissions in Australia. The utilisation of alternative and mass transit forms of transport by limiting the availability of private vehicle spaces is encouraged. With the additional building to the development site, only 41 cars spaces will be provided in the basement carpark in the east building for the additional 50 staff and 500 students for the full concept plan development. Therefore public transport is encouraged in the current concept design.

7.2 Facilitation of Pedestrian and Non-Motorised Transport

When designing a sustainable development it is important to minimise the use of individual motorised transport where possible and thus enhance energy savings and reduce environmental impact through reduced fossil fuel consumption and improved regional air quality. This can be achieved by encouraging all users of the development to make use of the energy efficient public transport that is immediately at hand.

Bike storage facilities should be installed in the proposed Stage 2 and 3 development, which will also help to minimise the requirement for individual motorised transport.

7.3 Commuting Using Public Transport

The school lies in close proximity of good transport nodes with frequent service. The present development lies less than 350 m from North Sydney train Station and frequent service bus routes on Miller Street (approximately 100 m from Edward Street).

The close proximity of the proposed development site to public transport will induce the use of the public bus and train transportation by the students and staff of the school.

8 INDOOR ENVIRONMENTAL QUALITY

Achieving enhanced Indoor Environment Quality (IEQ) ensures that the building and building services are designed and managed to benefit the health and well-being of building occupants and visitors.

8.1 Asbestos

It is recommended that hazmat investigation identifying asbestos and other hazardous materials and removal procedures be included in the heritage building Environmental Management Plan (EMP).

8.2 Internal Noise Levels

Internal noise levels are a significant factor in determining occupant and customer satisfaction and wellbeing. The aim of controlling internal noise levels is to encourage and recognise buildings that are designed to maintain internal noise levels at an appropriate level.

The development will be constructed to comply with:

- Relevant provisions in the Building Code of Australia (BCA)
- The internal acoustic isolation requirements for wall and floor constructions set by North Sydney Council.

SLR Consulting recommend that the proposed development meet the recommended design sound levels provided in BCA and Australian standards. Where relevant, the building design will incorporate measures to respond to the underlying North Shore Rail Line movements.

8.3 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.

SLR Consulting recommend incorporating a CO_2 monitoring system for all air conditioned buildings where appropriate to satisfy BCA requirements.

8.4 Materials Selection

Three key health areas with indoor pollution minimisation are:

- Volatile Organic Compounds.
- Formaldehyde.
- Mould.

8.4.1 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.

SLR Consulting recommend using low VOC paint, carpet, sealant and adhesives throughout the building to reduce the detrimental impact on occupant health from finishes emitting internal air pollutants.

8.4.2 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 is to encourage and recognise projects that reduce the use of formaldehyde composite wood products in order to promote a healthy indoor environment. All composite wood products used in the project should have low emission formaldehyde;

9 OPERATIONAL WASTE MANAGEMENT

An operational Waste and Recycling Management Plan is required as a minimum to meet sustainable building design best practice. As a guideline, the Waste and Recycling Management Plan must include:

- Collection areas.
- Separate waste and recycling streams.
- Transfer of material to common storage area.
- Communal storage areas.
- Frequency of collection.
- Signage and educational initiatives for student and staff.

SLR Consulting recommend developing a waste and recycling management plan that complies with the North Sydney Council guidelines.

10 MANAGEMENT

Building management helps to reduce greenhouse emissions and energy consumption through adequate commissioning and user guides. It is also to reduce environmental impact during construction activities. The following initiatives have been included as opportunities for the Project Team to adopt ESD initiatives during the project application and construction stages of the project:

- Having at least one ESD Professional Green Star Consultant on the design team;
- Improving building services performance and energy efficiency by incorporating comprehensive pre-commissioning, commissioning, and quality monitoring into a project;
- 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;
- Appointing an independent commissioning agent from design to handover to provide advice to the client and design team and to monitor and verify the commissioning of HVAC and building control systems;
- Providing Building User's Guides to provide information on the design features and ensure that they are used efficiently; and
- Providing a comprehensive Environmental Management Plan (EMP) for the works in accordance with Section 4 of the NSW Environmental Management System Guidelines (1998).

Above opportunities will be investigated during the project application stages of the projects

11 RENEWABLE ENERGY OPTIONS FOR THE PROPOSED DEVELOPMENT

As the worldwide demand for fuel increases, alternative and renewable energy sources are emerging as economical and sustainable options. Alternative renewable energy sources are becoming more attractive options because of increased global demand for fuels, environmental responsibility, affordability and new local, state and federal government legislations.

The following renewable energy options are available for the proposed development:

1. Wind Energy;
2. Solar Energy; and
3. Cogeneration Green Initiative.

A qualitative study has shown that Photovoltaic (PV) Solar Cells for the proposed development is considered viable economically due to the following:

- The shadow impact on the proposed west building located to the west of the site and the Graythwaite House are ideal for the installation of solar panels. Ideally the solar panels should face north and be inclined at approximately 35 degrees.
- The NSW “Solar Bonus Scheme” will pay the consumer a flat rate of 60c per kW hr for the electricity they feed into the grid. The scheme will be concentrated for seven years, an;
- Renewable Energy Certificates (RECs) are also created when PV solar systems are installed. Some solar installation companies rebate these back to the customer to reduce the price of the system.

SLR Consulting recommend conducting a detailed study to select, size, cost and conduct a payback analysis for the proposed PV system for the site if renewable energy options are desired.

12 SUMMARY AND CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR Consulting) has been commissioned on the Shore Graythwaite Project to provide a qualitative Ecologically 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 Union and Edward Streets, North Sydney.

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

- The proposed development will incorporate passive and active energy saving measures such as operable windows to enhance natural ventilation where appropriate. The proposed development will also incorporate a mechanical ventilation system to provide adequate outside air rates to promote a healthy indoor environment;
- North facing glazing to enhance solar access;
- All corridors (open galleries) are naturally ventilated;
- Retain most existing trees for the proposed site;
- Installation of sensor lighting in low use basement carpark areas.

Opportunities for ESD are limited in respect to the refurbishment of the heritage building whereas all options are available for consideration in the new buildings. The following additional recommendations have been made to improve the sustainability of the heritage building:

- Lighting system incorporating high frequency ballasts;
- On-site rainwater collection; and
- Low VOC paint, carpet, sealant and adhesives where appropriate.

The following additional recommendations have been made to improve significantly the sustainability of the proposed development:

- Line the inside of the roof with a minimum R3.0 insulation;
- Provide external walls insulation with R2.0;
- Incorporate openings to the east and west sides of the basement carpark to enhance natural ventilation;
- Achieve a Daylight Factor (DF) of 2% at desk-height level (720 mm AFFL) under a uniform design sky;
- Lighting system incorporating high frequency ballasts;
- Rainwater tank for irrigation and toilet flushing.
- Water efficient bathroom and kitchen fittings;
- A minimum 4 star energy efficient air conditioning systems, if provided;
- Power sub-metering to allow for effective monitoring and management of electricity consumption;
- Water sub-metering for different uses where appropriate;
- Cyclist parking facilities; and
- Low VOC paint, carpet, sealant and adhesives throughout the building.

A renewable energy option such as Photovoltaic (PV) Solar Cells for the proposed development is considered viable economically. SLR Consulting recommend conducting a detailed study to select, size, cost and conduct a payback analysis for the propose PV system for the site if this option is desired.

Recommendations regarding internal finishes pollutant emission and waste, building management etc. have been made within the body of the report.

The Graythwaite development proposal represents an opportunity for Shore School to demonstrate their commitment to ESD to their school and wider community. A combination of the current design features of the development proposal, along with SLR Consulting additional recommendations will help to achieve significant reductions in the energy and water required by the development both in building and operation. This will also ensure that the educational areas will provide suitable levels of comfort conducive to a healthy and progressive learning environment.

The environmental initiatives of the proposed development will be validated during the DA stage against Green Building Council of Australia (GBCA's) standards in consultation with the School to select an appropriate rating at that time.