SUSTAINABILITY

STEENSEN VARMING

Liverpool Boys and Girls High School Upgrade Project
Sustainability Report – REF Submission

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Sydney, 31st January 2025
Ref. No. 247063-S02

Prepared For:
School Infrastructure NSW (SINSW)

Prepared By:
Gagandeep Jadhav
Sustainability Consultant

gagandeep.jadhav@steensenvarming.com

1.0 Introduction

This Sustainability Report – REF Submission has been prepared by Steensen Varming on behalf the NSW Department of Education (the Applicant) to assess the potential environmental impacts that could arise from the redevelopment of the Liverpool Boys High School and Liverpool Girls High School, at 18 Forbes Street, Liverpool NSW, 2170 (the site).

This report has been prepared to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as "development permitted without consent" on land carried out by or on behalf of a public authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

This report accompanies a Review of Environment Factors that seeks approval for redeveloping the Liverpool Boys and Liverpool Girls High Schools into a single co-educational school, including:

- [redacted]
- Construction and operation of a six-storey school building, including school hall and gymnasium;
- Associated parking and building services;
- Tree removal;
- Associated landscaping and play spaces;
- Augmentation of service infrastructure; and
- Associated off-site infrastructure works to support the school, including (but not limited to) services, kiss and drop point and pedestrian crossings.

Refer to the Review of Environmental Factors prepared by Ethos Urban for a full description of works.

1.1 Site Description

The site is located at 18 Forbes Street, Liverpool, within the Liverpool Local Government Area (LGA). The site is legally described as Lot 1 DP1137425 and has a total area of approximately 74,973 m2.

The site comprises a broadly rectangular portion of land which currently contains the existing Liverpool Boys High School, Liverpool Girls High School, and the Gulyangarri Public School, which commenced operations in January 2024 and is located to the east of the wider site.

The site's western portion contains Liverpool Boys High School and Liverpool Girls High School. Liverpool Girls High School in the site's southwest comprises three, two-storey buildings. Liverpool Boys High School in the site's northwest, comprises approximately four, two-storey buildings, with adjacent at-grade carparking and various sports courts.

An aerial image of the site is shown at Figure 1 below.

Figure 1 Aerial image of site (source: NearMap)

1.2 Statement of Significance

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed development, it is determined that:

- The extent and nature of potential impacts are low in terms of bushfire and flood risks and will not have significant adverse effects on the locality, community and the environment;
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal effect on the locality, community.

2.0 REF Reporting Requirements & Responses

This section addresses the REF requirements issued for the project, as well as the requirements of the Sustainable Buildings SEPP 2022. The requirements and the associated responses are outlined in the following Table 1, along with corresponding references to sections within this report.

Table 1 REF Requirements and Relevant Responses and References

Requirement	Y	N	N/A	Comments
Ecologically sustainable development				
Does the ESD Report set sustainability targets for the activity in line with the department's commitments, including: • Green Star Buildings certification for projects with >1000m2 new building and >$10m EDC of 5 Star for Sydney, Wollongong and Newcastle metro or 4 Star for rest of NSW • Operational energy and potable water intensity targets for the activity?	☒	☐	☐	Yes, the project is targeting Green Star 5-Star Certification under Green Star Buildings v1 Tool.
If Green Star Buildings certification is required, does the ESD Report include: • the Green Star registration number for the project, and • a Green Star Building pathway showing how activity will achieve the required number of credit points to certify?	☒	☐	☐	Yes, the project's Green Star registration number is GS-9260B. Section 3.9 addresses the pathway for 5-Star certification.
If applicable under the Sustainable Buildings SEPP, has an NABERS embodied emissions material form been included in the ESD Report?	☒	☐	☐	Yes
Does the ESD report include a Climate Change Risk Assessment and Adaptation Plan?	☒	☐	☐	Yes
For sites identified as any high or extreme risks in the Climate Change Risk Assessment and Adaptation Plan, have design responses been identified to been incorporated into the project to mitigate the risks?	☒	☐	☐	Yes, Refer to section 3.8-Resilience and Adaptation
Does the ESD Report adequately address how the activity will: • minimise waste from associated demolition and construction; • minimise peak electricity demand; • minimise overall energy use through passive design; • generate and store renewable energy; • minimise consumption of potable water; and • meter and monitor energy and water consumption and energy generation?	☒	☐	☐	Yes Refer to Section 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8
Does the ESD Report include a Net Zero Action Plan / Net Zero in operations plan (exact name TBA) that adequately addresses how the activity has been designed to eliminate use of fossil fuels during operations, or how the use of fossil fuels will be minimised and will be eliminated by 2035?	☒	☐	☐	Yes, a Net Zero Statement is included. Appendix-B

3.0 Sustainability Approach

The following sustainability initiatives have been considered for the design. Relevant design documentation and reports to support these strategies will be developed and shared with the design team to inform the requirements for the following design phase and subsequent construction stage, where it will be the responsibility of the contractor to implement the targeted strategies.

3.1 Minimisation of waste

The project has been designed for the collection of separate waste streams and the design will ensure safe and efficient access to waste and storage areas for both occupants and waste collection contractors.

In addition to the above, the project is targeting the following waste-related ESD strategies for the contractor to implement during construction:

- The builder or head contractor will be contractually required to have an environmental management system in place to manage its environmental impacts on site.
- The builder or head contractor will develop and implement an environmental management plan to cover the scope of construction activities.

The builder will be contractually required to divert at least 90% of construction and demolition waste from landfills.

3.2 Reduction in peak demand for electricity

The following energy-efficient design features are being considered in the current design, to reduce peak demand for electricity.

- An air quality monitoring system is being considered for the project. This system can allow adjustments on ventilation rates based on air quality, minimising the demand for outdoor air and therefore saving energy.
- The project will sub-meter significant energy uses via the BMS system to track and manage energy consumption.
- In applicable non-specialist areas, the building is designed to maximise daylight availability,
- Electric lighting is designed to be comprised of high-efficiency LED (Light Emitting Diode) technology and to include occupancy sensors where possible.
- A 99kW Photovoltaic system has been incorporated for on-site renewable energy generation.
- Passive strategies detailed in Section 3.3 contribute towards reducing peak demand as cooling loads will be lower.
- The project is targeting a minimum 10% improvement over NCC 2022 Section-J energy efficiency requirements, targets included in Appendix A

3.3 Passive design

The following passive design initiatives have been considered for the project:

- Considering this is a school development, glazing has been strategically placed in spaces that can allow for more relaxed environmental conditions and that can benefit from access to daylight, views and natural ventilation.

- Where required the windows are designed to have appropriate shading or be of high performance to control heat gains and glare.
- The performance of the building fabric will be above NCC 2022 Section-J Energy Efficiency minimum requirements by at least 10% (Appendix A).
- The building will be tested for airtightness. This will ensure a well-constructed façade and will prevent unwanted heat transfer to the exterior.
- Occupancy sensors are considered for all non-critical spaces, to ensure the artificial lighting system is only activated when the space is occupied and remains turned off at all other times.

3.4 Energy efficiency

The proposed approach to sustainability and energy-related systems is based on applying an “energy hierarchy” methodology.

This methodology has the reduction of energy use as its priority and then seeks to meet the remaining energy demand by the most efficient means available, before the inclusion of on-site generation and procurement of green power.

Figure 2 Energy Hierarchy

The following initiatives are being considered for the project’s energy generation and storage capabilities.

- Currently, a 99kW PV system has been incorporated into the design. Further, a spatial allowance will be made in the architectural design of each building, to ensure an area of at least 20% of the roof space is available for PV installation. This is in accordance with the minimum deemed-to-satisfy (DTS) requirements of NCC Section-J.
- The main switchboard will be designed in accordance with NCC 2022 Section-J requirements, to allow for PV and future battery installation.

3.5 Metering and Monitoring of Energy Consumption

The following initiatives are being considered, to enable metering and monitoring of energy consumption of the project.

- A BMS system as per NCC requirements will be included in the project.
- The project will sub-meter significant energy uses via the proposed BMS to understand energy usage and distribution.

3.6 Minimise Potable Water Consumption

The following hierarchy alongside the Green Star Buildings and Educational Facilities Standards & Guidelines (EFSG) has been considered as the basis of water strategies/ initiatives implemented within the proposed new Liverpool Boys and Girls High School.

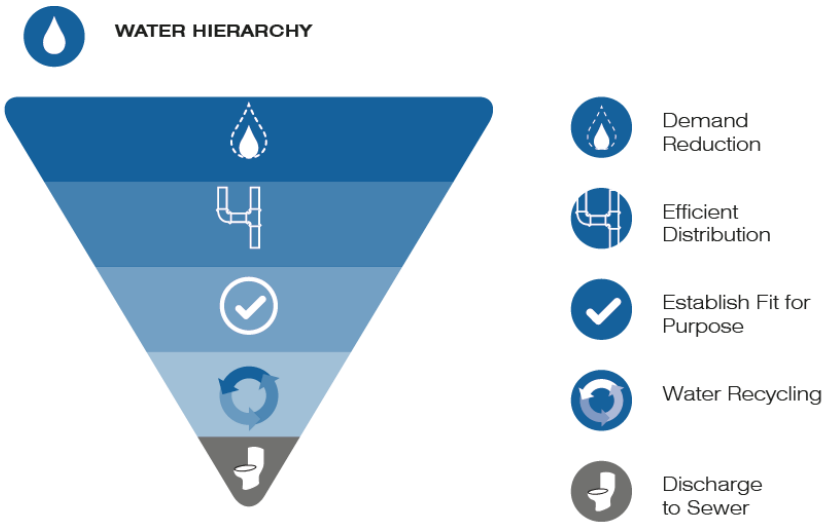

Figure 3 Water Hierarchy

The following initiatives are being considered in the current design, to minimise the project's potable water consumption.

- Water efficient fixtures and fittings, such as taps, showerheads, toilets, zip taps, dishwashers etc certified under the WELS rating scheme will be specified for the project.
- Rainwater harvesting is incorporated in the current design and will be reused for landscape irrigation.
- Efficient water management through an automatic water meter monitoring system will be installed.

3.7 Embodied Emissions Reporting

As part of the Sustainable Buildings SEPP, a NABERS Embodied Emissions Material form is required to be prepared by the quantity surveyor for the project and will be submitted as a stand-alone document.

The embodied emissions material form would disclose the quantities and types of materials proposed for the project to inform on the amount of embodied emission attributable to the development. This is to contribute towards developing a benchmarking tool for the industry.

To support a reduction in the embodied emissions for the project, the following have been considered:

- Material reduction through efficient design layouts, structure and façade.
- Prioritising prefabricated and modular components
- Specification of low-carbon materials
- Sourcing of local products
- Substitution of raw materials with recycled or reclaimed alternatives

- Design for disassembly & repurposing of demolition waste

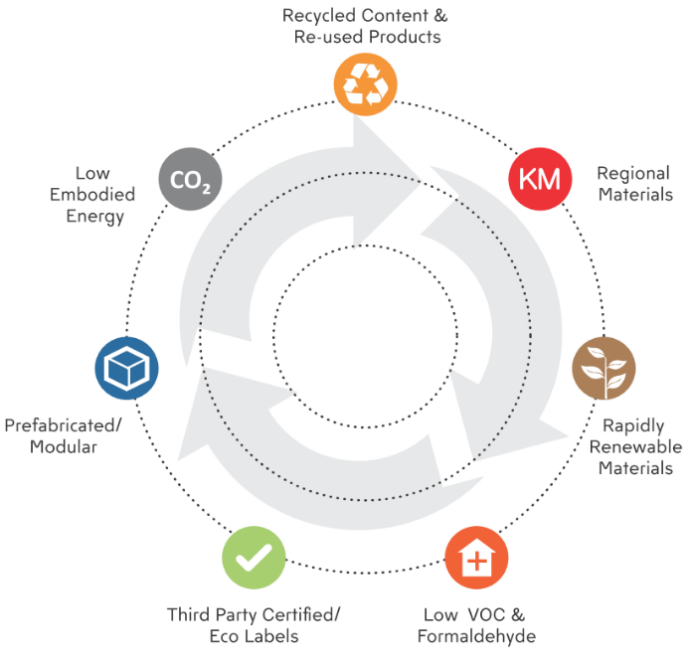

Figure 4 Material selection

3.8 Resilience and Adaptation

The project has identified and developed strategies to increase the resilience of the proposed new school; in response to potential risks arising from climate change.

The latest available global climate models show that in the coming decades, Australia is projected to experience the following:

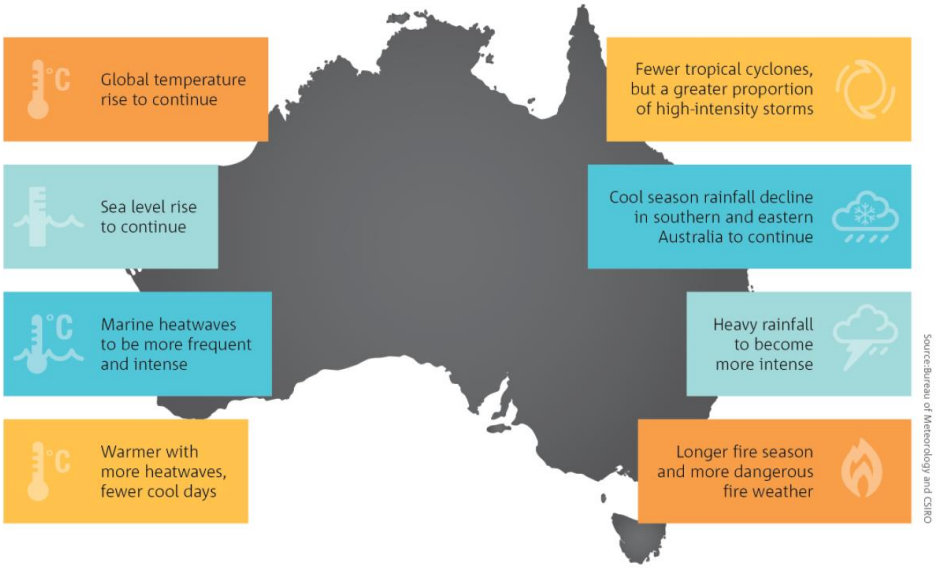

Figure 5 Diagram of climate projections for Australia. CSIRO and Bureau of Meteorology. Source: CSIRO

The below climatic variables will be considered to develop a resilience strategy have been considered to develop a climate change resilience and adaptation strategy.

- Temperature
- Precipitation
- Fire weather/Bushfires
- Drought
- Flood
- Solar Radiation
- Relative Humidity
- Evapotranspiration
- Soil Moisture
- Wind
- Sea-level rise
- Cyclones

A Climate change workshop was conducted during the early design stage to discuss the Climate Change impacts/ risks on the design and to assess how the design and services strategy will respond to future expected climate conditions or develop risk mitigation strategies. This has been detailed in a Climate Change Adaptation Plan by Steensen Varming.

The table below summarises the list of climate change risks and a review of how the design has addressed these risks based on the discussions at the Climate Change workshop held on 14.10.2024. The climate change risks/ impacts in the table below are gathered from Adapt NSW and Steensen Varming has developed and recorded the responses against each upon discussion with all the design consultants during the climate change workshop held.

Table 2 List of climate change risks and design responses (Source: AdaptNSW and Steensen Varming)

Climate Impact	Risk	Response / Design Considerations
 Increase in **extreme hot days and average temperatures**	Stress on electricity network/blackouts Increased **internal temperatures** Greater **energy consumption** Higher **peak loads** Accelerated **degradation of materials.**	**Redundancy** built into cooling capacity. **Ceiling fans** have provided for additional cooling. **Durable materials** selection **Mechanical equipment** is sized based on a predicted ambient temperature (2-2.5 degrees above the current peak ambient temperature) **Covered bridge areas** between blocks also provide **covered outdoor learning.** opportunities & additional shade. Application of **cool paint or light-coloured concrete** for hardscape pavements and roofs to reduce heat island and improve outdoor thermal comfort.
 Increased **drought duration**	Restrictions to **water supply** **Damage to landscape** and higher maintenance costs	**No water-based heat rejection** to be used **On-site efficiency measures** to reduce potable water demand **Roof catchment** area to feed water into rainwater tank to reduce potable water demand. **Drought-resistant planting** (native) selection
 Increased **fire weather**	**Smoke from bushfires** causing health impacts **Damage to powerlines** impacts supply	**Onsite generation** (Solar PV) Provision to connect a **temporary generator** during a power outage. **Filtration** for air intakes into buildings.
 Increased **rainfall variability** **And flooding**	**Damage to buildings**, landscape, and infrastructure. **Flooding impacts**	**Sustainable urban drainage** features will capture, treat, store stormwater, and reduce outflow. **Predictive / forecast management** of water storage
 Increased **storm intensity**	Blowing debris causing property damage and safety risks Interruption of waste collection services	**Durability** of materials selection **Predictive management** planning in event of large storm events Siphonic drainage is proposed for selected concrete roofs.

Considering the above, the project has identified the key risks arising from climate change projections for the parts of the project affected, as well as mitigation strategies to eliminate or reduce such risks as much as possible.

Key Climate Change risk mitigation strategies considered for the proposed new high school include:

- Passive Design Optimisation: (Increased thermal performance of the building envelope/ Shading / Air tightness / Heat recovery / etc.)
- Designed for natural ventilation and good airflow in indoor and outdoor areas (all classrooms and staff spaces) to allow for some increase in temperatures during peak times while maintaining comfortable conditions.
- Active design systems: Increase in plant capacity in buildings to accommodate higher ambient temperatures.
- Landscape strategy to include provision of trees, planting and covered walkways for shading and to connect outdoor spaces with buildings and use of soft landscape, hardscaping and roofing materials with high Solar reflectance index (SRI) to reduce the heat island effect and improve outdoor thermal comfort.
- Reduced stormwater runoff through rainwater harvesting from roofs and selection of native species with low irrigation (potable water) demands.

3.9 Green Star Certification

The project is targeting a formal Green Star Certification, under the Green Star Buildings v1. In alignment with NSW GREP, the project is aiming for a 5-star Rating. The project's Green Star registration number is GS-9260B.

To achieve the targeted rating the project must achieve a total of 35 points (minimum) plus at least 5 buffer points within the rating tool. The table below provides a summary of the Green Star points currently targeted per category as listed in the table below. The Liverpool Boys and Girls High School Upgrade Project is currently targeting 44 points (35 points minimum + 9 buffer points). Also, further stretch points have been identified to serve as an alternative consideration, should any of the targeted points not be achievable during the next stages of the project.

Category	Points Available	Minimum Requirements	Points Targeted	Stretch points	Required Points for 5-Star
Total	**116**	**15**	**43**	**19**	**35 minimum (+8 buffer)**
Responsible	**17**	**3**	**4**	**4**	
Healthy	**14**	**4**	**9**	**3**	
Resilient	**8**	**1**	**4**	**3**	
Positive	**30**	**4**	**9**	**2**	
Places	**8**	**1**	**4**	**4**	
People	**9**	**1**	**7**	**1**	
Nature	**14**	**1**	**6**	**2**	
Leadership	**16**	**0**	**0**	**0**	

Table 3: Summary of GS points targeted

4.0 Mitigation measures

The table below shows the key mitigation measures for the sustainability requirements of the activity and at what stage the measure is to be resolved:

Table 4: Key Mitigation Measures for the activity

Pre-construction stage			
Mitigation Number/ Name	**When is Mitigation Measure to be complied with**	**Mitigation Measure**	**Reason for Mitigation Measure**
Formal Green Star Certification / Green Star Buildings v1 / 5 Star	Pre-construction stage	A holistic approach to sustainability must be implemented, by addressing the requirements from Green Star Buildings framework, which is representative of an Industry Best-practice outcome.	To ensure the environmental performance and Indoor Environmental Quality of the building performs beyond the minimum regulatory compliance standard and achieves a high-performance outcome.
Passive design	Pre-construction stage	The final building design must achieve high levels of daylight and natural ventilation.	To reduce operational energy consumption, and also contribute towards reduction of Greenhouse Gas Emissions.
Reduction in energy demand	Pre-construction stage	The following strategies must be incorporated: Air Conditioning systems must utilise push-buttons with a run-on timer for activation and de-activation of the air-conditioning in all spaces. LED lighting fixtures must be provided with Passive Infrared Occupancy sensors. Sub-meters must be provided for monitoring and preparing targeted approach for future optimization.	To reduce the energy demand and move towards the Department of Education's Net-Zero Energy target.

Construction stage			
Mitigation Number/ Name	**When is Mitigation Measure to be complied with**	**Mitigation Measure**	**Reason for Mitigation Measure**
Minimise potable water consumption	Construction stage	Certified WELS rated water fixtures to reduce wastage of water. Rainwater tank of 200 kL must be installed for enabling rainwater harvesting, to reduce the load on potable water demand.	To reduce the stress on natural resources and water demand for purposes such as landscape irrigation.

Embodied Reporting	Construction stage	Must implement environmentally friendly materials and responsible procurement to reduce the stress on virgin materials. Head contractor must divert 90% of the construction waste from landfill	To align with Sustainable Buildings SEPP and Green Star guidelines to drive a sustainable design and operational building.

Operation stage			
Mitigation Number/ Name	**When is Mitigation Measure to be complied with**	**Mitigation Measure**	**Reason for Mitigation Measure**
On-site renewable energy generation	Operation stage	A 99kW Photovoltaic system must be incorporated in the design.	To enable the project to contribute towards the Department of Education's Net-Zero Energy target.
Formal Green Star Certification / Green Star Buildings v1 / 5 Star	Operation stage	For operations, meter, measure and monitor the building performance to address the requirements from Green Star Buildings framework, which is representative of an Industry Best-practice outcome.	Energy consumption data collection and analysis to reflect on the design initiatives and energy savings achieved because of them. Conduct post-occupancy audits as part of facilities management to monitor building performance. Help to aid with target-based approach for future improvement strategies.
Embodied Reporting	Operation stage	Potential waste streams that would occur during the operational stage must be identified, and a 'reduce-reuse-recycle' strategy must be implemented.	To align with Sustainable Buildings SEPP and Green Star guidelines to drive sustainable operation of the building.

5.0 Evaluation of Environmental Impacts

To support the sustainability targets for the project, a Green Star Pre-Assessment has been carried out. At this stage, a rating of 5 Stars is targeted through the Green Star Buildings tool. The associated requirements are addressed in the current design and expected to be implemented during the construction phase. The outcome of this process will ensure that the environmental impacts associated with the proposed activity is mitigated.

In conclusion, based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed activity, it is determined that:

- The extent and nature of potential impacts are low and will not have significant impact on the locality, community and/or the environment.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal impact on the locality, community and/or the environment.

6.0 Appendix A- Section J Assessment

Part J4 Building Fabric Summary Table		Minimum Project requirements	Project Target
Section-J Sub-sections	**Construction Element**	**NCC Section-J DTS Requirement**	**EFSG/Greenstar Requirement (DTS +10%)**
PART J4D4 Roofs/Ceiling constructions	Roof Constructions	R-Value: 3.2	R-Value: 3.52
PART J4D6 Walls and Glazing	Walls	R-Value: 1.4	R-Value: 1.4
	Internal Walls*	R-Value: 1.0	R-Value: 1.0
	Glazing	U-Value: 5.8	U-Value: 5.8
		SHGC: 0.69	SHGC: 0.61
	Roof skylights	Not Applicable (no skylight provision)	Not Applicable (no skylight provision)
PART J4D7	Slab on ground	R-Value: 2.0**	R-Value: 2.2**
Floors	Suspended floor above or below a non-conditioned space	R-Value: 2.0	R-Value: 2.2

*If Learning Commons (NLC) area is to be operated as outdoor area, a minimum of R-1.0 should be applied to walls that are common with the NLC room (highlited within thermal makups)

**It is noted that the project sits on the ground and the ground floor slab has no in-slab heating or cooling system, thus considered to meet the requirement of R-2.2 for slab-on-ground insulation.

When I'm working on a problem,
I never think about beauty. I think
only how to solve the problem. But
when I have finished, if the solution
is not beautiful, I know it is wrong.
Richard Buckminster Fuller

Mechanical Engineering
Lighting Design
Sustainable Design
Electrical Engineering

Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
ABN 50 001 189 037
t : +61 / 2 9967 2200
e : info@steensenvarming.com

STEENSEN VARMING

Mechanical and Electrical Services Schematic Design - Net Zero Statement

Liverpool Boys and Girls High School Upgrade Project in Liverpool, NSW

Sydney, 31th January, 2025
Ref. No. 247063 CER S01

Chris Arkins
Director

chris.arkins@steensenvarming.com
+61 / 02 9967 2200

This Net Zero Statement has been prepared in support of a Review of Environmental Factors (REF) Application for the proposed new proposed Liverpool Boys and Girls High School Upgrade Project located at 18 Forbes Street, Liverpool NSW, 2170.

This Net Zero Statement has been prepared to address the relevant requirements under the NSW Sustainable Buildings State Environmental Planning Policies (SB SEPP) Section 3.4, and as defined under Section 35C of the Environmental Planning and Assessment Regulation 2021 (EP&A).

This statement addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

Ref. No.	SB SEPP Requirement	Section of Statement where response is provided
3.4	If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies: - provide a net zero statement (as defined in section 35C of the EP&A Regulation) that includes: - evidence of how the development will either be fossil fuel-free after the occupation of the development commences or transition to be fossil fuel-free by 1 January 2035. - details of any renewable energy generation and storage infrastructure implemented and any passive and technical design features that minimise energy consumption. - estimations of annual energy consumption for the building (if available)	- This Net Zero Statement addresses this item - This Net Zero Statement addresses this item - This Net Zero Statement does not address this item. - A preliminary energy modelling was conducted, and Energy Modelling Report was prepared by Steensen Varming at Schematic Design stage. As the design progresses into Detailed Design phase, another iteration of energy modelling will need to be conducted to analyse system performance and energy efficiency achieved.

Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
ABN 50 001 189 037
t : +61 / 2 9967 2200
e : info@steensenvarming.com

We note that Steensen Varming are only engaged up to the completion of the Schematic design phase.

The following initiatives have included in the design; however, it remains the responsibility of the appointed design and construct contractor to ensure these initiatives are designed in detail and implemented during the construction phase.

While the mechanical and electrical services have been designed to be fossil fuel-free by way of being all-electric systems, it remains the responsibility of Schools Infrastructure to procure 100% renewable electricity in enabling a net zero emissions operation. This is in accordance to the NSW Department of Education's commitment to sustainability and net zero emissions in operation as per goal-5 of their "Our 9 goals to 2030" initiative.

On-site Fossil Fuel Usage

The mechanical and electrical services strategy for the proposed development has been designed to be all-electric from day 1 of its operation.

The electrical services design incorporates electric power outlets to serve the following equipment (provided by others) - domestic hot water heaters, kitchen equipment and science Bunsen burners.

Although the current directive is to move all schools to electric, there is ongoing review on the Bunsen burners and VET stovetops. The current direction under consideration with SINSW is to provide electric Bunsen burners with a backup of bottled gas in case the school is unable to procure electric burners. It is noted that the SINSW will have to purchase offsets equivalent to the usage of gas on site to be able to attain 100% net zero emissions in operation.

This allows the project to be capable of operating at net zero emissions once 100% renewable electricity is procured by Schools Infrastructure NSW, in line with the 1 January 2035 target, set out in Section 35C(2)(b) of the EP&A Regulation 2021.

Passive Design Features

The following passive design features have been integrated in order to minimise energy consumption.

- The buildings' orientation is considerate of the site's constraints, solar pathway, and overall functionality requirements.
- The shading strategy has been developed in respect to the buildings' orientation and to minimise energy consumption and glare risk, while maximising daylight ingress and as a result reducing the use of artificial lighting, use of cooling, and these systems' energy consumption.
- The façade has been designed in considerations of;
    - Abundant daylight to all spaces to improve visual comfort and in minimising the use of artificial lighting. Detailed daylight simulations have been undertaken as part of the Environmental Sustainability Design (ESD) scope of works, to document daylight compliance with regulations and Green Star certification.
    - Efficient natural ventilation for all teaching spaces to improve thermal comfort, indoor air quality, and to reduce the use of mechanical ventilation and cooling systems, thereby reducing energy consumption.
    - The natural ventilation to the teaching spaces is provided through the use of louvres, windows, and doors, with an effective opening area of minimum 6.25% of the floor area.
    - Compliance with the Section J requirements of the National Construction Code (NCC) 2022.

Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
ABN 50 001 189 037
t : +61 / 2 9967 2200
e : info@steensenvarming.com

Technical Design Features

The following technical design features have been integrated into the design in order to minimise energy consumption.

- The air-conditioning system is a variable refrigerant type of system which is considered the most suitable solution for a school building and which delivers good efficiencies, particularly at lower thermal loads.
- The mechanical ventilation system applies CO_2 monitoring in all spaces to activate the fans upon exceedance of the CO_2 threshold. This approach works in conjunction with the natural ventilation strategy in providing a high level of indoor air quality and a smooth transition between natural and mechanical ventilation, leading to reduced energy consumption.
- All the air-conditioning systems utilise push-buttons with a run-on timer for activation and de-activation of the air-conditioning in all spaces. This ensures that the air-conditioning is only activated when desired by the users and the run-on timer ensures the system deactivates after a set period (typically 2 hours).
- The lighting fixtures are highly efficient LED (Light Emitting Diode) technology.
- The lighting system applies passive infrared (PIR) sensors for all spaces to ensure the artificial lighting system is only activated once the space is occupied, and to ensure that the system is deactivated shortly after de-occupation of the space.
- In addition to the above, the lighting system applies daylight sensors to adjust the artificial lighting to the required levels.
- An Energy Monitoring System (EMS) will be applied to monitor the energy usage across the project. The energy and water usage data are available to staff and can be used to inform the students thereby assisting in their understanding of their consumption patterns, leading to improved, more resource-conscious user behaviour.

Renewable Energy Generation and Storage

The following initiatives have been implemented for the project's energy generation and storage capabilities.

- A 99-kW rated rooftop photovoltaic (PV) system has been designed to provide a portion of the project's electricity usage. The PV system is located on the roof of Building A.
- Furthermore, a spatial allowance has been made to ensure a total of 20% of the roof space (including the above) is available for future PV installation, on each building.
- The main switchboard has been designed to allow for future battery installation.

Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
ABN 50 001 189 037
t : +61 / 2 9967 2200
e : info@steensenvarming.com

Estimated Energy Consumption& GHG Emissions

Estimated energy consumption is not yet available for the project. Detailed energy modelling shall be undertaken during Detailed Design phase by responsible parties as the design progresses, to help inform the design and its targeted Green Star requirements, as well as verify the design for regulatory compliance. This will include an estimation of PV-solar electrical contribution to the site and an estimation of grid-purchased electricity and associated direct and indirect emissions.

Chris Arkins
Director
BEng Mechanical, Accredited Green Star Professional, FIEAust, EngExec, CPEng, NER, APEC Engineer, IntPE(Aus), FCIBSE

Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
ABN 50 001 189 037
t : +61 / 2 9967 2200
e : info@steensenvarming.com

Evidence

The following evidence has been provided to demonstrate electricity as the fuel source for mechanical services.

Document Reference Number	Description
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Authors:
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Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
ABN 50 001 189 037
t : +61 / 2 9967 2200
e : info@steensenvarming.com

5.6 Proposed Systems for the New Build

A summary of the mechanical systems serving are as follows:

Systems	System selection Description
Air conditioning systems	**Admin office areas:** Ducted type VRF or Cassette type VRF reverse cycle heat recovery air conditioners providing simultaneous heating and cooling. Subject to compliance with acoustics. **General Learning spaces and library:** Ducted type VRF reverse cycle heat recovery air conditioners providing simultaneous heating and cooling.
Specialist air conditioning systems	**Communications rooms:** Dedicated DX air conditioning split systems to serve
Heating only systems	**Gym, Hall, OSCH and Canteen:** Electric radiant panel heaters. **Disabled Toilet:** Electric heaters.
Mechanical Ventilation systems	**Admin, learning spaces** Outside air will be generally ducted locally from the façade to internal fan coil units. A dedicated outside air supply grilles will be provided adjacent to indoor cassette type units when the flow rate is above 20 l/s due to the limitations of the direct duct connected size. **Main switch rooms, Toilets, Changing areas, Stores, First aid, Communications rooms, Kitchen hoods, Fume cupboards, Dark rooms, Welding, Lazer cutting, Botany and the like:** Mechanical extract ventilation systems will be provided in accordance with AS1668.2. **Wood workshops:** Dust extractor will be provided individually for each wood workshop.
Natural ventilation	Natural ventilation must be provided in addition to mechanical ventilation to all learnings spaces, admin areas and the hall. The windows/louvres will be manually operated except for any high-level openings for example the hall. Opening must be based on the effective opening areas and not the structural openings, as per DG55 requirement.
Smoke management systems	Smoke extract systems will be provided to the Hall stage.

BMS/Controls	The BMS will consist front end display, virtual network on the SINSW LAN, LED traffic light digital controllers, 2 X weather and VOC stations, CO2 monitoring sensors, VOC sensors in selected areas, faults and alarms from all major plant and equipment. MCC's and VSD's mounted externally must be suitably protected from rain ingress. (The Energy metering and monitoring system forms part of the electrical package).

7.0 Appendix B- Net Zero Statement

Level 8, 9 Castlereagh Street
Sydney, NSW, 2000, Australia
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STEENSEN VARMING

Mechanical and Electrical Services Schematic Design - Net Zero Statement

Liverpool Boys and Girls High School Upgrade Project in Liverpool, NSW

Sydney, 31th January, 2025
Ref. No. 247063 CER S01

Chris Arkins
Director

chris.arkins@steensenvarming.com
+61 / 02 9967 2200

This Net Zero Statement accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act), in support of a Review of Environmental Factors (REF) Application for the proposed new proposed Liverpool Boys and Girls High School Upgrade Project located at 18 Forbes Street, Liverpool NSW, 2170.

This Net Zero Statement has been prepared to address the relevant requirements under the NSW Sustainable Buildings State Environmental Planning Policies (SB SEPP) Section 3.4, and as defined under Section 35C of the Environmental Planning and Assessment Regulation 2021 (EP&A).

This statement addresses the Secretary's Environmental Assessment Requirements (SEARs) issued for the project, notably:

Ref. No.	SB SEPP Requirement	Section of Statement where response is provided
3.4	If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies: - provide a net zero statement (as defined in section 35C of the EP&A Regulation) that includes: - evidence of how the development will either be fossil fuel-free after the occupation of the development commences or transition to be fossil fuel-free by 1 January 2035. - details of any renewable energy generation and storage infrastructure implemented and any passive and technical design features that minimise energy consumption. - estimations of annual energy consumption for the building (if available)	- This Net Zero Statement addresses this item - This Net Zero Statement addresses this item - This Net Zero Statement does not address this item. - A preliminary energy modelling was conducted, and Energy Modelling Report was prepared by Steensen Varming at Schematic Design stage. As the design progresses into Detailed Design phase, another iteration of energy modelling will need to be conducted to analyse system performance and energy efficiency achieved.

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We note that Steensen Varming are only engaged up to the completion of the Schematic design phase.

The following initiatives have included in the design; however, it remains the responsibility of the appointed design and construct contractor to ensure these initiatives are designed in detail and implemented during the construction phase.

While the mechanical and electrical services have been designed to be fossil fuel-free by way of being all-electric systems, it remains the responsibility of Schools Infrastructure to procure 100% renewable electricity in enabling a net zero emissions operation. This is in accordance to the NSW Department of Education's commitment to sustainability and net zero emissions in operation as per goal-5 of their "Our 9 goals to 2030" initiative.

On-site Fossil Fuel Usage

The mechanical and electrical services strategy for the proposed development has been designed to be all-electric from day 1 of its operation.

The electrical services design incorporates electric power outlets to serve the following equipment (provided by others) - domestic hot water heaters, kitchen equipment and science Bunsen burners.

Although the current directive is to move all schools to electric, there is ongoing review on the Bunsen burners and VET stovetops. The current direction under consideration with SINSW is to provide electric Bunsen burners with a backup of bottled gas in case the school is unable to procure electric burners. It is noted that the SINSW will have to purchase offsets equivalent to the usage of gas on site to be able to attain 100% net zero emissions in operation.

This allows the project to be capable of operating at net zero emissions once 100% renewable electricity is procured by Schools Infrastructure NSW, in line with the 1 January 2035 target, set out in Section 35C(2)(b) of the EP&A Regulation 2021.

Passive Design Features

The following passive design features have been integrated in order to minimise energy consumption.

- The buildings' orientation is considerate of the site's constraints, solar pathway, and overall functionality requirements.
- The shading strategy has been developed in respect to the buildings' orientation and to minimise energy consumption and glare risk, while maximising daylight ingress and as a result reducing the use of artificial lighting, use of cooling, and these systems' energy consumption.
- The façade has been designed in considerations of;
    - Abundant daylight to all spaces to improve visual comfort and in minimising the use of artificial lighting. Detailed daylight simulations have been undertaken as part of the Environmental Sustainability Design (ESD) scope of works, to document daylight compliance with regulations and Green Star certification.
    - Efficient natural ventilation for all teaching spaces to improve thermal comfort, indoor air quality, and to reduce the use of mechanical ventilation and cooling systems, thereby reducing energy consumption.
    - The natural ventilation to the teaching spaces is provided through the use of louvres, windows, and doors, with an effective opening area of minimum 6.25% of the floor area.

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- Compliance with the Section J requirements of the National Construction Code (NCC) 2022.

Technical Design Features

The following technical design features have been integrated into the design in order to minimise energy consumption.

- The air-conditioning system is a variable refrigerant type of system which is considered the most suitable solution for a school building and which delivers good efficiencies, particularly at lower thermal loads.
- The mechanical ventilation system applies CO_2 monitoring in all spaces to activate the fans upon exceedance of the CO_2 threshold. This approach works in conjunction with the natural ventilation strategy in providing a high level of indoor air quality and a smooth transition between natural and mechanical ventilation, leading to reduced energy consumption.
- All the air-conditioning systems utilise push-buttons with a run-on timer for activation and de-activation of the air-conditioning in all spaces. This ensures that the air-conditioning is only activated when desired by the users and the run-on timer ensures the system deactivates after a set period (typically 2 hours).
- The lighting fixtures are highly efficient LED (Light Emitting Diode) technology.
- The lighting system applies passive infrared (PIR) sensors for all spaces to ensure the artificial lighting system is only activated once the space is occupied, and to ensure that the system is deactivated shortly after de-occupation of the space.
- In addition to the above, the lighting system applies daylight sensors to adjust the artificial lighting to the required levels.
- An Energy Monitoring System (EMS) will be applied to monitor the energy usage across the project. The energy and water usage data are available to staff and can be used to inform the students thereby assisting in their understanding of their consumption patterns, leading to improved, more resource-conscious user behaviour.

Renewable Energy Generation and Storage

The following initiatives have been implemented for the project's energy generation and storage capabilities.

- A 99-kW rated rooftop photovoltaic (PV) system has been designed to provide a portion of the project's electricity usage. The PV system is located on the roof of Building A.
- Furthermore, a spatial allowance has been made to ensure a total of 20% of the roof space (including the above) is available for future PV installation, on each building.
- The main switchboard has been designed to allow for future battery installation.

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Estimated Energy Consumption& GHG Emissions

Estimated energy consumption is not yet available for the project. Detailed energy modelling shall be undertaken during Detailed Design phase by responsible parties as the design progresses, to help inform the design and its targeted Green Star requirements, as well as verify the design for regulatory compliance. This will include an estimation of PV-solar electrical contribution to the site and an estimation of grid-purchased electricity and associated direct and indirect emissions.

Chris Arkins
Director
BEng Mechanical, Accredited Green Star Professional, FIEAust, EngExec, CPEng, NER, APEC Engineer, IntPE(Aus), FCIBSE

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