OAKDALE WEST INDUSTRIAL ESTATE

Lot 4A & 4B

Sustainability Management Plan

Prepared for:

Goodman Property Services (Aust) Pty Ltd
1-11 Hayes Road
Rosebery NSW 2018

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Goodman Property Services (Aust) Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
610.30950.00000-R01-v1.0	14 September 2022	Dr Neihad Al-Khalidy	Lucas Wilson	Dr Neihad Al-Khalidy

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1 INTRODUCTION

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Goodman Property Services to prepare a Sustainability Management Plan (SMP) to support the Development Application for the proposed industrial buildings 4A & 4B at the Oakdale West Industrial Estate (OWIE).

The Development consists of two (2) new warehouse buildings each with ancillary office facilities, external hardstand spaces, staff carparking, landscaping and solar panels.

Approval is requested for the construction, operation and use, and fit-out of the buildings.

Building 4A spans 16,785 m^2 of warehouse space and 650 m^2 of office space, creating a total Gross Lettable Area of 17,435 m^2. The building has a proposed ridge height of 13.7m.

Building 4B spans 14,700 m^2 of warehouse space and 850 sqm of office space, creating a total Gross Lettable Area of 15,550 m^2. The building has a proposed ridge height of 13.7m.

24/7 operations are proposed with a focus on warehouse and industrial use.

The proposed developments comply with MOD 11 of SSD 7348 Concept Plan that is currently with the Department of Planning & Environment for assessment.

The proposed buildings form part of the larger OWIE which comprises 154 hectares of land within the Western Sydney Employment Area (WSEA) and is owned by a Joint Venture (JV) between Goodman and Brickworks Limited.

The subject sites are benched, serviced and ready for aboveground construction. SSD 7348 approved the infrastructure to these development pads.

This study has been prepared in accordance with the Oakdale Site Secretary's Environmental Assessment Requirements (SEARs) for the State Significant.

1.1 Objectives of the Study

The principal objective of this Sustainability Management Plan is to identify all potential energy savings that may be realised during the operational phase of the Project, including a description of likely energy consumption levels and options for alternative energy sources such as solar power in accordance with Council requirements.

The specific objectives of this plan are as follows:

- To encourage energy use minimisation through the implementation of energy efficiency measures;
- To promote improved environmental outcomes through energy management;
- To ensure the appropriate management of high energy consumption aspects of the Project;
- To identify energy savings procedures for overall cost reduction, greenhouse gas emission reduction and effective energy management;
- To assist in ensuring that any environmental impacts during the operational life of the development comply with DPIE's development consent conditions and other relevant regulatory authorities; and

- To ensure the long-term sustainability of resource use through more efficient and cost-effective energy use practices for the life of the development.

2 SUSTAINABILITY MANAGEMENT GUIDELINES AND LEGISLATION

2.1 Building Code of Australia

The Building Code of Australia (BCA) is produced and maintained by the Australian Building Codes Board (ABCB) on behalf of the Australian Government with the aim of achieving nationally consistent, minimum necessary standards of relevant health and safety, amenity and sustainability objectives efficiently. The BCA contains mandatory technical provisions for the design and construction of BCA class buildings.

Volume 1, Section J of the BCA outlines energy efficiency provisions required for BCA class buildings (including Class 7b Warehouses and Class 5 Offices). There are 8 Deemed-to-Satisfy subsections, J1 to J8, that focus on separate aspects of energy efficiency as follows:

- J1 - Building Fabric (i.e. the ability of the roof, walls and floor to resist heat transfer)
- J2 - External Glazing (i.e. the resistance to heat flow and solar radiation of the glazing)
- J3 - Building Sealing (i.e. how well parts of a building are sealed to ensure comfortable indoor environments are efficiently maintained)
- J4 - Air Movement (i.e. the provision of air movement for free cooling, in terms of opening and breeze paths)
- J5 - Air Conditioning and Ventilation Systems (i.e. the efficiency and energy saving features of heating, ventilation and air-conditioning systems)
- J6 - Artificial Lighting and Power (i.e. power allowances for lighting and electric power saving features)
- J7 - Hot Water Supply (i.e. the efficiency and energy saving features of hot water supply)
- J8 - Access for Maintenance (i.e. access to certain energy efficiency equipment for maintenance purposes)

2.2 Sustainability Management Plan Requirements

The SEARs of the Oakdale Site include the following requirement:

- **Greenhouse Gas and Energy Efficiency** – including an assessment of the energy use on-site and all reasonable and feasible measures that would be implemented on-site to minimise the development's greenhouse gas emissions.
- **Ecologically Sustainable Development** – including a description of how the development will incorporate the principles of ecologically sustainable development in the design, construction and operation of the development.

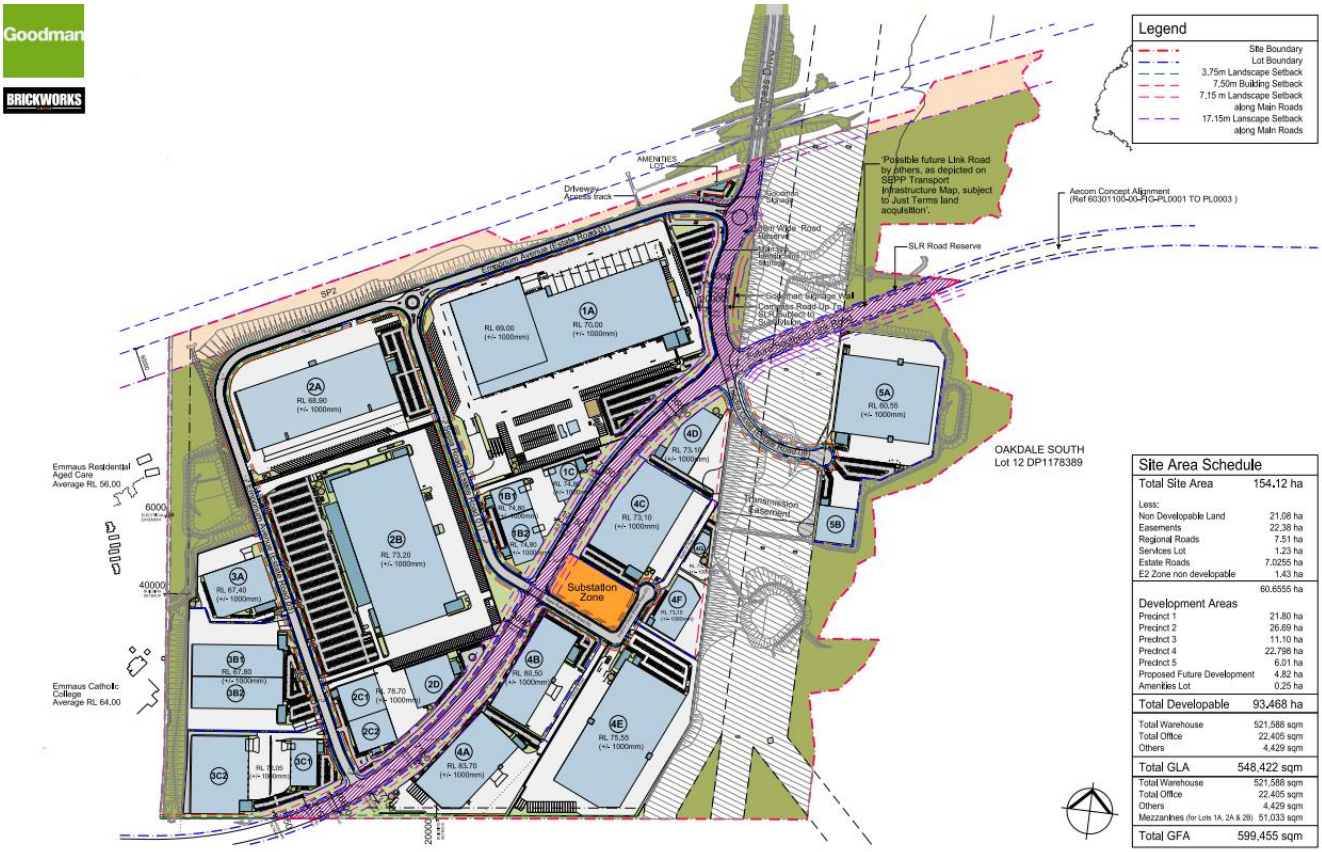
3 DESCRIPTION OF THE PROJECT

Goodman Property Services (Aust) Pty Ltd is developing the Oakdale West site at Lot 26 in DP 1269741 in Kemps Creek. This site will be comprised of Industrial warehouses and office precincts, including internal roads, car parking spaces and hardstand.

The project is a staged development which includes bulk earthworks, civil works and the construction of infrastructure and stormwater management. The project is a staged development which includes bulk earthworks, civil works and the construction of infrastructure and stormwater management. The overall Oakdale West Masterplan is shown in **Figure 1**.

The current study covers the sustainability management plan and greenhouse gas reduction for the proposed warehouse and distribution facilities of Lot 4A and Lot 4B (the Project).

Figure 1 Oakdale West Estate Master Plan – MOD 11



3.1 Overview of Proposed Development

The site area (4A and 4B) comprises 73,785 m^2 and the total building area (4A and 4B) is 32,985 m^2. The Overall building areas are outlined in **Table 1**.

Table 1 Building Areas – Lot 4A and Lot 4B

Site Area	Lot 4A and Lot 4B
Warehouse 4A	16,785 m^2
Warehouse 4B	14,700m^2
Office 4A (2 Levels)	600 m^2
Office 4B (2 Levels)	800 m^2
Dock office 4A	50 m^2
Dock Office 4B	50 m^2
Awning 4A	2,330 m^2
Awning 4B	2,330 m^2
Carparking 4A (including 5 EV Charging Spaces)	73
Carparking 4B (including 5 EV Charging Spaces)	70

Further details of the Lot 4A and Lot 4B development are shown in **Figures 2** to **Figure 4**

Figure 2 Oakdale West Estate: Lot 4A and Lot 4B

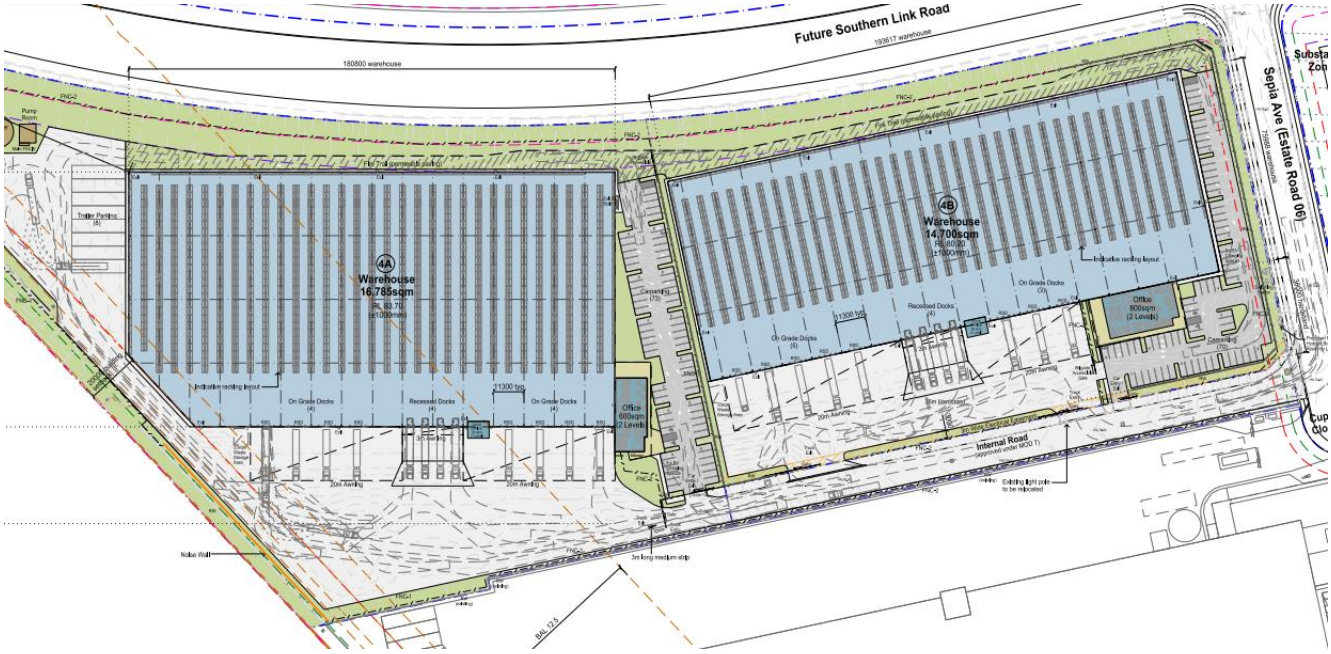


Figure 3 Oakdale West Estate: Warehouse 4A Elevation

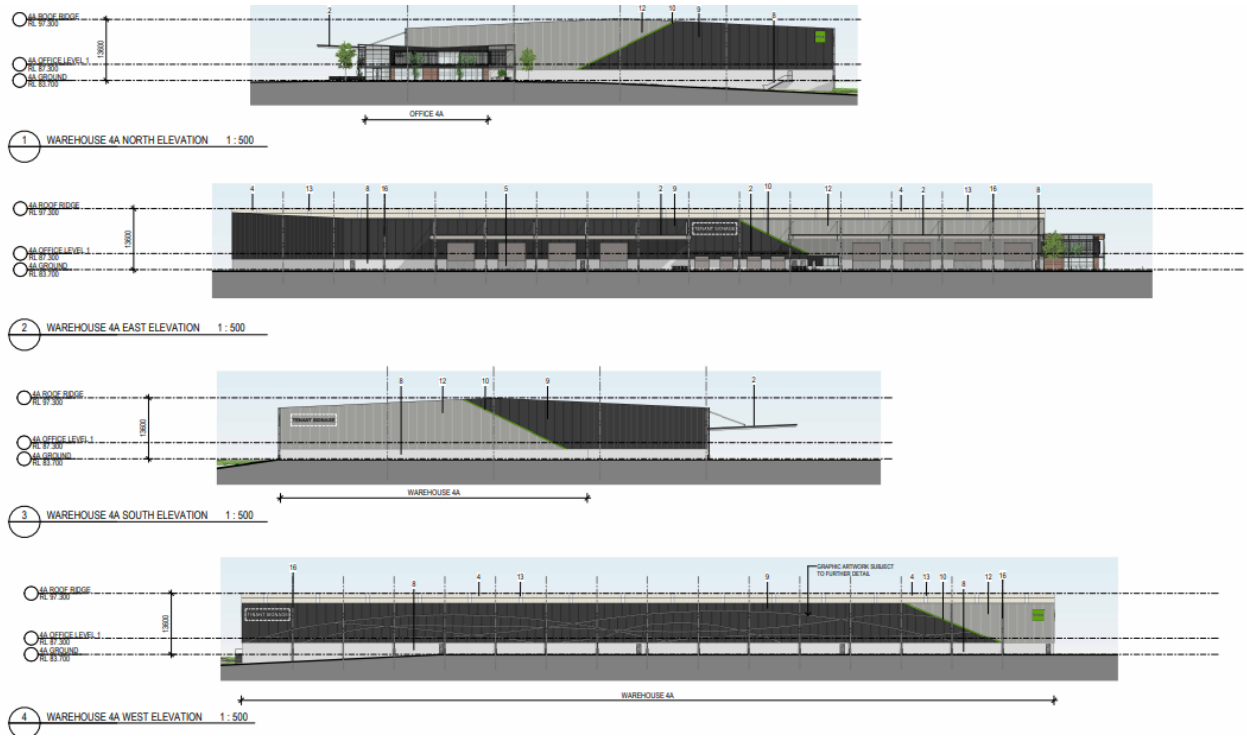
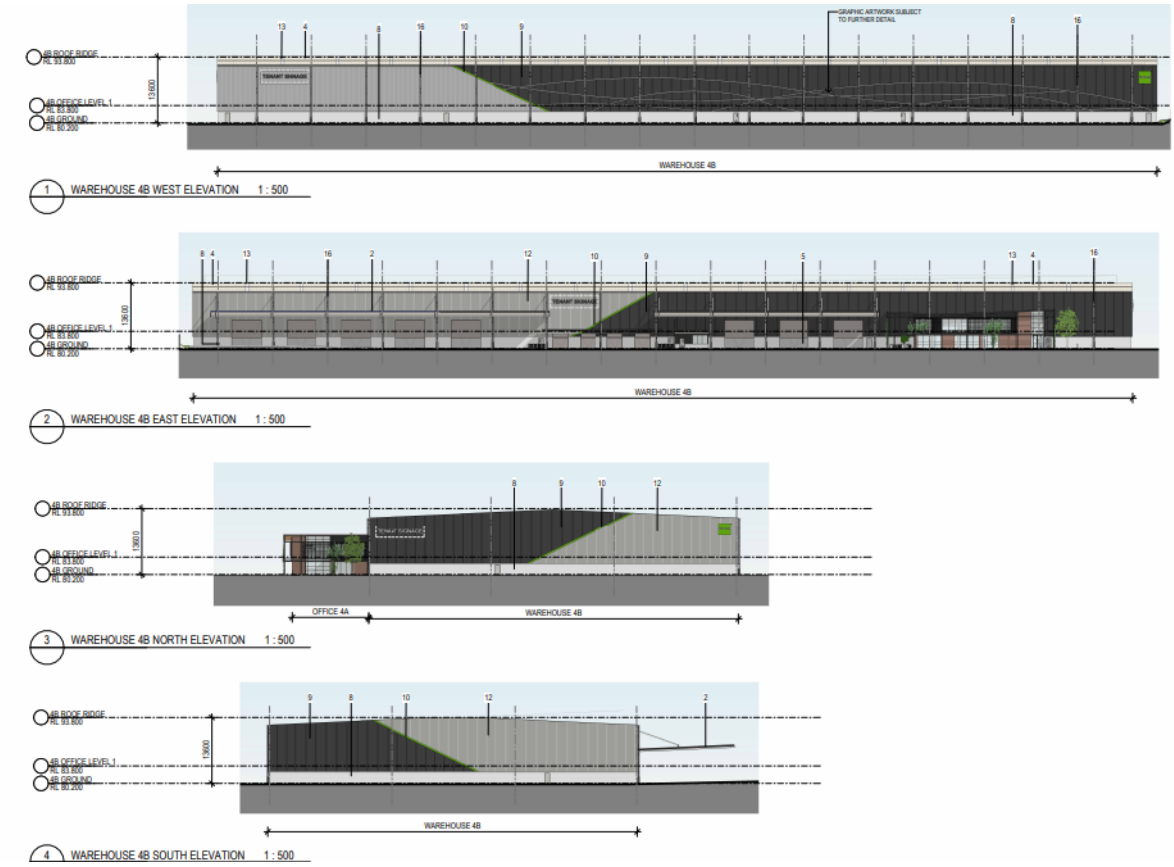


Figure 4 Oakdale West Estate: Warehouse 4B



4 OPERATIONAL ENERGY MANAGEMENT

Ineffective energy management for industrial and commercial premises can lead to unnecessary growth in greenhouse gas emissions and consumption of natural resources. Effective energy management reduces costs using energy efficiency measures and improves environmental outcomes locally, regionally and globally.

Effective energy management is achieved through the implementation of a Sustainability Management Plan (SMP) for the operational life of the Project.

4.1 Identified Major Energy Use Components

The major energy use components of the Project Site have been identified below based on information available within the Project Design Brief.

- Lighting (include natural and artificial lighting and shading);
- Air Conditioning; AND
- Power.

4.2 Energy Sources

The main source of energy for the proposed site is electricity.

5 SUSTAINABILITY MEASURES COMMITMENTS

5.1 Documentation

The documentations used in this report is listed in **Table 2**.

Table 2 Project Documentation Sources

Document Type	Document Number	Issue Date
Architectural Drawing	OAK 4A and 4B: DA 10)	25/08/2022
	Estate Master Plan – Mod 11	12/09/2022
Goodman Project Brief		04/07/2022

Energy Efficiency measures have been recommended and approved for project implementation and have informed the sustainability assessment of this project – they are listed in **Table 3**.

Table 3 ESD Assessment Summary

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Design & Management	• Documentation of design intent and expected outcomes. • Appropriate commissioning.	• Communicate sustainability initiatives and operation to building users. • Commissioning and building tuning required by contractors and reviewed for 12 months after completion.	• Provision of Building Users Guide. • Investigate costs and viability of commissioning and building tuning requirements and appointing an independent commissioning agent. • Independent consultant to perform quarterly tuning of fire, mechanical, electrical, hydraulic services.	✓ ✓ ✓	• SLR recommends the preparation of Building User Guide that enables building users to optimise the building's environmental performance. • A sub-contractor will be engaged to maintain the facility in accordance with the operations and maintenance manuals during the 12-month defects liability period.
Façade Performance	• Optimised façade performance.	• Achieve minimum performance requirements under NCC Section J1 and J2. • Reduce heat gain through the warehouse façade.	• Meet or exceed NCC Section J1 and J2 façade performance for conditioned spaces. • Light coloured roofing and appropriate insulation to reduce solar heat gain into the warehouse. • Performance glazing in office spaces appropriate to the window size and orientation.	✓ ✓ ✓ ✓	• Refer **Section 5.6, Table 8** of this report for all conditioned office spaces. This warehouse will comply with all the requirements specified within the report during construction stage. • Light colour Colourbond – Surfmist metal deck proposed • As per project NCC Section J report. Insulation proposed to warehouse roof and walls

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Social Sustainability	• Consider design with due regard to occupant satisfaction in accessibility, usability, Indoor air quality and public space utility.	• High level of occupant satisfaction. • Provide external as well as internal comfort.	• Flexibility of space for potential future configurations.	✓	• The design will incorporate open plan workspaces, offices, client rooms, meeting rooms, lunch room and outdoor seating area. Refer **Figure 2**
			• Use of Low VOC paints, carpets and sealants.	✓	• Low VOC paints, carpet and sealant will be used for the offices.
			• Consider Landscaping and dense planting.	✓	• Refer proposed landscaping, Architectural Drawings • Selection of endemic drought tolerance and low maintenance landscaping species
			• Consider occupant user control eg A/C systems, lighting etc.	✓	• Both AC and lighting control is provided to offices and warehouses.
				✓	• The project is committed to connect all lighting to the monitoring system and utilise daylight harvesting to minimize usage

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Minimising Transport Impact	• Consider location with links to public transport and employee services. • Consider location to reduce operational transport. • Consider the impact of industrial trucks on local traffic.	• Reward drivers of fuel-efficient vehicles by providing spaces for small cars and or motorbikes. • Provide alternatives to single-occupancy vehicles. • Reduce operational fuel consumption through close proximity to major arterial roads. • Reduce the impact of operational traffic on local communities.	• Consider providing 5% for electrical cars and 10% of total parking spaces for small cars and motorbikes where possible. • The site is located within close proximity (<5km) to both the M7 and M4 motorways. • The roads linking the site to the motorways are predominantly used for industrial traffic, as such the traffic is unlikely to impact on local areas.	✓ ✓	• 10 parking spaces (5 for Lot 4A and 5 for Lot 4B) are dedicated for electrical cars with charging stations proposed. • 16 bicycle parking spaces (8 for Lot 4A and 8 for Lot4B) . Refer **Figure 2** • Car Park numbers (73 spaces for Lot 4A and 70 spaces for Lot 4B) and provision are provided be in accordance with Consent Authority requirements.

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Optimising IEQ	• Optimise natural light to work environment. • Optimise fresh air ventilation. • Consider Thermal Comfort of occupants. • Consideration of noise transference in space planning. • Minimise use of materials that emit volatile organic compounds. • Create a pleasant working environment.	• Daylight: Daylight Factor (DF) of at least 2% at finished floor level under a uniform sky for at least 60% of the GLA. • Thermal comfort: 95% of office areas have PMV levels between -1 and +1 for 98% of the year; Warehouse spaces include passive thermal comfort strategies. • Finishes: 95% of all paints, adhesives & sealants and all carpet and flooring to be low-VOC finishes; use low-formaldehyde wood products. • Electric lighting levels: 95% of GLA has a lighting system that is flicker free and has a maintained illuminance of no more than 25% above those recommended in AS1680.2.4, 2.1 and 0.1. • Reduce visual glare.	• Daylight: rationalised glazing to offices; high performance glass. • Thermal comfort: Office envelope and HVAC system designed to meet thermal comfort requirements; • Provide sufficient roof and wall insulation to the air-conditioned spaces; • Finishes: Specify and track correct finishes and wood products. • Provide pleasant indoor and outdoor breakout spaces with sufficient daylight. • Lighting: Good light fixtures and well-designed layout. • Ventilation: Consider increased fan and duct sizing. • Provide sufficient shading and blinds with rationalised glazing for visual and thermal comfort.	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	• Proposed glazing of U=4.2, SHGC = 0.42 (refer **Section 5.6, Table 7)** • Refer **Section 5.5** of this report for proposed set up temperatures R2.8 Walls and R3.2 Roof, of conditioned office areas (refer **Section 5.6, Table 7)** • Low VOC finishes and low-formaldehyde wood products will be used • Refer Architectural Drawings • LED lighting , daylight harvesting and lighting controls to warehouse and offices. • Adequate ventilation will be supplied in accordance with AS1668. • Shading devices are shown on the Architectural Drawings

Minimising Energy Use	• Consider passive design to minimise energy use such as orientation, ventilation, shading and floor plate design. • Appropriate sizing of plant and equipment in heating and cooling, lighting, control systems, • Building management systems and renewable energy sources. • Reduce reliance on connection to grid electricity and gas.	• Target a 20% reduction in Greenhouse gas emissions. • Energy sub-metering for all major uses greater than 100kVa; linked to monitoring system. • High efficiency warehouse lighting and controls. • Reduce energy for water heating. • Integrated building management. • Consider renewable energy generation for a portion of energy consumption and/or consider future-proofing the building for future installation. • Reduce urban heat island effect and heat load through the roof by providing a highly reflective roof. • Reduce office equipment load from 20W/m² to 15W/m². • Optimise insulation for energy and thermal comfort.	• Roof Insulation, External Wall Insulations, Reduced Glazing area and associated heat loss in winter. • Consider office air conditioning temperature set-points for an increased comfort band. • Provide energy efficient T5 lighting, with zoning and automatic controls where reasonable. • Consider LED lighting strategies and advanced controls. • Consider a solar hot water system or a heat pump. • Sub-metering: install appropriate metering; develop metering and tracking strategy to allow for self-assessment, problem solving and ongoing improvements during operations • Use roofing material that has a high Solar Reflective Index • Investigate current insulation design and determine proposed options.	✓ ✓ ✓ ✓ ✓ ✓ ✓	• Awning Shown on the Architectural Drawing. Insulation as per the NCC requirements • Design brief sets the temperature - Refer Section 5.5 of this report. • LED lighting , daylight harvesting and lighting controls to warehouse and offices. • Lighting controls to warehouse and offices. • Solar hot water or heat pump system • Sub meters for major energy/water uses • Colourbond metal deck in surfmist of coolmax which has a light colour is proposed. • R2.8 Walls and R3.2 Roof, of conditioned office areas (refer **Section 5.6, Table 7)**

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Choosing Materials	• With consideration to energy inputs in manufacture. • Toxicity. • Consequential impacts – rain forest timbers. • Regional or local manufacturer employment support. • Lower embodied carbon content to typical material	• Reduce steel and cement in internal slab (10% reduction in embodied energy). • Reduce embodied energy in concrete and plasterboard elements. • Consider 95% of timber to be AFS or FSC certified. • Reduce emissions associated with insulation and refrigerant. • Reduce environmental impact of materials for tiling, awning.	• Jointless fibre reinforced slab. • Use pre-cast concrete panels with recycled content.	✓ ✓	• To minimise the environmental impacts of materials used by encouraging the use of materials with a favourable lifecycle assessment based on the following factors: - Fate of material - Recycling / re-use - Embodied energy - Biodiversity - Human health - Environmental toxicity - Environmental responsibility. - A Life cycle Assessment in accordance with ISO 14044:2006 will be undertaken during the detailed design stage to assist in selection of the most appropriate low-impact material for the project. • The project will replace 5% of cement with fly ash.

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Minimising Waste	• By clever design. • Contracted to builder as a requirement on site for construction waste. • During the life of the building. • And in dealing with building end of life options.	• Reduce construction waste going to landfill by 90%. • Reduce operational waste going to landfill. • Consider a design that can be disassembled at the end of the building's life.	• Contractor is to develop and implement a Waste Management Plan and track all waste going offsite to show that 90% of all construction waste is re-used or recycled. • Waste storage and recycling facilities to be provided for different operational recycling streams such as paper, glass, plastics, metals, food waste etc. Consider operational waste plans and training for staff to provide incentive to reduce waste.	✓ ✓	• At least 90% of the predicted construction waste arising from development will be re-used (on-site or at another development) or recycled off-site. • The following waste avoidance measures are recommended in the Waste Management Plan for the Project: - Provision of take back services to clients to reduce waste further along the supply chain.
Water Conservation and Reuse	• Monitoring of meters to track use. • Timely maintenance of fixtures and fittings. • Water sensitive landscape design. • Source potable water alternatives such as rain water harvesting, grey and black water treatment.	• Reduce potable water in internal fixtures. • Reduce potable water for irrigation. • Water efficient operation of appliances. • Utilise rainwater and/or recycled water.	• Water efficient sanitary taps and toilets. • Water efficient and drought tolerant landscaping. • Water and energy efficient dishwasher. • Rainwater collection for toilets, irrigation and truck wash down.	✓ ✓ ✓ ✓	• Low flow fixtures and fitting including taps and shower heads • Selection of endemic and low maintenance landscaping species • SLR recommends water efficient dishwashers • 120 kL rainwater tanks have been recommended for rainwater harvesting and re-use for landscape irrigation and flushing of toilets.

Category	Objective	Proposed Target	Proposed Strategy	Commitment	Comment
Land Use and Ecology Impact	• Consider local biodiversity impacts of flora and fauna. • Look to specialist advice on land in development.	• Encourage biodiversity. • Reduce light pollution from the site. • Consider reducing impact of stormwater flows off the site into the natural watercourses including Ropes Creek adjacent to the site.	• Install indigenous planting appropriate to the area and the adjacent biodiversity lots. • Design external lighting to avoid emitting light into the night sky or beyond the site boundary. • Consider integrated stormwater management to minimise the impact on receiving waters of flow volumes and pollution content, eg bioswales, bio retention, OSD tanks and treatment. • Consider permeable concrete/paving for staff parking areas and footpaths, etc.	✓ ✓ ✓ ✓ ✓	• Selection of endemic and low maintenance landscaping species • LED lights have been proposed for all external lights to avoid emitting light. All outdoor lighting will comply with AS4282:2019 Control of the Obtrusive Effect of Outdoor Lighting. • Box gutter and similar contained roof configurations will be designed to operate with rainfall intensities of no less than a 1:100-year frequency and incorporate 100% overflow relief. • The project is committed to achieve a 40% reduction in average annual stormwater discharge • The project will incorporate water sensitive urban design principles.
Renewables	• Supply renewable electricity to the building.	• Reduce carbon footprint for the project site • Reduce the peak electricity demand for the building	• Provisions of on-site renewable energy systems	✓	• At least 1,000 kW of rooftop PV solar systems (500 kW for Lot 4A and 500 kW for Lot 4B) have been proposed.

5.2 Baseline and Proposed Energy Consumption

An NCC Sections J Deem-to-Satisfy compliant building is used as the baseline building for energy consumption savings. NCC Section J provides the minimum requirement for energy efficiency, and it is predicted that the proposed development will have more than 249% energy reduction - refer **Section 5.8** for the energy simulation results. The reduction has been enabled via:

- On site PV solar system;
- All luminaire shall be low energy LED type;
- Warehouse lighting is generally to be zonally controlled via motion sensor;
- Office lighting shall be controlled via dual technology infrared/ultrasonic sensor;
- Daylight harvesting function to office with external windows; and
- Efficient air conditioning system.

All building information and associated parameters are listed in the following sections of this report.

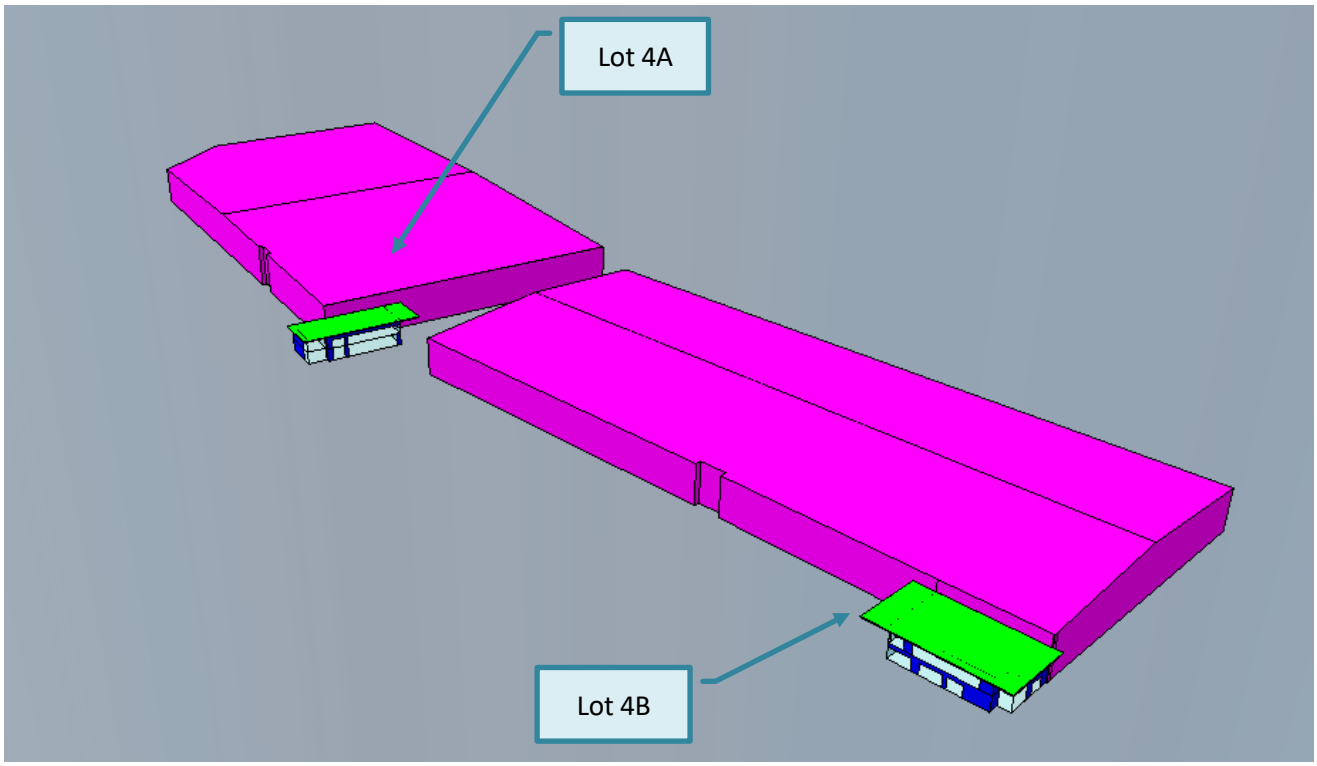
5.3 Energy Calculation of the Proposed and Reference Buildings

The Energy Simulation Program used in this study is the IES computer program Virtual Environment 2019 (VE). The program is based on the ASHRAE response factor and the modifications included utilising Australian weather data and including building materials more appropriate to those used in Australia and enabling the input of metric data.

- SLR supports a perpetual license of the Energy Simulation Software package IES <VE>;
- IES <VE> has passed the BESTEST (ASHRAE Standard 140) external validation process;
- The weather data from ACADS-BSG NSW_Sydney_RO_81 Test Reference Year (TRY) is used for the modelling;
- IES<VE> assesses U-Value, SHGC, and shade coefficient when evaluating the effect of glazing;
- Detailed warehouse operating schedules are not available at this stage. Therefore, NCC standard building operating profiles such as occupancy, lighting, air conditioning and equipment were adopted for the office areas; and
- At least 1,000 kW of rooftop PV system has been proposed.

The developed 3D model for energy modelling is shown in **Figure 5**.

Figure 5 Proposed Warehouses and Associated Offices in IES Model



5.4 Artificial Lighting

In Section J6 of the NCC, the requirement for the total lighting power load within the proposed spaces of a building is to be no greater than a maximum illumination power load, measured in Watts (W). The maximum allowable building illumination power load is based on the total illumination power load calculated for each space.

For artificial lighting, the aggregate design illumination power load must not exceed the sum of the allowances. This may be obtained by multiplying the area of each space by the maximum illumination power density (as found in Table J6.2a of the NCC 2019 Volume One). The maximum illumination density for a storage warehouse is 4 W/m² as per Table J6.2a of the NCC 2019 Volume One.

The proposed warehouses will adopt the following energy efficiency measures to reduce the lighting energy consumptions:

Office lighting

- LED fitting for offices.
- Occupancy sensors to low occupancy areas e.g. office, toilets and lunch room.

Warehouse lighting

- LED fitting for warehouse.
- Occupancy sensors to low occupancy areas.

Outside lighting

- LED external lighting for all outside areas.
- External lighting will be controlled via daylight sensor (photocell).

Electrical lighting is the major energy reduction component for warehouse with a large footprint.

The lighting calculation for NCC reference building is based on the maximum illumination power density specified within NCC Table J6.2A as below:

- Warehouse = 4 W/m^2
- Offices = 4.5 W/m^2

The electrical lighting layout of the proposed building is not provided at the time of preparing this report. It is assumed the maximum design lighting power density will be achieved as below:

- Warehouse 2 W/m^2
- Offices 4 W/m^2

Therefore, the proposed building is likely to achieve a 48% lighting energy reduction when compared with reference building. Detailed calculation is shown in **Appendix A.**

5.5 Mechanical Air-Conditioning

The mechanical service design is not available at this stage. Performance reverse cycle package units will be to offices with individual controls. There will be air conditioning in the warehouse also, but just to the southern dock face for the purpose of providing conditioned air into the back of the trailers.

Air conditioning will be designed to the BCA/NCC section J and other statutory authorities and applicable Australian standards.

As per the mechanical specification of the Goodman's Tenant Base Building Specification, air conditioning to be designed to the BCA/NCC section J and other statutory authorities and applicable Australian standards.

Air-conditioning temperature control and set point – refer Table 5

Table 4 AC Unit Temperature Control Range

Space Type	Temperature Control Range (°C)
Offices	Summer: 22.5±1.5°CBD Winter: 21±1.5°CBD
Space Type	**Relative Humidity**
Offices	50%

Air-conditioning energy efficiency requirements

2019 NCC Section J5.11 has specified the minimum energy efficiency ratios requirements for package air conditioning equipment.

Table 5 BCA Unitary Plant Requirement

Office Equipment	Minimum Energy Efficiency Ratio	
	NCC Requirement	**Proposed System [1]**
Cooling	2.9	4
Heating	2.9	4

Note 1: Detailed Mechanical design is not available at this stage. It is assumed that the proposed package system will achieve the performance requirements above.

When the air flow rate of a mechanical ventilation system is more than 1000L/s, the system must have a variable speed fan when its supply air quantity is capable of being varied.

Details or NCC Section J5 certification demonstrating compliance will need to be submitted with the application for a Construction Certificate

5.6 Building Fabric Requirements

Parts J1 to J3 of the BCA Section J contain the requirements of the Deemed-to-Satisfy compliance of the building fabric. The purpose of this subsection is to ensure that the building fabric will provide sufficient thermal insulation to minimise heating and cooling loads placed on the building and the commensurate energy consumption HVAC systems servicing internal building spaces.

All fabrics of the proposed building shall comply with NCC Section J. A Project Section J report will need to be submitted with the application for a Construction Certificate.

Parts J1 to J3 of the BCA Section J contain the requirements of the Deemed-to-Satisfy compliance of the building fabric. The purpose of this subsection is to ensure that the building fabric will provide sufficient thermal insulation to minimise heating and cooling loads placed on the building and the commensurate energy consumption HVAC systems servicing internal building spaces.

All fabrics of the proposed building shall comply with NCC Section J. A Project Section J report will need to be submitted with the application for a Construction Certificate.

The reference and proposed building fabric data and other modelling assumptions are shown below:

Table 6 Reference Dynamic Modelling Inputs for All-Conditioned Office Areas

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Climate Data</td><td>Weather data from ACADS-BSG, NSW_Richmond_88 Test Reference Year (TRY)</td></tr>
<tr><td>External wall</td><td>All external walls have a total R-value of R2.8</td></tr>
<tr><td>Internal wall</td><td>All internal walls to unconditioned space have a total R-value of R2.1</td></tr>
<tr><td>Glazing</td><td>Glazing system (glass and frame) with U value & Solar Heat Gain Coefficient as per reference wall glazing system building code calculations:
<table>
<tr><th colspan="3">Office 4A</th><th colspan="3">Office 4B</th></tr>
<tr><td></td><td>U-Value</td><td>SHGC</td><td></td><td>U-Value</td><td>SHGC</td></tr>
<tr><td>North</td><td>2.56</td><td>0.17</td><td>North</td><td>3.56</td><td>0.25</td></tr>
<tr><td>East</td><td>5.8</td><td>0.45</td><td>East</td><td>3.48</td><td>0.25</td></tr>
<tr><td>South</td><td>No Glazing</td><td>No Glazing</td><td>South</td><td>4.59</td><td>0.38</td></tr>
<tr><td>West</td><td>3.84</td><td>0.31</td><td>West</td><td>No Glazing</td><td>No Glazing</td></tr>
</table></td></tr>
<tr><td>Roof</td><td>Concrete/Metal roof with insulation: total system R-value = R3.2</td></tr>
<tr><td>Floor</td><td>Concrete Slab on ground with insulation: total system R-value = 2.0</td></tr>
<tr><td>Permeability</td><td>No more than 5 m3/hr.m^2 at 50 Pa reference pressure</td></tr>
<tr><td>Lighting Density</td><td>4.5W/m^2 as per NCC 2019 Table J6.2a</td></tr>
<tr><td>Lighting hours</td><td>24hrs</td></tr>
<tr><td>Equipment Density</td><td>Equipment load in the model is 11W/m^2 as per 2019 NCC Table 2l</td></tr>
<tr><td>Occupant Density</td><td>As per Table 2b of the 2019 NCC “Specification JV Annual Energy Consumption Criteria”</td></tr>
</table>

Item	Description
Occupancy Schedule	Schedules used in study are as per Table 2a in 2019 NCC JV Specification. See Appendix A
HVAC System type	HVAC efficiencies in the reference building are modelled in accordance with NCC Section J and Minimum Energy Performance Standards (MEPS)
HVAC Hours	24hrs
HVAC Control	Space temperature summer indoor conditions 22.0±1.5°CBD Space temperature summer indoor conditions 21.0±1.5°CBD
Document References	The reference buildings were modelled in IES <VE> as per the architectural drawing sets by SBA Architects: Project Ref: OWE MOD 11 – LOT 4A & 4B Drawing ref: DA10, DA13, DA15, DA23, DA25

Table 7 Proposed Dynamic Modelling Input for All-Conditioned Office Areas

Item	Description
Climate Data	Weather data from ACADS-BSG, NSW_Richmond_88 Test Reference Year (TRY)
External wall	All external walls have a total R-value of R2.8
Internal wall	All internal walls to unconditioned space have a total R-value of R2.1
Glazing	Glazing system (glass and frame) with U value & Solar Heat Gain Coefficient (SHGC) as follows: U-Value: 4.2; SHGC: 0.42
Roof	Concrete/Metal roof with insulation: total system R-value = R3.2
Floor	Concrete Slab on ground with insulation: total system R-value = 2.0
Permeability	No more than 5 m3/hr.m^2 at 50 Pa reference pressure
Lighting Density	4.5W/m^2 as per NCC 2019 Table J6.2a
Lighting hours	24hrs
Equipment density	Equipment load in the model is 11W/m² as per 2019 NCC Table 2l
Occupant density	As per Table 2b of the 2019 NCC “Specification JV Annual Energy Consumption Criteria”
Occupancy Schedule	Schedules used in study are as per Table 2a in 2019 NCC JV Specification. See Appendix A
HVAC System type	HVAC efficiencies for heating and cooling as follows: **EER:** 4.0; **CoP:** 4.0
HVAC Hours	24hrs
HVAC Control	Space temperature summer indoor conditions 22.0±1.5°CBD Space temperature summer indoor conditions 21.0±1.5°CBD
PV Solar system	1.0MW PV system

5.7 Domestic Hot Water (DHW)

The BCA specifies the thermal efficiency for hot water systems to be at least 80%. The solar hot water reticulation system shall be provided to all faucets' fittings, equipment and apparatus within the development. Hot water will be generated from the roof mounted solar water packaged plant.

A solar hot water or electric heat-pump system will be provided for the office domestic hot water use.

With the installation of water efficient fixture, the hot water consumption will be decreased and thus the domestic hot water usage will also decrease. If the domestic hot water usage is less than the energy required to heat to the water also decreases. Moreover, the supplement natural gas consumption will be reduced by using the proposed solar hot water system.

The energy simulation in this analysis is assumed both reference and proposed building are using same hot water system for DHW. The actual energy consumption will be reduced once solar hot water or electrical heat pump is adopted for the proposed building.

5.8 Minimization of Greenhouse Gas Emission

The predicted Total Annual Energy Consumption of the NCC Reference Building and the Proposed Building is summarised in **Table 8**. For both buildings, temperatures lie within the range 16°CDB to 27°CDB for 100% of the plant operation time.

The annual energy consumption of the proposed building may be reduced by the amount of energy obtained from:

- an on-site renewable energy source; or
- another process as reclaimed energy.

The reference building uses:

a. The Deemed-to-Satisfy (DtS) Provision such as J1 Building Fabrics, J2 External glazing;

b. A solar absorptance of 0.6 for the external walls and 0.7 for roofs;

c. The maximum lamp power density without any increase for control device illumination power density adjustment factor;

d. Air-conditioning with the conditioned space temperature within the range 18°CDB to 26°CDB for 98% of the plant operation time;

e. The profiles for occupancy air-conditioning, lighting and internal heat gains for people, hot meals, equipment and hot water supply systems of the project Specifications; and

f. Infiltration values:

    a. for the perimeter zone depth equal to the floor-to-ceiling height when pressuring plant is operating, 1.0 air change per hour and

    b. for the whole building, when the pressuring plant is not operating, 1.5 air change per hour.

g. Both the proposed and the reference building will use the same annual energy consumption calculation method and building features such as:

    a. location, adjacent structures, building form

    b. internal heat gains including people, lighting, appliances, meals and other electric power loads

c. and other features as specified in NCC JV3

The predicted Total Energy Consumed annually by the reference building and the proposed building with the reference services is summarised in **Table 8**.

- The proposed building is likely to achieve a 48% lighting energy reduction when compared with reference building. Refer **Section 5.3**
- At least 1,000 kW of rooftop PV solar system (500 kW for Lot 4A and 500 kW for Lot 4B) has been recommended.
    - The proposed 1,000 kW PV solar system will offset approximately 1,387 MWh/year of energy usage.

Table 8 Comparison of Annual Energy Consumption Between the Reference and Proposed Building

Electricity Usage	Reference Building (MWh)	Proposed Building (MWh)
Heating	13.07	12.41
Cooling	37.5	26.7
Auxiliary	7.3	6.7
Lighting	627.7	326.3
Lift	23.8	23.8
Equipment	assumed identical	assumed identical
DHW	assumed identical	assumed identical
PV System	-	- 1,387
Total	**661.77**	**- 990.2**

Note 1 these items are specific to a tenant's Fitout -hence assumed to be the same for the Reference and Proposed Buildings

By implementing all energy efficiency measures described in **Section 6**, the project is predicted to achieve a 249% GHG emission reduction when compared with 2019 NCC Reference Building.

6 POTABLE WATER CONSUMPTION

It is proposed that the Project will have a number of sustainable water-saving measures, including:

- Rainwater reuse and reticulation system – Rainwater will be harvested from the roof and reuse for irrigation and toilet flushing. The reticulation will be a separate system to the domestic cold water with domestic water top up in the event of insufficient rainfall;
- Use of water saving plumbing devices; and
- Water sensitive landscape design.

The rainwater tank will be sized during the detailed design stage to ensure as a minimum 80% of all non-potable water on each lot can be sourced from the tank. At this stage SLR recommends 60 kL rainwater tank for Lot 4A and 60 kL rainwater tank for Lot 4B.

Further to above sustainable water measures, the following items will be considered during the detailed design stage:

- Water efficient sanitary taps and toilets – install higher WELS Rating sanitary fixtures such as 4 stars for water taps, urinals and toilet.
- Water and energy efficient dishwashers with minimum 4-star WELS water rating.

By installing 4 star rated toilets, urinals and taps and the proposed 120 kL rainwater harvesting facility the proposed development will reduce its potable water demand by approximately 42%.

The quantities of each water fittings are assumed from the drawing and listed in **Appendix B**.

7 MONITORING AND REPORTING

All committed sustainability-related measures need to be commissioned and tuned once the project is completed, to ensure all services operate to their full potential and as designed.

As specified within the Tenant Base Building Specification, the building tuning will be provided by service contractors and overseen by an independent assessor, at least once a month within the Defects Liability Period (DLP) period to ensure that services are operating effectively and efficiently. Monthly reports to be provided to the tenant for DLP.

7.1 Energy Review and Audit

An energy usage review should be undertaken within the first few months of operation to ensure the Energy Management Plan is sufficient for the development's needs. A breakdown of energy usage per month at the Project Site will help to measure the development's baseline energy use and assess what appliances, equipment and processes are consuming energy.

An energy review is also necessary for the assessment of energy utilisation to further identify opportunities for improvement. Energy usage data obtained during the review process may be used to establish key performance indicators and annual energy targets for the Project.

Energy usage to be included in the review should include all purchased electricity and energy which is consumed by stationary equipment on site. Energy consumed by mobile equipment (e.g. forklifts) should also be examined as this will identify variations in warehouse operation efficiency. (Refer to 'Guidelines for Energy Savings Action Plans' (2005) (as developed by the former Department of Energy, Utilities and Sustainability) for reporting templates and further information.)

An energy audit and management review should also be undertaken on a half-yearly basis to ensure employees are following energy savings procedures correctly. Where audits show that energy savings procedures are not carried out effectively, additional employee training should be undertaken and signage and procedures re-examined.

The Energy Management Plan should be progressively improved and updated on an annual basis, or as required, to reflect changes to the Energy Management System and to promote continual improvement of energy management at the Project Site.

7.2 Energy Metering and Monitoring

To enable effective review of energy usage by the project, sub-metering will be implemented for all major energy consuming processes or items of equipment including:

- Whole tenancy parent meter (covering all end uses below)
- Warehouse lighting
- Warehouse power
- Office lighting
- Office power
- Office HVAC
- Lifts

- Domestic hot water
- Solar photovoltaic system
- EV charge points
- For loads over 100kVA, the energy meters are designed to connect to the building EMS/BMS system for ease of monitoring and collection of data

All electricity and water meters will be connected to a monitoring system to allow data analysis. The monitoring system will be designed to have the capability to generate reports on a monthly and/or as required basis for energy and water meters. The following information will be able to be obtained from the Building Management Control System (BMCS):

- Tenant / Use
- Metering Schedule – identifying the location and types of meters
- Meter No, Billing Address and Contact
- Monthly use
- Graph of previous 12 months usage (rolling time scale)
- Average daily use
- Actual versus target; and
- Cost.

Electrical equipment should be maintained to Australian Standards to ensure unnecessary energy wastage is minimised. Roof access system is proposed for third party access to roof for carry out necessary maintenance as required.

In accordance with the Goodman's Industrial Building Specification, a Building Users' Guide is to be prepared for the Project. The Building Users' Guide provides details regarding the everyday operation of a building and should include energy minimisation initiatives such as natural ventilation strategies, user comfort control, maintenance of air conditioning units and other electrical devices to ensure maximum operating efficiency, and lighting zoning strategies.

An effective Building Users' Guide will ensure that:

- Facility managers understand in detail their responsibilities for the efficient operation of the facility and any additional building tuning necessary to continuously improve energy management.
- Maintenance contractors understand how to service the particular systems to maintain reliable operations and maximum energy efficiency.
- Employees understand energy minimisation procedures and working limitations required to maintain design performance for energy efficiency.
- Future fit-out / refurbishment designers understand the design basis for the building and the systems so that these are not compromised in any changes.

7.3 Roles and Responsibilities

It is the responsibility of the facility manager to routinely check energy savings procedures are undertaken correctly (i.e. lighting turned off while areas of the development are not in use). The facility manager should also ensure all monitoring and audit results are well documented and carried out as specified in the Energy Management Plan.

Senior management should also be involved in energy management planning as an indication of the organisation's commitment to the Energy Management Plan.

8 CONCLUSIONS

SLR Consulting Australia Pty Ltd (SLR) has been engaged by Goodman Property Services to prepare a Sustainability Management Plan (SMP) to support the Development Application for the proposed industrial buildings 4A & 4B at the Oakdale West Industrial Estate (OWIE).

This study has been prepared in accordance with the following Oakdale Site Secretary's Environmental Assessment Requirements (SEARs):

- **Greenhouse Gas and Energy Efficiency** – including an assessment of the energy use on-site and all reasonable and feasible measures that would be implemented on-site to minimise the development's greenhouse gas emissions.
- **Ecologically Sustainable Development** – including a description of how the development will incorporate the principles of ecologically sustainable development in the design, construction and operation of the development.

The principal objective of this Sustainability Management Plan is to identify all potential energy savings that may be realised during the operational phase of the project, including a description of likely energy consumption levels and options for alternative energy sources such as PV solar power.

A BCA Sections J Deem-to-Satisfy compliant building is used as the baseline building for energy consumption savings. BCA Section J provides the minimum requirement for energy efficiency and it is expected that the proposed development will operate energy efficiently via:

- At least 1,000 kW of PV solar system (500 kW for Lot 4A and 500 kW for Lot 4B);
    - The proposed 1,000 kW PV solar system will offset approximately 1,387 MWh/year of energy usage.
    - The estimated greenhouse gas CO_2 emission saving is approximately 1,137,340 kgCO_2/annum
- 2 W/m^2 maximum illumination density for the warehouses instead of 4 W/m^2 as per Table J6.2a of the NCC 2019 Volume One resulting in a considerable energy reduction;
- Daylight controlled LED lighting for the warehouse instead of metal halide, resulting in a considerable energy reduction and reduced maintenance;
- Motion sensors to all LED lights within the warehouse, and offices;
- Translucent roof sheeting to warehouse areas;
- R3.2 Roof and R2.8 Walls insulation for all air conditioned office areas as per the 2019 NCC requirements;
- High performance glazing to all air-conditioned areas or minimum NCC requirements;
- Passive solar design for external outdoor areas;
- Efficient air conditioning system;
- Power sub-metering to enable continued review of power consumption for the offices, and warehouse;
- Selection of endemic and low maintenance landscaping species;
- 120 kL rainwater tanks for rainwater harvesting and re-use for landscape irrigation and toilet flushing;
- Low flow fixtures and fittings including taps and shower heads;

- Low VOC paints, carpet and sealant for all offices;
- 6% (spaces) of total parking spaces are dedicated for electrical cars with charging stations proposed;
- Low carbon construction materials including 5% replacement of cement with fly ash; and
- At least 90% of all construction waste is re-used or recycled.
- Other measures as detailed in this report.

By implementing all energy efficiency measures described in Section 6 of this report, the project is predicted to achieve a 249% GHG emission reduction when compared with 2019 NCC Reference Building.

By installing 4-star rated toilets, urinals and taps and the proposed rainwater harvesting facility the proposed development will reduce its potable water demand by approximately 42%.

In conclusion, the relevant ESD initiatives and Energy Efficiency measures outlined in this report are incorporated into the proposed building and development details. The proposed ESD initiatives will help to achieve significant reductions in the energy required by the development both in building and operation.

Building tuning will be conducted by builder and SLR recommends that quarterly reviews of actual building energy and water consumption be carried out once the warehouses are operational to check the actual energy usage and energy savings and verify that all systems are performing at their optimum efficiency. This will provide an opportunity for the systems to be tuned to optimise time schedules to best match occupant needs and system performance while satisfying the sustainability target for the project.

APPENDIX A

Energy Saving Lighting Design Recommendations

BCA Lighting Requirements Oakdale West Lot 4A & Lot 4B								
BCA Comply Building	**BCA Requirements**		**Area**	**Operating Hrs**	**Lighting Control**			**Total Annual Energy Consumption (kWh)**
Lots 4A/4B	Warehouse (Lot 4A and Lot 4B) W/m2	4	31,485	Monday to Sunday 24 hours	Motion Detector, Daylight Sensor	0.9	0.6	595,747
	Office (Lot 4A and Lot 4B)W/m2	4.5	1,400	Monday to Sunday 24 hours	Motion Detector, Daylight Sensor	0.9	0.6	29,802
	Dock Office (Lot 4A and Lot 4B)W/m2	4.5	100	Monday to Sunday 24 hours	Motion Detector	0.9	0.6	2128.68
			32,985				**Total**	627,677
							kWh/m2	**19.03**

BCA Lighting Requirements Oakdale West Lot 4A & Lot 4B								
BCA Comply Building	**BCA Requirements**		**Area**	**Operating Hrs**	**Lighting Control**			**Total Annual Energy Consumption (kWh)**
Lots 4A/4B	Warehouse (Lot 4A and Lot 4B) W/m2	2	31,485	Monday to Sunday 24 hours	Motion Detector, Daylight Sensor	0.9	0.6	297,873
	Office (Lot 4A and Lot 4B)W/m2	4	1,400	Monday to Sunday 24 hours	Motion Detector, Daylight Sensor	0.9	0.6	26,490
	Dock Office (Lot 4A and Lot 4B)W/m2	4	100	Monday to Sunday 24 hours	Motion Detector	0.9	0.6	1892.16
			32,985				**Total**	326,256
							kWh/m2	**9.89**

APPENDIX B

Water Saving Recommendations

WATER SAVINGS CALCULATION Oakdale West Lot4A & 4B

Table B1 - Number of fixtures

	Toilets	Urinal	Basins	Showers
Amenities	36	11	43	8
Total	36	11	43	8

Assume 100% of toilet water usage is supplied by rainwater

Fraction not supplied by RWH	0

Table B2 - Results

No water saving measures		**Max water usage rate [1]**	
Toilet	Adopt 3* Average Flush Usage in Table C3	144	L/s
Tap	Adopt 3* Tap Usage in Table C3	387	L/s
Urinal	Adopt 3* Urinal Usage in Table C3	22	L/s
Water reuse measures (4*) with RWH		**Max water usage rate [1]**	
Toilet	Adopt 4* Average Flush Usage in Table C3	126	L/s
Tap	Adopt 4* Tap Usage in Table C3	322.5	L/s
Urinal	Adopt 4* Urinal Usage in Table C3	16.5	L/s
Water reuse measures (5*) with RWH		**Max water usage rate [1]**	
Toilet	Adopt 5* Average Flush Usage in Table C3	108	L/s
Tap	Adopt 5* Tap Usage in Table C3	258	L/s
Urinal	Adopt 5* Urinal Usage in Table C3	11	L/s

	3* with RWH	4* with RWH	5* with RWH
Improvement Percentage (%) [3]	30	42	53

Calculation Notes

[1] *Water usage rate per use = Number of items in Table C1 x Usage rate in Table C3*

[2] *Assume total water usage is proportional to max water usage rate*

[3] *Improvement percentage = % difference between 3* rated fixtures max water usage rate with no rainwater harvesting and design fixture max water usage rate with 100% of toilet and urinal flushing supplied by rainwater harvesting*

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