WOOD & GRIEVE ENGINEERS

585-649 Mamre Road

Ecologically Sustainable Design Report

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Revision

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Contents

1. Executive Summary

This Ecological Sustainable Design Report has been prepared for HB+B Property for the proposed Snackbrands Distribution Warehouse Centre (Building 7) located at 585-649 Mamre Road, Orchard Hills, NSW. This report is intended to provide an overview of the potential key energy uses on site, and review methods to reduce the overall energy consumption. This is a design response to the Greenhouse Gas and Energy Efficiency components of the *Secretary's Environmental Assessment Requirements (SEARs)*. The report further addresses ecologically sustainable aspects included in the development.

This report includes:

- An overview of the sustainability drivers for the project (both regulatory & identified project drivers)
- An assessment of the energy use on site and proposed measures to ensure energy efficiency
- Detail regarding specific ecological sustainable development initiatives through all phases of the project.

Information contained within this report has been prepared in direct response to:

- Relevant State & Local Government Controls;
- The Request for Secretary's Environmental Assessment Requirements (SEARs); and
- Industry recognised best practice in sustainability

In coordination with the above, the project has chosen to implement a number of sustainable design principles and includes initiatives design to mitigate the environmental impact of the following:

- Energy – including improved energy efficiency across the buildings and its associated sources.
- Water Efficiency – including reduced potable water demand and improved stormwater quality.
- Passive Design Principles – reducing the projects overall requirement for building services.
- Ecology - Maintaining ecology through landscaping where practical

The following sections detail the development's specific sustainable design response in more detail.

2. Introduction

The proposed development is a Distribution Warehouse Centre to be developed for Snackbrands Australia. The development is located at 585-649 Mamre Road, Orchard Hills and it is envisaged to be a significant development in the Greater Western Sydney Employment Area - Precinct 11. The development is sitting on an approximately 50,000m^2 block of land and consists of approximately:

- 29,655m2 of Warehouse area facilitate the storage and distribution process
- 600m2 of office space (500m2 Main office and 100m2 dock office)
- 113 Car parking spaces
- A new access road around the site boundary
- New vegetated landscaping throughout the site setback region
- Bulk earthworks to establish building pads for the proposed estate allotments and cut/fill to level the site

The below image shows the proposed site and spatial breakdown:

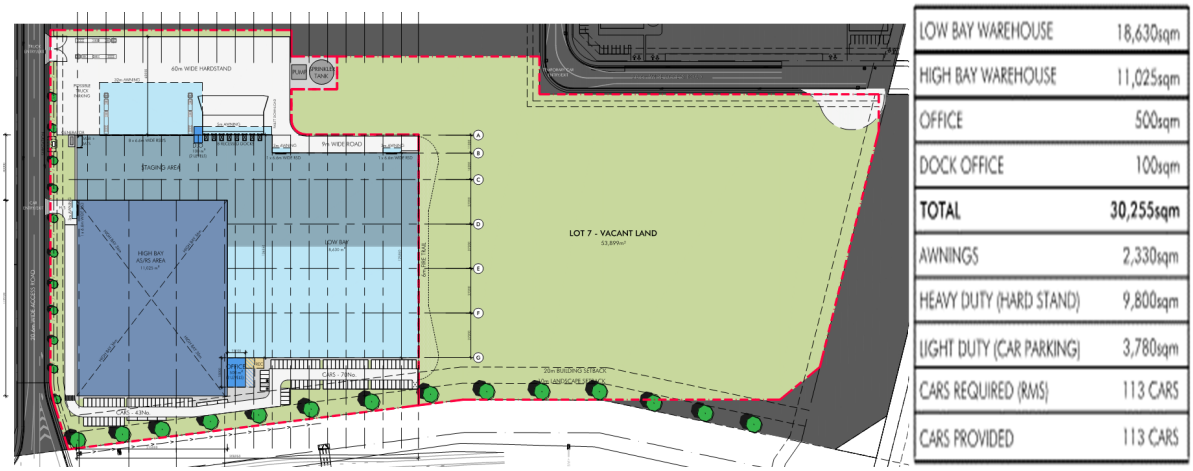


Figure 1 Overview of the site

This report addresses the Greenhouse Gas, Energy Efficiency and Ecologically Sustainable Development aspects in response to the *SEARs* for the project. It uses best practice sustainable design principals and borrows elements from external sustainability tools to develop a set of metrics for the site.

2.1 Sustainable Design Initiatives

In pursuit of the ecological design principles, the Mamre Road development will pursue excellence benchmarked from a number of sources. These include best practice design initiatives from:

- Mamre West Precinct Investigation Area DCP, February 2016
- Penrith City Council Local Environmental Plan (LEP) 2010, &
- *Secretary's Environmental Assessment Requirements (SEARs)* for this development.

2.1.1

The SEARs document outlines requirements for this development that must be addressed as part of the Environmental Impact Statement. These are:

- **Item #15 - Greenhouse Gas and Energy Efficiency** including an assessment of the energy use on site and demonstrate what measures would be implemented to ensure the proposal is energy efficient.

- **Item #16 - Ecologically Sustainable Development**. Including an assessment of how the development will incorporate ecological sustainable development principles in all phases of the development.

This report directly addresses these key issues in the *SEARs* requirements for the site, issued 11 September 2015 by *The Department of Planning and Environment* (DPE). This report is intended to form part of the Environmental Impact Statement (EIS) for the SSD 7173.

2.1.2 Mamre West Precinct Investigation Area DCP

The new Mamre West Precinct has a specific DCP developed in February 2016. The ESD elements associated with this report are replicated below:

6.*4 ECOLOGICALLY SUSTAINABLE DEVELOPMENT*

Objectives

(a) To encourage development that incorporates measures to minimise potential energy use
(b) To include water minimisation initiatives within the proposed subdivision and development of the site

Controls

(a) Development is to include sustainable building technologies and materials and use energy efficient fixtures within the building fit-out.
(b) Water saving devices and techniques are to be included within the design and fit-out of industrial buildings, including rainwater harvesting, dual flush toilets, use of non-potable water for irrigation and the like.

These controls are specifically addressed in this development, with a number of the elements outlined in this report.

3. Greenhouse Gas Emissions & Energy Efficiency

An analysis has been performed regarding the Greenhouse Gas Emissions of the site. This has been performed for both the office areas and the warehouse. This has been performed by performing an energy model for both the office and the warehouse to investigate the effects of differing designs. The results presented herein are intended to influence the architecture in finalising the design and operation of the spaces.

3.1 Office Design

3.1.1 Overview

The office has been analysed for a number of different design elements and configurations.

These include:

- High performance glazing
- Zoned mechanical systems (center/perimeter)
- Wider temperature control band
- Increased mechanical equipment performance
- Increased lighting efficiency
- Combining the above elements.
- PV to 10% of the roof.

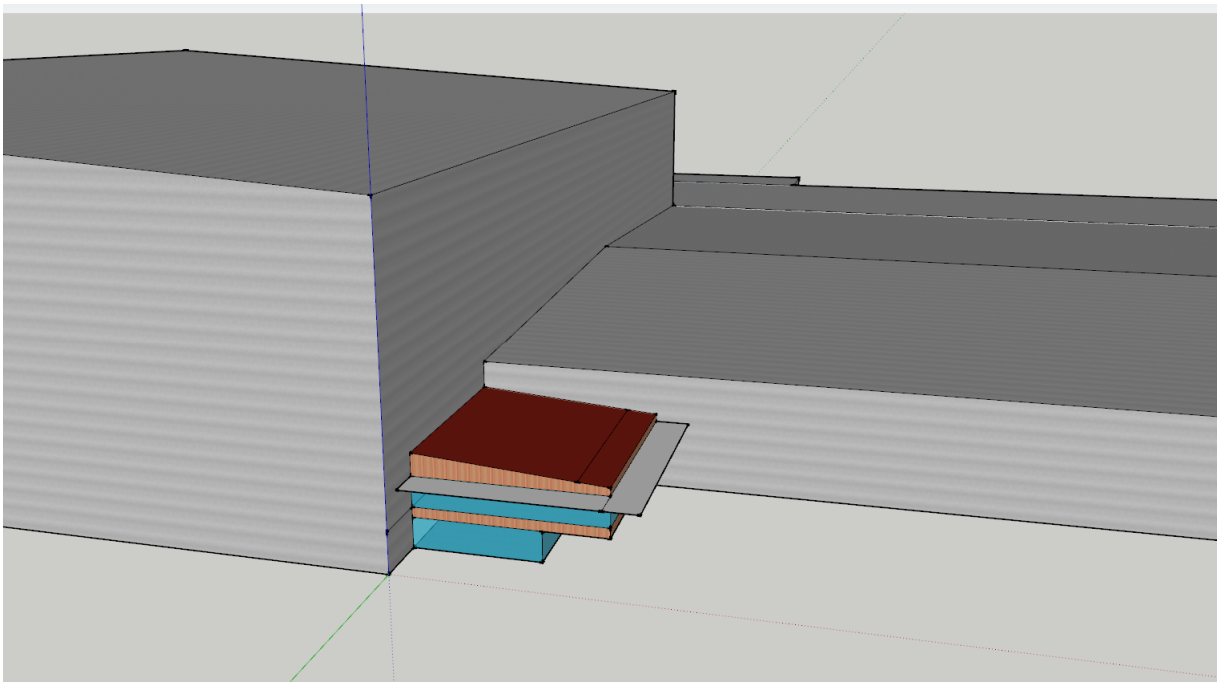


Figure 2 Model of the office

3.1.2 Description of inputs

The office has a base line model that begins with the following baseline assumptions. These have been chosen to describe a typical office construction that meets the NCC/BCA 2015 minimum requirements:

	Insulation	Glazing Performance	Window Height	Heating COP	Cooling COP	Internal Loads	Density
Base Case	BCA Deemed to Satisfy requirements	U-Value = 4.0 SHGC = 0.5	2.7m	0.87 (gas boiler)	3 (standard air conditioning cooling)	10W/m2 equipment 9W/m2 lighting	1person/ 15m2

A number of models have been developed to investigate the effects of changing a number of the design elements. The office to the largest warehouse has been modelled as it is believed this will be the most representative.

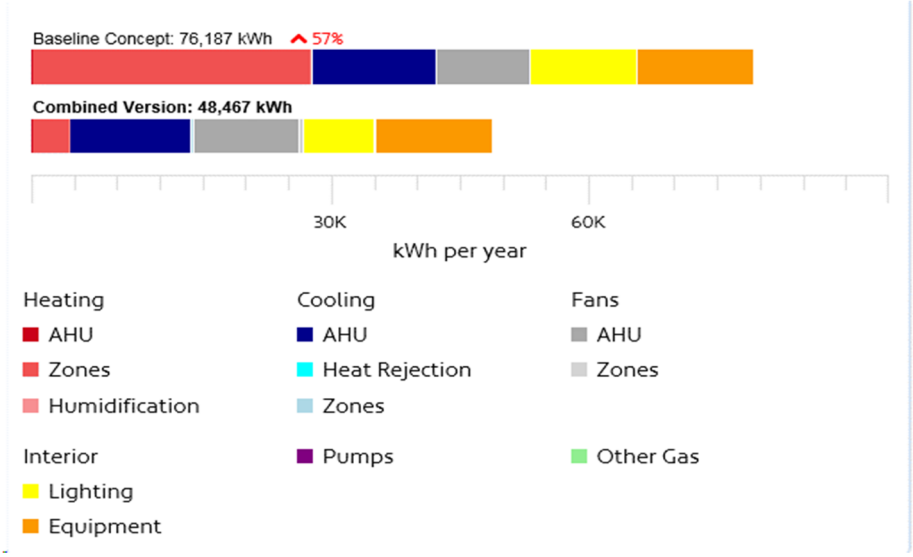
Case	Description
Baseline	Business as usual, in line with the BCA and standard operational procedures
Improved Mechanical Systems	Modelling a mechanical system that exceeds typical performances. This would include replacing the boiler and air conditioning system with an efficient DX reverse cycle cooling method (i.e. VRV).
Zoned Mechanical Systems	Splitting the floorplate into a perimeter/centre zone typically improves the performance as façade loads are captured in a smaller area. This is not always the case in small floor plates.
High Performance Glazing	Using glazing that exceeds typical construction values. These have been modelled at U-Value = 2.5, SHGC = 0.35, which represents a reflective double glazed unit with a low-e coating.
Temperature Control Band	Increasing the temperature control band from 21-24degC to 19-26degC.
Increased Lighting Efficiency	Reducing the glazing below the BCA maximum, from 9W/m2 to 6W/m2. 6W/m2 is representative of a low energy office.
Combined elements	Combining the above initiatives
Additional Photovoltaics	Adding a solar cell array to the roof to drive efficiency further. This represents 10% of the roof area.

3.1.3 Results

The following savings have been estimated for the office.

Case	Annual Energy Consumption (kWh)	% of baseline
Baseline Concept	76,187	100%
Improved Mechanical Systems	58,318	77%
Zoned Mechanical Systems	73,139	96%
Improved Glazing	71,660	94%
Wider Temperature Band	74,343	97%
Reduced Lighting	73,290	96%
Combined version	48,467	63%
Combined + PV	42,665	56%

These are further broken up into the following:

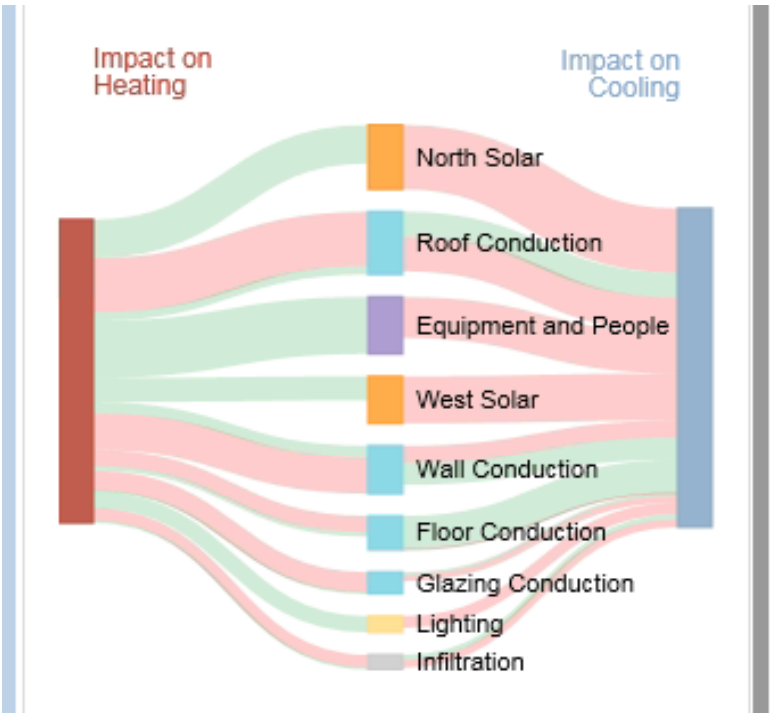


Combining all the above elements reduces the energy consumption of the building from the base case by 44%. Controlling for appliances which are required for functional reasons, the savings are 56% of the baseline case. The inclusion of photovoltaics (solar panels) could drive energy savings even further.

3.1.4 Analysis

The above model has been performed for the lot 7 office. The principals however will remain constant across the development. It can be seen that by making a number of improvements, the buildings' energy loads are drastically reduced.

The below infographic demonstrates the influence on heating and cooling loads for the base line case. It demonstrates that the primary loads are attributable to internal loads (equipment, people and lighting), followed secondly by conduction then solar loads. This is due to the orientation of the offices being south facing, or shaded from above in the case of the northern office.



The reduction of lighting power can be complemented with motion detectors, daylight sensors and time clocks. This will further reduce the direct energy consumption of the site. For functional reasons, loads from equipment and people are not controlled.

3.2 Warehouse Design

The warehouses contribute to approximately 98% of the total building area and as such are responsible for the significant component of energy consumption within the site. A number of initiatives have been proposed to reduce the greenhouse gas emissions and environmental damage associated with the warehouse component on the development. These include:

- Natural ventilation of the warehouses, except where for functional reasons this is not practicable (i.e. refrigeration rooms, freezer rooms as required)
- Roof ventilators are proposed to provide effective air changes to the space. This reduces the buildup of heat in the space and encourages air circulation. This also helps control humidity in the space, reducing concerns of mould in the space.
- Encouraging natural lighting where possible, through the use of translucent roof materials, targeting 10% across the warehouse roofing components.
- Rainwater harvesting and reuse
- Lighting controls including zoned switching, motion sensors and/or time clocks.

By providing an unconditioned space with natural ventilation, the key energy sources are lighting and plug loads. Plug loads are required for the function of the space and cannot be reduced. Lighting load can be reduced by 30% or even further by the introduction of zoned switching, time clocks and/or motion sensors. As such, this provides an energy efficient solution to the warehouse component of the stage 1 development.

3.3 Energy Consumption Estimation

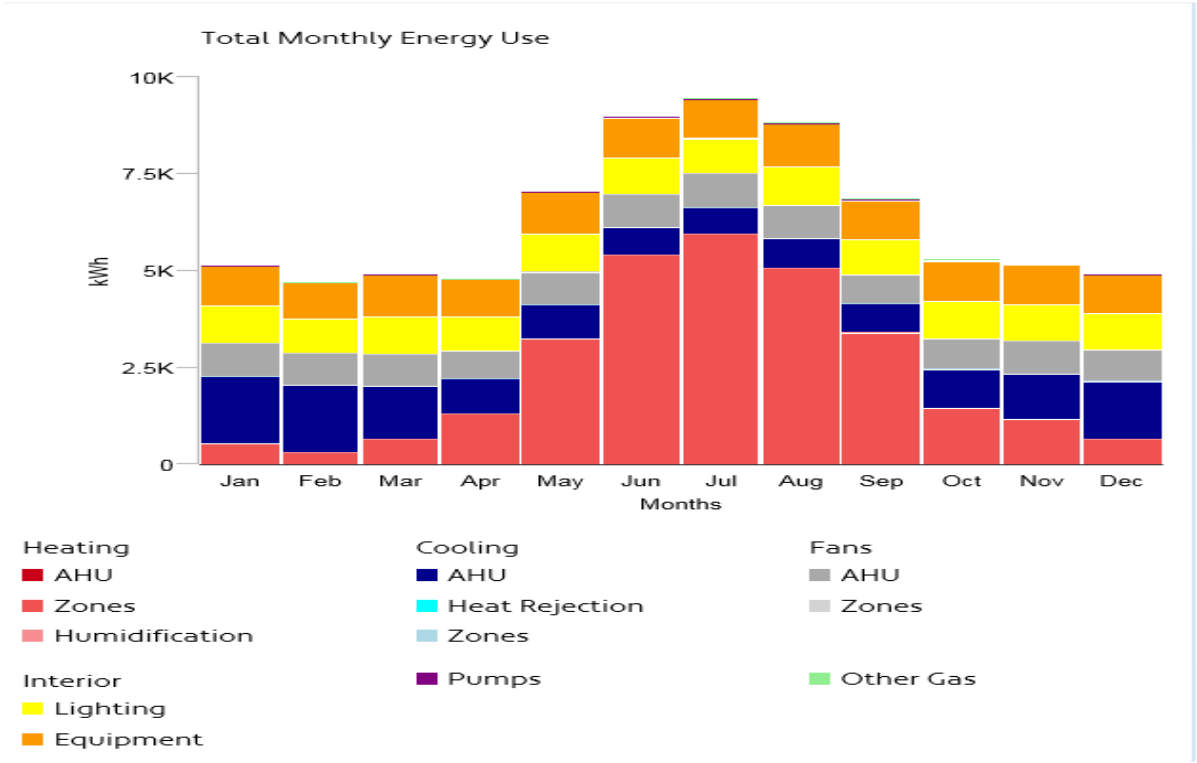
The following table is a simplistic estimation of the energy consumption of the site for the base case scenario and for the offices and warehouses.

	Baseline (kWh/m2/year)	**Combined Case (kWh/m2/year)**	**Total Area (m2)**
Office	127	86	600
Warehouse	34	24	29,655
Energy Saving		**32%**	

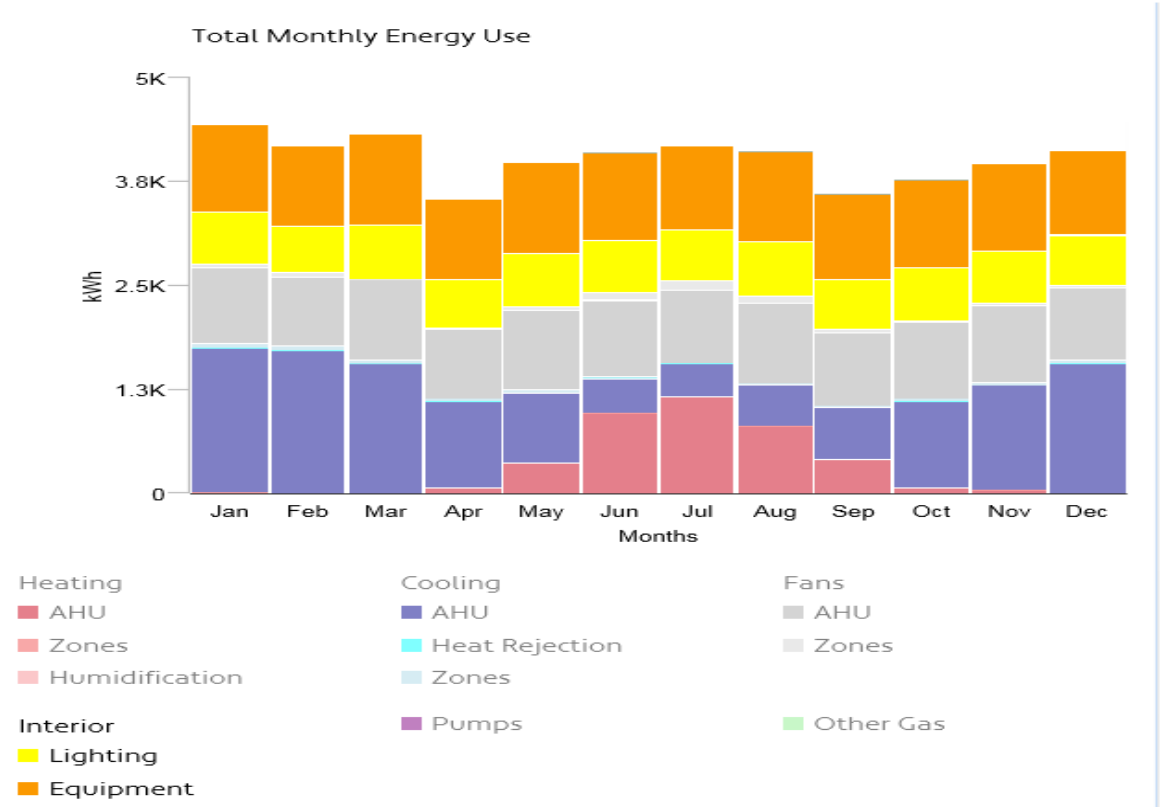
Note the above numbers are indicative and are based on the information presented herein only. These should not be used for sizing loads and are intended for comparative studies and architectural decisions only.

The below shows the monthly breakup of energy consumption for the office Baseline and Proposed cases:

Baseline Consumption:



Proposed Case:



4. ESD Opportunities & Initiatives

The following section identifies Ecological Sustainable Development opportunities and initiatives for potential inclusion within the project. The following examples are to be viewed in response to the conceptual design prepared by Nettleton Tribe. WGE note the design is in its infancy, and the following concepts will be considered going forward. As the design progresses, a number of documented elements may prove unfeasible, as well as undocumented initiatives proving attainable.

4.1 Design Overview

Fundamental to the success of improving the ESD outcome for the project is the adoption of strong design philosophy.

Passive thermal design features have the ability to:

- Improve building occupant comfort;
  - Lower operational energy demand via improved thermal performance;
  - Promote greater indoor environmental quality;
  - Reduce the requirements for artificial lighting & power;
  - Reduce the buildings' reliance on HVAC systems; and
  - Improve the project's ability to deliver a responsible development.

The design will attempt to include several passive design options and provide a robust and environmentally sensitive framework.

4.2 Penrith Council DCP Requirements

The following Ecologically Sustainable initiatives will be included in the design, to align with the controls and objectives of the Penrith DCP 2014 & Mamre West Precinct Investigation Area DCP 2016.

- **Landscaping:** The site offers a consistent landscaped border, with vegetation throughout. This is provided in the setback on all 4 sides of the development, including the 10m setback on Mamre Road and around the new access road around the site. These clearances are designed in line with access requirements and those outlined in the Mamre West DCP.

- **Access:** Pedestrian footpaths will be available at street level, encouraging a walkable site and alternative transport options.

- **Shade:** Awnings will be provided at each access point to the warehouses. This will be provided on the warehouse edge where trucks load/unload to provide sun protection for employees.

- **Vegetation:** The landscaping of the site will include the planting of new trees in the setback region around the site boundary. The 10m setback along Mamre road will be vegetated. Around the other three sides, a new access road is required. The remaining area besides the road will be vegetated.

4.3 Environmental & Building Management

Via the implementation of industry recognised best practice frameworks, the project design and built form will seek to respond to the ongoing environmental challenges of urban development and ensure the project implements a range of ESD initiatives aimed at improving ongoing building management.

Through specific contractual commitments and documented design intent the project will seek to address environmental management & building operational performance through the following initiatives.

- **Building Commissioning & Tuning Procedures –** (prior to practical completion / 12 months post practical completion). By implementing this via project contract documents the project ensures operational efficiency & building operation is optimised in accordance with the intended building design.

- **Energy Metering –** sub-metering will provide real-time data for the use & management of building staff. Ensures operational efficiency is maintained.

- **Waste provisions –** appropriate waste provisions are to be included within the project to ensure recycling rates & reduced waste to landfill is optimised.

4.4 Indoor Environmental Quality (IEQ)

Improved indoor environment quality is a significant by-product of sustainable building design. The architectural design by Nettleton Tribe will give significant consideration to the incorporation elements within the project intent to improve indoor environment quality.

The following design features are considered with the intent to improve indoor environmental quality.

- Office floor plate design and layout has focused on **maximising daylight access**. By maximizing daylighting opportunities, the building will inherently lower energy demand and GHG emissions via reduced lighting demand & improved passive thermal performance. This also increases occupant connection to the space. This is achieved by significant glazed areas, meeting rooms/cores being located away from the façade and the choice of glazing.

- Great proportion of **high-quality views**. The shape of the office is such that there are uninterrupted views from the majority of the open floor plates. This is also achieved by the extent of the glazed component of the building.

- **Thermal comfort** is provided through maintaining the internal temperature between 21 and 24degC for the occupied periods. Note this provided for the office and critical areas only – not back of house or warehouse spaces. Comfort will be achieved through providing adequate insulation in line with the NCC to all envelope elements and reducing draft by designing the indoor air velocity to a maximum of 0.25m/s. This will be achieved through the mechanical design criteria.

- **Glare and radiant temperature control** through the use of operable blinds on each window.

- **Artificial Lighting Design –** will be zoned & designed appropriately to ensure the optimum lighting comfort is achieved. This includes general illuminance and glare reduction in accordance with best practice standards, optimised surface illuminance for building users and localised occupant lighting controls.

- **Acoustic comfort –** will be optimised to ensure building internal noise levels, reverberation levels and appropriate acoustic separation levels are achieved in accordance with best practice standards. Examples include optimised internal materials and finishes to reduce reverberation improved building facades in order to ensure appropriate acoustic separation is achieved.

- **Material Selections –** will focus on reducing volatile organic compounds (VOC) levels and minimise formaldehyde impacts. Paints, sealants, adhesives, carpets, floor and material finishes will all comply with best practice VOC criteria via the architectural specification and design intent.

4.5 Potable Water Reduction

Reduced potable water demand is a key ESD initiative identified within industry best practice standards. The development will reduce potable water demand via the following initiatives.

- **Utility meters** will be designed to meet metering guidelines under the weights and measurement legislation, as outlined under the current National Measurement Regulations.

  An automatic monitoring system which records both consumption and demand will be included, capable of producing quarter hour, hourly, daily, monthly and annual use for all meters.

- **Sanitary Fixtures -** All sanitary fixtures are to be provided to the WELS ratings identified below:
- Taps – 6 Star WELS
- Urinals – 6 Star WELS
- Toilet – 4 Star WELS
- Showers – 3 Star WELS (>6 but <=7.5)
- Dishwashers (where included) – minimum 3.5 Star WELS

- **Rainwater Reuse -** A total of 112,000L rainwater tanks (22,000L from main office and 2 x 45,000 from Warehouses) will be provided on site to harvest rainwater from the warehouse and office roof areas and use it for landscape irrigation and flushing toilet cisterns in the office. A valve switch will be provided to switch the rainwater supply to main supply when the tanks water level runs low. Rainwater on this site is particularly advantageous given the significant rainwater collectable area across the warehouse roofs.

- **Landscape Irrigation-** Landscape irrigation supply will be sourced from on-site rainwater system potentially resulting in zero potable water demand.

5. Summary

The 585-649 Mamre Road Development will incorporate a number of ecologically sustainable initiatives to complement the initiatives undertaken to reduce the Greenhouse Gas emissions of the site. These have been developed around a response to the Secretary's Environmental Assessment Requirements by Department of Planning and Environment.

The development's commitment to reducing the overall environmental impact is evident of the holistic approach taken to long-term sustainability. Documented initiatives cover a range of categories including:

- Energy & Greenhouse Gas Emissions
- Potable water reduction
- Minimising waste to landfill
- The Indoor Environment
- Occupant amenity and comfort
- Land Use & Ecology
- Emissions and
- Building Management

We trust this report provides sufficient overview of the project commitment to environmentally sustainable design and the sustainability vision for the Mamre Road development.