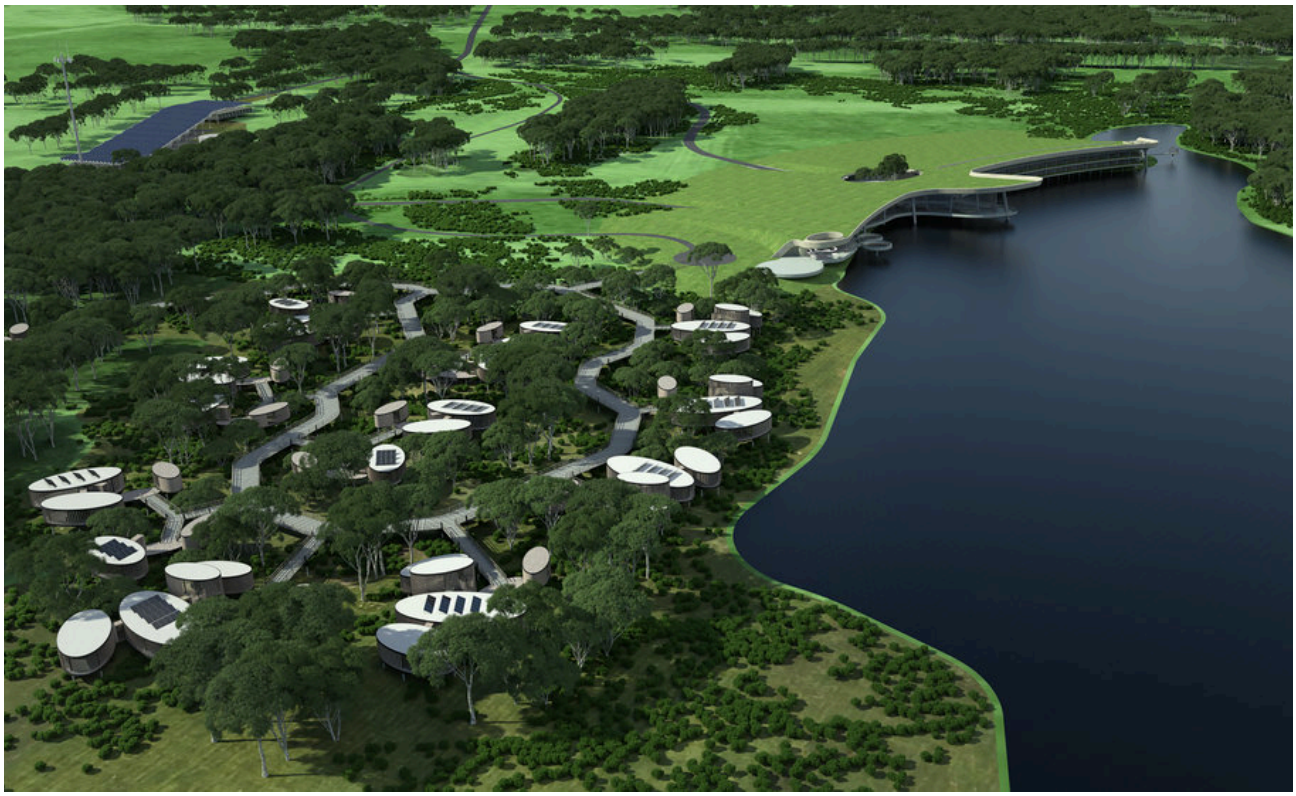

*Image credit: Studio Alfano Architects*

# Nunduk Retreat & Spa

## ECOLOGICALLY SUSTAINABLE DEVELOPMENT (ESD) OUTLINE DESIGN REPORT- FINAL DRAFT

FEBRUARY, 2018

atelier ten

Environmental Design Consultants + Lighting Designers
atelierten.com

**PROJECT INFORMATION**

| | |
|---|---|
| JOB TITLE: | NUNDUK RETREAT & SPA |
| JOB NUMBER: | 1075 |
| DOCUMENT TITLE: | ESD TOWN PLANNING REPORT |
| VERSION: | FINAL DRAFT |

**PREPARED**

| | |
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| PREPARED BY: | LACHLAN FINN, ENVIRONMENTAL DESIGNER |
| SIGNED: | LF |
| DATE: | 02.02.2018 |

**APPROVED**

| | |
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| APPROVED BY: | DAVID RITTER, ASSOCIATE DIRECTOR |
| SIGNED: | DR |
| DATE: | 06.02.2018 |

REVISIONS

| NO | DATE | CHECKED | APPROVED |
|---|---|---|---|
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## Contents

# 1.0 Introduction

## 1.1 Project Overview

The proposal is to develop a Retreat & Spa Zone, Access Park and supporting Infrastructure Zone located adjacent to the southern edge of Lake Wellington in Wellington Shire, Gippsland. The Retreat & Spa Zone will comprise a Central Retreat building and individual Villa units. The Central Retreat Building will comprise 36 rooms, a spa/wellness centre, restaurant, lounge/bar and gallery, while the secluded villas will have flexibility for 1, 2 or 3 bedrooms with up to 45 bedrooms in total.

The project objectives are stated as follows:

- Be integrally connected to the outdoors and provide relaxation and well-being benefits of a hot springs spa in a stunning natural landscape;
- To harness the natural site assets including geothermal resources;
- To be one of the first Australian projects purpose built on regenerative design principles and be a model and world leader in the export of regenerative development knowledge;
- To provide economic and financial benefit to the region and build the local economy by supporting local businesses that promote the contributive economy;
- To understand, honour and respect the aboriginal ancestry of the landscape;
- To protect and encourage resident and migratory species;
  To ensure development is self-sustaining;
- To have the potential to eat local food and support agriculture; and
- To be economically viable as an integrated operating business, matching the ecological vision of the project with an appropriately sustainable economic model.
- To provide leading edge sustainable construction, operation and leaving
- To showcase Australian Flora and Fauna in a natural setting
- To hold the environmental degradation and to regenerate the land thereby increasing biodiversity
- To involve local aboriginal community in the management of the land and to showcase aboriginal culture

## 1.2 Project Sustainability Brief

It should be noted that although the word ‘sustainability’ is used in this report, the commonly held understanding of ‘sustainability’ or ‘ESD’ (which is typically seen as limiting the negative impacts upon the ecologically) does not accurately represent the ambition of this project which seeks to go beyond this approach and become ‘regenerative’ in nature. The development incorporates regenerative design principles to the benefit of the degraded fresh water ecology of the Gippsland Lakes network and marshlands as well as the local and wider regional environment, economy and community. It will seek to regenerate employment opportunities and the economy of a region that has suffered the decline of many of its traditional industries. The project also seeks to be regenerative to the local community through the reinvigoration of an economy that is tied to the local land and services and will promote local interconnectivity and healthy living. Further to this, the project further seeks to learn from the Aboriginal culture and heritage of the land including the land management expertise accumulated through thousands of years of practice.

The project also aspires to achieve world leadership recognition through achieving the Green Star 6 Star benchmark. An initial Green Star appraisal of the scheme has been included within this report. The development scores highly for sustainable design best practice and innovation in the following areas:

- The project will be entirely self-sufficient in on-site renewable energy with export of surplus green energy to the grid
- The client team are committed to world leadership through the management of the design and construction process through to the operating principles of the development.
- There will no mains potable water connection to the development and it will be entirely self-sufficient through the harvesting of rainwater and on-site water resources.

- All water waste will be treated by a passive waste water treatment system with treated effluent exported to a local farm for use as the pasture land irrigation supply.
- As a Retreat & Spa development focused on health and well-being all buildings will provide a world leading standard of indoor environmental quality including an aspiration to meet the Passive House Standard.
- There will be several leading innovations within the scheme that will break new ground and demonstrate industry leadership.

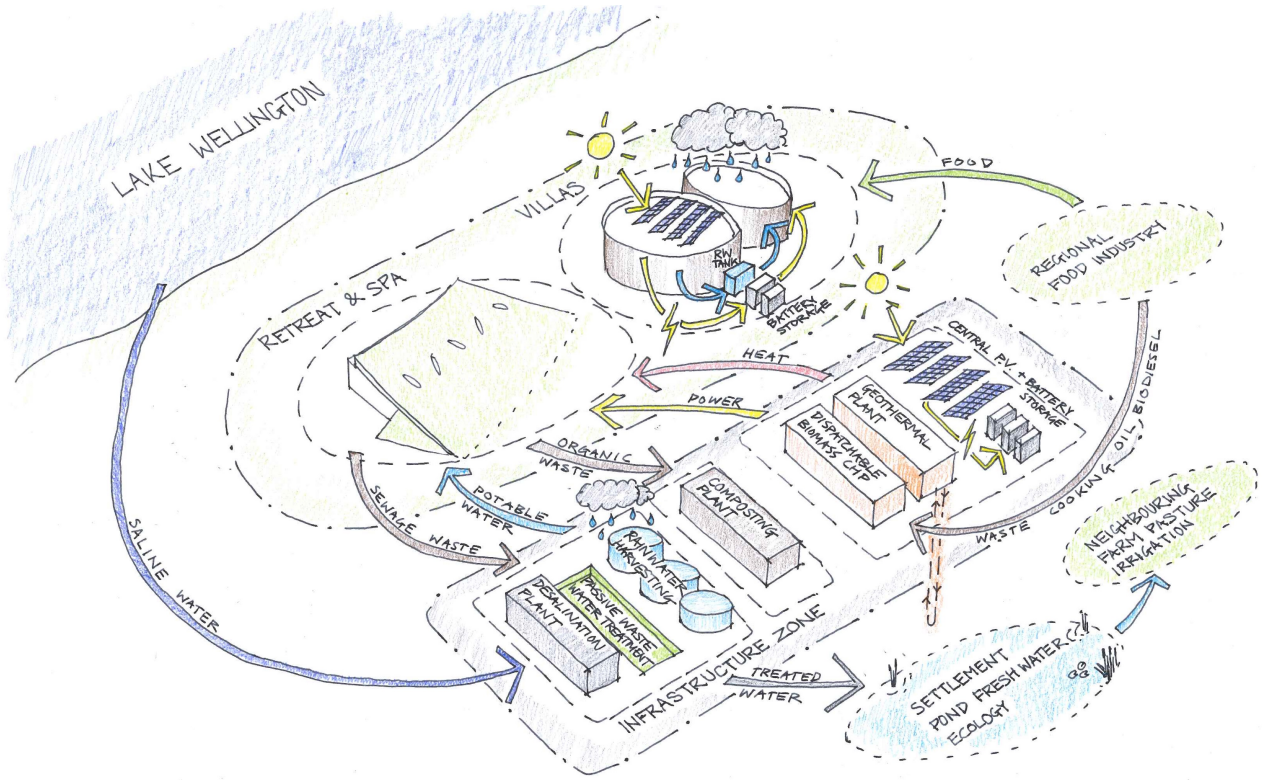
## 1.3 Report Overview

The following report gives an outline of the sustainable design strategy for Nunduk Retreat & Spa.

The initial section of the report outlines the key building design measures that will be employed within the Central Retreat building to optimise the health, well-being and comfort of guests to the Retreat, as well as reduce carbon emissions and energy consumption to a minimum. The project is committed to utilising intelligent application of passive design principles to achieve these goals.

The second section of the report provides an appraisal of the scheme against the Green Star Design and As-Built sustainability assessment tool and demonstrates that the Nunduk Retreat & Spa has been designed to achieve Green Star 6 Star in line with world leadership in sustainable development.

The following schematic diagram describes the regenerative design principles of the development.



# 2.0 Passive Design Strategy

## 2.1 Passive Design Objectives:

- Provide optimum health, well-being and comfort through opportunity for natural ventilation, indoor air-quality, thermal comfort and daylight in line with luxury health spa and 'health retreat' expectations
- Achieve optimum resilience and minimal dependence on active systems to achieve comfort goals. Reduce demand and reliance on energy infrastructure.
- Deliver building systems that are simple, robust and easy to operate and maintain.

## 2.2 Key Passive Design Strategies:

2.2.1 The Central Retreat & Spa building is situated close to the southern edge of Lake Wellington, oriented north facing to make the most of passive solar heating opportunities during the winter. Solar shading provided by the building roof overhang will ensure adequate summertime solar control.

2.2.2 Building thermal fabric standards for the Central Retreat& Spa and individual villa buildings will surpass BCA requirements and aspire to Passive House international energy efficiency best practice. The specification of thermal fabric will be as follows:

**NCC Section J1 Minimum External Envelope R-Value Requirements, Climate Zone 6**

| Volume / Class | Element | BCA Baseline Climate Zone 6 Minimum R-Value | 20% Improvement | Nunduk Retreat & Spa Initial Assumptions in line with Passive House (Estimated) |
|---|---|---|---|---|
| Vol 1 - Class 3 | Roofs | 3.20 | 3.84 | 6.00 |
| Vol 1 - Class 3 | Walls | 2.80 | 3.36 | 4.50 |
| Vol 1 - Class 3 | Suspended floors (unenclosed) | 2.00 | 2.40 | 4.50 |
| Vol 1 - Class 3 | in-screed heating or cooling | nil | | 4.00 (vertical slab edge) |
| | Glazing Specification | low E, double glazed, Uw=3.0 W/m2K approx. | | low E, double glazed, thermally broken frame, Uw=<2.0 W/m2K |
| | Air-tightness performance | none specified | | 1m3/m2hr @ 50Pa |

2.2.3 It is proposed that the Central Retreat and Villa buildings would be blower door tested at lock-up stage in line with AS NZS ISO 9972:2015 to minimise air leakage and infiltration

2.2.4 It is proposed that the Retreat& Spa building will adopt the Passive Annual Heat Storage (PAHS) concept to utilise the thermal mass of the proposed earth berming at the southern edge of the building. An insulation umbrella will be extended approximately 6m beyond the back of the building to create a thermal store that retains heat in winter and 'coolth' in the summer, i.e. utilising the thermal mass of the ground as a thermal battery to store heat and 'coolth' on a

seasonal basis. It is intended that this will act as a passive thermal store to provide regulation of indoor air temperature and mean radiant temperature in the building for optimum human comfort and zero heating aspiration.

2.2.5 A green roof will extend over the Central Retreat & Spa roof to minimise the visual and ecological impact of the development. This will also help provide resilience and reduce the summer cooling loads within the building.

2.2.6 Natural ventilation through opening windows will be provided to the Central Retreat building and Villa buildings so that occupants can open up rooms to enjoy the cool, fresh air off the lake.

2.2.7 Villa buildings will also be oriented for passive solar heating in winter incorporating larger north facing windows with key views out towards the lake landscape. Summer time solar control will be provided through extended eaves, shading devices or awnings to minimise cooling requirement.

2.2.8 It is anticipated that villas can be constructed using pre-fabrication techniques to ensure quality construction and speed up onsite construction. It is also envisaged that greater cost efficiency for achieving advanced building envelope standards can be achieved.

# 3.0 Active Systems

## 3.1 Active HVAC Systems Objectives:

- Ensure excellent indoor air quality and management of water vapour from spa usage.
- Utilise recovery of energy in air and water streams wherever practically possible
- Utilise geothermal heating resource for building hot water and space heating (if any) requirements
- Minimise visual impact and noise pollution of mechanical plant upon peaceful landscape surrounds

## 3.2 Key HVAC Strategies:

*Retreat & Spa Facility:*

3.2.1 It is proposed that the Central Retreat & Spa building will employ an earth tube air intake (cost effective concrete drainage duct) laid within earth berm insulation umbrella. Alternatively, the air path could be provided by box culvert or modular container retaining wall concepts proposed by architect and structural engineer. This strategy will provide passive pre-heating and pre-cooling of the air supply to the Retreat & Spa. Provisionally 2no. 1m diameter, 50m long concrete earth tubes located 2m below the top of the berm are assumed.

3.2.2 Mechanical ventilation with high efficiency heat recovery will be provided to ensure adequate provision of fresh air to Retreat occupants all year round. This system will also provide extract of air from all bathroom and spa spaces and will ensure that heat (or 'coolth') within outgoing air is transferred to the incoming air via a heat exchanger.

3.2.3 At present, it is uncertain what temperature the water from the geothermal well can be supplied to the building, but it is assumed that 60$^{o}$C water supply is possible based upon initial reports by the Geothermal Engineer, Hot, Dry, Rocks. It is currently anticipated that this water can be used directly within the building for bathing and domestic HW usage subject to water quality assessment of the test borehole. It is also assumed that this hot water can be utilised for a low temperature hot water space heating system for the building (if any).

3.2.4 The Passive Annual Heat Storage concept means that the building will largely remain within comfort bands throughout the year with minimal need for heating and cooling. A zero-heating requirement is likely; however, provision has been made for in-room fan-coil heating capability supplied with low temperature hot water from geothermal source.

3.2.5 It is anticipated that cooling will be required to maintain comfort during extended heat wave scenarios. Cooling will be provided by a ground-source water-water chiller. This will deliver chilled water to in-room fan-coil units for summer time temperature adjustment. On the heat rejection side the unit is connected to a 'slinky' heat rejection pipe that is laid into the landscape. The pipe is typically a 25mm dia. HDPE pipe and does not require complex civil engineering infrastructure to implement.

3.2.6 The building will utilise best practice levels of daylighting to minimise electrical power for artificial lighting during the daytime. All lamps will be specified as LED fittings. It is recommended to design a circadian lighting system to encourage well-being of occupants and harmony with the natural diurnal cycle.

3.2.7 It is currently envisaged that catering energy use will be all-electric, utilising highly efficient cooking methods including induction stoves. This will avoid the burning of fossil fuels (bottle gas delivery) and will be compatible with the vision for a local renewable energy infrastructure that will be net energy positive (i.e. net exporter)

*Secluded Villa Units:*

3.2.8 Villa units will be built to high performance fabric standards. To compliment this passive design strategy villas will be provided with a high efficiency heat recovery ventilation system to ensure adequate provision of fresh air to occupants all year round. This system will provide extract of air from all bathroom and spa spaces and will ensure that heat (or 'coolth') within outgoing air is transferred to the incoming air to living spaces via a heat exchanger.

3.2.9 Through application of best practice passive design, it is anticipated that a relatively small amount of cooling and heating will be necessary in the villas and can be provided by ceiling fans supplemented by high efficiency reverse cycle a/c units powered by on-site generated electricity.

3.2.10 It is anticipated that domestic hot water for the villas will be provided by a local high efficiency air-water heat pump with $CO_2$ refrigerant gas.

3.2.11 It would be desirable to utilise geothermal space heating and DHW pre-heat to the villas but it is not anticipated to be cost-effective to extend reticulation to the decentralised, dispersed location of the villas. This is due to the likely trenching and pipework costs together with relatively high pumping energy requirement for relatively small dispersed loads.

3.2.12 It is also envisaged that the Villa buildings will utilise LED light fittings throughout and incorporate all-electric, high-efficiency kitchen facilities including induction stove.

# 4.0 On-Site Renewable Energy Systems

## 4.1 On-Site Renewable Energy Objectives:

The renewable energy strategy is led by Analytical Engines. Refer to Analytical Engines report information for detail on renewable energy generation strategy. A summary of the key elements of this strategy is as follows:

- The development will be site net positive energy generation
- Project will not draw power from the utility grid.
- Project will utilise on-site geothermal resource for water heating and space heating needs where practicable

## 4.2 Key On-Site Renewable Energy Generation Strategies:

4.2.1 The key energy generation strategy is to use photovoltaic panels. A 300kWp (approximately) photovoltaic array will be included within the Infrastructure Zone.

4.2.2 In addition, the development will incorporate battery storage to enable use of PV power over 24-hour period and provide enough power during periods of peak demand or low solar energy generation. It is currently envisaged that there will be a main centralised battery array (approximately 200kWh) in the Infrastructure Zone with local battery arrays considered for each of the villa buildings

4.2.3 The electrical infrastructure will form an island grid network with all buildings on the development connected. Only a connection to the main power grid for export purposes will be considered.

4.2.4 The renewable energy supply infrastructure will be supplemented by a dispatchable biodiesel CHP system. The project will aim to source biodiesel from a local sustainable source to be determined, e.g. waste vegetable oil from regional food industry. The 2no. 100kW biodiesel generator units (approximately) will be located in the Infrastructure Zone.

4.2.5 As well as meeting the building electrical supply loads, power generated will be used for powering desalination plant to produce potable water for the development.

4.2.6 The site will utilise the geothermal energy source for spa water, domestic hot water and space heating wherever cost-effective. A thermal buffer storage vessel will be located in the Infrastructure Zone to act as a central heat store.

4.2.7 Wind generation is proposed as a supplementary renewable source to photovoltaic energy. Initial modelling suggests that the Nunduk Retreat & Spa load curve is well suited to a mix of PV and wind with a substantial night load. A 100kWp rated wind turbine is currently under consideration and would be in the Infrastructure Zone.

4.2.8 Smart Grid technology will be implemented to monitor and control the local renewable energy network and will ensure effective integration and efficient management of energy generation sources.

# 5.0 Water Management

## 5.1 Water Management Objectives:

The water management strategy is led by CJ Arms. Refer to CJ Arms report information for detail on water management strategy. A summary of the key elements of this strategy is as follows:

- The project will be totally self-sufficient in water supply – i.e. it will not require a mains potable water supply or imported water from off-site.
- Rainwater harvesting will be maximised for potable water supply. Rainwater supply targeted to be > 50% of the Central Retreat potable water supply and > 40% of the potable water supply to the Villas
- No offsite water waste treatment will be required, with passive on-site sewage water treatment
- The project will aim to be net positive in water supply through export of surplus treated effluent as irrigation supply to adjacent farm pastureland

- The waste water settlement pond will provide a fresh water wetland area to assist regeneration of the natural fresh water ecology of the site

## 5.2 Key Water Management Strategies:

5.2.1 Rainwater collection for Villas to supply an estimated 43% of all potable and non-potable water needs. Each villa to have individual rainwater collection system since they are in remote locations away from centralised infrastructure. During periods of extended drought, it is envisaged that rainwater tank to each building can be topped up via centrally managed tanker vehicle.

5.2.2 The green roof over the Central Retreat building will reduce rainwater collection potential from this element and therefore has been discounted as a useful water collection strategy. Instead, rainwater collection is proposed from the roof of the central infrastructure zone roof and is estimated to provide 55% of all potable and non-potable needs for the Central Retreat (not accounting for any landscaping irrigation)

5.2.3 Shortfall in potable water supply to the Central Retreat building and Villas will be sourced from a proposed desalination plant that draws water from Lake Wellington. Energy supply for the desalination process will be generated by on-site renewable energy resources including central PV array.

5.2.4 All domestic hot water for spa usage within the Retreat & Spa building will be drawn from geothermal aquifer source. It is currently assumed that there will be sufficient supply to meet spa usage needs. According to the Geothermal Engineers report it is currently assumed that spa water will be reinjected to the geothermal aquifer after use to maintain water balance in the aquifer. This will be subject to EPA and other authority approvals.

5.2.5 All grey water and black water from the Central Retreat building will be treated by a passive central waste water treatment plant that will use reed beds and wetlands to treat the waste water effluent. The plant has low energy loads compared to other waste water treatment systems and will be supplied by on-site generated renewable energy. It is currently proposed that treated effluent can be exported off-site for use as irrigation supply to the adjacent farm pasture land for sheep grazing.

5.2.6 Grey water and black water for Villa buildings will also be treated in the passive central waste water plant.

# 6.0 Waste Management

## 6.1 Waste Management Objectives:

- Minimum long-term operational waste landfill diversion target of 80% with aspiration to zero landfill waste through use of re-usable, recyclable or biodegradable packaging and products throughout

- All organic waste will be treated on-site via a composting system or anaerobic digester, with outputs to be used as a soil improver to the landscape

- Food packaging waste to be minimised through use of locally grown fresh ingredients wherever possible

- Guests will be encouraged to participate in zero landfill waste operational practice

- Construction waste will be minimised through the integration of offsite construction practices wherever possible – to minimise the production of on-site waste and disturbance to the site.

## 6.2 Key Waste Management Strategies:

6.2.1 An aspiration to achieve zero landfill will be a key operational strategy for the development and it is proposed that this will be part of the visitor education experience with the use of materials and products within the Retreat & Spa and villa buildings that generate minimal waste. Waste that is generated should be recyclable to a proven local recycling waste stream or be organic and suitable for composting. Further development of a zero waste to landfill policy is required in discussion with the development operator in the next stage. At this stage, a minimum long term operational waste landfill diversion target of 80% is assumed.

6.2.2 All Retreat restaurant waste, organic waste from the villas and land management green waste will be collected by site management and composted on site in the waste treatment zone. The preferred composting system is to be determined but will be either a composting system or anaerobic digester type.

6.2.3 The operational cleaning strategy will be compatible to the waste treatment strategy through avoidance of powerful cleaning agents that will damage the passive waste treatment and composting treatment systems.

# 7.0 Materials Strategy

## 7.1 Materials Selection Objectives:

- Embodied energy minimised through use of local materials selections wherever cost-effective

- Life Cycle Analysis will be carried out to inform key materials selections based on lowest environmental impact.

- Materials and construction methods to be selected in line with health and well-being requirements for clean indoor air quality.

## 7.2 Key Materials Selection Strategies:

7.2.1 The concept for the Central Retreat & Spa building will be to install a structure that has a long-life and is durable to the exposed climate of the location and acidic soil quality. It is anticipated that the superstructure of the building will be constructed of reinforced concrete.

7.2.2 It is proposed that the concrete superstructure will be fitted out with non-load bearing hotel modules that are lightweight construction with low ecological impact e.g. timber panel construction. It is anticipated that these module units will allow future flexibility to adapt or change configuration and will be designed to be re-usable or recyclable. These modules can also be pre-fabricated offsite and include a high quality thermal performance, considering air-tightness and thermal performance in line with Passive House standards.

7.2.3 It is anticipated that villas will be lightweight construction; likely to be a combination of steel frame and timber panelling. The villa buildings will be designed to touch the earth lightly with consideration of screw-pile or mega-pile foundation systems and a construction system that will be demountable and recyclable at the end of life.
7.2.4 The project will source timber from locally-managed sustainable sources wherever practicable
7.2.5 Where concrete is employed, low carbon emission concrete will be considered where practicable e.g. geopolymer concrete utilising recycled fly ash and blast furnace slag in lieu of virgin cement product
7.2.6 All road and hard surface construction to utilise local recycled aggregate material wherever cost effective.
7.2.7 The project will target sourcing of high % of materials from within local region, further research will be undertaken into the material supply chain to investigate availability.
7.2.8 Materials will be selected based on Life Cycle Assessment (LCA) to minimise life-cycle environmental impact. Building envelope and key structural systems will be investigated as a minimum.
7.2.9 In line with the health and well-being aspirations of the development, the design will ensure healthy indoor air quality to all buildings through selection of materials and construction systems with low pollutant emissions e.g. low VOCs, formaldehyde-free etc.

# 8.0 Ecology Strategy

## 8.1 Ecological Restoration Objectives:

- Restore vulnerable fresh water ecological habitats including Estuary Wetland and Damp Sands Herb-Rich Woodland

## 8.2 Key Ecology Strategies:

8.2.1 Create a protected wildlife sanctuary through the regeneration of native fauna typical to the ‘Damp Sands Herb Rich Woodland’ vulnerable ecology type
8.2.2 Integrate indigenous flora to all green infrastructure including green roofs and passive water waste treatment system reed beds and wetland.
8.2.3 A fresh water ecology will be created around storm water retention areas or around the passive waste water treatment system settling pond or lake. Proposals to be developed and integrated with landscape and ecology strategy.

# 9.0 Green Star Appraisal

## 9.1 Introduction:

Launched by the Green Building Council of Australia in 2003, Green Star is Australia's only national and voluntary rating system for buildings and communities and assesses the sustainable design, construction and operation of buildings. Green Star has a holistic approach to the appraisal of sustainability performance and covers the following categories:

- Sustainable management practices
- Indoor environmental quality
- Energy and associated greenhouse gas emissions
- Sustainable transport provision
- Sustainable management of water resources
- Materials specifications
- Land use and the impact on local ecology
- Pollution and emissions to air and water
- Innovation that is beyond best practice or contributes to a change in working practice across the industry

Green Star has been selected as a benchmark against which to appraise the performance of the scheme due to its universal acceptance across Australia and the ability to clearly demonstrate the leading-edge sustainability practice incorporated into Nunduk Retreat & Spa proposals.

The Central Spa & Retreat building will be benchmarked against the Green Star Design & As-Built v 1.2 which will cover the design and construction performance of the project.

Green Star also offers a pathway 'Passive House Standard & Green Star – Design & As-Built' to pursue the ambitious Passive House building fabric certification standard as a means to demonstrating compliance with Green Star Standards and offers a streamlined process for achieving both these sustainable design targets.

## 9.2 Green Star Appraisal Methodology:

The following Green Star appraisal has been based upon a review of design team and advisory consultants reports current as of January 2018, this review has included:

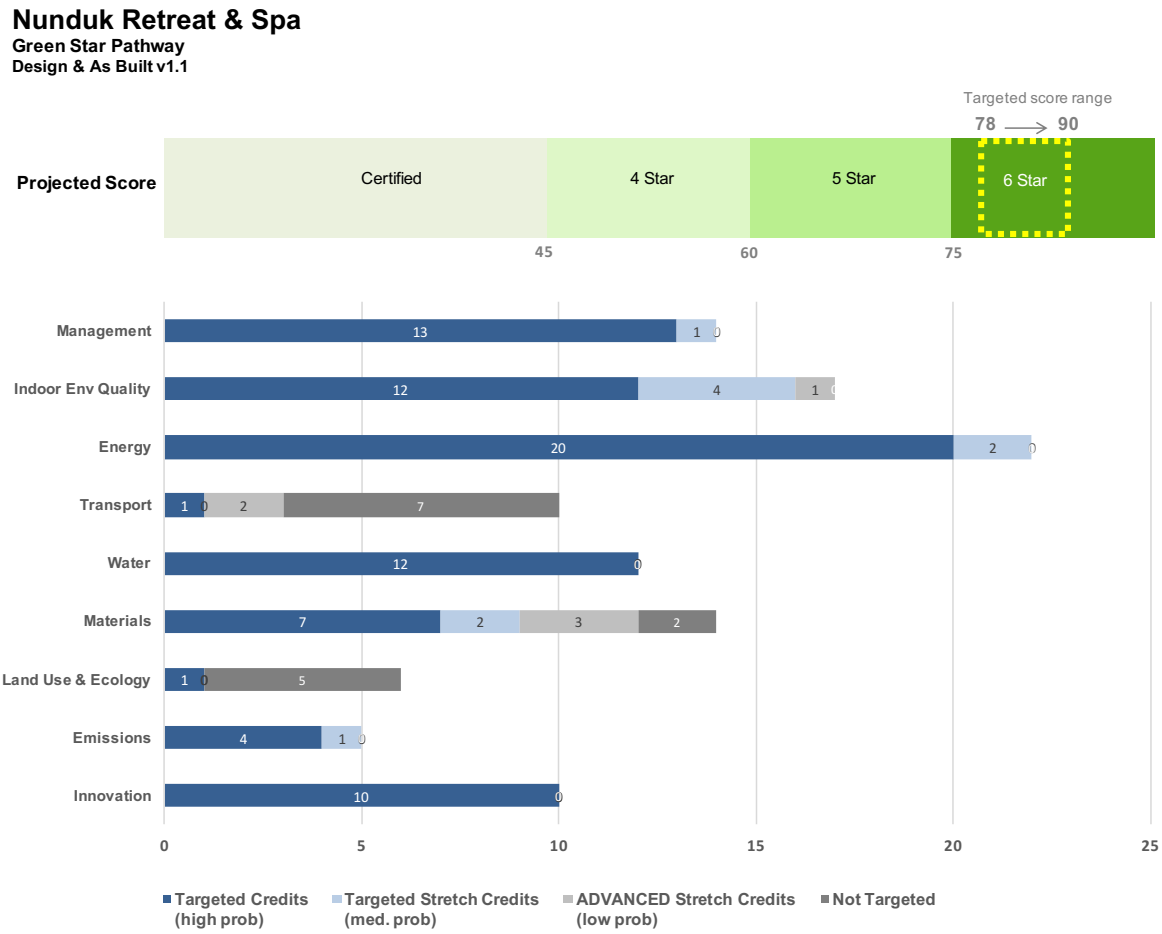
- CJ Arms & Associates - 20180112 integrated Water Cycle Management Strategy DRAFT
- Felicetti Pty - Preliminary Structural Concept for Proposed New Nunduk Retreat & Spa
- Cardno – Geotechnical Investigation for Nunduk Retreat & Spa
- Cardno – Flooding and Hydrodynamics, Nunduk Retreat & Spa
- Arup – Nunduk Retreat & Spa Waste Management Plan
- Analytical Engines – Nunduk Retreat & Spa Energy Concept Design
- Ecology Report – TBC
- Architectural Drawings – TBC
- Transport Report - TBC

Since the scheme is at an early design phase and not enough detail is available to carry out a full Green Star assessment the anticipated performance has been evaluated based on the design information and the commitment of the client to develop a world leading development incorporating regenerative design principles.

To represent this uncertainty, credits have been evaluated on the basis that they will be high, medium or low probability to achieve and from this, a minimum score target has been generated considering these different probability factors.

An upper range score target is defined by the scenario where all high probability and medium probability credits (the 'lower-hanging fruit') are targeted and achieved.

## 9.3 Green Star Performance Summary:




- Current appraisal of the development proposals confirm that the development is firmly on track to achieve the Green Star 6 Star Rating (requiring a Green Star score > 75) which represents world leadership in sustainable design, as defined by the Green Building Council of Australia.

- The project is projected to score highly in the categories of Management, Indoor Environmental Quality, Energy, Water and Innovation.

# 9.4 Green Star Appraisal Spreadsheet:



| Hi | Med | Low | No | Total |
|---|---|---|---|---|
| 72 | 5 | 1 | 0 | 78 |
| 90% | 50% | 10% | 0% | Total |
| 80 | 10 | 6 | 14 | 110 |

| Hi | Med | Low | No | Possible |
|---|---|---|---|---|
| 13 | 1 | 0 | 0 | 14 |

| Green Star Design & As Built v1.2 | Nunduk Health Retreat - Green Star Pathway | 2/2/18 |
|---|---|---|

| | Management | | | | Explanation | Responsible Party | Comments |
|---|---|---|---|---|---|---|---|
| 1 | **Green Star Accredited Professional** | To recognise the appointment and active involvement of a Green Star Accredited Professional in order to ensure that the rating tool is applied effectively and as intended. | 1.1 | Accredited Professional | Green Star Accredited Professional active in all stages of project. | Client Appointment | Standard Practice. |
| Y | **Commissioning and Tuning** | To encourage and recognise commissioning, handover and tuning initiatives that ensure all building services operate to their full potential. | 2.0 | Environmental Modelled Targets | Establish and documented project evironmental performance targets | ESD Consultant | Standard Practice. |
| 1 | | | 2.1 | Services and Maintainability Review | Perform comprehensive design review of services, maintainability, etc | Project Team | Good Practice. |
| 1 | | | 2.2 | Building Commissioning | Comprehensively pre-commission and commission nominated building systems | Commissioing Provider | Good Practice. ICA is a high value inclusion in delivering design intent. |
| 1 | | | 2.3 | Building Systems Tuning | Perform building systems tuning for no less than one year after occupancy | Commissioing Provider | |
| 1 | | | 2.4 | Independent Commissioning Agent | Engage independent Commissioning Agent to oversee commissioning process | Commissioing Provider | |
| 2 | **Adaptation and Resilience** | To encourage and recognise projects that are resilient to the impacts of a changing climate and natural disasters. | 3.1 | Implementation of a Climate Adaptation Plan | Develop and implement project-specific climate adaptation plan | ESD Consultant | Best Practice. Additional reporting requirement |
| 1 | **Building Information** | To provide information about a building's systems, operation and maintenance requirements, and environmental targets to enable optimisal performance. | 4.1 | Building Operations and Maintenance Information | Make comprehensive building Operations & Maintenance information available to facilities management team | Project Team | Good Practice |
| 1 | | | 4.2 | Building User Information | Make comprehensive building user guidance available to relevant occupants | Project Team | Good Practice. |
| 1 | **Commitment to Performance** | To recognise practices that encourage building owners, building occupants and facilities management teams to set targets and monitor environmental performance in a collaborative way. | 5.1 | Environmental Building Reporting | Commit to reporting building environmental performance metrics over two years; | End-User | Good Practice |
| 1 | | | 5.2 | End of Life Waste Management | Commit to measurably reducing construction waste building upgrades and tenant end of fitout | End-User | Best Practice, circular economy objectives can be expanded to include end of life |
| Y | **Metering and Monitoring** | To recognise the implementation of effective energy and water metering and monitoring systems. | 6.0 | Metering Strategy | Provide water and energy meters for all major end users or uses | ESD / Building Services Engineer | Good Practice |
| 1 | | | 6.1 | Monitoring Strategy | Provide monitoring strategy to capture and process metered energy and water use | ESD / Building Services Engineer | Good Practice |
| Y | **Construction Environmental Management** | To reward projects that use best practice formal environmental management procedures during construction. | 7.0 | Environmental Management Plan | Comprehensive Environmental Management Plan in place for construction | Contractor | Good Practice |
| 1 | | | 7.1 | Formalised Environmental Management System | Environmental Management System from EMP used through all stages of design and construction | Contractor | Good Practice |
| 1 | **Operational Waste** | To recognise projects that implement waste management plans that facilitate the re-use, upcycling, or conversion of waste into energy and stewardship of | 8.1 | Waste in Operations | Provide facilities to collect, process, and store multiple waste streams | Waste Auditor / Architect | Good Practice, ciruclar economy practices to deal with some waste streams onsite |

atelier ten

| Hi | Med | Low | No | Total |
|---|---|---|---|---|
| 72 | 5 | 1 | 0 | 78 |

| 90% | 50% | 10% | 0% | Total |
|---|---|---|---|---|
| 80 | 10 | 6 | 14 | 110 |

| Hi | Med | Low | No | Poss |
|---|---|---|---|---|
| 12 | 4 | 1 | 0 | 17 |

| Green Star Design & As Built v1.2 | Nunduk Health Retreat - Green Star Pathway | 2/2/18 |
|---|---|---|

| Hi | Med | Low | No | Poss | Indoor Environment Quality | | | | Explanation | Responsible Party | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | 1 | Quality of Indoor Air | To recognise projects that provide high air quality to occupants. | 9.1 | Ventilation System Attributes | Outdoor pollutants mitigated; ventilation system designed for cleaning + maintenance access; ventilation system cleaned prior to use | Building Services Engineer / Mech Contractor | Best Practice, limited exposure to outdoor pollutants |
| 1 | 1 | | | 2 | | | 9.2 | Provision of Outside Air | Provide 50-100% additional outdoor air, or maintain CO2 levels at 800-700 PPM | Building Services Engineer | Best Practice. Maintain internal air quality at 700ppm $CO_2$ for 2 credits |
| 1 | | | | 1 | | | 9.3 | Exhaust or Elimination of Pollutants | Direct exhaust kitchens, photocopier areas, other pollution point source zones | Building Services Engineer | Good Practice |
| 1 | | | | 1 | Acoustic Comfort | To reward projects that provide appropriate and comfortable acoustic conditions for occupants. | 10.1 | Internal Noise Levels | Internal ambient noise levels, including outside and building systems sources, are suitable for activities | Acoustic Consultant | Good Practice, quiet passive mechanical systems and negligible traffic noise |
| | 1 | | | 1 | | | 10.2 | Reverberation | Reverberation levels meet AS/NZ 2107:200 Reverberation Time tables | Acoustic Consultant | Good Practice, subject to finishes |
| 1 | | | | 1 | | | 10.3 | Enclosed Spaces | Reduce crosstalk between nominated spaces to weighted sound reduction index (Rw) of 45 | Acoustic Consultant | Good Practice |
| Y | - | - | - | - | Lighting Comfort | To encourage and recognise well-lit spaces that provide a high degree of comfort to users. | 11.0 | Minimum Lighting Comfort | Flicker free and high color rendition lighting | Lighting Consultant | Standard Practice |
| 1 | | | | 1 | | | 11.1 | General Illuminance and Glare Reduction | Lighting levels and quality comply with best practice; glare is eliminated | Lighting Consultant | Standard Practice |
| | | 1 | | 1 | | | 11.2 | Surface Illuminance | Improve lighting uniformity through fixture type and surface properties | Lighting Consultant | Best Practice, can increase energy consumption and fitting costs, subject to lighting design |
| 1 | | | | 1 | | | 11.3 | Localised control | Occupants provided individual control of lighting | Lighting Consultant | Best Practice, achieveable with DALI system or equivalent, subject to lighting design |
| Y | - | - | - | - | Visual Comfort | To recognise the delivery of well-lit spaces that provide high levels of visual comfort to building occupants. | 12.0 | Glare Reduction | Fixed shares or blinds minimize direct sunlight into building | Architect | Good Practice |
| 1 | 1 | | | 2 | | | 12.1 | Daylight | 40% / 60% of nominated area receives high daylight levels during 80% of day | ESD Consultant | 40% likely, 60% possible, configuration favours access to daylight |
| 1 | | | | 1 | | | 12.2 | Views | Direct line of sight to high quality internal or external views | Architect | Configuration favours access to views |
| 1 | | | | 1 | Reduced Exposure to Pollutants | To recognise projects that safeguard occupant health through the reduction in internal air pollutant levels. | 13.1 | Paints, adhesives, sealants and carpets | Internally applied products meet stipulated VOC limits | Architect / Contractor | Good Practice, subject to fit-out materiality |
| 1 | | | | 1 | | | 13.2 | Engineered wood products | 95% of products meet stipulated formaldehyde limits | Architect / Contractor | Good Practice, subject to fit-out materiality |
| 1 | | | | 1 | Thermal Comfort | To encourage and recognise projects that achieve high levels of thermal comfort. | 14.1 | Thermal Comfort | For 95% of nominated space, 98% of year, achieve 80% Acceptability in ASHRAE 55, OR PMV between +1 and -1; OR NatHERS 7 Star | ESD / Building Services Engineer | Good Practice. |
| | 1 | | | 1 | | | 14.2 | Advanced Thermal Comfort | For 95% of nominated space, 98% of year, achieve 80% Acceptability in ASHRAE 55, OR PMV between +1 and -1; OR NatHERS 8 Star | ESD / Building Services Engineer | Best Practice, additional energy and system capacity required for closer control |

| Hi | Med | Low | No | Poss |
|---|---|---|---|---|
| 20 | 2 | 0 | 0 | 22 |

| Hi | Med | Low | No | Poss | Energy | | | | Explanation | Responsible Party | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | 2 | | | 20 | Greenhouse Gas Emissions | Performance Pathway | 15-A.1 | Performance Pathway: Comparison to a Reference Building | Reduce project energy consumption up to 20% relative to Reference Building (4 pts); Reduce GHG emissions up to 100% relative to Reference Building (16 pts) | ESD Consultant | All 20 points targeted with Net Zero Energy baseline and Passive House envelope targets. Assumed 16 points for 100% reduction of GHGs and 4 points for 20% envelope improvement on Reference Building. |
| 2 | | | | 2 | Peak Electricity Demand Reduction | Reference Building Pathway | 16.1-B | Reference Building Pathway | Reduce peak electrical demand relative to Reference Building by 20% / 30% | ESD / Building Services Engineer | High efficiency façade, passive HVAC system. PV system contribute to sufficient reductions in peak demand for 2 points. |

atelier ten

| Hi | Med | Low | No | Total |
|---|---|---|---|---|
| 72 | 5 | 1 | 0 | 78 |

| 90% | 50% | 10% | 0% | Total |
|---|---|---|---|---|
| 80 | 10 | 6 | 14 | 110 |

| Green Star Design & As Built v1.2 | Nunduk Health Retreat - Green Star Pathway | 2/2/18 |
|---|---|---|

| Hi | Med | Low | No | Poss | Transport | | | | Explanation | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 2 | 7 | 10 | | | | | | | |
| | | | 3 | 3 | Sustainable Transport | Performance Pathway | 17-A.1 | Modelled Pathway | Reduce parking, make walkable, support transit, support active modes of transportation | Transport Consultant | Limited access to local transport or emissions reducing guest transit |
| | | | 3 | 3 | | Prescriptive Pathway | 17B.1 | Access by Public Transport | Accessibility of the site by public transport. The points score is determined by completing the *Access by Public Transport Calculator* | ESD Consultant | Calculation to confirm no points are available |
| | | 1 | | 1 | | | 17B.2 | Reduced Car Parking Provision | Reduction in the number of car parking spaces in the proposed building when compared to a standard-practice building. | Architect | Car parking required for guests |
| 1 | | | | 1 | | | 17B.2 | Low Emission Vehicle Infrastructure | parking spaces and/OR dedicated infrastructure to support low-emission vehicles - 5% EV, 15% fuel efficient. | Architect | EV charging points and priority parking for low emissions vehicles |
| | | 1 | | 1 | | | 17B.3 | Active Transport Facilities | Bicycle parking and associated facilities are provided to a proportion of regular occupants and visitors - 7.5% occupants | Architect | Possible but not applicable to development typology or location |
| | | | 1 | 1 | | | 17B.4 | Walkable Neighbourhoods | Walk Score of at least 80 as determined by the website www.walkscore.com. OR the project is located so that at least eight (8) amenities are within 400m of the project. | ESD Consultant | Calculation to confirm no points are available |

| Hi | Med | Low | No | Poss | Water | | | | Explanation | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 0 | 0 | 0 | 12 | | | | | | | |
| 12 | | | | 12 | Potable Water | Performance Pathway | 18-A.1 | Modelled Pathway | Reduce potable water and replace with non-potable where appropriate | ESD / Building Services Engineer | No potable mains water connection to site - all water needs will be supplied from local sources therefore all 20 credits targeted |

| Hi | Med | Low | No | Poss | Materials | | | | Explanation | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 2 | 3 | 2 | 14 | | | | | | | |
| 2 | 2 | 2 | | 6 | Life Cycle Impacts | Life Cycle Assessment Model | 19.A.1 | Comparative Life Cycle Assessment | Reduce building material and product environmental impacts across a range of categories through LCA or proscriptive pathways | LCA Consultant | Best Practice. Achievable with appointment of LCA Consultant and selection of additional low impact materials |
| 1 | | | | 1 | | | 19.A.2 | Additional Life Cycle Impact Reporting | Report environmental impacts across five additional categories | LCA Consultant | |
| 1 | | | | 1 | Responsible Building Materials | To reward projects that include materials that are responsibly sourced or have a sustainable supply chain. | 20.1 | Responsible Steel Maker and Fabricator | 95% of material sourced from Responsible Steel Maker; 65% reinforcing bar and mesh made using low-energy process | Contractor | Good Practice. May encounter procurement challenges |
| 1 | | | | 1 | | | 20.2 | Timber | 95% of timber (by cost) from sustinable sources | Contractor | Good Practice. May encounter procurement challenges |
| 1 | | | | 1 | | | 20.3 | Cables, pipes, floors and blinds | 90% (by cost) of cables, pipes, floors, blinds either PVC free or meet Best Practice Guidelines | Contractor | Good Practice. May encounter procurement challenges |
| | | 1 | 2 | 3 | Sustainable Products | To encourage sustainability and transparency in product specification. | 21.1 | Sustainable Products | 3% / 6% / 9% products are recycled, reused, third-party certified, come with EPDs, or through stewardship programs | Contractor | Emerging practice. Unlikely to be achieved; requires further exploaration |
| 1 | | | | 1 | Construction and Demolition Waste | To reward projects that reduce construction waste going to landfill by reusing or recycling building materials | 22.1 | Reduction of Construction and Demolition Waste | 90% of waste or more (by weight) diverted from landfill, or landfill waste less than 10 kg / m2 GFA | Contractor | Good Practice. May encounter procurement challenges |

| Hi | Med | Low | No | Poss | Land Use & Ecology | | | | Explanation | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 5 | 6 | | | | | | | |
| TBC | - | - | - | - | Ecological Value | To reward projects that improve the ecological value of their site. | 23.0 | Endangered, Threatened or Vulnerable Species | No ecologically vulnerable species or communities present at time of site purchase | Ecologist | High ecological value of site. Ecologist report to confirm compliance with this requirement |
| | | | 3 | 3 | | | 23.1 | Ecological Value | Improve ecological value of site by increasing and improving vegetated area | Lanscape Architect / Ecologist | Ecologist report to confirm the net improvement of endemic ecologies with the development. Score to be updated |
| TBC | - | - | - | - | Sustainable Sites | To reward projects that choose to develop sites that have limited ecological value, re-use previously developed land and remediate contaminate land. | 24.0 | Conditional Requirement | Site contains no old growth forest nor wetland of national significance | Ecologist | Wetland of National Significance noted on site, Ecologist to confirm wetland is improved through development and develop CIR with GBCA |
| | | | 1 | 1 | | | 24.1 | Reuse of Land | 75% of site area was previously developed land | N/A | Undeveloped Land |
| | | | 1 | 1 | | | 24.2 | Best Practice Site Remediation | Building or site contains was previously contaminated and has been remediated | N/A | Saline contamination, potential for developing point specific to wetland improvement. |

| Hi | Med | Low | No | Total |
|---|---|---|---|---|
| 72 | 5 | 1 | 0 | 78 |
| 90% | 50% | 10% | 0% | Total |
| 80 | 10 | 6 | 14 | 110 |

| Green Star Design & As Built v1.2 | Nunduk Health Retreat - Green Star Pathway | | | 2/2/18 | | |
|---|---|---|---|---|---|---|
| 1 | **Heat Island Effect** | To encourage and recognise projects that reduce the contribution of the project site to the heat island effect. | 25.1 | Heat Island Effect Reduction | 75% of total project sky-facing area (viewed in plan) must be cool-scaped. | Architect | Green roofing and minimal dark hardscape |

| Hi | Med | Low | No | Poss |
|---|---|---|---|---|
| 4 | 1 | 0 | 0 | 5 |

| Emissions | | | | Explanation | | Comments |
|---|---|---|---|---|---|---|
| 1 | **Stormwater** | To reward projects that minimise peak stormwater flows and reduce pollutants entering public sewer infrastructure. | 26.1 Peak Discharge To Sewer | Do not exceed pre-development stormwater peak event discharge | Civil Engineer | No discharge anticipated, onsite absorption and percolation |
| 1 | | | 26.2 Pollution Targets | When previous credit is met, also reduce pollutants to meet specified Targets. | Civil Engineer | Best Practice |
| Y | **Light Pollution** | To reward projects that minimise light pollution. | 27.0 Light Pollution to Neighbouring Properties | Outdoor lighting complies with AS 4282:1997 | Architect / Lighting Consultant | Good Practice |
| 1 | | | 27.1 Light Pollution to Night Sky | Minmize upward light OR Minimize light tresspass skyward and across project boundary | Architect / Lighting Consultant | Best Practice, pending lighting design |
| 1 | **Microbial Control** | To recognise projects that implement systems to minimise the impacts associated with harmful microbes in building systems. | 28.1 Microbial Control | building heat rejection systems include control measures for Legionella | Building Services Engineer | Good Practice |
| 1 | **Refrigerant Impacts** | To encourage operational practices that minimise the environmental impacts of refrigeration equipment. | 29.1 Refrigerant Impacts | Minimize environmental impacts of refrigerants by chosing low ODP and GWP refrgerants and implementing leak detection measures | Building Services Engineer | Minimal refrigerants required with earth-tube air-tempering and water-to-water heat exchange. Peak load systems only |

| Hi | Med | Low | No | Poss |
|---|---|---|---|---|
| 10 | 0 | 0 | 0 | 10 |

| Innovation | | | | Proposed Innovation Options: |
|---|---|---|---|---|
| 2 | **Innovative Technology or Process** | The project meets the aims of an existing credit using a technology or process that is considered innovative in Australia or the world. | 30.A Innovative Technology or Process | Proposed Options:<br>1. 100% + onsite renewable energy with local island grid and smart energy management<br>2. 100% + passive on site waste water treatment system |
| | **Market Transformation** | The project has undertaken a sustainability initiative that substantially contributes to the broader market transformation towards sustainable development in Australia or in the world. | 30.B Market Transformation | Proposed Options:<br>1. Sustainable sourcing of concrete aggregates - chain of custody or demonstrable sustainable source. |
| 1 | **Improving on Green Star Benchmarks** | The project has achieved full points in a Green Star credit and demonstrates a substantial improvement on the benchmark required to achieve full points. | 30.C Improving on Green Star Benchmarks | Proposed Options:<br>1. Ultra-low VOC paints |
| 4 | **Innovation Challenge** | Where the project addresses an sustainability issue not included within any of the Credits in the existing Green Star rating tools. | 30.D Innovation Challenge | Proposed Options:<br>1. Building air-tightness testing in line with Green Star best practice and Passive House Standard<br>2. Energy metering integrity - best practice, important for monitoring Net Zero Energy<br>3. Reconciliation Action Plan - in line with<br>4. Contractor Education - best practice approach to educating site staff on sustainability issues<br>5. Indoor plants for improved air quality and pollutant control |
| 3 | **Global Sustainability** | Project teams may adopt an approved credit from a Global Green Building Rating tool that addresses a sustainability issue that is currently outside the scope of this Green Star rating tools. | 30.E Global Sustainability | Proposed Options:<br>1. LBC v3 - Net Positive Energy<br>2. LBC v3 - Net Positive Water<br>3. LEED v4 - Follow Integrative Design Process<br>4. WELL-Building - Circadian lighting design<br>5. WELL-Building / Green Star Performance - Green Cleaning - Owner/Occupier initiative |

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