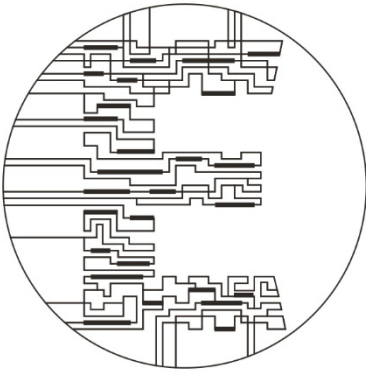




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Taronga Zoo – African Savannah & Congo Exhibits

Ecologically Sustainable Design – Design Intent

Document Control

Revision	Date	Title	Purpose	Prepared by	Reviewed by
A	30/1/2017	ESD – Concept Summary	For Information	A. Byrne	-
B	28/2/2017	ESD – Design Intent	For Approval	A. Byrne	N. Crace
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Introduction

Taronga Zoo, located in Mosman NSW, is undergoing the construction/upgrade of the African Savannah and Congo Exhibits. The new areas will incorporate visitor viewing spaces and amenities, house animals, incorporate landscaped areas and include back of house zoological facilities. New walkways, waterways and viewing platforms will be included in the project.

The existing space is generally currently in use as part of the zoo exhibition areas and incorporates several changes in level.

Taronga Zoo have requested an Ecologically Sustainable Design report as to provide guidance for the project team in the design and to submit as part of the Development Application package.

Document Purpose

The purpose of this document is to provide a framework of Ecologically Sustainable Design initiatives intended to be incorporated in the Taronga Zoo African Savannah & Congo Exhibit project. The items described within have been discussed with the key stakeholders for the project and agreed as desirable. Final incorporation of these items will be subject to the final architectural, landscape and services design and financial and environmental viability. It is intended this document will be referred to as a guide, rather than a mandate, by the design team.

It is noted that in no way does this document represent any formal ESD certification and no such statements shall be made, internally or to the public, that the project has undergone an ESD certification process.

Project Team

Client

Taronga Zoo

Architect

Tonkin Zulaikha Greer Architects

Landscape Architects

Green and Dale Associates

Ecologically Sustainable Design Engineers

Evolved Engineering

Building Services Engineers

TBC

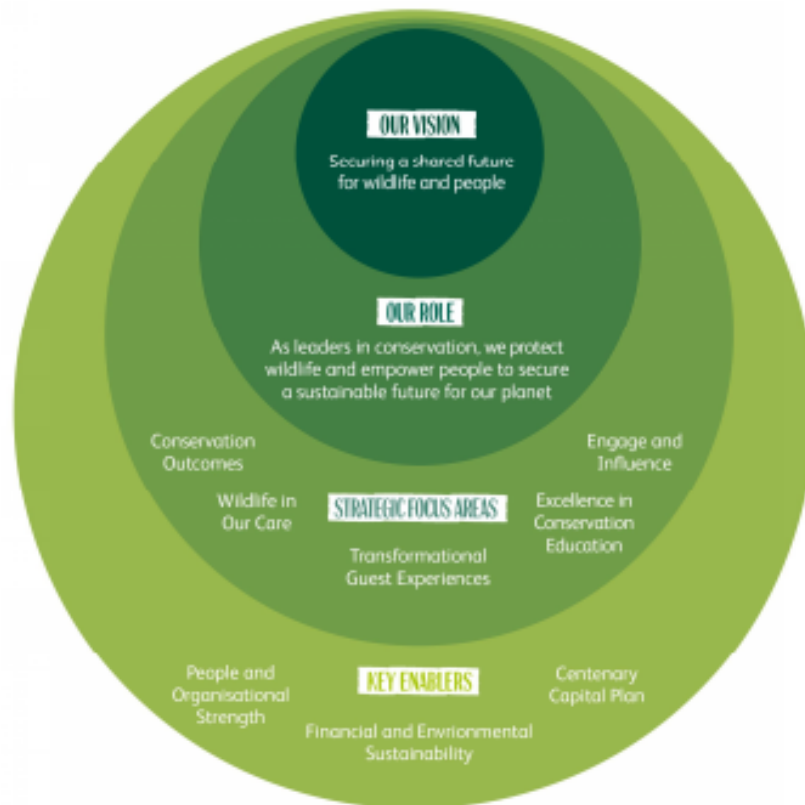


Vision and Targets

Taronga Conservation Society Australia's Strategic Plan identifies five focus areas underpinning the direction of the organisation;

- Animals in Our care
- Tangible Conservation Outcomes
- Financial Sustainability
- Visitor Experience and Learning
- Our People and Organisational Effectiveness

The African Savannah and Congo Exhibits is to be developed in line with the Zoo's Vision – Securing a Shared Future for Wildlife and People.



As depicted above, one of the Zoo's 'Key Enablers' is *Financial and Environmental Sustainability*.

Environmental Sustainability will be addressed through the following categories:

- Energy
- Water
- Materials and Embodied Energy
- Furniture, Fixtures and Equipment
- Visitor Education

Several sustainable initiatives have been targeted for each of the above categories.

Energy

Hot Water Production

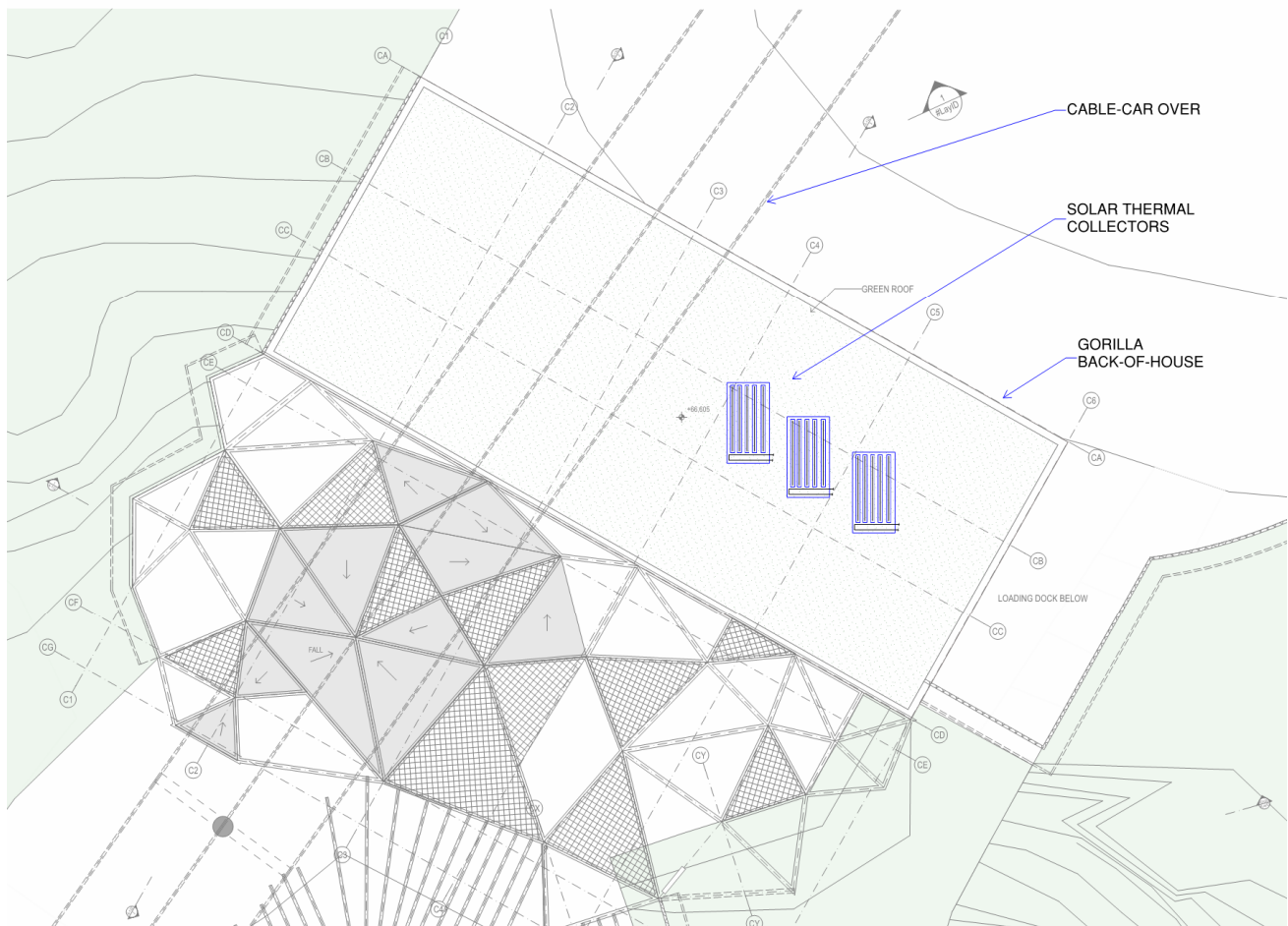
Hot water is traditionally produced using a submerged electric heating element or a gas fired burner. This energy use can be significantly reduced via the use of solar thermal energy collection. The hot water is anticipated to be used in significant quantities for back-of-house cleaning and animal care, and for use by the public in the amenities areas.

It is proposed to use Evacuated Tube Solar Collectors to either pre-heat or provide the complete heating of the potable hot water (depending on solar exposure and demand).

The solar collectors need to be mounted with exposure to the sun, with minimal obstructions.

It is suggested that the Gorilla Back-of-House roof would be a suitable location as it incorporates;

- Good solar exposure
- Flat roof structure for ease of installation
- Local hot water demand to minimise hot water reticulation
- Visibility to public from cable-car for educational purposes



Lighting Type

In recent years, light-emitting-diode (LED) technology has reached a point where there are significant sustainability and maintainability benefits available in comparison with traditional incandescent or fluorescent lighting solutions.

LEDs typically have higher lighting efficacy than traditional technologies, such as high-pressure-sodium or high-intensity-discharge fittings. The City of Sydney has reduced energy consumption in public space lighting by 48% since 2012, with the roll-out of LED street and park lights. (<http://www.cityofsydney.nsw.gov.au/vision/towards-2030/sustainability/carbon-reduction/led-lighting-project>)

LED design has significantly improved with respect to Colour Rendering Index (CRI) and choice of colour temperatures (i.e. warm or cool lighting) to a point where it is expected the aesthetic and functional output of the LED will not negatively impact on the resulting lighting in the space.

LED fittings have a very high level of directional control. This can greatly assist designers in minimising extraneous light leakage and thereby reducing light pollution.

It is proposed that all general lighting in the precinct is targeted to use LED technology.

Automated Controls and Metering

Substantial energy wastage can originate through poor operation of equipment and the inability to identify issues in existing systems.

It is proposed to provide automated control to all lighting, hydraulic and mechanical equipment installed as part of the precinct works. This is to be linked into the existing Taronga BMS system, to allow for holistic control and monitoring of the energy consuming equipment.

Pre-programmed schedules and/or sensors for lighting and equipment can prevent the requirement for reliance on users to manually switching on and off.

This is proposed to include:

- Scheduled lighting control to public accessible spaces
- Photoelectric control to external lighting to automatically switch/modulate lighting in response to the ambient lighting conditions
- Occupancy sensors to back-of-house areas to provide lighting only when staff are present
- Automatically scheduled operation of mechanical ventilation equipment
- Automatically scheduled and occupant sensitive control to mechanically heated/cooled spaces (i.e. Gorilla hydronic heating system)
- Automatically scheduled operation of hydraulic pumping and filtration equipment
- Sub-metering of significant energy uses as to allow identification of idiosyncrasies and/or abnormal usage patterns that may suggest issues in the system (i.e. hot water flow detected at 2am may indicate a leak in the system if it is known no staff/visitors are present in the precinct).

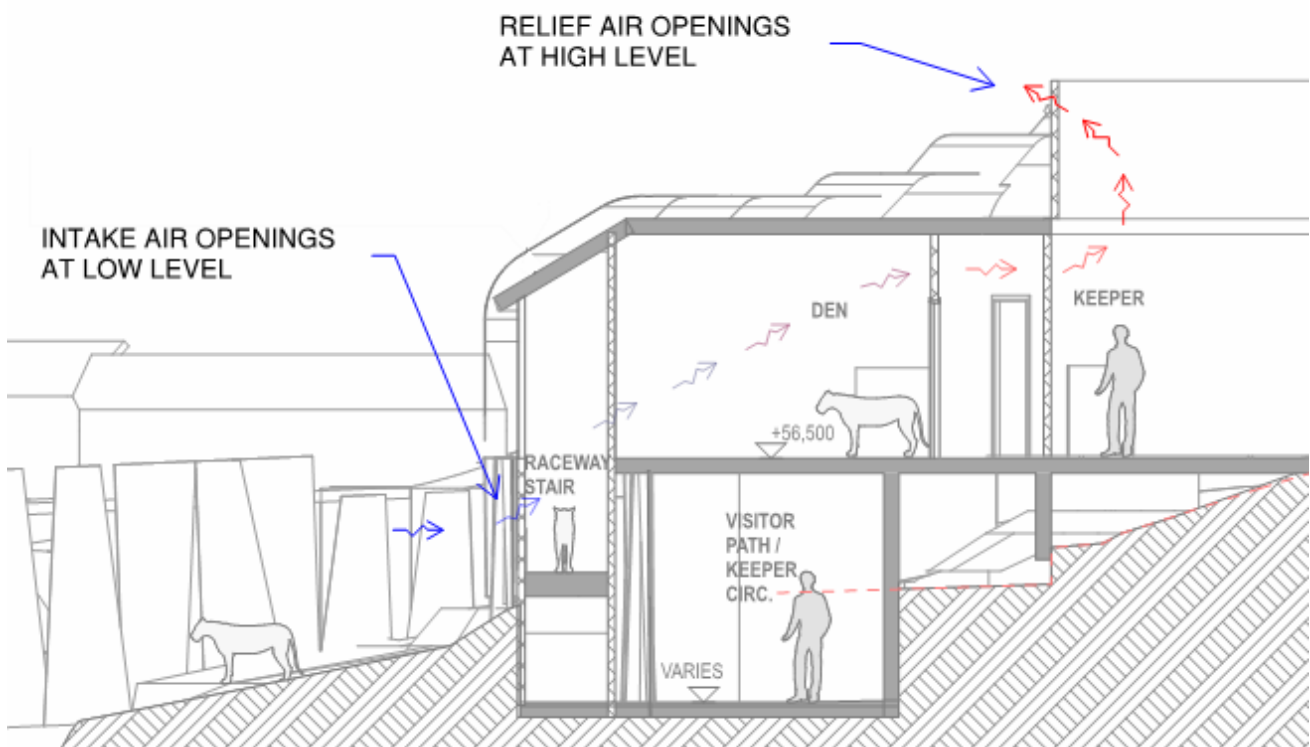
Passive Thermal and Ventilation Control

Actively cooling, heating and ventilating enclosed spaces is a significant consumer of energy in contemporary built spaces. In a typical commercial building, approximately 30% of the energy consumed is by the HVAC (Heating, Ventilation and Air Conditioning) systems, the highest single component (*www.environment.gov.au).

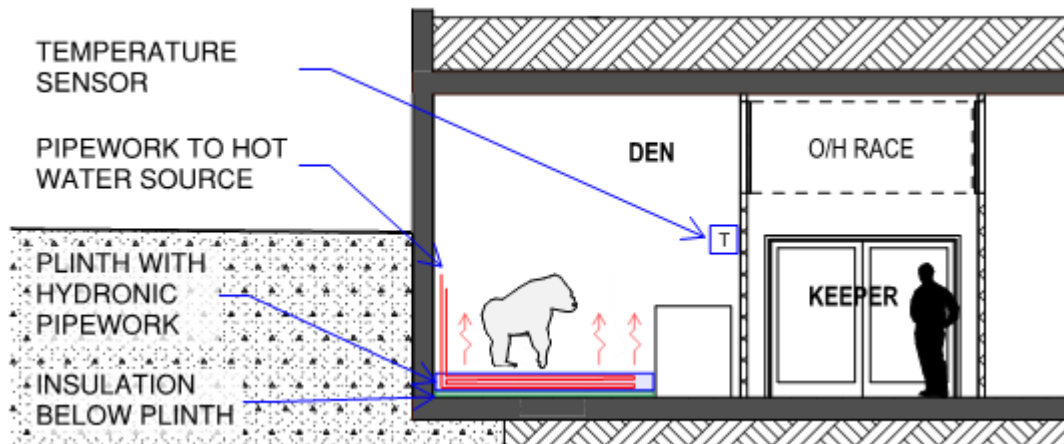
It is proposed to remove all active HVAC systems, where it will not impact on the wellbeing of the animals.

All enclosed spaces are to be designed to maximise natural ventilation opportunities to prevent excessive heat build-up and to assist in the removal of odours and dampness due to cleaning.

The Lion facilities will be wholly naturally ventilated with no active HVAC equipment. The location of air intake and relief will need to be considered during design to account for prevailing winds, local obstructions, acoustic break-out, thermal convection pathways and enclosure functionality and aesthetic.



The Gorilla enclosure will be predominantly naturally ventilated with a local in-slab hydronic heating system to provide a comfortable space in cooler ambient conditions. Provision of heating hot waste will be derived from either an air-sourced heat pump or solar thermal hot water with gas boost.



All bathroom spaces are to be provided with adequate openings to outdoors to negate the need for mechanical exhaust systems. Visual and acoustic privacy will need to be considered during the detailed design phase.

Building Fabric & Insulation

Due to the nature of the space and the provision of no active cooling to the built areas, the traditional Building Fabric requirements of the National Construction Code (NCC), Section J, do not apply. (* to be confirmed by BCA consultant)

It is proposed that the roof construction is still built in line with NCC requirements, with a total insulation value of R3.2. While this will not have an impact on energy consumption, as there is no active cooling, it will improve comfort conditions in the space by reducing the heat transfer, particularly from solar thermal gain.

Wall construction is not considered relevant in the naturally ventilated spaces as the intent is to move as much ambient air through the space as possible.

Thermal insulation will be required below the heated plinths used in the Gorilla enclosure. It is proposed an R2 level of insulation be constructed between the plinth and the main slab.

Water

Water Consumption

Water consumption will be minimised through the selection of water efficient fixtures throughout the project. It is proposed the following Water Efficiency Labelling Scheme (WELS) ratings are targeted:

Type	Star Rating	Rated Consumption Rate
Tapware	6 Star	< 4 L/s
Toilets	4 Star	< 3.5 L/s average flush rate
Appliances (<i>Dishwasher</i>)	5 Star	<i>Dependant on capacity</i>



The above targeted star ratings represent the highest commercially available star rating bands for each category.

Waste Water Management Plan

The waste water management for the new project will be designed to leverage off the site existing facilities.

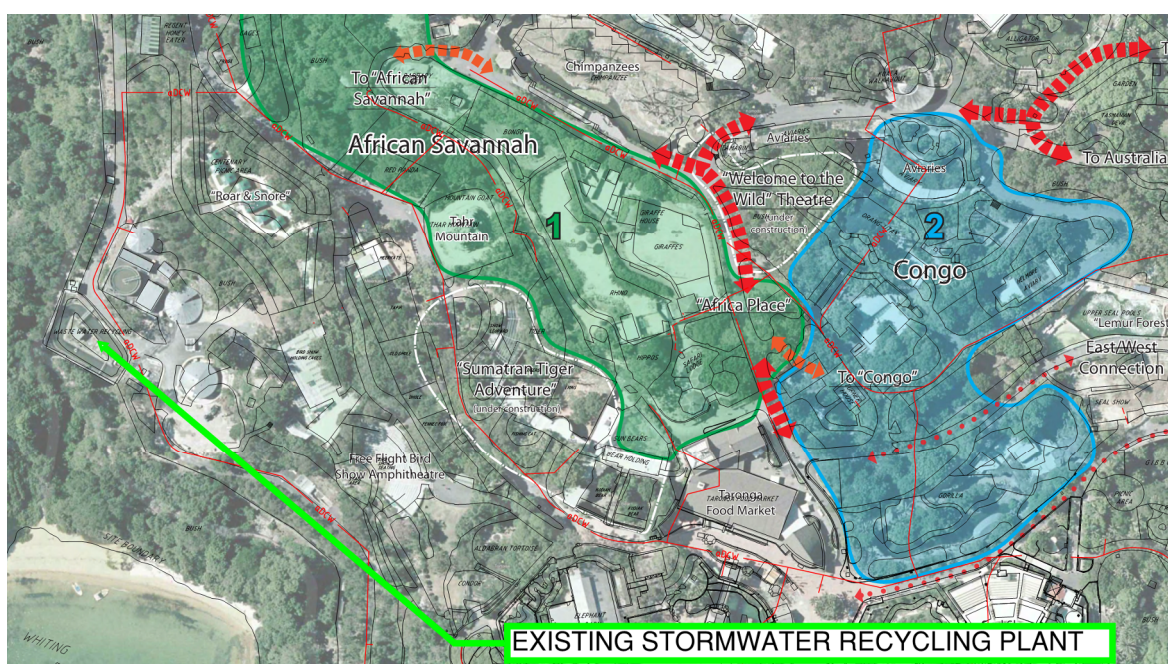
Stormwater Runoff

Water runoff to stormwater will be minimised where possible using permeable or semi-permeable surfaces. Limitations in the existing treatment and re-use plant mean that in large downpours, not all water can be captured or treated, and must be released directly into the harbour.

Where possible, these discharges are to be reduced, by allowing the water to be absorbed into the landscape.

Water Capture

Where rainwater is not absorbed into permeable surfaces (i.e. on roofing), the rainwater is to be captured and directed into the existing stormwater treatment and re-use plant. This will predominantly come from the roof structures that are not landscaped with plants.



Water Reuse

For non-potable water usage, i.e. subterranean irrigation, toilet flushing, etc., the reused water supply from the existing Taronga stormwater treatment and re-use plant will be used as the primary source.

Water reuse to and from the water bodies associated with the animal enclosures will be reviewed separately to ensure safety for both the primary and secondary water consumers. It may not be feasible to use or treat the water going to /from these water bodies.



Materials & Embodied Energy

Locally Sourced Materials

Embodied energy includes all energy consumed by the processes associated with the mining, manufacturing and transportation of a product or material.

It is proposed that the embodied energy of the built form is reduced by sourcing the raw materials (i.e. steel, concrete, timber, glass, etc.) from Australian suppliers only.

Net Balance of Soil

Soil moved for modifications to landscaping levels is to be reused locally on site as to maintain a net balance on the site. Where possible, soil should be transported the minimum distances possible.

This reduction in relocation of soil minimised energy expenditure associated with relocating soil. It is noted that the existing site has been previously built on, so the value of the topsoil may be negligible compared with a greenfield site.

The project should aim to maintain the balance of soil on site to within 10% of the original volume.

Recycled / Sustainable Timber

The Forestry Stewardship Council (FSC) is non-profit organisation that ensures wood products are sourced from a responsibly managed forest.

Timber products for the project should be sourced from FSC certified supply chains as to ensure the environmental impact of the timber is minimised.

Alternatively, recycled/reclaimed timber products may be used in lieu of new FSC certified timber.

Recycled Materials

Post-consumer recycled materials are items manufactured from disused or end-of-life products that were otherwise destined to be considered waste. Examples include materials made from tyres, disposable packaging and construction waste.

Preference will be given to materials manufactured with a post-consumer recycled material content, if financial feasibility and buildability requirements are achieved.

Demolition and Construction Waste

Construction waste will be reduced to by contracting the building to recycling/re-using 90% of materials produced in the construction of the new site.

This requirement will need to be captured in the tender documentation as to ensure the builder allows for, and is contracted to, meeting this requirement.

Operational Recycling

The existing recycling points for visitors to dispose of recyclable shall be supplemented to ensure there is convenient and adequately sized receptacles located throughout the precinct.

Typically, it is expected that each visitor will produce 1L in volume of recyclable materials, per visit. Minimising the time the visitors need to carry their recyclable waste increases the probability of it being disposed of correctly. General waste bins shall always be accompanied by a recycling collection point to reduce the likelihood of recyclables containers being sent to waste.



PVC Reduction

The production and disposal of products containing Polyvinyl Chloride (PVC) produces significant toxins that can be damaging to both human and animal life. Carcinogens, mutagens and teratogens are identified as some of the primary chemical components necessary for the manufacture of PVC products.

It is proposed that no PVC pipework be specified for the project.

It is proposed that no PVC sheathing or conduits for electrical cables is specified for the project.

It is proposed that no floor or wall coverings containing PVC be specified for the project.



Furniture, Fixtures & Equipment

GECA Certified Furniture & Materials

It is proposed that all new furniture and materials, are selected from Good Environmental Choice Australia (GECA) recognised product lines. (*www.geca.org.au)

GECA certification indicates a product has been assessed as environmentally preferable over its entire lifecycle for:

- Impact on the environment
- Health impacts on users
- Socially conscious manufacturing process



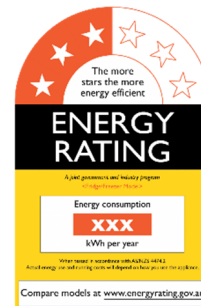
GECA is an independent, not-for-profit, eco-labelling program for the Australian construction industry. GECA certified products do not necessarily cost more, or less, than equivalent non-certified products.

Equipment Energy Rating (E3)

The Australian government's Equipment Energy Rating scheme allows consumers to make simple, like-for-like energy efficiency comparison of common items of electrical equipment (*www.energyrating.gov.au).

It is anticipated that refrigerators and dishwashers may be required in the back-of-house facilities. These should be selected from the star bands below, to ensure the highest commercially available energy efficiency.

Type	Capacity	Minimum Star Rating
Refrigerator	100-200L	3 Star
	200-300L	3.5 Star
	300-500L	4 Star
	500+ L	4.5 Star
Dishwasher	4 Star	4 Star



Education & Information Technology

Electronic Wayfinding

The Zoo is undergoing to the deployment of a smartphone application designed to accompany visitors to the zoo. The smartphone application is to include live mapping technology that will reduce the need to produce paper maps.

Cultural Appreciation and Conservation

Information screens are to be installed in suitable locations as part of the interactive theatrical works. A component of the information presented should educate visitors to value of the human cultures, associated with the presented animals. Topics such as commercial farming activities, poaching, recycling, deforestation, etc. may be covered in these presentations.

The intent is to casually educate visitors to the environmental challenges faced in other parts of the world.

