SUSTAINABLE BUILT ENVIRONMENTS

ESD STATEMENT

For the Part 3A Environmental Assessment

OF

Wet'n'Wild Sydney

AT

Prospect, NSW

FOR

Prospect Aquatic Investments

07100201

7 February 2011

SUBMITTED TO

Andrew Wilson

JBA Urban Planning Consultants

Quality Assurance

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Prepared by: Danielle McCartney

Reviewed by: Imm Chew

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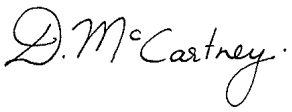
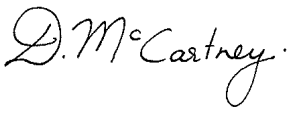
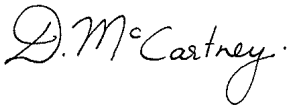
DRAFT	16-01-11		D. McCartney	
FINAL	19-01-11		D. McCartney	
FINAL	07-02-11	Amended	D. McCartney	

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Melbourne
Level 2, 525 Flinders St
Melbourne VIC 3000, Australia
+61 3 9923 2345

Sydney
Level 6, 61 Market St
Sydney NSW 2000, Australia
+61 2 8289 5720

Perth Agent
Level 10, 200 St Georges Tce
Perth WA 6000, Australia
+61 8 9321 8760

1. INTRODUCTION

1.1 Introduction

This Ecologically Sustainable Development (ESD) Statement has been prepared by Sustainable Built Environments Pty Ltd (SBE) for Prospect Aquatic Investments Pty Ltd (PAI) to accompany the Part 3A Environmental Assessment of the proposed Wet'n'Wild water theme park development at Prospect, NSW.

1.2 The site

The site, approximately 25.5 hectares, is bound by the M4 Motorway to the North, Reservoir Road to the South, Watch House Road to the East and a rural property to the West. The residential suburb of Prospect is located approximately 800 metres to the North of the site. The area South of the site consists of an environmental conservation area of native bushland surrounding the Prospect Reservoir. Greystanes employment lands are located to the East of the site. The area to the West of the site is owned by the NSW Government's Western Sydney Parklands Trust (WSPT) and is used for various rural and recreational purposes including Eastern Creek Raceway, the Western Sydney Dragway and a recently completed industrial land subdivision. The site is owned by WSPT and is currently subject to an Agreement to Lease to PAI, which will convert to a 50 year lease immediately upon practical completion of the construction works.

1.3 The proposed development

Stage 1 of the proposed Wet'n'Wild development includes :

- Entry building ;
- Water slides / rides ;
- Outdoor sporting facilities ;
- Events area ;
- Food and beverage facilities ;
- Merchandise space ;
- Office, administration and first aid rooms ;
- Restrooms and lockers ;
- Loading dock facilities ;
- Vehicle parking ; and
- Grassed area for overflow vehicle parking.

Stage 2 will consist of the progressive addition of water rides and attractions.

It is estimated that approximately 925,000 visitors will visit the theme park annually, with an average of 9,000 to 10,000 patrons per day in the peak Summer period.

The capital investment value of the project has been estimated by PAI to be $80 million.

1.4 Development timeframe

The key milestones for the development of the Wet'n'Wild Sydney water theme park are as follows :

- Lodgement of Part 3A Application by end of January 2011 ;
- Part 3A Approval by July 2011 ;
- Construction timeframe of 12 to 15 months ; and
- Water theme park envisaged opening in September 2013.

1.5 ESD Opportunities

The ultimate environmental design aim for our built environment is to create buildings that use no energy, no water, produce no waste in operation or construction and are made from materials that derive totally from sustainable sources. This will not be achieved in this project, but the aim acts as a theoretical lighthouse for the opportunities that should be considered in any project.

1.6 ESD context

The major strategic guidelines, requirements and standards that have informed the consideration of ESD in the Wet'n'Wild project include:

The Director General's Requirements, NSW Department of Planning
The *Director General's Environmental Assessment Requirements* (issued on 20th December 2010) for the Part 3A Environmental Assessment of the proposed development are as follows :

> ***3. Ecologically Sustainable Development (ESD)***
> - *Detail how the development will incorporate ESD principles in the design, construction and ongoing operational phases of the development; and*
> - *Include a description of the measures that would be implemented to minimise consumption of resources, water and energy, including an Integrated Water Management Plan* which details any proposed alternative water supplies, water recycling, proposed end uses of potable and non-potable water, and water sensitive urban design.*

**Undertaken by Browns Consulting.*

Building Code of Australia (BCA)
BCA Section J "Energy Efficiency Measures for Class 5-9 Buildings" was introduced in June 2006 and updated in 2010. The Section J regulations provide minimum energy performance requirements for: building fabric, glazing performance, building sealing, air movement, efficiency of air-conditioning and ventilation systems, efficiency of artificial light and power (internal and external/security) and efficiency of hot water supply. Maintenance provisions are also included to ensure that services and equipment are able to be accessed and that they operate in an efficient manner. A Section J compliance assessment of the development will be undertaken during the detailed documentation stage.

State Environmental Planning Policy (Western Sydney Parklands) 2009

Prospect Precinct Water Theme Park Environmental Management Guidelines between Western Sydney Parklands Trust (WSPT) and Prospect Aquatic Investments (PAI) v5 dated 12th January 2011.

Western Sydney Parklands Trust's ***Management Vision*** dated November 2004.

Western Sydney Parklands Trust's ***Draft Western Sydney Parklands Plan of Management*** **2020** dated October 2010.

Draft Holroyd Local Environmental Plan 2010

Draft Holroyd Development Control Plan 2010

Blacktown Local Environmental Plan 1988

Blacktown Development Control Plan 2006

Draft Fairfield City Council Local Environmental Plan 2010

Fairfield City Wide Development Control Plan 2006 v10

1.7 Report Format

The aim of this ESD Statement is to provide the NSW Department of Planning and stakeholders with a clear understanding of the ESD initiatives that will be incorporated into the proposed Wet'n'Wild Sydney development.

The methodology of the report is based on a checklist of items SBE has developed to inform our consultancy work. The checklist covers the ESD aspects listed below :

- Water
- Energy
- Materials and Resources
- Land and Biodiversity
- Environment Quality and Emissions
- Traffic and Transport
- Social Amenity

The ESD Statement will be accompanied by an Environmental Management Plan (EMP), which can be found in Appendix A. The EMP addresses the above-listed ESD aspects. Each of these aspects contains a number of sustainability objectives for the theme park, which have corresponding actions to be undertaken during the planning / concept design, detailed design, construction and / or operational phases of the development. Key performance indicators have been nominated where appropriate and are consistent with the *Prospect Precinct Water Theme Park Environmental Management Guidelines* between Western Sydney Parklands Trust (WSPT) and Prospect Aquatic Investments. In consultation and prior agreement with WSPT, sustainability targets will be confirmed and agreed following confirmation of Stage 1 rides and attractions and implemented into the EMP during the detailed construction phase. The indicators and targets will be further developed as the project progresses as part of an iterative process. Responsibilities have been allocated against each of the actions. However, in some cases the responsible party has not yet been selected or engaged. Finally, the progress of the action towards achieving the sustainability objective is noted in the Status column. The ESD Statement and EMP were developed during the planning and design development process and incorporate the specialised input of project team members for their respective disciplines.

1.8 Documents

This ESD Statement (and accompanying Environmental Management Plan), is based on meetings with Prospect Aquatic Investments (PAI), Warner Village Theme Parks and the project team, as well as the following drawings and documents :

- Site Survey Plans dated October 2010 (Bee & Lethbridge);
- Overall Site Plan, Staging Plan, Access Network Plan, Safety and Security Plan (WhiteWater);
- Architectural Drawings (WhiteWater);
- Landscape Master Plan Concept Design Report (Oculus);
- Services Location Plan, Stormwater Management Plans, Cut and Fill Diagram (Brown Consulting);
- *Phase 1 Environmental Site Assessment Report* dated December 2009 (RCA Australia);
- *Phase 2 Environmental Site Assessment Report* dated December 2010 (RCA Australia);
- *Hazardous Substance Audit Reports* dated December 2010 (RCA Australia);
- *Geotechnical Investigation Report* dated December 2010 (RCA Australia);
- *Consultation Report* dated 8th December 2010 (Cosway Australia);
- *Water Cycle Management Report* dated November 2010 (Brown Consulting);
- *Water Cycle Management Plan* dated November 2010 (Brown Consulting);
- *Transport and Accessibility Impact Report* dated January 2011 (Arup);
- *Statement of Heritage Impact Report* dated January 2011 (Graham Brooks and Associates);
- *Aboriginal Heritage Assessment Report* dated December 2010 (Mary Dallas Consulting Archaeologists);
- *Noise and Vibration Assessment Report* dated December 2010 (Renzo Tonin & Associates);
- *Access Review Report* dated January 2011 (Morris Goding);
- *Biodiversity Impact Assessment Report* dated January 2010 (EcoLogical Australia); and
- *Bushfire Protection Assessment Report* dated January 2011 (EcoLogical Australia).

2. WATER

2.1 Context

Australia is the second driest continent on the planet, and Australians are the world's largest consumers of water per capita. Guaranteeing the supply and quality of mains water to cities has huge ramifications in terms of availability of catchment resources and cost of delivery infrastructure. Water theme parks consume relatively large volumes of potable water. This site differs from typical commercial developments in that it has a small overall roof area and high water use. The main water uses are for pools and irrigation. Other uses include toilet flushing, showering before and after swimming, kitchen operations and outdoor deck wash down.

2.2 Demand management strategy

A water demand management strategy will be developed during the design process and implemented for the proposed development. Firstly, the demand for potable water in the development will be reduced, then technological solutions provided that collect, store and re-use water in the most efficient and economically feasible way. The reduction of potable water use through demand management represents minimal capital cost outlay for significant water (and cost) savings during the theme park's operational life.

A *Water Cycle Management Plan* dated November 2010 has been developed for the site by Brown Consulting. This Plan describes the hydrology and hydraulics of the existing site and that of the proposed water theme park development, outlines the stormwater management plan, describes the rainwater use plan and finally details the site water balance.

2.3 Potable water

The proposed theme park includes the relocation of the Sydney Water easement that currently runs through the middle of the site. It is proposed for relocation along Watch House Road and part of the Northern boundary of the site.

A new potable water main is proposed to replace the existing main fronting the site in Reservoir Road. The new water main will connect with the existing main located approximately 350m to the East in Reservoir Road / Picrite Close.

Brown Consulting's *Water Cycle Management Plan* states that 90% of the water required for irrigation, toilet flushing and washdown can be supplied by reused water (i.e. treated stormwater and rainwater). The remaining 10% of water needed for these purposes will be obtained from Sydney Water's potable water supply. The projected annual potable water demand, as calculated by Brown Consulting in their *Water Cycle Management Plan*, is 102.2ML/year (excluding irrigation, toilet flushing and wash down water demand which will be supplied by re-used water).

2.4 Water conservation measures

Significant reductions in potable water use will be made through the selection of low flow tapware, water efficient toilets, low water use (or waterless) urinals, low flow showerheads (with button timers), low flow spray heads for outdoor wash down and low water-use appliances (e.g. dishwashers). These items will be specified according to the best available and fit-for-purpose fittings and appliances under Australia's Water Efficiency Labelling Scheme (WELS).

Where possible, perlite regenerative filters will be installed to the pools as these are the most water efficient technology currently available. They are high in efficiency, lead to significant energy and water savings and the improved filtration of particles results in cleaner water and a more healthy environment. Brown Consulting state in their *Water Cycle Management Plan* that this is expected to save approximately 20Ml of water per annum. Some pools, such as those with high water temperatures or in water features, will have high rate sand filters. Brown Consulting state that backwash volumes from perlite filters are approximately 5% of that from high rate sand filters commonly used.

The volume of water carried out of the pools by people can be significant. This water loss can be reduced by approximately two thirds by designing the pools as “run-out” rather than “splash-out” in the proposed development. Deck areas will be designed to drain water carried out of the pools by people back into the pool system. Splash guards to rides and attractions will further reduce water loss from the system.

Water loss to evaporation can be reduced by pool blankets. These will be added where possible, but unfortunately is not feasible for a significant number of pools due to their size and irregular shape. For example, the lazy river and the wave pool which contains islands. Shading over the pools will reduce evaporation, but this would increase the heating requirement and, consequently, energy consumption.

If cooling towers are used, they should have 6 cycles of concentration or greater, which will reduce the water consumed by air-conditioning by around 50%, as well as reducing the volume of chemicals used for water treatment.

2.5 Stormwater retention strategy

Controlling peak flows of stormwater during major rainfall events is a major issue for Sydney’s aging stormwater infrastructure. Initiatives to harvest rainwater and stormwater assist in detaining peak flows of stormwater into the drainage system thereby reducing the likelihood of neighbourhood flooding.

The site is located in close proximity to Prospect Reservoir which is surrounded by environmental conservation areas of native bushland. A Water Sensitive Urban Design (WSUD) strategy has been developed during the design process which aims to reduce surface water run-off and peak stormwater flows during storm events, preventing this water from being carried off site directly into river systems. WSUD initiatives will include bioswales, wetlands and the planting of drought tolerant native species.

The developed Wet’n’Wild site is substantially less pervious than the pre-development site with the result being that stormwater run-off velocities will increase and much less water can permeate to the ground. Proposed stormwater quality and quantity control measures include the installation of Gross Pollutant Traps (GPTs), treatment swales and a constructed wetland. Bioswales will be located in between the rows of car parking under the front bumpers of the cars. These provide primary water quality treatment of initial runoff prior to stormwater collection in a piped system for conveyance to the tertiary treatment and storage ponds. The access road off Reservoir Road also has a central median bioswale collecting the surface runoff. The GPTs will be located on stormwater mains prior to discharge into the wetland. The stormwater detention pond will be 2,000sq.m with 3,000sq.m of wetland located in the natural drainage corridor in the Northern part of the site. Approximately 95% of the annual irrigation demand (21ML/year) of the theme park will be supplied from re-use of the collected stormwater stored in the wetland ponds. The water will be UV treated before being re-used. The overflow from the stormwater detention and reuse pond will discharge into Blacktown Creek.

Brown Consulting’s flood modelling has indicated that the park is unaffected by flooding, and that on large rainfall events, there will actually be a substantial reduction in flows passing the M4 when compared to the site in its current condition. However, during the Probable Maximum Flood event the M4 may experience increased flows over its surface.

2.6 Rainwater collection

The collection of rainwater from the roofs of the building will reduce potable water use and reduce peak stormwater flows.

Buildings with permanent roofs will have rainwater tanks buried underneath their floor slabs. The harvested rainwater will be stored and re-used for non-potable purposes such as toilet flushing and external deck washdown following filtration of sediment and UV sterilisation. The afore-mentioned roof areas are also where the majority of the park’s toilets will be located, thereby minimising the need for a non-potable reticulation system.

2.7 Greywater collection

Brown Consulting state in their *Water Cycle Management Report* dated November 2010 that greywater collection, treatment and re-use is not considered to be a viable option for this site. The reason being that a large amount of re-use demand can be supplied by harvesting stormwater and that stormwater is more fit-for-purpose than greywater.

2.8 Sewage treatment

A new sewer main is proposed to connect to the existing sewer main in Norman Street, Prospect approximately 800m to the North of the site. The sewer will drain by gravity. The wastewater from the proposed theme park will be stored in an in-line sewage storage tank or balance tank before being discharged to the public sewer network. This will detain peak flows of sewerage. The projected annual wastewater discharge (made up of wastewater from kitchen, amenities, rides etc.), as calculated by Brown Consulting in their *Water Cycle Management Report*, is 21.7ML/year.

2.9 Landscaping

The Landscape Master Plan Concept Design Report by Oculus outlines the landscaping strategy for the proposed development. Where possible, existing trees on the site will be retained. Areas of lush sub-tropical rainforest planting are located to the South and North-West of the wave pool. Plants typically found around the beaches of Sydney's Eastern suburbs and along the Eastern seaboard of Australia are located around the wave pool and along the promenade. Tree planting adjacent to water rides will provide shading to visitors as well as reduce evaporative losses from the pools. The existing woodland areas on the site will be supplemented with plantings of Cumberland Plain Woodland species that will provide a corridor between the two existing remnant stands. The water detention area will be planted with native wetland and sedge species. There will be a tree-lined entry and one tree planted for every 4 cars in the car parking area, which will provide shading, and assist in reducing glare and the heat island effect. Plant species are zoned based on water needs to optimise water efficiency (i.e. sub-tropical rainforest planting, drought-resistant native plants etc). Drought-resistant native species will require little or no watering.

2.10 Landscape irrigation

Efficient landscape watering systems, such as sub-surface drip irrigation with timers and / or rainwater or soil moisture sensors, will be installed. Water for landscape irrigation will be supplied from non-potable source i.e. treated stormwater and rainwater.

2.11 Water metering and monitoring

Individual water meters will be installed for any large water uses and / or zones on the site. Water consumption will be monitored at regular intervals (possibly by a Building Management System (BMS)) to enable detection of any leaks in the potable and non-potable water supplies, determine if the building services on the site are operating at optimal efficiency or if some tuning or maintenance is required to improve performance, and to raise awareness of water consumption and the promotion of responsible water use, which results in reduced water use and lower water bills. A number of indicators will be used to track the operational water performance of the theme park from year to year. These include :

- Total Sydney Water consumption (L/year);
- Potable water consumption per visitor based upon design number of visitors (L/design number of visitors); and
- Percentage total water sourced from alternative supplies (%/year).

Collected data from the water meter(s) could be used to compare and benchmark water consumption across the Wet'n'Wild water theme park portfolio (whilst taking into account the unique climate, varying occupancy and technology of each park). With the aim of promoting continual improvement, an operational water management and efficiency plan will be implemented that includes a regular review of water use and enables the detection of any inefficiencies or leaks.

2.12 Water education

Water education and training will be provided for all staff with the aim of implementing water efficient practices in the theme park and promoting continual improvement. Signage will be placed in the foyer of the entry building outlining the theme park's water cycle management strategy in easy to understand language so that visitors are informed of the environmental benefits of the water conservation measures implemented and the re-use of water from alternative supplies. Interpretive signage may also be strategically placed around the theme park to highlight other water conservation features, such as rainwater tanks, wetland / stormwater retention pond etc.

2.13 Water offsets

Participation in existing water conservation projects in the community as a means of offsetting the development's potable water may be considered.

3. ENERGY

3.1 Context

Energy remains one of the key environmental initiatives in building developments and is the area in which life cycle cost considerations are likely to be the most favourable. Australians are the world's largest generators of greenhouse gas per capita, and the built environment contributes to over 40% of these emissions.

3.2 Demand management strategy

An energy demand management strategy will be developed during the design process and implemented for the proposed redevelopment. Energy consumption will first be minimised, then energy losses minimised, then technological solutions provided that deliver or convert energy in the most efficient and economically feasible way. Finally, renewable energy systems will be installed where technically and economically feasible. An energy consultant will be engaged in the detailed design phase to optimise the energy flows in the park design.

3.3 Building orientation, form and layout

The layout of the development is somewhat governed by the standard layout and space requirements of the Wet'n'Wild theme park's rides and attractions. For optimal solar orientation, the proposed administration building is elongated along the East-West axis, with the longer facades facing North and South. The East and West facades, typically more difficult to shade due to the early morning and late afternoon sun angles, are shorter. All office, administration spaces and other occupied rooms will be located on the perimeter of the building, maximising daylighting. As the majority of these offices face North solar access is maximised. The building layout is efficient with circulation spaces minimised and core and service areas grouped together. The solar orientation of the other buildings, such as amenity buildings, change rooms etc, is not as critical as they are not continuously occupied. The North-East facing food and beverage café and outdoor terrace will have sunlight access for most of the day.

Passive solar design principles will also be applied to the layout of the rides, attractions and adjacent shading. Where possible, pools will be sheltered from prevailing breezes with buildings and landscaping.

3.4 Building envelope – glazing and shading

The design of the administration building with offices and other habitable rooms on the perimeter and service areas grouped together is conducive to allowing maximum daylight penetration into the building, resulting in energy savings due to the reduced need for artificial lighting during the day. There will be openable windows in all buildings. Glazing will be specified to comply with Section J of the Building Code of Australia (BCA) or better, which will further improve the efficiency of the mechanical heating and cooling systems. Solar calculated window shading will ensure that direct short-wave solar access is excluded over the cooling period (to reduce cooling loads) and allowed over the heating period (to reduce heating loads). External fixed shading will be provided to the North, East and West facing orientations where required. This Passive Solar Design strategy of maximising daylighting, installing improved glazing and shading appropriate to façade orientation will significantly reduce the energy requirements of the building through passive means.

3.5 Building envelope – insulation and infiltration

Roof, ceiling, wall, floor and building services (e.g. gas boilers, water piping, water storage) insulation will be specified to comply with Section J of the BCA or better, and the building appropriately sealed to reduce air leakage, which will reduce the heating and cooling load of the mechanical systems, thereby improving energy efficiency.

3.6 Choice of fuel

Gas will be used to supply as many of the energy demands on site as possible as it produces less than 30% of the greenhouse gas outputs of mains electricity derived from coal-fired power stations.

The site does not currently have a connection to natural gas. A new gas connection will be installed to the existing gas main in Hampton Crescent, Prospect approximately 600m to the North of the site. It is expected that the largest portion of gas use on the site will be for water heating.

A new electricity connection to the existing substation will be installed approximately 1,200m to the South-East of the site near Reconciliation Drive on the edge of the Greystanes industrial estate.

3.7 Low carbon technology - Cogeneration

Installing a cogeneration plant provides both power and heat to a site. Cogeneration typically involves the generation of electricity for use on the site from natural gas and the utilisation of the generated waste heat for space or water heating. Cogeneration is efficient as it lowers fuel consumption (and associated greenhouse gas emissions) by generating heat and power rather than supplying those needs separately. Cogeneration also reduces greenhouse gas emissions by replacing grid electricity with natural gas fired generation (which produces one-third of the greenhouse gas emissions of electricity generated from coal-fired power stations) and by replacing some of the site's heat requirements with waste heat from the generation process. However, cogeneration is also more expensive than grid electricity as the cost of natural gas is higher. Cogeneration systems for private developments can be grid-connected which is commonplace in Europe, but not in Australia due to the existing utility infrastructure and regulatory barriers.

For this system to operate efficiently and provide financial and environmental benefits, the power and heating demands must be carefully matched. Peak demand as well as daily and seasonal profiles must be taken into account. For the proposed Wet'n'Wild development, it was concluded that cogeneration by itself is not effective, but could be effective when combined with a number of different measures, such as thermal storage and passive measures. The installation of a gas main to the site means that the infrastructure required for a cogeneration system is in place should this low carbon technology become feasible in the future. The installation of a cogeneration plant for the proposed Wet'n'Wild development may be investigated for feasibility in the subsequent detailed design and construction stages.

3.8 Heating, cooling and ventilation (HVAC)

The heating and cooling energy demand for the habitable buildings on the proposed theme park site will be reduced by firstly eliminating, or minimising, the need for heating and cooling, and secondly by installing a heating and cooling system that requires the minimum energy input for the given heating or cooling demand.

An efficient HVAC system for the buildings will be developed in the subsequent stage of design. The Green Building Council of Australia's Green Star Office Designv3 tool will be used to guide the design of the office spaces. The HVAC system will most likely consist of a mixed-mode air-conditioning system (combined natural ventilation and HVAC). The larger spaces within the buildings could have Variable Air Volume (VAV) air-conditioning with economy cycle, high efficiency variable speed drives (VSDs) for pumps and air-handling units, heat recovery etc. Hallways and circulation areas should be naturally ventilated. Where possible, the amenity blocks, toilets and change rooms will be naturally ventilated. If this is not considered to be feasible, mechanical exhausts could be ducted to the façade with efficiency controls or centrally ducted with individual fan controls and VSDs on the fans. High efficiency chillers and motors should be installed to commercial and retail areas. Air-conditioned areas should be zoned according to common occupancy rates and times. Motion sensors and timers could be used to automatically switch off plant when rooms are unoccupied. The mechanical ventilation system will be designed to maintain a comfort band of 22 degrees Celsius plus or minus 1.5 degrees in the internal environment. All building services ducts and pipes containing hot or cold air or fluids will be appropriately insulated to reduce thermal losses.

Passive design can assist in reducing heat requirements and losses. For example, light coloured pool bottoms can reduce evaporation and heat loss to the night sky and dark coloured surfaces to water slides and other surfaces that are in contact with water during the day can retain heat. The feasibility

of using pool covers will be investigated as they can retain heat, but are not feasible in many cases for the proposed Wet'n'Wild development due to the irregular shapes of some of the pools and islands within them. VSD pumps will be installed to rides where appropriate. They cannot be installed to rides that require a constant flow of water to function. In this case the pumps will be linked to automatic timers and have an on/off switch. High efficiency pump motors will be used where possible, especially for filtration systems. Water heating and space heating controls will be automated, set and monitored.

The passive solar design features of the buildings (e.g. shading, improved insulation levels) and rides reduce the amount of energy required for heating and cooling and the installation of an efficient HVAC system will supply the heating and cooling demand in an efficient manner, thereby reducing the volume of greenhouse gas emissions.

3.9 Lighting

The penetration of natural daylighting into the buildings will be prioritised, resulting in energy savings due to the reduced need for artificial lighting during the day.

For general lighting, T5 fluorescent fittings will most likely be installed to all office areas, service areas and general circulation spaces. T5 lamps fitted with high frequency electronic ballasts use approximately 25% less energy than the standard T8 lamps, thereby producing 25% lower greenhouse gas emissions. Low-power light-emitting diode (LED) lamps with good colour temperature control may be used for feature lighting. Lower background lighting levels, dimmers, and task lighting will be used where appropriate. Time switches and motion and daylight sensors will be installed to selected light fittings where appropriate (e.g. external lighting, store rooms) to ensure that these lights are only operating when required. The lighting layout will incorporate zoning to allow switching control over spaces, thereby improving energy efficiency. The Green Building Council of Australia's Green Star Office Designv3 tool will be used to guide the lighting design of the office spaces. External lighting levels will be set according to the requirements of the Building Code of Australia, monitored and adjusted seasonally. Solar external lighting will be explored for feasibility.

Lighting is responsible for around 33% of a building's greenhouse gas emissions. By reducing the requirement for artificial lighting in the building (by maximising use of natural daylighting), then supplying the lighting demand with energy efficient fittings and controlling their operation as required, energy consumption (and associated greenhouse gas emissions) will be significantly reduced in the proposed development.

3.10 Hot water heating

Hot water for pool heating will most likely be supplied by natural gas fired boilers. It may be possible to reduce the pool water temperature from 26 to 24 degrees Celsius during the shoulder months, with benefits including a reduced heating energy requirement and reduced heat loss overnight.

Solar hot water heating systems significantly reduce energy consumption and greenhouse gas emissions by using renewable energy from the sun to heat water. Gas back-up is preferable to electric back-up as it produces one-third of the greenhouse gas emissions of electricity generated from coal-fired power stations. The feasibility of installing a solar hot water heating system (with gas back-up) will be determined in the detailed design stage. The system could supply the hot water requirement for domestic hot water (DHW) and / or pre-heat water for the pools. The system could be mounted on the roof of a building that provides unobstructed solar access from the North. Unfortunately there is not a significant extent of roof area in this development. Evacuated solar tube systems will be considered. They are around 20-40% more efficient than the traditional flat-plate solar collectors, have vacuum technology, low heat losses and good performance at low sun-angles.

3.11 Renewable energy generation

A grid connected photovoltaic (PV) array could be mounted on the roof of a building or structure that provides unobstructed solar access from the North. PVs provide electricity from renewable sources (i.e. the sun) with no operational CO_2 emissions. The installation of a PV array is a significant capital

investment, so feasibility in terms of electricity output and cost-effectiveness will need to be thoroughly explored in the subsequent design stage.

Wind can be harnessed to generate electricity through the installation of wind turbines. This technology produces electricity at relatively low cost. Wind turbines are generally located in regional areas of high elevation or near the ocean where the wind is strong and there are few obstructions, such as buildings. There are two types of wind turbines; horizontal and vertical axis. Generating electricity from wind turbines is typically more cost-effective and space efficient than PVs, but less reliable due to the variability and unpredictability of the wind. The feasibility of wind power to generate electricity on the site was investigated and it is concluded that, due to the relatively low wind speeds, this would not be an efficient or cost-effective technology. 70% of the time the wind speed would be less than 3m/s, meaning than 70% of the time a typical wind turbine would not generate electricity, resulting in higher capital costs as more turbines would be required.

The sourcing of a proportion of the electricity load from accredited Green Power sources will be considered. Green Power is electricity generated by renewable technology off-site. This would reduce the greenhouse gas emissions associated with electricity use on the site.

3.12 Power Factor Correction (PFC)

Power factor correction equipment does not reduce the energy consumption of a building or development, but improves energy efficiency by increasing the capacity of the electrical infrastructure network. The installation of PFC equipment on all main switchboards reduces the material and equipment required for electrical utility infrastructure as the size of transformers, submains and high voltage reticulation equipment can be downsized and still achieve the same capacity. The installation of PFC equipment will be explored for feasibility by the electrical engineers during the detailed design phase.

3.13 Peak energy demand reduction

Peak energy demand for electricity sourced from the grid typically occurs during the hot summer months in regular occupancy hours when the HVAC system is providing maximum cooling for the buildings. This obligates energy providers to have excess power generation and transmission capacity, which often requires secondary power plants to be built or older lesser efficient ones to be retained. Designing thermally efficient building envelopes and using low energy technologies, (e.g. fans) and high efficiency HVAC systems will reduce peak demand and the energy infrastructure required to meet the needs of the development.

3.14 Operation and maintenance manual

The plant and equipment will be serviced and maintained regularly to ensure that it performs at optimal efficiency. Maintenance requirements and ongoing tuning requirements will be specified for each plant item and schedules provided by the respective plant installation sub-consultants for incorporation into the Operation and Maintenance manual(s). This will assist ongoing managers of the Wet'n'Wild development to correctly and efficiently operate the systems as they were designed, to minimise energy wastage and to improve energy efficiency.

3.15 Energy metering and monitoring

Energy meters and sub-meters will be installed for any large energy uses on the site. This allows the monitoring and management of energy use, facilitating the detection of any problems and promoting continual improvement. Collected data from energy meter(s) could be used to compare and benchmark energy consumption across the Wet'n'Wild water theme park portfolio (whilst taking into account the unique climate, varying occupancy and technology of each park). An operational energy management plan will be developed. If applicable to this development, National Greenhouse and Energy Reporting System (NGERS) requirements will be included in the energy management plan, as well as guidance from the NSW Energy Savings Action Plan Guidelines and Energy Efficiency Opportunities Guidelines. Energy consumption will be monitored at regular intervals (possibly by a Building Management System (BMS)) to determine if the building services on the site are operating at

optimal efficiency or if some tuning or maintenance is required to improve performance. A number of indicators will be used to track the operational energy performance of the theme park from year to year.
These include :

- Total carbon emissions (Scope 1 and Scope 2) as per NGERS requirements (in tCO2-e);
- Energy intensity – electricity consumption per visitor and gas consumption per visitor based upon design number of visitors (in MW or kWh/visitor);
- Carbon intensity – emissions per visitor based upon design number of visitors (in tCO2-e/visitor); and
- Percentage total energy sourced from renewable sources (in % MJ or kWh).

The establishment of an energy management committee with members from theme park maintenance, facilities management and corporate management and communications will be investigated with the aim of monitoring performance, promoting continual improvement and communicating performance to stakeholders.

3.16 Energy education

An energy education, communication and continual improvement program for internal and external stakeholders incorporating the training of staff and a communications and marketing strategy will be established. This could include school-group education programs, staff inductions, ongoing energy management training for staff etc.

3.17 Energy offsets

Participation in existing greenhouse gas abatement projects in the community as a means of offsetting the development's greenhouse gas emissions will be considered. This could include local tree planting programs.

4. MATERIALS AND RESOURCES

4.1 Context

The environmental impacts of material usage in buildings and developments are numerous and include the depletion of natural resources, the degradation and pollution of the environment in their extraction, production and use, and health impacts associated with off-gassing of pollutants in production and use. Waste created by the building industry accounts for more than 40% of waste going to landfill. One of the major imperatives of sustainable design is to reduce, reuse and recycle. The environmental opportunities pertaining to waste management include the reduction of demolition and construction waste streams, as well as those resulting from ongoing operational waste during the life cycle of the building. The objective is to minimise waste to landfill.

4.2 Building layout efficiency

The building layout of the proposed Wet'n'Wild development aims to minimise circulation and utility spaces whilst maximising useable space in order to conserve non-renewable resources and materials.

4.3 Low embodied energy materials

In selecting urban design materials, structural building materials, second-fix elements (e.g. work stations, kitchen cupboards), and operational materials preference will be given to resources that:

- Are locally sourced;
- Are renewable;
- Are from demonstrably sustainable sources;
- Do not contribute to poor air quality or harm the ozone layer;
- Are natural or involve limited processing;
- Have been previously used;
- Have a high content of recycled material;
- Can be recycled at the end of their life; and/or
- Are shown to have a reduced impact on the environment over their full lifecycle (i.e. low embodied energy).

4.4 Construction waste management

A Construction Waste Management Plan (CWMP) will be prepared for the proposed development and will identify types of demolition and construction waste on the site and how it is to be collected, separated and stored. This could include the collection of masonry (bricks, concrete etc.), wood, steel and miscellaneous metals, and paper and cardboard. These waste materials would need to be separated and stored in separate skips on the site. Estimated waste targets will be identified as well as how these targets will be achieved. During the construction phase the contractor (and sub-contractors) will be required to keep records that demonstrate the volume of waste recycled, including waste disposal reports that detail the weight of materials recycled or sent to landfill.

It is recommended that a minimum construction waste target of a 60% reduction be set (this is a target set under the NSW government 'Waste Challenge' initiative). Best practice waste targets are 95% reduction in waste to landfill and 90% reuse of demolition material.

4.5 Operational waste management

Dedicated spaces will be provided in the administration, service areas and public spaces of the theme park for the collection, separation and temporary storage of recyclable waste. This will include clearly labelled and colour-coded bins for general waste (non-recyclable) and recyclable waste (glass, paper and cardboard, plastics, and metals). The bins may be co-mingled depending on local Council waste management procedures or the waste contractor engaged by Wet'n'Wild. Organic material may be collected in the kitchen and food preparation areas and composted for re-use on the theme park's landscaping. To facilitate the removal of waste off site dedicated space for the general waste and recyclable waste, will be located near the back-of-house loading dock for pick-up by service vehicles

from Watch House Road. Where eligible, office spaces will achieve 5 stars under National Australian Built Environment Rating System (NABERS). A number of indicators will be used to track the operational waste performance of the theme park from year to year. These include total waste generation (including recyclables) in Kgs, percentage of total waste to landfill in %, and total waste generation based upon design number of visitors in Kg/visitor.

4.6 Concrete

Traditionally made concrete is high in embodied energy, mainly due to the significant energy input required for its production. The embodied energy can be reduced by substituting a portion of Portland cement with an industrial waste product, which saves resources and reduces energy consumption. Where appropriate, at least 15% of the cement used in the concrete for the development (i.e. in-situ, pre-cast, stressed) will be replaced with fly ash. If possible, no natural aggregates will be used for non-structural uses e.g. road base, backfill to service trenches.

4.7 Steel

Steel is high in embodied energy, mainly due to the significant energy input required for its extraction, transport and manufacture. The embodied energy can be reduced by substituting a portion of virgin steel for recycled steel, which saves resources and reduces energy consumption. Where appropriate and supply is available, at least 60% of the steel used in the development (i.e. reinforcing, structural steel) will have either a post-consumer recycled content greater than 50%, or is re-used.

4.8 Timber

Where possible and supply is available, any timber specified for the development (i.e. formwork, structural, second-fix, composite wood timber) will be supplied from sustainable sources. These include re-used timber, post-consumer recycled timber or Forest Stewardship Council (FSC) certified timber. No timber will be sourced from old-growth forests or rainforests in Australia or overseas.

4.9 Poly Vinyl Chloride (PVC) minimisation

PVC has a harmful effect on the environment as cancer-causing chemicals are used in its manufacture, the production of PVC creates highly toxic by-products and it cannot be easily recycled due to the release of toxins when it is melted down. PVC disposed of in landfill releases dioxins that can contaminate the groundwater below. Where feasible, alternatives to materials that contain PVC should be selected. PVC is typically found in stormwater and sewage pipes, electrical cabling, telephone and data cables, cable conduits, floor coverings, blinds, finishes etc. These could include linoleum instead of vinyl flooring, High Density Polyethylene (HDPE) pipes as an alternative to PVC drainage pipes and polyethylene as an alternative to PVC power cables.

4.10 Ozone Depleting Potential (ODP) and Global Warming Potential (GWP)

Ozone depleting substances, such as CFCs, HCFCs, HFCs and halons, are responsible for thinning the stratospheric ozone layer, heightening exposure to ultraviolet radiation and contributing to high rates of skin cancer. Products with high GWP release greenhouse gases into the atmosphere and contribute to global warming. Where possible, the project architects will specify insulation (to walls, roofs, ceilings, floors, ductwork etc.) with zero ODP both in manufacture and composition, as well as specifying fire extinguishers and refrigerants with zero ODP and low GWP.

4.11 Hazardous chemicals

Where possible, the use of environmentally hazardous chemicals for landscape treatment, cleaning and water treatment will be minimised.

4.12 Sustainable packaging and materials

Where practical and appropriate, minimal packaging of operational materials, food products and merchandising will be negotiated with manufacturers. Where practical and feasible, disposable food equipment and utensils (e.g. plates, cups, cutlery) will be recyclable.

5. LAND AND BIODIVERSITY

5.1 Context

It is preferable that the land that is to be developed has limited ecological value, and that any areas that are identified as ecologically valuable in terms of flora and fauna are preserved and enhanced. Land that has previously been used, developed or is remediated contaminated land should be built upon rather than building on prime agricultural land or developing greenfield sites, such as natural wetlands or old-growth forests. The development should make efficient use of the land. The ecological integrity of topsoil should be conserved. The site layout, building design and construction materials should respond to identified bushfire risks.

5.2 Ecology

The topography of the site forms a gentle sloping amphitheatre from a high point around the South-East corner to the low point towards the centre of the Northern boundary. In the past the site has been used for mainly for agricultural and horse agistment purposes and contains some dilapidated houses. The site is largely cleared of trees and is vegetated with native and improved pastures, exotic grasses with some isolated remnant native trees. There are 3 existing dams on the site. According to Brown Consulting's *Water Cycle Management Report* dated November 2010, Blacktown Creek runs through the site and is considered to be "ephemeral" (flows only during and after intense rain).

The Section 149 Certificate states that the land does not include or comprise a critical habitat and is not within a conservation area.

EcoLogical Australia*'s Biodiversity Impact Assessment Report* dated January 2010 describes the ecological environment of the site and assesses the potential impacts of the proposed Wet'n'Wild development on threatened and migratory species, threatened populations and ecological communities. The site survey recorded two threatened microbat species listed under the NSW Threatened Species Conservation (TSC) Act 1995 and the Critically Endangered Ecological Community, *Cumberland Plain Woodlands,* listed under the TSC Act and Commonwealth Environment Protection and Biodiversity Conservation (EPBC) Act 1999. The Remnant Cumberland Plain Woodlands were identified in the centre North of the site (assessed as being of high value) and in the South-East corner (assessed as being of low value). No threatened or migratory species listed under the EPBC Act were recorded or considered 'likely' to occur at the site.

The works for the proposed Wet'n'Wild development involve the clearing and excavation of around 20 hectares of degraded exotic grassland. It will also involve the removal of approximately 0.78 hectares of Cumberland Plain Woodland, mainly within the natural drainage depression area on the site to enable the development of the stormwater detention and reuse pond and associated water treatment wetland. The extent of this basin has been reduced to the minimum size necessary meet hydraulic requirements. The trees removed in the development are proposed to be replaced in the landscaping of the site. Where possible, existing trees will be retained throughout the rest of the site. Ecological Australia states that the removal of the vegetation will not affect habitat connectivity nor increase fragmentation as the vegetation to be cleared / modified is currently in a degraded state with a high prevalence of exotic flora species and horse grazing.

EcoLogical Australia's Report outlines a number of recommended impact mitigation and amelioration strategies which mitigate the effects of the proposed theme park on threatened species, populations, ecological communities, or their habitats and minimise the impacts of the proposed development on the flora and fauna values of the site in general.

EcoLogical Australia concluded that the proposal is unlikely to have a significant effect on threatened species, populations, ecological communities, or their habitats.

5.3 Geotechnical

According to RCA Australia's *Phase 1 Environmental Site Assessment Report* dated December 2009, there is considered potential for pesticide and herbicide contamination on the site due to past agricultural activities on the site. However, the Section 149 Certificate states that the land has not been declared to be significantly contaminated land.

RCA Australia has undertaken geotechnical and environmental site investigations and outlined their findings in their *Phase 2 Environmental Site Assessment Report* dated November 2010. During the site investigations surface soil samples were collected, test pitting was undertaken and groundwater monitoring wells were installed at a number of locations across the site. Samples were collected and analysed. According to the Report all soil analyses reported analyte concentrations below site guidelines and while some metals slightly exceed Ecological Investigation Levels (EIL) guidelines their ecological impact is considered insignificant. The Report states that, whilst a few groundwater samples displayed concentrations of TPH C10-C36 and phenanthrene slightly in excess of the EIL guidelines, the ecological impact is considered insignificant and RCA Australia considers that no specific remediation is required. RCA Australia considers from the site characterisation of soil and groundwater contamination that the site is appropriate for its intended redevelopment.

Descriptions of the surface and subsurface conditions and advice for site preparation, earthworks and foundation conditions for the design of the proposed development have been outlined RCA Australia's *Geotechnical Investigation Report* dated December 2010. RCA Australia concludes that if the geotechnical guidelines set out in this Report are complied with RCA considers that the site is appropriate for its intended redevelopment.

5.4 Bulk earthworks

The goal of the earthworks design is to minimise the extent of site disturbance and mould the design of the theme park to fit into the existing topography as much as possible while achieving a balance in cut and fill volumes to create pad levels for theme park attractions and facilities and appropriate grades for car parks and access connections in between, in accordance with relevant Australian Standards. Preliminary calculations by Brown Consulting show that the cut to fill ratio is 168,000 cubic metres and that the topsoil removal to stockpile for respreading is 53,000 cubic metres. Surplus topsoil may be used for earth berms and excavated earth and rock may be crushed and re-used for developments that require fill.

5.5 Hazardous materials

Hazardous Substance Audits were undertaken by RCA Australia on five existing residential properties (and their outbuildings) on the site; 5 and 15 Watchhouse Road and 431, 467 and 491 Reservoir Road at Prospect. The results are outlined in five *Hazardous Substance Audit Reports* dated December 2010. RCA Australia found visual evidence in all five properties of hazardous substances such as asbestos building products and lead based paints. In accordance with the recommendations made in the RCA Australia Reports, the identified bonded asbestos cement (AC) sheeting building materials will be treated as asbestos and removed by a licensed asbestos removal contractor in accordance with the requirements of WorkCover NSW and the National Occupational Health and Safety Commission Code of Practice for the Safe Removal of Asbestos 2nd Edition [NOHSC:2002 (2005)], the Guide to the Control of Asbestos Hazard in Buildings and Structures [NOHSC: 3002 (1988)] and *AS 2601-2001* The Demolition of Structures. All asbestos products removed will be appropriately contained and disposed of at a facility licensed by the NSW Department of Environment and Conservation (DECC) to accept such material.

5.6 Bushfire

A *Bushfire Protection Assessment Report* dated January 2011 has been prepared by EcoLogical Australia. According to the Report the Southern side of the subject land is mapped as Bush Fire Prone Land by Blacktown City Council and the NSW Rural Fire Service (RFS). EcoLogical Australia has assessed the proposed Wet'n'Wild development against the aim and objectives of the Rural Fire Service's (RFS) Planning for Bush Fire Protection 2006 (PBP) as follows :

- To provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;
- To ensure that safe operation access and egress for emergency service personnel and residents is available;
- To provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the asset protection zone (APZ); and
- To ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bushfire fighting).

Ecological Australia has concluded that if the recommendations within their report are implemented, they will provide an adequate standard of bushfire protection for the proposed development that is consistent with Planning for Bushfire Protection requirements for commercial development (RFS 2006).

6. ENVIRONMENT QUALITY AND EMISSIONS

6.1 Context

A number of factors contribute to the environment quality of a site, the indoor environment quality of buildings and the wellbeing of site visitors and building occupants. The development of the site should aim to minimise construction pollution, water pollution, noise pollution, light pollution and maintain air quality. Buildings should meet the needs of users in terms of thermal comfort, indoor air quality, visual comfort and acoustic comfort and be healthy places to work or visit. Creating spaces with high indoor environmental quality improves occupant comfort and can increase staff productivity.

6.2 Daylighting

Natural daylighting will be prioritised in the layout of spaces in the buildings. Occupied spaces of the buildings, such as offices and administration areas, will have direct access to natural daylighting. If possible, these occupied spaces will be on the building perimeter and North-facing, thereby optimising solar access. As well as providing a visual connection to the exterior and a better, more natural visual environment for staff and visitors, the energy required for artificial lighting will be reduced.

6.3 Glare control

Where appropriate, glare-control devices, such as external louvres or internal blinds, will be installed to occupied spaces of the buildings, such as offices and administration areas, to reduce any visual discomfort to staff or visitors that may be caused by reflected light.

6.4 Views out

Occupied spaces of the buildings, such as offices and administration areas, will be located on the building perimeter to facilitate access to views out for staff or visitors. This creates a direct visual link to the outside which is important for visual comfort.

6.5 Visual landscape

Graham Brooks and Associates has studied the view corridors across the site from surrounding public vantage points, significant view corridors from within the site to surrounding areas and the potential impact of the proposed development on the visual landscape. Findings of the study are outlined in their *Statement of Heritage Impact Report* dated January 2011. Graham Brooks and Associates found that the most significant view corridor extends from the Policeman's Cottage in South-Western corner of the site in a North-Easterly direction, towards St Bartholomew's Church and Cemetery. This will be protected by the careful placement of the tall ride structures within the water theme park. The Report states that the M4 motorway, whilst serving as a vantage point to views across the landscape, has effectively severed historical and physical links between significant historical elements and the landscape. To a large extent existing vegetation and topography along the M4 reserve screens the site from motorists on the M4, thereby ensuring that the theme park is not a distraction whilst driving or traffic hazard. The theme park will be highly visible along most parts of Reservoir Road. The park will be visible in the distance from the nearest residential zone in Prospect, approximately 500m to the North. The Report states that views to and from the Reservoir, Hotel and Post Office will not be affected by the proposed development in any way. Graham Brooks and Associates conclude that there is nothing in the proposed theme park that will have a detrimental effect on the existing setting of the Church. The site is indentified as within the "Tourism Hub" of the Western Sydney Parklands and it is therefore considered reasonable that there is some visual impact on the landscape.

6.6 Occupant environmental control

The development aims to maintain the thermal comfort of staff and visitors through heating the pool water to appropriate temperatures and by providing a significant amount of shading around the pools, rides, attractions, outdoor recreation areas, amenities and access pathways.

Where possible in the buildings, staff will be given individual control over heating, cooling, ventilation (HVAC) and lighting systems which allows them to optimise their thermal and visual comfort. HVAC controls (e.g. thermostats) will be centrally located and labelled in each thermal zone of the building and staff will have direct control over temperature. The lighting system will be designed so that all switches are centrally located and labelled for each lighting zone so that building users have direct control over their visual environment. If possible, an occupancy based lighting control system (e.g. using lighting zoning, movement sensors in utility rooms, daylight sensors, time delays etc.) will be installed to allow smaller rooms and zones to operate only when staff or visitors are present, leading to greater control over their visual environment as well as conserving a significant amount of energy. Where appropriate, task / desk lights will supplied to desks in office / administration areas, augmenting control over the visual environment and providing an opportunity to reduce ambient lighting levels.

6.7 Lighting levels

Artificial light fittings, lighting layout and lighting levels will be designed and specified to comply with Section J Energy Efficiency provisions of the Building Code of Australia (BCA) or better, which will improve energy efficiency as well as optimise the occupants' visual comfort. Lighting levels will meet the requirements of Australian Standard AS1680 - 1990 Interior Lighting.

External light fittings will be carefully selected and designed in accordance with AS4282-1997 Control of the Obtrusive Effects of Outdoor Lighting. In order to protect nocturnal fauna habits and night sky visibility, street and car park lights on the site, external light fixtures to buildings, pathway lighting, feature lighting and external signage will be selected so that light is not focused upwards into the sky or beyond site boundaries.

6.8 Noise pollution

Renzo Tonin & Associates have undertaken an investigation of environmental noise impact from the proposed Wet'n'Wild Sydney theme park compared to relevant noise guidelines set by the NSW Department of Environment, Climate Change and Water (DECCW). Their findings have been outlined in their *Noise and Vibration Assessment Report* dated December 2010. Potential noise sources from the theme park include noise emissions from patrons, screams on slides, traffic movement on public roads and in the car park, construction noise and vibration, mechanical plant and events (particularly those with amplified music). Sensitive receivers consist of adjacent residences.
Their recommendations are as follows :

- The installation of an acoustic fence between one residence and the access driveway to Reservoir Road as that residence may be affected by car park noise and use of this driveway;
- The orientation of the stage and speakers towards the M4 motorway during outdoor music events could assist in minimising noise levels for adjacent residences;
- Implement good management measures such as notifying adjacent residents of scheduled events and providing a noise complaints contact phone number;
- An increase in traffic noise along Reservoir Road is predicted due to the proposed Wet'n'Wild development. However, in the future the planned Prospect Highway to Wetherill Park will result in significantly increased traffic flows. Consequently, Wet'n'Wild traffic may not be such as significant contributor to overall traffic noise in the future. As the project progresses, traffic noise mitigation measures can be considered if required;
- The implementation of noise management measures during construction (particularly during the bulk earthworks) where reasonable and feasible would mitigate excess noise levels for receivers, though none are predicted to be "highly affected"; and
- Vibration emission is not expected to be an issue due to the significant distances between large construction plant and adjacent neighbours.

Low ambient noise levels improve building occupant comfort and amenity in the working environment. The design and building services of the theme park buildings will incorporate good practice sound attenuation levels in accordance with (or better than) AS2107-2000 "Acoustics – Recommended design sound levels and reverberation times for building interiors".

6.9 Volatile Organic Compounds (VOCs)

Materials, furnishings, furniture, paints, carpets, finishes, plastics, wood preservatives, sealants and adhesives that use solvents and other products in the manufacturing process with a high Volatile Organic Compound (VOC) content become volatile at room temperature, contributing to poor indoor air quality and significantly affecting occupant health. Products containing VOCs have been linked to "sick-building syndrome" and worker absenteeism. In selecting sustainable construction materials, furnishings, furniture, paints, carpets, finishes, sealants and adhesives etc., preference should be given to resources that minimise contractors' and building users' exposure to VOCs.

6.10 Formaldehyde minimisation

Formaldehyde, a common VOC, is often found in the glues that bind particleboards and composite wood products which are mainly used in kitchen cupboards, cabinets, shelving etc. Zero or low-formaldehyde particleboard, chipboard and medium density fibreboard (MDF) products are now widely available on the market. In selecting particleboards and composite wood products, preference should be given to zero or low-formaldehyde products.

6.11 Environmental Management Plans (EMPs)

An EMP has been developed for the Wet'n'Wild Sydney development (see Appendix A). It is broad-based and covers several sustainability aspects including water, energy, materials and resources, land and biodiversity, environment quality and emissions, traffic and transport and social amenity. Each of these aspects contains a number of sustainability objectives for the theme park, which have corresponding actions to be undertaken during the planning / design, construction and / or operational phases of the development. Key performance indicators have been nominated where appropriate and are consistent with the *Prospect Precinct Water Theme Park Environmental Management Guidelines* between Western Sydney Parklands Trust (WSPT) and Prospect Aquatic Investments. In consultation and prior agreement with WSPT, sustainability targets will be confirmed and agreed following confirmation of Stage 1 rides and attractions and implemented into the EMP during the detailed construction phase. The indicators and targets will be further developed as the project progresses as part of an iterative process. Responsibilities have been allocated against each of the actions. However, in some cases the responsible party has not yet been selected or engaged. Finally, the progress of the action towards achieving the sustainability objective is noted in the Status column. The EMP was developed during the planning and design development process and incorporate the specialised input of project team members for their respective disciplines. The EMP will be updated as the project advances and will be communicated to all operational staff and linked into policies and procedures across the site.

Brown Consulting has developed a *Water Cycle Management Plan* dated November 2010 that outlines how the impact of the proposed theme park on potable water supply is limited by the reuse of stormwater. Also described are water quantity management strategies to limit the development's impact on flooding issues and stream morphology and both water quantity and quality measures that ensure the downstream aquatic environment is not adversely affected.

The contractor for the project (not yet selected) will develop a project-specific EMP prior to construction that addresses the environmental impacts of construction, describes how they will be mitigated and outlines auditing methods and responsible parties. The EMP should be in accordance with Section 4 of the NSW Environment Management System (EMS) guidelines 1998. Ideally the contractor will also have ISO 14001 EMS accreditation.

7. TRAFFIC AND TRANSPORT

7.1 Context

There are many negative environmental impacts associated with transport to and from development sites, including the consumption of fuel energy and the resultant greenhouse gas emissions, air pollution and traffic congestion. Motorised transport results in the release of benzene, alkenes and other pollutants apart from Carbon Monoxide, Oxides of Nitrogen and Sulphur Dioxide, which are detrimental to health. The development should aim to reduce reliance on the private car by promoting public transport and prioritising personal mobility routes.

7.2 Public transport

The proposed development site is not ideally located in terms of connection to public transport. The nearest major railway station is Blacktown station, approximately 5 kilometres to the North of the site. There is a Westbus route (182 - Fairfield to Blacktown) that operates along Reconciliation Drive on Mondays to Fridays between 5am and 7pm. The bus stop is 400m to the East of the site. Busways, a private bus operator, also services a number of bus routes in the Blacktown area, but none in close proximity to the site.The proponent is investigating the provision of shuttle buses to the site from Blacktown station and would encourage visitors to travel to the theme park by public transport by advertising this service on the Wet'n'Wild website. This initiative would reduce staff and visitor reliance on the private car, which in turn reduces transport energy use (and its resultant air pollution and greenhouse gas emissions) and the impact of the site on traffic congestion. A Transport and Travel Strategy will be implemented which aims to maximise public transport use whilst minimising individual vehicle travel.

7.3 Traffic impact

Arup has undertaken a study into the traffic impact of the proposed development and has outlined their findings in their *Transport and Accessibility Impact Report* dated January 2011. This report addresses the existing transport and accessibility situation, forecast trips and traffic generation, traffic modeling scenarios, and transport and accessibility impacts of the proposed development, car parking arrangements, the capacity of the surrounding road network to accommodate the traffic and any necessary road works and traffic measures, as well as measures to facilitate public transport use, walking and cycling. Arup has concluded that the increase in traffic volumes as a result of the proposed theme park can be accommodated on the road network and intersections with acceptable levels of service with the exception of the roundabouts at the M4 Motorway and Prospect Highway interchange. Accordingly, the proponent has made a contribution to road and intersection upgrades in the locality as part of the lease agreement for the land with the NSW Government.

7.4 Vehicle parking

Visitors will access the Wet'n'Wild site from Reservoir Road. Staff access and access to the back-of-house loading facilities will be provided off Watch House Road on the North-East side of the site. Emergency vehicles will have access around the site and emergency egress from both Reservoir and Watch House Roads.

The main car park is outdoor, at grade, sealed and located on the Western side of the site. There will be parking provision for 742 cars, 12 spaces for coaches and 6 spaces for mini-buses. There will be a drop off / pick-up zone adjacent to the main entry forecourt, which has a kerb length to accommodate 3 coaches and 15 cars or taxis. Provision has been made for 42 disabled car spaces, with the majority in close proximity to the entry building. There is room for approximately 20 motorcycles, mopeds and scooters adjacent to the information booths. There are may be premium car parking spaces for parents with prams and for small fuel-efficient cars. The provision of dedicated spaces for small cars (including hybrid and electric cars) aims to encourage more efficient use of private transport. 1,073 additional car parking spaces are available as overflow parking on grassed areas to the North-West of the site for the theme park's busier days.

An unsealed car park for staff will be located in the North-East corner of the site. The use of electric vehicles or vehicles that rate 5 stars for emissions under the Green Vehicle Guide will be considered for the fleet of permanent on-site vehicles within the Wet'n'Wild site.

7.5 Bicycle facilities

The proposed theme park will provide secure bicycle parking facilities for both visitors and workers. There are amenity blocks inside the theme park for change rooms, toilets, shower facilities and lockers.

8. SOCIAL AMENITY

8.1 Context

One of the three cornerstones of sustainability is the enhancement of social issues, which results in a safe and healthy physical environment that meets the needs of staff and visitors and enhances their wellbeing. This involves the engagement of stakeholders during the planning and design process of the development, the design of the theme park to be safe and accessible to all, the acknowledgement of the site's aboriginal and cultural heritage, the environmental education of site and building users and the contribution of the proposed development to the local region's economic prosperity.

8.2 Consultation

Stakeholder consultation has been undertaken by Cosway Australia. The key groups engaged include Councillors from Blacktown, Holroyd, Fairfield, Parramatta, Liverpool, Auburn, Penrith and the Western Suburbs Region of Councils (WSROC), Local Federal Members of Parliament, Local State Members of Parliament, NSW Government representatives, NSW Opposition representatives, local heritage trusts, local residents and tenants, and special interest groups (e.g. Tourism NSW, Western Sydney Parklands Trust). The key responses and outcomes have been outlined in Cosway Australia's *Consultation Report* dated 8th December 2010. In general there are strong expressions of the support for the proposed development, particularly for its tourism potential and employment generating opportunities. The majority of the stakeholders' suggestions and recommendations have been integrated into the design of the proposed Wet'n'Wild development.

8.3 Accessibility

Morris Goding has reviewed the proposed Wet'n'Wild development with the aim of providing advice to maximise reasonable provisions of access for people with disabilities. Their recommendations have been outlined in their *Access Review Report* dated January 2011. The theme park was reviewed in terms of ingress and egress, paths of travel, circulation areas, support buildings and facilities, sanitary facilities, rides and attractions, food and beverage facilities and car parking facilities. Morris Goding found that, in general, there are accessible paths of travel that are continuous throughout the development. Access for people with disabilities will be provided to the majority of rides and attractions and support buildings. However, some 'high thrill' rides may not be fully accessible to people with disabilities due to health and safety regulations. In this case, there will be viewing areas provided adjacent to these rides to enable equitable participation and proximity to the experience in line with the Federal Disability Discrimination Act (DDA) Access Code. Morris Goding concluded that the proposed development has demonstrated an appropriate degree of accessibility and response to the AS1428 series, Building Code of Australia (BCA), and the Federal Disability Discrimination Act (DDA). The recommendations made in their report will be addressed prior to construction certificate.

8.4 Aboriginal Heritage

Mary Dallas Consulting Archaeologists (MDAC) has undertaken an Aboriginal archaeological survey and Aboriginal heritage assessment of the site. Consultation has also been initiated with the Deerubbin Local Aboriginal Land Council, Darug Aboriginal Cultural Heritage Assessments, Darug Custodians Aboriginal Corporation and Darug Tribal Aboriginal Corporation. The findings of these investigations, and the proposed management of significant artefacts or deposits, have been outlined in MDAC's *Aboriginal Heritage Assessment Report* dated December 2010.

The MDAC Report finds that the vast majority of the site is moderately to highly disturbed by historical and current land use and it is not considered likely to retain any extensive or intact Aboriginal cultural remains or archaeological potential. A search of the NSW Department of Environment, Climate Change and Water (DECCW) Aboriginal Heritage Information Management System Aboriginal Sites Register (AHIMS) found that there no previously recorded or registered Aboriginal sites within the subject lands. During the archaeological survey a low density surface artefact scatter (BC1) and an isolated find (BC2) was recorded within the site, as well as an area of potential archaeological deposit

(BC PAD1). BC1 and BC2 are considered to be of low archaeological significance. BC PAD 1 is assessed to be of moderate archaeological sensitivity and on the basis of previous archaeological excavations in nearby similar contexts, may potentially contain significant Aboriginal cultural remains. MDAC has found that, excluding BC1 and BC2 and BC PAD1, the remainder of the site is generally disturbed and has low archaeological potential. MDAC believes that there are no archaeological constraints to development in these areas and no further archaeological investigations are required.

In accordance with the MDAC Report recommendations, the portion of BC PAD1 which is proposed for development impact will be subject to combined test/salvage investigation to document the presence/absence, extent and significance of any Aboriginal archaeological remains that it contains. An Aboriginal heritage management plan will also be prepared for those portions of BC PAD1 which are not proposed for impact under the current proposal. The artefacts from sites BC1 and BC2 will be collected. A plan for the long term care and control of retrieved Aboriginal archaeological objects resulting from the recommended excavations and collection will be developed. Consideration will be given to the incorporation of Aboriginal heritage interpretation (e.g. signage), where appropriate, in the context of the current theme park development.

8.5 Heritage

Graham Brooks and Associates has undertaken a review of the proposed development with the aim of determining its heritage impact. The study reviewed the heritage impacts on the evolved cultural landscape of the site, the unlisted but historically significant Policeman's cottage, potential archaeological sites, listed heritage items and conservation areas in the vicinity of the site and remnant physical evidence of the former Prospect Village. The Policeman's cottage will be restored and re-used for an as yet undetermined purpose. The findings of this study and recommendations are outlined in their report *Statement of Heritage Impact Report* dated January 2011. Graham Brooks and Associates concluded that should be no hesitation, from a heritage perspective, in approving the application.

8.6 Safe Design

The proposed theme park development will reduce the opportunities for, and fear of, crime through the implementation of Crime Prevention Through Environmental Design (CPTED) principles including access control surveillance and territorial reinforcement. White Water have produced a Support Facilities, Safety and Security Plan which outlines fencing and access controls (turnstiles, restrictions to back of house facilities etc), escape routes in case of emergency, the location of lifesavers and ride attendants, the location of first-aid posts, the location of guest relations personnel and rest and shade areas. Lighting design will promote safety for staff and visitors. The theme park will be well managed and maintained to ensure that visitors feel safe and comfortable, including replacement of defective lighting and the prompt removal of any vandalism and graffiti.

8.7 Building User's Guide

A Building User's Guide will be developed and provided to Wet'n'Wild Sydney staff. The Guide should contain information on the sustainability initiatives implemented into the site, attractions, rides and buildings as well as their architectural design and engineering systems and how they are operated to optimise sustainability performance during the operational phase of the development. Where relevant, energy and water metering and monitoring information should be included so that energy and water consumption is reviewed, problems pinpointed and improvements made. The Guide should contain information on waste and recycling i.e. what can be recycled, where the collection bins are and schedules for collection. Details of environmentally responsible cleaning products and practices should be tabled. Details of sustainable transport options (e.g. public transport to the site, bicycle facilities) should be included.

8.8 Environmental education

Signage will be placed in the foyer of the entry building outlining the theme park's water cycle management strategy in layman's terms so that visitors are informed of the environmental benefits of the water conservation measures implemented and the re-use of water from alternative supplies.

Interpretive signage may also be strategically placed around the theme park to highlight sustainability features, such as significant heritage items, solar water heating panels, waste recycling, rainwater tanks etc.

8.9 Economic prosperity

The capital investment of the proposed Wet'n'Wild development has been estimated by Prospect Aquatic Investments (PAI) to be $80million. The development has significant economic benefits to the tourist industry, economy and employment in the Western Sydney region. Where possible local labour will be hired, and materials, resources and equipment will be purchased as close to the theme park as possible.

9. SUMMARY

The Ecologically Sustainable Development (ESD) strategy for the proposed Wet'n'Wild development has been outlined in the Report above and in the attached Environmental Management Plan (EMP) and describes how the proposed theme park design reduces the impact on the environment.

Water

The implementation of a water demand management strategy that involves reducing the demand for potable water and providing technological solutions that collect, store and re-use water in the most efficient and economically feasible way, will result in significant water (and cost) savings during the theme park's operational life. The strategy involves reducing water losses, the installation of water efficient fittings, low water use appliances and efficient perlite regenerative filters, the storage, treatment and re-use of stormwater and rainwater from roofs, and landscape design with plant zoning based on water needs delivered by an efficient irrigation system. 90% of the water required for irrigation, toilet flushing and washdown will be supplied by reused water. Monitoring of potable and non-potable water consumption against the selected indicators will facilitate continual improvement, as will the ongoing education of staff and visitors.

Energy

The implementation of an energy demand management strategy that involves minimising energy losses, reducing energy demand, providing technological solutions that deliver or convert energy in the most efficient and economically feasible way and installing renewable energy systems where technically and economically feasible will result in significant energy (and cost) savings during the theme park's operational life. The strategy involves the application of passive solar design principles, using gas as the preferred energy source, and the installation of efficient heating, cooling and ventilation (HVAC) and water heating systems, and energy-efficient light fittings and layout. Monitoring of energy consumption against the selected indicators will facilitate continual improvement, as will the ongoing education of staff and visitors.

Materials and Resources

The selection of low environmental impact and low embodied energy materials, the recycling of demolition and construction waste, the recycling of operational waste and the sustainable procurement of operational materials, products and equipment will minimise the development's waste to landfill. Monitoring of waste streams against the selected indicators will facilitate continual improvement, as will the ongoing education of staff and visitors.

Land and Biodiversity

Measures will be implemented to mitigate the effects of the proposed theme park on threatened species, populations, ecological communities, or their habitats and minimise impacts on the flora and fauna values of the site in general. Recommendations for the removal of hazardous materials and the mitigation of bushfire risks will be implemented.

Environment Quality and Emissions

A strategy to enhance the environmental quality of the site and indoor environmental quality of the buildings for the health and wellbeing of visitors and staff will be applied. The strategy includes the prioritisation of natural daylighting and views out of buildings, use of glare-control devices, consideration of view corridors, thermal comfort initiatives, lighting designed for visual amenity, noise pollution mitigation measures, indoor air quality improvement initiatives, and ongoing monitoring of environmental aspects during the construction and operational phases of the proposed theme park.

Traffic and transport

The development will mitigate the traffic impact of the proposed development by contributing to road and intersection upgrades in the locality and through measures to reduce reliance on the private car, such as promoting public transport and providing bicycle facilities.

Social Amenity

A strategy to enhance the social amenity of visitors, staff and other stakeholders will be applied, resulting in a safe and healthy physical environment that meets their needs and enhances their wellbeing. The strategy includes the engagement of stakeholders in the development process, the design of the theme park to be safe and accessible to all, the acknowledgement of the site's aboriginal and cultural heritage, the environmental education of site and building users and the contribution of the proposed development to the local region's economic prosperity.

Environmental Management Plan (EMP)

The EMP has addressed the above-listed ESD aspects. A number of sustainability objectives have been developed for the theme park, which have corresponding actions to be undertaken by the designated responsible parties during the planning, design, construction and operational phases of the development. Key performance indicators have been nominated that are consistent with the *Prospect Precinct Water Theme Park Environmental Management Guidelines* between Western Sydney Parklands Trust and Prospect Aquatic Investments. In consultation and prior agreement with WSPT, sustainability targets will be confirmed and agreed following confirmation of Stage 1 rides and attractions and implemented into the EMP during the detailed construction phase. The indicators and targets will be further developed and the status of the actions updated as the development progresses as part of an iterative process.

10. CONCLUSION

The Ecologically Sustainable Development (ESD) strategy for the proposed Wet'n'Wild water theme park development has been outlined in the Report above and in the attached Environmental Management Plan (EMP). The ESD strategy has detailed how the proposed development will incorporate ESD in the planning, design, construction and ongoing operation and management of the water theme park. The measures that will be implemented to reduce the impact of the development on the environment in terms of water, energy, materials and resources, land and biodiversity, environment quality and emissions, traffic and transport and social amenity have been outlined. The ESD strategy for the proposed Wet'n'Wild water theme park development is therefore consistent with the Director General's Requirements.