Illawarra Business Park
ESD Opportunities Report

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Client

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Advanced Environmental

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EXECUTIVE SUMMARY

This paper summarises the opportunities that exist to improve the environmental sustainability of the developments at the proposed Business Park development at 78 Tongarra Road, Albion Park. It summarises the key impacts that typical business park buildings have on the environment and looks at solutions which work towards addressing these impacts within the existing framework of the storage of goods in large warehouse buildings.

The paper investigates five key areas in which the design of park could generate an environmental impact. These areas are:

- Site Selection and Sustainability – how the selection and development of a site for business park buildings has a significant environmental impact and actions and concepts which can be used to reduce the impact of site selection and use;
- Materials Selection – how different materials typically used in various buildings have environmental impacts and what decisions can be made during the procurement of such materials to lessen that environmental impact;
- Passive Design Opportunities – how the design of a business park should first look towards passive design solutions for ventilation, cooling and lighting and the types of passive design features which might be suited to the climate of the south coast;
- Building Services Opportunities – how choices regarding the systems used for heating, cooling, ventilation, lighting and water and waste in a building has a significant ongoing environmental and cost impact and strategies and concepts for reducing the impact of those systems;
- Office Indoor Environmental Quality – how office spaces within the business park are some of the most important spaces in the building, providing an indoor environment for employees which has a significant impact on health well-being and productivity. This section looks at concepts and opportunities to improve indoor environmental quality and occupant wellbeing.

Large scale business park buildings can have a significant site impact and general impact on motorised freight and transport.

This paper, however, finds that a significant number of environmental impacts associated with the design of business parks can be markedly reduced through the implementation of sustainable design concepts nominated.

It is important to note that this paper only provides a general summary of opportunities and design concepts that could be adopted in the design of a new business park. The implementation of these concepts and opportunities will require additional thought, analysis and consideration to be sure of the design approach that is most suited to each individual site and specific building use.

The next step for Delmo Albion Park is to apply a detailed design assessment for the site and to ensure that all buildings introduced onto the site implement sustainable initiatives into their design. With some careful planning and well-considered design, it should be feasible to significantly reduce the environmental impact of the proposed business park.

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1 Introduction

This project provides the opportunity for the Illawarra Business Park to become a leader in environmentally sustainable design in business park design.

We have given specific consideration to warehouse and office environmental performance and are providing a set of environmentally focussed initiatives and concepts for consideration.

The following set of Environmental Design Concepts will provide a list of environmental initiatives that could be adopted by each of the design proposals for the development.

1.1 Understanding the Development

The proposed development consists of 74 hectares, of which 44 hectares con be developed. The development is to be sub-divided into numerous sizes ranging from 2,000m^2 to 30,000m^2. It is expected that the developments will be approximately 75% warehouse and 25% office space.

The non developable land consists of a creek and two wetlands. This area will be remediated to improve the quality of the land and returned to the Council as public land.

1.2 Limitations

This report identifies concepts only. It does not attempt to provide detailed designs for specific projects. Analysis and detailed design of options for the site and individual buildings should be undertaken to ensure that design solutions are appropriate and correctly applied to the project conditions.

2 Sustainable Sites

2.1 Issues

Business parks by their nature represent a significant piece of the built environment and have traditionally represented development which does not touch the ground lightly or express sustainability. Some of the key factors which contribute to the environmental impact of warehouses are as follows:

- The need for large tracts of inexpensive land for the development of business parks, which usually means that facilities:
    - Place pressure on the development of green field sites (sites previously not developed for the built environment);
    - Are isolated from public transport routes and services, requiring trucks for the delivery of freight and motor vehicles for commuters to and from the site;
    - Are often located where the climate of the region is least appealing for residential development;
- The need for large areas of pavement to allow goods to be delivered and taken away, which usually:
    - Converts previously permeable land to impermeable land, disrupting natural water flows and ground water supply and creating stormwater hazards;
    - Contributes to a heat island effect through the storage of heat on large paved surfaces during the day;
    - Creates large tracts of non-landscaped space which contributes to a decline of all ecology in the area.

2.2 Opportunities

Sustainable design concepts relating to the site will generally try to look at reducing the impact of these environmental issues. These concepts generally revolve around the following:

- Water Sensitive Urban Design features reduce the impact of the hard surfaces on stormwater systems and local waterways by absorbing more of the stormwater, reducing the flow into stormwater systems and improving the quality of stormwater (this is covered in more detail in the “Water Cycle Management Plan” completed by Costin Roe Consulting)
- Shading through the use of trees helps reduce the “heat island effect” caused when large thermally massive areas (such as bitumen or concrete parking areas) are left unshaded and absorb heat during the day;
- Landscaping and plants help in part to provide a break on the site for fauna living in the region (can also be used to hide or replace security fences to add visual amenity to a typically inhospitable environment), Using landscaping with native planting that thrives in the local climate the requirement for supplementary irrigation and maintenance is minimised;
- Encourage water conservation through the use of demand management through water efficient irrigation systems. This can be done through items such as drip flow irrigation or even irrigating at night time or morning in order to reduce water loss through evaporation;
- Avoiding the use of upward external lighting to minimise light pollution from the site.

- Opportunities exist to provide a pedestrian micro-climate through the use of landscaped shading, this can potentially improve thermal comfort and offer relief from solar radiation

- Addressing the impact of heavy vehicle transportation and isolation issues by:

    - Providing on-site heavy vehicle bays or alternative heavy vehicle access to avoid the prevalence of trucks disturbing air quality and social amenity in the streetscape;

    - Providing easy access to the site will encourage the use of public transport, including comfortable and well-lit waiting stops and safe, dedicated bicycle access (that is clearly separable from heavy vehicle access);

    - Avoiding conflict between heavy vehicle exhaust and natural ventilation systems;

    - Providing sustainable refuelling options, such as bio-diesel refuelling.

Well-considered and dedicated implementation of these concept design initiatives would help to reduce the overall environmental impact of the site.

3 Materials Selection

3.1 Issues

Business park developments represent large structures which, whilst they can be simple in their design, demand significant resources to construct. Some of the environmental impacts associated with the procurement of materials used to develop a warehouse site include:

- Significant energy consumption and resulting greenhouse gas emissions as a result of mining, harvesting, processing and transporting raw construction materials;
- The damage or destruction of forests or ecosystems through unsustainable forestry practices or mining techniques;
- Toxic pollution and environmental damage caused by the manufacture and processing of construction materials;

3.2 Opportunities

There are many opportunities to reduce the environmental impacts associated with the procurement of materials used in construction and many suitable off-the-shelf alternatives exist which have a reduced environmental impact. Some opportunities to reduce the environmental impact of material selection include:

- The use of steel and other metals with a high recycled content. Recycled steel creates a demand for steel waste products, uses less energy to create and reduces the need to mine iron ore for steel manufacture. Recycled aluminium uses significantly less energy to process than it does to process bauxite into aluminium;
- The substitution of raw concrete elements with recycled waste products. Concrete is largely made from cement, fines (usually sand), aggregate and water. Cement can often be substituted with flyash and similar industrial waste products. Aggregate, which is usually mined, can sometimes be substituted with other recycled construction waste;
- The use of timber that is post consumer recycled or from sustainably harvested sources. One good sustainable source of timber is FSC (Forest Stewardship Council) timber, which monitors the sustainable harvesting of timber from a range of forests and which has a full chain of custody;
- The avoidance of materials which have been found to generate toxic or environmentally damaging pollutants in manufacture such as PVC and insulation blown with ozone depleting gasses. PVC can be substituted with a variety of products, depending on the use, examples being HDPE for above ground pipework and rubber or linoleum for wet area flooring. Insulation products which do not use ozone depleting blowing agents are also available.

Other opportunities worth investigating to minimise the impact of material procurement include:

- Design of construction systems which are flexible and which can accommodate expansion easily without requiring demolition of old structure through the use of modular components and mechanical fixing of sections;
- The use of materials which do not require additional finishes or treatment to reduce maintenance and improve end of life recyclability;
- Recycling of construction waste – recycling rates of 80% should be targeted for construction waste;

- The provision of space to store recyclable and reusable waste such as packaging waste to maximise the reuse and recycling of waste from the operation of the facilities.

These opportunities could significantly reduce the environmental impact of material selection without significantly affecting design flexibility or outcome.

4 Passive Design Opportunities

Large warehouses present a significant opportunity to save energy through the well-considered implementation of passive design solutions. Well-considered passive design solutions can significantly reduce the environmental impact of warehouses such as this by:

- Delivering effective and consistent natural ventilation that eliminates the need for mechanical ventilation of storage areas and maintains ambient conditions in the warehouse;
- Reducing the heat loads on the building by external factors such as solar heat gain and temperature differences between the inside and outside;
- Preventing the build up of indoor air pollutants, including mould through the effective ventilation of warehouse spaces;
- Providing natural light for ambient lighting as an alternative to artificial lighting to reduce energy consumption.

Passive systems are often designed badly and therefore passive design concepts to be adopted should be well-considered and suited to the local environment. Concepts should be designed to suit the Illawarra climate, the sorts of products being stored, the extent of human interaction and the overall scope of each development.

Some passive design concepts and opportunities which might work well in a typical South Coast climate of hot summers and relatively mild winters include:

- The use of external shading to reduce the exposure of the building to direct solar loads, particularly the roof and glazed areas;
- The use of insulation in mechanically cooled areas to reduce heat gain through the façade;
- The use of natural ventilation, with ample openings and exhaust points designed to drive buoyancy ventilation and take advantage of the height of the space.
- The use of passive ventilation controls to help operate high level outlets;
- Weather resistant openings which can provide natural ventilation in most weather conditions;
- Good levels of natural light in the warehouse, with lighting systems which avoid or minimise the exposure of goods to direct sun.

Well-considered passive design features would have the potential to save significant amounts of energy (and money) through avoidance or minimisation of mechanical ventilation, cooling and artificial lighting.

5 Building Services Design

5.1 Issues

Once Passive Design Opportunities are exhausted, the buildings will still be left with a range of building services systems. These systems use energy, require maintenance, and generally represent the highest ongoing demand for resources of the building. Key environmental impacts from building services include:

- Demand on energy infrastructure from cooling, ventilation and lighting systems;
- Greenhouse gas emissions from electricity, gas and other fuel uses;
- Demand on potable water resources;
- Impacts on stormwater and sewage systems due to high peak loads and unusual pollutant characteristics.

5.2 Opportunities

There are a range of opportunities to reduce the demand on resources of building services systems, reducing the environmental impact as well as the ongoing costs of the facility. Some of the opportunities and concepts that should be explored and considered include:

- Management strategies that will assist the building facilities manager in operating the building more efficiently. Opportunities may include:
    - Separate metering of energy and water uses to allow managers to identify system leaks or uncharacteristic operation of systems and troubleshoot problems quickly;
    - System controls to operate plant efficiently. Controls for lighting systems, such as discrete zoning to avoid the need for all lighting to be on at once, and co-ordination between artificial and natural ambient lighting systems;
    - System controls to identify air and water borne pollution quickly, such as stormwater pre-treatment tanks and refrigerant leak detection systems in the plant room;
- Efficiency strategies to improve the overall effectiveness of equipment such as:
    - Selection of chillers with high COP values that deliver more cooling for the same amount of energy;
    - Waste heat recovery systems which use waste heat from refrigeration systems or other industrial systems for other uses such as winter time early morning office tempering, pre-heating domestic hot water, etc.
    - Alternatives to cooling towers which do not require as much water for heat rejection such as efficient air-cooled systems, ground source heat rejection or even a pond/lake heat rejection system.
    - Use of water efficient fixtures and fittings for toilets, hand basins and showers as well as waterless urinals.
- Additional systems which reduce the demand on public infrastructure such as:

- Rain water collection, which represents an enormous opportunity for warehouse sites, with large areas for the collection of rainfall and large quantities of water available which could be used for cooling towers, irrigation and wash down with minimal treatment required. Collection from hard surface for reuse with additional treatment may also be considered.

- There is also a potential for blackwater recycling, opportunities exist to collect water from the sewer, both on site and off-site depending on the water demands. This collected and recycled water can potentially be used for the following:

    - Toilet flushing
    - Irrigation
    - Public water fountains
    - Heat rejection ponds
    - Manufacturing processes
    - Hard surface washdown; or
    - Potentially exported to neighbouring sites, such as the air port.

- On-site renewable power generation – with potentially a large roof area and open areas on the site, renewable energy systems such as solar and wind power might be worth considering if reductions could be negotiated for a large scale.

- Cogeneration - The burning of gas is a cleaner method of creating electricity than burning coal and so less greenhouse gases are emitted than if electricity were obtained from a coal fired power plant. Further, the utilisation of waste heat for other processes optimises the quantity of energy obtained from the combustion process. Cogeneration plants are generally only viable where there is a significant requirement for the waste heat collected. Waste heat from a cogeneration plant can be used for:

    - Domestic hot water
    - Heating hot water
    - Hot water for other purposes
    - Cooling though absorption chillers (tri-generation)

Finally another opportunity exists to design central plant facilities in a modular fashion, to allow additional capacity to be added with future expansion of the site. The benefit of this is that by centralising the plant for future buildings, there may be significant efficiency gains possible at the central plant to further reduce running costs and energy.

6 Office Design Opportunities

Sustainable office design has developed dramatically over the past 5 years, particularly in the awareness and understanding of what the environmental impacts of office buildings are. Even though the office component of business parks can potentially be relatively small, it is arguably one of the most important parts of a building, because it is at the centre of occupant wellbeing and productivity. There is a wealth of research which indicates that worker satisfaction, retention rates and productivity can be significantly improved through the provision of a good indoor office environment.

There are two key stakeholders involved in initiatives to bring sustainability to the office component of the building:

- Global stakeholders – mostly affected by the resource use and environmental impact of operating the office, from greenhouse gas emissions, water consumption, material use, etc.
- Staff – mostly concerned with the indoor environment of the office. Air quality, lighting, noise levels access to views, natural light and removal of indoor air pollutants.

An excellent benchmarking system for office spaces exists. It is a rating system called Green Star Office Design, which is managed by the Green Building Council of Australia. The use of the rating system helps review all aspects of the office design and compare the overall environmental impact of initiatives on an equal footing.

Many of the initiatives covered by Green Star are discussed earlier in this opportunities report and relate to the entire building. This section will focus mainly on opportunities to improve the wellbeing of the office environment. Key elements to providing a good quality indoor office environment include:

- Excellent air quality, provided by:
    - Ventilation systems which supply generous amounts of fresh air, and preferably which do not recycle the air supplied to the space (examples include natural ventilation, chilled beams, full fresh air displacement);
    - Avoidance of finishes and products which emit pollutants such as Low-VOC paints, floor coverings, adhesives and low-formaldehyde furniture;
- Excellent visual comfort, provided by:
    - Effective provision of natural light;
    - Control of direct sun on the working plan and in work areas;
    - Two-component artificial lighting which includes a reflected light component to light the ceiling and task oriented lighting for desks;
- Thermal comfort for occupants, provided by;
    - Control of radiant heat through the glazed façade (usually through the use of shading and/or performance glass);
    - Air conditioning systems which minimise draft and discomfort causes by cold air movement;
    - Occupant control of comfort parameters (through, for example, occupant control of operable windows, temperatures, air flow, etc).
- Control of noise.

- Protect from external noise (especially when natural ventilation is employed)
- Minimise internal noise reverberation and allow speech privacy