Terminals Australia

Sustainability Report

January 2006

Contents

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Glossary

Alternative Waste Technology	Alternative Waste Technologies include mechanical separation systems that sort and separate waste from reusable and recyclable materials, biological processes, thermal technologies that incinerate or melt waste (also creates energy) and mechanical biological treatments
Ecological footprint:	The following definition comes from PBS (www.pbs.org/strangedays/glossary/E.html, 2005) "A calculation that estimates the area of Earth's productive land and water required to supply the resources that an individual or group demands, as well as to absorb the wastes that the individual or group produces".
Embodied energy	The following definition comes from the 'Your Home' Guide (Reardon, 2001). "Embodied energy is the energy consumed by all of the processes associated with the production of a building, from the acquisition of natural resources to product delivery. This includes the mining and manufacturing of materials and equipment, the transport of the materials and the administrative functions."
Embodied water	Embodied water like embodied energy is the water used by all processes associated with the production of the material or product, from acquisition of natural resources to product delivery, including the mining of materials, industrial processes and the transport of the material.
Life Cycle Assessment	the following definition comes from the 'Your Home' Guide (Reardon, 2001). "Life Cycle Assessment (LCA) is the method used to measure environmental impacts over the total life span of the materials. This includes extraction, manufacture, transportation, use or operation and eventual disposal or reuse. LCA can be applied to a whole product (house or unit) or to an individual element or process included in that product".
Stationary Energy:	The following definition comes from the National Greenhouse Gas Inventory 2003 Fact

	Sheet 1 (Commonwealth of Australia, 2005). "Stationary energy is energy generated from fuel combustion to provide energy in the following areas: Energy industries – electricity generation, petroleum refining, gas processing and solid fuel manufacturing. Manufacturing industries and construction – direct emissions from combustion of fuels to provide energy used in manufacturing such as steel, non-ferrous metals, pulp and paper and food processing. Other sectors – energy used by commercial institutions, residential sector as well as fuel use by agriculture, fisheries and forestry equipment and all remaining fuel combustion emissions of engine lubricating oil and military fuel use.
Thermal mass	The following definition comes from the Sustainable Development Guide for Nottinghamshire "Refers to the solid part of a building, such as block or brickwork, in which heat energy, from the sun or other sources, is absorbed, stored and then gradually given off".

Executive Summary

GHD was commissioned by Terminals Australia to prepare a report outlining the key environmental impacts and opportunities to incorporate environmental sustainability as part of the master plan. The proposal, which includes the development of a large scale transport, warehousing, manufacturing and storage of freight will have impacts on the environment.

This report provides an overview of the Building and Sustainability Index (BASIX) and the relevant targets established. BASIX applies to energy and water use in all new residential development. While addressing the relevant section of BASIX, this report goes further and also addresses the following sustainability opportunities and impacts:

- The energy use from the development including external lighting areas;
- Likely greenhouse impacts from the development including opportunities to offset greenhouse impacts;
- Surface water impacts which outlines the management issues of surface water runoff and the impacts of water use within the proposed development;
- Transport impacts
- Opportunities to improve sustainability through careful selection of materials;
- Waste generation impacts from the construction phase of the development and from the operation of the facilities; and
- Impacts on local biodiversity.

This report outlines key sustainability initiatives that if integrated into the development at the early planning stages can mitigate the impacts of the development. Examples of national and international 'best practice' have been incorporated to ensure the proposal achieves the highest sustainability outcomes and becomes a showcase for sustainability.

1. Background

Ecologically Sustainable Development (ESD) is a term used to describe developments that minimise their environmental and social impact, while maintaining economic viability. The definition of ESD developed by the Australian government states that ESD is 'using, conserving and enhancing the community's resources so that ecological processes, on which life depends are maintained and the total quality of life, now and in the future, can be increased' (DEH, 1992).

The proposed development has the capacity to have considerable environmental impacts, in the local and the broader regional context. Incorporating sustainability into the design and operation of the facility can mitigate these impacts and reduce the ecological footprint of the development.

Environmental sustainability related to buildings and construction includes addressing issues such as energy use, water use, transport, waste generation, materials selection, indoor air quality, biodiversity and occupant satisfaction. This report will address some of these issues and suggest ways to incorporate sustainability into the development.

To maintain the environmental performance of the facility once operating, Terminals Australia should consider developing an Environmental Management System (EMS) in line with International Standard Organisation (ISO) 14001. The ISO 14001 is an environmental management standard and defines a set of requirements for environmental management systems. The purpose of an EMS is to assist organisations in protecting the environment, preventing pollution, and improving their overall environmental performance and efficiency. By implementing this standard, Terminals Australia can continue to monitor its environmental performance and to ensure the sustainability initiatives integrated into the development are carried through to the operation of the facility.

2. Project description

The purpose of the Intermodal Terminal would be to provide a strategic location between the freight service user and a destination such as a port, whereby freight operators could take advantage of the road/rail transport modes. In addition, the freight operators utilise terminal facilities such as cold storage, refuelling facilities and long/short-term storage. The Intermodal Terminal would have the primary function of:

- Container stack and storage facilities, including storage capacity for empty containers;
- Warehousing and distribution facilities; and
- Associated rail and road infrastructure to support the Terminal.

The potential users of the Intermodal Terminal would include:

- Importers who are dependent on a single port of call shipping service; and importers wanting to use a single port, rather than multiple ports. Importers could build supply chains around Parkes warehouse and terminal;
- Major refrigerated facilities could be developed for cold storage;
- The Terminal could provide consolidation point for East Coast wool handling, packing and distribution for export;
- Terminal for rail fright moving to the East Coast freight corridors and for double stacking and reconfiguration of trains for West Coast services; and
- Bulk freight, including fuel and minerals could benefit from the facility.

It is envisaged that the Parkes Intermodal Terminal will be developed in a progressive basis driven by market forces.

2.1 Location

The proposed site for the Intermodal facility is located approximately 5 kilometres west of the urban centre of Parkes. The site is located south of the State Route 90, north of Brolgan Road and west of the Parkes Narromine Railway. The primary access to the site will be via Brolgan Road.

Dominant features of the landscape include the Parkes-Narromine rail line, derelict dwellings, agricultural fields and associated dwelling/fences, Brolgan Road, the Sydney-Adelaide-Perth rail line and a predominant ridge on the western side of the site.

3. BASIX

The Building and Sustainability Index (BASIX) was developed by the Department of Planning and is a NSW Government initiative to ensure new homes use less potable water and produce fewer greenhouse gas emissions. BASIX has been designed to be flexible in the ways it assesses a development, by offering a range of options that will meet the energy and water reduction targets.

BASIX applies to residential developments and requires a BASIX certificate to be submitted with the development application as part of the development approvals process. The certificate is issued once a BASIX assessment has been satisfactorily completed, using the on-line tool. The applicant is responsible for completing the assessment. This ensures BASIX commitments are marked clearly on the plans prior to development application submission (www.basix.nsw.gov.au, 2005).

BASIX is a mandatory requirement that applies to all new residential developments including multi-unit dwellings. It does not apply to alteration and additions or to commercial or industrial developments. BASIX establishes targets for energy and water that need to be met prior to Council approval. The energy target is 25% reduction (on business as usual – i.e. an average development) except in the case of multi unit dwellings that are six storeys or more. In this case the energy target is 20% reduction. The water target ranges from 40% to 0% (on business as usual) depending on the location of the development. The water reduction target for Parkes is 30% (BASIX, 2005).

BASIX considers the location, size and design features of the proposal when determining the overall score. The score correlates to the percentage water or energy saved based on a 'typical' residential dwelling. For example, 28% of the energy used in a home is on water heating. If the proposal puts in place a solar hot water system, it can receive a score of 28 based on the energy saved compared to a typical house.

Although BASIX does not cover commercial or industrial type developments, the principles of BASIX can be applied to this development. These principles include issues relating to thermal comfort such as installing insulation, heating and cooling systems, ventilation, energy and water efficient appliances and alternative water and energy supplies. These will be covered in more detail in the energy and water sections.

3.1 Resources/websites

http://www.basix.nsw.gov.au/information/index.jsp BASIX

http://www.basix.nsw.gov.au/information/common/pdf/water_target/target_map.pdf Water targets

4. Minimising energy use

Energy can come from either renewable or non-renewable sources. Renewable energy sources include solar, wind and hydro power. These sources are naturally replenished and produce very little greenhouse gas emissions when operating. Non-renewable energy sources come from diminishing stocks of fossil fuels and are finite. They can produce large amounts of greenhouse gases.

4.1 Impacts of this development

Electricity use on this site is likely to be very significant. Electricity is required to power lighting in external areas, lighting in internal areas including the administration building, the terminal plant, the warehousing and distribution facilities and the container storage areas. The major electricity use will be the lighting of the external areas. It's important to note that this is a 24 hour operation and thus, the site will be lit daily for at least 10 hours. A study of the proposal estimates that 396,347 kWh of electricity will be used annually at an estimated cost of $27,750[1].

4.2 Implementation of 'best practice' to mitigate impacts

The impacts of energy use can be minimised through conservation and efficiency measures. These include harnessing renewable energy onsite, implementing energy efficiency measures in the selection of electrical appliances systems and the incorporation of energy efficiency measures in the design of the facilities.

4.2.1 Renewable energy

There are great opportunities for this development to be a showcase for sustainability by producing some of its energy requirements onsite. There are limited opportunities for wind turbines; therefore the most practical way of generating energy onsite will be through the use of photovoltaic panels. There are a number of photovoltaic manufacturers in Australia including British Petroleum (BP), Uni-Solar, Kyocera and Sharp.

Though the exact number of solar panels depends on installation, conditions and the efficiency of the panel, to generate 1% [2] of the site's energy needs, approximately 25 PV panels will need to be installed.

There are a number of rebate schemes to promote solar installations. The Commonwealth and NSW State government have rebate schemes that may offset the initial costs of utilising solar energy. These schemes include the Federal Renewable Remote Power Generation Program. The Federal government provides rebates of up to 50% of the capital costs to install solar panels to generate 'clean' energy that would otherwise come from diesel generators. The State government also provides additional funding, though this is restricted to systems that will generate more than 10 kW of energy.

1 Based on estimated energy costs per kWh. This does not factor in the cost of network charges or any additional market charges this site may incur. The actual price for this site will vary and it is important to investigate this further.

2 Data estimated using a 160 watt PV panel as a standard panel installed. The actually number of PV panels will vary depending on the brand and the efficiency. It is important to investigate these options further. The amount of energy converted also depends on environmental conditions and installation.

BP also operates an Enviro cash back scheme for those that install BP panels. This scheme provides the customer with a manufacturer cash back rebate and payments for the value of the emissions saved. This is known as the Renewable Energy Certificate (REC), in accordance with Federal government legislation.

These schemes have specific eligibility criteria, therefore it's important for Terminals Australia to consider this when developing its environmental plan.

Another opportunity is to install solar streetlights for some external lighting areas. The approximate cost of these systems will be approximately $5000 [3] per streetlight though this will be offset by savings made to reduce demand on utilities. This provides an important cost saving, particularly during peak daytime and summer time rate periods, which is when solar panels generate the most energy. Additionally, the costs of electricity are predicted to rise, reducing the payback period.

Carefully sizing the solar panel for the streetlight and matching it to the lamp size can reduce the net energy consumption of the lighting installation over a year to zero. As electricity tends to be more expensive during the day (when demand is highest), there may be additional financial benefits in this option.

4.2.2 Building design

The design of a building is very important in ensuring sustainability considerations such as energy are incorporated at an early stage. For the Parkes Intermodal Facility this includes the location of buildings and external lighting and the design of buildings to minimise energy requirements for lighting, heating, cooling and ventilation.

The proposal will need to incorporate the principles of passive design into the design of the administration, warehouse and maintenance buildings. Incorporating passive design will make buildings more comfortable for the employees and will save money from reduced lighting heating/ cooling and ventilation energy use. The principles of passive design need to address the orientation of a building (north facing windows will reduce lighting and heating energy requirements, though care needs to be taken to minimise overheating and glare), shading (by using plants and well designed eaves), insulation and allowing for cross ventilation (consider a convector stack that releases hot air, while drawing in cooler air).

Parkes experiences hot dry summers and very cold winters, therefore the design of the buildings will need to consider the local climate. Incorporating the appropriate thermal mass into the design and materials selected for the development will moderate the internal temperatures by averaging the day and night extremes in temperatures, increasing comfort and reducing energy costs. The thermal mass needs to absorb heat and re-radiate it and allow convection currents to pass over the mass and draw out heat. This can be achieved by having dense materials, such as concrete which has a high thermal mass. The materials used need to also have good conductivity (concrete or brick) and be dark, matt or textured (to absorb and re-radiate more energy). Things to consider are the locations of the thermal mass and the embodied energy of the materials.

3 Information gained by averaging the cost of solar streetlights from different suppliers. For more accurate estimates contact the chosen solar streetlight provider.

Other considerations include the materials used, such as windows and the window frame. To minimise energy use, double glazed windows should be used. The frames are also important. Aluminium frames reduce the insulation value of the window. For good results Fibre-Reinforced Polyester or uPVC frames should be used. Alternatively, Terminals Australia can use the Window Energy Rating Scheme to assist in selecting the appropriate windows and frames. This rating scheme is similar to the star rating scheme of electrical appliances.

Incorporating zoning of lighting and cooling requirements will impact on the energy use during the operation of a building. Different areas of a building have different heating, cooling, ventilation and lighting needs. Creating controlled zones ensures the appropriate amount of air, temperature and light is provided, reducing excess energy use on areas not requiring high lighting and air conditioning.

Designing and installing sensors can reduce energy use during the operation of the building. There are different sensor types including light lux level sensors (or photoelectric sensors) that adjust lighting in accordance with the amount of natural light entering the specific area, timers (to switch off lights at certain times), movement sensors (can be installed in meeting rooms or bathrooms) turn on lights when movement is detected, carbon dioxide sensors adjust ventilation rates to ensure enough fresh air is supplied and temperature sensors that adjust ventilation and heating and cooling systems as required.

Once operational, Terminals Australia can investigate participating in sustainability accreditation schemes such as NABRS (currently being developed by the Department of Utilities, Energy and Sustainability) or the Australian Greenhouse Rating Scheme (ABGR), which will establish industry standards in ‘best practice’.

4.2.3 Energy efficiency measures

As well as addressing the source of energy and the design of the facilities, Terminals Australia can reduce its energy use by considering the energy efficiency of lighting and office equipment.

External areas can be lit by energy efficient streetlights such as Light Emitting Diodes (LED). They use 30% less energy than normal streetlights and have a long life expectancy (100,000 – 200,000 hrs or 20 years). Other energy efficient lighting technologies include T5 lights. T5 lights are 45% more efficient than mercury vapour lamps.

It’s also important to consider lighting needs in internal areas. Internal lighting and the heating/ cooling and ventilation system (HVAC) are the two areas that use the most energy in office buildings. Energy efficiency measures that can be incorporated at the design stage to reduce energy needed for lighting include using energy efficient fluorescent tubes such as T5 or T8. Sulphur lights can also be used in commercial and industrial applications and are energy efficient. Better results can be achieved by combining energy efficient light fixtures and lights with reflectors.

Energy efficiency measures need to be incorporated into the HVAC system of the administration building. Some options for reducing energy use from air conditioning are to incorporate natural and passive ventilation in place of mechanical ventilation. If air conditioners are to be used they should have an energy rating of at least 4.5 stars.

Energy can be saved from heating requirements by investigating opportunities for cogeneration and geothermal applications. Cogeneration systems burn gas to produce electricity and use the waste heat locally, thus reducing energy needs for heating. Geothermal systems use the earth's ground temperature as a source of heating and cooling of a building. If heaters are to be used they need to have an energy rating of at least 4.5 Stars.

When purchasing equipment, Terminal Australia should consider the energy requirements during the life of the equipment and investigate more efficient options, if available. There are many opportunities to incorporate energy efficient equipment in the administration building. As well as the heating and cooling requirements that have been discussed, purchasing energy efficient office equipment such as printers, photocopiers and computers can further reduce energy requirements. For example, Liquid Crystalline Display (LCD) computer monitors use 77% less energy than Cathode Ray Tube computer monitors. Additionally, due to the reduction in the internal heat load of the monitor, this can have flow on impacts to cooling requirements (Department of Environment and Heritage, 2005). Ensure all office equipment is Energy Star enabled so that they switch to low energy mode when not in use. This simple action has the potential to save considerable energy.

A purchasing policy will need to be developed that includes selection criteria such as energy and water use, waste generation, recyclability of materials and recycled content of materials.

4.3 Resources/ websites

http://www.bp.com.au/solar/default.asp BP solar website

http://www.sunlightsolar.com.au/ solar streetlights

http://www.sunlightsolar.com.au/LED%20street%20lights.htm LED streetlights

http://www.designawards.com.au/ADA/03-04/Furniture%20and%20Lighting/134/134.htm T5 Streetlight

http://www.greenhouse.gov.au/lgmodules/wep/streetlighting/index.html Department of Heritage Streetlight toolkit

5. Minimising greenhouse impacts

Global warming is one of the most critical issues facing the world today. Australia's greenhouse gas emissions in 2003 were 550 million tonnes (Mt) making Australians the highest greenhouse gas producers per capita in the world. Australians produce 30% more greenhouse gas emissions per capita than Americans and more than double of those in other industrialised countries. Australia's total greenhouse emissions exceed those of major European countries including France and Italy (Clarke, 2005). Also, there has been a 34% rise in stationary energy use, which accounts for 49% of total CO_2 emissions. The transport sector accounts for 15% of total CO_2 emissions (AGO, 2004).

It is predicted that annual temperatures will rise by 0.4 to 2 degrees Celsius by 2030 and by 1 to 6 degrees Celsius by 2070 (AGO, 2004).

5.1 Impacts of this development

This development has the potential to produce significant levels of CO_2 emissions, the main greenhouse producing gas. CO_2 emissions will be produced during the construction and operation of the proposed development.

5.2 Implementation of 'best practice' to mitigate impacts

In addition to the energy efficiency measures (discussed in the minimising energy use section), this development can mitigate its greenhouse gas emissions by offsetting them. Greenhouse offsets from this site include purchasing accredited *GreenPower* from the electricity provider. The percentage of G*reenPower* purchased will need to be negotiated with the electricity retailer. The percentage purchased ensures investment in renewable energy sources to source that percentage to feed back into the grid.

Another way of offsetting greenhouse impacts is through tree planting. Trees absorb CO_2, hence reducing CO_2 levels in the atmosphere. This development can offset its greenhouse gas emissions, by planting locally indigenous trees on the site. This will improve biodiversity and reduce the greenhouse gas impacts of the development. A possibility is to investigate opportunities to make the operation of the development greenhouse neutral through tree planting, generating renewable energy onsite and purchasing *GreenPower*, thus setting the benchmark for 'best practice'.

5.3 Resources/ websites

http://www.greenhouse.gov.au Australian Greenhouse Office

6. Minimising surface water impacts

The continuing drought in NSW and the impacts of global warming is making water management a very important sustainability issue. Nationally, approximately 55% of water is used in industrial and urban applications. Globally, industrial developments consume 23% of total water consumed.

Parkes is located in an arid region and forms part of a catchment with two major river systems: the Bogan and Lachlan Rivers, which are major tributaries of the Murray Darling Basin system. The site is situated in an area with an annual average rainfall of 588 mm and an area that experiences climatic extremes with very hot summers and very cold winters. Therefore it's important to have water efficiency measures in place. Water saving initiatives include reducing water demand through efficiency measures, harvesting rainwater, onsite wastewater reuse, stormwater management and outdoor water use. Minimising water use saves money on water bills, reduces infrastructure operating costs, reduces energy bills and places less pressure on water utilities particularly during drought periods. This development can reduce its water needs by harvesting rainwater and implementing water efficiency measures.

6.1 Impacts of this development

Once constructed, the development will have over one million square meters of paved (impermeable) areas, which affect the hydrological cycle. This 'hardening' of the surface will result in reduced infiltration of rainfall to the soil and more rainfall becoming runoff. If not managed effectively, key impacts could include:

- Impacts to the water balance, in groundwater recharge. This has the potential 'knock-on' impact on local base flows effecting streams and groundwater;
- Stormwater pollution (by runoff and accidental spills entering the stormwater system). Also, the increased stormwater runoff volumes, could impact on downstream creeks in terms of flushing regimes (frequency, volume and rate), water quality, and wetting cycles;
- Construction phase impacts, such as erosion and sedimentation;
- Development and infrastructure on the site could lead to increased recharge due to removal of vegetation, over-irrigation, and structural leakages; and
- Site compaction, fill, landform reshaping and underground structures could impact groundwater flow.

There are potentially a number of causes leading to pollution of stormwater discharging from the site. They include:

- Increased runoff volume during regular rainfall events would more readily entrain and mobilise pollutants (particularly first flush) and increase pollutant loads to the receiving environment;
- The type of development and associated activities may introduce differing pollutant profiles; for example, vehicular traffic could increase hydrocarbon introduction. In general, typical pollutants include litter, sediment, suspended solids, nutrients, hydrocarbons and toxicants;
- Accidental spills on un-bunded areas of the site could discharge to the site stormwater system and the receiving environment. This could lead to groundwater contamination;

- The generation of wind borne sediment/material by any of the operational activities could be deposited to the stormwater system;
- Contamination from waste streams from the site entering the drainage system and groundwater;
- Contamination from storage facilities (for example machinery storage), and covered/uncovered works areas which may include fuel, oil, grease, coolant, solvents and/or cleaning agents; and
- During construction there is a significant risk of increased stormwater pollution. This is further discussed below.

Onsite stormwater runoff peak flow rates and volumes would increase due to the increased impermeable surfaces. During moderate rainfall events the resultant discharges can be highly erosive to stream beds/banks and the receiving environment, thereby causing downstream degradation. Increased peaks would raise onsite and offsite flood risk if not adequately managed. This could raise the flood risk (to life and property), compromise downstream infrastructure capacity and impact downstream environments leading to increased erosion and sedimentation. Flood risk at the site could also be impacted by local drainage channels that bisect or are located in close proximity to the site, and that convey runoff from larger upstream catchment areas either through or past the site.

During the construction phase, clearing and earthmoving activities have the potential to impact on surface water quality at or in the vicinity of the site, especially during high rainfall events. The activities and aspects of the works that have potential to lead to erosion, sediment transport, siltation and contamination of natural waters include:

- Earthworks undertaken immediately prior to rainfall periods;
- Work areas that have not been stabilised, and clearing of land in advance of construction works;
- Stripping of topsoil, particularly in advance of construction works;
- Bulk earthworks and construction of pavements;
- Washing of construction machinery;
- Works within drainage paths, including depressions; and
- Maintenance of plant and equipment.

6.2 Implementation of 'best practice' to mitigate impacts

6.2.1 Onsite water surface water management

A number of measures can be implemented to effectively manage and mitigate the above-mentioned impacts:

- *Water balance*
  - Provision of stormwater retention strategies and infiltration;
  - Rainwater harvesting;
  - Management and monitoring of onsite activities (irrigation) and infrastructure (leaks);
- *Stormwater pollution* (by runoff and accidental spills entering the stormwater system)
  - Treatment of stormwater targeting pollutants;

- Bunding;
- First flush systems;

» *Stormwater peak flows and flood risk (onsite and local)*

- Onsite detention strategies;
- Flood planning levels;
- Flood evacuation;

» *Construction phases Impacts*

- Soil and Water Management planning for construction activities;
- Implementation of erosion and sediment control strategies;
- Ongoing monitoring and maintenance of erosion and sediment control strategies;

These strategies would need to be incorporated into the detailed design of the proposal and measures to monitor their effectiveness would need to be included in the construction and operation environmental management plans.

Water Balance

The impacts on the water balance at the sites can be mitigated and managed by:

» Provision of stormwater retention strategies and infiltration-based management where site conditions permit. These can be provided in the form of dedicated infiltration areas, permeable pavers for roadways and paths, bio-retention swales and extended detention water bodies and wetlands. Infiltration strategies would need to maintain the movement of groundwater to such artificial wetlands; and

» Management and monitoring of onsite activities and infrastructure will also be essential in managing the water balance, to prevent over-recharge to the groundwater.

Stormwater quality and pollution

Stormwater quality and pollution can be effectively managed and mitigated by providing a number of strategies, which typically comprise both structural and procedural mitigation measures, and should aim at 'source control':

» Proposed structural measures (for example first flush basins and drains) are likely to have a direct, measurable effect on water quality while, procedural measures (for example improved housekeeping/maintenance) will play an important role in mitigation and will reduce the pollutant load on the structural mitigation measures. This will manage water quality and reduce the maintenance requirements for the structural measures. Key opportunities identified for the site include:

- Opportunities for diverting "clean" stormwater, preventing contact with contaminated runoff;
- Reduction in the sediment load by source controls from high risk contamination areas. This could be achieved through housekeeping, maintenance, treatment of surfaces and diversion and treatment of stormwater runoff using first flush basins and other treatment strategies;
- Separation of wastewater and stormwater streams across the site;
- Separation of roof water from primarily the office, warehouses and storage facilities and surface stormwater runoff, if appropriate;

- Provision of structural mitigation measures such as Gross Pollutant Traps and Oil and Water Separation Devices; and
- Maximising vegetated overland flow paths for stormwater runoff, by using swales, buffer strips and bio-retention swales.

» All contamination areas, for example fuel storage areas can be bunded to contain overflows or accidental discharges. A plan would need to be developed to manage disposal of contaminated runoff from within the bunds, potentially for reuse or as a licensed discharge;

» All hardstand areas can be directed to first flush basins. This captured runoff can be reused on site, or discharged to the stormwater system if of suitable quality; and

» Site maintenance will be the key to managing stormwater pollution. This may require frequent sweeping and regular house keeping practices. Regular maintenance of stormwater infrastructure, particularly water quality strategies will be essential.

Stormwater peak flows and flood risk

Onsite detention in the form of on-ground basins and storage areas, or in-ground tanks can be used to effectively mitigate the increase in peak flows. In addition, stormwater quantity management can be achieved by:

» A general site grading towards the discharge outlet point;

» Kerbs and gutters on internal roads collecting runoff and discharges, after treatment and reuse, via an internal stormwater pipe network and conveying these to a detention basin; and

» Adopting flood planning levels, which ensure that floor areas are located above any flood levels on account of on-site and local flood peaks; and

» Providing a flood evacuation plan/strategy for the site.

Construction phase impacts

Construction phase impacts can be managed by implementation of a ‘Construction Phase Soil and Water Management Plan’ detailing stormwater management strategies. These would include amongst others:

» General site practices and responsibilities

» Material management practices;

» Topsoil practices; and

» Erosion control practices (earth sediment basins, straw bales, sediment fences, turbidity barriers, stabilised site accesses, diversions and catch drains).

6.2.2 Water reuse

In general, water reuse onsite is dependant upon water quality and finding a suitable use with effective yet minimal water treatment measures. There is an optimum storage volume that will maximise the water supply while minimising the number of overflows from the storage facility. Rainwater harvesting for reuse can be sourced from roofed areas and from on-ground stormwater runoff. Roof water would require adequate first flush treatments and can be directed to a single or a number of holding tanks for re-use as process water, toilet flushing or irrigation of landscaped areas. On-ground stormwater can be directed to in-ground storage facilities and reused for landscape irrigation

Although the develop may not generate major quantities of grey water, implementation of a grey water reuse program should be investigated. Water reuse is when wastewater from the site is used again for another purpose within the site, rather than being discharged to the sewerage system (Sydney Water, 2005).

6.2.3 Water efficiency

Operational water use can be minimised through monitoring meters and sub-meters to identify water use and leaks. To reduce water loss through leaks, maintenance regimes need to be implemented to ensure water leaks are promptly reported and fixed. Where possible, water efficient appliances and equipment should be purchased. Although the operation of the development may not require a lot of water, it is important to ensure the development incorporates water efficiency measures. This includes incorporating initiatives such as having sensor operated taps and flow restrictors for taps.

Toilet flushing uses a lot of water. This can be minimised by installing 3 L/ 4.5 L dual flush toilets, sensor controlled urinals or installing waterless urinals. The water-free and odour-free urinals use an odour trap instead of a water flushing system. Waterless urinals save on the cost of installing and maintaining the urinals and also on the cost of water which would otherwise be needed for flushing (Specnet, 2005).

If shower facilities are included as part of the development, ensure the showerheads are AAA or AAAA rated. Water efficient showerheads can more than halve the water used during a shower and will also save money on energy bills.

Retaining and planting vegetation on the site, particularly deep rooted trees can lower the water table, bind the soil, filter nutrients and decrease runoff velocities, capture sediment and reduce the potential for dryland salinity in addition to managing stormwater runoff. Stormwater can further be managed by retaining stormwater onsite with impermeable paving, pebble paths, infiltration trenches, soak wells, swales and garden areas. Planting locally indigenous drought tolerant species not only improves the biodiversity of the site, but will also reduce water needed to water a water thirsty garden planted with exotic species.

Minimising water use through water efficiency measures in addition to rainwater harvesting and surface water runoff management will ensure this development minimises its water impacts on the environment, thus ensuring a sustainable development.

6.3 Resources/ website

http://www.tradelink.com.au/trade/content/?action=getfile&id=14 Waterless urinal

7. Minimising transport impacts

The transport sector is the second highest greenhouse gas producing sector in Australia, accounting for approximately 15% of total CO_2 emissions. Greenhouse gas emissions from the transport sector are expected to rise by 42% between 1990 and 2010. Approximately 88% of these emissions come from road travel including cars, trucks and buses (AGO, 2005).

7.1 Impacts of this development

It is estimated there will be 48 trains and 1,792 trucks will move through the proposed development per week (GHD Pty Ltd, 2005). As well as the impacts on air quality, the vehicle movements will generate CO_2 emissions. Although Terminals Australia cannot fully control the transport impacts of the development, there are opportunities to promote greenhouse issues. A business as usual assessment of the site can be conducted. This assessment needs to compare the greenhouse gas emissions of hauling freight using trucks only and compare it to the greenhouse gas emissions from using rail and trucks. It's estimated that rail freight uses one third of the fuel used by road transport per tonne of freight hauled. Rail is twice as energy efficient as road transport even when considering the fuel used for rail haulage, road pickup and delivery from the rail terminus, manufacture of transport equipment and the construction of roads and railway lines (GHD Pty Ltd, 2005). The CO_2 savings can be documented to promote the sustainability of the proposal in reducing transport impacts.

7.2 Implementation if 'best practice' to mitigate impacts

The proposal can promote government initiatives such as the Alternative Fuels Conversion Programme. This program is designed to assist operators and manufacturers of heavy commercial vehicles and buses (>3.5 t GVM) to convert to Natural Gas or Liquefied Petroleum Gas (LPG). The programme provides grants of up to 50% of the cost of converting existng vehicles from diesel to LPG or to purchase new LPG vehicles (AGO, 2005).

Terminals Australia can take a leadership role in offsetting a proportion of the greenhouse gas emissions from the vehicles that pass through the proposed development by investing in tree planting initiatives such as *GreenFleet. GreenFleet* currently operates in most Australian states and territories including NSW. This program plants a locally indigenous species mix in areas of environmental concern. To date *GreenFleet* have planted over 2 million trees nationally. *GreenFleet* charge 40 dollars to plant 17 trees. This is based on the number of trees required to offset the CO_2 emissions from the average car per year (4.3 tonnes). Should this option be pursued, Terminals Australia will need to negotiate and coordinate a suitable fee for offsetting greenhouse gas emissions from trucks.

As well as the vehicles that pass through the proposed development, this proposal is a trip generator (for anyone who comes to the site, including staff, clients, customers, visitors, couriers etc). It is assumed that most staff will be from Parkes, therefore there are great opportunities to minimise their transport impacts. Although these impacts may be insignificant compared to the transport impacts of the truck and train movements, opportunities exist to implement programs to reduce traffic to the site. This can be achieved by providing a shuttle bus service from Parkes to the site, particularly during the construction phase when it is estimated that 600 workers will be involved in the proposal.

The proposal is also within easy riding distance from the Parkes urban centre (5 km), thus it is possible that some employees may want to ride a bicycle to the site. To facilitate this, lockers, showers and bike racks are needed at the site. A 'tuck shop' and some food preparation facilities in the administration building will reduce the need to travel to the Parkes to purchase food, coffee and drinks, further reducing traffic from the site impacts.

7.3 Resources/ websites

http://www.greenfleet.com.au/ Greenfleet

http://www.greenhouse.gov.au/transport/afcp/pubs/type-guidelines.pdf Alternative Fuels Conversion Program

http://www.greenhouse.gov.au/transport/index.html AGO Sustainable Transport

8. Materials selection

8.1 Impacts of this development

The materials selected for the construction of the development can have health and environmental impacts that extend beyond their specific use on site. The impacts of materials include the embodied energy and water of the material and the potential to impact on toxicity in manufacture. The impacts of materials can occur at all stages of the lifecycle from extraction and processing, to use, maintenance and disposal. As well as considering the cost and suitability of materials in the proposal, Terminals Australia should also consider issues such as lifecycle analysis and the embodied energy of materials. Table 1 outlines the embodied energy of different building materials.

Table 2 Embodied Energy of Building Materials

Material	Per embodied energy MJ/KG
Plastics (general)	90
PVC	80
Acrylic paint	61.5
Plasterboard	4.4
Fibre cement	4.8
Cement	5.6
Insitu concrete	1.9
Precast tilt-up concrete	1.9
Clay bricks	2.5
Concrete blocks	1.5
AAC	3.6
Glass	12.7
Aluminium	170
Galvanised steel	38

Source: 'Your Home' Guide (Reardon, 2001)

8.2 Implementing 'best practice' to mitigate impacts

Undertaking a full lifecycle analysis of materials can be a complex process, however there are some simple ways to reduce the embodied energy of materials, including designing for long life of buildings. Designing buildings and facilities at the site to be flexible in use allows for adaptability. Materials that require low maintenance reduce the additional energy input during their life. One very simple way of reducing the embodied energy of materials is to use reused materials, or to use materials with recycled content. 'Reusing materials can save about 95% of the embodied energy that would otherwise be wasted' (Reardon, 2001). Terminals Australia can investigate opportunities to use recycled concrete in some areas. This should be done in accordance with the *Specification for Supply of Recycled Material for Pavements, Earthworks and Drainage,* developed by ResourceNSW (now the Department of Environment and Conservation), the Construction and Demolition (C&D) branch of the Waste Management Association of Australia and the Institute of Public Works Engineering Australia.

Other considerations when selecting materials include sourcing materials from local suppliers (to reduce transport costs and greenhouse gas emissions), selecting materials with low toxic emissions and selecting materials that are highly reusable and recyclable under current technologies. This ensures materials can be easily recovered at the end of the facilities' life. The toxicity of materials to the environment is an important issue and can be addressed by specifying materials that are not listed on the National Pollutant Inventory.

Websites such as '*Ecospecifier'* provide details on over 1000 environmentally preferable products, materials and resources. This can be a very useful resource when considering and selecting materials during the design phase of the development.

The materials selected can also have an impact on Indoor Air Quality (IAQ). Occupants of buildings with poor IAQ can suffer from headaches, fatigue, coughing, sneezing, dizziness and eyes, nose, throat and skin irritation. Studies have shown that poor indoor air quality can have a negative impact on workplace productivity, therefore it is important to address indoor air quality impacts when selecting materials. Avoiding or minimising the following can achieve this:

» Materials that emit volatile organic compounds (VOCs). VOCs are chemical substances that at room temperature become volatile or air borne. Most paints, paint strippers, wood preservatives, aerosol sprays, glues, cleansers and disinfectants and stored fuels and automotive products give off VOCs.

» Formaldehyde is a common VOC, which is released from some manufactured wood products such as plywood, wall paneling, particleboard, fibreboard and furniture made with these products. Formaldehyde is also released from combustion sources, tobacco smoke, treated textiles, and some glues.

» Carbon monoxide and nitrogen oxide sources include automobile exhaust from attached garages, and tobacco smoke.

» Xylene and Toluene are solvents in paints, glues and carpets as well as polyurethane.

8.3 Resources/ websites

http://www.resource.nsw.gov.au/data/18-6%20Green%20Spec%202003.pdf Greenspec

www.npi.gov.au/ National Pollutant Inventory

http://www.ecospecifier.org/ Ecospecifier

http://www.deh.gov.au/atmosphere/airquality/indoorair/index.html DEH

9. Waste minimisation

Australians on average generate approximately one tonne of waste per person per year, 40% of which is construction and demolition (C&D) waste. In NSW over 4 million tonnes of waste are disposed at landfill per year, of which approximately 20% is C&D waste and 40% is commercial and industrial (C&I) waste.

To address waste management the NSW *Waste Avoidance and Resource Recovery Strategy* establishes targets for 2014 and key outcome areas. They are to avoid and prevent waste, increase the capture and use of recoverable and renewable materials, reduce toxicity in materials and to reduce littering and illegal dumping. Specific targets to increase resource recovery for the different waste sectors are to increase C&D waste recovery from 60% to 76% and to increase C&I waste recovery from 28 % to 63% (Resource NSW, 2003).

Recovering building waste will continue to be a major sustainability issue. The World Watch Institute predicts that by 2030 most of our building materials will come from recovered resources. This is one of the reasons to apply the waste hierarchy of: Avoidance, Resource Recovery and Disposal to all stages of the development.

9.1 Impacts of this development

There is great potential for this development to generate large volumes of waste, during both the construction and operational phases. The location of the proposed development is a greenfield site that will require significant amounts of excavation. As Table 2 shows, soil and rubble makes up a large proportion of the C&D waste stream, hence it is important to minimise the amount of soil and rubble leaving the site during the construction phase.

Table 3 NSW construction and demolition waste generation rates

Material	Disposed to Landfill (tonnes/year)	Proportion of total C&D waste
Soil/Rubble	360,000	36%
Other (eg. Metal, packaging)	220,000	22%
Concrete based	160,000	16%
Clay based	160,000	16%
Timber	100,000	10%
Total	1,000,000	100%

Source: Wright,2000 Independent Public Assessment – Landfill Capacity and Demand. State Government of NSW, Office of Minister of Urban Affairs and Planning.

The development is also likely to generate high quantities of concrete and metals such as steel. These materials are highly reusable and recyclable and efforts should be made to plan for the likely quantities of materials generated during construction of the proposal.

9.2 Implementation of 'best practice' to mitigate impacts

9.2.1 Construction waste

Currently, Parkes does not have a waste management facility to recover and recycle waste, therefore it is very important to avoid creating waste through design and to ensure the buildings are constructed to allow for future disassembly. The design of the facilities should incorporate the following principles:

- Minimise cut and fill. If this cannot be avoided, reuse excavated material onsite;
- Include waste management clauses in contracts to ensure contractors are aware of the waste management targets and objectives of the development and their obligations;
- If possible, design for standard sizes, this avoids unnecessary offcuts and waste generation;
- Use pre-fabricated components. Usually, pre-fabricated components are delivered to site where they are assembled, saving money and reducing onsite waste;
- Specify for materials that are easily reusable and recyclable, avoiding potential future waste;
- Design for disassembly to ensure the buildings are able to be easily taken apart, thus facilitating future resource recovery;
- Look at ways of using materials that have recycled content;
- Avoid specifying and ordering potentially harmful substances and materials; and
- Arrange supplier take-back for excess or damaged material and for excess packaging.

9.2.2 Operational waste

Waste management onsite also extends to waste generated during the operation of the building. Although, currently the Parkes area has no recycling facilities, the development should be designed so as to maximise opportunities for future waste recovery through reuse and recycling. Table 3 outlines waste likely to be generated from the operation of the proposed development that can be reused and recycled.

Table 4 Reusable and recyclable waste likely to be generated from proposal

Paper/cardboard
Food organics
Oil
Batteries
Packaging waste including plastic strapping
Containers (aluminium cans, plastic bottles, glass, cartridges)
Metal
Wood products and off-cuts including timber pallets and sawdust

Although no current waste management facilities exist in Parkes, future recovery of waste should be facilitated through the design of the proposal to allow for storage room/ areas and manoeuvrability of waste containers such as bins or skips. It is also possible that waste may be transported in fright containers via rail from the site to other locations with proper waste recovery facilities. This makes the storage areas designed in the development important. Incorporating and implementing the following guidelines in the design and operation of the development will ensure maximum recovery of waste:

- Calculate the type and the volumes of waste expected to be generated by the operation of the proposed development. This should include waste generated from the office, landscaped areas, refuelling facilities and warehousing and distribution activities. These should be based on industry standards;
- Ensure the proposal has been designed with storage areas. The waste storage areas should have sufficient room to store the required containers to accommodate the estimated quantity of waste and recyclables generated and to allow for manoeuvrability;
- Waste storage areas need to be undercover and drained to sewer;
- Terminals Australia needs to select appropriate waste handling equipment and the design has to allow adequate space for onsite separation, storage and manoeuvring of waste prior to collection and transport;
- There should be adequate space for the storage of containers of at least three waste streams – recovered waste (for reuse or recycling), residual waste (for disposal or Alternative Waste Technology) and hazardous waste (wastes that are toxic, corrosive, flammable, explosive or reactive);
- Design a separate storage area for liquid wastes (oils etc) that is bunded and drains to grease trap. Liquid wastes from grease traps must only be removed by a licenced contractor approved by the relevant water authority or NSW DEC;
- Provide adequate space for bulky items;
- Provide a separate storage and collection area for hazardous/ special wastes;
- The waste storage areas and wash down areas should have smooth, impervious floors, be graded to a silt trap and connected to the sewer;
- Prevent wastewater (from cleaning the waste storage area (s) and bins) from entering the stormwater system;
- Comply with WorkCover NSW requirements for the storage of dangerous goods;
- Ensure there is adequate drainage;
- Provide details of provision made to prevent waste water, liquids, solid waste and debris from entering stormwater drains;
- The proposed development must comply with the Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Waste (DEC) http://www.epa.nsw.gov.au/resources/waste_guide.pdf;
- Ensure the waste storage areas do not compromise fire safety objectives by having adequate fire protection measures in accordance with Australian Standards;

» This site will be used for goods receival and export. Therefore the waste storage areas should be designed to be separated from the goods receiver dock, particularly if more than 10 m^3 of uncompacted recyclable materials and waste is likely to be generated per day. Use compaction units where appropriate;

» Though the site is located away from the town centre and not close to residents, there may still be a need for security measures of waste storage areas, particularly if hazardous wastes will be stored onsite. Terminals Australia needs to ensure the design the storage area is secure by providing security access measures. This will prevent entry to the waste storage areas, scavenging, vandalism and illegal dumping. Some measures can include fences, lockable gates, natural barriers such as ditches and embankments and surveillance systems; and

» In future a private waste contractor may be used to manage the site waste. Terminals Australia needs to provide access for servicing and for the collection of waste by a private contractor where desirable and/or necessary;

» Provide a proper transport route to the main or communal storage area;

» If a private contractor is employed, access to the storage areas by collection trucks should implement measures for road design to have adequate strength, clearance and geometric design for truck movements on access driveways and internal roads;

9.3 Resources/website

http://www.resource.nsw.gov.au/cd2.html Department of Environment and Conservation, C&D case studies

http://www.resource.nsw.gov.au/strategy.htm#download Waste Avoidance and Resource Recovery Strategy

10. Ecology and biodiversity

10.1 Impacts of this development

The proposed site is on land that has previously been cleared for agricultural use. There are two main vegetation communities open grassland and open woodland communities. There have been no threatened species found at the site and the site is not listed as a threatened ecological community, therefore the proposal is unlikely to have a significant impact on local biodiversity. Despite this, there are opportunities to potentially improve the biodiversity of the site. Areas that have been restricted from grazing are of a higher ecological value than the rest of the site therefore it's important to maintain this by fencing this area (GHD Pty Ltd, 2005).

10.2 Implementation of 'best practice' to mitigate impacts

Tree planting of locally indigenous plant species can create a habitat for some wildlife, buffer some of the noise generated from the site and improve the local air quality. Additionally trees planted can act as a greenhouse sink, offsetting some of the greenhouse gas emissions generated from the site.

Parkes Shire Council has a list of locally indigenous plants. Terminals Australia can work with Parkes Shire Council and the community to undertake tree planting of the area and to investigate the possibility of linking this to remnant vegetation. This can create a wildlife and plant corridor, increasing habitat, facilitating movement of wildlife and improvement in the local biodiversity.

To minimise site impacts effective sediment and erosion controls should be in place onsite and sediment contaminated water should be prevented from leaving the site.

Social considerations also form an important part of sustainability. Part of the re-vegetated area can provide employees of the facilities with shaded outdoor seating areas and small parklands, creating a pleasant area to eat lunch or simply to relax.

10.3 Resources/websites

http://www.basix.nsw.gov.au/pdf/indigenous_species/4.pdf List of indigenous and low water plants

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