

# EGLINTON

LOCAL STRUCTURE PLAN AUGUST 2010

APPENDIX 1: SUSTAINABILITY STRATEGY



# LSP

EGLINTON ESTATES, OCEANSCAPES ALLIANCE

• GHD; development planning strategies; macroplan; urbis;  
skm; coffey environments; ethnosciences; david lock associates;  
woodsme management; cossill and webley; geografia



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# Executive Summary

## Scope and Approach

The purpose of this report is to outline how the Eglinton Local Structure Plan (LSP) will address and implement sustainability initiatives relevant and considered important to the residential estate.

The Eglinton Local Structure Plan area is approximately 633ha of which around 198ha is owned by Oceanscapes Alliance, a partnership between Eglinton Estates and Stockland; the balance area is owned by Eglinton Estates.

Eglinton will be developed for residential and commercial purposes including the Eglinton District Centre, Urban Development, including primary schools and playing fields, the Eglinton Marina and Coastal Village, Regional Open Space and Public Open Space as indicated in the Local Structure Plan.

This document follows the sustainability elements set out in the DSP demonstrates how the objectives and strategies detailed in the DSP have been further developed, guided and informed the LSP design, and will be progressed following approval of the LSP.

The document is structured in accordance with the DSP report, and outlines objectives and strategies under the elements of Community, Water, Energy and Greenhouse Gases and Ecosystem Health.

Sustainability objectives and strategies developed for the LSP, together with actions required to progress the strategies post LSP are set out in the tables below.

## Community

Objective	Strategy	Post Structure Plan Actions
C1 Promote investment consistent with strategic vision	Investigate and allow for marina and tourism associated development at Eglinton with a resort centre and hotel	Investigate details and feasibility for marina and resort development, including scale and operation of resort Identify specific development sites for tourist facilities (according to investigation above)
	Develop regional commercial and employment centres, integrated for Eglinton and Alkimos town/activity centres	Implementation of economic and employment strategy
C2 Advocate provision of communications infrastructure	Develop broadband and intra-network infrastructure (e.g. to support home based work)	Infrastructure to be incorporated in subdivision works
C3 Encourage diversity of housing	<ul style="list-style-type: none"> <li>Allow for housing sizes to match emerging demography</li> <li>Allow for the development of wide range of housing types</li> </ul>	Undertake ongoing research to inform discussions on provision of housing sizes / types Ensure Design Guidelines accommodate housing size and diversity strategies
	Investigate and allow for affordable housing initiatives for both sale and rent	Consider appropriate affordable housing strategy for Eglinton Facilitate and encourage partnership approach to delivery of affordable housing
C5 Encourage social cohesiveness and civic participation	Develop indoor and outdoor spaces for community and social activity and interaction	Planning and design of formal public spaces and 'transitional' spaces





Objective	Strategy	Post Structure Plan Actions
C6 Promote the provision of community facilities and services that meet the needs of the community	Early provision of community facilities and services that meet the needs of the community	Develop strategies for early provision and funding of community facilities and services
	Develop community services structured around Eglinton District Centres, Coastal Villages, Neighbourhood Centres/Nodes, "bus stop" nodes	Develop partnerships with service providers Subdivision design to accommodate necessary services and amenities

## Water

Objective	Strategy	Post Structure Plan Actions
WCM1 Promote more efficient use of water	Investigate and develop feasible water efficiency initiatives:	Seek partnership with Water Corporation on Waterwise Homes program
		All front yard landscaping installed by the Developer shall be Waterwise Ensure Design Guidelines cover fixtures and fittings, garden design and irrigation systems
WCM2 Develop integrated water management strategies to increase water efficiency	Allow for water sensitive urban design to replenish superficial aquifer	BMPs to be developed for subdivision design UWMP to be prepared to support subdivision application
	Investigate and develop alternative water sources for irrigation and nondrinking water uses	Progress concept design and dialogue with Water Corporation and Dept of Water
Water Management at the District Scale	Development of district wide management strategy	Convene a steering group of key stakeholders (including DoW, WaterCorp, City of Wanneroo)
		Prepare a District Water Management Strategy
		Prepare a groundwater allocation plan Concept design for a non-potable water supply (subject to feasibility assessment, approvals and issue of a non-potable water licence).

## Energy and Greenhouse Gases

Objective	Strategy	Post Structure Plan Actions
E&G1 Reduce private transport emissions	Develop integrated primary and secondary transport network	Design Special Transport System stops, inclusive of pedestrian routes, shelter areas, provision for CCTV/IT systems. Integrate stops within high intensity surrounding land activity Conformation and detailed development of safe walking and cycling routes integrated with the movement network Detailed multimodal design of key precincts including all activity centres to mitigate traffic speeds, support active streetscapes and provide regular, safe street crossing points A detailed car parking supply and management plan for the Marina Village (Precinct 1) and Eglinton district centre Pulse timetabling of public transport to integrate the STS with the metro rail
	Investigate car sharing	Investigate car sharing in conjunction with City of Wanneroo and private sector partners



Objective		Strategy	Post Structure Plan Actions
E&G2	Reduce material intensity / embodied energy	Investigate electric vehicle infrastructure	Investigate electrical vehicle infrastructure requirements
		Encourage use of recycled construction and demolition waste in road base and low grade concrete (kerbs, driveways etc)	Undertake study to establish the opportunities, technical and economic feasibility of incorporating recycled materials
		Housing requiring proportion of lightweight materials	Establish a framework for the adoption of building materials with low embodied energy
		Encourage use of concrete utilising low EE cement replacement materials (fly ash and blast furnace slag)	Develop a specification for the construction concrete to include a proportion of blast furnace slag or fly ash
E&G3	Reduce operational energy consumption	Investigate and develop feasible energy efficiency initiatives	Prepare to meet the mandatory 6-star energy efficiency rating for all Eglinton housing
			Commercial buildings should be prepared to undergo NABERS energy audits and should be designed according to energy efficient principles and to enable energy monitoring
			The potential for the introduction of Smart Meters should be pursued to facilitate householder energy education and participation in energy demand management
			Subdivision planning for lot layout and orientation to encourage building orientation so as to achieve best use of natural heating, cooling and lighting
E&G4	Increase renewable energy	Investigate and develop feasible renewable energy initiatives	The feasibility of a geothermal powered District Cooling project should be pursued, including the design requirements for a heating / cooling reticulation system, to high density centres
			A bulk purchase agreement with hot water systems (solar or heat pump) suppliers and installers should be pursued in consultation with key builders representatives.
			Local electricity infrastructure, such as distribution lines and substations, should be planned to accommodate the substantial uptake of rooftop PV
			A bulk purchase agreement with PV supply and installers should be pursued in consultation with key builder's representatives
			Investigate land purchase contracts that could include a requirement for the purchaser to use Green Energy
			Generate a wind resource map for the district and identify specific building locations that could be powered by small scale wind installations. Identify the expected cost / benefit equation for these buildings and develop a proposal for their inclusion in the land sale package
E&G5	Identify and respond to climate change risks	Identify risks that could impact on the development as a result of climate change and plan to manage these risks	Gain advice from DoP Coastal Division on coastal vulnerability study



## Ecosystem Health

Objective		Strategy	Post Structure Plan Actions
EH1	Conserve and Enhance Local Biodiversity	Conservation of existing significant environmental assets	Implement environmental management methods and works in accordance with EMP developed as part of Eglinton LSP
			Prepare Graceful Sun Moth Management Strategy and Carnaby's Cockatoo foraging habitat offset strategy for inclusion in EPBC Referral
		Apply biodiversity based landscaping of public and private spaces	Implement environmental management methods and works in accordance with EMP developed as part of Eglinton LSP Predominant use of low water use native vegetation in all public realm landscaping, and only provide high water use areas in strategic locations where they best serve the community
EH2	Encourage local environmental awareness in the community through initiatives such as local bush care	Develop and implement community based environmental awareness program (including bush regeneration and protection)	Implement community environmental awareness program (including bush regeneration and protection) for new Eglinton residents
EH3	Encourage sustainable waste management options and improve resource recovery	Waste management controls and targets to minimise, reduce, or recycle construction, household, and commercial wastes	Development of Eglinton Waste Management Plan (EWMP) Implement EWMP during subdivision construction where possible
		Recycle organic wastes locally for use in parks and gardens	Incorporate in EWMP



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# 1. Introduction

## 1.1 This Report

The purpose of this report is to outline how the Eglinton Local Structure Plan (LSP) will address and implement sustainability initiatives relevant and considered important to the residential estate.

This report needs to be read in conjunction with the Eglinton LSP documentation (prepared by DPS) and submitted to the City of Wanneroo in July 2010.

## 1.2 About the Project

The Eglinton Local Structure Plan area is approximately 633ha of which around 198ha is owned by Oceanscapes Alliance, a partnership between Eglinton Estates and Stockland; the balance area is owned by Eglinton Estates (Figure 1).

The Eglinton Local Structure Plan area is within the Alkimos Eglinton District Structure Plan which was approved by the City of Wanneroo in July 2008 and the WAPC in June 2010.

It is proposed that Eglinton will be developed for residential and commercial purposes including the Eglinton District Centre, Urban Development, including primary schools and playing fields, the Eglinton Marina and Coastal Village, Regional Open Space and Public Open Space as indicated in the Local Structure Plan (Figure 2).

The Eglinton LSP is consistent with the intent of the adopted Alkimos Eglinton DSP, with the general arrangement of land uses and infrastructure as depicted on the DSP Map and relevant State and Local Government Policies, including proposed land uses, residential density targets, road hierarchy and linkages to surrounding existing and planned developments.

The DSP requires that at the time of lodgement of the Structure Plan, the proponent shall provide supporting information to demonstrate how the objectives and strategies detailed in Part 1 of the DSP have been addressed and the supporting information utilised to guide and inform the LSP design. This supporting information is included in Part 2 of the DSP and as Appendices to the LSP.

All other matters required to be addressed by the LSP (as per Part 1 of the DSP) have been addressed in this strategy document.

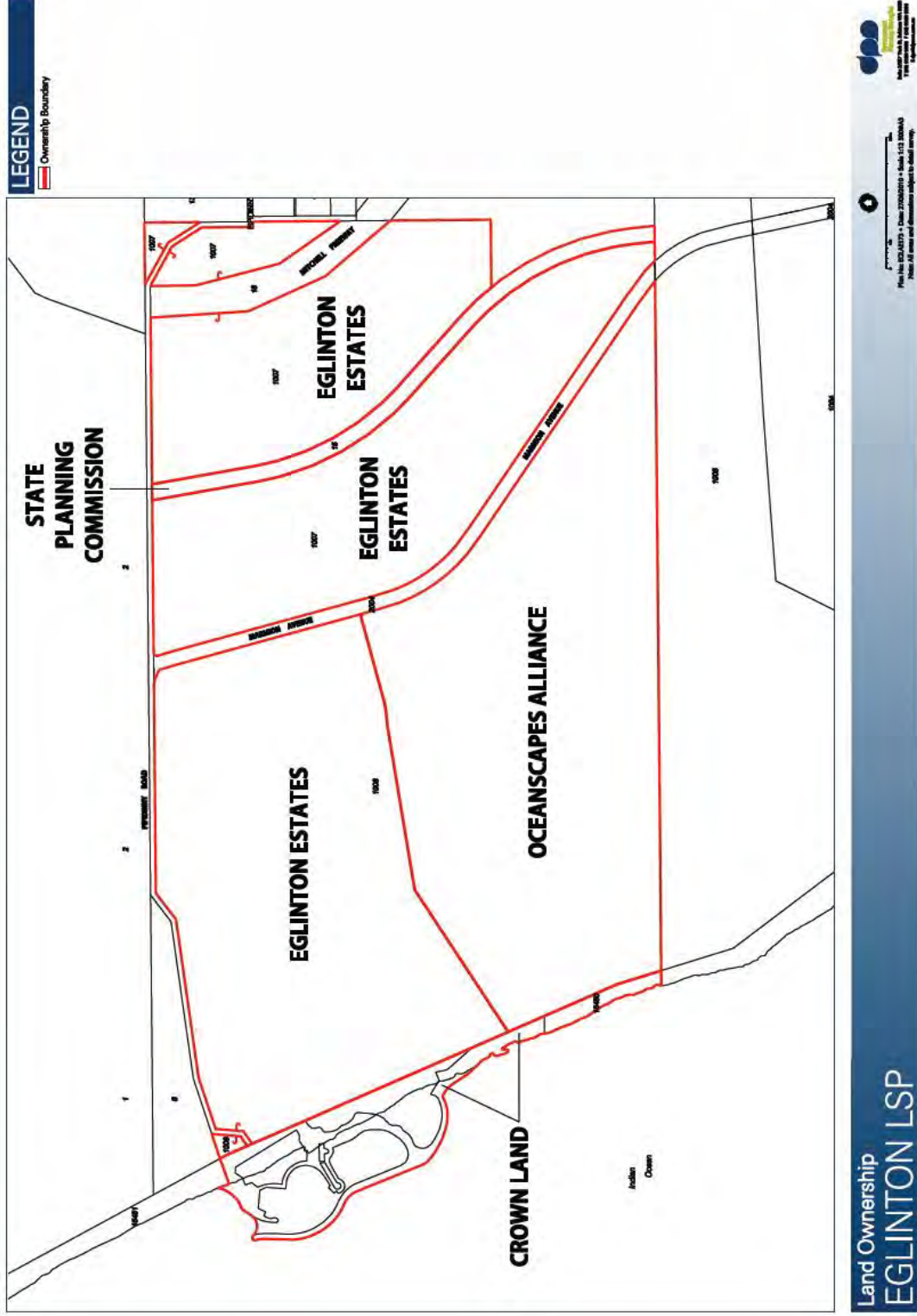
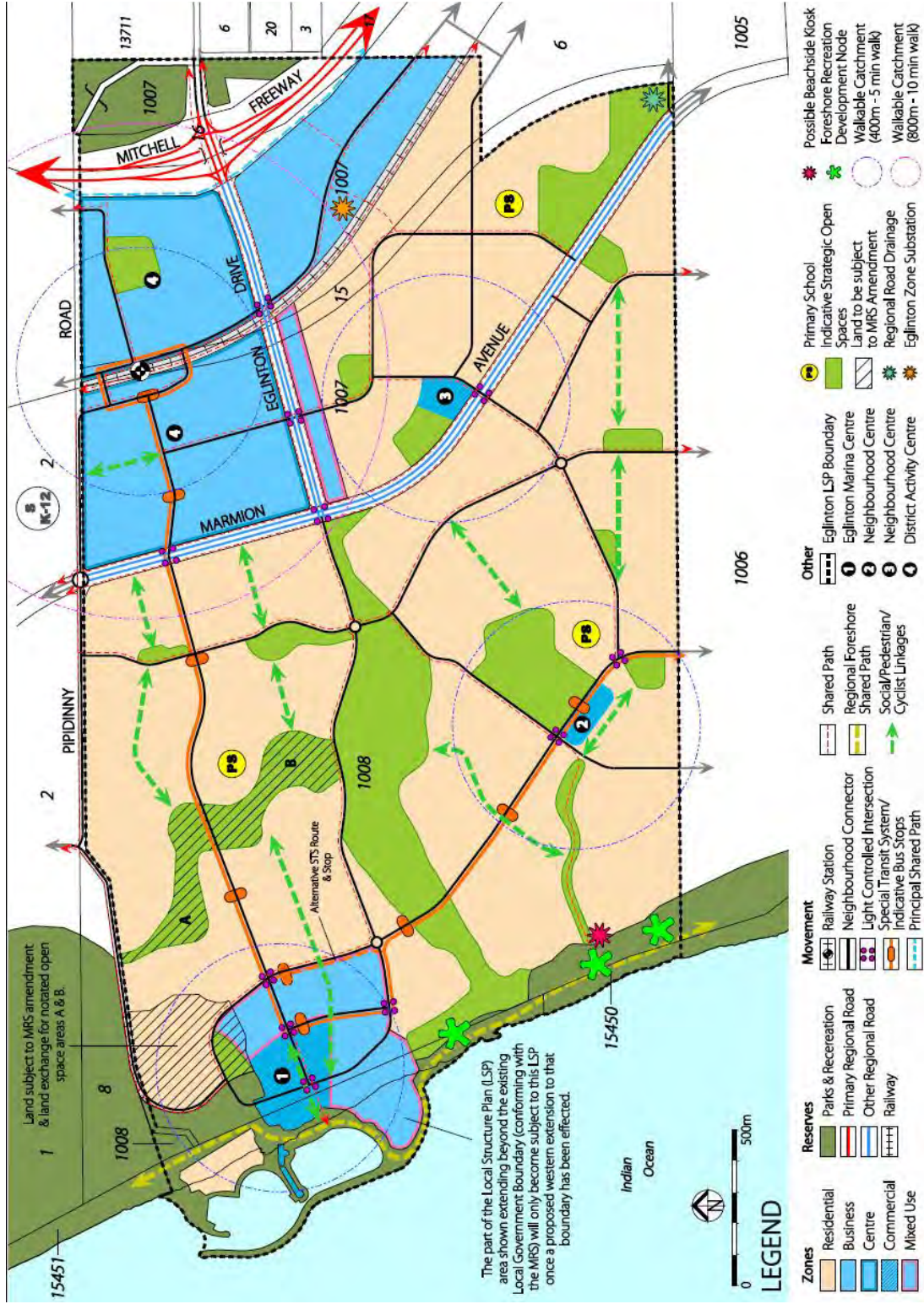


Figure 1 Eglinton Local Structure Plan Area - Ownership Plan





## **1.3 Background and Context**

### **1.3.1 Sustainability in Urban Development**

Human settlements have a large impact on the earth's ecosystems. Urban development and buildings in particular contribute significantly to the negative impact we are having on our environment. It has been estimated that buildings consume 32% of the world's resources including 12% of the world's water and up to 40% of the world's energy. Buildings also produce 40% of waste going to landfill and 40% of air emissions.

At a time when climate change is already affecting Western Australia, when water quantity and quality is in decline and when animal and plant extinctions in Australia are occurring at an unprecedented rate, the advancement of Sustainability is not an option but all of our responsibility.

Ecologically Sustainable Development therefore, represents one of the biggest challenges facing Australia's governments, industry, business and the community at large. In Perth and Peel this is particularly so as it faces an unprecedented rate of economic growth and a projected population increase to 2.2 million by 2031. With about 90% of the Western Australian population living in towns and cities, the quality of the urban environment is important in relation to our wellbeing. The movement towards sustainable communities takes recognition of the need for environmentally sustainable forms of development a step further towards the need to ensure that a community is socially sustainable. A sustainable community, also described as a "healthy" or "liveable" community, maximises quality of life for its residents and is more environmentally and economically sustainable.

The key to achieving a sustainable community is to address issues in an interconnected manner and ensure that all the key dimensions of the planning process are strongly integrated throughout the process. This integration involves the development of an urban form strongly informed by the following issues:

- ▶ Environmental protection (or remediation);
- ▶ Land use planning that takes account of demographic trends, living, employment and leisure needs;
- ▶ Transport and access requirements;
- ▶ Energy and water efficiency objectives;
- ▶ Market and development trends; and
- ▶ Regional planning objectives.

### **1.3.2 Sustainability and District Structure Planning**

In 2006, GHD prepared the Sustainability Strategy to support the Alkimos Eglinton DSP. The strategy outlined the sustainability objectives and key priorities applicable to the residential land development project, building upon the Smart Growth Assessment Tool (SGAT, see Section 1.3.3) and the State Sustainability Strategy (see Section 1.3.4).





The DSP Sustainability Strategy identified the following priority sustainability objectives:

Community development:

- ▶ Promote investment consistent with [the City's] strategic vision;
- ▶ Advocate provision of communications infrastructure;
- ▶ Encourage diversity of housing;
- ▶ Ensure affordable housing;
- ▶ Encourage social cohesiveness and civic participation; and
- ▶ Promote the provision of community facilities and services that meet the needs of the community.

Water:

- ▶ Promote more efficient use of water;
- ▶ Develop integrated water management strategies to increase water efficiency.

Energy and greenhouse:

- ▶ Reduce private transport emissions;
- ▶ Reduce materials intensity/embodied energy;
- ▶ Reduce operational energy consumption; and
- ▶ Increase renewable energy.

Ecosystem health:

- ▶ Conserve and enhance local biodiversity;
- ▶ Encourage community participation in local bushcare efforts; and
- ▶ Encourage sustainable waste management options and improve resource recovery.

The Eglinton LSP Sustainability Strategy (this document) has been designed to respond to and augment the sustainability objectives stated in the Alkimos Eglinton DSP.

### **1.3.3 City of Wanneroo Smart Growth Strategy**

In 2005, the City of Wanneroo Council developed the Smart Growth Strategy, with an accompanying Smart Growth Planning Policy, to guide application of sustainability principles and strategies. Smart Growth seeks to manage growth more effectively to improve the outcomes of development for new and existing communities.

Smart Growth represents a local approach to state sustainability. The Smart Growth Strategy complements the Foundation Principles, visions and goals of the State Sustainability Strategy.

- ▶ Principle 1 Lifestyle and Housing Choice: Smart Growth encourages the provision of a variety of housing types and the enhancement of lifestyle options.
- ▶ Principle 2 Effective Use of Land and Infrastructure: Smart Growth supports the effective use and development of land and buildings for the benefit of the local area.





- ▶ *Principle 3 Long Term Health of the Environment:* Smart Growth promotes development that minimises environmental impact, together with practices that conserve and enhance natural areas
- ▶ *Principle 4 Identify, Equity and Inclusiveness:* Smart Growth is creating opportunities to enhance and develop the identity of our places and our people, and to improve equity and inclusiveness within our community.
- ▶ *Principle 5 Long Term Economic Health:* Smart growth supports opportunities that enhance industry growth and promote job creation within our region.
- ▶ *Principle 6 People and Government:* Smart Growth encourages citizen and stakeholder participation in governance and development decisions.

The Smart Growth Assessment Tool (SGAT) was designed to assist developers in preparing their structure plans to reflect the Smart Growth. SGAT is currently in a trial phase, during which time assessment (using the tool provided) is voluntary. The Eglinton Sustainability Strategy has been designed to meet the City of Wanneroo's Smart Growth requirements.

#### **1.3.4 State Sustainability Strategy**

The State Sustainability Strategy (2003) defines sustainability as “meeting the needs of current and future generations through integration of environmental protection, social advancement and economic prosperity”.

In recognition that development must occur in a way that creates a more enduring future, the State Sustainability Strategy (2003) sanctions the goal that we “plan and provide settlements that reduce the ecological footprint and enhance our quality of life”.

The Strategy's overall vision for settlements in WA is that they ‘are among the most attractive places to live in the world, constantly becoming more innovative and efficient in their use of resources and management and use of wastes while simultaneously being more liveable and equitable’ (SSS 2003). This underpins the concept that sustainability is about process as well as product and as new technologies are developed and society's values change the sustainability of urban developments also increases.



## 2. Community

### 2.1 Overview

Community development is a key focus of the overall sustainability strategy for Eglinton. The vision for community wellbeing for the Alkimos Eglinton is set out in the DSP:

*To be an outstanding place to live and work. Affordability, diversity, availability of land supply and job creation will be high on the agenda that prioritises place making and values participation. Alkimos will ensure the development of communities that foster active citizenship, are safe and healthy with access to jobs, services and learning.*

Key objectives to guide community development have been set for the LSP. These are:

1. To create a place that will initiate and support the self development of a sustained community;
2. To enable diversity and interest in the built environment;
3. To facilitate the movement of the community through the implementation of a wayfinding system;
4. To provide the capacity for community growth and development over time by supporting adaptable and appropriate facilities and services;
5. To provide infrastructure and economic conditions that enable the community to meet as many needs as possible within Eglinton;
6. To facilitate a healthy local economy that compliments and supports the district economic growth and provides jobs to meet local needs; and
7. To ensure the community are real stakeholders in the development of their community.

Additionally MacroPlan have established an economic development strategy for the LSP area with two key themes that support the establishment of a sustainable community.

<i>Economic Sustainability</i>	Maintenance of high levels of economic prosperity in the medium and long term
<i>Sustainability Economics</i>	Economic and commercial activity in the field of environmental sustainability

### 2.2 Sustainability Objectives and Strategies

The table below summarises the community objectives addressed in the Alkimos Eglinton DSP Sustainability Strategy, including the strategies to meet these objectives. The following sections in this report outline how these objectives and strategies have been incorporated into the Eglinton LSP, and which implementation steps are required post structure planning.

**Table 1 Eglinton & Community – Sustainability Objectives and Strategies**

Objective	Strategy to Meet Objective
C1 Promote investment consistent with strategic vision	Investigate and allow for marina and tourism associated development at Eglinton with a resort centre and hotel Develop regional commercial and employment centres, integrated for Eglinton town/activity centres
C2 Advocate provision of communications infrastructure	Develop broadband and intra-network infrastructure (e.g. to support home based work)
C3 Encourage diversity of housing	Allow for housing sizes to match emerging demography Allow for the development of wide range of housing types
C4 Ensure affordable housing	Investigate and allow for affordable housing initiatives for both sale and rent
C5 Encourage social cohesiveness and civic participation	Develop indoor and outdoor spaces for community and social activity and interaction
C6 Promote the provision of community facilities and services that meet the needs of the community	Early provision of community facilities and services that meet the needs of the community Develop community services structured around Eglinton District Centres, Coastal Villages, Neighbourhood Centres and Local Activity Centres, “bus stop” nodes

## 2.3 Local Structure Plan

### 2.3.1 Objective C1 - Promote Investment Consistent With Strategic Vision

#### Marina and tourism at Eglinton with a resort centre and hotel

The LSP design for the Coastal Village reflects the objective/strategy through provision of:

- ▶ Short term accommodation and service apartments;
- ▶ Leisure and entertainment pier (e.g. Hotel).

MacroPlan have reported that approximately 25% of the floor space in 2036 will support and service tourism and visitor activity and expenditure. The primary driver of this will be short - stay accommodation, however, it will also be driven by chandlery retail and tourist - oriented café and restaurant offering.

The potential for a resort and hotel is accommodated in the plan.

#### Regional commercial and employment centres

The LSP identifies Eglinton District Centre as a mixed use high density activity centre designed along transit oriented development (TOD) lines and comprising:

- ▶ Retail, offices, commercial, civic and education uses within the centres that will provide local employment opportunities; and
- ▶ Public transport, particularly the heavy rail station and a frequent Special Transit System (STS) service are to be provided early on in the development of the centres.

The LSP provides for major employment generators including:

- ▶ The District, Coastal Neighbourhood and Local Activity Centres;



- ▶ A 24 hectare major Economic Precinct/Employment Corridor adjacent to the District Activity Centre;
- ▶ Education Facilities; and
- ▶ Tourism activities.

The landowners have prepared an Economic and Employment Strategy aimed at delivering a 60% self sufficiency employment target within the Alkimos Eglinton DSP area.

### **2.3.2 Objective C2 - Communications Infrastructure**

Home based work is an important element of the sustainability strategy in terms of both creating community and reducing car dependence.

MacroPlan have estimated non-centre sources of employment, namely primary and secondary education facilities and home-based employment.

In terms of home-based employment, it is estimated that by 2041, the DSP area will be home to:

- ▶ 502 people working at home in home - based businesses;
- ▶ 301 people telecommuting on average per business day; and
- ▶ 1,003 mobile trades' workers using their home as a base.

The development of adequate communications infrastructure at Eglinton to support home based work is required to ensure the opportunities are realised.

The National Broadband Network (NBN) will be Australia's first national wholesale-only open access, high speed broadband platform and is targeting 100 megabits per second (Mbps) technology to be delivered in new estates with fibre to the home networks. The design of Eglinton will meet the specifications of the NBN as soon as they are available.

The Engineering Infrastructure report (Appendix 5 of the DSP) provides specific details about a strategy for implementing broadband related services. The Engineering Services Report produced for the Eglinton LSP provides specific details on the communications infrastructure for Eglinton.

### **2.3.3 Objective C3 - Diversity of Housing**

#### *Housing sizes that match emerging demography*

The average number of occupants in Australian households has been dropping steadily for many years. From 1990 to 2001 the number dropped from 2.8 to 2.6 people across Australia and the figures are similar for Perth. In the same period, the size of housing increased by some 30 m<sup>2</sup> to an average of around 210 m<sup>2</sup>. This represents an increase in housing size of some 25% per person over the decade to 2001.

In recent times houses with 4 to 5 bedrooms plus separate lounge, family rooms and theatres have become increasingly common. Notwithstanding the implications for energy efficiency and greenhouse emissions, there are also questions about the quality of the investment in such houses over the long term given that 30% of households in Perth now house only couples or individuals (up from 25% in 1991).

Reducing the size of new housing to suit the real needs of families and individuals, now and in the future would have many benefits including housing affordability, maintenance of housing values and energy efficiency (embodied and operational).



The Local Structure Plan incorporates a wide range of housing densities to enable the facilitation of delivering a diverse range of dwelling types and sizes to match market demand emanating out of the emerging demography, including for seniors. The densities will range from up to R160 - (one and two bedroom apartments) within the Eglinton District Activity Centre and Eglinton Marina to more contemporary single residential dwellings of densities of R20. Between these two density ranges the LSP provides for attached, detached and multiple dwellings in the medium density ranges by incorporating density codings in the R30 to R60 range located along and within close proximity to the secondary transit route and high amenity areas.

Negotiations are underway with architects and builders to develop a diverse range of housing types and demonstration models specifically designed for the LSP area to broaden market awareness and acceptance for more diverse dwelling types and sizes.

Within the various Precincts defined in the LSP minimum density yields have been prescribed to ensure delivery of a diverse range of dwelling types and sizes.

At subdivision stage it is intended that design guidelines will be developed for special housing areas to guide specific development requirements to maximise the design intentions of the LSP associated with retention of natural topography.

#### Wide range of housing types

The other consequence of the changing demographics is the need for a more diverse housing product that can cater to singles living alone or in groups, families (including extended families) and “empty nesters”. Eglinton will strive to set a new benchmark in housing diversity to cater for the 21<sup>st</sup> century demographic.

To cater for the emerging market arising out of changing demographic density codes incorporated within the LSP will enable a very wide range of innovative housing types and sizes to be approved and developed.

The distribution of housing density accords with current WAPC and Council Policies and Strategies, focussing on increasing densities within and adjacent to Activity Centres, Public Transport and around areas with high amenity e.g. adjacent to open space.

Both the district and coastal centres will contain a range of housing types and densities from High (apartment) to Medium (townhouse) with standard density housing (detached) to be provided in the areas outside of the centres. Within the District Activity Centre and Eglinton Coastal Activity Centre the LSP provides for densities up to R160 enabling dwellings ranging from one and two storey studio apartments through to large apartments, Terrace Houses, and Town Houses to be developed and complimenting more traditional single detached dwellings within adjacent areas.

The LSPs are by very nature very flexible planning documents that are required to be reviewed on a regular and ongoing basis, facilitating changes to be made, responding to changing demographics and market trends.

### **2.3.4 Objective C4 - Affordable Housing**

Purchasing a house is becoming increasingly difficult for Perth families. Accordingly strategies are needed that facilitate entry into the ownership market, as well as meet the needs of those who either





cannot, or don't wish to become homeowners. Eglinton will seek to promote initiatives to achieve both objectives.

Allowing for a mix of affordable housing is essential for Eglinton's economic and social health. There is both a need and an opportunity to establish a principle that affordable housing will be part of the housing mix in all locations adjacent to public transport and employment nodes.

Sites will be identified within the District Centre for delivery of community housing via Housing Associations. Ideally these sites will be located adjacent to public transport and employment nodes, targeting niche affordable housing markets that match local economic conditions.

The National Rental Affordability Scheme (NRAS) is a long term commitment by the Australian Government to invest in affordable rental housing. The Scheme seeks to address the shortage of affordable rental housing by offering financial incentives to the business sector and community organisations to build and rent dwellings to low and moderate income households at 20 per cent below-market rates for 10 years. Housing sites suitable for the NRAS will be brought to the market for purchase by investors.

### **2.3.5 Objective C5 - Social Cohesiveness and Civic Participation**

#### *Indoor and outdoor spaces for community and social activity and interaction*

The Community Development Strategy (Eglinton LSP Technical Report) highlights the role of planning in community development. One important element of this is the creation of both indoor and outdoor spaces for community and social activity and interaction. The creation of informal public spaces and 'transitional' spaces (such as 'liveable' front yards) that create opportunities for unplanned social interaction will be a focus for design at Eglinton.

Geografia have established a comprehensive strategy for the provision of all community services and amenities for Eglinton. A summary of the relevant elements of this follows.

- ▶ So that community activities are inclusionary and people from across the social spectrum are able to regularly interact, the intention is to provide, in the first instance, several outdoor spaces, forming active parts of the public open space network within Eglinton.
- ▶ In time, a multi-purpose facility adjacent to the District Centre should be provided. While planning for the facility will require community consultation and a feasibility study, it may incorporate public open space with capacity for outdoor performances, public art and multipurpose halls and meeting rooms of different scale. Some component of both the temporary and permanent community space must be youth friendly to ensure young people are engaged locally.
- ▶ A second community based facility will be associated with the Marina, in the amphitheatre area, with performance, skatepark and markets – i.e. an area for youth and family.
- ▶ These nodes of activity will be connected through different transport links, including dual use pathways and trails where practical. The pathways have the additional advantage of encouraging bike commuting, thereby also contributing to employment self-containment.
- ▶ Community infrastructure will be designed in a way so that it can more easily be repurposed as the community and its desires, change.

All recommendations within the Eglinton LSP, in relation to community services, are aligned with the Alkimos Eglinton DSP and have been included in the draft Alkimos Eglinton District Developer Contributions Plan.



**Figure 3 Family Friendly Street in Vauban Neighbourhood in Freiburg, Germany**

### **2.3.6 Objective C6 - Early Provision of Community Facilities and Services that Meet the Needs of the Community**

As development proceeds, there will be a staged approach to collaboration between key service agencies including schools and educational institutions, community and cultural service providers, shops, and other human service agencies to explore all opportunities for co-location and sharing, that will result in the earliest, most effective service provision possible.

Further details regarding community facilities and services are provided in the Community Development Planning Report prepared by Geografia for the Eglinton LSP.



Geografia have identified the following key facilities and services targeted for completion during Phase One of the project (2011-2016)<sup>1</sup>.

**Facility/Service**

- Community Infrastructure
- Child Care Centre (Long Day Care)
- Primary School
- Aged Care
- Telekiosk
- Playground
- Footpaths and cycle ways
- Trails
- Multipurpose community space
- Off-leash park
- Percent for Creative Space
- Broadband Network
- Community Garden
- Business Incubator
- Public Art
- Town Square

**Community Services & Initiatives**

- Community Development Officer (CDO)
- Online presence, including 'Bang-the-Drum' or similar
- Community arts and recreational activities
- Eglinton video journal
- Baseline Survey
- Eglinton Residents and Business Associations
- Neighbourhood Watch
- Walking bus
- Bike Through Event
- Community arts support

*Community services structured around District Centres, Coastal Villages, Neighbourhood and Local Activity Centres, "bus stop" nodes*

The DSP set out the following as an operational principle:

*Co-location of facilities around schools, regional, district, neighbourhood and local activity centres, including full-sized playing fields;*

The LSP has adopted this principle with most of the amenities set out above located at a district or neighbourhood centre or coastal village.

A multi-purpose facility adjacent to the District Centre is proposed, potentially incorporating public open space with capacity for outdoor performances, public art and multipurpose halls and meeting rooms of different scale. This facility should be designed in a way that allows its function to change over time. It is important, also, that community groups of all types and sizes have effective access to the facilities. This will require a mix of space sizes and functions. To expand the town centre function, a major regional sporting precinct is to be developed immediately to the north of the District Centre.

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<sup>1</sup> Assumes upper bound population estimates.



## 2.4 Post Structure Plan Implementation

The table below sets out the actions to be taken post structure planning as part of the formulated strategies to meet the Eglinton Sustainability objectives, including responsible parties, applicable precincts, and implementation pathways.

**Table 2 Eglinton & Community – Post Structure Plan Implementation**

Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
C1 Promote investment consistent with strategic vision	Investigate and allow for marina and tourism associated development at Eglinton with a resort centre and hotel	Investigate details and feasibility for marina and resort development, including scale and operation of resort	Landowners / developers	Marina Precinct	Precinct	Feasibility study / design / construction
		Identify specific development sites for tourist facilities (according to investigation above)	Landowners / developers	Marina Precinct	Subdivision	Feasibility study / design / construction
C2 Advocate provision of communications infrastructure	Develop regional commercial and employment centres, integrated for Eglinton and Alkimos town/activity centres	Implementation of economic and employment strategy	Landowners / developers	Activity Centres Employment Precinct	District / Precinct	Feasibility study / design / construction
		Infrastructure to be incorporated in subdivision works	Landowners / developers / NBN Co	All precincts	Subdivision	Design / construction
C3 Encourage diversity of housing	Allow for housing sizes to match emerging demography Allow for the development of wide range of housing types	Undertake ongoing research to inform discussions on provision of housing sizes / types	Landowners / developers	All residential precincts	District / Precinct and subdivision	Research and consultation
		Ensure Design Guidelines accommodate housing size and diversity strategies	Landowners / developers	All residential precincts	Subdivision	Design Guidelines
C4 Ensure affordable housing	Investigate and allow for affordable housing initiatives for both sale and rent	Consider appropriate affordable housing strategy for Eglinton	Landowners	All residential precincts	District / Precinct	Strategy and consultation
C5 Encourage social cohesiveness and civic participation	Develop indoor and outdoor spaces for community and social activity and interaction	Facilitate and encourage partnership approach to delivery of affordable housing	Landowners / developers	All residential precincts	District / Precinct	Partnership
		Planning and design of formal public spaces and 'transitional' spaces	Landowners / developers	All precincts	District / Precinct	Design / construction



Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
C6 Promote the provision of community facilities and services that meet the needs of the community	Early provision of community facilities and services that meet the needs of the community	Develop strategies for early provision and funding of community facilities and services	Landowners / developers	All precincts	District / Precinct	Strategy and consultation
		Develop partnerships with service providers	Landowners / Developers	All precincts	Subdivision	Design and construction
	Develop community services structured around Eglinton District Centres, Coastal Villages, Neighbourhood Centres/Nodes, "bus stop" nodes	Subdivision design to accommodate necessary services and amenities	Landowners / Developers	All precincts	Subdivision	Design and construction





## 3. Water

### 3.1 Overview

The following principles have been adopted to guide the water strategy for Eglinton:

- ▶ Adopt an integrated approach to management of all elements of the water cycle;
- ▶ Minimise the use of water from all sources;
- ▶ Use water which is fit-for-purpose;
- ▶ Protect the health of receiving waters; and
- ▶ Protect human health and amenity.

#### 3.1.1 Water Management at the District Scale

The WAPC's "Better Urban Water Management" (BUWM) document provides a framework for achieving better management of urban water via the land planning/development process. Normally a District Water Management Strategy (DWMS) is required at the re-zoning stage. However these requirements were not in place at the time of the Alkimos Eglinton MRS amendment and so presently there is no DWMS to guide water management at the LSP level.

The DWMS, supported by findings at the regional and subregional level, should (inter alia):

- ▶ State the water quantity and quality management objectives to be achieved, which address all elements of the total water cycle. Guidance is provided in Section 1.3 of BUWM;
- ▶ Broadly describe issues likely to influence the water management strategy in the study area due to existing infrastructure, existing land uses, possible groundwater pollution plumes and groundwater capture zones of significant wetlands and other water dependent ecosystems;
- ▶ Discuss potential water sources for drinking water and other uses, including irrigation of public open space, having consideration of impacts of use/allocation and infrastructure and management requirements, highlighting the preferred options for supply of non-potable water for fit-for-purpose use and giving consideration to major infrastructure needs.

At present GHD is advising the DSP landowners on the development of an Alkimos Eglinton wide water management approach in line with the DSP recommendations (which include implementing a non-potable groundwater supply) and will involve the preparation of a DWMS.

An application for funding under the National Stormwater Harvesting and Re-use Projects Program has been prepared and submitted. The funding application requested money to assist in the finalisation of the Water Management Study and the construction of infrastructure for stormwater harvesting, aquifer storage and recovery scheme at a district scale.

The initial design concept for the non drinking-water (NDW) system were for stormwater harvesting, aquifer storage and recovery, treatment and distribution through localised third pipe systems. Preliminary discussions with the Water Corporation have indicated that there is also the possibility of using the treated sewerage effluent (TSE) from the Alkimos Wastewater Treatment Plant for direct reuse or groundwater replenishment.



The following key actions are necessary to progress the development of a district wide management strategy at Alkimos Eglinton.

- ▶ Convene a Steering Group of Key Stakeholders (including DoW, WaterCorp, City of Wanneroo);
- ▶ Prepare a District Water Management Strategy including:
  - All water management requirements and design objectives;
  - Develop water supply, conservation and sustainable use strategies;
  - Stormwater modelling;
  - Groundwater analysis; and
  - Water resources management and monitoring.
- ▶ Prepare a Groundwater Allocation Plan; and
- ▶ Concept Design for a Non-Potable Water Supply (subject to feasibility assessment, approvals and issue of a non-potable water licence).

These activities will be occurring in parallel with, and beyond the development of the Eglinton LSP.

### **3.1.2 Local Water Management Strategy**

A formal Local Water Management Strategy (LWMS) is required to accompany the LSP. The requirements of the LWMS are outlined in the report “Better Urban Water Management”, which provides a framework for achieving better management of urban water via the land planning/development process. In addition to addressing water conservation objectives, a LWMS investigates a range of pre-development conditions and formulates strategies for groundwater and surface water management to manage the potential impact of development. A LWMS has been prepared for Eglinton as a complementary LSP Annexure by Coffey.

Most aspects of the LWMS have now become part of the land development process. However the use of alternative water supply options (through integrated water management) to meet the water efficiency and water re-use targets of the State Water Plan is an area where the land development process has struggled to make progress. This has consequently been an area given special focus for Eglinton, and the LWMS proposes integrated water management to achieve the water efficiency and water re-use targets of the State Water Plan:

- ▶ Reduce unrestricted annual residential water consumption to 100 kL/person, including not more than 40 – 60 kL/person/year scheme water; and
- ▶ Substitute drinking quality water with fit-for-purpose water for non-drinking water uses with 20% wastewater reuse by 2012, and a long-term target of 30% (subject to feasibility, approvals and licences).

## **3.2 Sustainability Objectives and Strategies**

Table 3 outlines the water related objectives from the Alkimos Eglinton DSP Sustainability Strategy, including the strategies to meet these objectives. The following sections in this report address how these objectives and strategies have been incorporated into the Eglinton LSP, and which implementation steps are required subsequently post structure planning.



**Table 3 Eglinton & Water – Sustainability Objectives and Strategies**

Objective	Strategy to Meet Objective
WCM1 Promote more efficient use of water	Investigate and develop feasible water efficiency initiatives, including: <ul style="list-style-type: none"> <li>Water efficient fixtures and fittings in homes and other buildings</li> <li>Water efficient irrigation systems</li> <li>Low water requirement plantings</li> <li>Only provide high water use areas (such as turf) in strategic locations where they best serve the community</li> </ul>
WCM2 Develop integrated water management strategies to increase water efficiency	Allow for water sensitive urban design to replenish superficial aquifer Investigate and develop alternative water sources for irrigation and nondrinking water uses (e.g. rainwater, groundwater, recycled wastewater)

### 3.3 Local Structure Plan

#### 3.3.1 Objective WCM1 - Efficient Use of Water

Water efficiency can be realised through a range of measures including:

- ▶ Water efficient fixtures and fittings in homes and other buildings;
- ▶ Water efficient irrigation systems;
- ▶ Low water requirement plantings and/or synthetic turf; and
- ▶ Only provide high water use areas (such as turf) in strategic locations where they best serve the community.

The Water Corporation has been trialling a Waterwise Homes program since 2003, and is planning to develop a new permanent Waterwise Homes program including:

- ▶ Regular water meter readings;
- ▶ Access to Waterwise specialists to advise on water saving activities at home;
- ▶ Regular letters and phone calls to households to provide:
  - Advice regarding ways to reduce water consumption; and
  - Ongoing information to encourage water savings.

The landowners will seek a partnership with the Corporation to make Eglinton a launch pad for this new program.

Significant water savings can be achieved by helping households change the way gardens are landscaped. As the climate continues to dry, household gardens should be redesigned to require less water to sustain them. These changes involve:

- ▶ Replacing non-native plants with native plants or other species suitable for a dry climate;
- ▶ Minimising the amount of lawn in the garden by replacing it with waterwise plants, groundcover, paving or synthetic turf;
- ▶ Using larger shrubs and trees or ground cover to provide shaded areas and conserve soil moisture; and
- ▶ Ensuring all irrigation systems are water efficient.

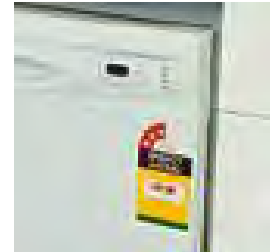
The Water Efficiency Labelling Scheme (WELS) is a Federal Government initiative that requires certain household appliances to be registered and labelled with a star rating to indicate their level of water efficiency. Introduced in July 2006, the following products are now legally required to have a WELS rating:

- ▶ Showerheads;
- ▶ Tap equipment;
- ▶ Toilet and urinal equipment;
- ▶ Clothes washing machines; and
- ▶ Dishwashers.

Design guidelines and householder information will be provided to encourage the efficient use of water inside and outside the house.



**Figure 4 Drip Irrigation System**



**Figure 5 Water efficient appliances**

### **3.3.2 Objective WCM2 - Integrated Water Management**

Integrated Water Management (IWM) is a strategy that draws together all facets of the water cycle, including water supply, sewage and stormwater to ensure holistic water cycle management. A high level integrated water cycle management study was undertaken for the Alkimos Eglinton study area during the DSP stage. Eglinton's detailed approach to IWM will be set out in the DWMS referred to in Section 3.1.1 and in the LWMS prepared by Coffey. Some key elements of the water cycle cited in the DSP are discussed below.

#### *Water sensitive urban design to replenish the superficial aquifer*

Water sensitive urban design seeks to incorporate stormwater drainage into the urban fabric in a manner that ensures the protection of surface and groundwater quality, and enhances the opportunities for reuse of stormwater. Eglinton will be developed in accordance with the Department of Water's Stormwater Management Manual and adopt the stormwater principles of Better Urban Water Management.



**Figure 6 Biodiversity Landscaping and Water Sensitive Urban Design at Majorua Rise, ACT**

*Investigate and develop alternative water sources for irrigation and non-drinking water uses*

A range of non-potable water supply initiatives including wastewater re-use, stormwater/groundwater and rainwater were investigated for Eglinton at the DSP stage.

Whilst the opportunity for wastewater re-use is regarded as significant (given the close proximity of the planned Alkimos Wastewater Treatment Plant) the direct recycling of treated wastewater is constrained by the existence of Public Drinking Water Source Areas (PDWSAs) over a large portion of the LSP. In the longer term the indirect recycling of wastewater via Managed Aquifer Recharge (MAR) east of the PDWSAs is potentially attractive and is being investigated by the Water Corporation.

Consequently the integrated water management study focussed on rainwater, groundwater and stormwater.

Further consideration of these sources will occur as part of the process set out in Section 3.1.1.





### 3.4 Post Structure Plan Implementation

Table below sets out the actions to be taken post structure planning as part of the formulated strategies to meet the Eglinton Sustainability objectives, including responsible parties, applicable precincts, and implementation pathways.

**Table 4 Eglinton & Water – Post Structure Plan Implementation**

Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
WCM1 Promote more efficient use of water	Investigate and develop feasible water efficiency initiatives:	Seek partnership with Water Corporation on Waterwise Homes program	Landowners / developers	All precincts	Lot level	Engagement with Water Corporation
	▶ Water efficient fixtures and fittings in homes and other buildings	All front yard landscaping installed by the Developer shall be Waterwise	Developer	All precincts	Lot level	Purchaser rebates
	▶ Water efficient irrigation systems	Ensure Design Guidelines cover fixtures and fittings, garden design and irrigation systems	Landowners / developers	All precincts	District / Precinct	Design Guidelines
	▶ Low water requirement plantings					
WCM2 Develop integrated water management strategies to increase water efficiency	▶ Only provide high water use areas (such as turf) in strategic locations where they best serve the community					
	Allow for water sensitive urban design to replenish superficial aquifer	BMPs to be developed for subdivision design	Landowners / developers	All precincts	Subdivision	Design and construction
	Investigate and develop alternative water sources for irrigation and nondrinking water uses (e.g. rainwater, groundwater, recycled wastewater)	UWMP to be prepared to support subdivision application Progress concept design and dialogue with Water Corporation and Dept of Water	Landowners / developers	All precincts	Subdivision	Design and construction
			Landowners / developers	All precincts	District / Precinct	Engagement / Feasibility Study / Design / Construction



Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
Water Management at the District Scale	Development of district wide management strategy	Convene a steering group of key stakeholders (including DoW, WaterCorp, City of Wanneroo)	Landowners / developers	All precincts	District	Engagement
		Prepare a District Water Management Strategy including:	Landowners / developers	All precincts	District	DWMS
		<ul style="list-style-type: none"> <li>• All water management requirements and design objectives</li> <li>• Develop water supply, conservation and sustainable use strategies</li> <li>• Stormwater modelling</li> <li>• Groundwater analysis</li> <li>• Water resources management and monitoring</li> </ul>				
		Prepare a groundwater allocation plan	Landowners / developers	All precincts	District	Groundwater Allocation Plan
		Concept design for a non-potable water supply (subject to feasibility assessment, approvals and issue of a non-potable water licence).	Landowners / developers	All precincts	District	Design and construction

## 4. Energy and Greenhouse Gases

### 4.1 Overview

It has been the objective of the landowners to ensure that the Eglinton development sets a new low benchmark for greenhouse gas emissions associated with land development in the State. This objective goes hand in hand with minimising dependence on fossil fuel and electricity use, and minimising exposure of residents and business owners to future increases in energy prices.

These objectives can be reached by engaging in specific actions at the development, community, and individual lot level. The opportunities presented are those which have been considered to be possible under the current regulatory environment, and with technology that is available today. Planning to capture these opportunities needs to be built into the development process at the LSP and post structure plan stages.

### 4.2 Sustainability Objectives and Strategies

The energy and greenhouse gas related objectives provided in the Alkimos Eglinton DSP Sustainability Strategy are summarised in Table 5, including the strategies to meet these objectives. The following sections in this report address how these objectives and strategies have been incorporated into the Eglinton LSP, and which implementation steps are required subsequently post structure planning.

**Table 5 Eglinton & Energy & GHG – Sustainability Objectives and Strategies**

Objective		Strategy to Meet Objective
E&G1	Reduce private transport emissions	Develop integrated multimodal transport network incorporating options for travel by walking, cycling, public transport and private vehicle
		Investigate car sharing
		Investigate electric vehicle infrastructure
E&G2	Reduce material intensity / embodied energy	Encourage use of recycled construction and demolition waste in road base and low grade concrete (kerbs, driveways etc)
		Housing requiring proportion of lightweight materials
		Encourage use of concrete utilising low EE cement replacement materials (fly ash and blast furnace slag)
E&G3	Reduce operational energy consumption	Investigate and develop feasible energy efficiency initiatives: <ul style="list-style-type: none"> <li>▶ LSP to encourage building orientation so as to achieve best use of natural heating, cooling and lighting</li> <li>▶ Energy efficient housing</li> <li>▶ Energy efficiency requirements for other buildings</li> <li>▶ Encourage use of Smart Meters to form a Smart Grid and enable energy demand management</li> <li>▶ Investigate novel energy efficient built-in appliances (e.g. combined air-conditioner / heat pump hot water systems)</li> <li>▶ Provide information on energy use and energy efficient appliances to homebuyers</li> <li>▶ Encourage use of natural gas as clean fossil fuel</li> </ul>



Objective	Strategy to Meet Objective
E&G4 Increase renewable energy	<p>Investigate and develop feasible renewable energy initiatives:</p> <p>District scale</p> <ul style="list-style-type: none"> <li>➤ Investigate use of renewable sources, solar and geothermal, to provide a district heating and cooling service for homes and other buildings (with high density centres as priority areas)</li> <li>➤ Investigate street lighting powered by renewable energy</li> <li>➤ Investigate efficient public open space water infrastructure Powered by renewable energy</li> </ul> <p>Lot scale</p> <ul style="list-style-type: none"> <li>➤ Greenhouse efficient hot water in homes and other buildings</li> <li>➤ Promote grid connected PV installation in homes and other buildings</li> <li>➤ Investigate Green Power purchase options</li> <li>➤ Identify specific buildings that could benefit from a small scale wind project to supply that building</li> </ul>
E&G5 Identify and respond to climate change risks <sup>2</sup>	Identify risks that could impact on the development as a result of climate change and plan to manage these risks

## 4.3 Local Structure Plan

### 4.3.1 Objective E&G1 - Reduce Private Transport Emissions

#### Integrated primary and secondary transport network

The transport system design has focussed on managing traffic and promoting walkability and public transport access in the coastal village and Eglinton district centre.

The LSP has incorporated plans for the phased introduction of a Special Transit System (STS) which will have priority status at key intersections, by-pass lanes at appropriate locations, and optimised walkable public availability. Street layout and design has been set to maximise connectivity and minimise journey distances. Safe and direct walking and cycling access has been provided to schools to minimise the need for car drop off and collection. A network of direct walking and cycling routes to connect major attractions has been established, along with leisure walking and cycling routes. Car parking in the Eglinton district centre and coastal village is planned to be effectively managed to discourage over-use of private vehicles.

Detailed planning of the transit stops, pedestrian routes, shelter areas, close circuit television (CCTV) / IT systems and safe walking and cycling routes would take place after the LSP is finalised. The detail of the multimodal design of key centres to mitigate traffic speeds, support active streetscapes and provide regular, safe street crossing points would occur post-LSP, along with a detailed car parking supply and management plan. The STS timetable to integrate with the metro rail timetable would also need to be developed at this stage.

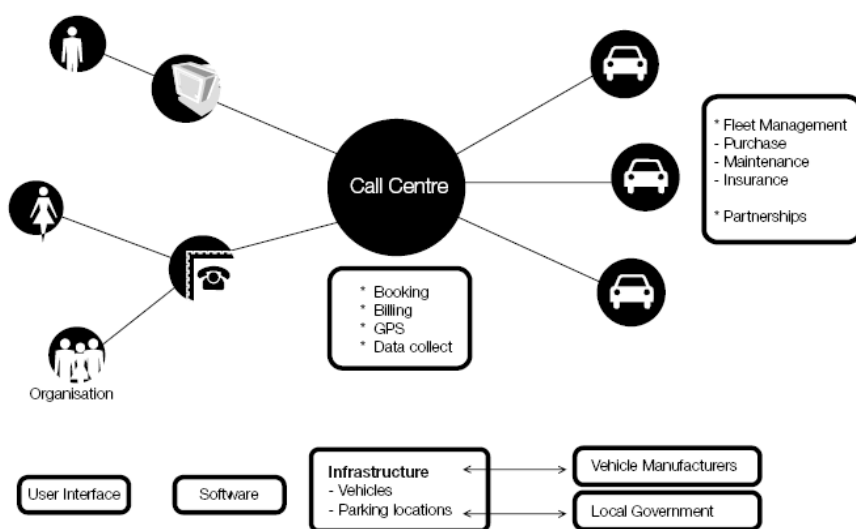
#### Car sharing

Car sharing is a model of car rentals that are shorter-term (e.g. rental by the hour) and are attractive to people or companies that only require occasional use of a vehicle and wish to minimise reliance on

<sup>2</sup> This objective has been added since the preparation of the DSP documentation.

driving. Car sharing schemes typically fall into two categories: commercial (i.e. fleet outsourcing) and consumer or residential schemes.

The elements of a car sharing scheme recommended for the Eglinton LSP are illustrated below. In this model a car sharing organisation manages the fleet and booking of vehicles while the local government is responsible for prioritising provision of parking spaces in sought-after locations as well as the funding the administration and implementation costs. These locations are generally at high density, mixed use on-street locations (e.g. at retail and recreational centres).



**Figure 7 Elements of a Car Sharing Scheme (Source: Australian Greenhouse Office, 2004)**

A car sharing scheme can help bridge the mobility gap between public transport and private automobile travel. Car sharing has been operating successfully in Europe and North America for over 30 years and has boomed in the last 5 years with the advent of web-based booking and management. There are now over 120,000 people world-wide, sharing approximately 8,000 cars.

There are at least three car sharing organisations operating in Sydney: Charter Drive, Flexicar and GoGet<sup>3</sup>. These organisations are expanding across the CBD and suburban areas, which suggests there is a viable market for their services. A Perth based company (Nexus Carshare) operated for 2 years but has recently closed its business.

It is recommended that the landowners, together with the City of Wanneroo seek to investigate the feasibility of such a scheme at the district scale, including in relation to the City's parking policy / guidelines. An example of such a policy is in NSW where the Roads & Traffic Authority (RTA) has developed guidelines with local governments regarding the implementation of on-street car share parking.

<sup>3</sup> <http://www.goget.com.au/>

## Electric vehicle infrastructure

With every major automobile manufacturer in the world expecting to have a plug-in vehicle on the market between 2010 and 2012, consideration should be given to the provision of vehicle charging infrastructure.

Already, cities such as Berlin<sup>4</sup> have announced a large-scale electric vehicle infrastructure project that was launched in 2009. The German government plans to trial 100 electric vehicles throughout the city with 500 charging points in homes, offices and commercial centres to provide its residents access to electric vehicles.



**Figure 8 Electric Vehicle Charging Points in Berlin, Germany**

Plug in vehicles; either plug-in hybrid-electric vehicles (PHEVs) or electric vehicles (EVs), are cars that have a battery that can be charged from an external power source, usually a general power outlet (240V, single phase). As in most cases, charging is done by a general power outlet (GPO). There is no special infrastructure required for in-home charging, only provision of a GPO in a suitable location in the garage, car port or driveway. Provision of charging infrastructure in commercial or public locations would require incorporation of payment systems, however such systems have already been developed and installed internationally.

In-home car charging capabilities can be retro-fitted however the cost is significantly higher than if undertaken at the time of construction. In addition, provision of infrastructure at Eglinton may encourage uptake of plug-in vehicles and marketing benefits can be realised by having 'EV Ready' homes.

Depending on the penetration of EVs and PHEVs into the market, it may be harder to justify the installation of public and commercial charging infrastructure during the early stages of development due to the investment required. However, planning should be undertaken with the installation of such infrastructure at a later date in mind. Such planning may include ensuring electricity and sufficient space is available at expected charging locations.

<sup>4</sup> GreenCarCongress, 5 September 2008, *Daimler and REW Launch EV Project in Berlin*, <http://www.greencarcongress.com/2008/09/daimler-and-rwe.html>





#### **4.3.2 Objective E&G2 - Reduce Material Intensity / Embodied Energy**

Very significant amounts of energy are used in the manufacture, transport and assembly of building materials into their final form on site. For example the average Perth house has approximately 680 GJ of energy embodied in its construction. This represents around 17 years of the energy consumed in operating the house. Given the level of housing activity, embodied energy in construction is a major greenhouse source.

Landowners have significant influence in the development process, and can direct the adoption of the following principles to guide the materials strategy at Eglinton:

- ▶ Preference materials with a low life cycle environmental impact;
- ▶ Minimise the quantity of materials used in each application;
- ▶ Design for durability and lowest life cycle cost.

Appendix A includes a comparative review of conventional versus alternative material options in terms of recycled content, embodied energy, indicative costs, durability, and availability in WA.

Detailed design of roads, pavements and buildings will occur after the LSP development, and action that should be taken at that stage includes:

##### *Encourage use of recycled construction and demolition waste in road base and low grade concrete*

A specific study needs to be undertaken to establish the opportunities, technical and economic feasibility of incorporating recycled materials from recycled construction and demolition waste into roads, pavements, kerbs and retaining structures, and whether the surplus material from the Water Corporation Alkimos Wastewater Treatment Plant can be included (subject to agreement with other landowners).

##### *Housing - lightweight materials*

A framework for the adoption of building materials with low embodied energy and lightweight external cladding systems would need to be established based on a Material Substitution Decision Framework to be developed post LSP.

##### *Encourage use of concrete utilising low embodied energy replacement materials*

A specification for concrete to contain a proportion of blast furnace slag or fly ash as a substitute to cement would need to be developed.

Developers would work directly with suppliers of alternative materials to determine the best approach for those materials that can be easily implemented within the current regulatory framework and are not subject to misperceptions such as assumptions of inferior quality.

#### **4.3.3 Objective E&G3 - Operational Energy Consumption**

The energy used by residential and commercial buildings in the development can be minimised by energy efficient design, selection of appliances and user behaviour. Landowners have significant influence in the development process, and can directly reduce energy demand and emissions up to and including the development of the lots. Thereafter, community information, education and engagement are the only available controls over the residents' energy consumption patterns, and the consequent greenhouse gas emissions.

However, it is possible to influence these factors by providing the framework for reduced energy consumption and related greenhouse gas emissions at the planning, development, time of sale and



building design stages. A combination of energy efficiency requirements and technologies are recommended for implementation at the subdivision and lot scale. These measures are discussed below.

#### ***Lot orientation and solar access***

Of importance at the LSP level is the determination of the orientation of lots such that houses with optimal orientation for capturing natural heating, cooling and lighting, can be easily constructed. Generally, this involves having north facing living areas to capture the benefits of the sun in winter.

Principles for providing winter solar access, facilitating summer breeze pathways and solar setbacks are set out in the Your Development guideline<sup>5</sup>.

#### **Street layout**

- ▶ Align streets east-west and north-south wherever possible;
- ▶ Aim for north-south streets within 20° west and 30° east of true north;
- ▶ Aim for east-west streets within 30° south and 20° north of true east.

#### **Land uses and densities**

- ▶ Concentrate the highest densities on sites with the greatest potential for good solar access;
- ▶ Locate larger lots where solar access is poor.

The LSP has achieved the following outcomes in respect of solar orientation:

**Table 6      % of Development Areas Achieving Optimum Street Orientation**

Precinct	% of Precinct Area Compliant with Optimum Street Orientation	Comments
District Activity Centre	100%	
Eglinton Hill (Precinct 4)	65%	Areas located adjacent to Marmion Ave and Railway do not achieve optimal orientation as the direction of these routes begin to curve away from the ideal orientation
Marina Village (Precinct 1)	30%	Marina precinct layout has lower optimisation due to direction of arterial roads
Marina Hinterland (Precinct 2)	100%	
Coastal Village (Precinct 3)	50%	Non-compliant streets responding to retained topography
Total	67%	

The optimum orientation has been achieved in the majority of the northern and eastern parts of the LSP area. Achieving the ideal street orientation in the other precincts has been constrained by maintaining as much of the pre-development topography as possible (another key project principle).

<sup>5</sup> Your Development is a national project developed in partnership with CSIRO and the Australian Department of the Environment, Water, Heritage, and the Arts. Content has been written and reviewed by leading researchers and industry experts. Guidance on solar access and lot orientation is provided at: <http://yourdevelopment.org/factsheet/view/id/21>



Some 67% of the development area has achieved the optimum orientation, which translates to around 70% of total dwellings (as the higher densities are in the District Centre).

Post LSP phase subdivision planning for lot layout and orientation will address the following:

- ▶ Where streets are within the acceptable orientation range, use rectangular lots;
- ▶ Locate as many long lot boundaries as possible within the permissible orientation range;
- ▶ Where the street is not within the orientation range, consider skewed lots, that is, lots with side boundaries that are not perpendicular to the street;
- ▶ Undertake a Solar Access for Lots (SAL) study to determine the relevant solar access zones;
- ▶ Locate the narrowest lots on the north side of east-west streets;
- ▶ Lots on the south side of the east-west streets need to be wider;
- ▶ East-west lots need to be wider unless two storey construction is to be restricted; and
- ▶ East-west lots can be narrower if there is road or open space to the north (e.g. a corner lot).

#### Energy efficient housing

The Building Code of Australia 2010 (Volume 2) includes a requirement for housing to achieve 6 star energy efficiency in respect of heating and cooling loads for single dwellings. However Western Australia has maintained the 2009 requirement which is for 5 stars. Similarly the Western Australia requirement for multiple dwellings is lower than the national benchmark: 4 stars (average) and 3 stars (minimum for any individual dwelling).

It is expected that the mandatory rating for new houses in Western Australia will soon be raised to 6 stars, in line with a Council of Australian Governments agreement in 2009.

Design Guidelines requiring at least a 6 star rating will be prepared as part of the post structure plan development.

#### Energy efficiency requirements for other buildings

The Building Code of Australia contains performance requirements for non-residential buildings which will deliver energy efficiency for those buildings. These requirements are documented in the Energy Efficiency sections of Volume 1 of The Building Code of Australia.

Mandatory disclosure of the energy efficiency performance of commercial buildings is expected to be introduced later in 2010. This is part of the Ministerial Council of Energy's National Strategy of Energy Efficiency. Under this requirement, a mandatory energy audit would need to be carried out prior to sale or lease, initially for buildings covering 2,000 square meters, and later to cover other commercial buildings of less than 2,000 square meters such as hotels, warehouses, and retail facilities. Energy efficiency certificates would be issued based on the completion of a NABERS assessment, and these would be valid for a period of 12 months.

Design Guidelines for non-residential buildings will be developed post structure plan.



**Figure 9 “The Sun Ship” Energy Efficient Complex of Retail and Commercial Buildings, Freiburg, Germany**

Smart meters / smart grid

Establishing a Smart Grid would enable power companies to have improved demand management practises, with demand reduction by the action of individual households themselves according to a price incentive / contract arrangement. Householders would have increased energy awareness and control over their electricity bills, with the ability to reduce costs, reduce energy consumption and reduce their greenhouse gas footprint.

If deployed at scale some capital expenditure on power infrastructure upgrades could be deferred as a result. Power companies could also have the ability to monitor and potentially control distributed generation, assisting them further with peak load management and dealing with faults. Retailers would also have the ability to apply innovative incentivised tariffs.

Western Power is currently engaged in a Smart Meter trial that forms part of the Solar Cities program. The potential to include Eglinton as part of the trial or future roll out of Smart Meters should be engaged within the next stage of planning. Initial discussions have being held with Western Power to investigate the large scale application of smart meters and smart grid in Eglinton.

Smart Meters and the Smart Grid are described in more detail in Appendix B.

Novel energy efficient built – in appliances

Some novel appliances are emerging that combine the air-conditioner and heat pump hot water system to achieve an overall improvement in efficiency. The readiness of this technology and potential savings should be evaluated.

These are described in more detail in Appendix C.

Provide information on energy efficient appliances for households

In many instances, new homebuyers will also be looking to purchase new appliances for the house. This is an opportunity for the homebuyer to purchase appliances that are more energy efficient. Appliances are rated according to a 5-star energy efficiency system administered by the State and Federal governments. Considerable savings are achievable by selecting appliances that have a higher star



rating. Information could be provided to homebuyers demonstrating the savings that can be made, in dollars and in greenhouse gas emissions, by selecting high star appliances.

### **Natural gas**

Natural gas has significantly lower greenhouse gas intensity than electricity in Western Australia<sup>6</sup>:

- ▶ Consuming 1kWh of electricity from Western Power's south west electricity grid emits approximately 0.84 kg of carbon dioxide equivalent;
- ▶ Consuming 1kWh of natural gas emits approximately 0.18 kg of carbon dioxide equivalent.

Accordingly, the use of natural gas for domestic cooking and water heating is beneficial from a greenhouse emission perspective.

### **4.3.4 Objective E&G4 - Renewable Energy**

#### DISTRICT SCALE

##### District cooling and heating

It is possible, using the principles of District Cooling and a locally available renewable energy heat source such as solar thermal or geothermal, to provide reticulated air-conditioning as a service to centres in Eglinton that would be both renewable and emissions free. This is possible with today's technology and with specialist knowledge developed and held in Western Australia. Cold water for air-conditioning could be reticulated to high density centres using standard technology. Initial design and planning for the pumping and reticulation network and the renewable energy station would need to take place soon after the LSP is developed prior to the lot level planning of utilities and services.

Other district scale renewable energy projects are difficult to implement due to regulatory constraints, as discussed below. The district scale renewable energy technologies that have been considered in this process include wave power, wind power, solar photovoltaic and solar thermal and biomass. Wind has been considered to be the most economically feasible, but would not be able to be supplied preferentially to local residents under current regulatory arrangements.

A preliminary desktop review of geothermal and solar thermal energy for district cooling and heating is included in Appendix D and Appendix E respectively.

##### Street lighting

Street lighting comes in many types, sizes and configurations. Historically, mercury vapour and high pressure sodium lighting have proved to be a reliable choice. However there are a number of lighting types which are beginning to replace the traditional lighting, and other technologies which will emerge over the next decade.

For main roads there are still not any light types that are large enough to replace the high pressure sodium lights. However for smaller street lighting there are a number of more efficient options available.

The following table shows current lighting options. LED and Induction lighting have had limited implementation in street lighting applications (has been implemented for pedestrian lighting) but are expected to become attractive options in the near future.

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<sup>6</sup> Department of Climate Change: National Greenhouse Accounts (NGA) Factors (June 2009)

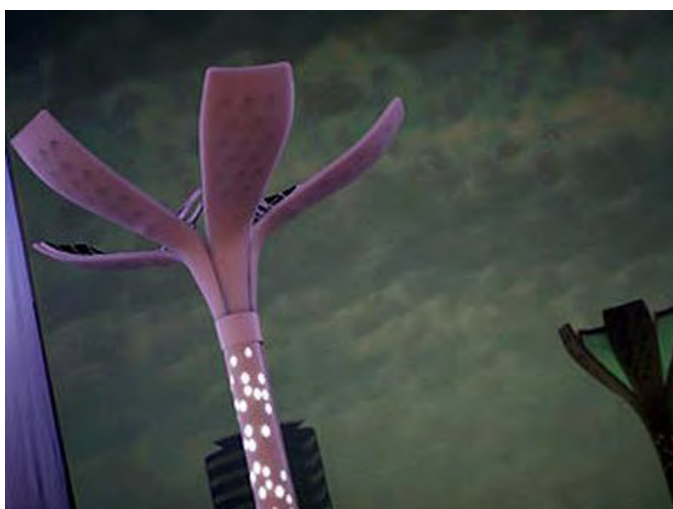
**Table 7 Current and Future Lighting Types**

Lamp Type	MV	HPS	MH	FL	LPS	LED	IND
Rated Life (1000h)	24	24	6-30	10-30	10	100	100
Economic Life (1000h)	15	24	6-20	10-20	10	100	100
Power Range	50-400	50-250	35-400	18-57	18-180	1	70-150

*MV – mercury vapour, HPS – high pressure sodium, MH – metal halide, FL – fluorescent, LPS – low pressure sodium, LED – light emitting diode, IND – induction*

Solar street lighting can be used for small footpath lighting quite easily, provided there is no shading from buildings or trees to block the sunlight. For larger street lighting on main roads, solar lighting can also be used, however the lights are still wired to the grid for reliability. These come at a cost of approximately \$10,000 per pole, or twice the cost of a regular pole.

Street lighting is an area that is constantly being developed. New, innovative designs and concepts are released by companies regularly. For instance, Philips recently released the “light blossom” as a demonstration, seen below. The concept uses energy efficient LED lighting for high efficiency and to save energy, the lights dim when people are not around and increase luminosity when people walk by. Aside from these efficiency measures, the petals open up during the day to capture sunlight on solar cells as well as utilising wind energy to rotate the petals to generate electricity. The solar and wind generation is then used to power the lights during the night.



**Figure 10 Philips Concept “Light Blossom”**

### **Public open space water infrastructure**

At the time of writing the water infrastructure design for Alkimos Eglinton has not been confirmed, but is likely to include the use of groundwater for (at least) irrigation of public open space. Solar water pumps may be an option for this and should be considered when more information becomes available.

There are a number of suppliers who specialise in solar water pumping solutions. Lorentz is one such manufacturer who has solutions capable of pumping up to 155 m<sup>3</sup> of water per day. Systems such as





this consist of a photovoltaic array, of approximately 1.8 kW and a suitably sized battery. There are many systems configurations that can be tailored to match different applications.

To reduce consumption due to water pumping, pumps should be chosen for the highest possible efficiency. Variable speed drives should also be installed on all pumps to increase control and efficiency of all pumps. The efficiency of a pump system also depends greatly on the design of the irrigation system.

### LOT SCALE

Lot level renewable energy initiatives that have been identified as opportunities for the settlement to minimise its greenhouse gas footprint by using renewable energy can be influenced at the post structure plan stage. These relate to specific choices that are made in selecting hot water systems, solar photovoltaic (PV) rooftop installations or other building scale power options that can be influenced by the land owner, including small scale wind projects. The uptake of lot level renewable energy can be influenced by land owners pursuing bulk purchase agreements with suppliers of rooftop PV systems, and solar hot water systems or heat pump systems. Further investigation of the potential for specific buildings to be powered by a small scale wind system should also be pursued.

### Solar hot water

Household water heating comprises approximately 31% of the average household energy use in Western Australia (Office of Energy, n.d.).

Solar water heaters are a proven, reliable and cost effective method of reducing household energy demand, with lower ongoing running costs and greenhouse gas emissions than solely gas or electric water heaters. Flat panel collector solar water heaters are the most common type of system installed, however evacuated tube systems are becoming more widely available and offer a slightly better efficiency. Storage tanks range in size from 150 L to over 400 L, with a 300 L system generally deemed appropriate for an average Western Australian household. Storage tanks can be de-coupled from the solar collector for ground level storage; however these systems generally also have higher costs and require a pump that will consume additional electricity.

Gas boosted solar water heaters typically have lower greenhouse gas emissions than electric boosted systems supplied with conventional grid connected electricity that is generally sourced from fossil fuels. Utilising renewable energy at either household level or through the purchase of Green Power (Horizon Power's Green Select scheme) can negate the use of fossil fuelled electricity, and potentially give the lowest overall greenhouse gas emissions for a solar water heater.

It should also be noted that a solar water heater in Western Australia that is sized, orientated and used correctly has the potential to require zero boosting and rely solely on the energy provided by the sun. It is expected that a minimum of 85% of the energy needs for household water heating could be provided from the solar collectors.

A \$500 subsidy is available through the Sustainable Energy Development Office (SEDO) for natural gas boosted solar hot water systems installed in Western Australia. The rebate is available to homeowners but is not limited to a primary place of residence. Private residential developers may apply for rebates for 20 or more solar water heaters in one development, subject to pre-approval in writing by SEDO. The systems will also be eligible to generate renewable energy credits (RECS), worth up to \$900 per unit. The amount of RECS available is also dependent on the model of hot water system being installed, with each model allocated a specific number of RECS by the Office of Renewable Energy Regulator (ORER).



The Federal Department for Water Environment Heritage and the Arts (DEWHA) also provides rebates of \$1000 for the installation of approved solar hot water systems. Further reductions in system cost may be possible through bulk/preferred supplier arrangements with solar hot water system manufacturers. Owners of systems will save considerably each year through reduced fuel bills for water heating.

### **Photo-voltaic systems**

The utilisation of Solar Photovoltaic (PV) systems at household level is a proven and reliable renewable energy technology, however relatively high capital costs for individual systems remains a barrier to widespread implementation. The Australian PV market has increased considerably in recent years, largely as a result of federal government rebates available for homeowners installing PV and public awareness of climate change issues.

The PV funding model currently in place operates as part of the Renewable Energy Target (RET) scheme. Under this program, wholesale electricity purchasers are required to acquit a certain number of Renewable Energy Certificates (RECs) every year, depending on the target for that year and the amount of energy purchased. RECs are created by entities that generate renewable electricity (1 REC is equivalent to 1MWh of electricity generation), and who register this generation with the Office of the Renewable Energy Regulator (ORER). Owners of a PV system are able to obtain RECs for the renewable energy produced by the system and are also eligible for an additional incentive known as Solar Credits, which multiplies the number of RECs that can be created by an eligible system (up to 1.5kW of system capacity). The Solar Credits multiplier is initially set at five times the amount of RECs created under the standard deeming arrangement if a system is installed between 9 June 2009 and 30 June 2012. The multiplier then reduces to four for systems installed between 1 July 2012 and 30 June 2013 and then continues to reduce linearly until it discontinues in from 1 July 2015.

The number of RECs that can be registered for a given system is dependent on the size and location of the system. RECs can be sold in the marketplace, either to an agent trading RECs or via the REC registry operated by the ORER. RECs usually trade at around \$40 each but are a subject to supply and demand. Under the currently proposed amendments to the scheme, small generation systems such as household solar PV's will be separated from large scale renewable energy systems and guaranteed a price of \$40/REC. RECs are awarded for 15 years of operation of the system and these can be awarded every year, every five years, or for the full 15 years at the outset. The number of RECs that would be generated by a 1kW system has been calculated using the ORER calculator (<https://www.rec-registry.gov.au/sguCalculatorInit.shtml>) as 103 over the 15 year period (including the five times Solar Credits multiplier). This amounts to an income of around \$4,120.

The PV system also offsets the costs of power. The degree of offset depends on the size of the systems and the size of the household power consumption. Grid connected PV systems allow excess electricity to be exported onto the electricity grid if the household energy demand is less than the PV system output. During times where household demand exceeds the PV output, electricity from the grid supplies the difference. An energy efficient household with an adequately sized PV system has the potential to be energy neutral in terms of their electricity needs.

A residential net feed-in tariff scheme is scheduled to be introduced in Western Australia from 1 July 2010. The net tariff will be paid on all excess electricity exported to the grid from small-scale household renewable energy systems. The State Government has also committed to investigating the feasibility of providing a renewable energy feed-in tariff scheme to small business and commercial premises as a separate scheme, however no implementation date has been scheduled.



**Figure 11 Rooftop PV**

### **Green Power**

Green Power is a national program to accredit electricity retailers' renewable energy products and ensure they meet strict environmental standards. Synergy currently offers two Green Power accredited renewable energy products – Natural Power and EasyGreen. Through these programs, customers can specify that a certain percentage (Natural Power) or monetary block (EasyGreen) of their electricity consumption is supplied by Synergy from an accredited Green Power source. Although other Green Power products are available from interstate electricity retailers, Synergy's Green Power products currently offer the best value for money at 4.4 cents/unit.

The purchase of 100% Green Power for a 6 star rated home would add approximately \$200 - \$300 to the average annual household electricity bill. Alternatively, a household can purchase a block of Green Power for each electricity bill, ranging from \$10 to \$80. Purchasing a \$40 block of Green Power for bi-monthly electricity bill will offset more than 100% of average annual electricity consumption.

Subscription to a Green Power product is a voluntary consumer choice, and further investigation of the viability of covenants or design guidelines is necessary.

In any case landowners and / or City of Wanneroo could provide rebates or incentives for the additional cost of Green Power electricity, to be provided on evidence a Green Power contract.

### **Small scale wind**

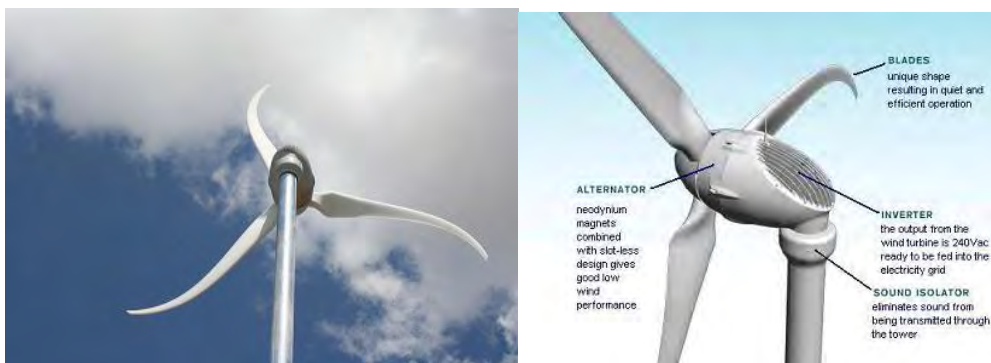
Small scale wind turbines may be an attractive option for household or commercial renewable energy generation, however small wind turbines currently on the market have been beset by noise, safety and visual impact issues that have lead to them being considered generally unfavourable for urban generation.

Small wind turbines are generally designed as either horizontal axis wind turbines (HAWT) or vertical axis wind turbines (VAWT). HAWT's are generally a more efficient system for maximising the wind resource, however the existence of wind turbulence in built up areas may reduce their performance and lifetime due to increased turbine stress. To overcome this, many small scale HAWT's require a relatively large pole height that or are generally recommended to be installed on open land. VAWT's are less sensitive to wind turbulence and as such are more easily installed on buildings and other structures in

built up areas, however their efficiencies are often significantly lower. The presence of greater wind turbulence generated from obstacles in built up areas will actually increase a VAWT's output when compared to a site with less obstacles (i.e. open areas).

There are a number of small wind turbines in Australia that offer future potential for household integration. Once the certification process becomes a national program, it will be possible to investigate small scale wind turbines further for use in Eglinton.

Turby turbines have been proposed for an office building in Perth. These turbines are rated at 2.5kW and are designed to be installed specifically in built up areas, however may not be suitable for houses as they are ideally situated at a height of 20m or more. The turbines have not yet been approved for installation.



**Figure 12 Skystream 1.8kW Wind Turbine**

#### **4.3.5 Objective E&G5 - Climate Change Risks**

Climate change is an emerging issue, and exact predictions about its effects cannot be made with high levels of certainty at this stage. However, there is a significant probability that there will be climatic impacts as a result of the enhanced greenhouse effect, and that these will affect settlements and infrastructure such as those planned for Eglinton. Impacts could include sea level rise, increased frequency and strength of storms and storm surges that might result in coastal damage and flooding.

The potential for this type of event to impact on the settlement should be evaluated using a risk management approach. The Eglinton LSP area will rely on current advice from the Department of Planning (Climate Change and Coastal Planning) about the appropriate methodology for the risk assessment, taking into account guidance recently released from the Department of Climate Change<sup>7</sup>. The findings will assist in planning the coastal foreshore reservation width, setbacks and levels to mitigate possible impacts of climate change, as it is understood by the State at this time.

<sup>7</sup> Climate Change Risks to Australia's Coasts, DCC (2009)



#### 4.4 Post Structure Plan Implementation

The table below sets out the actions to be taken post structure planning as part of the formulated strategies to meet the Eglinton Sustainability objectives, including responsible parties, applicable precincts, and implementation pathways.

**Table 8 Eglinton & Energy & GHG – Post Structure Plan Implementation**

Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
E&G1 Reduce private transport emissions	Develop integrated primary and secondary transport network	Design Special Transport System stops, inclusive of pedestrian routes, shelter areas, provision for CCTV/IT systems. Integrate stops within high intensity surrounding land activity	Developers / Transport Consultant	All precincts	District / Subdivision	Design / construction
		Conformation and detailed development of safe walking and cycling routes integrated with the movement network	Developers / Transport Consultant	All residential precincts	Subdivision	Design / construction
		Detailed multimodal design of key precincts including all activity centres to mitigate traffic speeds, support active streetscapes and provide regular, safe street crossing points	Developers / Transport Consultant	All precincts	Subdivision	Design
		A detailed car parking supply and management plan for the Marina Village (Precinct 1) and Eglinton district centre	Developers / Transport Consultant	Marina Village and District Centre Precincts	Precinct	Design / construction
Investigate car sharing	Investigate car sharing	Pulse timetabling of public transport to integrate the STS with the metro rail	Developers / Transport Consultant	All precincts	Subdivision	Engagement
		Investigate car sharing in conjunction with City of Wanneroo and private sector partners	Developers / City of Wanneroo	All precincts	Subdivision	Engagement / design / construction
		Investigate electrical vehicle infrastructure requirements	Developers	All precincts	Subdivision	Engagement / design / construction

Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
E&G2 Reduce material intensity / embodied energy	Encourage use of recycled construction and demolition waste in road base and low grade concrete (kerbs, driveways etc)	Undertake study to establish the opportunities, technical and economic feasibility of incorporating recycled materials	Developers / Sustainability Consultant	All precincts	Subdivision	Study / Design / construction of subdivision works / Design Guidelines
	Housing requiring proportion of lightweight materials	Establish a framework for the adoption of building materials with low embodied energy	Developers / Sustainability Consultant	All precincts	Subdivision	Study / Design Guidelines
	Encourage use of concrete utilising low EE cement replacement materials (fly ash and blast furnace slag)	Develop a specification for the construction concrete to include a proportion of blast furnace slag or fly ash	Developers / Sustainability Consultant	All precincts	Subdivision	Study / Design / construction of subdivision works / Design Guidelines
E&G3 Reduce operational energy consumption	Investigate and develop feasible energy efficiency initiatives:	Prepare to meet the mandatory 6-star energy efficiency rating for all Eglinton housing.	Developers / Land owners	All residential precincts	Subdivision	Design guidelines / engagement
	<ul style="list-style-type: none"> <li>Encourage building orientation</li> <li>Energy efficient housing</li> <li>Energy efficiency requirements for other buildings</li> </ul>	Commercial buildings should be prepared to undergo NABERS energy audits and should be designed according to energy efficient principles and to enable energy monitoring.	Developers / Land owners	Marina and District Centre Precincts	Subdivision	Design guidelines / engagement
	<ul style="list-style-type: none"> <li>Encourage use of Smart Meters</li> <li>Investigate novel energy efficient built-in appliances</li> <li>Provide information on energy use and energy efficient appliances to homebuyers</li> </ul>	The potential for the introduction of Smart Meters should be pursued to facilitate household energy education and participation in energy demand management.	Developers / Western Power	All precincts	Subdivision	Engagement / subdivision design / Design Guidelines
	<ul style="list-style-type: none"> <li>Encourage use of natural gas as clean fossil fuel</li> </ul>	Subdivision planning for lot layout and orientation to encourage building orientation so as to achieve best use of natural heating, cooling and lighting.	Landowners / developers	All precincts	Subdivision	Design / construction



Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
E&G4 Increase renewable energy	Investigate and develop feasible renewable energy initiatives: District scale	The feasibility of a geothermal powered District Cooling project should be pursued, including the design requirements for a heating / cooling reticulation system, to high density centres	Developers / Sustainability Consultant	High density centres	Subdivision	Study / Design / construction
	Investigate use of renewable sources, solar and geothermal, to provide a district heating and cooling service for homes and other buildings	A bulk purchase agreement with hot water systems (solar or heat pump) suppliers and installers should be pursued in consultation with key builders representatives. The available models should be assessed for value for money and emissions reductions.	Developers / Sustainability Consultant	All precincts	Subdivision	Engagement
	Investigate street lighting powered by renewable energy	Local electricity infrastructure, such as distribution lines and substations, should be planned to accommodate the substantial uptake of rooftop PV.	Developers / Sustainability Consultant	All precincts	Subdivision	Design / construction
	Investigate efficient public open space water infrastructure Powered by renewable energy	A bulk purchase agreement with PV supply and installers should be pursued in consultation with key builder's representatives. The available models should be assessed for value for money and emissions reductions.	Developers / Sustainability Consultant	All precincts	Subdivision	Engagement
	Lot scale					
	Greenhouse efficient hot water in homes and other buildings	Investigate land purchase contracts that could include a requirement for the purchaser to use Green Energy.	Developers / Sustainability Consultant	All precincts	Subdivision	Contracts of sale / Design Guidelines
	Promote grid connected PV installation in homes and other buildings	Generate a wind resource map for the district and identify specific building locations that could be powered by small scale wind installations. Identify the expected cost / benefit equation for these buildings and develop a proposal for their inclusion in the land sale package.	Developers / Sustainability Consultant	All precincts	Subdivision	Study
	Investigate Green Power purchase options					
	Identify specific buildings that could benefit from a small scale wind project to supply that building					
	Identify risks that could impact on the development as a result of climate change and plan to manage these risks	Gain advice from DoP Coastal Division on coastal vulnerability study	Planning Consultant	Alkimos Eglinton coastal precincts	District	Design / construction
E&G5 Identify and respond to climate change risks						



## 5. Ecosystem Health

### 5.1 Overview

Ecosystem Health, as defined in this Sustainability Strategy, deals with the conservation and enhancement of local biodiversity, community participation on local bush care efforts, and sustainable waste management practices in Eglinton.

Furthermore, the DSP documentation sets out broad principles for the management of the Alkimos-Eglinton Regional Open Space (ROS) areas which have been reflected in the LSP.

### 5.2 Sustainability Objectives and Strategies

The table below summarises the ecosystem health related objectives stated in the Alkimos Eglinton DSP Sustainability Strategy, including the strategies to meet these objectives. The following sections in this report address how these objectives and strategies have been incorporated into the Eglinton LSP, and which implementation steps are required subsequently post structure planning.

**Table 9 Eglinton & Ecosystem Health – Sustainability Objectives and Strategies**

Objective		Strategy to Meet Objective
EH1	Conserve and enhance local biodiversity	Conservation of existing significant environmental assets
		Apply biodiversity based landscaping of public and private spaces
EH2	Encourage local environmental awareness in the community through initiatives such as local bush care	Develop and implement community based environmental awareness program (including bush regeneration and protection)
EH3	Encourage sustainable waste management options and improve resource recovery	Waste management controls and targets to minimise, reduce, or recycle construction, household, and commercial wastes
		Recycle organic wastes locally for use in parks and gardens

### 5.3 Local Structure Plan

#### 5.3.1 Objective EH1 - Conserve and Enhance Local Biodiversity

##### Conservation of existing significant environmental assets

The environmental commitments for the implementation of the DSP in the LSP stage are provided below:

1. Implement the environmental conditions of the Minister for the Environment's Statement 722;
2. Prepare Environmental Management Plans (EMPs) in accordance with Condition 2 of the Minister for the Environment's Statement 722 for areas of ROS including Bush Forever Sites 397 and 294 and land that may be an ecological linkage. The EMPs shall include:
  - a. A description of existing environmental values and the identification of the environmental outcome to be achieved through the implementation of this plan;
  - b. Clear delineation of boundaries or significant areas to be protected;
  - c. Management of construction, access and rehabilitation;



- d. Vegetation mitigation strategies;
  - e. Allocation of responsibilities and identification of timing and duration of implementation;
  - f. Provision for routine monitoring and environmental values; and
  - g. Provision of details of contingency plans in the event that the monitoring surveys indicate that the development is having or has had an adverse impact upon environmental values.
3. Maintain ecological integrity and biodiversity value of regional ecological linkages in Regional Open Space (ROS) as well as can be practically achieved whilst also enabling effective functioning of the area for urban uses;
  4. Retain as much Carnaby's Black Cockatoo foraging habitat as can be practically achieved whilst also enabling effective functioning of the area for urban uses;
  5. Undertake a reptile relocation program for each stage of development.
  6. Retain and protect significant portions of vegetation with a herb layer dominated by *Lomandra maritima* to provide for the conservation of the Graceful Sun Moth/Sun moth.
  7. Ensure public places, facilities and public access to the beach through the foreshore reserve to be developed in a manner that does not compromise the ecological value of the area.
  8. Retain the small number of tuart trees that occur on the site wherever possible in POS and road reserves.

#### Biodiversity based landscaping

There are three main areas of landscaping within the Eglinton LSP area. The approach to biodiversity based landscaping is different for each:

- ▶ Conservation areas: There are two main areas of conservation as well as the foreshore area. These are the dunal conservation areas and the Banksia Woodland foraging area to the south east. The strategy is similar for both – in principle, access will be encouraged in a controlled manner via boardwalks and access tracks. This will ensure the current biodiversity within these areas is protected and appreciated.
- ▶ Public Open Space: There are a broad range of Public Open Space environments. The general principle will be to utilize predominantly native trees and shrub planting with a view to providing habitat for birds and insects. Where possible, areas of revegetation will be included within POS areas. Exotic tree species and areas of turf will be restricted to appropriate high-use areas.
- ▶ Drainage areas: A number of Public Open Space areas include a significant area of Drainage provision. The 1:1 flood zones will be retained within Wetland style planting areas. These areas will provide another flora/fauna environment within the LSP area.

In relation to private areas of landscaping, it is anticipated that planting palettes and design strategies will be provided to property purchasers to guide their selection of landscaping materials, with specific strategies for lot types and locations. A number of strategies will be explored, such as partnerships with native plant nurseries and landscaping packages to purchasers to encourage the retention of coastal plant diversity and waterwise planting outcomes.

The principles for biodiversity in Eglinton LSP have been built on the biodiversity principles from the DSP:

- ▶ Utilizing and responding to the site's natural features to achieve conservation and enhancement of the sites highest conservation values;
- ▶ Areas of vegetation retention for fauna foraging should be integrated into recreation spaces which would also allow access by the local community;
- ▶ Areas of foreshore vegetation retention should be integrated into recreation spaces, car parking areas, drainage areas as well as pedestrian and cyclist movement networks to the beach as well as to coastal villages. Where applicable, other areas of existing vegetation suitable for retention should be integrated with public open spaces;
- ▶ Balance environmental outcomes and community needs.



**Figure 13 Bioretention System, Treendale Estate, Western Australia**

### **5.3.2 Objective EH2 - Encourage Local Environmental Awareness in the Community through Initiatives such as Local Bush Care**

Enhanced awareness of the local physical environment is to be a distinctive characteristic of Eglinton residents and businesses. Community activities and infrastructure with an environmental theme (e.g. community garden; bike-throughs; and tree planting days) will form an important part of the annual calendar of events

The EMPs that will be prepared in accordance with Condition 2 of the Minister for the Environment's Statement 722 for areas of ROS including Bush Forever Sites 397 and 294 and land that may be an ecological linkage will include a community awareness/education component. The community awareness program would include the following principles:

Recognise, interpret and understand natural environment through:

- ▶ Establishment of community groups such as Coastcare or Bushcare that also provide residents with opportunities for social interaction and for creating memorable and distinctive places and spaces that give rise to sense of place;
- ▶ Provide interpretative signage communicating the importance of protecting remnant vegetation and the importance of staying on designated paths;
- ▶ Create educational opportunities to monitor Graceful Sun Moth activity in ROS and POS; and
- ▶ Explore provision of biodiversity educational package for all new landowners.



**Figure 14 Bush Regeneration at Muogamurra, NSW**

### **5.3.3 Objective EH3 - Encourage Sustainable Waste Management Options and Improve Resource Recovery**

The following principles have been adopted to guide waste strategies at Eglinton:

- ▶ Design and manage civil and building works to minimise waste;
- ▶ Design for future waste recycling; and
- ▶ Facilitate household waste recycling.

#### *Developing an Eglinton Waste Management Plan*

It is recommended that an Eglinton Waste Management Plan (EWMP) be developed for Eglinton to:

- ▶ Inform and guide the City of Wanneroo's management of construction, municipal and commercial wastes; and
- ▶ Identify clear implementation routes for increasing the reuse, recycling, and recovery of materials from Eglinton.



The EWMP is best developed in conjunction with, or as a subset of, waste management plans developed by the City of Wanneroo and/or Mindarie Regional Council. Alternatively, a customised plan could be prepared for the Alkimos Eglinton DSP area.

The EWMP will need to consider whether expanded waste management services are to be provided to Alkimos Eglinton DSP area beyond the normal City of Wanneroo council services.

The EWMP should be reviewed before the physical development of each LSP area.

The EWMP would address the two specific strategies identified in the DSP strategy:

- ▶ Construction waste management controls and targets to minimise waste and reuse / recycle residuals – for the construction phase of the Eglinton development; and
- ▶ Recycle organic wastes locally for use in parks and gardens – for the operational phase of Eglinton.

Key issues to be considered in preparation of the EWMP include:

- ▶ Knowledge of existing waste streams characteristics and contamination within the City of Wanneroo;
- ▶ Knowledge of waste management systems and infrastructure within City of Wanneroo; and
- ▶ Understanding of the socio-economic factors and demographics at Eglinton and how these may impact waste streams and services.

Stakeholders to be involved with development of the EWMP include the following.

- ▶ Local government - the City of Wanneroo will be responsible for kerbside recycling in Eglinton and operates the Wangara Materials Recovery Facility (MRF) where dry recyclable materials from Eglinton will be processed.
- ▶ Mindarie Regional Council (MRC) – the City of Wanneroo is a member council of the MRC. The MRC Tamala Park Landfill receives household putrescible wastes in residual bins from the City of Wanneroo and has been processing this material at the MRC Resource Recovery Facility at Neerabup since 2009.
- ▶ Community – the community are participants in the waste management and recycling programs and need to be engaged in, and influence the development of, the waste management strategy and management plans.
- ▶ Waste Management Contractors – contractors should be surveyed to gather their knowledge of the waste management processes, and engaged to ensure the success of new or revised waste management programs.
- ▶ Consultants – appropriate consultants to be commissioned who can liaise with local government, contractors and the community, to produce the Waste Management Plan.





## 5.4 Post Structure Plan Implementation

Table below sets out the actions to be taken post structure planning as part of the formulated strategies to meet the Eglinton Sustainability objectives, including responsible parties, applicable precincts, and implementation pathways.

**Table 10 Eglinton & Ecosystem Health – Post Structure Plan Implementation**

Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
EH1 Conserve and Enhance Local Biodiversity	Conservation of existing significant environmental assets	Implement environmental management methods and works in accordance with EMP developed as part of Eglinton LSP	Landowners / developers	All precincts	Subdivision	EMPs
		Prepare Graceful Sun Moth Management Strategy and Carnaby's Cockatoo foraging habitat offset strategy for inclusion in EPBC Referral	Landowners / developers	All precincts	District / Precinct	Graceful Sun Moth Management Strategy Carnaby's Cockatoo foraging habitat offset strategy
		Apply biodiversity based landscaping of public and private spaces	Landowners / developers	All precincts	Subdivision	EMPs
EH2 Encourage local environmental awareness in the community through initiatives such as local bush care	Develop and implement community based environmental awareness program (including bush regeneration and protection)	Predominant use of low water use native vegetation in all public realm landscaping, and only provide high water use areas in strategic locations where they best serve the community	Landowners / developers	All precincts	Subdivision	Landscape Guidelines
		Implement community environmental awareness program (including bush regeneration and protection) for new Eglinton residents	Landowners / developers	All precincts	District / Precinct	Engagement



Objective	Strategy	Post Structure Plan Actions	Responsible	Applicable Precincts	Level	Implementation Pathway
EH3 Encourage sustainable waste management options and improve resource recovery	Waste management controls and targets to minimise, reduce, or recycle construction, household, and commercial wastes	Development of Eglinton Waste Management Plan (EWMP)	City of Wanneroo	All precincts	District / Precinct	EWMP
		Implement EWMP during subdivision construction where possible	Landowners / Developers	All precincts	Subdivision	Design / construction
	Recycle organic wastes locally for use in parks and gardens	Incorporate in EWMP	City of Wanneroo	All precincts	Subdivision	CoW Waste Mgt & Landscaping policies



## Appendix A

# Desktop Review of Conventional Versus Alternative Materials



The alternative substitution options identified have been subjected to a preliminary comparative review of environmental impacts (recycled content and embodied energy), economic impacts (costs and durability compared to conventional material), and availability. The results are summarised in the table attached.

**Table 11 Comparative Review of Material Options**

#	Material Options	Environment	Economic		Availability	
		Recycled Content	Embodied Energy <sup>8</sup>	Costs Compared to Conventional Material	Durability Compared to Conventional Material	
1	Cement	0%	6 to 15 MJ/kg	-	-	Local
a	Cement made with up to 40% fly ash	40%	3.6 to 9 MJ/kg	Similar or less	Similar or increased	Local / national
b	Cement made with up to 70% blast furnace slag	Up to 70%	1.8 to 4.5 MJ/kg	Similar or less	Similar or increased	National / international
c	Cement made with direct iron making slag (Hismelt)	Unknown	Unknown, but much lower than virgin cement	Unknown	Unknown	Will be local
d	Cement made with up to 10% silica fume	Up to 10%	5.4 to 13.5 MJ/kg	More	Increased	Local / national
e	Cement made with bauxite residue red sand (high silica fraction)	Unknown	Unknown, but likely lower than virgin cement	Unknown	Unknown	Will be local
f	High reactivity metakaolin (HRM) based cement	Unknown	Unknown, but likely lower than virgin cement	Similar or more	Increased	National (QLD)
g	Geopolymer made from 100% PFA (pulverised fuel ash, mostly fly ash) and 100% alkaline waste materials	100%	Unknown, but much lower than virgin cement	Unknown	Unknown	Will be local
h	Geopolymer made from 100% blast furnace slag and 100% alkaline waste materials	100%	Unknown, but much lower than virgin cement	Unknown	Unknown	Will be local

<sup>8</sup> Provided embodied energy values are indicative and dependent on specific process and supply chain parameters (e.g. location suppliers, production route, energy sources used, transportation).

Embodied energy values were consolidated from the following reports:

- GHD. 2008. Report for New Perth to Bunbury Highway – Carbon Footprint Calculation.
- Treloar, G., Fay R., 2005. Building Materials Selection – Greenhouse Strategies. BDP Environment Design Guide, Melbourne. <http://www.environmentdesignguide.net.au>.
- Glover, J., White D.O., Langrish T.A.G., 2002. Wood versus concrete and steel in house construction. Journal of Forestry: 100, 8; Career and technical Education, pg 34.
- Alcorn, A., 2003, Embodied Energy and CO2 Coefficients for New Zealand Building Materials, University of Victoria Centre for Building Performance Research, Accessed online: [http://www.victoria.ac.nz/cbpr/documents/pdfs/ee-co2\\_report\\_2003.pdf](http://www.victoria.ac.nz/cbpr/documents/pdfs/ee-co2_report_2003.pdf) (Accessed October 2008).



## # Material Options

#	Material Options	Environment	Economic		Availability	
		Recycled Content	Embodied Energy <sup>8</sup>	Costs Compared to Conventional Material	Durability Compared to Conventional Material	
2	Concrete and aggregates	0%	1.5 to 4.5 MJ/kg (concrete) 0.1 MJ/kg (aggregate)	-	-	Local
a	Concrete with up to 100% alternative aggregates	Up to 100% (aggregates)	1.4 to 4.4 MJ/kg (assumed 40% aggregate content in concrete)	Similar, less, more or expensive	Similar	Alternative aggregates are locally available
b	Concrete with up to 40% of cement replaced with fly ash	Up to 40% (cement)	0.9 to 3.9 MJ/kg (assumed 15% cement content in concrete)	Likely similar	Similar or increased	Local / national
c	Concrete with up to 75% of cement replaced with blast furnace slag	Up to 40% (cement)	0.9 to 3.9 MJ/kg (assumed 15% cement content in concrete)	Likely similar	Similar or increased	National / international
d	Geopolymers	As above	As above	As above	As above	As above
e	Mudcrete	Unknown	Unknown	Less	Likely similar	International (NZ)
3	Bricks	0%	1 to 7.6 MJ/kg	-	-	Local
a	Bricks made with alternative raw materials	Up to 50%	0.5 to 3.8 MJ/kg (estimated at 50% of embodied energy conventional brick)	Similar or less	Likely similar	Local / National
b	Geopolymer bricks	Up to 100%	Unknown, but likely very low	May be more	Increased	Will likely be local
c	Fly ash brick	Up to 100%	Unknown, but likely very low	Unknown	Likely similar	Will likely be national
d	Reclaimed / recycled bricks	100%	Unknown, but likely very low	Less	Similar	Local
e	Unfired bricks	Likely up to 50%	0.07 MJ/kg	Likely less	Likely similar	International (UK)
f	Rammed earth	Up to 100% (sand, gravel)	0.3 to 0.8 MJ/kg	May be more	Likely similar	Local
4	Asphalt	0%	0.2 to 0.36 MJ/kg	-	-	Local
a	Asphalt concrete with up to 100% alternative aggregates and filler	Up to 100% (aggregates, filler)	0.15 to 0.27 MJ/kg (estimated at 75% of embodied energy conventional asphalt)	Similar or less	Similar	Alternative aggregates and filler are locally available
b	Bioasphalt	Unknown	Unknown	Unknown	Unknown	Unknown



## # Material Options

#	Material Options	Environment		Economic		Availability	
		Recycled Content	Embodied Energy <sup>9</sup>	Costs Compared to Conventional Material	Durability Compared to Conventional Material		
c	Asphalt made with up to 50% recycled asphalt	Up to 50%	0.1 to 0.18 MJ/kg (estimated at 50% of embodied energy conventional asphalt)	Less	Similar	Will be local	
5	Road base	0%	0.2 to 0.36 MJ/kg (asphalt) 0.1 MJ/kg (sand)	-	-	Local	
a	Road base with up to 100% alternative aggregates	Up to 100% (aggregates)	Unknown, but likely lower than virgin road base	Similar or less	Similar	Alternative aggregates are locally available	
6	Fill materials	0%	0.1 MJ/kg (sand)	-	-	Regional	
a	Fly ash	100%	Unknown, but likely lower than virgin sand	Likely less	Similar	Local	
b	Bottom ash	100%	Unknown, but likely lower than virgin sand	Likely less	Similar	Local	
c	Red sand from alumina refining	100%	Unknown, but likely lower than virgin sand	Likely less	Similar	Local	
d	Foundry sand	100%	Unknown, but likely lower than virgin sand	Likely less	Similar	Local	
e	Overburden	"100%"	Unknown, but likely lower than virgin sand	Likely less	Similar	Local (on-site)	
f	Mudcrete	As above	As above	As above	As above	As above	
7	Timber	0%	0.3 to 40 MJ/kg <sup>9</sup>	-	-	Local	
a	Timber made with up to 50% recycled timber	Up to 50%	0.15 to 20 MJ/kg (estimated at 50% of embodied energy virgin timber)	Less	Likely similar	Local	
b	Timber made with up to 100% recycled timber	Up to 100%	0.03 to 4 MJ/kg (estimated at 10% of embodied energy virgin timber)	Less	Likely similar	Local	

<sup>9</sup> High embodied energy values are for timber hardboard products





## # Material Options

#	Material Options	Environment		Economic		Availability	
		Recycled Content	Embodied Energy <sup>8</sup>	Costs Compared to Conventional Material	Durability Compared to Conventional Material		
c	Certified (sustainable) timber	0%, but timber is from sustainable sources	0.3 to 24 MJ/kg (same as conventional timber)	Likely more	Similar	National	
d	Cork	Up to 50%	Unknown	May be more	Likely similar	Local	
e	Bamboo	0%	Unknown	May be more	Likely similar	Local	
8	Steel	0%	30 to 115 MJ/kg	-	-	Local	
a	Structural steel made with up to 20% recycled steel	Up to 20%	25 to 95 MJ/kg	Similar	Similar	Local / National	
b	Reinforcement steel made with up to 20% recycled steel	Up to 20%	25 to 95 MJ/kg	Similar	Similar	Local / National	
c	Structural steel made with up to 100% recycled steel	Up to 100%	8 to 16 MJ/kg	Similar	Similar	National / international	
d	Reinforcement steel made with up to 100% recycled steel	Up to 100%	8 to 16 MJ/kg	Similar	Similar	National / international	
e	Timber (structural)	As above	As above	As above	As above	As above	
9	Aluminium	0%	200 to 260 MJ/kg	-	-	Local	
a	Aluminium made with up to 50% recycled aluminium	Up to 50%	105 to 140 MJ/kg	Similar	Similar	International	
b	Aluminium made with up to 100% recycled aluminium	Up to 100%	9 to 20 MJ/kg	Similar	Similar	International	
c	Steel	As above	As above	As above	As above	As above	
d	Timber	As above	As above	As above	As above	As above	



## Appendix B

# Desktop Review of Smart Meters



Smart Grids are electricity networks capable of dynamically adjusting to changes in electricity supply and demand through a tripartite approach encompassing metering and communications, demand side management and distributed energy generation. A smart meter is a device which measures and records the production and consumption of electricity, and is also capable of including functionality requirements such as load management ability, tamper detection, remote access and communication, and customer interaction interfaces.

Smart grids are currently in the early stages of development; however global demand for the smart metering technology that underpins a smart grid is expected to reach \$11 billion dollars by 2011 (with greater than 200 million units installed). The state network provider in Western Australia, Western Power, aims to begin a mass rollout of smart meters across the South West Interconnected System during 2012. The initial phase of the program is currently being developed and includes a smart grid trial that aims to assess the change requirements for the network and quantify the costs, benefits and risks whilst gaining a thorough understanding of the technology.

The smart meter trial is being undertaken as part of the Perth Solar City program, which will install around 9,000 smart meters in concentrated locations across the city. This program aligns primarily with the objectives of the Ministerial Council on Energy (MCE), which is the national policy and governance body for the Australian Energy Market.

Benefits are outlined as part of the Ministerial Council on Energy's objectives for a smart meter program. These are:

- To drive efficiency and innovation in electricity business operations, including improved investment price signals and promoting competition in retail electricity markets.
- To enable consumers to make better, more informed decisions in regards to their energy use and receive greater information in regards to their carbon footprint.

Smart meters may also provide a platform for demand side response measures and supporting (and optimizing the use of) distributed alternative energy generation, including household photovoltaic systems and electric vehicles/battery storage.

The Australian Government has recently closed funding for the Smart Grid, Smart City to support the installation of Australia's first commercial scale smart grid as part of the National Energy Efficiency Initiative. According to a pre-deployment study undertaken for the project, the deployment of smart grid technologies across Australia could deliver at least \$5 billion of gross annual benefit to Australian society in areas ranging from improvements in the operation of the power industry, reduced greenhouse gases and improved grid reliability.

The combination of 'time-of-use' tariffs and the functionality of Smart Meters provide the opportunity for households to make cost-effective electricity consumption decisions. The half hourly consumption measurement recording of the meters allows the recording of active energy consumption for 48 data points per day, providing daily consumption profiles for each individual household (and possibly extended to particular appliance profiles). Time-of-use tariffs are electricity pricing structures that reflect the different costs of power at different times of day due to the generation activity required to meet a given load on the network. In combination with remote communications (data exchange and time clock synchronisation), the development of innovative time-of-use tariffs has the ability to enable each household to cost-effectively manage electricity use in response to market conditions.

Households are thus able to become actively engaged with their energy consumption on a real time basis and can potentially use the information to take advantage of time of use tariff arrangements



through their electricity retailer. Households will benefit from more accurate meter reading cycles and will not require meter readers to enter their premises as all meters can be read remotely.

Household load management through dedicated circuits provides for remote and/or programmable load control ability for items within a dwelling, including electric storage water heating, space heating systems and air conditioners. Active smart meter communication can be realized through the use of an in home communications device that facilitates a Home Area Network (HAN) communication system between any appliances (including computers and air conditioners) and the electricity meter.

MCE requirements also state that two way communications should also provide for commands to be broadcast to 99 percent of meters within 1 minute of action. This allows for appliances to be automatically cycled on and off during peak periods (and other specified timeframes) in response to pricing signals, saving customers money without reducing comfort or performance. Direct load control capability would also be possible, with the use of an in-home display unit to further enhance the opportunities for consumers to maximize their demand response.

A primary benefit of smart metering and the development of a smart grid is the expected reduction in peak power demand, which may lead to additional benefits associated with network augmentation and deferred generation investment. Further benefits from smart meter installation include supply quality recording and loss of supply and outage detection. Meters are able to record supply quality events such as outage, under-voltage, and disconnection, meter loss of supply and changes of settings. These events are then able to be relayed to the network provider with the potential for innovative solutions such as localized islanding / self healing of affected networks, providing benefit (and cost savings) to transmission network providers whilst reducing outage times for customers. Improved accuracy and a reduced need for manual meter reading or estimated billing will also provide direct benefits to both consumers, who receive more accurate and regular data on their personal consumption, and electricity businesses in the form of reduced operating costs.

The integration of rooftop PV and a smart grid system enables the supply and consumption of energy to be seamlessly optimized. Decentralized energy generation close to the load enables reduced losses through the transmission and distribution network (which accounts for approximately 6.7% of all electricity currently flowing through the SWIS) and can also improve power quality while imposing minimal additional costs and risks to network assets. Modelling undertaken by the CSIRO has shown the deployment of distributed energy generation has reduced the frequency and severity of high spot prices for electricity, allowing these cost benefits to be passed through in the form of lower tariff increases, whilst also deferring investment in additional peaking plants.

A smart meter installed in conjunction with a PV system allows the householder to make use of time of use tariff arrangements, including the net feed in tariff being introduced into Western Australia for small scale renewable energy systems. This new tariff provides a financial return on any electricity exported to the grid from a residential PV system (at a rate greater than the household cost to consume electricity). The programmability of an interactive smart meter will allow householders to minimize their loads at peak generating times and thereby maximize the feed in tariff return (and reducing payback periods of installed systems).

Benefits to the greater electricity network include the potential for network augmentation or deferral of upgrade works due to an improved localized capacity for electricity delivery. Critical peak load reduction yields both savings in providing high expense electricity at extreme peaks whilst reducing the need for future peak power generation infrastructure. A more resilient network with greater controls allows for improved power quality and reduced blackout events, particularly with the possibility of self



healing and islanded networks (although islanding networks still have issues to be resolved before being fully realized).

Having a large concentration of small scale renewable energy generation allows them to be categorized as a single semi-dispatchable energy generator. Smart meters in combination with PV systems, storage (such as electric vehicles), other dispatchable systems and demand management resources can create a viable firm capacity to be delivered, and may even compete with conventional generation in suitably adapted markets. Part of the Perth Solar Cities project includes a PV saturation trial that will help to quantify the benefits of clustering of PV systems in combination with smart metering and demand management.

Electricity retailers may benefit from improved ability to manage electricity purchase arrangements and sell distributed generation at peak periods to those that are willing to pay higher prices. Retailers are also obliged to purchase Renewable Energy Certificates (RECs) as part of the expanded Renewable Energy Target (RET), and an increase in household PV installations may correspond with a reduced REC price.

Some international examples of smart grid / smart meter trials include:

***Edison SmartConnect, Southern California***

Southern California Edison (SCE) has planned to install 5 million smart meters in a program authorized by the California Public Utilities Commission for the widespread installation of smart meters in Central, Coastal and Southern California. The meters include features that allow communication with other smart devices and in combination with new pricing plans, programs and services, the program is expected to reduce electricity demand by more than 1000MW.

***Energy Smart Miami, Florida***

The installation of over 1 million smart meters at every home and most businesses in the Miami-Dade County area by 2011. This will then be expanded to the installation of over 4 million meters in Florida over the next five years. 300 plug-in hybrid electric vehicles (PHEV), 50 charging stations with additional PV and PHEV trials slated for universities in the county.

***PRIME Project, Europe***

The PRIME project focuses on the European Union requirement that at least 80 percent of households across its 27 member states have a smart meter installed by 2020, with full coverage by 2022.



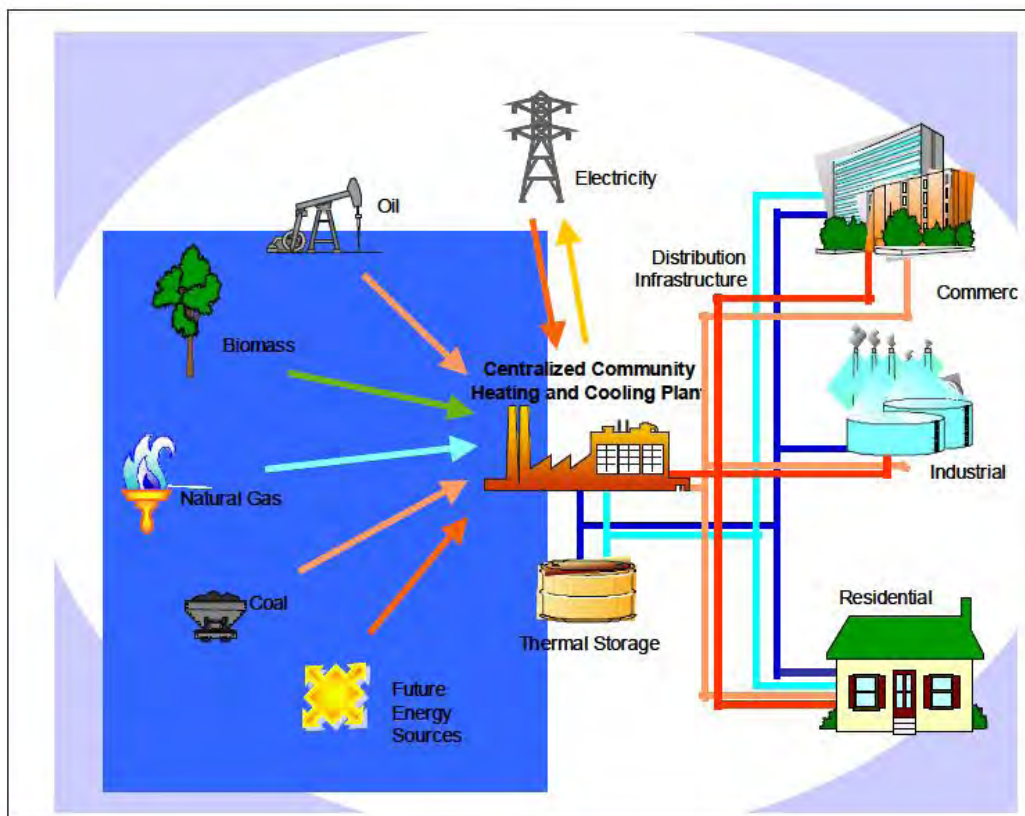
## Appendix C

# Desktop Review of Combined Heat and Power



Large scale district heating systems are utilized throughout the world for providing relatively cheap space and water heating predominantly in cooler climates such as Europe, Japan and North America. District heating systems may be a combination of combined heat and power (CHP or cogeneration) stations and stand alone boilers, with the fuel source ranging from fossil fuels such as coal, gas or oil to renewable resources such as geothermal, solar thermal, waste biomass, waste gases from wastewater treatment and landfill gas amongst others. District cooling is utilized extensively throughout the USA, Europe and also notably in the expanding Middle East market, where significant growth in air conditioning demand has led to the development of several district cooling projects. Several district cooling projects have also been undertaken in Malaysia and Singapore.

District cooling applications are also able to be realized from waste heat through the integration of absorption chillers, which then supply reticulated chilled water for air conditioning purposes. A district cooling system would potentially comprise of an arrangement of absorption chillers connected to various distributed heat sources, possibly in conjunction with electric compression chiller systems, connected to a cold water reticulation network that delivers the chilled water requirements to the reticulated district heating / cooling network. Chilled water pipelines may extend over 80km in length and may consist of a number of cooling plants depending on the configuration of the system. A thermal energy storage tank may also improve the efficiency of the system by allowing chilled water storage and associated load delay/shifting potential.



**Figure 15 Simplistic District Heating and Cooling Model Showing Various Energy Inputs**

Utilising heat waste heat recovery systems for combined heat and power or combined cooling and power reduces the need for additional fossil fuel energy use to provide for heating or cooling demand. The efficiency of a conventional thermal power station will generally not exceed 50% energy conversion from fuel input to electricity; however by capturing the waste heat as useful energy, efficiencies of up to 90% may be achieved. The use of reticulated heat energy also requires a more distributed energy network in order to minimise piping networks and

maximise the energy efficiency of a district heating system. The primary application for district heating (or cooling systems) is for concentrated regions of demand such as higher density urban areas and building clusters.

Absorption chillers require significantly less electricity input than conventional compression chillers, as heat is the primary method of raising the pressure of the refrigerant rather than using an electrical motor to drive a compressor. Using absorption chillers that operate on waste heat for a district cooling system would provide both an enhanced efficiency of an open cycle power station whilst reducing electricity demand from conventional decentralized cooling systems in households and businesses, which can defer the need for future investment in electricity infrastructure. A portion of the chilled water produced may also be able to be used to cool the inlet air for the gas turbines, improving the efficiency of the power plants. Centralised cooling systems also reduce the space requirements for new buildings to house their own plant.

An energy option that has recently been developed in the Australian market is a tri-generation district energy system powered by natural gas from Grid-x Power. This system produces district heating, cooling and electricity from a single fuel source and has recently been established in a housing estate in western Sydney. The natural gas powers an electricity generator and the heat by-product is utilised to produce hot and cold water for heating and cooling purposes. Transmission losses may be significantly reduced when compared to the SWIS grid (Grid-x claims a 10% reduction in costs due to reduced line losses), and utilising the waste heat means that the conversion efficiency is high. Customers in the housing development also receive lower electricity bills; however this may only apply in Western Australia if full retail contestability is introduced to small consumers. The possibility also exists to integrate this technology with renewable energy systems.

Qantas has recently announced that it will introduce tri-generation systems at three of its Sydney facilities, providing heating, cooling and electricity to its Jet Base, catering centre and domestic terminal. It is anticipated that this project, expected to be completed by mid-2011, will be the largest commercial tri generation system in Australia.



**Figure 16 Grid-x Power Tri-Generation System**

Household combined heat and power systems are also becoming available that combine natural gas household heating and water heating with electricity generation to supplement grid electricity. Small scale household systems may also comprise of a split system air conditioner with heat recovery for heat pump water heating. Heat pumps are a more energy efficient method of heating water than conventional electric storage water heaters, as they transfer latent heat energy from the air and use it to heat water, rather than converting electrical energy into heat. Heat pumps operate much like a refrigerator but in reverse, using a refrigerant circulated through a coil to absorb latent heat energy, which is then pressurized to raise the temperature and heat a coil inside the storage tank. The only electricity required is to operate the compressor pump that circulates the refrigerant, offering potential energy savings of up to 70% over a standard electric storage tank.

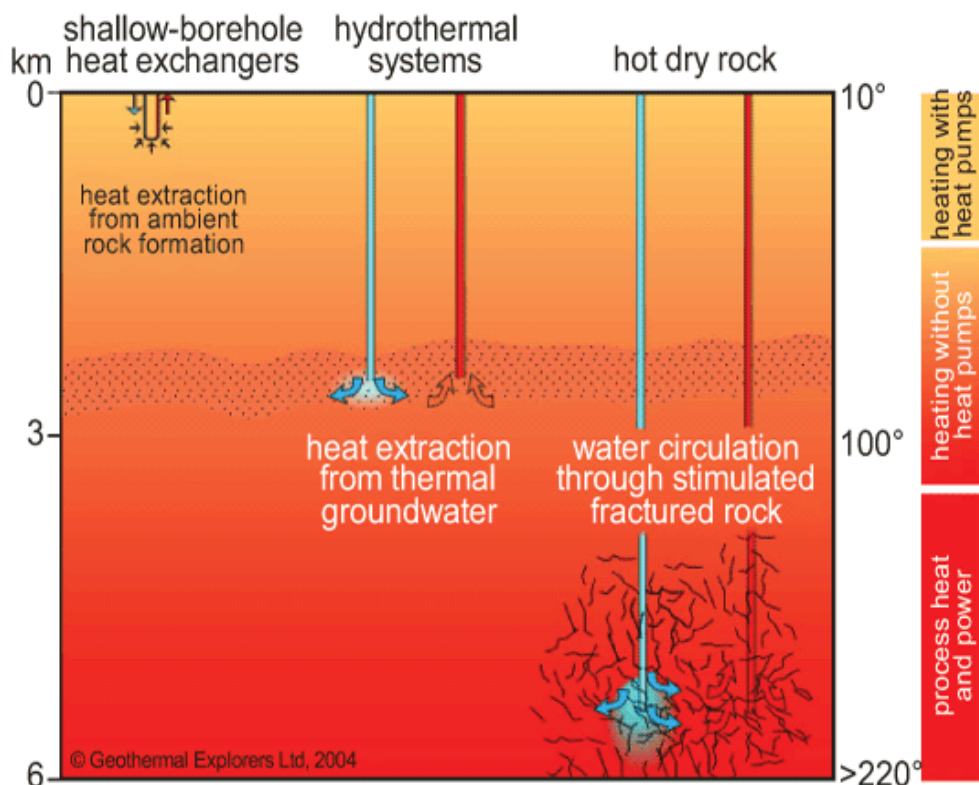


## Appendix D

# Desktop Review of Geothermal Energy for District Cooling and Heating

Geothermal bore systems predominantly utilise the thermal energy from either hot dry rock sources or hot water steam sources that exist below the ground. District heating applications may be typically derived from low temperature hydrothermal fields for direct house heating (less than 150°C) through the use of either ground source heat pumps or absorption chillers. Higher temperature fields from fractured dry rock may provide district heating and cooling in conjunction with providing electricity and hot water. Low temperature fields offer significant cost advantages as less deep drilling is required and it is also sufficient to target the top of hydrothermal convection cells where heat, salinity and topography naturally transfer heat to shallower levels.

Geothermal heat pumps utilise the stable temperatures of the sub surface level to circulate sensible heat for air conditioning purposes, working along the same principle as a conventional reverse cycle air conditioner. A heat exchanger is located below ground that either transfers heat from the ground in winter for heating or transfers indoor heat from the home to the earth for cooling purposes. The heat extracted for cooling may also be utilised for water heating applications. Although more expensive than conventional air conditioning systems, the high efficiency of the heat pumps mean that energy use is around 40-50% of the total energy consumption of a conventional system. Geothermal heat pumps have been used extensively through-out Europe and North America, and are becoming more widespread in Australia, with systems utilised in a variety of university campuses, offices and community centres. Geothermal heat pumps may be an attractive option if the possibility for installing a heat exchanger is available at the civil works or pre-construction phase, as some of the additional costs are due to the excavation and burying requirements of the system.



In Western Australia, Green Rock Energy has recently proposed a 5MW district scale energy system via an absorption chiller utilising geothermal energy. This is due to replace a standard electric chiller at Perth's University of Western Australia (UWA) Crawley campus in 2011, linking in with UWA's existing cooling system.



## Appendix E

# Desktop Review of Solar Thermal Energy for District Cooling and Heating

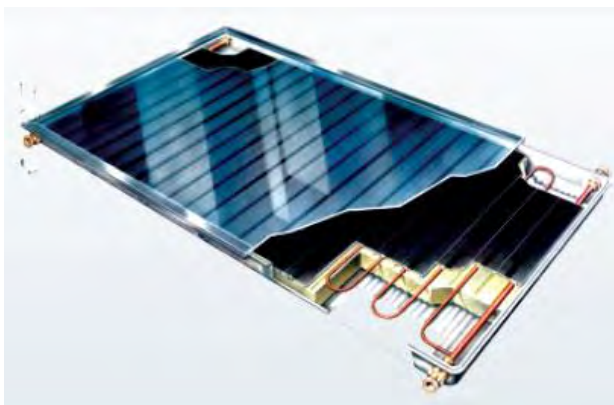
In a summer peaking electricity market, solar cooling would have the benefit of reducing electric cooling demand at peak periods. At the household level, solar thermal water heating is a relatively mature technology as it is often incorporated into hydroponic or under-floor heating systems, however solar thermal cooling (utilizing an absorption chiller or other cooling technologies) is relatively expensive to implement at the individual household scale. Passive solar design will optimize the natural solar climate conditions in order to regulate heating and cooling within the home, and can be achieved through simple design features such as thermal mass storage, correct orientation, considered glazing design and adequate insulation. Incorporating passive solar techniques into housing design is extremely cost effective in reducing energy consumption for heating and cooling as in many cases it will not result in additional costs to build, and should be the first stage in maximizing the energy efficiency of any building.

Larger scale solar thermal cooling is typically achieved through solar collectors connected to an absorption (or adsorption) chiller (or multiple chillers), which may also be implemented in conjunction with domestic solar water heating. Absorption chillers can be either single or two stage chillers, with two stage chillers being more efficient but require a higher temperature heat source. Most standard flat panel domestic systems are able to consistently provide the heat source for single stage absorption chillers (approximately 70-100°C or greater), however concentrating (trough) and evacuated tube/panel solar thermal systems are available that can provide the desired temperatures for two stage chillers. Lower grade heat sources are able to utilize alternative cooling variants, however these may be comparatively expensive or performance limited.

Solar Cooling Matrix		
Collection Variants	Cooling Variants	Delivery Variants
Flat Plate	Single Stage ABsorption	Air
Air Collector	Two-Stage ABsorption	Water
Evacuated Tube	ADsorption	
Trough	Liquid Desiccant	
	Solid Desiccant	

[www.ausSCIG.org](http://www.ausSCIG.org)

An example of evacuated tube panels are Genersys panels, which are a glazed, evacuated, indirect, copper pipe-type collector made of high quality, high strength components. They are a highly efficient design and are capable of producing usable heat in low temperature and low insulation (e.g. in non-summer months) conditions.



**Figure 17 Genersys Solar Panel**

The largest current example of solar cooling technology is at the Fletcher business park in South Carolina, where 640 solar collectors provide heating and cooling for offices and an industrial/commercial warehouse.





## Appendix F

# Summary of District/Precinct and Subdivision/Lot Level Requirements



## District / Precinct

Based on the post LSP implementation plans provided in this Sustainability Strategy (Table 2, Table 4, Table 8, and Table 10), the table below summarises the sustainability requirements relevant to the district and precinct development.

**Table 12 Summary of District / Precinct Requirements**

Category	District / Precinct Requirements	Responsible
Community	Investigate details and feasibility for marina and resort development, including scale and operation of resort	Landowners / developers
	Implementation of economic and employment strategy	Landowners / developers
	Undertake ongoing research to inform discussions on provision of housing sizes / types (e.g. match emerging demography, and allow for range of housing types)	Landowners / developers
	Consider appropriate affordable housing strategy for Eglinton	Landowners / developers
	Facilitate and encourage partnership approach to delivery of affordable housing	Landowners / developers
	Planning and design of formal public spaces and 'transitional' spaces for community and social activity and interaction	Landowners / developers
	Develop strategies for early provision and funding of community facilities and services	Landowners / developers
Water	Ensure design guidelines cover fixtures and fittings, garden design and irrigation systems	Landowners / developers
	Progress concept design and dialogue with Water Corporation and Dept of Water on alternative water sources for irrigation and nondrinking water uses	Landowners / developers
	Convene a steering group of key stakeholders on development of district wide management strategy	Landowners / developers
	Prepare a district water management strategy	Landowners / developers
	Prepare a groundwater allocation plan	Landowners / developers
	Concept design for a non-potable water supply (subject to feasibility assessment, approvals and issue of a non-potable water licence).	Landowners / developers
Energy and GHG	Design Special Transport System stops, inclusive of pedestrian routes, shelter areas, provision for CCTV/IT systems. Integrate stops within high intensity surrounding land activity	Developers / Transport Consultant
	A detailed car parking supply and management plan for the Marina Village (Precinct 1) and Eglinton district centre	Developers / Transport Consultant
	Gain advice from DoP Coastal Division on coastal vulnerability study	Planning Consultant
Ecosystem health	Prepare Graceful Sun Moth Management Strategy and Carnaby's Cockatoo foraging habitat offset strategy for inclusion in EPBC Referral	Landowners / developers
	Implement community environmental awareness program (including bush regeneration and protection) for new Eglinton residents	Landowners / developers
	Development of Eglinton Waste Management Plan (EWMP)	City of Wanneroo



## Subdivision / Lot Level

Based on the post LSP implementation plans provided in this Sustainability Strategy (Table 2, Table 4, Table 8, and Table 10), the table below summarises the sustainability requirements relevant to the subdivision and lot level development.

Table 13 Summary of Subdivision / Lot Level Requirements

Category	Subdivision Requirements	Responsible
Community	Identify specific development sites for tourist facilities	Landowners / developers
	Broadband and intra-network infrastructure to be incorporated in subdivision works	Landowners / developers / NBN Co
	Undertake ongoing research to inform discussions on provision of housing sizes / types (e.g. match emerging demography, and allow for range of housing types)	Landowners / developers
	Ensure Design Guidelines accommodate housing size and diversity strategies	Landowners / developers
	Develop partnerships with community service providers	Landowners / Developers
	Subdivision design to accommodate necessary community services and amenities	Landowners / Developers
Water	Seek partnership with Water Corporation on Waterwise Homes program	Landowners / developers
	All front yard landscaping installed by the Developer shall be Waterwise	Developers
	BMPs to be developed for subdivision design (to allow for water sensitive urban design to replenish superficial aquifer)	Landowners / developers
	UWMP to be prepared to support subdivision application (to allow for water sensitive urban design to replenish superficial aquifer)	Landowners / developers
Energy and GHG	Design Special Transport System stops, inclusive of pedestrian routes, shelter areas, provision for CCTV/IT systems. Integrate stops within high intensity surrounding land activity	Developers / Transport Consultant
	Conformation and detailed development of safe walking and cycling routes integrated with the movement network	Developers / Transport Consultant
	Detailed multimodal design of key precincts including all activity centres to mitigate traffic speeds, support active streetscapes and provide regular, safe street crossing points	Developers / Transport Consultant
	Pulse timetabling of public transport to integrate the STS with the metro rail	Developers / Transport Consultant
	Investigate car sharing in conjunction with City of Wanneroo and private sector partners	Developers / City of Wanneroo
	Investigate electrical vehicle infrastructure requirements	Developers
	Undertake study to establish the opportunities, technical and economic feasibility of incorporating recycled materials in road base and low grade concrete	Developers / Sustainability Consultant
	Establish a framework for the adoption of building materials with low embodied energy	Developers / Sustainability Consultant
	Develop a specification for the construction concrete to include a proportion of blast furnace slag or fly ash	Developers / Sustainability Consultant
	Prepare to meet the mandatory 6-star energy efficiency rating for all Eglinton housing	Developers / Land owners
	Commercial buildings should be prepared to undergo NABERs energy	Developers / Land owners



Category	Subdivision Requirements	Responsible
	audits and should be designed according to energy efficient principles and to enable energy monitoring	
	The potential for the introduction of Smart Meters should be pursued to facilitate householder energy education and participation in energy demand management	Developers / Western Power
	Subdivision planning for lot layout and orientation to encourage building orientation so as to achieve best use of natural heating, cooling and lighting.	Developers / Land owners
	The feasibility of a geothermal powered District Cooling project should be pursued, including the design requirements for a heating / cooling reticulation system, to high density centres	Developers / Sustainability Consultant
	A bulk purchase agreement with hot water systems (solar or heat pump) suppliers and installers should be pursued in consultation with key builders representatives. The available models should be assessed for value for money and emissions reductions	Developers / Sustainability Consultant
	Local electricity infrastructure, such as distribution lines and substations, should be planned to accommodate the substantial uptake of rooftop PV	Developers / Sustainability Consultant
	A bulk purchase agreement with PV supply and installers should be pursued in consultation with key builder's representatives. The available models should be assessed for value for money and emissions reductions	Developers / Sustainability Consultant
	Investigate land purchase contracts that could include a requirement for the purchaser to use Green Energy	Developers / Sustainability Consultant
	Generate a wind resource map for the district and identify specific building locations that could be powered by small scale wind installations. Identify the expected cost / benefit equation for these buildings and develop a proposal for their inclusion in the land sale package	Developers / Sustainability Consultant
Ecosystem health	Implement environmental management methods and works in accordance with EMP developed as part of Eglinton LSP <ul style="list-style-type: none"> <li>Conservation of existing significant environmental assets</li> <li>Biodiversity based landscaping of public and private spaces</li> </ul>	Landowners / developers
	Predominant use of low water use native vegetation in all public realm landscaping, and only provide high water use areas in strategic locations where they best serve the community	Landowners / developers
	Implement EWMP during subdivision construction where possible	Landowners / developers
	Incorporate recycling of organic wastes locally in parks and gardens in EWMP	City of Wanneroo









## GHD

GHD House, 239 Adelaide Tce. Perth, WA 6004  
P.O. Box 3106, Perth WA 6832  
T: 61 8 6222 8222 F: 61 8 6222 8555 E: [permail@ghd.com.au](mailto:permail@ghd.com.au)

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