

School of Built Environment

**The sustainability of suburban design: the impact of 'green' marketing on
environmental achievement. A Case Study of New Suburbs in Perth.**

Kate Ringvall

This thesis is presented for the Degree of

Doctor of Philosophy

of

Curtin University

December 2013

Declaration

“To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university”.

Signature

Date

Acknowledgements

There are so many people who need and deserve my complete and utter thanks in this lengthy and arduous journey towards thesis submission. Primary among those is my amazingly adaptable and forgiving son Geordie, who at 8 has no memory of me doing anything else but sit at my computer all hours of the day and night. To my friends who have fed me, clothed me, counselled me, supported me emotionally, physically and on occasion financially I could not have done this without you. To my family, adopted and blood, your ongoing support and encouragement has helped me stay the course when many have fallen by the wayside. Thanks must also go to my Osteopath David for continuing to repair the damage to my tired body, from long days in front of my computer. To my new supervisors Dave Hedgcock and Garry Middle (and to Shane Greive for help with Planning Theory) I wouldn't have finished this without you, thank you for rescuing me when I really needed it! Thanks also to my boss Julie Brunner for giving me safe harbour and starting the process for my rescue! This thesis journey has taken much longer than it needed to because Australia and our universities are yet to cater to and understand the needs of mature age adults with responsibilities as full time post-graduate students; in addition to the changes in the education sector that is increasingly making learning and teaching a commercial interaction rather than a creative, dynamic and enriching experience. My final and most heart-felt appreciation goes to my beloved Adam, thank you for accepting that during this time a part of my attention has been elsewhere, thank you for your unflappable belief in me and my dreams, and thank you for continuing to make me laugh despite everything.

When we try to pick out anything by itself, we find it hitched to everything else in the Universe (John Muir 1911:110).

Abstract

Developers are increasingly looking for the next marketing niche to sell their product, and in Perth there have been a rising number of newly developed suburbs being marketed as 'sustainable' or 'green'. This research has examined the capacity of developers to include sustainability principles and practices into their new suburbs as they have advertised using case study methodology, interviews, surveys and multi-criteria analysis. What this research has found, in this exploration of 'green' marketed suburbs, is that thoughtful design has the potential to create suburbs that have a much greater opportunity to be sustainable and assist residents to live more sustainable lives. However the houses that are being built in such suburbs are not matching such sustainability goals or outcomes. Residents overwhelmingly supported the inclusion of high quality community spaces that encouraged social interaction and a connection to nature, they valued the proximity to schools and services so that they could leave their cars at home; and they also appreciated the active participation of the developer and the local governments in helping their community to interact and feel welcome. These are aspects that deserve to be fostered and when included alongside houses that are actually energy efficient, suburbs will have a much greater potential of supporting people to live more sustainably.

Table of Contents

CHAPTER 1: Introduction and Background	13
1.1 Introduction.....	13
1.2 Public and Private Sector Responses to Sustainable Housing and Suburbs.....	16
1.3 Problems in suburban development.....	18
1.3.1 The Costs of the Current Urban Form.....	18
1.4 Examples of ‘Green’ Marketed Suburbs Internationally	23
1.5 Examples of ‘Green’ Marketed Suburbs around Australia	24
1.5.1 Queensland	25
1.5.2 Victoria.....	25
1.5.3 Australian Capital Territory.....	26
1.5.4 South Australia	29
1.5.5 New South Wales	29
1.5.6 Examples of ‘Green’ Marketed Suburbs in Western Australia.....	31
1.6 ‘Green’ Products and Services	36
1.7 Research Objectives.....	38
1.7.1 Research Questions	38
1.8 Methodology Overview.....	39
1.8.1 Structure of the Thesis.....	39
1.8.2 Scope and Limitations.....	40
1.9 Conclusions.....	41
CHAPTER 2: Theoretical and Governance Perspectives	43
2.1 Introduction.....	43
2.2 Defining Sustainability.....	45
2.3 The History of the Term ‘Sustainability’.....	46

2.4	Sustainability as a Contested Term.....	47
2.5	Theories and Concepts in Sustainability	49
2.6	Valuing Nature.....	49
2.7	Natural and Social Capital.....	53
2.8	Strong and Weak Sustainability	55
2.9	Holism and Sustainability	56
2.10	Ethics and Sustainability.....	57
2.10.1	Ethics and the Built Environment.....	58
2.11	Sustainability in Planning	59
2.12	Theories in and of Planning	61
2.13	Rationalism, Knowledge and Values.....	61
2.14	Rationality, Positivism and Power in Planning	63
2.15	Communicative Planning.....	66
2.16	The New Urbanism Design Theory	70
2.17	Deliberative Democracy and Participative Planning.....	72
2.18	History and Governance of Planning in Australia	74
2.19	Historical Context of Planning in WA.....	76
2.19.1	Review and Enforcement of Planning Instruments.....	85
2.19.2	Related Policies and Acts	88
2.19.3	Other State Government Initiatives	89
2.20	The Building Code in Australia.....	90
2.21	Summary of the key changes for post 2010/11	94
2.22	Conclusions	97

CHAPTER 3 The History and Current State of the Planning and Development of

New Suburbs

3.1 Introduction

3.2	A History of Suburbs.....	102
3.2.1	The Journey to 19 th Century Urban Forms	104
3.2.2	Modern Suburban Development	106
3.3	Early Planning and Development History in Australia.....	107
3.4	The Australian Experience of Suburban Development.....	110
3.5	Early Planning History in Western Australia	111
3.6	Modern Suburban Development	112
3.6.1	The Residential Sector and Energy Efficiency	113
3.6.2	Housing Affordability and Sustainability.....	116
3.6.3	Changes in Consumption, Behaviour and Expectations of Thermal Comfort	117
3.6.4	Consumption Drivers	118
3.7	Sustainability in Suburbs – Shades of Green.....	120
3.7.1	Defining Sustainable Urban Forms.....	122
3.7.2	Sustainable Settlements Nationally and Internationally	124
3.7.3	Defining a Sustainable Suburb	125
3.7.4	Defining an Environmentally Sustainable House.....	127
3.8	Energy Efficiency Rating Tools	139
3.9	Conclusions.....	144
CHAPTER 4 Methodology and Research Design		147
4.1	Introduction	147
4.2	Methodological Background.....	148
4.2.1	Case Study Research.....	149
4.2.2	Interview Methodology	150
4.2.3	Survey Methodology.....	152
4.2.4	Focus Group Methodology.....	153
4.2.5	Sustainability Assessment Methodology	154

4.3	Research Design.....	158
4.3.1	Choice of Cases.....	158
4.4	Data Collection	160
4.4.1	Survey, focus group and interview techniques	161
4.4.2	Survey Design.....	162
4.5	Conclusions.....	163
CHAPTER 5 The Case Study Suburbs		164
5.1	Introduction to the ‘Green’ Case Study Suburbs.....	164
5.1.1	Changing the Way We Plan and Develop Suburbs	165
5.1.2	The Building and Development Sector in WA.....	168
5.1.3	The Householder Sector	171
5.2	Overview of the Case Study Suburbs	172
5.2.1	Harvest Lakes Case Study.....	176
5.2.2	Newhaven Case Study	182
5.2.3	Evermore Heights Case Study	188
5.2.4	Rivergums Case Study.....	191
CHAPTER 6 Results and Findings		195
6.1	Introduction	195
6.1.1	Data Sources.....	195
6.1.2	Results of the Sustainability Indicator Tools	199
6.2	Overview of Interview, Focus Group and Survey Findings.....	205
6.2.1	Issues working between Government, Agencies and Developers	206
6.2.2	Difficulties understanding and then implementing sustainability	212
6.2.3	Perceptions of ‘Green’ Marketed Suburbs	226
6.2.4	Non-compliance to Building Guidelines and BCA Issues.....	237

6.2.5	Quantitative Measures of Sustainable Living.....	241
6.3	Conclusions.....	243
CHAPTER 7	Discussion and Planning Implications	249
7.1	Introduction	249
7.1.1	Indicators of Sustainability in the Case Study Suburbs.....	251
5.3	Indicators of Sustainability in the Built Form.....	276
7.1.2	Designed for the local climate and prevailing breezes	278
7.1.3	Orientated so that main windows and living areas face north	281
7.1.4	Makes good use of thermal mass; provides high insulation.....	281
7.1.5	Designed for good ventilation but minimising leakage of air or heat	285
7.1.6	Manages water wisely	287
7.1.7	Limited or no need for extra heating and cooling.....	288
5.4	Discussion.....	289
5.5	Conclusions.....	296
9	References.....	329
Appendix A	Survey, Interview and Focus Group Questions	348
Appendix B	Transcripts from Developer Interviews	355
Stocklands	Interview	392
Appendix C	Raw Data from the case study residents online survey.....	406
	Raw Data from the non case study online survey	425
Appendix D	Local Government Interview Transcripts	431
Local Government	Number Two.....	434

Table of Figures:

FIGURE 1: PLANNING SYSTEM OVERVIEW	80
FIGURE 2: LOCAL PLANNING.....	82
FIGURE 3: STATE PLANNING POLICY.....	83
FIGURE 4: REVIEWS AT THE STATE ADMINISTRATIVE TRIBUNAL	87
FIGURE 5: EXTERNAL AND INTERNAL AIR TEMPERATURES FOR THE CAVITY BRICK AND BRICK VENEER MODULES, FEBRUARY 2004.	131
FIGURE 6: R-VALUES FOR BUILDING TYPES.....	132
FIGURE 7: CROSS VENTILATION.....	133
FIGURE 8: HEAT AND COLD TRANSFER	134
FIGURE 9: GREY WATER REUSE	136
FIGURE 10: GREY WATER REUSE IN-HOUSE	136
FIGURE 11: SOLAR HOT WATER SYSTEMS.....	138
FIGURE 12: SMALL SCALE WIND TURBINES.....	139
FIGURE 13: COMPARISON OF ACTUAL ANNUAL ENERGY USE AND ANNUAL ENERGY USE OF AVERAGE HOUSES IN THE SAME REGION.....	141
FIGURE 14: EIA-DRIVEN/OBJECTIVES-LED INTEGRATED ASSESSMENT APPROACH TO SUSTAINABILITY ASSESSMENT (MINIMISE ADVERSE IMPACTS)	155
FIGURE 15: THE AVERAGE BUILDING PROCESS.....	170
FIGURE 16: CASE STUDY SITES IN THE PERTH METROPOLITAN AREA	175
FIGURE 17: ENERGY EFFICIENT FEATURES RESIDENTS CHOSE TO INCLUDE IN HOUSE DESIGNS.....	223
FIGURE 18: PHRASES TO MARKET SUSTAINABILITY	227
FIGURE 19: NUMBER OF VEHICLES PER DWELLING.....	270
FIGURE 20: JOURNEY TO WORK METHOD OF TRAVEL	273
FIGURE 21: CLIMATE ZONES IN AUSTRALIA	279
FIGURE 22: CAPTURING PREVAILING BREEZES WITH PASSIVE SOLAR DESIGN	286
FIGURE 23: CHANNELLING PREVAILING BREEZES AND THE PATTERN OF AIR MOVEMENT INTO OPEN WINDOWS	286

Table of Photos:

PHOTO 1: GUNGAHLIN TOWN CENTRE MEDIUM DENSITY DWELLINGS.....	27
PHOTO 2: SHOP TOP APARTMENTS IN GUNGAHLIN	27
PHOTO 3: GUNGAHLIN MEDIUM DENSITY TOWNHOUSES ABOVE SHOPS	28
PHOTO 4: CRACE MEDIUM DENSITY TOWNHOUSES.....	28
PHOTO 5: HARVEST LAKES COMMUNITY SPACE	177
PHOTO 6: THOROUGHFARE THROUGH HARVEST LAKES.....	178
PHOTO 7: HARVEST LAKES MEDIUM DENSITY HOUSING	182
PHOTO 8: NEWHAVEN ENTRY	184
PHOTO 9: THOROUGHFARES WITHIN NEWHAVEN.....	184
PHOTO 10: NEWHAVEN STORM WATER GARDEN AND RETAINED TREES.....	186
PHOTO 11: NEWHAVEN DISPLAY VILLAGE.....	186
PHOTO 12: EVERMORE ENTRY.....	189
PHOTO 13: EVERMORE HEIGHTS OPEN SPACE.....	189
PHOTO 14: EVERMORE HEIGHTS HOUSES.....	190
PHOTO 15: EVERMORE HEIGHTS SOLAR PANELS	190
PHOTO 16: RIVERGUMS ENTRY.....	192
PHOTO 17: RIVERGUMS COTTAGE BLOCKS.....	192
PHOTO 18: RIVERGUMS HOUSE BEING BUILT	193
PHOTO 19: IMPRESSIONS THE BUILDERS 8 STAR HOUSE	202
PHOTO 20: HARVEST LAKES OPEN SPACE	253
PHOTO 21: NEWHAVEN OPEN SPACE	253
PHOTO 22: EVERMORE HEIGHTS OPEN SPACE.....	254
PHOTO 23: RIVERGUMS OPEN SPACE	254
PHOTO 24: TOPOGRAPHY OF NEWHAVEN AND EVERMORE HEIGHTS.....	255
PHOTO 25: HARVEST LAKES OPEN SPACE	255
PHOTO 26: NEWHAVEN OPEN SPACE	255
PHOTO 27: EVERMORE HEIGHTS RAINGARDEN	256

PHOTO 28: EVERMORE HEIGHTS CURB RAINGARDEN.....	256
PHOTO 29: HARVEST LAKES STORMWATER WETLAND	257
PHOTO 30: HARVEST LAKES CREATED WETLAND	257
PHOTO 31: NEWHAVEN BLACK ROOFS	264
PHOTO 32: EVERMORE HEIGHTS DARK ROOF WITH PV CELL AND MINIMAL EAVES.....	264
PHOTO 33: RIVERGUMS PROJECT DISPLAY HOMES.....	265
PHOTO 34: EVERMORE HEIGHTS CURB RAINGARDENS	275
PHOTO 35: EVERMORE DISPLAY HOME WITH BLACK ROOF AND PHOTO 35: RIVERGUMS DISPLAY HOME	284
PHOTO 36: RIVERGUMS DISPLAY HOME.....	285

Table of Boxes:

BOX 1: DIFFERENCE IN DEVELOPMENTS.....	34
BOX 2: THE GREEN SWING PROJECT: PLANNING AND APPROVAL DIFFICULTIES.....	35
BOX 3: THE HISTORY OF THE BUILDING CODE	92
BOX 4: CHANGES FOR VOLUMES 1 & 2 OF THE BCA 2010.....	95
BOX 5: HARVEST LAKES CASE STUDY FACT SHEET.....	176
BOX 6: NEWHAVEN CASE STUDY FACT SHEET.....	183
BOX 7: EVERMORE HEIGHTS CASE STUDY FACT SHEET.....	188
BOX 8: RIVERGUMS CASE STUDY FACT SHEET.....	191

Table of Tables:

TABLE 1: CASE STUDY SELECTION MATRIX	160
TABLE 2: CASE STUDY DEVELOPERS SUBURB FEATURES MATRIX.....	174
TABLE 3: CASE STUDY SUBURBS SUSTAINABILITY INDICATORS TOOL.....	201
TABLE 4: CASE STUDY RESIDENT’S HOUSES SUSTAINABILITY INDICATOR TOOL –	203
TABLE 5: CASE STUDY DISPLAY HOMES SUSTAINABILITY INDICATOR TOOL -	204

CHAPTER 1: Introduction and Background

1.1 Introduction

Globally governments and nations have largely accepted that significant attention and effort, and a change in behaviour, is required to ameliorate the environmental damage already done to the planet, through such processes as the Rio “Earth Summit”, the Kyoto Summit and the many varied and related United Nations (UN) international processes (Roseland 2000). However within this concentration of attention and effort there has been less focus or understanding on how local communities fit into this global model, and far less on what can reasonably be done to change the way we all live on the planet (Roseland 2000). Although the Local Agenda 21 (see the International Local Governments for Sustainability organisation that implements much of the actions of the Local Agenda 21 - <http://www.iclei.org/>) mechanism has been successful in organising and coalescing local government effort towards greater sustainability at a community level, it’s influence on individuals and households is diluted (United Nations 1992; Australian Local Government Association 2002). More importantly the many, seemingly insignificant, decisions made by local governments all over Australia can have (and have had) a significant impact globally (Wackernagel and Rees 1996; Gleeson and Low 2000; Australian Local Government Association 2002; Newman and Kenworthy 1999; Beatley and Newman 2009; Newman, Beatley, and Boyer 2009; Falconer, Newman, and Giles-Corti 2010; Trubka, Newman, and Bilsborough 2010). While local governments are not the only ones making decisions that impact local

communities, they implement much of the policies and actions sought by state and federal governments, and have the closest interaction and capacity to influence households and individuals towards more sustainable lifestyles (Australian Local Government Association 2002).

It is now clear to most observers that “our communities as presently planned and developed are not sustainable in a global ecological sense” (Roseland 2000, :74). In Australia the residential sector is responsible for producing more than 63 Metric Tonne *Carbon Dioxide* Equivalent (Mt/a CO₂-e) of greenhouse gases each year, which is about 20% of Australia’s total emissions (Australian Bureau of Statistics 2006, 2010a). For each household in Australia that amounts to nearly 9t/a CO₂-e of emissions annually, and the embodied energy alone from the more than 120,000 new houses added to the Australian housing stock each year adds another 6 Mt CO₂-e of emissions (Grace 2007). The Australian Government has highlighted the need to reduce greenhouse gas emissions in the residential and building sectors through the introduction of the National Partnership Agreement (2010) of Energy Efficiency, and reducing the energy demand from residential houses is one way of achieving that goal (Council of Australian Governments 2009, 2010).

The context and aspirations of sustainability in the residential sector focuses on “efficient use of urban space, minimisation of the consumption of essential natural capital, multiplying social capital” and creating settlements where people can drive less, housing is more affordable, residents can connect meaningfully with their neighbours, children can play safely in parks, work and services are close by and the surrounding natural environment is an important part of the community (Roseland

2000, :75; Crabtree and Hes 2009; Marshall 2010; Mapes and Wolch 2010). The capacity of developers and governments to plan and deliver that however is contested, and less obvious. Such idealistic notions of community, espoused in New Urbanist visions of sustainable communities sound almost utopian and begs the questions of how achievable is such a goal, and is it being achieved (Schuyler 1997; Australian Council for New Urbanism 2006; Department of Planning 2008; Falconer, Newman, and Giles-Corti 2010; Marshall 2010)?

There are a number of motivations for this research, primary among them is the understanding that Australia's residential sector is expected to be significantly affected by any climate change impacts and adaptations from environmental degradation and the understanding that governments have a responsibility to help them to do so (Gardiner 2004; Marden and Mercer 2005; Vucetich and Nelson 2010). As elected community representatives governments have an obligation to create the best possible opportunities to enable the reduction of carbon and other greenhouse gases in the atmosphere (World Commission on Environment and Development 1987; Australian State of the Environment Committee 2001; Garnaut 2008; Australian Government 2010; Council of Australian Governments 2010). Whilst many levels and sectors in industry and the community will be (and are) affected differently by climate change, for the individual, the impacts and costs of such changes will likely be felt most within the home (Grace 2007; Randolph, Kam, and Graham 2007; Garnaut 2008).

1.2 Public and Private Sector Responses to Sustainable Housing and Suburbs

There would appear to be at least the beginnings of government acceptance of the importance of increasing sustainability outcomes in the residential sector, with the introduction of the National Energy Efficiency Strategy by the Federal Labour Government, but the level to which this has been implemented successfully to date is unknown (Department of Planning 2008; Council of Australian Governments 2010). In response to the changes highlighted in the National Energy Efficiency Strategy, governments have begun to make the policy and practice changes that would be required to make the housing stock, and the suburbs (housing estates) they exist within more energy-efficient (Major Cities Unit 2010; Australian Government 2010; Council of Australian Governments 2010). In 2007 the Building Code of Australia (BCA) was amended to include mandatory energy efficiency rating and performance criteria for new housing (Australian Building Code Board 2007). There have been numerous changes in government and industry policy to accommodate these changes through the building code: the New South Wales Building Sustainability Index (BASIX) initiative, Victoria's 'First Rate', Western Australia's 6-Star Plus, the Housing Industry Association's 'Green Smart' program, and the Australian Green Building Council's 'Green-Star' Accreditation program, and a vast array of local government initiatives across Australia that attempt to encourage more sustainable buildings and developments (Department of Housing and Works 2007; Ambrose 2008; Low et al. 2005; Randolph, Kam, and Graham 2007; Beatley and Newman 2009).

However, while more sustainable housing options exist outside the mass-produced house industry, the capacity of the majority of first home buyers to buy more sustainable homes remains limited (Randolph, Kam, and Graham 2007). According to Randolph et al. (2007, :204) the introduction of mandatory Building Sustainability Index (BASIX) (in NSW) energy and water efficiency measures has seen the introduction of 'better practice models for more environmentally sustainable project homes'; and this large scale implementation of such measures has the potential to make new homes far more affordable and sustainable.

Competitive and government policy pressure has increased the prevalence of 'green' products in the Australian market and 'green' marketed housing suburbs are no exception (see: <http://www.csiro.au/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/YourDevelopment.aspx>). More and more builders are also offering house designs that are marketed as more 'sustainable', 'eco-friendly' and 'environmentally sound' options, than mainstream house designs. However, there currently exists no compulsory, mandated, commonly-agreed benchmark for what is an energy efficient, sustainable house or suburb/housing estate. While the BCA mandates a minimum level of energy efficiency required for compliance, as recent media and research attention has highlighted, there is significant debate about the efficacy of the software tools designed to provide energy efficiency ratings for house designs and whether the standards are actually getting energy efficiency outcomes (Thomas 2010d, 2010b, 2010c; Williamson, Soebarto, and Radford 2010). Much of the knowledge and technology for sustainable building design is already available, however the implementation of these principles and practices by

developers, designers, builders and consumers is yet to happen on a widespread scale (Ambrose and Miller 2005).

1.3 Problems in suburban development

Australia is now in eighth place as far as ecological footprint (the measure of human demand on the earth's natural capital resources) rankings are concerned, and has the "ninth worst absolute environmental impact out of 171 countries" (Pulzl; and Treib; 2007, :627; Wackernagel and Rees 1996). A recent State of the Environment Report (2011, :627) highlights that all Australian cities will be obliged to manage more effectively population growth and "where and how people live, and the consumption of natural resources per person".

The growing need for houses and housing developments that use resources efficiently and provide a viable sustainable alternative is further emphasised by the now well documented environmental damage, due in part to the unbalanced and over consumption of limited resources (Low et al. 2005; Stern 2007; Garnaut 2008). Sustainable settlements is a burgeoning area of research that seeks to find the lifestyle, design, materials and building options that create houses and housing suburbs that enhance and support the local environment and ultimately people's lives (Bang 2005; Green, Grimsley, and Stafford 2005; Low et al. 2005; Ambrose, Mead, and Miller 2006).

1.3.1 *The Costs of the Current Urban Form*

According to a number of researchers the current 'unsustainability' of our cities has occurred as a result of embedded development patterns encouraged by planning and development paradigms that rely on the premise that land, energy and

materials are abundant, infinite and cheap, and that the structure of families has not changed since the 1950s and will not in the future (Productivity Commission of Australia 2005; Garnaut 2008; Newton 2008). Rees and Roseland (1991 pg 17, cited in (Newton 2008)) suggests that “cities were built using technologies which assumed that abundant and cheap energy and land would always be available. Cheap energy influenced the construction of our spacious homes and buildings, fostered our addiction to the automobile and increased the separation of our workplaces from our homes”. The costs to society and the environment of the types of urban forms that currently exist in cities are significant, however these costs are hidden by the apparent economic benefits of the way in which contemporary urban form has been planned and developed (Gonzalez 2005; Productivity Commission of Australia 2005; Newton 2008; Ehrenfeld 2008; Garnaut 2008; Major Cities Unit 2010).

Australia’s total domestic energy consumption in 2007-08 was 5, 772PJ, and the ABS (2012) suggests that this represents a compound annual growth of nearly 2.4%, in other words Australian households are using 25% more electricity and 22% more gas than they were a decade ago. In 2009-10 Australia’s net energy consumption, including both industry and household energy use, was 3,962PJ, this was a 1% increase of 39PJ from 2008-09 (Australian Bureau of Statistics 2012). Increased household energy use is influenced by a range of factors some of which includes the increasing size of dwellings despite the decreasing number of people per dwelling, changes in consumer preferences for housing design, increases in consumption patterns more generally and the changing expectations about personal comfort (Australian Bureau of Statistics 2006). Changes in population and average energy

use are expected to continue to increase residential energy consumption in the future (Australian Bureau of Agriculture and Resource Economics 2003).

The costs of urban development can be categorised under three main headings: environmental, social and economic or financial costs that are either obvious and upfront or hidden and subsidised (SGS Economics 2003). Like Newton (2008) Low et. al. (2005) and Gonzalez (2005) suggests that the inexpensive fossil fuel based energy that helped motivate the development of urban sprawl brings numerous economic benefits, and these continuing benefits are enabling the phenomena of urban sprawl to continue. Such benefits include increasing land values, expanding markets for automobile manufacturers and fuel producers and increasing employment in construction. The environmental consequences of urban development are well known with headline indicators showing that Australia's household environmental impacts and related costs are significant (Newton 2008).

Australia's State of the Environment Report (2001; 2006), clearly highlight that headline indicators of resource use continue to be at unsustainable levels, and are currently at the equivalent of three-to-four planets worth of consumption (Newton 2008; Australian State of the Environment Committee 2001, 2006). Newton (2008) blames the Neo-Liberal planning and development paradigm that has been in operation since permanent settlement began in Australia, some 200 year ago, that relies on the misguided premise that land, energy and materials are abundant, infinite and cheap (a paradigm that is also prevalent in North America).

While it is apparent that unsustainable consumption patterns are in some ways 'built-in' to our cities, through energy inefficient building/infrastructure design and

the use of inexpensive inputs, there is still a significant proportion that is attributable to the individual behaviour and lifestyles of households (Australian Bureau of Statistics 2001; Productivity Commission of Australia 2005; Australian Bureau of Statistics 2006, 2007; Australian Conservation Foundation 2007; Australian Bureau of Statistics 2008e, 2008d, 2009, 2010a, 2010b). The most recent research highlights that the trend for larger houses, on smaller blocks with smaller households is continuing with the average size of a new house now at 215sqm, one of the largest in the world (Pulzl; and Treib; 2007).

The economic boom that Australia, and particularly Western Australia, experienced in the period between 2000-2007 (and has continued to a lesser extent in the ensuing period) saw a dramatic increase in median household and individual income and a significant change in consumer patterns and expectations of comfort (Australian Bureau of Statistics 2008c, 2010a). According to the Australian Bureau of Statistics (ABS) Australian Social Trends Report (2006) Australia's per capita consumption of space, energy and water are amongst the highest in the world and are continuing to increase. In addition, the national headline indicators are showing that Australia's household environmental impacts and related costs are significant, and are far from sustainable (Australian State of the Environment Committee 2006; Australian Bureau of Statistics 2006, 2007; Newton 2008; Garnaut 2008; Australian Bureau of Statistics 2010a, 2010b). Moreover the 2011 State of the Environment Report argues that human pressures to continue to urbanise puts the greatest stress on biodiversity, ultimately because urban development removes habitat (Pulzl; and Treib; 2007). Increasingly urban development reduces the quality and complexity of habitats through fragmentation, over-simplification and changing the

composition of ecosystems that exist in urban environments (Pulzl; and Treib; 2007). An important challenge for Governments in Australia will be to manage population growth and the inevitable impact of urban development on biodiversity (Pulzl; and Treib; 2007).

Traffic congestion, the state of the road network and access to good public transport networks can determine the liveability of cities and their suburbs; however the continued growth in populations of cities where increasing numbers of people choose to drive their car everyday is a significant problem in Australia's urban areas (Pulzl; and Treib; 2007). Research from the then Australian Bureau of Transport and Regional Economics (2007) reports that the avoidable social cost (includes extra travel time, loss of productivity, increased vehicle operating costs, poorer air quality, and higher health costs) of congestion in Australia's capital cities was close to 49.4 billion in 2005. In particular public transport, when appropriately prioritised, can reduce the demand for increasing road space and the need for parking (Curtis 2008, 2009; Pulzl; and Treib; 2007).

Global economic demand has escalated as a result of sprawling urban communities, most especially since World War II, increasing the demand for commodities such as land, fuel, energy, automobiles and household appliances (Gonzalez 2005). The unintended consequence of this unfettered global demand and urban sprawl is a changing climate and irreversible environmental damage to the planet, predicated on large undervalued, inexpensive inputs of energy from fossil fuels (Newman, Beatley, and Boyer 2009; Frey et al. 2009; Falk 2009b; Beard 2009; Speth 2008; Garnaut 2008).

1.4 Examples of 'Green' Marketed Suburbs Internationally

Mapes and Wolch (2010) found comparatively few recent studies of the performance of 'green' marketed suburbs in the literature, however there are some examples of more successful 'green' marketed housing and estate developments internationally including:

- Whilst Beddington Zero Emission Development (BedZed) is not a suburb it is a development that has been recognised and marketed as a sustainable development (yourdevelopment.org.au ND). BedZed consists of 100 homes and communal facilities and workspaces for 100 people and was completed in 2002 and the site was chosen for its proximity to transit and that it would be redeveloping a brownfield site south of London (yourdevelopment.org.au ND). The BedZed development had a strong sustainability focus from the very beginning, from the initial planning and design phase through construction and then eventual habitation. BedZed incorporates use of roof gardens, communal open space, a car free interior space with parking on the outside, use of solar orientation, high insulation in the buildings, a biomass combined heat and power system and photovoltaic cells (yourdevelopment.org.au ND).
- Kronsberg in Hannover Germany has 3000 dwellings housing nearly 6600 people with nearly 3000 jobs located in the local area; it is a sustainable community development that has followed the tenets of the United Nations Agenda 21, which includes: a link to a train station within 600 metres for all residents, reduced household

energy use of between 60-80%, preservation of the surrounding woodlands and countryside and a 50% reduction in household waste (yourdevelopment.org.au ND).

In addition, Mapes and Wolch's (2010) research examined 29 North American communities that had been marketed and awarded as 'sustainable' including:

- Amelia Park in Fernadina Beach, Florida
- Atlantic Station in Atlanta, Georgia
- Baldwin Park in Orland, Florida
- Del Sur in Rancho, Santa Fe
- Harmony in Saint Cloud, Florida
- Prairie Crossing in Graystake, Illinois
- Stapleton in Denver, Colorado (Mapes and Wolch 2010).

While all of these developments have gone some way to establishing more sustainable practices when developing new housing estates and housing developments, they are in the minority and overcame significant barriers and challenges during their development and construction phases.

1.5 Examples of 'Green' Marketed Suburbs around Australia

There are a number of projects going ahead around Australia, which are seeking to integrate sustainability into suburb design and bring a very different suburb product to the marketplace. The following sections detail some of those projects.

1.5.1 Queensland

Queensland has a number of sustainable suburb developments that are focused on increasing sustainability outcomes for the residential sector including: Delfin's Sanctuary Pocket located 20kms west of the Brisbane Central Business District, is a 400 home site developed as a 33-hectare village. Delfin require each homeowner to include specific energy and water-saving features into their homes in return for a solar hot water system and a rainwater tank, and the developers estimate that the 400 homes built will save 1,740 tonnes of greenhouse gas emissions per year and 108 million litres of water per year (Ambrose, Mead, and Miller 2006). Other suburbs that are being marketed as sustainable in Queensland include: Plantation Palms in Mackay North Queensland; Pimpama Coomera Waterfuture Master Plan (although this development's focus is primarily on water saving); and now well known EcoVillage at Currumbin that is marketed as Queensland's most sustainable residential development (yourdevelopment.org.au ND).

1.5.2 Victoria

Victoria has a number of 'green' marketed housing developments including the more recent VicUrban development Aurora, in Epping North which is a 6-star housing suburb that has sustainability as the overriding focus, it will house 8000 homes and over 25, 000 residents, and it will include water sensitive urban design, mandatory 6star energy ratings for houses, pedestrian focused streets and access to public transport and the preservation of native habitats; other projects include the West Footscray Urban Design Framework (UDF) that seeks to improve the area over the next 15 years to reduce car dependence, funding community projects and

improving public spaces; and the WestWyck sustainable settlement (and also termed an EcoVillage) occupies the grounds and building of the former Brunswick West Primary School in inner suburban Melbourne, and has been designed to be materials, energy and water efficient.

1.5.3 Australian Capital Territory

The ACT Government has more recently been focusing on encouraging the development of more sustainable suburbs, and Crace and Forde in the northern suburbs of Canberra are two of these examples. They are linked to the town centre of Gungahlin, which is among the newest town centre developments in Canberra's north. To achieve more sustainable urban form, the ACT government has particularly focused on encouraging employment options into the town centre, and creating higher densities closer to the town centres (the ACT Plan for 2010). Canberra has a number of 'green' marketed housing suburbs that have recently come on to the market including: Macgregor West which is a development to the west of the suburb of Macgregor and south of the suburb of Dunlop (which are all outer fringe developments). The developers have included walking tracks, WSUD and initiatives to reduce greenhouse emissions.

Photo 1: Gungahlin town centre medium density dwellings



Source: K.Ringvall, 2010.

Photo 2: Shop top apartments in Gungahlin

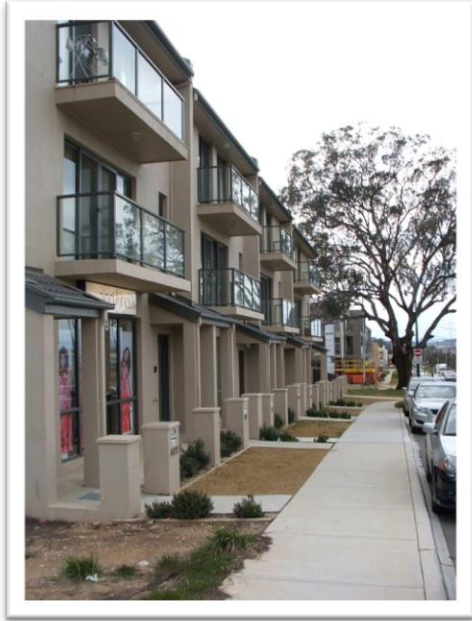


Source: K.Ringvall, 2010.

Gungahlin has been developed by the ACT government as a suburb with a distinct village 'centre' that has services, shopping and medium density residential dwellings in close proximity to each other (ACT Govt. 2001b, 2001a).

Other 'green' marketed suburbs that are coming onto the market include: the 92 hectare suburb of Crace (see Photo 4) located near the southern suburbs of Palmerston and Giralang and next to the Ginninderra Creek/Percival Hill Nature Park, which will include a

Photo 3: Gungahlin Medium Density Townhouses above shops



Source: K.Ringvall 2010.

Photo 4: Crace Medium Density Townhouses



Source: K.Ringvall, 2010.

1.5.4 South Australia

Although Christie Walk isn't a suburb development, it has been lauded for its strong sustainability focus and particularly for its attention to affordable housing in an inner city location (Beatley and Newman 2009). It is a multi-unit inner city Adelaide development that was completed in 2006, and was developed by a co-operative with sustainability as a core component in all aspects of the development (yourdevelopment.org.au ND). It was built on a 2000m² of land in inner city Adelaide, close to public transport and the Adelaide Markets; and the development includes a:

- Linked three story townhouse with solar orientation
- Three story block of six apartments with east-west orientation and a full roof garden
- Three two story strawbale cottages and two story strawbale townhouse
- Five story apartment building with thirteen apartments including community facilities such as meeting rooms, a library, kitchen and toilet (yourdevelopment.org.au ND)

1.5.5 New South Wales

The New Rouse Hill development was planned for as early as 1980 by the New South Wales State Government, when they purchased 122 hectares to develop a regional centre in the north west area of the Sydney metropolitan area, and is located on the former Mungerie Park Golf Course. It has been marketed as a more sustainable option than traditional suburbs (yourdevelopment.org.au ND). The

development will house 1500 residential lots including 180,000m² of retail/commercial development and more than 20 hectares of public open space, and is planned to be linked to the 'T-way' bus station that will connect residents via a rapid bus link to Parramatta and with a train station at Rouse Hill on the proposed North West Rail Link commuters will be linked to the city via train (yourdevelopment.org.au ND). The development also incorporates a 104 residential apartment with a multi-unit cogeneration demonstration plant that will provide hot water, heating and electricity (yourdevelopment.org.au ND).

Other projects include:

- Seaspray – a master planned residential community at Coconut Point, Zilzie in Queensland that includes a 61 hectare National Park, with 400 residential lots and plans for the development of 300 units, and community facilities such as a recreation club and a resort. Seaspray has achieved EnviroDevelopment certification for ecosystems, energy, water and community
- Blackwood Park – located 15kms from the Adelaide (South Australia) CBD in the Adelaide Hills. Covering 168.7 hectares, the development has been built on land originally used for agricultural purposes and has 1200 residential lots and large open spaces, and achieved EnviroDevelopment certification for the ecosystems, waste, energy and community elements
- Beyond Today – a 220 lot residential development that includes wetlands, parks and reserves and is located 220 kilometres from the

coast and midway between Port Elliot and Victor Harbor. Beyond Today has achieved EnviroDevelopment certification across all six elements including ecosystems, waste, energy, materials, water and community

- Fitzgibbon Chase – a 114 hectare 1700 lot site in Fitzgibbon Queensland, with 50% remaining as a reserve. Fitzgibbon Chase is located 12 kilometres from the Brisbane CBD and has achieved certification for all six elements of EnviroDevelopment.
- Waverly Park – a development that has transformed the old Waverley Park Oval complex in Melbourne into a community with a strong sustainability focus. It incorporates the Mirvac Design 9.2 star sustainable prototype house – the Harmony 9. Source: (yourdevelopment.org.au ND)

1.5.6 Examples of 'Green' Marketed Suburbs in Western Australia

Through the introduction of the WA Department of Planning's Liveable Neighbourhoods Policy, trialled between 1998 and 2008, many suburbs in Perth have been developed with a strong New Urbanist influence (Western Australian Planning Commission 2007). Such suburbs have tried to be more walkable, less car dominated, provide a better mix of housing types, better access to services and public transport and have more public open space; although there has been some criticism of the entrenched car dominance (Falconer, Newman, and Giles-Corti 2010).

New Urbanism has also influenced the development of the more recent Transit Orientated Developments (TOD) in Perth including: Cockburn Central, Gosnells Town Centre, Midland Central, Quattro Queens Park, Somerly, Subi Centro and Wellard (Australian Council for New Urbanism 2006). TOD's obviously are focused on providing access to public transport, however they also usually have a broader sustainability focus as well such as the Subi Centro development (Curtis 2008). Other suburb developments in the Perth metropolitan area that have an explicit or implied 'sustainability' or 'green' focus include:

- Brighton Beach
- Capricorn Village
- Claisebrook Village
- Harvest Lakes
- Ellenbrook
- Harbour Rise
- Harrisdale Eco-Village
- Joondalup City Centre
- Lakelands
- Mandurah Ocean Marina
- St Andrews
- Vale
- Seville Grove
- Alkimos
- Evermore Heights

- Newhaven
- Rivergums (Australian Council for New Urbanism 2006)

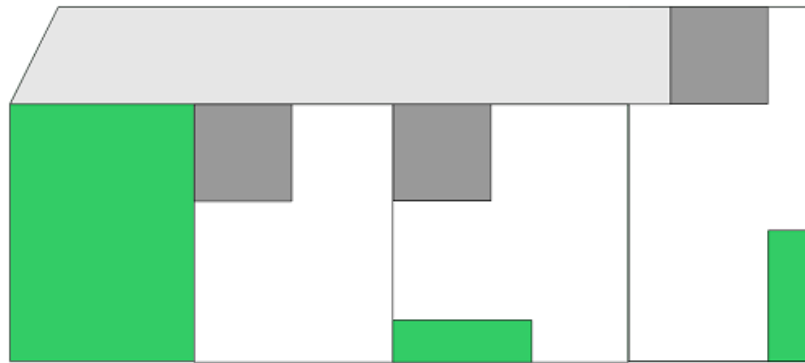
1.5.6.1 Sustainable Housing in WA

There are a few examples of single dwelling housing developments that could be described as sustainable, but for the most part sustainable housing is still in isolation in Perth. More recently there has been a multi-unit development in Lathlain, an inner city suburb of Perth that has been developed with strong sustainability principles and practices. The Green Swing development is unusual in that it has been established by a group of individuals rather than either a building company or a developer. The project on Rutland Avenue, “consists of two town houses and two apartments on a 837 m² block in Lathlain, Town of Victoria Park, within walking distance to the train station and shops. The goal is to create affordable medium density housing in an inner city area with a primary focus on sustainability” (The Green Swing 2010). Unlike a typical residential redevelopment, the members of the Green Swing project decided to leave the block un-subdivided to allow for a more innovative approach to solar orientation and energy efficient design outcomes in each house (see Box 2). There were a number of sustainability considerations that the project wanted to prioritise including:

- **Passive Solar Design:** to build dwellings that would not need energy (or at least as little as possible) for heating or cooling.
- **Think small:** Build houses with a small footprint that reduces the cost of the housing and its environmental impact and increases the amount of open space available for gardens (The Green Swing 2010).

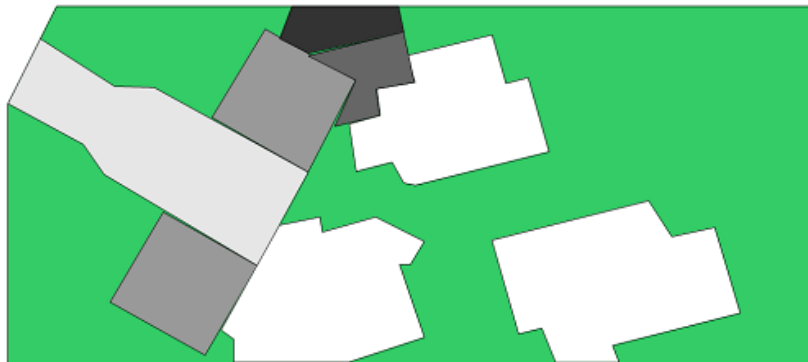
Box 1: Difference in developments

- Driveway along one boundary
- Dwellings along the other boundary
- Three double garages, one for each dwelling
- Dwelling size maximized
- No regard for solar orientation
- Green space limited to small private courtyard and set back area at front



Our development:

- Much shorter driveway
- Dwellings oriented to be solar passive
- Two double garages, to be shared between the four dwellings
- Small footprint dwellings
- 60% of open space, productive and waterwise gardens



- Green space: important for natural cooling of dwellings in summer, habitat for animals and space to be in nature. The project wanted to show that medium density development does not have to result in a concrete jungle and have achieved this by reducing the impact of the car.
- Community Interaction: to create an environment where people are encouraged to interact with their neighbours, and where creativity would be stimulated (The Green Swing 2010).

For a project that placed sustainability principles as a foremost guiding principle, it is perhaps surprising that it experienced significant difficulty getting the development plans approved. Essentially the local government's inability to approve such an innovative development stemmed from its own planning policies

being unable to actually cater to a sustainable development despite the council's adoption of such principles. Box 2 describes some of the main issues that the Green Swing project had to overcome to get their sustainable development approved by council.

Box 2: The Green Swing Project: Planning and Approval Difficulties

According to the Council's planning officer the development: was inconsistent with the residential character of the area; was not in keeping with the residential amenities of the area; was out of context with the character of the surrounding residential area; will negatively impact and does not positively contribute to the area; and will set a precedent for other similar situations in the future.

The main planning issues:

- Combination of Grouped and Multiple dwellings on the same site
- Common areas versus 'exclusive use' areas – requirement for large private spaces
- Parking requirements – 2 bays per household
- Streetscape requirements – front doors to face the street
- Sustainability – perceived as having no impact

The block is 837m2 and under R40 we needed:

- 220m2 for a Grouped Dwelling
- 250m2 for a Multiple Dwelling
- 166m2 for a Single Bedroom Dwelling

Compliant Alternatives	Non Compliant Alternatives
3 Grouped Dwellings	2 Grouped Dwellings and 2 Multiple Dwellings
3 Multiple Dwellings	2 Grouped Dwellings, 1 Multiple Dwelling and 1 Single Bedroom Dwelling
3 Grouped Dwellings and 1 Single Bedroom Dwelling	
2 Multiple Dwellings and 2 Single Bedroom Dwellings	

As per the R-Codes, the development is required to have 6 parking bays. This is calculated as follows:

- 2 bays for each grouped dwelling (2x)
- 0.75 for each single bedroom multiple dwelling (2x) (The Green Swing 2010).
- 0.25 visitor bay for each single bedroom multiple dwelling (2x)

Total 6 parking bays. Various measures have been adopted to reduce the visual impact of the garages and make them look like inhabited spaces:

- Facing the garages inwards;
- Having windows in the roadside face;
- Use of eaves and gables (and design of roofline generally);
- Bring balcony of upstairs apartment forward (The Green Swing 2010).

The Green Swing project has highlighted some of the wider barriers to more sustainable housing being developed, that exist at the individual lot level and at the

suburb level. For the most part such barriers and constraints seem to exist because there is a, so far unchallenged assumption, that the way in which we are currently creating new housing and suburbs is getting the community positive outcomes, especially where sustainability is concerned. At the very least there seems to be a significant gap in what local governments are saying they want to achieve in creating more sustainable housing and suburbs and what is actually being achieved in practice.

1.6 'Green' Products and Services

In the last decade, 'green' or ethical products have become increasingly profitable and significant as a niche market in an economy that is continually looking for the next trend (TerraChoice 2009; Ottman 2008). Connolly et al. (2006) highlight that in 2003 in the U.K alone 'ethical' products increased by approximately 13% alongside an economy that in 2002 only grew by 1%, translating to a 6.9 billion pounds sterling increase. Between 2007 and 2009 the prevalence of 'green' products in North American stores rose by 40% translating to a 79% increase (TerraChoice 2009). Moreover, consumer boycotts of companies behaving unethically cost those companies nearly 2.9 billion pounds a year (Connolly et al. 2006).

Unfortunately, in a highly competitive market there are opportunities for marketing products and services whose 'green' credentials are limited at best. 'Greenwashing' is a term that has been used in the last few decades to describe those products and services whose marketed claims of 'greenness' are unsubstantiated, misleading and vague at best or worse fabricated (Laufer 2008; TerraChoice 2009, 2010; Dahl 2010). Between 2007 and 2010 TerraChoice, a North American environmental

marketing company, conducted research on products making an environmental claim in the United States, Canada, United Kingdom and Australia. TerraChoice found that in the United States and Canada alone 2,219 products made 4,996 'green' claims, and these claims were tested against the government standards organisations in each country (TerraChoice 2009). TerraChoice's research found that of the 2,219 North American products making claims of 'greenness' 98% were either unsubstantiated by a certified labelling body, used misleading or irrelevant claims or used claims that were vague about the actual benefits (TerraChoice 2009).

In the context of housing suburbs/housing estates, more recent innovations in the real estate sector have begun to include environmental and 'green' aspects to the design of houses and suburbs (Crabtree and Hes 2009; Mapes and Wolch 2010). The increasing prevalence of suburbs that are being marketed for their environmental or sustainability claims suggest that the demand is also increasing (Mapes and Wolch 2010; Adhikary 2008). In Australia and world-wide, these new developments are winning progressively more environmental and urban design awards for various criteria in 'Environmental Excellence' including: the wise use of water, walkability, providing community spaces and retaining remnant vegetation (yourdevelopment.org.au ND; Urban Development Institute of Australia ND; Mapes and Wolch 2010). In particular, research by Ambrose (2006) suggests that increasing demand for energy efficient buildings from both investors and/or occupiers has the potential to force market change and render traditional buildings uncompetitive in the long run. Obviously one of the more important tasks for the 'green' building and suburb sector is to package the 'environmental product that is cost-competitive, has a range of benefits, and minimises the trade-offs in terms of aspects such as style

and functionality' (Crabtree and Hes 2009). However without a commonly agreed benchmark of what makes a suburb sustainable in Australia, there is debate about the efficacy of the various versions of 'green' that developers and builders are using to market their particular suburb (Mapes and Wolch 2010).

1.7 Research Objectives

This thesis explores the capacity of developers of 'green' marketed suburbs to incorporate sustainability principles into their developments, into the houses residents build and whether sustainability principles have influenced their lifestyles by living in such suburbs. Such suburbs are becoming more available in the marketplace and this research seeks to bridge the research gap in understanding of:

How to create sustainable suburbs, from urban design through to housing and sustainable lifestyles and how it is applied in practice in our suburbs.

1.7.1 Research Questions

Given that 'green' marketed suburbs in Perth are beginning to increase in popularity, and governments are looking to integrate sustainability principles into mainstream suburban housing developments, the following research questions were developed to guide the research:

- 1 Do policy, institutional or other barriers to the mainstream planning and development of sustainable settlements in Perth exist, in particular in sustainable housing?
- 2 Are 'green' marketed suburbs creating a more sustainable alternative to mainstream, modern suburban housing?

- 3 Do the sustainability features used by developers match those found in the literature?

1.8 Methodology Overview

Qualitative methodology has been used to answer these questions, including case study, document analysis, multi-criteria analysis, interview, online survey and focus group techniques. In particular case study methodology has enabled an in-depth exploration of four cases, namely new 'green' marketed housing suburbs in the Perth metropolitan area.

1.8.1 Structure of the Thesis

While this Chapter establishes the initial background of 'green' marketed suburbs and sets the scene for the overall purpose of the research, Chapter Two establishes the theoretical and historical background for the planning and development of suburbs in Australia, and the theoretical context of the research that will be echoed throughout the rest of the thesis. The review of the literature in Chapter Three establishes what are empirically accepted as being the indicators and features that make suburbs and houses energy efficient and therefore 'sustainable', 'green', or 'eco', and what is meant by these terms in the marketplace and the literature. Chapter Three also provides the background to the marketplace and policy drivers for energy efficiency in housing and suburb design, the changes in how people have developed and lived in cities and their suburbs, and the consequences of unsustainable development and planning decisions by governments. Chapter Four highlights the methodology used for collecting data, and the design of the research. In Chapter Five four WA (Perth) suburbs were chosen as case studies to enable a

more thorough examination of 'green' marketed suburbs and the current 'sustainable', 'eco' and 'green' suburbs that are becoming increasingly popular were examined. In addition Chapter Five examines the extent to which governments are involved in the development of 'eco', 'green' or 'sustainable' suburbs in an effort to progress their respective policy agendas, how well the Building Code of Australia (BCA) is implemented, and how this is occurring at the individual house and suburb level. The results from the data collected in the development, building, householder and regulation sectors are discussed in Chapter Six; and provide a summary of the overall discussion of 'green' marketed housing suburbs and the indicators of sustainability found therein. Final conclusions and recommendations for further research and policy development are discussed in Chapter Seven.

1.8.2 Scope and Limitations

For the purposes of providing a boundary to the research this thesis topic has focused specifically on the planning and development of those new suburbs in Perth, WA that are particularly marketed for their 'green' or sustainability credentials. This research has sought to focus on the mainstream example of 'green' marketed suburbs in Perth, as opposed to the highly 'niche' market example of 'Eco-villages' and similar; because it is understood that with rising energy and water prices, fluctuating resources prices generally, increasingly uncertain weather patterns and an ever tightening supply of land and goods and services that accompany increasing populations residents in mainstream suburbs will face the brunt of such changes.

One of the limitations of exploring suburbs that are still in the process of being built is finding available residents to survey and interview, and this research has certainly experienced such difficulties. However this has meant that, through the choice of using a range of methodologies to collect the data, a picture has emerged of the current state of sustainability in 'green' marketed suburbs in Perth, and more generally the capacity of developers and governments to integrate and implement sustainability in suburbs.

1.9 Conclusions

This Chapter has established a clear *raison d'être* for seeking greater energy efficiency and increasing sustainability in the residential housing stock and lifestyles of Australians, and an imperative to find out how best to undertake it. The world is becoming more and more complex, yet our need for shelter, food, companionship and employment remain unceasing despite a constantly changing environment in which we live and there is a growing understanding that humans need to live in balance and harmony with our planet (Major Cities Unit 2010; Mapes and Wolch 2010; Marchand, Walker, and Cooper 2010; Anderson 2011).

Given this, Chapter One has established that there exists a considerable impetus for improving the sustainability of suburban development in Australia. The growing size of houses and residential energy use despite smaller families is negating government efforts to reduce greenhouse gas emissions in Australia (Australian Bureau of Statistics 2007; Australian Conservation Foundation 2007). Even with the inclusion of sustainability criteria into the BCA, framed through increasing energy efficiency in the building stock, there remain a number of issues related to actual

energy efficiency performance of suburban residential development in Australia. The more recent development phenomenon of the 'green' marketed suburb is moving the residential market towards what government policy (WA LN Policy) sees as the future of residential development, but are they actually achieving the sustainability goals they are advertising? Hence this thesis exploration of 'green' marketed suburbs in Perth questions the capacity of developers to achieve sustainability goals in such specifically marketed housing developments; and seeks to highlight the impediments to the implementation of sustainability in suburb development and their governance.

CHAPTER 2: Theoretical and Governance Perspectives

2.1 Introduction

This Chapter outlines the theoretical, regulatory, governance, environmental and historical background that underpins the planning and development of suburbs; and the governance frameworks that currently exist within Australia to manage land use and the built form. Ultimately this research seeks to understand the different values each of the different 'stakeholders', 'actors' or 'agents' in the suburb planning and development industry holds in regards to sustainability, so as to determine what values and social constructs they each individually bring to their experience of suburb planning and development and how it influences their decisions and actions.

This understanding of these values will assist in appreciating the data collected, and posit reasons for particular behaviour choices by individual stakeholders and whether there is a gap between what stakeholders say and how they act when considering sustainability in their respective experiences of their suburb. This necessitates an exploration of the theoretical underpinning for these values and social constructs, as it is assumed and implied that each stakeholder brings to the planning and development of suburbs differing perspectives as producers, regulators and consumers of the suburb product, and that implicitly these perspectives are rational and therefore value laden.

As Sen (1995, :1, 2) suggests everybody has "disparate objects and interests" and they ultimately influence how they behave and interact in the world, and further that "the prospects of rationality in social decisions must be fundamentally conditional on the nature of individual rationality" and the general assumption is

that people are always making rational decisions. However it's generally understood that people rarely make decisions based on rational thinking alone, even if it was possible to agree on what was a 'rational' decision, everyone brings their own biases, value judgements and emotions to bear when making decisions (Sen 1995; Minogue 2001). After all, "planning has always meant taking intelligent, rational action. However, what constitutes intelligent action is the subject of much argument" (Faludi 1973, :35).

It is important to understand and clarify governance of these sectors in order to highlight any gaps in implementation of sustainability principles and practices in the suburb planning and development sector, as it relates to 'green' marketed suburbs; or any lack of support from complementary policy frameworks, and to describe the actual policy hierarchy around the urban and built form environment. The Australian Building Code (BCA) is the principle regulation enacted to manage the governance of the built form in Australia, and comprises the mandated standards for building design developed by the Australian Building Codes Board of Australia, the BCA, on behalf of the Australian Government and State and Territory Governments (Australian Building Code Board 2007). All States and Territories have given the BCA the status of building regulations within their local governments (Australian Local Government Association 2002).

The states and local governments manage and plan land use and urban form through the enactment of planning policies and legislation (MacCallum and Hopkins 2012; Searle and Bunker 2010). States and local governments manage urban regional development through the enactment of regional and local development

planning controls (Sandercock 1990; Hamnett and Freestone 2000; Western Australian Planning Commission 2003a). This chapter sets the context of the history of planning in Australia, and then concurrently in Western Australia (WA). The process of regulation and compliance is reviewed, as it relates to the planning, development and construction of suburbs and houses in Australia, and in particular WA. This chapter also explores the introduction and evolution of the BCA, and in particular the inclusion of energy efficiency criteria into the BCA and how this relates and impacts the development of houses in Australia.

2.2 Defining Sustainability

Where people live is an important part of their day-to-day lived experience and this research investigates sustainability and the connection between urban form (suburb design) and the built form (house design) and their impacts on the environment and people's ability to live more sustainably. Changing the patterns of consumption and production that have created the kinds of environmental challenges the planet is now facing will be a significant challenge for governments, especially while trying to support the capacity of all living beings to create a healthy and productive life for themselves (Australian Conservation Foundation 2007; Suzuki, McConnell, and Mason 2007). Sustainability is fundamental to living in balance with nature in more and more complex cities and suburbs (Major Cities Unit 2010; Fielding et al. 2010; Mapes and Wolch 2010). The importance of this research is that it describes and explores the connections between the ideal and premise of sustainability; and how we live in suburbs, in houses and to a certain extent how we

conduct our lifestyles; and how governments and developers are currently applying these concepts in our suburbs.

2.3 The History of the Term ‘Sustainability’

Sustainability as a general concept started very early in recorded history. Forestry management in the early sixteenth century in Germany and Japan used a term equivalent to ‘sustainable yield’ to acknowledge the inherent limits to timber production (Frey and Yaneske 2007). The scientific field of ecology continues to use the term to imply ‘carrying capacity’ or more formally, maximum sustainable yield. (Carrying capacity is the concept that an ecosystem can only sustain a limited density or number of individuals at any one time because each individual uses a certain amount of limited resources in that system (Bell and Morse 1999)).

The modern term sustainability was derived from the term ‘sustainable development’, used by the International Union for the Protection of Nature (IUCN)’s World Conservation Strategy of 1980 and the Brundtland Report’s ‘Our Common Future’ (1987), and later used as a guiding principle at the 1992 Rio de Janeiro United Nations Conference on Environment and Development (UNCED), ‘sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (World Commission on Environment and Development 1987). Sustainability and sustainable development are terms for a vast range of qualities, programs, lifestyles and schools of thought meant to convey the impression of environmental sensitivity, longevity and long-term economic, environmental and social viability

(Kidd 1992; Bell and Morse 1999, 2005; Dryzek 2005; Dryzek and Schlosberg 2005; Edwards 2005; Filho 2005).

The precursor to the current understanding of 'sustainability' was the environmental awareness and activism of the 1960s and 1970s (Bell and Morse 1999; Dresner 2002; Costanza et al. 2007; Frey and Yaneske 2007; Patton 2008). The influential *Limits to Growth* report from the Club of Rome in 1972 came just a few months short of the United Nations Conference on the Human Environment (UNCHM) in Stockholm and had the mission: '...to act as global catalyst of change that is free of any political, ideological or business interest' (Meadows and Club of Rome 1972, : 64). The 1972 Yearbook of the International Union for the Conservation of Nature (IUCN) is reputed to have been one of the first places where the term 'sustainable' was explicitly used, and it suggested that the environment be managed "so as to achieve the highest sustainable quality of human life" (Kidd 1992; Patton 2008). However, the then editors of 'The Ecologist' who published *Blueprint for Survival* which espoused the sustainability mantra more definitively, had a significantly different take on the meaning of 'sustainable', suggesting that the "...principal defect of the industrial way of life with its ethos of expansion is that it is not sustainable...indefinite growth of whatever type cannot be sustained by finite resources" (Goldsmith 1972, : 4).

2.4 Sustainability as a Contested Term

Technology and economic growth were espoused in the Brundtland Report as the central means for addressing the ills that faced the world (including poverty, environmental degradation, drought and food shortages) (World Commission on

Environment and Development 1987). According to the Brundtland Report, while sustainable development implied limits they were not absolute but “limitations imposed by the present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities” (World Commission on Environment and Development 1987, : 23). The major theme was the assumption that technology and economic growth would provide the mechanism for improving the Earth’s carrying capacity, thereby implying that nature and humanity had biophysical limits to be overcome rather than be respected (Patton 2008). The Commission also made the clear distinction that they saw the source of environmental degradation as poverty, such as the collection and use of firewood by families in developing countries, as opposed to the spending habits of the wealthy (Roseland 2000). However as Roseland (2000) points out the major source of deforestation isn’t firewood collection, rather it is the large-scale forestry activities, the expansion of agricultural land, the overuse of the existing agricultural land, over grazing, the burning of forests for cattle feed and other resources and the expanding urban growth of cities. It was this untested assumption of the source of degradation being poverty rather than wealth, that ultimately led to the argument for the stimulation of economic growth as a way of eradicating poverty, both in developing and developed countries (Roseland 2000). Patton (2008) observes that these concerns regarding the ‘unsustainability’ of growth-focused economies meant that the concept of ‘sustainability’ evolved from the critical discourse that arose counter to the notion of a steady-state economy (see also (Goldsmith 1972; Meadows and Club of Rome 1972; Bell and Morse 1999;

Hawken, Lovins, and Lovins 1999; Costanza et al. 2007; Frey and Yaneske 2007; Speth 2008)).

2.5 Theories and Concepts in Sustainability

This chapter effectively sets the context for what sustainability is defined as within the parameters of this thesis and explores the theoretical foundations of sustainability more generally. It ultimately reflects the integral differences in meaning and intent between the ‘neo-liberal’ flavoured sustainable development encouraged by the IUCN and the Brundtland Report (Patton 2008) and the ‘within the limits of the planet’ sustainability ethos echoed in the Club of Rome’s (1987) *Limits to Growth Report* and Goldsmith’s (1972) *Blueprint for Survival*. This difference is also reflected in what Beckerman (1972), Roseland (1994) and Vucetich and Nelson (2000) suggest is the ‘weak sustainability’ position of an emphasis on sustaining human welfare over nature’s and economic progress indefinitely, and the ‘strong sustainability’ position of a focus on sustaining natural capital as a primary goal over unlimited economic progress. Rees (1992) in particular insists that the ecological base line for sustainable development can be quantified as an economic allegory: humankind must acquire the ability to live on the ‘interest’ created by the residual stocks of living natural capital, and any human activity reliant on the consumption of bioresources cannot be continued indeterminately if it also expends annual production, and also reduces capital stocks.

2.6 Valuing Nature

The subtle difference of meaning embedded in the concept of sustainable development lies at the heart of why, some of its detractors consider that the

'sustainable development' movement has achieved so little to date (Shearman 1990; Girardet 2000; Gardiner 2004; Marden and Mercer 2005). It is a disparity that also intrinsically includes a subtle difference in meaning between "humans and nature" and "humans and the rest of nature"; implying that sustainability requires a far more holistic and inclusive interpretation than sustainable development has been able to provide thus far; and one that shows a "more integrated understanding of how humans interact with each other, with resources, with other species and with the environment" (Edwards 2005; Costanza et al. 2007; Frey and Yaneske 2007; Ehrenfeld 2008; Patton 2008; Speth 2008).

The value of nature and therefore the environment is an understanding that is implicitly related to Aristotle's theory of immanent value in nature (Costanza 2007, : 12). Such an understanding considers nature both as a whole and in its parts as having an inherent value because of its very existence (Millett 2011).

Early Western scientific thought relied on a Cartesian worldview where a "notion of a 'dead' nature" prevailed, and moved away from a view of nature as having value in and of itself (Millett 2011). This move away from considering nature as "something richly informed with telos (purpose), and with principles of spirit and agency" has had significant consequences for the state of the environment as we live within, and of it, in modern society (Pulzl; and Treib; 2007).

It has brought about a move away from a humanity that considers itself inherently within, and of, nature to one that is superior and in ultimate command over Nature (and the problems that has caused) (Millett 2011, :180). This is echoed by the theories of Bookchin's Social Ecology, Naess' Deep Ecology (Marden and Mercer

2005; Bookchin 2005; Dryzek 2005; Dryzek and Schlosberg 2005) and Lovelock's Gaia Hypothesis (2005). In many ways these scholars paved the way for a modern ethic based on an assumption of the value of nature, and more recently authors have begun to suggest that this status quo of considering Nature to be if not 'dead' at least inert and without inherent accountable value is leading us down a path that has potentially disastrous consequences (Lovelock 1979). Humanity's unease with its place, in and with nature, has created a chain of events that we are only now starting to understand (Suzuki, McConnell, and Mason 2007; Ehrenfeld 2008; Speth 2008). Ehrenfeld (Goldsmith 1972; Meadows and Club of Rome 1972; Bell and Morse 1999; Dresner 2002; Ehrenfeld 2008) describes sustainability in terms of Aristotle's "flourishing" or "eudemonia" where life is not just about surviving, and that a "sustainable ecosystem is one that generates a level of health, vitality and resilience that allows its members to both live and evolve". For some researchers the route to a more sustainable future is through nurturing possibility rather than merely solving problems, and humanity's decision to reduce everything to a set of problems to solve is a manifestation of modernity; stemming from our general unease about the world around us (in other words 'nature') (2008, :iv). In particular Ehrenfeld (2008) conceptualises sustainability as a journey that 'shifts back to the flourishing fullness of "Being" from its environmentally, emotionally and spiritually impoverished modern form of "having"...and that humanity's immersion in the modernist cultural paradigm has disaffected human beings in three critical domains of living, namely':

- "The human, arising out of our (lost) sense of what it is to be a human being,

- The natural, arising out of our (lost) sense of our place in the natural world, and
- The ethical, arising out of our (lost) sense of responsibility for our actions and our relationships to others”.

Suzuki, McConnell and Mason (2008, :6) go further by suggesting, “there is no environment ‘out there’ that is separate from us. We can’t manage our impact on the environment if we are our surroundings. Indigenous people are absolutely correct: we are born of the earth and constructed from the four sacred elements of earth, air, fire and water”. Humanity cannot live in harmony and balance with the planet if we don’t also recognise that the “notion of separateness or isolation is an illusion”, and that we are “intimately fused to our surroundings” (Suzuki, McConnell, and Mason 2007, :17). If we assume an ethic of responsibility for our place in and of Nature, and more importantly our human impacts on Nature, we also have a responsibility to improve the negative impacts and increase the positive ones for the betterment of all living things (Suzuki, McConnell, and Mason 2007, :18).

“An ethic of responsibility for nature makes the possession of certain forms of *immanent* purposiveness relevant, perhaps centrally relevant, in determining the moral considerability of an entity. Such an ethic also views humans as part of nature and not in any way apart from nature since in this ethic immanent purposiveness is a characteristic of all living things, including humans. That humans also have a *conscious* purposiveness may separate them off as moral *agents*, but *prima facie*, gives them no special privileges as moral subjects” (Millett 2011).

If we accept that a “living thing is a being-for-itself with an immanent good that places anyone who recognises that good under an obligation to care for it” and we accept that humans have no particular privilege over any other living thing, irrespective of their inherent complexity as an organism or sophistication as a considering, moral entity; then “we are bound to accept that, as moral agents, humans are obliged to care for living things” and this may involve a passive and an active obligation - “a passive obligation to leave living things alone to flourish according to their own inherent telos and an active obligation to avoid causing harm and to mitigate and ameliorate harm if it is caused” (Millett 2011, :208).

2.7 Natural and Social Capital

There has been significant research undertaken to progress our knowledge regarding the importance of forms of capital other than financial capital. Lovins, Lovins and Hawken (2010) extended the term ‘natural capital’ to encapsulate a new and more holistic way of living in the world, yet the term is essentially borrowed from ecological economics (Hawken, Lovins, and Lovins 1999). Natural capital is the holding or ‘stock’ of naturally occurring assets in an ecosystem that “yields a flow of valuable goods and services into the future”, with the natural stock of fish or forest being the ‘natural capital’ and the sustainable yield of that stock being the ‘natural income’ (Wackernagel and Rees 1996; Rees 2009; Roseland 2000). Such natural capital stock includes: “non-renewable resources such as minerals and fossil fuels; the finite capacity of natural systems to produce “renewable resources” such as food crops, forestry products and water supplies – which are renewable only if the natural systems from which they are drawn are not overexploited; and the capacity

of natural systems to absorb the emissions and pollutants which arise from human actions without side effects which imply heavy costs passed onto future generations (such as activities that release chemicals which deplete the atmosphere's ozone layer and greenhouse gases which may cause climatic imbalances) (Wackernagel and Rees 1996; Roseland 2000, :78)". Whereas the natural income of an ecosystem includes such environmental services as: "waste assimilation, erosion and flood control, and protection from ultraviolet radiation (the ozone layer is a form of natural capital)" (Roseland 2000, :78)". In a sustainable development context it is now abundantly clear that for development and human activity to be truly 'sustainable' it can't continue to deplete the natural or environmental capital of the planet (Roseland 2000, :78). Human capital is described by Roseland (2000, :81) as the "acquired knowledge and skills that individuals bring to productive activity...is formed consciously through training and education and unconsciously through experience". Whereas social capital is seen as the groups, organisations, relationships and structures that people develop between themselves and separate from any government or authority, that creates the fabric of a community – notably it is created by individuals "who form social networks, to produce goods and services, non-monetised as monetised" (Roseland 2000, :81).

The key to linking the concepts of natural and social capital is the understanding that there needs to be a significant 're-interpretation' of how Western society conceives "wealth and capital in terms of fundamental human and ecological needs", and that we can't continue to try to solve 'new' problems with 'old' ways of thinking and expect a different result (Roseland 2000, :83).

2.8 Strong and Weak Sustainability

'Strong' sustainability is informed by the theoretical perspective that as a species humans have lost touch with their 'natural' selves and their intrinsic place within and of nature, and that this separation and disconnection has led indirectly to our society creating settlements and lifestyles that are ultimately 'un-natural' and in the long term unsustainable (Roseland 2000, :88). Further, that having lost our 'sense' of our intrinsic and natural place in nature, humans are tending to create lifestyles and consumption patterns from a place of deep disconnection rather than from a place of wholeness – and it is this that is ultimately unsustainable (Carson 1962; Goldsmith 1972; Meadows and Club of Rome 1972; Lovelock 1988; Gottlieb 1996; Beatley and Manning 1997; Nasr 1997; Dryzek and Schlosberg 1998; Suzuki, McConnell, and Mason 2007; Ehrenfeld 2008; Speth 2008; Suzuki 2010).

'Weak' sustainability is a reflection of the neo-classical ideology that assumes that all natural and non-natural assets have viable substitutes, and the liquidation of natural assets is valid assuming sufficient investment in a similar natural asset for the next generation (Suzuki, McConnell, and Mason 2007; Ehrenfeld 2008; Speth 2008; Suzuki 2010). Clearly however there are some natural assets that are simply not transferrable for anything else, (i.e clean air). The 'weak' sustainability position also assumes that it is possible that other forms of capital such as manufactured, financial and human capital can be converted back into natural capital, however this position fails to consider the "irreversible processes such as the extinction of species or the destruction of ecosystems", not to mention the complexity with pricing ecological processes that are difficult to price or monetise (Wackernagel and Rees 1996; Roseland 2000; Rees 2009). This highlights that the "economic benefits

of destroying natural capital stock or the social costs of conservation may seem large, but only as a function of our inability to adequately assess such costs and benefits” (Roseland 2000).

2.9 Holism and Sustainability

Sustainability and its assessment are grounded in the ‘whole’ picture and not just its individual parts (Bell and Morse 1999, 2005). This research supports Bell and Morse’s (Bell and Morse 1999, :26; 2005) contention that “the idea of measuring sustainability in absolute, traditional, objective, empirical and reductionist terms...is non-viable”, and further that sustainability is “a highly complex and contested term open to a wide variety of interpretations and conceptualisations. In short, it is a concept dependant upon the various perceptions of the stakeholders residing within the problem context. Sustainability is not an absolute quantity to be measured”. For it to work in a practical way sustainability needs a framework to operationalise it in every context and sector, at scales that are relevant for that context and within a time period that is appropriate and achievable (1999, :126, 127). Even more importantly any sustainability project needs to view the whole issue and not just one part of it, for there to be a reasonable expectation of success (Heinen 1994).

In the context of this research Holism reflects the understanding that one part of an issue cannot be examined and critiqued without also understanding the interdependent and connected parts that make up the whole sector that an issue belongs within (Gremmen and Jacobs 1997; Bell and Morse 1999, 2005). Holism is most relevant to this research because it deals specifically with systems as a whole

unit, where the universe is seen as 'comprised of "self-contained systems"'. This kind of approach can be said to find a logical end-point in the notion of the world as a living system' and humans, like all animals, being a valuable part of that living planet (Bell and Morse 2005).

2.10 Ethics and Sustainability

The connection between ethics and sustainability is important, especially when we consider that ethics "involves everyday life choices by all individuals living in society" the link is perhaps more clear (Bell and Morse 1999, :109). Marden and Mercer (2005, :17) describe ethics as the capacity to "reflect on what we do and whether or not we have acted for the good of others or for our own selfish ends" and the connection to sustainability as the concern for "what we value today and what we believe people in the future will also value". Intergenerational equity is one of the main ethical principles of the modern sustainability concept, which emphasises the importance of development that doesn't rob future generations of natural and financial capital at the expense of living well today (Marden and Mercer 2005, :17). Sustainability and development that is sustainable also involves considering the ethical implications of any actions taken or not taken, in a way that is not entirely anthropocentric (World Commission on Environment and Development 1987; Kidd 1992). Being responsible for ones actions and the consequences is inherent in the understanding of the ethical dimensions of sustainability (Marden and Mercer 2005).

"Acting responsibly involves understanding the relation between thought and action. Ethics demands of us to examine our actions and our motivations, and quite

often this means making uncomfortable decisions...it may mean that we have to change the way we think about the environment and our place in the natural world...An ethic of sustainability demands that we not only think long-term but also beyond ourselves and our immediate needs” (Marden and Mercer 2005; Farmer and Radford 2010; Farmer and Guy 2010).

Ethics with respect to sustainability emphasises the social and cultural aspects of sustainability, and acknowledges that those that can least afford the consequences of past unsustainable behaviour need to be supported to live a more sustainable lifestyle (Marden and Mercer 2005, :19).

2.10.1 Ethics and the Built Environment

Researchers such as Fox (2000), Farmer and Guy (2000) and Gardiner (2000) have given more consideration to the relationship between ethics and the environment in recent years, however the notion of ethics with respect to the built environment has yet to be explored in great depth. Fortunately in the last decade or more researchers have given more credence to the presence of a very strong ethic in relation to the built environment and the need to establish sustainability as an important part of that discussion (Gardiner 2004). Fox (2000) argues that an environmental ethic should by rights include not just the ‘natural’ environment but also the human devised ‘built’ environment, because ‘the world around us – what we call ‘the environment’ – consists of both spontaneously occurring and humanly constructed environments’. Ethical considerations for the built environment not only cover the ongoing sustainability of the actual building but also of its maintenance and running costs (Fox 2000, :2). In respect to suburbs the ethical

considerations can be said to be related to building houses and settlements that are affordable to live in and maintain, and do not require expensive and energy intensive heating and cooling to be comfortable (Guy and Farmer 2000; Whitelegg 2000; Williamson and Radford 2000; Gardiner 2004; Fewings 2009). Given the initial cost of housing, to the low or middle-income buyer it is important to ensure that the ongoing costs of housing are also affordable (Fewings 2009; Williamson, Soebarto, and Radford 2010).

2.11 Sustainability in Planning

While there is a widespread acknowledgement by researchers and governments that there is much to be done to cities urban forms to improve sustainability outcomes (see (Ambrose 2008; Barton 1998; Wiland, Bell, and D'Agnese 2006; Frey and Yaneske 2007; Friedman 2007; Newton 2008; Farr 2008; Falk 2009b, 2009a)) there is still considerable debate on how to achieve such a goal and very few examples of real success stories (Barton 1998; 2008; Keilar 2008; Hollick and Connelly 1998). The connection between urban form, land use and transport has a significant influence on the over all, long-term sustainability of any settlement (Ambrose 2008; Newman and Kenworthy 1999; Scheurer 2000; Scheurer 2001; Scheurer 2007, 2008; Falconer, Newman, and Giles-Corti 2010). Yet as Scheurer (2007, :84) notes, until the 1990s “transport and mobility were rarely included in toolboxes for instigating sustainable urban development in neighbourhoods, even though the extent and character of travel behaviour are quite clearly connected to the internal layout, functional diversity and interactivity of a locale”.

This research is predominantly concentrating on Barton's (1998) 'meso' level of sustainable settlements, that is, those suburb housing estates and suburbs that have been developed with sustainability as an explicit or implied focus. Such developments in Perth are characterised by the significant influence of the Liveable Neighbourhoods Policy, which is heavily weighted with Australian New Urbanist features (Department of Planning 2008). Although this research is not specifically focusing on New Urbanism developments as such, by virtue of its current prevalence in Western Australia's settlement product it will feature as an important part of the discussion of sustainable sub-divisions considered in this research.

The review of the literature in Chapter Three explores the creation of the suburb from its earliest beginnings to enable an understanding of where suburbs have currently evolved to; and has discussed the definition and practice of sustainability in the built and urban form. Ambrose, Mead and Miller (2006) discussed the difficulties associated with developing more sustainable suburbs in Australia, and suggest that the current focus of the new energy efficiency regulations of the BCA are on construction rather than suburb design. The study highlighted a number of barriers to developing more sustainable suburbs and they include: regulatory barriers that inhibit the development of more sustainable suburbs, by not rewarding the implementation of sustainability principles within developments, and in some cases local government planning authorities finding it difficult to approve such developments under their current planning frameworks; market barriers that do not allow for the true valuation of more sustainable homes and suburbs, which has a considerable impact on financiers being able to fund such developments (Ambrose, Mead, and Miller 2006). The authors do however concede that with

tighter Energy Efficiency Rating (EER) standards allotment size and orientation will become increasingly more important (Ambrose, Mead, and Miller 2006).

2.12 Theories in and of Planning

In light of this, knowledge (such as theory) and how it is applied, can be seen as something that “abstracts from reality a set of general or specific principles to be used as a basis for explaining and acting with the theory being tested and refined if necessary”. More specifically Burchell, cited in Harvey (1985), describes planning theory as a “theory represented by a procedural rational model that is both simultaneously under attack yet re-emerging as a defaultingly accepted explanatory structure for the actions of practioners”. Whereas Allmendinger (2009, :12) differentiates between theories of planning that define ‘why it exists and what it does’ to theories in planning that discuss “how to go about it”. Rationalism and concepts of rationality in planning theory are important to the discussion within this thesis, as it constituted the dominant paradigm within the planning sector of Australia during the 1970s and early 1980s, and the assumption of the superiority of rational decisions is still apparent in the plans that have come to fruition in Perth in the last decade or more (especially considering the lead time between plans made and their eventual execution) (Sandercock 1990, 1998; Allmendinger 2009; MacCallum and Hopkins 2012).

2.13 Rationalism, Knowledge and Values

The rational theoretical model in planning has a long history of use and debate. Faludi (1986, :10) in particular made the distinction between critical and uncritical rationalist planning theory, critical rationalism being that which is capable of

“turning upon itself” and realising that all rational arguments begin from assumptions, and a commitment to “resolving issues by argument instead of force”. Although adaptations of the rational model are still used today, in planning around the world, it may succeed as a “rhetorical protocol even as it fails as a meaningful theoretical guide” and has largely been replaced by other planning models (Hoch 2011, :xi).

Sen (1995, :1) maintains however, that the “idea of using reason to identify and promote better – or more acceptable – societies, and to eliminate intolerable deprivations of different kinds, has powerfully moved people in the past and continues to do so now”. Although philosophical Rationalism, as theorised by Descartes, Spinoza and Leibniz, can be defined as the “theory of knowledge which maintains that reason is in and by itself a source of knowledge, and that knowledge so derived has superior authority over knowledge acquired through sensation”, it also underpins the understanding of the construction of knowledge (The Encyclopaedia Britannica 11th Edition cited in (Doney 1983, :4).

While the debate continues about what exactly is ‘knowledge’ and how it is constructed, generally the distinction is made between the source and method of attaining knowledge in the theories of Aristotle’s empiricism and Plato’s rationalism (Ferne et al. 2003). Ferne et al. (2003, :184) believe knowledge is essentially the ability of an individual to make judgements about the reality at hand, and they further contend that knowledge is not a “commodity that can be easily captured and transferred across sectors or contexts” nor can it be necessarily separated from the ‘knower’.

2.14 Rationality, Positivism and Power in Planning

In the discourse of planning there are a range of ideas, theories, concepts and socially constructed values that represent community norms when considering the development and use of land and these have undoubtedly had an influence on the way in which urban development has been framed (Healey et al. 1995; Healey 2002, 2006; Maginn 2007; Hillier and Healey 2010; Crabtree 2006; Falconer, Newman, and Giles-Corti 2010; Trubka, Newman, and Bilsborough 2010; MacCallum and Hopkins 2012). Ultimately there are two significant inputs to any theory – that is the ‘normative’ societal/cultural and individual elements and the ‘discursive’ elements, which are both shaped by power (Allmendinger 2009). In Flyvbjerg’s (1998, :227) study of the Danish Aalborg Project he highlights ten propositions about rationality in planning:

- “Power defines reality
- Rationality is context-dependent, the context of rationality is power, and power blurs the dividing line between rationality and rationalisation
- Rationalisation presented as rationality is a principal strategy in the exercise of power
- The greater the power, the less the rationality
- Stable power relations are more typical of politics, administration, and planning than antagonistic confrontations
- Power relations are constantly being produced and reproduced

- The rationality of power has deeper historical roots than the power of rationality
- In open confrontation, rationality yields to power
- Rationality-power relations are more characteristic of stable power relations than of confrontations
- The power of rationality is embedded in stable power relations rather than in confrontations”.

It is suggested by Flyvbjerg (1998) therefore that a democracy based on weak rationality and an impaired understanding of the influence of power is also weak because “modernity relies on rationality as the main means for making democracy work”...“power defines and creates, concrete physical, economic, ecological, and social realities”. This also is the implication behind Allmendinger’s (2009, :79) assertions that the study of urban areas and planning can’t be separated from society, that because they are generated by society they “have an internal logic and function that is primarily derived from the economic structuring forces within that society”, which in the majority of cases in the developed world is capitalism. Nor can the practice of planning be separated from the state because it is “an extension of the state and changes its imperatives (goals, emphasis and theories etc) in response to the needs of capital”.

Until the early 1980s Faludi (1973) provided the widely held planning theory typology that was founded on an assumption of a difference of approach between substantive and procedural theory, and this had a significant influence on the practice of planning as we know it today (Allmendinger 2009). However such

concepts were also deeply influenced by the positivist and post-positivist understandings of “indeterminacy, incommensurability, variance, diversity, complexity and intentionality” (Allmendinger 2009, :32). Whereas positivism sought to categorise life around what was thought to be ‘real’ or positive knowledge as opposed to ‘fictional’ or ‘imagined knowledge or myth’, and were most interested in the interactions and connections between things based on empirical or mathematical observations; post-positivists considered that individuals worked within a world where there was no one ‘answer’, rather only ‘diverse and indeterminate options’ and within planning there was an emphasis on language and ‘making meaning’ instead of ‘objective reality’ (Allmendinger 2009).

Cities and their regions, and the efficient and aesthetic organisation of them continues to be a principal focus of governments and the public. The practice of planning has evolved from a public social conscience about ‘shaping places’ and supporting ongoing social and economic change to grow communities and cities to be places that people are happy living in (Healey 2006). Planners in Europe in particular, found themselves to be a vital part of the “transforming effort, building the welfare states which would deliver a reasonable quality of life to the majority of citizens, after the horrendous experiences of war and of the economic depression before it” (Healey 2006, :8). Furthermore it has been suggested by Healey (2006, :10) that spatial planning is focused on the “management of a product, the physical shape and form, the morphology and spatial organisation of the region”, and can be traced to three important concepts including:

- Economic planning to “manage the productive forces of nations and regions” and can be traced directly from rationalist ideas on a planned social order that assist in the efficient production and distribution of goods and services to ensure continued economic growth;
- Management of the physical development of towns and urban living; and the
- Management of public administration and policy analysis”.

Hudson et al. (1979) cite the rational comprehensive or synoptic tradition of planning as being the planning approach that all others either represent a modification of, or a reaction to. With four conventional elements including: goal setting; identification of policy alternatives; evaluation of means against ends; and implementation of decisions it is comparatively simple in its operation and combines qualitative and quantitative information when determining outcomes (Hudson, Galloway, and Kaufman 1979). Critics of the rational approach to planning however suggest that because of its overwhelming focus on the process, it served to ignore the more important aspects of political conflict, the built environment and the nature of the terrain it was working within (Fainstein 2000).

2.15 Communicative Planning

Fainstein (2000) cites the philosophical approaches of the American pragmatists John Dewey and Richard Rorty and Habermas’s communicative rationality as the theoretical sources for the communicative model. The existence and appreciation of the social processes underpinning spatial and urban development planning, as

opposed to the neo-liberal ideals of rationality and an emphasis on microeconomics, has led to the growth of different ways of cooperating in planning (Healey 2002, 2006; Hillier and Healey 2010). Healey (2006, :29) suggests that this alternative planning approach, communicative or collaborative planning, is based on the understanding that "...knowledge and value do not merely have objective existence in the external world to be 'discovered' by scientific inquiry", and therefore "public policy, and hence planning are thus social processes through which ways of thinking, ways of valuing and ways of acting are actively constructed by participants".

Communicative or collaborative planning is described by Healey (2006) as deriving from Habermas's critical theory, Giddens's structuration theory as well as elements of cognitive psychology, but it also has clear links to the post-positivist tradition in planning (Allmendinger 2009, :43). These new approaches to planning have emerged from a period of what Habermas (1984) described as a life dominated by "abstract systems". Where the "free individual became an autonomous utility-maximiser with material preferences and interests disconnected from the social situations of existence", and the market-economy focused on individuation and modernity (Healey 2006, :40). Collaborative or communicative planning has emerged out of this friction between modernity and post-modernity where "utility-maximising individuals and rationally ordered polities are contrasted with hedonistic, self-realising individuals and anarchistic polities" and the need to find an approach to planning that sits in the middle ground of that friction (Healey 2006, :44).

The major aspects to communicative planning include a:

- Recognition that all forms of knowledge are socially constructed; and that the knowledge of science and the techniques of experts are not as different from 'practical reasoning' as the instrumental rationalists had claimed;
- Recognition that the development and communication of knowledge and reasoning take many forms, from rational systematic analysis, to storytelling, and expressive statements, in words, pictures or sound;
- Recognition, as a result of the social context within which individuals form interests; individuals thus do not arrive at their 'preferences' independently, but learn about their views in social contexts and through interaction;
- Recognition that, in contemporary life, people have diverse interests and expectations, and that relations of power have the potential to oppress and dominate not merely through the distribution of material resources, but through the fine grain of taken-for-granted assumptions and practices;
- Realisation that public policies which are concerned with managing co-existence in shared spaces which seek to be efficient, effective and accountable to all those with a 'stake' in a place need to draw upon, and spread ownership of, the above range of knowledge and reasoning;
- Realisation that this leads away from a competitive interest bargaining towards collaborative consensus-building and that,

through such consensus-building practices, organising ideas can be developed and shared which have the capacity to endure, to coordinate actions by different agents, and to transform ways of organising and ways of knowing in significant ways, in other words, to build cultures;

- Realisation that, in this way, planning work is both embedded in its context of social relations through its day to day practices, and has a capacity to challenge and change these relations through the approach to these practices; context and practice are not therefore separated but socially constituted together (Healey 2006, :29-30).

Despite the influence of communicative or collaborative planning principles in the Government's Liveable Neighbourhoods Policy, that most new suburbs since 2006 have been guided by; it is clear from this research that green suburbs in Perth have been designed/developed with limited reference to the people that are going to live in them. This situation has likely occurred because the overriding imperative for the developers, despite the initial 'green' fervour, is to sell as many lots as possible. In response to the deterministic rational planning model of the 1960s, the 'communicative' model sought to change the dominant modes of thought within planning at the time and respond to the "events on the ground". Fainstein (2000, :455) however provides some criticism for the communicative/collaborative model, by suggesting that while 'ideal speech' might supply a vehicle for demystification when it "becomes the object of planning, the argument takes a moralistic tone, and its proponents seem to forget the economic and social forces that produce endemic social conflict and domination by the powerful". Ultimately the challenge for our

societies and governments is to find a way of bridging the tension between individuation and the inherent value in diversity, and the recognition of our many commonalities as humans and our place in and of nature (Healey et al. 1995; Healey 2006; Millett 2011).

The rationalist theoretical model has had a long and influential history in Australian planning, and modernity has relied on rationalist concepts for the continuation of democratic governance and in many ways also capitalism (Flyvbjerg 1998; Allmendinger 2009). Rationality in planning has influenced the way in which urban and regional planning has been conducted, and framed in the political arena. More importantly for the practice of planning however, is the understanding of Flyvbjerg's (1998) that "not only is knowledge power, but more importantly power is knowledge" and that "power determines what counts as knowledge, what kind of interpretation attains authority as the dominant interpretation" which has clearly had significant influence on what is counted as good or useful knowledge in planning practice, and what is not (Flyvbjerg 1998, :226).

2.16 The New Urbanism Design Theory

At the same time that there has been resurgence in the application of planning theories that seek to engage more with the community, the design theory of new urbanism is seen as being a "backlash to market-driven development that destroys the spatial inequality engendered by capitalism" that was occurring concurrently with the rational planning model and was an "atheoretical, physical outcome-oriented vision" that saw metropolitan areas being developed through urban renewal with "low density development, and spatial and functional segregation"

(Fainstein 2000, :453). Fainstein (2000, :453) cites new urbanism as being frequently labelled as 'neo-traditionalism', presumably because it echoes 'old town' design ideologies that "paints a physical picture of a desirable city to be obtained through planning". Such ideas about orientation are similar in content and intent as the early planning theorists: Howard, Olmsted and Geddes; where 'spatial relations' are manipulated to create a close-knit social community that "allows diverse elements to interact" (Fainstein 2000, :461). New urbanism is particularly reacting to suburbia's 'responsibility' for traffic congestion, big box shopping centres over 'village' street shops and urban sprawl (Fainstein 2000). While there are many critics of the new urbanist design ideal citing the issues associated with its environmental and spatial determinism, and the compromises made to developer's sensitivities against socially inclusive developments (see: (Harvey 1985; Falconer, Newman, and Giles-Corti 2010; Fainstein 2000); it is equally lauded for its ability to create good public spaces, its emphasis on the connection of work and living and its consideration of environmental quality (Fainstein 2000). Western Australia has particularly been influenced by the design theories of new urbanism, with the creation and implementation of the Liveable Neighbourhood's policy that has been the design guideline for new suburbs since the mid 2000s, and this will be discussed in more detail in Chapter 5 (Western Australian Planning Commission 2007; Department of Planning 2008; Falconer, Newman, and Giles-Corti 2010; MacCallum and Hopkins 2012).

2.17 Deliberative Democracy and Participative Planning

A number of changes to the way in which communities and government's interact, and a general re-flourishing of urban regeneration initiatives worldwide have occurred almost simultaneously since the early 1990s, and has generally increased the opportunities for communities to have a say in local decision making (Maginn 2007; Healey 2002, 2006; Hillier and Healey 2010). Maginn (2007, :332) cites Barnes et al. (2004) and Saunders and Tsumori (2003) as suggesting that these pluralistic developments are grounded in a number of factors including:

- "A perception that the neo-liberal/conservative project has run its course
- Growing political concerns about declining public involvement and antipathy towards political processes
- A re-discovery of poverty, only this time the term social exclusion has come to dominate policy discourses
- A latent realisation by government that the responsibility for resolving urban social problems is a shared endeavour involving the private, voluntary and community sectors"

This 'pluralistic turn' has highlighted many of the deficiencies in community consultation as it has been constructed in the last two decades (Maginn 2007). Community consultation has, according to Hartz-Karp (2007, :1), not been able to fix the problems that enabling community input was supposed to, and in some cases "consultation has frequently resulted in the unintended consequence of community frustration and anger at tokenism and increased citizen disaffection". Hartz-Karp

(2005, :1) describes deliberative or participative democracy as a reaction to the “inadequacies of representative democracy”, and cites Levine as suggesting that democracy needs deliberation for three reasons namely:

- “To enable citizens to discuss public issues and form opinions
- To give democratic leaders much better insight into public issues than elections are able to do
- To enable people to justify their views so we can sort out the better from the worse”

According to Hartz-Karp (2005, :9) the “Dialogue with the City” process was chosen because it enabled “innovative ways of engaging in joint decision making with government” to occur, and suggests that the process could only be effective when an “environment of trust, where open and honest dialogue can develop”, and that this enabled participants to be more willing to allow alternative solutions to come about and consider compromises. Maginn (2007) however is less sure that the ‘Dialogue with the City’ process was in any way successful, suggesting that Hartz-Karp’s (2005) claim that the Dialogue process “achieved an outcome that truly reflects the deliberative process” was an exaggeration. Given that the eventual policy development that came out of the Dialogue process, ‘Network City’, remained in draft form and unimplemented till the new strategy ‘Directions 2031’ was made government policy in 2010 Maginn (2007) may have a valid point (MacCallum and Hopkins 2012). An examination of the theoretical underpinnings influencing the planning and development of ‘green’ marketed suburbs has been important, as it is understood that not only are policies not created in a vacuum,

they are also heavily influenced and dependant on the governance framework they sit within, the political climate of the day and the social and culture mores prevalent at the time. These all influence the success and implementation capacity of different planning and development mechanisms, in the public and private sector. What is most obvious in this examination is the importance of real and worthwhile engagement with potential residents, governments and the private development sector, and the very real need to understand the capacity of the government to support that or not.

2.18 History and Governance of Planning in Australia

Australia, like many industrialised nations, was shaped and driven by modern urban planning responses to late 19th Century problems associated with rapid urbanisation (Sandercock 1990; Davison 1993; Hamnett and Freestone 2000; Freestone 2007; Searle and Bunker 2010; MacCallum and Hopkins 2012). Governments began enacting public health legislation to regulate and control urban streets and buildings and opening up green field sites for community development (Sandercock 1990; Davison 1993; Hamnett and Freestone 2000; Davison 2006; Freestone 2007). Regulation of this sector was important on social not just environmental health grounds, with the new workers flooding into rapidly growing towns it was essential that the dwelling and services development be consistent with public health and safety priorities rather than those of big business (Mumford 1961; Sandercock 1990; Hamnett and Freestone 2000). In the early stages of the planning and development of cities and urban areas, especially in Australia, additional enhancements to the city were frequently a hit and miss affair

(Sandercock 1990; Davison 1993; Freestone 2007; HRSCLTS 1992). According to Freestone (2007) it was not until the early 1910s that an integrated and coordinated approach to city planning surfaced, incorporating the architecture, engineering and surveying disciplines.

Particular to Australia is the experience of Federation that created a framework of a federal system of government, with separate state governments and relatively weak local governments (Australian Local Government Association 2002; Searle and Bunker 2010; MacCallum and Hopkins 2012). The Australian experience of city development is distinctive because it is embedded in the consequences of the arrangement of government power; capital city dominance because of the relatively inhospitable regional areas; the 'tyranny' of distance from sources of innovation and new learning overseas; a small population often spread over long distances; a medium-sized economy; and the early British dominance of planning and legal responses to urban issues (Freestone 2007).

Australian planning in the 1940s was dominated by American city functional/city beautiful thought overlaid by British town and country planning precepts predominantly based around the concept of municipal land use control and the eventual dominance of the private car (Freestone 2007). Australia in particular was heavily influenced by the most popular planning ethos of the day, which meant that city planning in the early 1900s was dominated by the British 'garden city' movement which sought to guide housing and land reform to develop model house and garden suburbs (McLoughlin and Huxley 1986; Hamnett and Bunker 1987; Sandercock 1990; Berry 1999; State of the Environment Committee 2011).

Unlike the metropolitan planning system in Europe or America, Australia has had a long history of state governments developing much of the large-scale, high level planning 'blueprints' to manage land use in the capital cities (Searle and Bunker 2010; MacCallum and Hopkins 2012). This planning arrangement has come about because of the nature of the federated states, and the decision made at Federation that the States would manage the affairs of their own cities including, by implication, their suburbs (Hamnett and Freestone 2000; State of the Environment Committee 2011). Uniquely to Australia "constitutional responsibility lies entirely with the state governments. Local government and its planning are legally bound by state planning laws and controls" (Searle and Bunker 2010, :165).

2.19 Historical Context of Planning in WA

Garnaut (2008) cites Perth as being one of the more compelling examples of 'town planning on garden city lines', with the development and eventual implementation of the Perth Endowment Lands Master Plan that created large tracts of bush land connecting the city to the ocean, that has remained untouched to this day. The first regional plan for Western Australia was published in 1955, followed by the enactment of legislation to develop a statutory regional plan and a Regional Planning Authority to implement it (Forbes 1994). The features of the plan included a binding region scheme, backed by strong legislation, a region improvement fund created by a small levy on land tax, and an independent expert body to manage the planning scheme, make impartial decisions about development proposals and to use the improvement fund to acquire open space and transport corridors (Forbes 1994; Western Australian Planning Commission 2007).

Forbes (1994) cites the original region scheme as being particularly influential in shaping Perth as we know it today, by ensuring that land was available for Perth's regional open space system and for its transportation system. The statutory regional plan for Perth was initially developed in 1963 with the Metropolitan Region Scheme (MRS) and was replaced by the Corridor Plan in 1973. In 1990 the Corridor Plan was overtaken by Metroplan, in 1997 it was redeveloped to become the State Planning Strategy and in 2004 this was transformed into the Network City policy (Western Australian Planning Commission 2007). Metroplan in particular, introduced the urban consolidation ethos with 80, 000 new houses being developed in established areas, increased the recognition of the need for greater public transport choice and a decreased reliance on the private vehicle for transport (Forbes 1994; Western Australian Planning Commission 2007).

After significant public consultation in the early 2000s – Dialogue with the City, the new Labour Government established a review of Metroplan to “cater for the population growth of approximately 760, 000 residents by 2031, representing a 51% increase on Perth's 2001 population” (MacCallum and Hopkins 2012, :492). In 2004 Network City was developed as the draft strategic framework for guiding Perth and Peel to a more sustainable future; the guiding theme being ‘managing growth by sharing responsibility between industry, community and government’; and was seen to encourage a “a more compact form for the city, in line with a view that continued low-density sprawl was the cause of many social and environmental problems” (Western Australian Planning Commission 2007; MacCallum and Hopkins 2012, :492). Network City aimed to plan “better and smarter to meet the challenges of climate change, water, oil and resource depletion, at the same time catering for

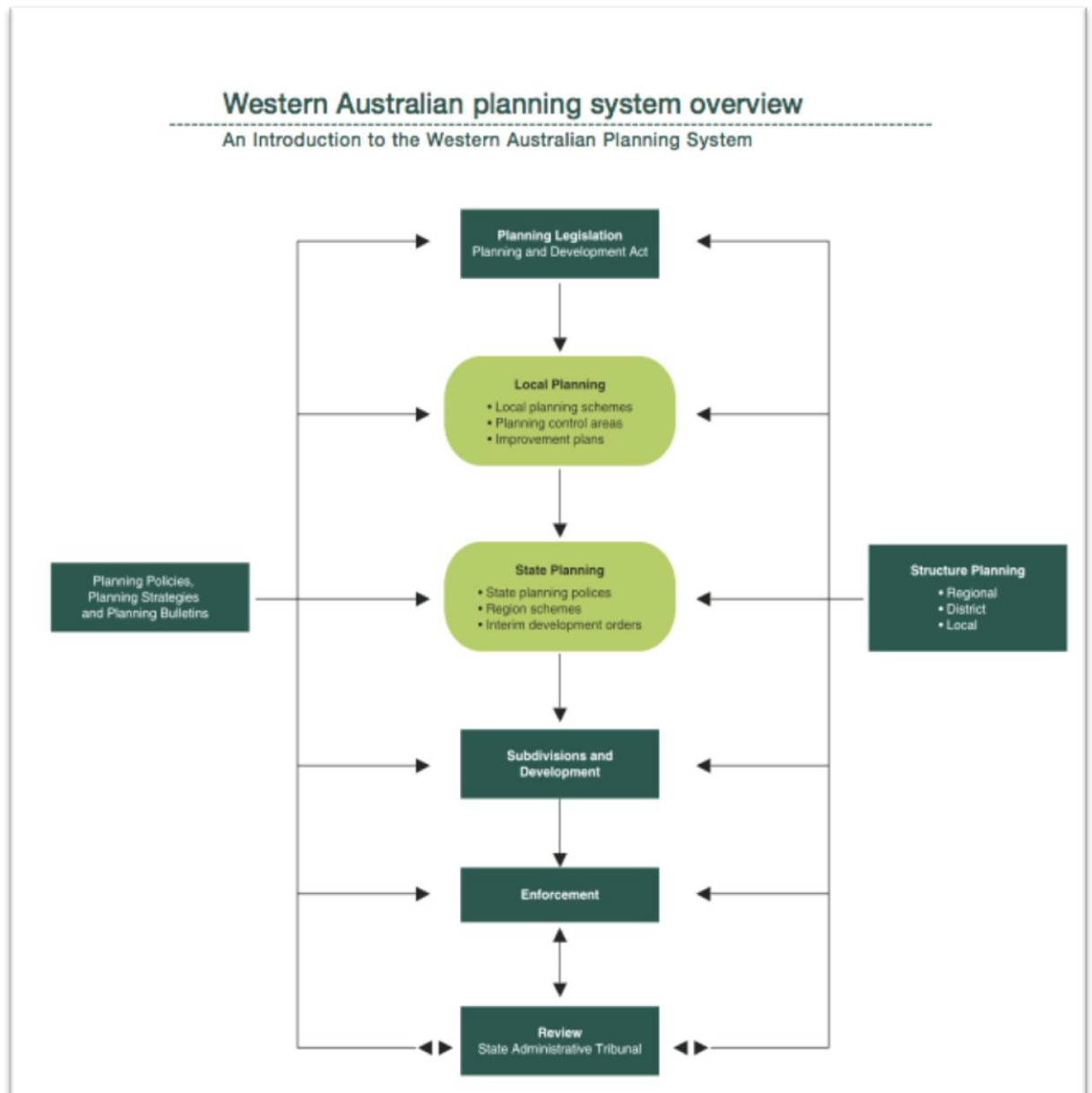
the demands of rapid population growth driven by a strong economy and increased affluence”, through corridor planning of ‘activity’ centres connected by transport networks (public transport, road, walking and bicycle paths) (Western Australian Planning Commission 2003a, 2003b; Western Australian Planning Commission 2007; Curtis 2006).

However, the WAPC didn’t modify the strategy in response to the community input straight away, producing an interim document confirming Network City’s status as the overarching metropolitan strategy for Perth - the ‘Statement of Planning Policy: Network City’ in 2006 (MacCallum and Hopkins 2012). It wasn’t until 2009 that the Government released another consultation paper and another draft strategy, Directions 2031, which was then endorsed as a final plan in 2010 called ‘Directions 2031 and Beyond’ (State of WA 2009, 2010). According to MacCallum and Hopkins (2012, :492) this final strategy did maintain the intent of the basic principles of Network City urban form, and was modified to include a reduced infill target of 47% while still encouraging a “pattern of development based on defined activity centres connected by a strong transport network”; but it was a ‘normalisation of its predecessor’ and was the result of a “conventional consultation process, restructur(ed) according to standard generic conventions, and generally ‘taming’ it for the sake of easier implementation”. This changed outcome, and reversion to relying on a ‘conventional consultation process’ would seem to confirm Maginn’s (2007) suggestion that Hartz-Karp’s (2005, 2007) assertion of the success of the Dialogue process was an over exaggeration. Rather, Maginn (2007, :334) suggests, the Dialogue process went to some pains to give the “impression of being a deliberative democratic process through execution of various consultative and

participatory events combined with the rhetorical utterances of key actors” whilst actually manipulating participants by offering an “illusion of choice and utilising a stealth discourse that espoused sustainability and new urbanism to steer them towards a preferred policy path”.

There are a number of pieces of legislation that give effect to the operation of the planning system and they include: the Planning and Development Act (2005) which was the melding of three former acts – the Western Australian Planning WAPC Act (1985), the Metropolitan Region Town Planning Scheme Act (1959) and the Town Planning and Development Act (1928); the Environmental Protection Act 1986 – which brought together the planning and environmental assessment procedures and integrated them at the early land rezoning stage of the planning process; the Town and Planning Regulations (1967); and the Town and Planning Development (Suburb) Regulations 2000. Through the enactment of these legislative instruments the WAPC and the Department of Planning (as of 2009), uses the State Planning Strategy to set the overview of the future challenges for the State, sets the key principles to guide future planning decisions and determines the key challenges for their implementation and regulation, actions and strategies for government to improve the environment, community, economy and infrastructure of Western Australia (Western Australian Planning Commission 2007). This process is highlighted in Figure 1.

Figure 1: Planning System Overview

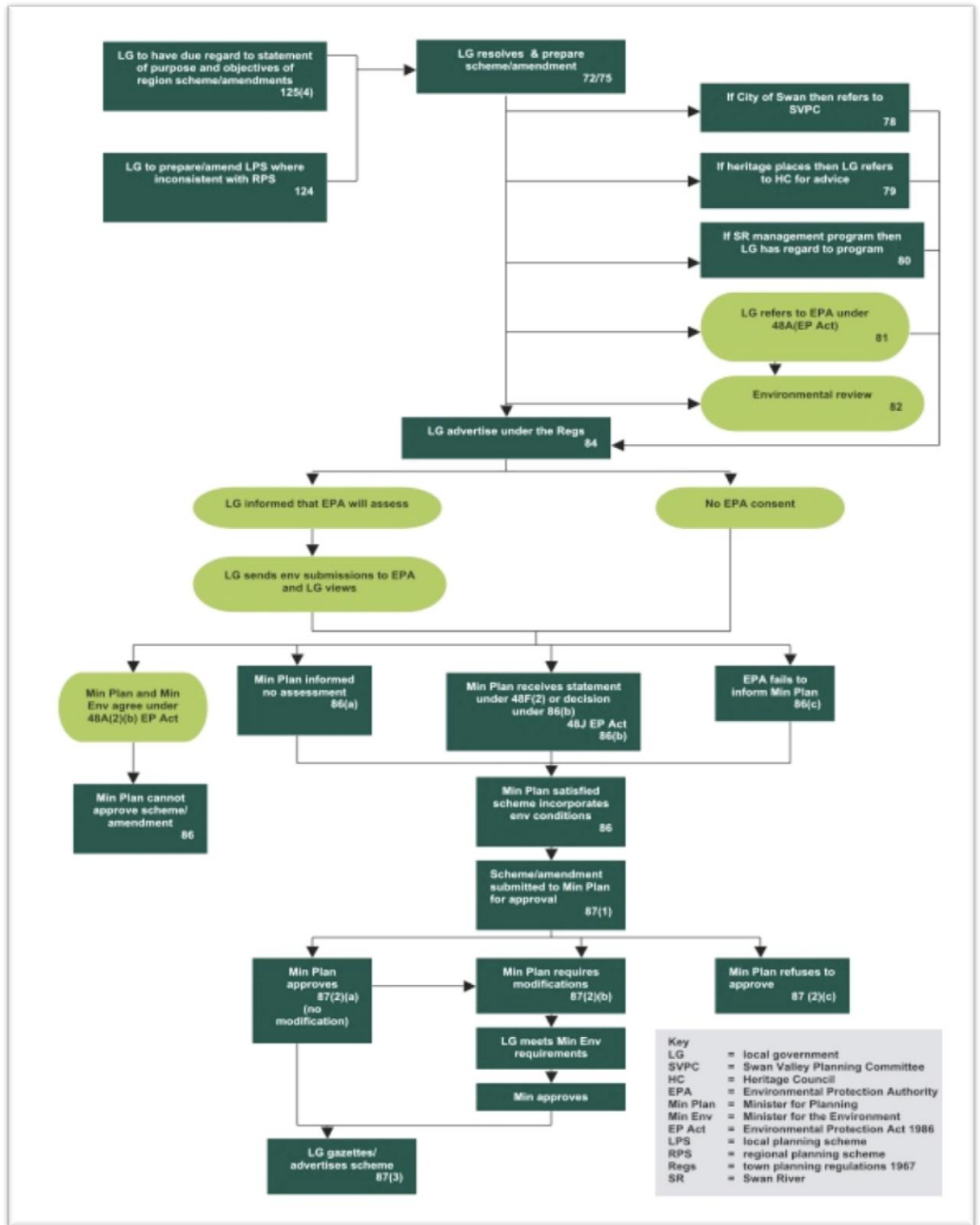


Source: (Western Australian Planning Commission 2007, :19).

WAPC delegates authority to local governments to determine some development applications under the MRS. In addition local governments are given an opportunity by WAPC to comment on suburb proposals and planning policies that guide decisions on suburb or development matters (Western Australian Planning

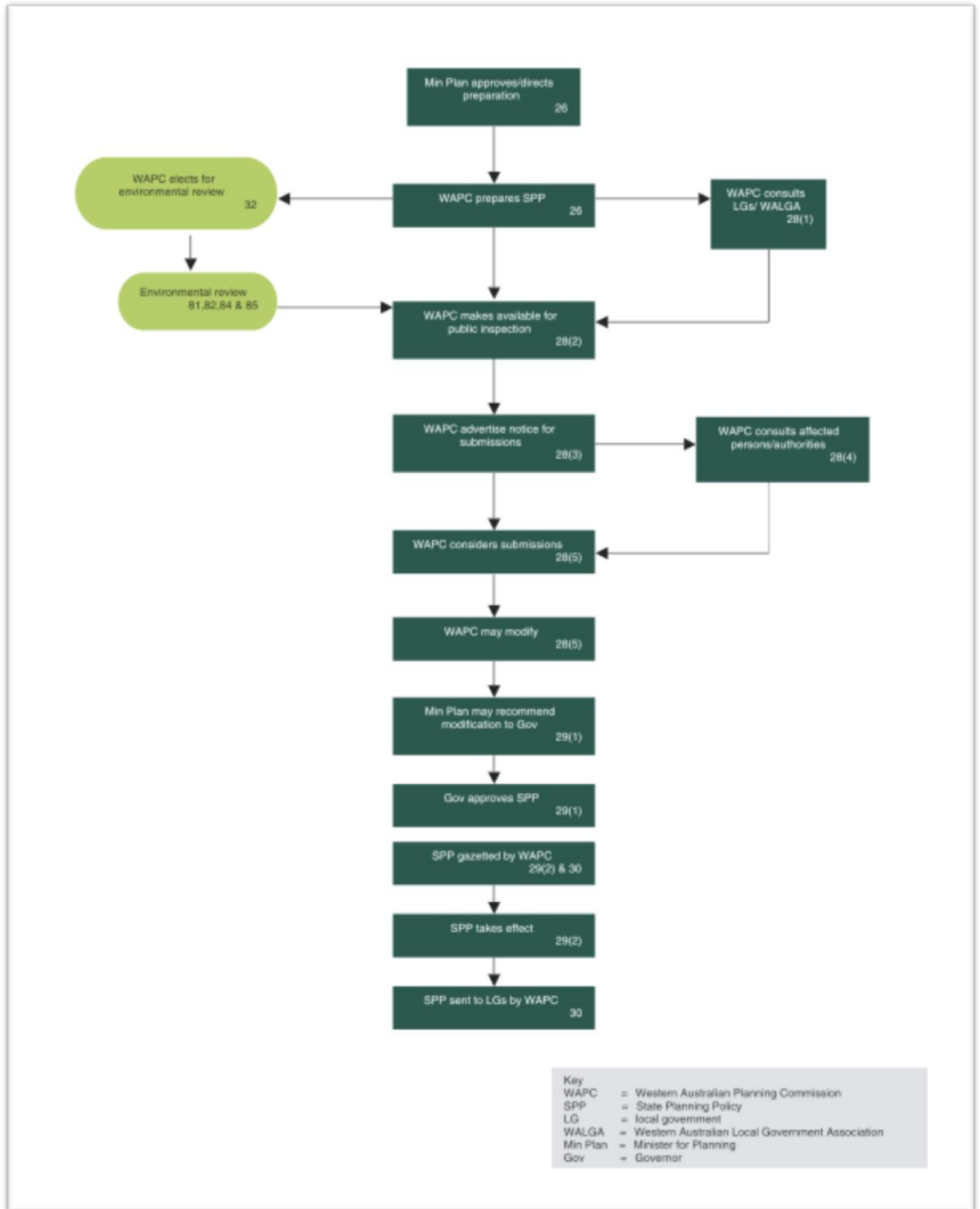
Commission 2003a). This model of regulation on three levels, that is the Minister for Planning and Infrastructure, the Western Australian Planning Commission (WAPC) and local government, is still current today. The WAPC provides advice to the Minister and is responsible for all land use planning and development concerns; and determines all suburb applications, administers regional planning schemes and provides advice to the Minister on local planning schemes. The Department of Planning provides advice and administrative services to the WAPC and implements WAPC decisions and **Error! Reference source not found.**highlight the planning process that guides local governments to ensure their own local plans match the intent of the higher order state plans. Local governments are tasked with the responsibility for establishing planning controls such as appropriate land uses and residential densities, and base planning decisions on the provisions in their local planning scheme(s) (Western Australian Planning Commission 2007).

Figure 2: Local Planning



Source: (Western Australian Planning Commission 2007, :20).

Figure 3: State Planning Policy



Source: (Western Australian Planning Commission 2007, :20).

The WAPC is a unique and largely autonomous regional planning body (the WAPC with equal representation from state and local government) and is an integral part of a planning system that includes a strategic plan setting broad, long-term directions for metropolitan growth and a statutory regional plan implementing the strategic proposals (Forbes 1994; Western Australian Planning Commission 2007). The WAPC has developed the State Planning Framework to encapsulate the suite of policies that it regularly uses to guide development in Western Australia, with regard to the State Planning Strategy. Some of these policies are legislative/statutory in nature and are developed under the auspices of the Planning and Development Act (2005) (Western Australian Planning Commission 2007); whereas the more strategic policies are concerned with broad planning controls and may be related to a local planning scheme or to a specific region or area (coastal planning, residential design codes or rural and regional land use). The less formal development control policies developed by the WAPC usually relate to the suburb of land, development controls, public open space, rural land use planning and residential road use planning. Additionally, the WAPC issues planning bulletins to provide further guidance regarding statutory planning issues such as designing out crime, child care centres and residential leasehold estates (Western Australian Planning Commission 2007).

Local government has the mandate to develop and administer local planning schemes related to the land area under their management. Local planning schemes typically set out the way land is to be used and developed and include classification of areas for particular land uses, provisions to coordinate infrastructure and

development locally and controls to manage long term strategic planning goals (Western Australian Planning Commission 2007). These local planning schemes are administered under the provisions of the Planning and Development Act (2005), providing a legislative backing to enable certainty of decisions. Generally local planning schemes work within the provisions of a regional planning scheme by specifying particular land uses complementary to the more broad scale of the regional planning scheme.

In addition, just as the WAPC has its own planning policies, local governments also develop local planning policies to assist in the planning, development and use of land in their control. Local government policies need to be in alignment with the planning policies set out by WAPC, and do not preclude the need for development application assessment (Western Australian Planning Commission 2007). Other planning instruments that local governments and WAPC use to control and determine land use include district and local structure plans that show in more detail the generalised pattern of land uses for a particular area. Structure plans give further guidance for more comprehensive planning and development of an area by including such information as the opportunities and constraints on development in the area, the location and density of residential areas, the placement of industrial and commercial precincts, the details on retail strategies, location of schools, community facilities, public open spaces and the transport network.

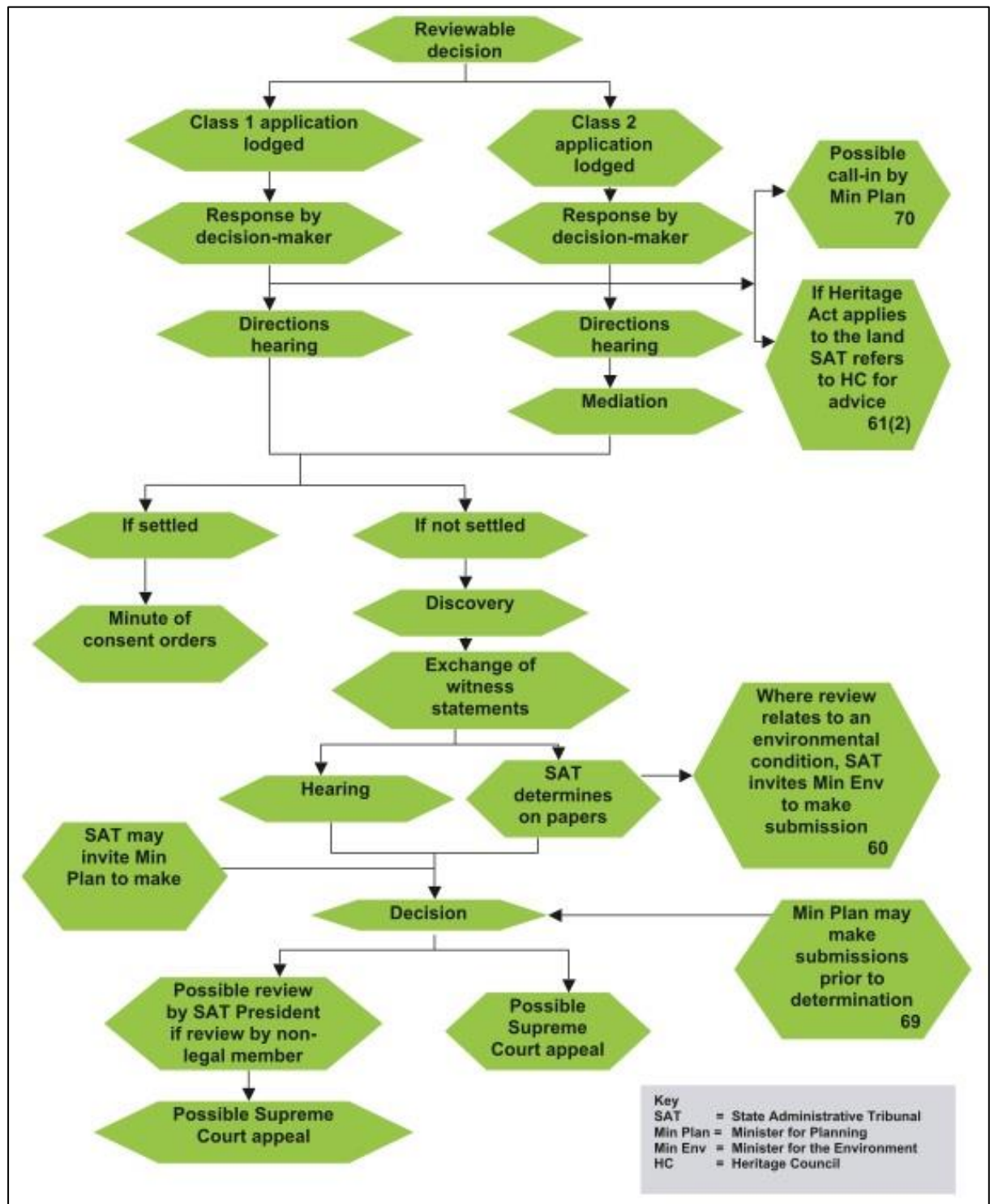
2.19.1 Review and Enforcement of Planning Instruments

Local governments are able to grant approval of a development application with or without conditions or refuse an application entirely. The applicant then has the

right of review and can apply to the State Administrative Tribunal for a review of the decision in the event that the decision is unacceptable and this is highlighted in (Western Australian Planning Commission 2007).

Whilst the Tribunal will take evidence and make a decision on the evidence provided the Minister for Planning still has the right of veto to overrule or direct the Tribunal to make a particular decision. The Tribunal or Minister then publishes the decision reached, and this then becomes a precedent for determining future planning applications (Western Australian Planning Commission 2007). Local governments have the mandate to enforce their local planning schemes and conditions of planning approvals, and the Minister of Planning may, if required, overrule the local government to enforce the local planning scheme or conditions of planning approval (Western Australian Planning Commission 2007).

Figure 4: Reviews at the State Administrative Tribunal



Source: (Western Australian Planning Commission 2007).

2.19.2 Related Policies and Acts

There is a number of other State Government legislation and policies that directly or indirectly influence the capacity of local governments to provide the opportunity for sustainable suburbs to be created. The State Sustainability Strategy (SSS) was adopted in 2003 to establish sustainability principles and practices within government actions and services and beyond (WA Govt. 2003). The strategy seeks to ensure that the Government:

- Govern in such a way as to drive the transition to a sustainable future
- Play our part in solving the global challenges of sustainability
- Value and protect our environment and ensure the sustainable management and use of natural resources
- Plan and provide settlements that reduce the ecological footprint and enhance our quality of life
- Support communities to fully participate in achieving a sustainable future; that we assist business to benefit from and contribute to sustainability (WA Govt. 2003)

At about the same time that the SSS was being developed, WAPC introduced the Liveable Neighbourhoods Policy in 1998 that was trialled in WA for a period of 10 years (Department of Planning 2008). From 2008 Liveable Neighbourhoods Policy was adopted as policy and was then mandatory for all suburb and infill development (Department of Planning 2008). The Liveable Neighbourhoods Policy (LN) is based on the sustainability provisions of the American founded New Urbanist theories (refer to the discussion in Chapter 1) (Department of Planning 2008;

Australian Council for New Urbanism 2006; Falconer, Newman, and Giles-Corti 2010; Marshall 2010). In WA the LN Policy is a design code that is performance-based to specifically meet the mandates of the SSS, and has been designed to integrate sustainability into suburb and community development (Falconer, Newman, and Giles-Corti 2010; Department of Planning 2008).

In addition, the Local Government Act (1995) legislated the need for integrated sustainability principles and practices into everything local governments do. Whilst some local governments have implemented this requirement through their strategic planning process, there is little guidance from government as to the preferred process or the capacity within most local governments to understand the enormity of the task or the requirements.

2.19.3 Other State Government Initiatives

In May 2007 the State Government announced a range of energy efficiency measures, collectively named Five Star Plus, which will make houses more energy and water efficient. In addition to requiring a five-star energy rating for dwellings, these measures include solar or five-star gas hot water systems, water efficient showerheads, tap fittings in bathroom basins and vanities, efficient dual-flush toilets, and pool blankets for all new pools to reduce the rate of evaporation. The second stage of the Five Star Plus standards, which began in 2008, required owners of new houses to install plumbing to toilets to allow for alternative water supply and easy recycling of grey water at a later date and, where single dwellings are located on larger lots, an alternative water supply (such as rainwater tanks) for flushing toilets and for washing machines (<http://www.5starplus.wa.gov.au/>).

The Council of Australian Governments (COAG) announced on 30 April 2009, that it would request the Australian Building Codes Board (ABCB) to increase the energy efficiency provisions in the 2010 edition of the Building Code of Australia (BCA). However after consultation with the industry this was stalled until 2011 to allow for the impacts of the global economic downturn to settle. The changes will mean that the 2011 BCA will require: 'a 6 star energy rating, or equivalent, for new residential buildings; and a significant increase in the energy efficiency requirements for all new commercial buildings' (Australian Building Code Board 2010a, 2010b).

2.20 The Building Code in Australia

The BCA's unambiguous goal is to facilitate the attainment of nationally consistent, minimum compulsory standards of relevant, health, safety (including structural and fire safety), amenity and sustainability objectives efficiently. As such this goal is applied so that:

- There is a rigorously tested rationale for the regulation
- The regulation generates benefits to society greater than the costs (that is, net benefits)
- The competitive effects of the regulation have been considered and the regulation is no more restrictive than necessary in the public interest
- There is no regulatory or non-regulatory alternative that would generate higher net benefits (Australian Building Code Board 2007, 2010b, 2010a)

The BCA contains technical provisions for the design and construction of buildings and other structures, including: structure, fire resistance, access and egress, services and equipment, and energy efficiency as well as certain aspects of health and amenity. The performance-based BCA was seen to be advantageous and potentially allowing for cost-savings through:

- Permitting the use of alternative materials, forms of construction or designs to the prescriptive requirements
- The innovative use of materials, forms of construction or designs
- Permitting designs to be tailored to a particular building
- Giving clear information on what the BCA is trying to achieve
- Allowing the designer flexibility in the use of materials, forms of construction or design provided that the intent of the BCA is met (in other words, allow for flexibility provided the performance required by the BCA is met); while still allowing acceptable existing building practices through the deemed-to-satisfy provisions (Australian Building Code Board 2007, 2010b, 2010a)

Historically, as with many other sectors, Australia has had strongly individual and considerably different systems for the regulation of public safety, health and amenity in buildings in each of the six states and two territories. As the Constitution does not refer to matters regarding the safety, health and amenity of people in buildings, responsibility for them rests with the state and territory governments, which has led to eight separate Acts of Parliament, one for each of the states and territories (Australian Building Code Board 2007). This has created a range of

differences between the Building Acts leading to eight quite distinct building regulatory systems; furthermore some states delegated many of their building regulatory powers to their local governments, which developed their own building regulatory systems by way of council by-laws (Australian Building Code Board 2007).

Box 3: The History of the Building Code

History of the Building Code of Australia

After World War II several of the states started to establish more uniform technical building requirements, and those states which delegated their primary responsibilities to municipal councils started to reclaim control. The first national group to standardise the regulation of building requirements met in the early 1960's, and in 1965 they negotiated the establishment of the Interstate Standing Committee on Uniform Building Regulations (ISCUBR). ISCUBR was an agreement between the state administrations responsible for building regulatory matters to pool their resources for the benefit of all states, and its first work was to draft a model technical code for building regulatory purposes. This document was referred to as the "Australian Model Uniform Building Code" (AMUBC), and was made public in the early 1970's. The AMUBC contained proposals for both technical matters and some administrative matters which were based on the then Local Government Act of New South Wales, and the intention was that states could use the AMUBC as a model for their own building regulations. Not surprisingly, variation from the model was substantial and many states chose to pursue their own administrative necessities. Some states opted to leave the matter to their local councils, and changed the provisions in accordance with their perceptions of local needs.

Source: (Australian Building Code Board 2007, 2010b, 2010a).

The Building Regulatory Review Task Force established in 1989, by the Council of Australian Governments, which includes Australia's Prime Minister and the state Premiers and territory Chief Ministers examined the building regulatory system and

attempted to identify its weaknesses and costs and made a number of recommendations. The Task Force reported that problems with the regulatory systems were causing costs of between several hundred million and one billion dollars a year to industry, Government and the community and strongly recommended the formation of a well-funded body with a mission of achieving far-reaching national reform, including the conversion of the BCA into a more fully performance-based document (Australian Building Code Board 2007).

The expanded and strengthened organisation, with increased funding, and a governing Board, which included representatives of the signatory Governments, industry and the Local Government sector, was called the Australian Building Codes Board (ABCB). This new agreement set in place a co-operative arrangement between the Commonwealth, state and territory Governments, Local Government and the various elements of the building industry to achieve nationally consistent, performance-based building regulatory systems that aimed to be efficient, cost effective and met community, industry and national needs (Australian Building Code Board 2007).

At that time the advantages of a performance-based BCA were seen as allowing cost savings in building construction by allowing for:

- The use of alternative materials forms of construction or designs to the prescriptive requirements
- Innovative use of materials forms of construction or designs
- Designs to be tailored to a particular building
- Giving clear information on what the BCA was trying to achieve

- The designer flexibility in the use of materials, forms of construction or design provided that the intent of the BCA was met (in other words, allow for flexibility provided the performance required by the BCA was met) (Australian Building Code Board 2007)

Because responsibility for building regulatory matters lies with the states and territories, only they can give the BCA the force of law, and whilst this took several years to be established, all states and territories have included the BCA under their primary building regulatory legislation as the basis of their technical requirements for the construction of buildings (Australian Building Code Board 2007).

2.21 Summary of the key changes for post 2010/11

There have been a number of changes to the BCA for 2010/11, particularly for the energy efficiency criteria:

- Revised Objective, Functional Statements and some Performance Requirements to recognise that the goal is greenhouse gas emission reduction rather than energy efficiency alone and in doing so, give further credit for renewable energy sources
- Solution for a dwelling based on a house energy rating has been relocated to the Deemed-to-Satisfy Provisions
- A general increase in stringency across all aspects
- A restructuring of tables and clauses as needed for the increased stringency, including more detailed provisions in some cases
- In increasing roof insulation performance; recognition is given for light coloured roofs

- New provisions for artificial lighting within dwellings and associated Class 10a buildings with the allowance for the dwelling able to be increased if control systems are installed
- Other specific lighting provisions such as separate switching for high and low efficiency lamps
- Insulation on duct and pipe services must be to AS/NZS 4859.1 and, as a result of an industry submission, are now specified in terms of material R-Value (Australian Building Code Board 2010b)

Other changes are highlighted in Box 4.

Box 4: Changes for Volumes 1 & 2 of the BCA 2010

Volume One:

- A new Part has been added as a pathway to the Deemed-to-Satisfy options including a house energy rating scheme approach for apartments (Class 2 sole-occupancy units and Class 4 parts). There is no Deemed-to-Satisfy solution for Class 2 sole-occupancy units and Class 4 parts.
- Inclusion of a table for adjusting ceiling insulation if penetrations exceed 0.5%.
- Insulating performance of internal envelope walls and envelope floors now a function of climate zone, whether a floor has an in-slab conditioning system, suspended or on ground, enclosed or mechanically ventilated.
- Glazing method 1 in J2.3 has been removed because it was primarily for Class 2 sole occupancy units and Class 4 parts, which now must use house energy rating software Class 3, and 9c aged care buildings are to use the glazing method in J2.4.
- Glazing allowances in J2.4 are now base on three separate sets of indices, i.e. one set for Class 3 and Class 9c aged care buildings, another for display glazing in a shop or showroom and another for all other applications.
- The air-conditioning of a Class 3 sole-occupancy unit must cease if an external door to a balcony, patio or courtyard is left open.
- The over-supply permitted of outside air has been reduced from 150% to 120%.
- As well as the current provisions for heating a space using a water heating system, there are now requirements for a heating system other than water based one, e.g. electricity is not permitted and oil is limited to locations without reticulated gas.
- Fixed space heating appliances installed outdoors must have automatic controls.
- At the request of some industry stakeholders, the definitions of fan power and pump power have been revised.
- Some illumination power density allowances have been increased while others reduced.
- The adjustment formulae for the lighting of small rooms has been amended and relocated to directly under the illumination power density table.
- Large single function spaces such as auditorium and sports stadiums have been exempted from the switching area limit provisions.
- New provisions have been added for the heating and pumping plant of swimming pools and spa pools and also pool & spa covers in some circumstances.
- New provisions have been added for the metering of energy usage.
- Additional information has been added to the Guide to Volume One. Source: (Australian Building Code Board 2010b).

Volume Two:

- A new Performance Requirement and Deemed-to-Satisfy Provisions for supply water heaters favouring heaters using an energy source that is renewable or of low greenhouse gas intensity.
- New Part 3.12 as a pathway to the Deemed-to-Satisfy options.
- Recognition of the benefit of an outdoor living area in climate zones 1 & 2.
- A new requirement for at least half the required insulation to be laid on the ceiling.
- New explanatory information warning about the need to consider the weight of insulation on plasterboard, its fixings and framing members.
- Revision of the table for adjusting ceiling insulation if penetrations exceed 0.5% (now based on the R-Value required rather than the climate zone).
- Inclusion of “worst case” advisory information on roof lights performance, with and without a ceiling diffuser.
- Inclusion of a convection barrier in wall cavities.
- Revision of the tables for floor performance so that floors and enclosures are now considered as a system and includes different values for different constructions and ground-to-floor heights.
- The provision for an attached Class 10a building (garage) in climate zone 5 now has an option for reducing the glazing allowance of the Class 1 building.
- The glazing formulae and allowances have been modified to allow for the benefit of passive winter solar heating (this means an additional table for winter exposure factors).
- Habitable rooms in climate zone 5 are now to be sealed irrespective of whether the space is conditioned.
- Where an external door is to be sealed, a draft protection device is now required on the bottom of the door.
- Air movement opening sizes have been moderated because reduced glazing allowances may result in designers choosing smaller windows.
- There are new provisions for the energy source and the performance of supply water heaters including a new Performance Requirement, Verification Method and reference Standards.
- There are now limitations on the use of electric resistance space heating.
- There are new provisions for supply water heaters that specify the performance of the heaters and also severely limit the use of electric resistance heaters. Source: (Australian Building Code Board 2010b).

2.22 Conclusions

This chapter has explored the range of theoretical concepts and planning and governance frameworks underpinning the motivations, values and outcomes associated with urban planning in Australia, sustainability in a planning framework and the broader concepts inherent in a more full understanding of sustainability that represents the lens through which this research has been undertaken. Planning practice in Australia has been heavily influenced by the rationalist and positivist traditions that were reactions to the Enlightenment's focus on religious fervour, myth and the assumed inherent rights of the aristocracy (Simon 1964; Doney 1983; Habermas 1984; Faludi 1986; Sen 1995; Flyvbjerg 1998; Minogue 2001; Searle and Bunker 2010; MacCallum and Hopkins 2012). Rationalist theories brought a framework of scientific rigour to the planning and development of urban areas in cities, provided a sense of a benchmark for worthwhile outcomes, and a way of evaluating the potential benefits of one project against another (Simon 1964; Doney 1983; Habermas 1984; Faludi 1986; Sen 1995; Flyvbjerg 1998; Minogue 2001).

However from a planning perspective rationalist theories have been criticised for their inability to 'see' a broader vision of a community, how a space is used, the actual behaviour of its people, and also the inherent 'irrationality' of decision-making of all individuals and the implied imbalance of power within governance structures (Simon 1964; Sen 1995; Flyvbjerg 1998; Healey 2006; Allmendinger 2009). Hence the communication and deliberative developments in planning practice are an attempt to bring about a process of planning that is able to transcend the "problem of power, by creating planning processes grounded in principles of free speech and rational argument" (Richardson 2004, :344). However,

as Richardson (2004, :344) points out “these are normative approaches that cannot lead to universal solutions: that there is no escape from power, instead power must be embraced”.

The value and importance of nature, and human’s inherent place in it, has also been discussed at length in this chapter. The notion of human’s forgotten place in nature, at the heart of the current ‘unsustainability’, has given rise to a number of environmental, social and economic outcomes that we are only now beginning to appreciate (Bell and Morse 2005; Edwards 2005; Filho 2005; Ehrenfeld 2008; Anderson 2011). Sustainability, in a planning context captures the need for developing communities that enhance human lives and nature rather than deteriorate them; and the need to have a governance system that supports those goals. For this thesis it has been important to explore and understand the theoretical background to some of the key theoretical influences in the planning and development of ‘green’ marketed suburbs in Perth. The quite obvious influences of New Urbanism and Communicative/Collaborative Planning have emerged out of a very clear Rationalist Planning dogma that the discipline and practice of planning in Australia experienced since the late 20th Century. The Rationalist Planning ideology saw the Planner as the ‘expert’ and communities were implied to be uneducated in planning and therefore an unreliable source of advice or information; whereas the Communicative/Collaborative planning tradition sees the community as a far more reliable, albeit sometimes difficult to manage, source of valid information and advice about their communities (Healey et al. 1995; Healey 2002, 2006; Hillier and Healey 2010). The design tenets of New Urbanism have also emerged out of this rationalist planning ideology and can be seen to be a clear

reaction to it, by echoing the “Garden City” and “City Beautiful” movements of earlier in the century. New Urbanism seeks to recreate the inclusive communities that were seen to be such successes of Howard’s Garden Cities, and community participation in the design of their communities is an important principle of New Urbanism (Schuyler 1997; Australian Council for New Urbanism 2006; Falconer, Newman, and Giles-Corti 2010; Marshall 2010). The difficulty with different planning ideologies having influence on major policy decisions is always in how they are applied in practice, and what is the eventual outcome of that application, and does it still reflect the original theoretical ideology?

This Chapter has described the history and evolution of the current suite of legislative and regulatory frameworks that manage the development of the urban and built form nationally, and in WA. Given the many layers of government, this has created a planning and development context that is complicated and highly bureaucratised (Davison 1993; Forbes 1994; Troy 1995; Gleeson and Low 2000; Hamnett and Freestone 2000). The implementation for which, is predominantly left to local governments, through their capacity to sign off on building designs in accordance with the BCA and through local planning development codes to enact the higher order State Planning Legislation.

Like many urbanised cities in Australia and internationally, Perth in particular, has experienced urban expansion almost exclusively on the metropolitan fringe over the last 50 years (Western Australian Planning Commission 2003a; SGS Economics 2003; Western Australian Planning Commission 2003b). The vast majority of housing stock development in this period has been detached dwellings, which are increasing in

size on smaller and smaller blocks (SGS Economics 2003; Productivity Commission of Australia 2005; Australian Bureau of Statistics 2006, 2007). In the period up to 2001, 55% of detached dwellings were located on the urban fringe with those dwellings representing 40% of total dwelling stock in the metropolitan area (SGS Economics 2003; Australian Bureau of Statistics 2006, 2007).

As far as the development of 'green' marketed suburbs in Perth is concerned, this Chapter has identified that the overarching legislative and regulatory context is the implementation of the national BCA, its subsidiary energy efficiency requirements, and the WA Liveable Neighbourhoods Policy. These two government policies influence and drive the eventual development and design of houses and suburbs in WA. Chapter Three highlighted that there was some difficulty in defining what a sustainable suburb might be, although the literature was clear on what features made a suburb and a house sustainable. Some of this difficulty comes about because Australia currently lacks a mandatory benchmarked minimum standard for achieving sustainability in suburbs. Whilst EnviroDevelopment and Green Star communities go some way to establishing the criteria for a minimum standard, as they are voluntary developers need only certify those aspects of a new suburb development that meets the criteria of each program. Such certification does not guarantee that those suburbs are in any way sustainable, merely that they have gone some way to achieving that (Hahn 2008; Hendrickson 2010; Mapes and Wolch 2010). Moreover, without the support of the wider community and government, research has shown that the Department of Planning's LN Policy's ability to create sustainable urban form in practice is limited (Falconer, Newman, and Giles-Corti 2010).

CHAPTER 3 The History and Current State of the Planning and Development of New Suburbs

3.1 Introduction

To enable an understanding of the motivating forces behind the planning and development of 'green' marketed suburbs, this chapter reviews the literature currently available on the origins and early development of the modern residential expression of suburbs, the changes that have occurred within suburbs and what some of those drivers for change are. This chapter will examine the literature on sustainability in the urban context, the history of the planning of suburbs, especially as it relates to suburbs, and what makes a house sustainable and the technologies that are currently available.

It is crucial to understand both where suburbs have come from and what condition suburbs are in currently to be able to examine 'green' marketed suburbs in particular. In industrialised countries, suburbs are where 80% of people in cities live, yet debates about the future of cities tend to focus on the central and inner areas (Girardet 2000; Newton 2008; Falk 2009b). Falk (2009b) suggests that the last 50 years in Europe has seen a concentration of effort in the revitalisation of inner city industrial areas. Whilst this has to some extent stemmed the loss of valuable agricultural and conservation areas, it has however "largely ignored the cumulative impact of the sprawl of out of town retail, leisure and employment, and urban exodus or 'white flight' to new housing estates located away from the older cities" (Falk 2009a; 2009b, :228). In Australia 1.24 million people were added to the five

main capital cities between 1991 and 2001 (equating to 94% of the total population change), and although inner city suburbs in Australia experienced population loss until the 1990s they continue to grow at a much slower rate than the outer suburbs (Australian Bureau of Statistics 2006; Newton 2008; Australian Bureau of Statistics 2010a). So although now many cities are experiencing revivals in their inner city and inner urban areas, out in the suburbs and the fringe neighbourhoods the “journeys to work and shopping are overwhelmingly by car, leaving only dog walkers and joggers to use the pavements, and both choices and connectivity are surprisingly limited” (Falk 2009b, :252).

3.2 A History of Suburbs

The history of urbanisation and human endeavour can be traced back to our Neanderthal roots, in the Neolithic ‘revolution’ of transition from a predominantly hunter-gatherer society to one that is largely agricultural-urban in nature (Mumford 1961; Newman and Kenworthy 1999; Newman, Beatley, and Boyer 2009). This change from gathering food to growing and harvesting crops brought about significant changes in the way people lived and the cultures that developed as a result (Mumford 1961; Wiland, Bell, and D’Agnese 2006; Beard 2009). Settlements were ultimately focused around the capacity of the area to sustain agricultural development and protection through numbers (Mumford 1961). Cities evolved from their surrounding rural settlements; and had a close connection with the agricultural production systems in their local areas (Newman, Beatley, and Boyer 2009). Once they were able to settle in one place, storing surplus foods for trade and for winter, communities developed because ultimately individuals no longer

needed to hunt for food every day (Jacobs 1964, 1984; Newman, Beatley, and Boyer 2009).

This change eventually led to the modern form of urbanisation, and the way in which cities and their towns existed reflected that the “spatial concentration of communication, markets and physical infrastructure were required before capital accumulation could begin” (Allmendinger 2009, :88). Moreover we can see that “towns and cities are not simply a reflection of the dynamics of capitalism, they are also its pre-requisite” they also “provide an efficient and effective means of concentrating labour in one place ensuring its availability and maintaining its compliance with the system through civil controls such as the police and military” (Allmendinger 2009, :88). Friedman (2007) and Mumford (1961) trace the early development of neighbourhoods in Ancient Greece from as early as 7th Century B.C.; suggesting that the Greek ‘Milesian’ form of planning effectively divided cities into ‘neighbourhood units’ that were comparatively autonomous, with institutional buildings located in the centre of the city. However the Middle Ages are generally noted to be the time of the origins of the suburb, with Medieval urban forms creating communities inside walled fortresses and away from the outlying settlements and agricultural plots and small holdings (Mumford 1961; Friedman 2007; Bert 2009; Newman, Beatley, and Boyer 2009). The walled fortresses provided a natural segregation between towns folk and the communities outside the protection of the walls (Friedman 2007; Newman, Beatley, and Boyer 2009). Compared to how we experience urban life now medieval towns were, in some respects (as far as home/work/food connection), far more environmentally sustainable. With narrow, irregular streets that best accommodated pedestrian or

animal traffic, and which remained even after the advent of the car, the inner cities of many medieval towns were highly accessible and had greatly reduced ecological footprints (Newman, Beatley, and Boyer 2009). The other important factor in making such early examples of urban settlements sustainable was the dual role that most residential dwellings served: a place to live with one's family and a place to conduct business and provide a service to the community (Friedman 2007; Frey et al. 2009; Falk 2009b; Newman, Beatley, and Boyer 2009).

Friedman (2007) suggests that the level of urbanity changed significantly during the Renaissance period, with the advent of the 'Modern Era' that placed humans at the centre of importance and as the master of their own destiny. This relegated the natural world and the animal kingdom implicitly under the dominion of human kind (Friedman 2007; Suzuki, McConnell, and Mason 2007; Newman, Beatley, and Boyer 2009; Newman and Kenworthy 1999). The Renaissance reflection back to the Classical Greek and Roman forms created widespread and flamboyant urban designs including large blocks and wide streets, (Friedman 2007). During this period home and work were first separated; with a distinct movement away from a more organic urban development to one which was far more organised and formal, with a spatial separation of urban activities (Mumford 1961; Lynch 1981; Frey and Yaneske 2007; Friedman 2007; Falk 2009b, 2009a; Frey et al. 2009; Newman, Beatley, and Boyer 2009).

3.2.1 The Journey to 19th Century Urban Forms

While the European Renaissance period experienced great change in the way in which urban settlements were configured, Friedman (2007) cites the Industrial

Revolution (the period from mid 1700s to mid 1800s) as a 'turning point in human history' that influenced significant changes to the structure of neighbourhoods. The Industrial Revolution saw the rapid and unprecedented increase in the productivity of the agricultural and manufacturing sectors, ultimately through the replacement of manual labour by machinery (Mumford 1961; Friedman 2007). In Europe land that had been a part of the feudal land system, 'the commons', was divided and sold off; resulting in many cases a mass migration of peasant workers into the growing towns to find employment (Friedman 2007). The resultant overcrowding and disease in cities (caused by rapid growth without available amenities and sanitary conditions) became the seed for the development of suburban neighbourhoods that were seen by some to be a healthier lifestyle, allowing the more wealthy citizens to flee the typical city of the late 19th and early 20th Centuries (Burke 1975).

Mumford (1961) and Friedman (2007) refer to two movements in particular, as influential in the development of the 'suburban ideal' in the late 1800s, particularly in North America, Howard's Garden City Movement and the City Beautiful Movement. The 'place making' ethos (from Jane Jacob's early ideas about making places more liveable (Jacobs 1964)) that was at the centre of these movements proved seductive to the more affluent citizens who could move 'out to the suburbs' (Mumford 1961; Jacobs 1964). What started as seasonally used homes became permanent dwellings when the advent of passenger transit (trams and trains) and commuting became commonplace (Friedman 2007; Newman, Beatley, and Boyer 2009). By the early 20th Century the increasing affordability and prevalence of the

automobile allowed the 'growing middle class to follow its more affluent counterparts to the suburbs' (Friedman 2007, :38).

The beginnings of the trend for segregated land-use planning (or Euclidean zoning) was seen in the early Radburn, New Jersey development of the 1930s; a product of Clarence Stein and Henry Wright and heavily influenced by Howard's Garden Cities (Ausubel and Herman 1988; Jacobs 1992; Wiland, Bell, and D'Agnese 2006). Radburn fully accommodated the automobile and separated pedestrians from vehicles (using footpaths and overpasses), and produced the first housing arranged in large blocks with interior areas of green, using (what was then thought to be innovative) cul-de-sacs (Low et al. 2005; Friedman 2007). Friedman (2007) suggests that this change in planning towards segregated land uses came about as a result of a desire to simplify the planning process, but ultimately the outcome was a geographical segregation by income of residents, and further separation of work from home by longer distances and longer commutes. Unsustainable planning and living patterns have gradually taken hold through the separation of city and suburbs: work and home; single-use zoning; automobile dependency; the desire to live in low-density, single family homes; and the popular notion of the suburb as the best place to raise a family (Friedman 2007; Newman, Beatley, and Boyer 2009). Rethinking these planning and living patterns represents one of the greatest challenges for twenty-first-century sustainable community design (Friedman 2007).

3.2.2 Modern Suburban Development

The last 50 years has brought tremendous change in the way our cities have developed and evolved (Hudnut 2008; Frey et al. 2009). Hudnut (2008) traces some

of the forces that have changed the shape of metropolitan America, similar to those that have shaped and changed the Australian suburb – two World Wars, a baby boom, the birth of television, air conditioning, interstate highways and mass housing development and planned obsolescence in manufactured goods. America, like Australia, has had a much shorter urban settlement history than much of Europe and this has had a significant influence on the way in which the cities and metropolitan areas in these countries have evolved over time (Low et al. 2005; Hudnut 2008; Berry 2009; Bert 2009; Newman, Beatley, and Boyer 2009). “The suburbs lured millions of Americans into thinking they had found the new repository of American virtues. Half a century after Levittown, that dream is coming apart at the seams” (Hudnut 2008, :1). It was a phenomenon in America that was also reflected to some extent in the Australian experience of mass movements to the suburbs, away from farms and central city locations, spurred in part by interstate/intrastate highway development, faster cars and the introduction of mass produced houses (Newman and Kenworthy 1999; Low et al. 2005; Hudnut 2008; Newman, Beatley, and Boyer 2009).

3.3 Early Planning and Development History in Australia

Australia’s development into a highly urbanised colony of Great Britain was essentially created through the transportation of convicts and consequent colonisation of British citizens (Sandercock 1990; Hamnett and Freestone 2000). Sandercock (1990, :3) in particular suggests this beginning as a convict colony changed the initially similar trajectories of Australia and the U.S, and provides an important foundation for their ‘respective city planning histories’. For all intents and

purposes Australian cities were “peopled, financed, and equipped from Britain as Australia became an integral part of the British economic system” (State of the Environment Committee 2011). From as early as the mid 1800s Australia held an important place in the Empire’s economy as a source of trade in exports such as wool, gold and mineral mining (State of the Environment Committee 2011). However as Sandercock (1990) suggests, it wasn’t just capital and investment that was sourced from Britain, the political, cultural and social institutions of the Empire were transplanted with minimal change to Australia as well. Moreover the era of settlement (1800s) had a great influence, naturally, on the evolution of the development in Australia and other British colonies (State of the Environment Committee 2011; Hamnett and Freestone 2000). “The spatial expression of towns in the colonies was determined by a dynamic process which had more to do with contact with the parent metropolitan power than with a perception of the geographical nature of the country settled” (State of the Environment Committee 2011).

The English established colonies through a deliberate policy of urbanisation, starting with a definitive town centre that would be the centre for “trade and defence, and a civilising influence” and based on variations of a grid pattern (Hamnett and Freestone 2000, :12). The colonised cities might look different, and vary in placement of settlements, patterns of urbanisation and the like; but their similarities invariably included a distinct initial grid pattern to the town centre and were essentially formed from the Greco Roman tradition of ‘symmetry, proportion and regularity of the grid layout” (Sandercock 1990; Hamnett and Freestone 2000, :13).

The British Housing and Town Planning Acts of 1909 and 1919 established low density housing as the prevailing standard for planning, and acted subtly as a means of social segregation by pricing the housing at middle-class budgets while also being thought to assist building community and social integration that heavily influenced planning in Australia (Sandercock 1990). Sandercock (1990, :56) suggests that these concepts of community and social integration were seen as important to develop, and came about as a “reaction against the loss of the church’s concern for the whole spiritual life of man as a result of changes taking place in the 19th Century” and the moves away from a “feudal, land-based society to an industrial society”. While social integration was seen as a reaction to the “social and physical manifestations of inequalities in the distribution of capital” (Sandercock 1990, :56).

Australia’s constitution enshrined responsibility for planning and housing to the States and so the national government’s history of involvement in urban affairs was intermittent; and in some cases dependent on which party was in power and what other world events were occurring at the time (Sandercock 1990; Hamnett and Freestone 2000). According to Sandercock (1990, :6) from as early as 1913 the Australian Labour Party was calling for government intervention in providing ‘working-class housing’; but it was the Great Depression of 1930 that ultimately motivated a resurgence in federal governments providing funding for public housing for the poor. The election of a conservative national government in 1949 forwarded responsibility for cities and their urban areas to the states, while maintaining the previous Labour Government’s state housing program leaving the states to “cope as best they could with their urban problems through the fifties and sixties”

(Sandercock 1990, :9). This is still the case in most respects in the modern political arena of Australia.

3.4 The Australian Experience of Suburban Development

Unlike the European experience of early densely populated, walkable city residential locations; Australian urban development predominantly started from a low density, sparsely populated base in most new residential areas (exceptions to this would be parts of New York, Sydney and Melbourne because of the era in which these cities were initially developed) (Newman and Kenworthy 1999). In addition, while most new cities in Australia and America during the late 1800s and early 1900s had some form of public transit, whether trams, trolley cars or rail, these were soon replaced by roads for car and truck use (the exceptions being Melbourne and New York in particular) (Newman and Kenworthy 1999; Low et al. 2005; Speth 2008; Newman, Beatley, and Boyer 2009). The advent of affordable automobiles in the middle of the 20th century underpinned the demise of many public transit systems through under investment and poor planning, and has had an enormous influence on the way in which cities and their suburbs have been planned and envisioned since (Newman and Kenworthy 1999; Ambrose, Mead, and Miller 2006; Scheurer 2007; Farr 2008; Frey et al. 2009; Newman, Beatley, and Boyer 2009; Beard 2009; Berry 2009; Bert 2009).

For Australia in particular, a unique experience of settlement developed as a direct result of the way in which the nation as a whole was initially established. The planning system was largely influenced by three main factors: “by geography, as a relatively small population in a vast and largely inhospitable land; by history, where

separate states developed individual administrative structures under conditions of colonisation; and by resource endowment, which has led to dominance of the economy by rural and mineral exports in a largely unrefined state” (Australian Urban and Regional Development Review 1995, :13). The 1995 report on urban trends in Australia by the Australian Urban and Regional Development Review (1995) highlights that this particular style of settlement pattern emerged in each of the separate states, each with a capital city (some such as Perth, being very isolated), with population and economic activity dispersing as access and mobility improved.

3.5 Early Planning History in Western Australia

In Western Australia, Perth’s early town planning considerations began with William Bold, the first Town Clerk of Perth, who made the connection between land values and transport access and the importance of public ownership of land on the suburban fringe to better control future growth and expansion (Sandercock 1990). However Alexander and Grieve (2005) cite the influence of the early colonial administration in Perth, in spite of the strong town planning tradition, as the source of the “seeds of the city’s later sprawl” because there was a significant lack of urban infrastructure such as reticulated water and sewage and when it was provided it was based on a standard quarter acre block size. By 1830 the area that had been planned as Perth’s metropolitan area was already “alienated, subdivided, granted, sold, leased or otherwise held by the colonial administration” and the town planning efforts of the ensuing years were reactionary rather than progressive, reacting to problems rather than guiding future development in the direction the

government desired (Crabtree 2006; Sandercock 1990; Crabtree 2005). By 1954 although Perth was the smallest capital city in Australia with approximately 349,000 people, it had begun a spectacular period of growth (of people and development) fuelled by the post-war building boom and growing resources sector (Sandercock 1990).

Despite the planning traditions that were further emphasised by the Stephenson-Hepburn Metropolitan Plan and a 'reputation of a strong metropolitan planning system', Perth has expanded well past its original planned metropolitan boundaries taking up two and half times more land and sprawling across more than 100 kilometres with one and half million people (Crabtree 2005). Alexander and Grieve (2005) suggest that although 'speculative developers' are partially to blame in pushing housing development further and further out to the fringes of the metropolitan area, the State Government's Housing Commission has also had a significant influence on the growth of the metropolitan boundary. The focus of development to date has maintained the importance of the private car at the expense of pedestrian access and comfort with streets being "widened to accommodate the car, with parking bays, additional traffic lanes, right and left turning lanes to keep traffic moving. The design approach delivers high speed arterial roads at the perimeter of residential cells with internal neighbourhood centres designed for car-based travel" (Curtis 2006):262}.

3.6 Modern Suburban Development

From humanity's early beginnings in small organic villages to the mass planned communities where the majority of people in our cities now live, there has been a

gradual but significant move away from a form of settlement that was relatively sustainable (the need for travel outside of the town or city was limited, food, trade and culture were mostly available within the surrounding regions) (Girardet 2000; Friedman 2007; Speth 2008; Marsden 2008; Hudnut 2008; Farr 2008). Even though there are many examples, worldwide, of communities, governments and developers working together to create more sustainable and liveable urban settlements (see (Gause, Franko, and Urban Land Institute. 2007; Frey and Yaneske 2007; Friedman 2007; Farr 2008; Hopkins 2008; Hudnut 2008; Marsden 2008; Beatley and Newman 2009), the majority of urban dwellers are still experiencing settlements and houses that are less than sustainable (Falconer, Newman, and Giles-Corti 2010).

3.6.1 *The Residential Sector and Energy Efficiency*

While there has been considerable policy and regulative change to the government's approach to the need for greater sustainability in the residential sector, recent research suggests that the community has yet to gain significantly from these changes (Thomas 2010d, 2010b, 2010c; Williamson, Soebarto, and Radford 2010; Stevenson and Leaman 2010). The Productivity Commission of Australia's (PCA) 2005 report *The Private Cost Effectiveness of Improving Energy Efficiency* investigated the barriers and impediments to improving the net energy efficiency of housing in Australia (Productivity Commission of Australia 2005). The report highlights that previously in Australia energy was priced well under the true cost of its provision (and although prices have increased there is still a considerable gap) – in part due to the presence of natural monopoly influences in the transmission and distribution of energy; imperfect competition in the generation of

electricity in some jurisdictions, and environmental externalities that are not included in the price of energy (Productivity Commission of Australia 2005; Nelson 2007). This distortion in the price of energy effectively influences the energy efficiency measures taken up by households and manufactured by industry; so that less energy efficient products and services continue to be used and produced because they are artificially cheaper investments (buyers estimate the payback price, when comparing renewable energy sources to non-renewable ones, upon this artificially cheaper price for less efficient and non-renewable energy products and services and spend accordingly) (Productivity Commission of Australia 2005).

Suburbs have become the defining life experience for most people in Australia (Newman, Beatley, and Boyer 2009). Our cities and suburbs and how they have developed express our collective identity, and are the “summation and densest expressions of infrastructure, or more accurately a set of infrastructures, working sometimes in harmony, sometimes with frustrating discord, to provide us with shelter, contact, energy, water and means to meet other human needs” (Ausubel and Herman 1988, :1). Human creativity and intelligence have created cities with unprecedented opportunities in technology, trade and culture; and cities have become a key source of economic expansion and development (Mumford 1961; Jacobs 1964; Lynch 1981; Ausubel and Herman 1988; Newman, Beatley, and Boyer 2009). Unfortunately they have also had “the greatest destructive impact on nature of any human activity” (Register 2006, :1).

The type and form of residential development (urban design and the built environment) impacts on the state of the environment and is resulting in an

escalating level of residential energy use and carbon emissions per person in Australia and lifestyles that are far from sustainable (Australian Bureau of Statistics 2001, 2006, 2007, 2008e, 2010a). Decisions as to how we inhabit the planet and the places we call home have brought environmental, social and economic disruption to many parts of the world and sectors of society (World Commission on Environment and Development 1987; Ausubel and Herman 1988; Bell and Morse 2005; Stern 2007; Suzuki, McConnell, and Mason 2007; Garnaut 2008). Changes in population and average energy use are expected to continue to increase residential energy consumption in the future, and the Australian Bureau of Agricultural and Resource Economics (ABARE) has estimated that between 2003/04 and 2029/30, energy use per person in the residential sector is projected to increase by 1.7% a year (Australian Bureau of Agriculture and Resource Economics 2003). The environmental damage that the planet is experiencing, due in part to the unbalanced and excessive consumption of finite resources, emphasises the need for houses and residential developments that are in balance with nature (Low et al. 2005; Suzuki, McConnell, and Mason 2007; Garnaut 2008). There is considerable research on sustainability indicators in city and urban design (urban form), and on how to develop a better understanding of liveability, walkability and good urban design to encourage community development and sustainability outcomes as well as the importance of energy efficiency in building and suburb design (Gleeson and Low 2000; Hamnett and Freestone 2000; Scheurer 2000; Ambrose and Miller 2005; Green, Grimsley, and Stafford 2005; Low et al. 2005; Ambrose, Mead, and Miller 2006; Davison 2006; Crabtree and Hes 2009; Mapes and Wolch 2010; Marshall 2010). In contrast, while the literature on sustainability in the housing design (built

form) is extensive, it is generally focused on non-suburb, non-mainstream and more individual expressions of housing design or commercial building (see (Edwards 2001; Friedman 2007; Farr 2008; Moskow 2008; Yudelso 2008)) rather than the more mainstream suburban suburb product that has been a common expression of modern urban development in Australia (notable exceptions in Australia being Miller, Ambrose and Ball (2006; 2008) and Crabtree and Hes (2009)).

3.6.2 Housing Affordability and Sustainability

According to Randolph et al (2007) for housing to be truly sustainable it must also be affordable, and a house that is environmentally sound reduces the impact on the environment and household budgets in the long term. However Randolph et al (2007) question who ultimately benefits from these recent changes in the BCA and industry performance in relation to more sustainable housing, suggesting that the 'trickle down' effect to low income residents will be a much slower and less equitable process than other societal progressions such as public health improvements or telecommunications advancements.

Ultimately sustainable housing can be sold on the accrued financial and environmental benefits, which can be experienced almost as soon as the homeowners have moved in (Randolph, Kam, and Graham 2007). Such benefits include the direct costs savings from reduced energy, water and waste, and lower operating and maintenance costs in the life cycle of the house (Randolph, Kam, and Graham 2007). Of course new home owners can recover the initial additional costs when they come to sell, as research indicates that more environmentally sound housing can sell at a much higher rate than standard housing (Randolph, Kam, and

Graham 2007) (see (Reidy, Reardon, and Milne 2008) where the house energy rating system in Canberra was found to lead to higher sale prices for better rated houses). However, given the increasing cost of housing in general, and new housing most particularly, Randolph et al (2007) rightly question who benefits from sustainable housing?

3.6.3 Changes in Consumption, Behaviour and Expectations of Thermal Comfort

There are a number of reasons for the unprecedented increase in consumption of space, energy and water in the residential sector including: higher incomes, smaller families living in bigger houses with more household appliances and electronics, and more importantly for this thesis there has been a slow but significant change in the collective expectations of thermal comfort in the indoor environment over the last generation (Wackernagel and Rees 1996; Australian Bureau of Agriculture and Resource Economics 2003; Hamilton and Denniss 2005; Australian Bureau of Statistics 2006). The economic boom that Australia, and particularly Western Australia, experienced in the period up to 2009 saw a dramatic increase in average household and individual income and a significant change in consumer patterns and expectations of comfort (Australian Bureau of Statistics 2006). As a consequence according to the Australian Social Trends report (Australian Bureau of Statistics 2006), Australia's per capita consumption of space, energy and water is amongst the highest in the world and is continuing to increase.

Recent research explored by Guerra-Santin and Itard (2010) suggest that as the increasing energy efficiency of the built environment increases, the behaviour of the occupants influences changes in consumption. Indeed the actual amount of

energy consumed in a building is not only dependent on the efficiency of the building per se and the technologies within it, but also the consumption behaviour of the occupants (Gram-Hanssen 2010; Guerra-Santin and Itard 2010). Cole et.al (2008) suggests that there is a vast range of factors that affect and influence a person's interaction and experience of a building's (indoor) environmental conditions including: 'physiological, cultural, behavioural and contextual' and that these factors are fluid and dynamic between people and buildings. Although personal expectations of comfort are widely subjective, and dependant on the 'intersection of technical comfort provisions and the psychological and social realms of experience, movement (mobility) and interaction', physiological understandings of comfort are being used to determine conditioned indoor environments (Cole et al. 2008, :324). However the majority of research into understandings of comfort within buildings has been centred around the expectation of mechanised conditioning, rather than more passive techniques for regulating the indoor environment of a building (Cole et al. 2008).

3.6.4 Consumption Drivers

To be able to understand the consumption behaviour of residents of 'green' marketed suburbs, it is important to understand the drivers behind consumption more generally and specifically as it relates to 'green' products and services. Mont and Power (2010) maintain that the environmental consequences of imbalanced consumption patterns and levels are now becoming increasingly clear, and whilst the efficiency of production processes and products has been improving and are vital, over-consumption is a driving force for environmental damage. A finding that

is echoed in the research of Seyfang (2004), Dubuisson-Quellier (2010), Gibson et.al (2010) and Marchand et.al (2010).

Consumption patterns come about through a complex and dynamic mixing of a number of factors including: economic influences, marketing of products and technological innovations, regulations governing consumption, and what peers and the media are doing (Power and Mont 2010). Power and Mont (2010, :2574) suggest that 'consumer behaviour is commonly perceived to be driven by rational decision making based on individual preferences. In reality, the situation is far more complex, with social norms, cultural traditions, habits, and many other factors shaping our everyday consumption behaviour'. As Power and Mont (2010, :2575) suggest, it can be difficult to remove our behaviours from the particular context in which we find ourselves 'particularly with respect to the social norms around us and the infrastructure we live and work in'. Although our perceived needs appear to be the driver for our consumption they are in fact influenced by far more than that and 'the ways in which we choose to satisfy our needs and wants are influenced by cultural and institutional factors, and do not always contribute to our overall well-being' (Power and Mont 2010, :2576).

According to the Australian Conservation Foundation's (2007) research, the strongest predictor of higher carbon footprint and energy consumption is affluence, for householders and consumers in general. Whilst high earners are less likely to radically change their lifestyles through reduced consumption, affluent consumers however can also lead in the take up of new green innovations that are usually more expensive in their infancy, such as hybrid and electric cars, solar panels and

green energy (Bates and Kristofek 2008; Gibson et al. 2010; Mont and Power 2010; Power and Mont 2010). Although consumers and householders generally say they support energy efficiency efforts, and in some cases would be prepared to pay more for such, they consistently underestimate their actual household energy and water use which suggests that the level of real awareness of their own impacts is low (Crabtree and Hes 2009; Randolph and Troy 2008; Attari et al. 2010; Guerra-Santin and Itard 2010; Fielding et al. 2010). Attari et al's (2010, :4) research identified that participants in their study "exhibited relatively little knowledge regarding the comparative energy use and potential savings related to different behaviours...participants were overly focused on curtailment rather than efficiency, possibly because efficiency improvements almost always involve research, effort, and out-of-pocket costs".

3.7 Sustainability in Suburbs – Shades of Green

Recently there has been interest in developing appropriate benchmarks for quantifying the sustainability of housing and urban developments. The Queensland Office of the Urban Development Institute of Australia (UDIA QLD) has developed a measurement tool, EnviroDevelopment, for the ecological footprint of urban developments that seek 'sustainability' certification. This tool provides a scientifically based certification process for developers wishing to certify their particular 'green' development to a set standard or benchmark of sustainability (see www.envirodevelopment.com.au). Like the Green Building Council of Australia's Green Star program, EnviroDevelopment is a voluntary incentive focused certification process that allows designers to choose what criteria (water,

ecosystem, waste, energy, materials and community) their particular development is certifying (see <http://www.gbca.org.au/green-star/rating-tools/>). The actual practice of achieving such environmental outcomes however is not always easy and there is still limited evidence that achieving a certain star or certification rating actually achieves good environmental or sustainability outcomes in practice (Williamson, Soebarto, and Radford 2010).

In 2007 Bond University commenced a study commissioned by the Green Building Council of Australia, looking at the economic, environmental and social performance of about 40% of Australia's Green Certified buildings (which are predominantly commercial buildings) on an ongoing basis over a period of five to six years to assess their performance against expectations (Welsh 2008). In addition, the CSIRO, Queensland University of Technology, the Australian Building Code Board and the CRC for Construction Innovation have all been exploring the issues of measuring sustainability in residential dwellings and urban developments or suburbs (Ambrose and Miller 2005; Ambrose, Mead, and Miller 2006; Miller, Ambrose, and Ball 2006; Ambrose 2008). While much of their respective research is in its infancy, the overriding conclusion has been that energy and water efficiency, environmental conservation and social integration are becoming important factors in the way we build our communities. In 2010 the Australian Green Building Council of Australia launched another voluntary certification program but this time for communities, called Green Star Communities, which is currently in the development stage (see www.gbca.org.au/green-star/green-star-communities/rating-tool).

3.7.1 Defining Sustainable Urban Forms

The sustainable settlements literature (see (Girardet 2000; Gleeson and Low 2000; Scheurer 2000; Wheeler 2004; Girling and Kellett 2005; Gonzalez 2005; Green, Grimsley, and Stafford 2005; Low et al. 2005; Ambrose, Mead, and Miller 2006; Wiland, Bell, and D'Agnese 2006; Friedman 2007; Gause, Franko, and Urban Land Institute. 2007; Birch and Wachter 2008; Curtis 2008; Farr 2008; Hopkins 2008)) appears to be divided between describing purpose built and 'intentional' communities that are either called eco-villages or sustainable villages (or something similar), to the 'Transit Orientated Development'/New Urbanism model of urban development and the more recent sustainable cities or towns concept, with very little in between (although the most recent work of Ambrose (2008), Crabtree and Hes (2009) and Mapes and Wolch (2010) has begun to fill the gap). There is also a significant variation in the terminology, from eco-villages, to eco-neighbourhoods and eco-cities, sustainable suburbs and green neighbourhoods and more recently 'green' suburbs, transition towns or eco towns; and the meanings and implications of each are subtly different.

Early research by Barton (1998) developed a simple typology that differentiates and describes six types of 'eco-neighbourhoods', at the 'meso' level. The 'meso' level being what Barton (1998, :164) describes as the level between the 'macro' planning strategies and the 'micro' building designs and 'that recognise ecological imperatives and attempt to reinforce a sense of local community'. Type I is rural based eco-villages with an emphasis on farming and small-holdings and a focus on the permaculture ethos of Bill Mollinson (Ref); Type II are televillages which seek to

promote home or locally based teleworking over commuting; Type III are urban demonstration projects sometimes developed through competitions or for research purposes, generally promoted by governments and seen to be driven by technological innovation; Type IV are urban eco-communities that Barton (1998) suggests are inspired and driven by social and environmental ideals of conviviality and mutual support and to a lesser extent resource sharing. This type of eco-neighbourhood is also termed co-housing and has been prevalent in Denmark for many years; a more recent example would be Vauban in Germany (Scheurer 2008). Type V are 'new urbanism' developments such as transit orientated development (TODs) which seek to minimise car travel and focuses on providing 'compact pedestrian-scaled neighbourhoods focused on transit stations that provides a high level of local accessibility by foot and regional accessibility by public transport' (Barton 1998, :170). Type VI are ecological townships and are described as urban forms that are wholly focussed on sustainability as opposed to the other types that might deal with only a few aspects of the sustainability puzzle, such as Scheurer's (2008) car-free villages like Frieberg in Germany (Barton 1998). This thesis is predominantly interested in an updated version of Barton's (1998) Type VI settlements; thereby creating a new typology.

Type VII would be purpose built sustainable suburbs that are focused on creating sustainable communities that exist within the mainstream housing market, are created through supportive networks between local government, state governments and developers; actively support increased accessibility for all people, enabling good transport modal choice with a pedestrian focus, and mix of housing types and land uses.

3.7.2 Sustainable Settlements Nationally and Internationally

The original and earliest versions of intentional eco-villages are generally taken to be the Findhorn community in rural Scotland and 'The Farm' eco-village in Tennessee, USA (Hollick and Connelly 1998). These were purpose built communities centred around the common themes of social, economic and environmental sustainability (Barton 1998; Hollick and Connelly 1998; Keilar 2008). More recently there are many examples of purpose built communities along the 'eco-village' concept including: the Ithaca eco-village in upstate New York, the Eco-village Torri Superiore in Liguria Italy, the Aldinga Arts Eco-village on the Adelaide fringe; and the Eco-village at Currumbin in south-east Queensland (Keilar 2008).

Car-free housing is another approach to sustainable settlements which, is seeing a resurgence in interest by developers and buyers predominantly in Europe (Ornetzeder et al. 2008; Scheurer 2008). Car-free housing was historically the norm for all residential development before the era of mass motorisation in the early 1940s, and hence cannot strictly be called 'new'. The difference now is that while the early century examples of car-free housing did not obviously cater to any motor vehicle use, the 21st century example at the very least builds in the occasional or shared use of a car with parking on the outskirts of developments (Scheurer 2008). Scheurer (2008, :271) describes the purpose of car-free housing as being '...designed to roll back these disincentives to abstention from car ownership. This is done, on one hand, by ending the cross-subsidy enabling car owners to park their vehicles at little or no cost on valuable land'. Another study evaluated the sustainability outcomes of people living in a car-free housing settlement in Vienna,

in comparison to people living in comparable buildings elsewhere in Vienna; and found car-free settlements to offer the opportunity for significantly reduced ecological footprints by residents (Ornetzeder et al. 2008). The particular car-free housing settlement that the study researched shared many facilities including workshops, laundry room, activity rooms and playgrounds and generally displayed better infrastructure for more sustainable consumption than average housing settlements (Ornetzeder et al. 2008). Whilst the difference in praxis and context between the eco-village concept and the sustainable suburbs currently being marketed in Perth is significant, it is possible to see the similarities in the vision of creating more liveable spaces under the guise of sustainability (Newman, Beatley, and Boyer 2009; Keilar 2008).

3.7.3 Defining a Sustainable Suburb

In the built environment literature there is some difficulty in defining exactly what a 'green' or 'sustainable' house or suburb might look like in practice. This review of the literature will explore the contested meanings of 'sustainable', 'environmental', 'green' and 'eco' and the range of definitions in more detail. Friedman (2007, :12) describes a sustainable community or development as one in which there is a clear integration of people, land and buildings; an incorporation of different people from differing cultures, living comfortably with the natural features of the land in buildings that harmonise with existing older structures and the environment they dwell in. By contrast, Ambrose, Mead and Miller (2006) describe sustainable communities or, in particular suburb developments, as those that take into consideration the overall impact on the environment and its inhabitants by

considering environmental degradation, waste and pollutants, construction methods and materials, developer and consumer energy consumption and water use.

Wiland, Bell and D'Agnese (2006) describe six tools as a measure of a suburb's sustainability. They include the provision of:

- Open space and public parks
- Urban forestry or bushland
- Watershed management
- Environmentally conscious waste disposal and recycling
- Energy efficient buildings
- Mass transit/transport management
- Promoting accessibility instead of mobility

Using such, an integrated response means that new suburbs can emulate the natural processes that occur in ecosystems such as:

- Minimising waste
- Reducing latent heat
- Capturing and retaining water
- Reducing pollution
- Reusing and recycling everything possible (Wiland, Bell, and D'Agnese 2006)

A sustainable suburb has been described as one in which the houses exhibit the qualities described above, where there is a mix of activities and house types and where services, employment and recreation are within walking distance (Green, Grimsley, and Stafford 2005; Langdon 2005; Low et al. 2005; Girling and Kellett 2005; Zetter and Watson 2006; Mander, Brebbia, and Tiezzi 2006; Frey and Yaneske 2007; Friedman 2007; Gause, Franko, and Urban Land Institute. 2007; Crabtree and Hes 2009).

3.7.4 Defining an Environmentally Sustainable House

It is commonly accepted in the literature that ecologically or environmentally sustainable development (ESD) principles in housing design, building components and urban planning and development are vital mechanisms for long term sustainability (Edwards 2001; Low et al. 2005; Horne 2006). Within the literature, a number of criteria for what could be called a sustainable house have been identified, in particular Low et al. (2005), and Friedman (2007) and Karol (2007) have used a range of criteria that constitute a house that is sensitive to its environment including:

- Designed for the local climate and prevailing breezes
- Orientated so that main windows face north (south in the northern hemisphere)
- Makes good use of thermal mass; provides high insulation
- Designed for good ventilation but minimising leakage of air or heat
- Manages water wisely

- Limited or no need for extra heating and cooling
- Use of heat absorbing building materials internally to stabilise indoor temperature
- Landscaping to create appropriate micro-climate

Additionally, Horne (2006) and Friedman (2007) suggest that a sustainable house, developed along ESD principles, will function well in conserving water and energy and utilise low-impact materials compared to the typical four-bedroom, two-bathroom suburban house that is currently the mainstream housing option. Yet, much of the knowledge and technology requisite for sustainable building design is already available, however the implementation of these principles and practices by developers, designers, builders and consumers is yet to happen on a widespread scale (Ambrose and Miller 2005).

Some of the technologies that are readily available include:

3.7.4.1 Solar Orientation

Solar orientation is the practice of orientating a house so that it faces north/south to capture winter and summer light or heat and prevailing breezes in summer for cooling. In summer North and Westerly shading is required to prevent the entry of heat into the house, whilst in winter the heat and light is allowed entry in the house through reduced shading (Low et al. 2005; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, Mosher, and Clarke 2008).

3.7.4.2 Passive Solar

Passive solar design in Australian housing enables a house to be thermally comfortable throughout the year with minimal or no additional artificial heating or

cooling (Low et al. 2005; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, Mosher, and Clarke 2008). A passive solar house incorporates solar orientation for winter/summer sun orientation, as well as:

- Efficient breezeways around and through the house to aid in cooling the house down
- Wide eaves surrounding the house to shade walls and windows in summer without blocking winter sun
- High value insulation in walls and roofs to better regulate indoor thermal comfort
- Extra summer shading via shade sails or deciduous trees on the North and West sides of the house to prevent heat warming the walls and windows
- Fans in bedrooms and living areas to help airflow
- Louvers or cantilevered windows to aid airflow and living areas located in the northern part of the house with bedrooms in the cooler southern area of the house (Low et al. 2005; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, Mosher, and Clarke 2008; Peterkin 2009; Williamson, Soebarto, and Radford 2010)

3.7.4.3 Thermal Mass of Building Materials

Thermal mass describes a measure of the 'heat storage capacity' of a particular material, and is a function of the material density and a specific level of heat (Stevenson and Leaman 2010; Gregory et al. N.D; Sugo, Page, and Moghtaderi 2004;

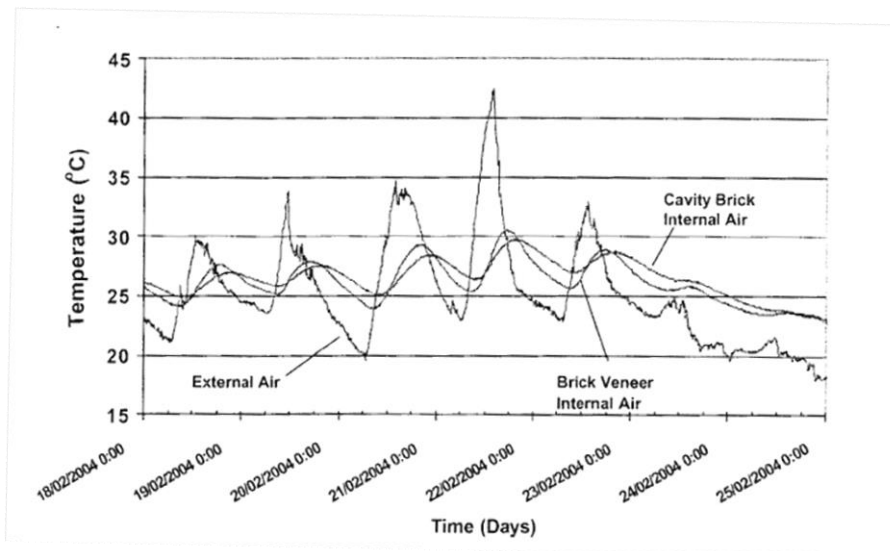
Williamson, Soebarto, and Radford 2010; Isaacs et al. 2010). Building materials with a higher thermal mass can capture or store more heat than materials with a lower thermal mass, in other words materials with greater density and weight can trap heat more efficiently (and for longer periods) than lighter, less dense materials (Gregory et al. N.D; Sugo, Page, and Moghtaderi 2004; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008). The reason thermal mass is so important in the built form is because it can assist in maintaining a more even temperature for longer during the diurnal fluctuations in temperature that are especially prevalent in Australian climate zones (Gregory et al. N.D; Sugo, Page, and Moghtaderi 2004; Ambrose 2008). Passive solar design is premised on the utilisation of the properties of thermal mass to regulate the internal temperature environment of a building coupled with the active participation of the inhabitants (Low et al. 2005; Miller, Ambrose, and Ball 2006; Australian Building Code Board 2007; Department of Housing and Works 2007; Ambrose 2008).

3.7.4.4 Brick Veneer vs. Double Brick Cavity

The majority of houses in Perth continue to be built using double brick cavity construction. This trend has been in existence since the mid 1900s and is still prevalent today, and is unique to the Perth metropolitan area (Peterkin 2009). The brick industry in Perth has developed a very strong advertising campaign to highlight the claimed energy efficiency benefits in particular, of double brick construction over brick veneer, reverse brick veneer or other light weight building materials (see www.thinkbrick.com.au). However research that the brick industry uses to prove that double brick cavity is more energy efficient than any other

building material, in fact shows that brick veneer and double brick cavity modules respond very similarly to diurnal temperature fluctuations albeit with a response lag; and that double brick cavity constructions while allowing heat in at a slower rate, takes longer than brick veneer to cool down once the outdoor temperature exceeds 30° Celsius on consecutive days (as can be seen in Figure 1) (Sugo, Page, and Moghtaderi 2004; Gregory et al. N.D). With a lack of wall insulation, cross ventilation and sufficient eave shading in the hotter months a double brick house will tend to retain heat due to the greater thermal mass of this building material and the inability of the heat to escape (ACT Govt. N.D; Sustainable Energy Authority Vict. 2002; Sugo, Page, and Moghtaderi 2004; Gregory et al. N.D; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008).

Figure 5: External and Internal Air Temperatures for the Cavity Brick and Brick Veneer Modules, February 2004.



Source: (Sugo, Page, and Moghtaderi 2004)

As such 50% of heat loss and gain can be through the walls, and insulating brick veneer and double brick cavity reduces heat transfer through the wall by 85% and

63% respectively (ACT Govt. N.D). Without insulation the R-value of double brick is no better than weatherboard construction, as can be seen in Figure 6 where even with insulation double brick cavity walls have a lower R-value than insulated brick veneer or weatherboard construction (the higher the R-value the better the insulation) (ACT Govt. N.D).

Figure 6: R-Values for Building Types

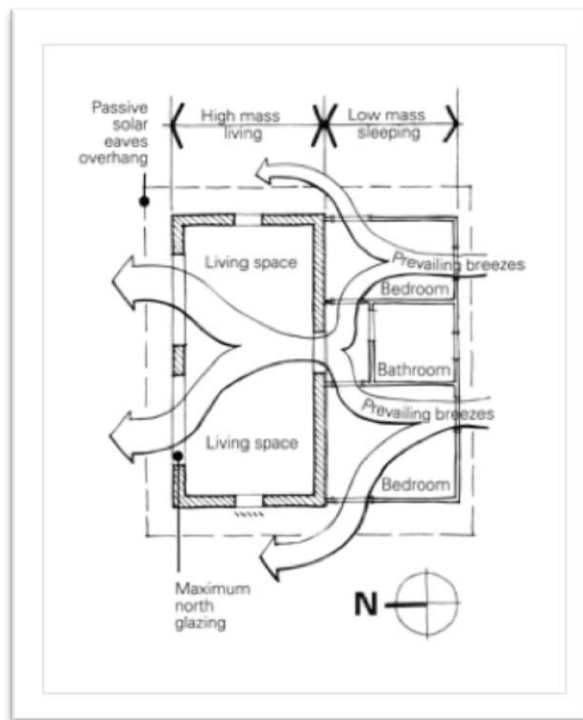
House Type	No insulation	After insulation
Double brick:	R 0.5	R 1.5
Brick veneer:	R 0.4	R 3.4
Weatherboard	R 0.5	R2.5

Source: (ACT Govt. N.D).

3.7.4.5 Ventilation

Cross ventilation is a vital component of any passive solar design, because it relies on the passive movement of air through a house using the principles of convection to pull hot air out of a house when it's hot and into a house when it's cold (Reardon and Clarke 2008; Reardon and Downton 2008). If the house has been designed in such a way that the prevailing breezes can enter and exit the house freely, the house will be able to expel the heat relatively quickly.

Figure 7: Cross Ventilation

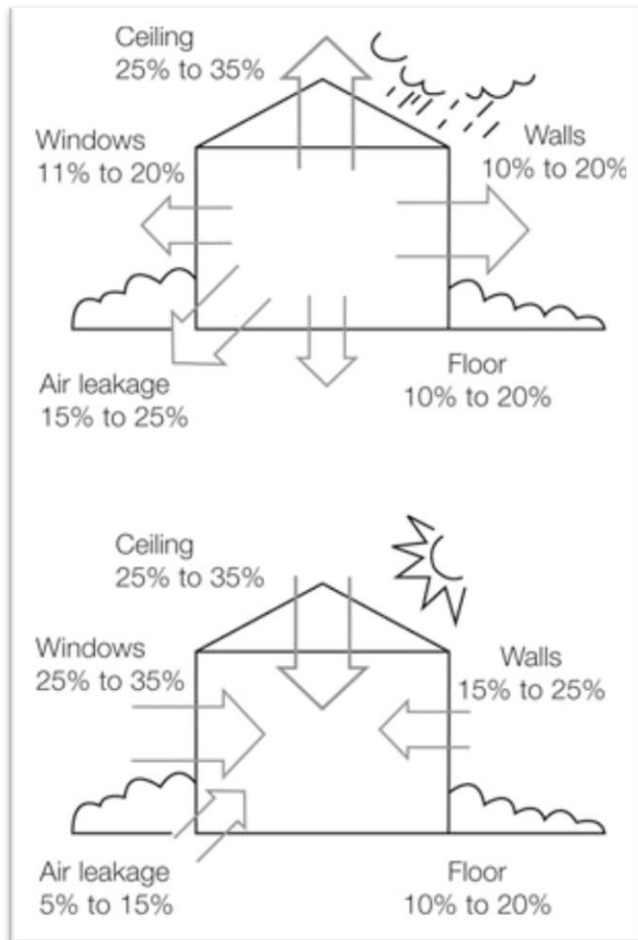


Source: (Reardon and Clarke 2008)

3.7.4.6 *Insulation*

Insulation keeps the heat in a building when the weather is cold outside, and keeps the heat out of a building out when the weather is hot outside. It acts as a barrier to the flow of heat between building materials, and is essential for keeping the temperature of the house more stable during the fluctuations in temperature (McGee, Mosher, and Clarke 2010). It is important to use passive design techniques with high insulation levels because if a house is not shaded properly an 'oven' effect will be created where the heat is stuck inside the house, especially if there is limited cross-ventilation (McGee, Mosher, and Clarke 2010). Such is the case with uninsulated double brick cavity houses, with limited or no eaves/shading, black roofs and limited cross-ventilation.

Figure 8: Heat and Cold Transfer



Source: (McGee, Mosher, and Clarke 2010).

3.7.4.7 *Water Wise*

The term water wise is now being used in the common vernacular to denote any gardening or building appliance that uses less water than the traditional appliance or use would have. The Australian Water Efficiency Labelling and Standards (WELS) scheme now rates showerheads, taps, toilets and water using appliances such as washing machines for water efficiency (Department of Climate Change and Energy Efficiency 2008).

3.7.4.8 Recycled Building Materials

Recycled building materials are those products and materials that have been used before in another building and is still in a condition to be able to used again, using recycled building materials is important because it lowers the embodied energy of the construction of a house (Milne and Reardon 2008). Embodied energy is the energy that is consumed during the process of producing all the materials used in the construction of a building, including the processing of the natural resources, the manufacturing, transport and delivery of the product (Milne and Reardon 2008).

3.7.4.9 Water Management

In suburb design, in the more innovative examples, excellent water sensitive urban design (WSUD) is becoming a common design feature (Department of Climate Change and Energy Efficiency 2008). WSUD involves the innovative management and reuse of storm water, runoff from gardens and community parks (Department of Climate Change and Energy Efficiency 2008). It involves maintaining the original topography of the land so that the existing drainage pattern is maintained, and retaining as much of the original vegetation as possible, particularly the deep rooted trees that act to keep the water table low, the soil bound and filters the nutrients (Department of Climate Change and Energy Efficiency 2008).

3.7.4.10 Grey Water Recycling

Grey water is the term used to describe the wastewater from non-toilet sources such as showers, basins and taps inside the home, and generally, grey-water reuse is for use outside the home for irrigation, and in some cases after being appropriately treated the grey water can be reused in the toilet or washing machine (Fane and Reardon 2008). The common reason for wanting to reuse grey water is to

reduce the use of potable water on the garden, and where potable water use isn't a necessity, such as in the washing machine or for irrigation. In fact reusing grey water can reduce the use of potable water for a household by nearly 50% (Department of Climate Change and Energy Efficiency 2008).

Figure 9: Grey Water Reuse

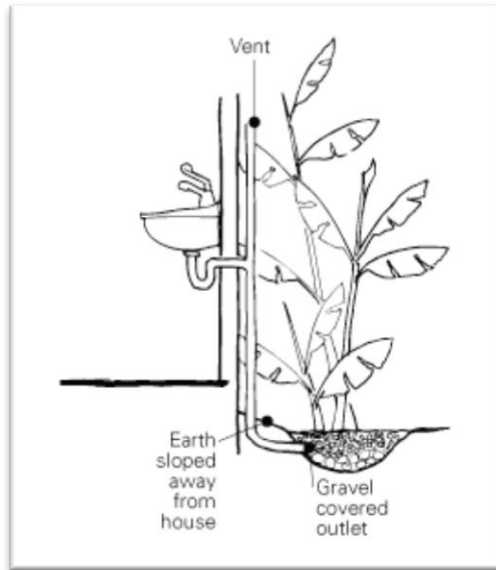
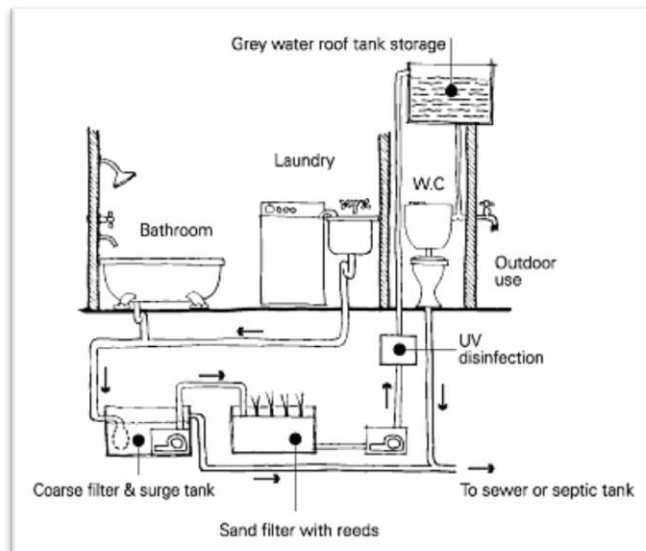


Figure 10: Grey Water Reuse In-house



Source: (Fane and Reardon 2008).

3.7.4.11 Eco-Waste Disposal

In Australia, nearly 40% of the waste that is generated is classified as building waste – waste that is accumulated through the construction of buildings (Reardon, Fewster, and Harkness 2008; Milne and Reardon 2008). Disposing of building waste usually involves either reusing it somewhere else or recycling it so it can be made into something else, but ideally the consumption of any material needs to be assessed first and reduced where possible (Fane and Reardon 2008).

3.7.4.12 Solar Panels

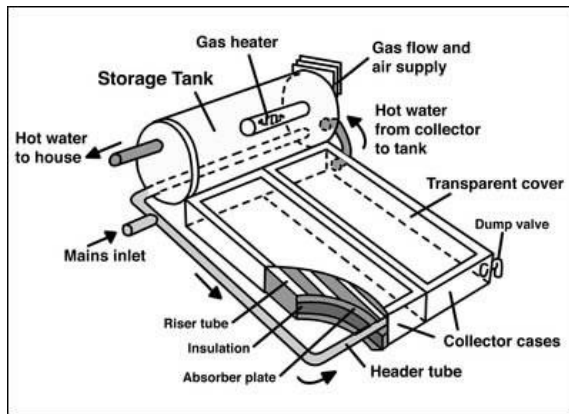
Photovoltaic systems capture the sun's energy where it is transformed into electricity. Currently there exists two types of solar modules – crystalline silicon or amorphous silicon photovoltaic cells (Stapleton et al. 2008). Australia has sufficient sun to power the nation's total electricity needs, and photovoltaics (PV) are getting much cheaper for the average consumer to buy. Siting and orientation is critical for getting the highest level of energy generation, with PV cells requiring a north facing position with minimal shading and an operating angle of approximately 22 degrees (Stapleton et al. 2008).

3.7.4.13 Solar Hot Water

Solar hot water heaters have been in use in Australia for many decades, however they have gained in popularity more recently as the BCA now requires an energy efficient module to heat water for indoor use (Riedy, Milne, and Reardon 2010). Solar hot water heaters can significantly reduce the household electricity bills, and although the up-front cost is greater they last much longer than conventional water heaters and provide an environmentally sound option for heating water. The two types of solar hot water heaters currently available are the more common flat-plate

solar collectors and the more recent evacuated tube solar collectors (Riedy, Milne, and Reardon 2010).

Figure 11: Solar Hot Water Systems



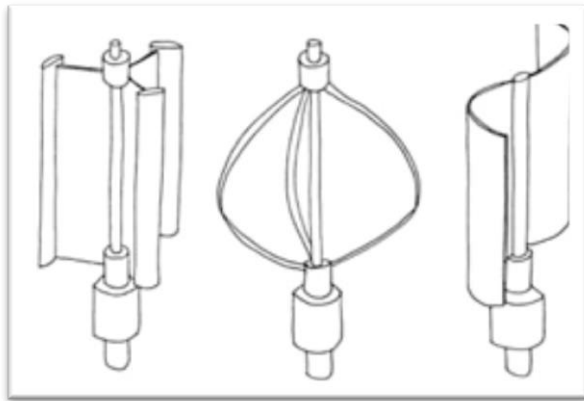
Source: (Riedy, Milne, and Reardon 2010).

Like solar panels orientation and lack of shading can all make a system perform significantly better, north orientation as much as possible and at an angle to catch enough sun the whole year around is necessary (Riedy, Milne, and Reardon 2010).

3.7.4.14 Wind Power

Domestic sources of wind power are beginning to gain in popularity, especially since the development of small, roof mounted noiseless vertical axis turbines (Stapleton, Milne, and Riedy 2008). More conventional large wind generators have horizontal axis turbines and considerably larger and can be very noisy in high wind environments. The smaller, more aerodynamic wind generators are quieter for built up environments and are more able to maintain a consistent output in turbulent wind conditions (Stapleton, Milne, and Riedy 2008).

Figure 12: Small Scale Wind Turbines



Source: (Stapleton, Milne, and Riedy 2008).

3.8 Energy Efficiency Rating Tools

The BCA has a number of energy rating tools that are used to measure the energy efficiency performance of a building design and allocate a star rating according to the achieved energy efficiency of the building (Australian Building Code Board 2007). One of these tools is AccuRate, which has been developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Commonwealth Scientific and Industrial Research Organisation 2004). AccuRate gives an indication of the heat needed to be added or removed to keep the **conditioned** floor area of the building comfortable and then assigns a corresponding star rating (Gregory et al. N.D; Commonwealth Scientific and Industrial Research Organisation 2004). The other energy efficiency rating tools (BERS & NatHERS) use a similar model of operation (Williamson, Soebarto, and Radford 2010).

As the research of Williamson, Soebarto, and Radford (2010) has recently highlighted there are two major flaws with the baseline assumptions of the NatHERS energy rating tool in particular, that have a significant effect on its efficacy in relation to reducing the energy load from the built environment in Australia.

Firstly it assumes, as a starting point, that home owners will be supplementing the heating and cooling of their home with mechanical air-conditioning, and secondly it uses 'comfort level' assumptions based on what Williamson, Soebarto, and Radford (2010, :513) describe as 'arbitrary bureaucratic based limits set by the various jurisdictions with the objective of ensuring what they take to be a minimum level of thermal performance for the building envelope' rather than being based on settings that are evidence based or based on international standards of thermal comfort (such as those of the American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE)). Nor does it consider personal choice in relation to comfort; thermal comfort is a subjective preference that isn't a fixed value for all time and space (Williamson, Soebarto, and Radford 2010; Stevenson and Leaman 2010; Isaacs et al. 2010).

Williamson, Soebarto, and Radford (2010) are particularly critical of this aspect of the NatHERS tool as the temperature control settings can not be modified, and means that houses that are designed not to need air-conditioning, in other words passive designed houses, will receive a lower star rating than a house that is artificially air-conditioned. NatHERS makes no assumptions for the actual 'lived' experience of the inhabitants of a passive design house, that requires it's owners to actively control the temperature and thermal comfort (Williamson, Soebarto, and Radford 2010; Stevenson and Leaman 2010). Williamson, Soebarto, and Radford's (2010) research assessed five passive designed houses, all winners of environmental design awards, across a range of Australian climate zones from Adelaide to Queensland and the Northern Territory. Table 1 highlights the difference in both the

energy used and the typical star rating that would have been given to each house design (the houses were built before the star rating was introduced).

Figure 13: Comparison of actual annual energy use and annual energy use of average houses in the same region

House	Annual total energy use ^a	Annual energy use in average houses in the region with the same number of occupancy and fuel used (GJ) ^b	NatHERS predicted total heating and cooling energy load ^c	NatHERS Star Rating achieved (out of zero to 10 Stars); 5 Stars is the minimum Building Code of Australia (BCA) requirement
1	23.9 GJ (194 MJ/m ²)	36.5	49.8 GJ (404.8 MJ/m ²)	4.6
2	14.7 GJ (84 MJ/m ²)	33.4	39.1 GJ (322.6 MJ/m ²)	2.4
3	23.3 GJ (141 MJ/m ²)	30.8	8.3 GJ (71.4 MJ/m ²)	4.5
4	4.4 GJ (27.2 MJ/m ²)	26.6	26.2 GJ (186.1 MJ/m ²)	4.3
5	6.0 GJ (65.2 MJ/m ²)	28.3	n.a.	Zero

Notes: ^aIncludes energy use for cooking, water heating, lighting and appliances minus electricity generated by photovoltaic panels, if applicable.
^bBased on Australian Greenhouse Office (AGO) (1999), and Oliphant (2003).
^cLoad per sq.m. based on conditioned floor area.
n.a., Not available; NatHERS, Nationwide House Energy Rating Scheme.

Source: (Williamson, Soebarto, and Radford 2010).

Williamson, Soebarto, and Radford's (2010) research shows very clearly the difference in the lived experience of energy use of people in these five passive solar houses and the energy use of typical houses located in the same region. The energy use expectations of the NatHERS energy rating tool is high even just for the annual energy use in average houses in the region, which is a figure that includes all other energy uses in addition to heating and cooling. Clearly, this difference also highlights the difference in energy use between what is at best a forecast of how a building design will perform, as opposed to the actual performance of that building once it has been constructed and its inhabitants are living in it. The five houses tested in Williamson, Soebarto and Radford's (2010) research were all passive solar designed houses, which by implication require the inhabitants to be active by way of opening and closing curtains and windows to maintain the indoor thermal comfort rather than turning on an air conditioner or heater. The tool also makes no

allowance for the type of window covering used in the house, and to be fair even if the window treatments have good thermal properties to prevent the egress or entry of heat and cold, if they're not used properly they contribute very little to the energy efficiency of the house.

Such an energy load just for heating and cooling seems at odds with the obvious intentions of the BCA energy efficiency regulations. The BCA makes it very clear in the initial introduction that the intention of the energy efficiency requirements that were introduced in 2006 was to increase energy efficiency in the residential sector and built environment. In fact, the new changes for 2010 to the energy efficiency requirements, state that the 'revised objective, functional statements and some performance requirements to recognise that the **goal is greenhouse gas emission reduction rather than energy efficiency alone** (sic) and in doing so, give further credit for renewable energy sources' (Australian Building Code Board 2010b). What the research of Williamson, Soebarto, and Radford (2010, :526) has emphasised is that 'the implied intentions of the energy efficiency regulations of the BCA is to ensure that the process of occupying the building does not entail the excessive use of energy and/ or CO2 emissions (thus, both an individual and a community benefit) and at the same time ensure that the building is comfortable for its occupants (thus an individual benefit)'.

Yet because the energy rating tools assume that the occupant will always want to, and presumably need to, supplement the indoor thermal conditions of the house with mechanical air-conditioning such houses cannot be more energy efficient than a truly passive solar house. Incongruously within the parameters of the NatHERS

energy rating tool, the occupants are taken to always act to maintain the thermal comfort of their home by turning on some form of mechanical heating or cooling device, and the level of that thermal comfort is taken to be a constant 'universally accepted necessary condition for dwelling, and that everyone will act to achieve that condition' (Williamson, Soebarto, and Radford 2010, :526).

One of the ways that developers and governments in Australia are testing the capacity of the residential market to accept sustainability is through the development and support of 'green' marketed suburbs. In 2008 the Federal Government in collaboration with the Council of Australian Governments (COAG), 'agreed to develop a National Strategy on Energy Efficiency (the Strategy) to accelerate energy efficiency efforts, streamline roles and responsibilities across levels of governments, and help households and businesses prepare for the introduction of the Carbon Pollution Reduction Scheme (the Scheme)' (Council of Australian Governments 2009, :4). A decade previously the WA Government had introduced a trial New Urbanist-influenced design code for suburbs called 'Liveable Neighbourhoods' (Department of Planning 2008). In particular, Liveable Neighbourhoods sought to integrate sustainability into suburb design in suburbs via a 'New Urbanist' lens, throughout WA (Department of Planning 2008; Beatley and Newman 2009; Falconer, Newman, and Giles-Corti 2010). Internationally New Urbanism and Smart Growth have been influential in changing the way developers and planners frame 'community', ostensibly moving away from creating places that focus on the movement of vehicles to ones that provide for the easy movement of pedestrians (although there has been considerable debate about the efficacy of New Urbanism more recently) (Falconer, Newman, and Giles-Corti 2010; Mapes and

Wolch 2010; Marshall 2010). Meanwhile developers continue to seek market niches to differentiate their product from their competitors. 'Green' marketed suburbs have developed out of these two complementary motivations. Unfortunately regulations for benchmarking such innovations have not kept pace with the developments to date (although that is changing).

3.9 Conclusions

This review of the literature has established that there are considerable technologies and techniques available to create more sustainable houses and suburbs, and that they are readily available now (Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, Mosher, and Clarke 2008). However, Crabtree and Hes (2009) and Nielsen et.al (2009) report that there remains a lag between the development of sustainable building technologies and their uptake by builders and consumers. Nielsen et.al (2009, :54) suggest that the implementation of 'sustainable design solutions' is a form of risk taking and requires a certain amount of courage to lead in the uptake of such new technologies irrespective of the potential economic benefits (cost savings in the long term). However while sustainability initiatives in the building sector remain more as ad hoc add-ons after the fact, instead of being integrated into the design of buildings and the development process up front, short term economic pressures will be uppermost in priority for the majority of consumers (Nielsen et al. 2009).

One of the major problems that Nielsen et al. (2009) report in their research is the deadlock in driving sustainable building technology uptake that is created between building companies and consumers who wait for the other to take the lead.

Fortunately governments can play an integral part in motivating change and taking on some of the initial 'risk' of being a leader in new technology uptake (Nielsen et al. 2009; Crabtree and Hes 2009). Indeed in the development and promotion of more sustainable design solutions governments "can play a crucial role as translators between existing and new networks, due to their role and influence on the early phase of building projects" (Nielsen et al. 2009, :60). Crabtree and Hes's (2009) research particularly highlights that the range of barriers to developing more sustainable housing opportunities include: social, economic and political shortcomings rather than technological or practical knowledge deficiencies and that the consumer can play an important motivating role. In particular, Crabtree and Hes (2009) cited research that suggests that such barriers also include the difficulty of gaining widespread adoption of innovation in the housing industry because of its inherent fragmentation and conservative nature.

Moreover the surveys that represented part of Crabtree and Hes's (2009) research indicates that there is a significant gap between potential consumers of sustainable houses and products saying they would pay more for such, to them actually making the purchase. There was apparently "minimal impact of environmental awareness on purchasing intentions, which may suggest that ecologically conscious consumer behaviour is highly sensitive to perceived cost premiums and trade-offs" (Crabtree and Hes 2009, :221). Interestingly the research also highlighted the 'cross-antagonism' between the building and development sectors as to their perceived level of impediment to more sustainable building technologies and opportunities being implemented where "key barriers perceived by the various players in the housing sector (developers, builders and homeowners) seem to be each other"

(Crabtree and Hes 2009, :222). There were a number of criteria that Crabtree and Hes's (2009) research has highlighted as vital for the uptake of sustainability in the building sector and they included:

- Consistency in legislation
- Clarity and consistency in costing information
- Mechanisms for funding
- Incentives to encourage sustainable use post-occupancy (especially for rental properties).

Crabtree and Hes's (2009, :223) research clearly highlights that the "barriers to the integration of sustainability into the housing markets are mainly institutional ones rather than technological ones" and the "sustainable housing technologies are being successfully developed, but their rolling out is being stymied by issues of awareness and communication". Randolph and Troy (2008) came to a similar conclusion in their research into the attitudes of householders to water consumption and conservation, where most were unaware of their actual usage because of the lack of real-time information about usage from suppliers.

CHAPTER 4 Methodology and Research Design

4.1 Introduction

Chapters 1 - 4 have established that globally, nationally and locally there are more than enough reasons to create suburbs and cities that people thrive in rather than just survive in. The environmental and social imperatives to do so are clear and abundant as was highlighted throughout the earlier chapters. This thesis seeks to explore and understand what the current status of suburb planning and development is, how sustainability is integrated and implemented into their planning and development and each sector 'player' or agent behaves within that. This chapter outlines the methods, methodologies, research design and techniques used to collect data for this thesis research, which examines the indicators of sustainability from 'green' marketed housing suburbs. The research undertakes an examination of what makes a suburb, and by implication, the houses in the suburb 'green', 'eco' or 'sustainable', as it is marketed in each case study suburb. The research involved investigating the presence of sustainability features that developers had advertised and the in the houses from four case study suburbs in the Perth area that are currently being marketed as 'green', 'eco' or 'sustainable'; using qualitative data collection.

Research methods have experienced a number of changes over the last almost 40 years, moving from a period where social and behavioural research was led by the more positivist-quantitative world view to one where the researcher is not necessarily neutral or objective and the subject is not always easy to measure (Tashakkori and Teddlie 2003). During this time qualitative research methodologies

emerged to embrace a more constructivist and socially and culturally more sensitive way of collecting data and information about the world (Tashakkori and Teddlie 2003).

A number of methods of collecting and analysing the data were chosen in this research, both as a reflection of the multi-disciplinary nature of the topic, which made the use of qualitative research techniques a logical choice, and as a way of triangulating the data from many different sources to enhance efficacy. Designers from a range of building companies were approached to do an online survey to gain a perspective from the building industry, and after no responses were received, a major building company in Perth (where a contact was already known) was contacted and a small focus group and email interviews were conducted.

4.2 Methodological Background

The researcher in the gathering of information about activities, actions, opinions, interactions and issues of the research focus, builds a framework for the research question; then reflects on the implications and meanings and eventually comes to a form of conclusion and interpretation of what has been observed (Marshall and Rossman 1995). "Research is a process of trying to gain a better understanding of the complexities of human interactions" (Marshall and Rossman 1995, :15). Denzin and Lincoln (2005, :3) define the practice of qualitative research as a "situated activity that locates the observer in the world" and that "consists of a set of interpretative, material practices that make the world visible"; and further that quantitative research, in contrast to qualitative research asks "how social

experience is created and given meaning”, emphasises the “measurement and analysis of causal relationships between variables, not processes”.

Primarily this research will utilise case study methodology through document and policy analysis, multi-criteria analysis observation of the features of each estate and house, semi-structured interviews and surveys of developers and online surveys of residents of each case study estate, analysis of the technical features of the estates and buildings as compared to commonly agreed sustainability features to examine their planning, development, energy, transport and water use data, and marketing and habitation information to determine:

How and how well are sustainability principles being integrated into ‘green’ marketed suburbs, and how do they relate to sustainability principles and practices found in the literature, and what do developers of ‘green’ marketed housing suburbs mean by ‘green’ (or other terms such as ‘eco’ or ‘sustainable’) when labelling such suburbs, and to what extent is this achieved?

4.2.1 Case Study Research

The case study is an important methodology for exploring particular ‘cases’ or phenomena, and primarily useful when asking ‘how’ or ‘why’ questions or the research involves real life situations such as the ‘lived’ experiences of residents in ‘green’ marketed suburbs (Yin 2003, :1). This methodology has enabled the examination of each case study’s planning, development, energy, transport and water use data analysis, and the analyses of the marketing and habitation data results to determine actual environmental outcomes. The case study methodology

was chosen because the 'case' is a "...spatially delimited phenomenon (a unit) observed at a single point in time or over some period of time. It comprises the type of phenomenon that an inference attempts to explain"; the case study is seen to be an intrinsic part of the whole, that provides the basis to the research and analysis of the phenomenon of how developers are measuring the 'green-ness' of their 'green' or 'sustainable' marketed suburbs and whether they are performing as they are marketed (Gerring 2007, :36). The case study method was chosen as the best way to examine a range of sites, that have been identified in the real estate market as purpose built sustainable or green estates; so that their sustainability performance could be measured.

While a case study may investigate a single case to illuminate a larger population, case study research is usually taken to mean the intensive study of a number of cases (Gerring 2007). Yin (1984, :14) defines the case study as "an investigation of a contemporary social phenomenon within its real life context, using multiple data sources", a theme that Anfara and Mertz (2006) share and is pertinent to the research in this thesis. In addition, the case studies will enable an evaluation of how such 'green' marketed developments compare according to existing indicators of sustainability, such as the minimum standards of the Building Code of Australia and the policy directions of the Western Australian State Government's Liveable Neighbourhoods Strategy.

4.2.2 Interview Methodology

Qualitative interviews have been widely used in the social sciences as a way of gaining knowledge and data and is an important research technique for collecting

knowledge of the social world; particularly as a listening approach that seeks thoroughly tested knowledge; it is a structured and purposeful conversation and a research technique that is ideally suited to knowledge that requires unearthing in the context of this research (Kvale 2007). Interviews of developers of 'green' marketed suburbs (from the four case study suburbs) were conducted to explore what the industry believes to be criteria that entail a 'green or sustainable' estate, and determine the industry views on perceived or actual barriers to more environmentally sensitive or sustainable housing developments being created. Kvale's (2007, :21) 'miners' (or a more post-modernist) approach is used in this research; one that sees "interviews as a site of data collection separated from the later data analysis, where knowledge is seen to be already there waiting to be 'found'...". The interview technique was used to enable the personal perceptions, opinions and impressions of housing development industry members to be explored; and was most pertinent to this research because the various participants' 'lived' experience within their specific sector is necessary knowledge in building up the story of 'green' marketed housing suburbs in Perth. Research interviewing as a specific technique is a more recent development, and qualitative interviews have been widely used in the social sciences as a way of gaining knowledge and data for a long time (Kvale 2007).

This research mixed the techniques of interviews and questionnaires as a way of obtaining different answers to similar research questions (Kvale 2007). Although the use of mixed methodologies has attracted some controversy in research circles, for this research it is used as an important technique for getting a range of data, both qualitative and quantitative, by asking similar questions through different

techniques (Tashakkori and Teddlie 2003; Morse 2003; Maxcy 2003). Psychological research has used mixed methods for gaining research data for a long time, with both types of data having equal and important relevance (Kvale 2007).

4.2.2.1 Interview Theme Analysis

Interviews were conducted with Project Managers of each developer of the case study suburbs, and the respective local government Development Control Units for each case study. Common and general themes were highlighted in each relevant chapter as a way of providing context for particular issues and a framework for discussion.

4.2.3 Survey Methodology

Through the use of the online survey tool website an online survey was developed to enable residents of the case study estates to be surveyed, to enable members of the Urban Developers Institute of Australia (UDIA) WA Environment Committee and Sustainability Committee to be surveyed for their views on the development of more sustainable suburbs and to allow the surveying of anybody who had built a house in the last five years in Australia. This research used online surveys as a cost and time effective method of gaining an understanding of residents' reasons for buying into an estate, to understand their lived experience of living in a 'green' marketed suburbs, and to be able to collect more quantitative data about their lifestyle as it relates to their housing choices without having to go to the expense and time of physically surveying them or posting hard copy surveys.

4.2.4 Focus Group Methodology

Robinson (1999, :905) suggests that a focus group is best defined as an “in-depth, open-ended group discussion of 1-2 hours duration that explores a specific set of issues on a predefined and limited topic”. Typically the focus group consists of between 5-8 participants with the researcher convening the group and facilitating the flow of question and discussion (Robinson 1999). It is understood that the focus group methodology has a number of purposes including:

- “Basic research, to contribute to fundamental theory and knowledge
- Applied research, to determine program effectiveness
- Summative research to determine program effectiveness
- Formative evaluation, for program improvement
- Action research, for problem solving” (Robinson 1999, :905).

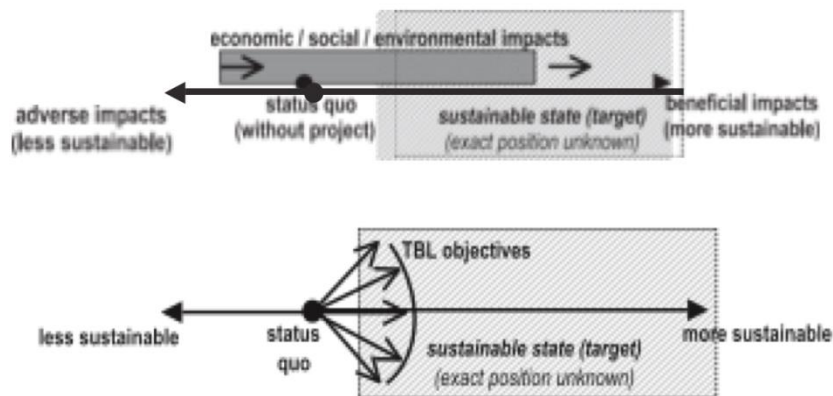
In particular focus group methodology consists of an interviewing technique, although it is not a discussion as such, nor a problem solving session or a decision making group, it is foremost an interview (Robinson 1999). The participants of the focus group are typically a ‘homogenous group of people who are asked to reflect on a series of questions posed by the interviewer’, and while the group is asked the questions together there is no expectation of coming to a group consensus (Robinson 1999, :905). The methodology of focus groups has come out of the market research tradition as a tool to gain an understanding of consumer sentiment because “consumer decisions are made in a social context and often as a result of discussions with others” (Robinson 1999, :905).

The use of focus groups for this research was imperative as it allowed for a much thorough discussion of the issues highlighted in the questions that could not be gained by a survey alone, which were a reflection of the research questions within this thesis.

4.2.5 Sustainability Assessment Methodology

Objective led assessment using a simplified multivariate analysis has been used to examine each case study suburb from the perspective of the urban and built form. Sustainability assessment is a new field of research, coming out of the environmental impact assessment (EIA) and strategic environmental assessment (SEA) field (Pope, Annandale, and Morrison-Saunders 2004; Bond, Morrison-Saunders, and Pope 2012). However as Pope et al (2004) suggest, such integrated assessment processes don't necessarily create a sustainable practice outcome. Emerging from the research and applications of environmental impact assessment (EIA) and the more current strategic environmental assessment (SEA) (see Figure 13) sustainability assessment theory has become a way off assessing activities and actions across the three spheres of sustainability more readily (Pope, Annandale, and Morrison-Saunders 2004). For Pope et al. (2004, :602) the triple bottom line (TBL) (social, economic, environment) model of sustainability assessment has sought to ensure that all impacts that may occur within a development or project has no 'unacceptably negative' impacts generally, or in other words "meaning that the guiding acceptability criterion for a proposal is that it does not lead to a less sustainable outcome".

Figure 14: EIA-driven/Objectives-led integrated assessment approach to sustainability assessment (minimise adverse impacts)



Source: (Pope, Annandale, and Morrison-Saunders 2004).

The question of how to assess the sustainability of an act, incident or plan has caught the focus of research and governmental attention world-wide since the requirements of doing so have become more obvious (Ravetz 1999). What characterises sustainability assessment is the ‘multiple reinforcing gains from decision-making’, that replicate the ‘complexity of the socio-ecological systems that define the context for the assessment’; and must be ‘considered in the context of the long term time horizons’ (Pope, Annandale, and Morrison-Saunders 2004; Gibson 2006; Morrison-Saunders and Pope 2012, :55). In contrast to traditional EIA assessment, sustainability assessment pursues a consideration of the long term benefits to future stakeholders, instead of ‘favouring current generations or short-term benefits at the expense of future stakeholders’ (Morrison-Saunders and Pope 2012). Importantly, Morrison-Saunders and Pope (2012, :55) also recommend that a final facet of sustainability assessment is an ‘explicit examination of trade-offs both during the (internal) development of the proposal and at the (external) approval

decision point'. Ravetz (1999, :33) believes that because the implicit theme of sustainability is inherently 'multidisciplinary and multisectoral' effectual appraisals should also therefore be holistic and based on an *integrated assessment* (IA) approach. Equally, Pope et al. (2004) maintain that an important aspect of sustainability assessment is to guarantee that any assessment focus on the three pillars of sustainability equally, and to ensure that any assessment is integrated across these three pillars equally.

4.2.5.1 *Choosing Sustainability Criteria*

In this instance, the choice of sustainability criteria is important and has two 'overarching approaches', one a bottom-up style approach and the other a more top-down one (Pope, Annandale, and Morrison-Saunders 2004, :609). The first assumes that in generating criteria that simultaneously achieve a 'series of environmental, social and economic goals or objectives' the presence or capacity for sustainability is implied; and the second, a top-down approach, 'begins with the concept of sustainability as a state to which society aspires, and then moves on to define this state in terms of sustainability criteria' (Pope, Annandale, and Morrison-Saunders 2004, :609). Gibson (2001) and Pope et al. (2004, :610) consider that the separation of the three pillars, meant to convey the concept of sustainability, can mean that they become competing interests instead of highlighting the "linkages and interdependencies between them making the task of integration extremely difficult and promoting trade-offs, often at the expense of the environment". In addition, the TBL model is considered by Pope et al. (2004, :610) to be a particularly 'reductionist approach to sustainability', and further, is in danger of "dividing the holistic concept of sustainability into three pillars as a starting point invariably runs

the risk of the sum of the parts being less than the whole". Hence this research has been influenced by Pope et al.'s (2004) 'top-down approach' to the assessment of sustainability in 'green' marketed suburbs and the houses built in them, where the understanding and aspiration of sustainability has been explored and discussed at length in Chapters 1, 2 and 3; and then the chosen sustainability criteria that have been used in the sustainability indicator tool, have been taken from what has been defined in the literature as that which embody sustainability in suburbs and housing.

4.2.5.2 Sustainability Indicator Tool

A specific field data 'sustainability indicator tool' was developed as part of this thesis research, using objective led assessment utilising a simplified multivariate analysis as a way of assessing the basic indicators of sustainability and energy efficiency from houses built in each suburb and the design of the suburb, with a concentration on what could be reasonably observed from the street, given the constraints of actually entering and assessing individual houses. The indicators used in the context of this research are not to be confused with Bell and Morse's (1999) Sustainability Indicators (SI). The case study sustainability indicator matrix tested a random selection of houses for a range of energy efficiency criteria that were found to be consistently agreed upon in the literature and was discussed in depth in Chapter Three. In addition each suburb was analysed for its performance against a set of criteria that were also widely agreed upon in the literature and discussed at length in Chapter Three. The indicators of sustainability that were identified in the research were also used to examine the integration of sustainability into the display homes in each suburb, the results of which are discussed in Chapter Five and Six.

Three out of the four case study suburbs had display homes that highlighted the style and type of houses available by some of the builders. In the absence of information directly from builders, these were taken to be examples of houses that complied with the building guidelines in each suburb, given that they were built and ready for eventual habitation. Each suburb, and a random selection of houses, was assessed for the presence of indicators of sustainability as found in the literature review, and an explanation provided where necessary.

4.3 Research Design

In line with Yin's (2003, :20) suggestion that research design is "a logical plan for getting from here to there", this section describes the design of the research conducted for this thesis research. Case study methodology was important in establishing the information and detail for each suburb in sufficient detail to be able to be useful for analysis against the research questions.

4.3.1 Choice of Cases

There were a comparatively large number of potential cases that could have been chosen to be a case studies for this research including:

- Ellenbrook - adjacent to the Swan Valley North East of Perth
- Evermore Heights – within the Settlers Hill suburb development of Baldivis, South of Perth
- Alkoomi – a far northern beaches suburb
- Brighton – a northern beaches suburb

- Newhaven – in Piara Waters in Forrestdale in the new mid Eastern suburbs
- Harvest Lakes – in Atwell, adjacent to the Southern Train Line in Cockburn
- Rivergums – in Baldivis, south of Perth
- Harrisdale – eastern foothills of the Darling Scarp
- Seville Grove – a new planned estate in Armadale

The four case study suburbs were chosen (See Table 1) as those that had fulfilled all four of the selection criteria of:

- Having received some form of Environmental or Sustainability award
- The marketing of the suburb had a distinct ‘eco’ or ‘sustainability’ flavour
- Having ‘green’ covenants or building guidelines
- Providing some type of ‘green’ incentive or offer for matching the building guidelines

Newhaven was the only suburb that didn’t have specific covenants but had chosen to influence house buyers through education and awareness, and it was chosen despite this for its strong ‘eco’ marketing in particular. Originally Ellenbrook had been chosen as one of the earlier examples of a ‘green’ marketed housing suburb, however in the interim period of the initial data collection the marketing of Ellenbrook had moved significantly away from advertising its ‘eco’ credentials and so it was dropped as a potential case study.

Table 1: Case Study Selection Matrix

Suburb:	Enviro Awards	'Green' Marketing	'Green' Covenants	'Green' Incentives
Newhaven	UDIA Enviro 07/08/09 HIA Green Smart	'A Sustainable Community'	*Sustainable design features encouraged	Encourages sustainable design through education and awareness
Harvest Lakes	UDIA Enviro & HIA Green Smart 04/05	'Change your world'. WA's first GreenSmart Village.	*Tuscan style/no eaves theme banned	Waterwise garden incentives
Rivergums	UDIA Enviro & HIA Green Smart	"Back to Nature"	*No black roofs and must have eaves	Waterwise garden incentives
Evermore Heights	UDIA Enviro 09 & HIA Green Smart	"Live for Today and Tomorrow".	*Minimum eaves and no black roofs	1kw PV unit; 3000ltr rainwater tank plumbed to the toilet and cold water laundry; third-pipe reticulation of groundwater to all domestic gardens; front and rear Waterwise landscaping; Telstra Smart Community package.

4.4 Data Collection

Surveys are a valuable way of collecting information to describe, compare, explain and discern individual and group knowledge, opinions and preferences on a particular issue or range of issues (Denzin and Lincoln 2000). Additionally surveys can be a valuable method of collecting data from a large group of people, to be able to make inferences about the population or compare different populations (Denzin and Lincoln 2000). In accordance with the requirements of the Curtin University Human Research Ethics Committee protocol, respondents remained anonymous at all times, and where possible identifying names were hidden to protect

business/commercial information. All data has been stored on a secure server, with the researcher being the only person with access, and will be stored for a period of seven years. The survey and interviews questions can all be found in Appendices A, B, C.

4.4.1 Survey, focus group and interview techniques

This cohort study used a number of different techniques to collect data. Initially open-ended questions in an interview were used to gain an understanding of the perceptions and impressions of the developers in the four case study housing suburbs and the relevant local government representatives, regarding the use of 'green/eco/sustainable' features in their housing developments. In addition an online survey was used to draw out the perceptions and intentions of the members of the Western Australia Urban Development Institute of Australia (UDIA WA branch) (the cohort) regarding their use of 'green/eco/sustainable' features in their housing developments.

To collect data from residents in the case study suburbs, an online survey was developed using the online survey tool 'Survey Monkey' (www.surveymonkey.com) and a copy of the questions are at Appendix A. For the two types of surveys the units of analysis are slightly different. For the interview survey the units of analysis are the employees responsible for the 'green/eco/sustainable' features or aspects within each case study housing development namely Harvest Lakes, Rivergums, Newhaven and Evermore Heights. For the email survey the units of analysis are the individual experience of members of the UDIA WA in relation to their experience of implementing sustainability into their development projects. A focus group among a

group of residents of one of the case studies was also undertaken, and they were asked similar questions to that of the online survey. The group consisted of 8 friends and neighbours who all lived within the case study suburb, and owned their own house; with one member of the group living in an adjacent suburb to provide a potential contrast to the rest of the group. The group gathered at one of the participant's house and the session last for a couple of hours.

Initially it was difficult to get any response from the building sector about participating in this research, the Housing Institute of Australia (WA) were approached and they declined being involved or their members being contacted; and further emails and phone calls to the range of building companies involved in the four case studies also declined being involved. Through the assistance of a contact from a major Perth-based building company with a parent company with multiple interests in the building and construction sector, designers and planners were approached and consented to be involved in this research. A focus group and an email interview were conducted. The research of Crabtree and Hes (2009, :205) experienced similar constraints when trying to survey the building sector in Victoria and New South Wales, and suggested that this was due to builders being 'doers not talkers' and not disposed to write or fill out paper work. Hence, the surveys and research undertaken by Crabtree and Hes (2009) and Mapes and Wolch (2010) will be important to this thesis, and will be discussed in Chapter 6.

4.4.2 Survey Design

The online survey was constructed using the web based tool 'Survey Monkey', using questions related to the lived experience of residents living in 'green' marketed

housing developments, and the experience of members of the development industry to the design, development, production and marketing of 'green' marketed housing suburbs in Perth. An experienced project manager in a high-end building company, and a person who had just built their own house piloted the survey. Some questions were adapted as a result of the feedback during the pilot, to increase the clarity and continuity.

4.5 Conclusions

Whilst this thesis is not particularly focused on establishing a new methodology, or testing a unique methodological stance, it is furthering and consolidating the aims and techniques of qualitative research. Case study and interview research has allowed this research to collect a range of qualitative data from a variety of sources, which has in some way alleviated the problem of not being able to get a large enough sample from any one source. The focus of the different methodologies in this research has been on collecting data from as many different sources within the wider industry, using a range of techniques to build up validity. With the aim of determining the differences in outcomes between the various 'players' in the industry, as well as seeking to highlight the gaps and barriers that currently exist to more sustainable suburbs being developed routinely.

CHAPTER 5 The Case Study Suburbs

5.1 Introduction to the 'Green' Case Study Suburbs

This Chapter explores the case studies that have been chosen for this research, the building, planning and development sector and the building stock available in the case study suburbs, particularly as it relates to the implementation of the Building Code of Australia (BCA) and compliance with the building guidelines of each suburb. Chapter Two highlighted the policy and regulatory framework that guides the development of suburbs and regulates the housing sector. In this chapter and Chapter 6 the planning and development sector was explored, the case study suburbs are discussed in greater detail and the results from the sustainability indicator tools, interviews and survey are presented and discussed. This chapter and Chapter Six establish that whilst the developers of the case study suburbs have been able to integrate certain aspects of what the literature suggested made a community sustainable, the houses that were built in the suburbs generally did not adopt similar sustainability features. This Chapter and Chapter Six will explore why this was the case (through the results from the sustainability indicator tool used to assess display homes and interviews with the building sector); while also providing an understanding of how the building sector works; what may be the barriers to more sustainable housing being developed; and the wider government policy issues that may either influence or inhibit more sustainable houses being built. This Chapter provides the necessary background to answering the research questions for this thesis, it will also predominantly address the thesis hypothesis that within Perth's housing industry, there are significant barriers to the mainstream

development of sustainable settlements; in particular sustainable housing and this will be tested throughout the research.

5.1.1 Changing the Way We Plan and Develop Suburbs

New urbanist design theories have heavily influenced the development of suburbs in Perth since the early 2000s, through the finalisation of the Department of Planning's Liveable Neighbourhoods Policy (Department of Planning 2008). New urbanist ideals have brought a 'neo-traditionalism' essence to the designs of new green-field suburbs, which echo seemingly 'old town' ideals of manipulating land use planning to achieve increased social capital and 'close-knit communities' (Fainstein 2000; Marshall 2010). Perth's Liveable Neighbourhoods influenced suburbs exhibit good community spaces, walkable roads that are linked to parks and services, grid patterned roads that encourage legibility and access for pedestrians and a focus away from encouraging big box shopping centres (large sprawling shopping malls surrounded by parking) towards 'village' street shops (Fainstein 2000; Falconer, Newman, and Giles-Corti 2010; Major Cities Unit 2010; Marshall 2010). However such design theories are still heavily embedded within the governance framework that has supported rationality and the concepts of capitalism, in Australia (Fainstein 2000; Allmendinger 2009). While more recent developments in the evolution of planning theories have become more concerned with cooperation and public participation, such as participatory and deliberative planning, the structures and assumptions of the superiority of rationality remain such that Flyvbjerg's (1998) suggestion that "power determines what counts as

knowledge, what kind of interpretation attains authority as the dominant interpretation” continues to hold true (MacCallum and Hopkins 2012).

Given the current lack of mandatory benchmarks, (EnviroDevelopment and Green Star Communities are voluntary and not widely used), this thesis questions what the role of ‘green’ marketed suburbs is in a post-global financial crisis, highly competitive real estate market; and what is the actual capacity of ‘green’ marketed suburbs to be a part of the solution or just more greenwash? Mapes and Wolch (2010, :107) suggest that irrespective of whether ‘green’ marketed suburbs or mainstream suburbs are an urban infill or a new greenfield project, they are still:

...“Embedded in larger metropolitan regions, and have little control over regional social and economic dynamics. They are limited in the types of policy tools they can apply, for example, cities cannot sensibly impose carbon taxes due to the open nature of the urban system, and thus their efforts should be judged within a framework of nested indicators that acknowledges that different sustainability challenges must be addressed at different spatial and governmental scales”.

Despite this criticism, Mapes and Wolch (2010) believe that it is possible for such suburbs to be more sustainable than conventional neighbourhood design (CND). If they are designed using: energy efficient and climate responsive buildings; green infrastructure; are linked to alternative transport options; enhanced access to economic and business opportunities that are close to home; allow for a mix of housing options and communities facilities; and an inclusive community culture.

Mapes and Wolch's (2010) research explores the capacity of 29 suburbs in North America that have been marketed and awarded as 'sustainable' to achieve common indicators of sustainability. Mapes and Wolch (2010) suggest that all types of suburban settlement models can be a part of the solution to creating more sustainable communities, whether they are urban infill single unit or higher density housing units, suburbs built on brownfield sites and rehabilitated to enhance the surrounding settlement, or new suburbs on greenfield sites on the outskirts of the metropolitan area. With a myriad of more sustainable urban design tools and methodologies available it is possible to design urban settlements that incorporate all the best indicators of sustainability, but Mapes and Wolch (2010) suggest it requires support from government, education for the development and consumer sector and more importantly a benchmarked minimum standard for what is a sustainable suburb/community .

The research of Mapes and Wolch (2010), like this thesis, questions the capacity of such suburb projects to be a sustainable community, as being awarded and marketed as such does not necessarily translate to it being actually sustainable in practice. Even with the North American Leadership in Energy and Environmental Design for Neighbourhood Development (LEED-ND), the Australian EnviroDevelopment, WA's Liveable Neighbourhood Policy or the more recent Green Star Communities new 'green' marketed suburbs will still not be subjected to rigorous sustainability monitoring based on empirical evidence, and until such benchmarks are mandatory and integrated into the planning system they remain aspirational goals only (Hahn 2008; Mapes and Wolch 2010). Moreover, there is yet to be any substantial evidence that obtaining a 'Green Star' rating, LEED-ND

certification or EnviroDevelopment certification leads to more sustainable communities in practice (Hahn 2008; Mapes and Wolch 2010).

5.1.2 *The Building and Development Sector in WA*

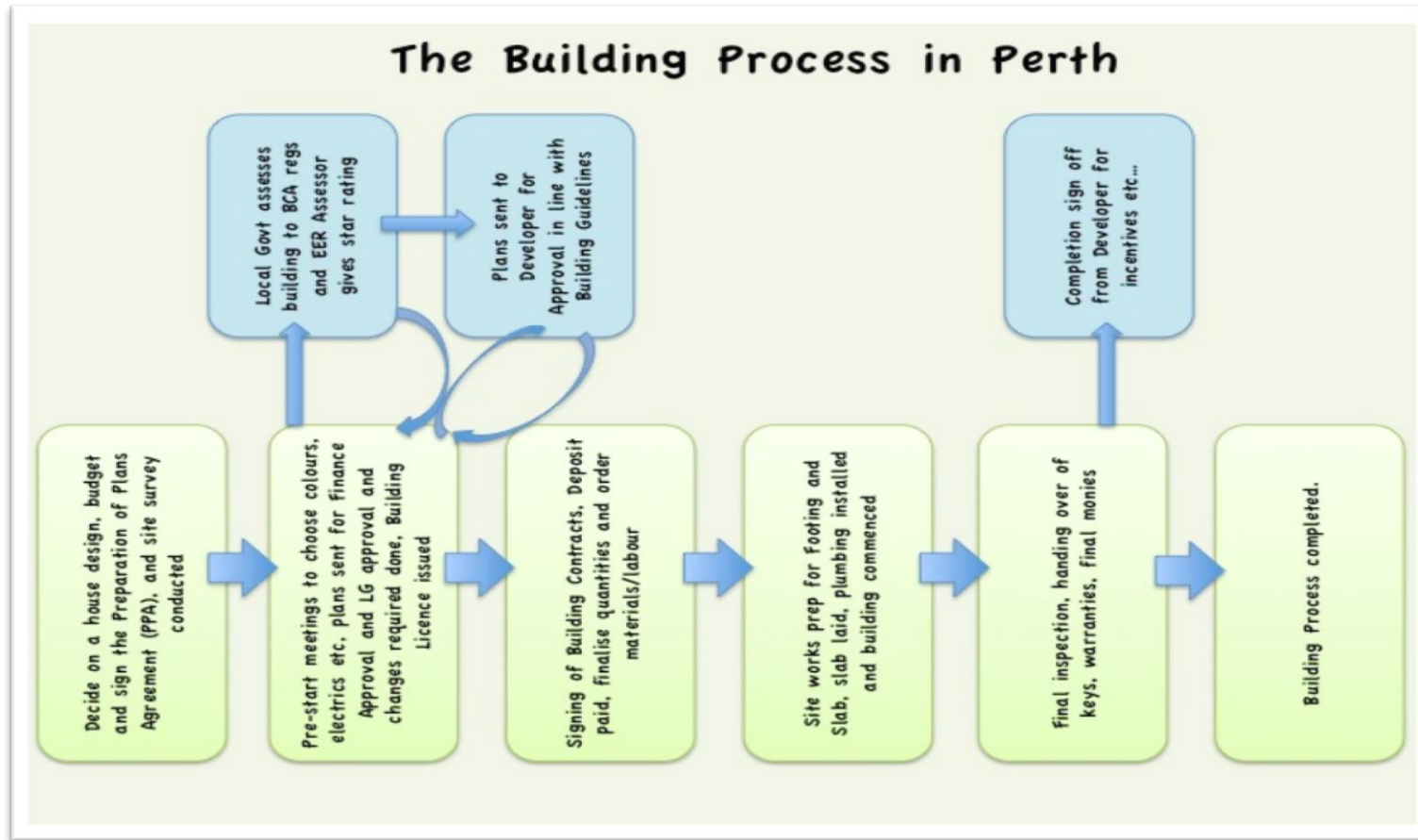
The development and building sector is a complex and amorphous industry, which is highly fragmented and conservative in nature (Crabtree and Hes 2009). The building sector in Perth in particular is characterised by a relatively small and fragmented number of building companies, ranging from the larger project home builders to more boutique builders; and the house product is dominated by 4 bedroom 2 bathroom double brick cavity (DBC) construction (Grace 2007; Peterkin 2009). The development sector is very similar with a cluster of smaller 'boutique' developers focused primarily in Perth, surrounded by much larger developers doing extensive suburb developments across Australia, Crabtree and Hes's (2009) research highlighted the fragmented nature of the development and building sector and the housing industry more generally, which means that innovation, information and knowledge regarding sustainability can sometimes be slow in its uptake and adoption. Moreover the BCA's more recent changes to the way in which it deals with energy efficiency in the home, means that Australia has now moved to mandatory 6 Star ratings in 2011 for all residential dwellings, which will force all builders to begin to consider more energy efficient designs for houses they build (Australian Building Code Board 2010a). The building sector is the most noticeable implementing body of the BCA, regulated by local government. Yet as Crabtree and Hes (2009) found, they are also the slowest sector in the housing industry to innovate particularly when it comes to sustainability.

In Perth, the development sector works within the overall planning system, and unlike Europe or America is separated from the building sector. Land is developed separate from the building of houses, and the planning system manages the development of land and has a limited influence on the design or construction of the houses being built on newly developed land. More specifically, the development sector in Perth is divided into private; public and government developers and they each approach the development of residential land a little differently. Private developers are not listed on the stock exchange and are usually smaller 'niche' developers who tend to develop smaller suburbs or partner with government. Examples of this type of developer such as Satterley and Peet, a model that has been followed in two of the case study suburbs. Whereas public developers are those that are listed on the stock exchange and are usually a much bigger company such as Stockland, and develop extensive suburbs; and in Perth the State Government has created an agency to conduct its land development, and LandCorp create extensive redevelopments of older suburbs and partner with smaller developers to create new innovative suburbs around the State.

5.1.2.1 The Building Process

Figure 7 highlights the average process for constructing residential buildings in Perth. The process from beginning to end can take anything up to a year, sometimes more in periods of high labour demand, such as was experienced in the height of the boom in WA before 2008 (see www.homebuyers.com.au/content_common/pg-Construction-Process). The process, whilst comparatively straightforward, can be complicated by changes to the design, and supplier and sub-contractor delays.

Figure 15: The Average Building Process



Source: www.homebuyers.com.au/content_common/pg-Construction-Process; www.narrowlohomes.com.au/services/the-building-process/

5.1.3 The Householder Sector

The household sector is an important component of this research because they are ultimately the reason for 'green' marketed suburbs existing in the first place. Without the consumer demand for housing, the government's desire to encourage more sustainable development, combined with the developer's desire to capture a niche market and expand the customer base there would be no need for such developments. By 2031 it is likely that the population of Perth and its surrounding area will increase to approximately 2.22 million people, translating to a 52% increase from 2001 (Western Australian Planning Commission 2003b). The WAPC estimates that the majority of these residents will be new to Perth, nearly 260, 000 being newborns and 500, 000 being migrants from interstate and overseas (Western Australian Planning Commission 2003b). Given this forecasted scenario it is therefore likely to expect that there will be a need for at least an additional almost 380, 000 new homes in the Perth and Peel metropolitan area (Western Australian Planning Commission 2003b). There are a number of sustainability issues that such an increase in population poses to the infrastructure and environment of Perth. Water sensitivity in Perth is a common scenario that has been the experience of urban dwellers for the last 30 years or more, with rainfall down more than 20% and stream flows down 65% from 1911-1975 averages and 65% of household potable water now coming from limited groundwater sources (Grace 2007). Moreover, Perth households generate 280 ML/d of wastewater that is given secondary treating before being pumped out to sea; the extreme nutrient poverty of Perth soils means that the 500, 000 residential gardens and municipal parks are

leaching fertilisers into the waterways; and Perth households dump 2.5 Mt/a of municipal solid waste in landfills around the metropolitan area (Grace 2007). The ABS (2010b, 2007, 2011) has found that “electricity use per person rose nearly one-fifth (19%) throughout the period 2001–02 to 2006–07. Larger home sizes, more appliances and IT equipment in homes and increased use of heaters and coolers have contributed to this increase and resulting residential greenhouse gas emissions”. Additionally, “between 1994 and 2008, the number of homes with four or more bedrooms rose from 21% to 29%, while the number of one, two and three bedroom homes all decreased. Despite the increasing size of homes, household size in Australia is decreasing, from 2.6 people per household in 2001 to projections of between 2.2 and 2.3 people per household in 2026” (Australian Bureau of Statistics 2010c).

Such continued growth in resource use and waste generation has serious implications for any efforts towards a more sustainable urban lifestyle. For this reason it is timely to investigate the capacity of developers to create more sustainable suburbs, and for builders to create more sustainable houses given the impending need for another 380, 000 new homes before 2031 in Perth (Pulzl; and Treib; 2007).

5.2 Overview of the Case Study Suburbs

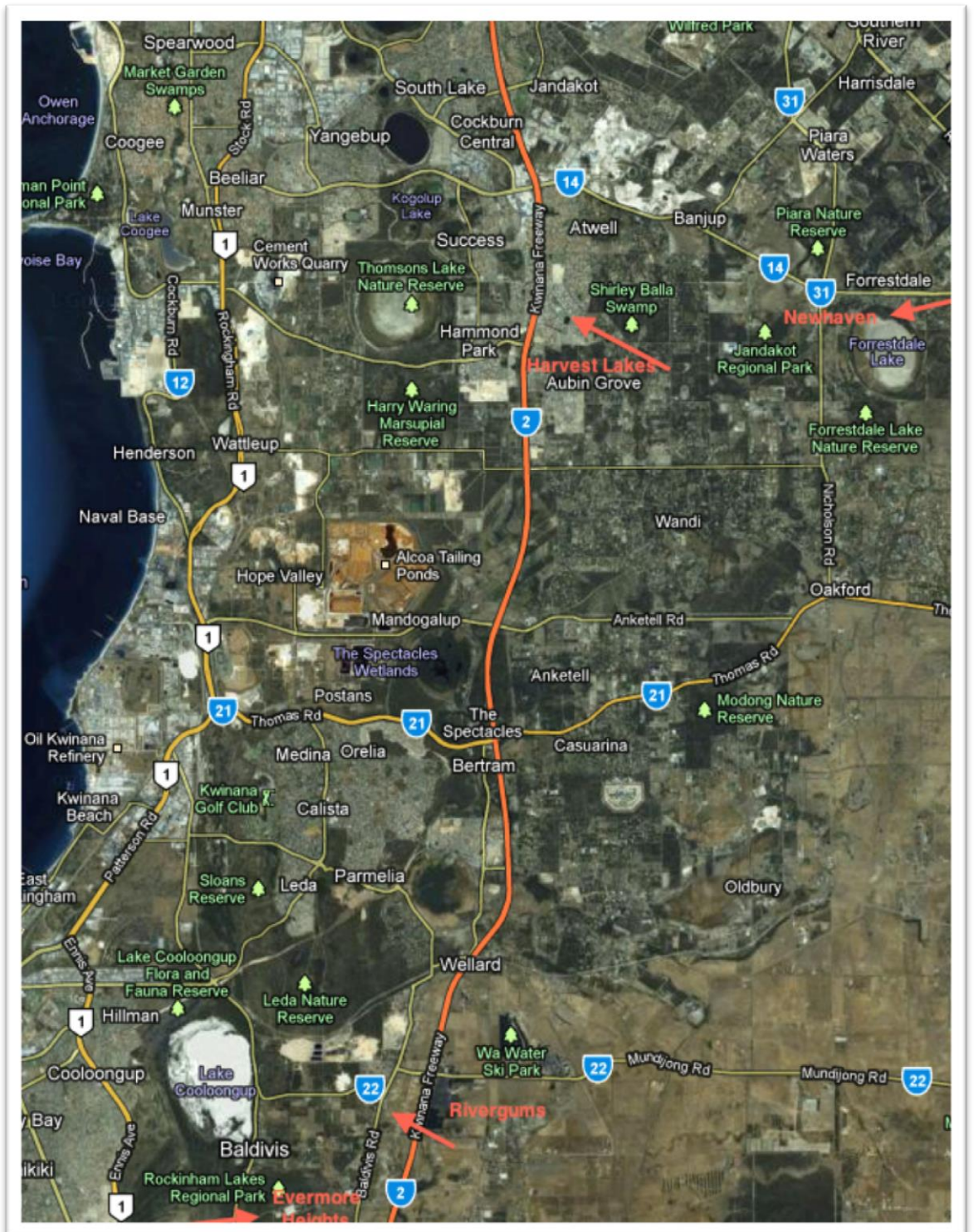
The location of the four case studies suburbs chosen can be seen on the map in Figure 8. The suburbs are located along the central spine of the Perth Metropolitan area, with Newhaven being the most easterly suburb. The more basic criteria for choosing case study sites included ensuring a selection of price ranges for house

and land packages and age of the development between all the suburbs, and a spread of different locations around the Perth metropolitan area to reduce any chance of there not being enough difference between the selected suburbs (see Table 3). Harvest Lakes is located within the southern area of Cockburn; Newhaven is located further east towards the foothills of the Darling Scarp whilst Rivergums and Evermore Heights are both located in the newer redeveloped suburb of Baldivis. Evermore Heights was chosen as the final case study because it is regarded as an ambitious suburb that is attempting to set a new benchmark (personal communication with Project Manager). All the case study suburbs have been developed in the last 10 years, with most of the first wave of housing being approximately 5 years old. All four suburbs have been designed using the framework of the Department of Planning's Liveable Neighbourhoods Policy, which espouses the tenets of New Urbanism (Australian Council for New Urbanism 2006; Department of Planning 2008).

Table 2: Case Study Developers Suburb Features Matrix

Suburbs	Developer	Building guidelines/Covenants	Age of Development	Size of Development	Location	Marketed as 'Green' or equivalent	Green' Industry Awards
Harvest Lakes	Landcorp/ Satterleys	<ul style="list-style-type: none"> • Window shade awning to front of dwelling & eaves overhang to front of dwelling. • Minimum of 2m wide verandas to front of dwelling. • Tuscan themes, porticos and dwellings with no eaves to the primary street frontage are not permitted. • Minimise west / east facing windows and adequate summer shading (e.g. awnings, eaves, pergolas) or use of energy efficient glazing (e.g. solar performance film, tinting, toned) 	5 years +	115 hectares, 1000 lots with approximately 3500 people	Atwell - south central	HIA GreenSmart /Liveable neighbourhoods	UDIA 2004/5 Awards for Environmental Excellence
Rivergums	Cedar Woods	<ul style="list-style-type: none"> *Provide adequate eaves and pergolas on all sides; *Lighter roofs preferred and black roofs are prohibited; *Deciduous trees along northern boundary for summer shading; 	5 years	400 approx lots	Baldivis - South Coastal	HIA GreenSmart	UDIA 'Water Sensitive Urban Development Award'
Newhaven	Stockland	Land purchasers will be actively encouraged to build a home incorporating elements that represent best practice in sustainability including passive solar design, Waterwise and energy efficient initiatives and the use of sustainable building materials.	5 years	500 approx lots	Forrest dale Sth East-foothills	HIA GreenSmart	UDIA 2008 Awards for Environmental Excellence
Evermore Heights	Satterleys/ Landcorp	<ul style="list-style-type: none"> *Maximise solar orientation, minimise glazing to minimise heat in summer but allow winter sun; * 450mm eaves to entire home; *Allow favourable cross ventilation in summer & draught proofing for winter; *Light coloured roof material; 	1 years old	379 lots	Baldivis - South Coastal	Sustainable Community	UDIA 2009 Awards for Excellence - Urban Water

Figure 16: Case Study Sites in the Perth Metropolitan Area



Source: Google Maps (2011).

5.2.1 Harvest Lakes Case Study

Box 5: Harvest Lakes Case Study Fact Sheet

Suburb Name: Harvest Lakes

Developed By: LandCorp

Year of Development: 2005

Sustainability/Environmental Awards: UDIA Enviro & HIA Green Smart 04/05.

Number of houses/residents: 3500

Distance from Perth and location: in the southern suburb of Atwell and Aubin Grove, within 5kms of Cockburn Central Train Station and Kwinana Freeway, 24kms to Perth.

Census Data for the suburb of Atwell:

- Median age of persons - 30
- Median individual income (\$/weekly) - \$681.00
- Median family income (\$/weekly) - \$1, 558.30
- Median household income (\$/weekly) - \$1, 498.50
- Median housing loan repayment (\$/monthly) - \$1, 365.00
- Median rent (\$/weekly) - \$250.00
- Average number of persons per bedroom - 1
- Average household size – 3.1
- Average water use
- Average energy use (australian bureau of statistics 2008a).
- Sustainability marketing: 'change your world' and WA's first greensmart village.
- Sustainability incentives: waterwise garden incentives.

Sustainability Features:

- Retaining Significant Trees For Landscaping And Habitat Values In Public Open Space (Pos);
- Promoting Efficient Land-Use Through Reduced Road Widths And Building Setbacks;
- Creating A Dual Use Paths Network To Encourage Walking And Cycling Rather Than Car Use For Local Trips;
- Installing Solar-Powered Lighting In Pos;
- Reusing Cleared Vegetation On-Site As Mulch;
- Mill On-Site Surplus Trees For Re-Use In The Development;
- Restore Existing Wetlands To Become A Key Community And Natural Feature Of The Project;
- Developing And Implementing, With The City Of Cockburn A Building Performance Criteria For Energy And Water Efficiency Enacted Through The Development Approval Process; And
- Improving The Waste Management Through Mandatory Waste Management Plans For All Civil Works And Building Contractors.

Sustainability Features Focused On: Conservation Of Resources As The Environmental Sustainability Focus – In Particular The Conservation Of Energy, Water And Resources More Generally.

'Green' Covenants: Tuscan/No Eaves Theme Banned.

Photo 5: Harvest Lakes Community Space



Source: K.Ringvall 2010.

5.2.1.1 The Developer

LandCorp is the WA Government's land and property development authority, and works throughout the State. Working within the auspices of the Western Australian Land Authority Act 1992, LandCorp acts to acquire and develop land and property and plan new developments (LandCorp 2010c).

LandCorp has a specific focus in sustainable development and works expressly through a Sustainability Framework that seeks to integrate four elements of sustainability including: community wellbeing, design excellence, environmental leadership, and economic health (LandCorp 2010b). LandCorp has a number of demonstration projects, including Harvest Lakes, Seville Grove in Armadale and Alkimos in Perth's northern beaches area. These suburb demonstration projects also include project homes built to exhibit sustainable and affordable living, such as the Elements at Harvest Lakes (LandCorp 2010a).

Photo 6: Thoroughfare through Harvest Lakes



Source: K.Ringvall 2010.

5.2.1.2 The Development

According to the Harvest Lakes Project Manager: “the primary target market was predominantly owner occupiers who were purchasing their second or subsequent home, including families, empty nesters and retirees. The first wave of residents came from within five kilometres of the site. Many of these people were former residents of a neighbouring LandCorp development they had bought into as first homebuyers.

Having been in the market for five to ten years they had built up enough equity to be able to afford an upgrade to Harvest Lakes” (Personal Communication, HL Project Manager, September, 2010). The Harvest Lakes Project Manager explained that the development was undertaken to ensure 5 Star energy efficiency standards were made a “...requirement for its homes and was leading edge and did mean that people building in Harvest Lakes paid a premium for their houses. During this time,

Harvest Lakes provided a benchmark example of how suburban residential development can incorporate significant environmental features without being unprofitable for the developer or unappealing to homebuyers. Today, due to the more level playing field, building a house at Harvest Lakes is no more expensive than building a house elsewhere” (Personal Communication, HL Project Manager, September, 2010).

Harvest Lakes was one of the first suburb developments to utilise the guidelines of the then trial design code of the Western Australian Department of Planning and Infrastructure, the Liveable Neighbourhoods Policy; and was WA’s first HIA GreenSmart estate (LandCorp 2004).

Water conservation actions included:

- The inclusion of a water management system that incorporates the principles of WSUD through the reuse of storm water runoff to irrigate gardens and POS
- Landscaping in-line with efficient use of water as recommended by the Water Corporation’s Waterwise Program in POS;
- Top dressing of the playing fields with phosphorus absorbing soil to reduce fertiliser leaching into the groundwater,
- Financial incentives to residents to promote the installation of a Waterwise garden;
- Mandatory requirements for the inclusion of water efficient home and garden fixtures including AAA rated showerheads and low-flow taps (LandCorp 2004).

Energy conservation measures included:

- Suburb design which enabled passive solar design in the built form (the development has been designed to ensure that 75% of lots have solar passive orientation);
- Using the City of Cockburn's planning provisions to mandate all homes to comply with passive solar design criteria including room zoning, natural cross flow ventilation, door and window seals, ceiling and wall insulation as well as gas boosted solar hot water heating;
- Fact sheets and purchaser incentives (like free landscaping etc) for the installation of energy efficient appliances;
- Solar powered lighting in the POS;
- Cycleways and footpaths to encourage alternatives to car dependence and construction of an affordable project-designed energy efficient home (LandCorp 2004).

The use of local council planning provisions to mandate building requirements is unusual in WA, and Harvest Lakes is one of the few that has utilised this avenue. Resource conservation was implemented across a number of different areas including building practices/resources, transport, biodiversity and built form environment.

In particular this included:

- Boardwalks and parks benches constructed from wood recovered from cleared vegetation;
- The reuse of cleared vegetation as mulch;

- The adoption of a HIA GreenSmart Construction Waste Management Plan;
- Mandatory requirements for builders and civil works contractors to produce and implement waste management plans;
- Recycling of excess bricks and ceramics for the base of driveway crossovers;
- Street layout and dual use path network supporting walkability and cycling;
- The location of nearby regional shopping centre and planned major public transport interchange to assist in decreasing car use to reduce greenhouse gas emissions and road maintenance,
- The early introduction of public transport;
- The retention of significant trees in reserves for landscape and habitat value – nearly 200 established trees have been retained at Harvest Lakes;
- Relocation of trees in the path of development for use as wetland perching habitat,
- The return of fauna to the areas as a result of rehabilitation of natural habitats;
- The use of mandatory local government Development Application Plans (mandatory planning guidelines) to promote variety of housing types and diversity in the built form;
- Incorporating efficient land-use through a variety of lot sizes, reduced road widths and building setbacks;

- A 'Smart Housing Village' ensuring appropriate sustainable housing by catering for a range of household sizes and types;
- Developing WA's first state-of-the-art custom designed and built sustainable primary school;
- The construction of a sustainable Community and Environmental Centre for social and environmental education programs;
- The inclusion of a Community Development Plan engaging community members as facilitators of sustainability and environmental management (LandCorp 2004).

Photo 7: Harvest Lakes Medium Density Housing



Source: K.Ringvall 2010.

5.2.2 Newhaven Case Study

Newhaven has 149.9 hectares allocated for residential properties and 8.38 hectares zoned for retail activities, 3.9 hectares for a primary school, and 21.8 hectares for POS (which includes mandatory Arterial Drainage) (Stockland 2008).

Box 6: NEWHAVEN Case Study Fact Sheet

Suburb Name: Newhaven

Developed By: Stockland

Year of Development: 2005

Sustainability/Environmental Awards: UDIA Enviro 07/08/09 HIA Green Smart

Number of houses/residents: ...

Distance from Perth and location: In the suburb of Piara Waters, Forrestdale close to the Eastern foothills of the Darling Scarp and is 29kms to Perth.

For the suburb of Atwell:

- Median age of persons - 31
- Median individual income (\$/weekly) - \$672.00
- Median family income (\$/weekly) - \$1, 682.10
- Median household income (\$/weekly) - \$1, 650.70
- Median housing loan repayment (\$/monthly) - \$1, 600.00
- Median rent (\$/weekly) - \$180.00
- Average number of persons per bedroom – 1.1
- Average household size – 2.8
- Average water use -
- Average energy use - (Australian Bureau of Statistics 2008a).

Sustainability Marketing: 'A Sustainable Community'.

Sustainability Incentives: Waterwise garden incentives.

Sustainability Features:

- A residential environment that celebrates existing landform and minimises cut-to-fill;
- Retention of remnant mature pine, paperbark and gum trees;
- Generous network of green spaces that accommodates best-practice urban water initiatives;
- The first 5 star Energy Efficient display village and design guidelines to reduce energy and water consumption; and
- Integration of residential with commercial/retail, educational and recreational uses (Stockland 2008).

Sustainability Features Focused on: 'protecting and enhancing the existing environment and encouraging water and energy efficiency'.

'Green' Focused Covenants: Sustainable design features encouraged.

Photo 8: Newhaven entry



Source: K.Ringvall 2010.

Photo 9: Thoroughfares within Newhaven



Source: K.Ringvall 2010.

5.2.2.1 The Developer

Stockland is a large publically listed development company with interests across Australia in the residential and commercial building sector, and they have a strong commitment to sustainability and have a comprehensive corporate responsibility and sustainability strategy that drives how they do business, particularly in the residential sector (Stockland 2008, :1).

This has been manifested through the design of the estate to ‘maximise the potential of existing landforms; from implementing best practice Water Sensitive Urban Design initiatives to protect nearby waterways and bushland.

This created WA's first 5 Star energy efficient display village; to using organic and local food at Welcome Events to support local businesses' (Stockland 2008, :1). Stockland has concentrated on a number of sustainability features within Newhaven and they include:

- Utilising the natural topography;
- Working with existing vegetation;
- Protecting nearby wetlands;
- Promoting energy efficiency; and
- Supporting walkability.

By utilising the topography of land, which included a low-lying dual dune system, the unique topography has become an asset rather than something that needed to be eradicated. This action involved the development of a number of new designs to manage 'storm water run-off:

- A strategic swale drainage (natural stormwater drainage) and rain garden (recycling of stormwater runoff for lawn reticulation) system,
- Reduced road lengths to achieve minimum engineering grades for stormwater drainage,
- Efficient subsoil drainage system to control the peak groundwater levels, and
- POS areas in strategic locations for flood storage to reduce peak flows from the site (Stockland 2008).

Photo 10: Newhaven storm water garden and retained trees



Source: Kate Ringvall 2010.

Photo 11: Newhaven Display Village



Source: Kate Ringvall 2010

The Newhaven display village was the first 5 Star rated development under WA's House Energy Rating Scheme. Stockland worked in collaboration with the South East Regional Energy Group – which included the Cities of Armadale and Gosnells and the Shire of Serpentine- Jarrahdale, to develop the display village (Stockland 2008). Stockland cite the key successes at Newhaven as:

- A residential environment that celebrates existing landform and minimises cut-to-fill;
- Retention of remnant mature pine, paperbark and gum trees;
- Generous network of green spaces that accommodates best-practice urban water initiatives;
- The first 5 star Energy Efficient display village and design guidelines to reduce energy and water consumption; and
- Integration of residential with commercial/retail, educational and recreational uses (Stockland 2008).

5.2.3 Evermore Heights Case Study

Box 7: Evermore Heights CASE STUDY FACT SHEET

Suburb Name: Evermore Heights

Developed By: Satterley/LandCorp

Year of Development: 2010

Sustainability/Environmental Awards: UDIA Enviro 09 & HIA Green Smart

Number of houses/residents: 379 lots

Distance from Perth and location: in the South West Metropolitan region of Baldivis/Rockingham 45kms to Perth.

Census Data for the suburb of Baldivis:

- Median age of persons - 37
- Median individual income (\$/weekly) - \$522.00
- Median family income (\$/weekly) - \$1, 322.00
- Median household income (\$/weekly) - \$1, 188.40
- Median housing loan repayment (\$/monthly) - \$1, 100.00
- Median rent (\$/weekly) - \$180.00
- Average number of persons per bedroom – 1.1
- Average household size – 2.8
- Average water use -
- Average energy use - (Australian Bureau of Statistics 2008a).

Sustainability Marketing: “Live for Today and Tomorrow”.

Sustainability Incentives: 1kw PV unit; 3000ltr rainwater tank plumbed to the toilet and cold water laundry; third-pipe reticulation of groundwater to all domestic gardens; front and rear Waterwise landscaping; Telstra Smart Community package. Sustainability Features:

- Waterwise principles throughout the development (including the introduction of a third pipe to deal with recycled groundwater from rain gardens),
- solar passive design principles to maximise energy efficiency, and
- general energy efficiency design principles in homes.

Sustainability Features Focused on: ‘protecting and enhancing the existing environment and encouraging water and energy efficiency’;

‘Green’ Focused Covenants: Minimum eaves and no black roofs.

Photo 12: Evermore Entry



Source: K.Ringvall 2010.

Photo 13: Evermore Heights Open Space



Source: K.Ringvall 2010.

5.2.3.1 The Developer

Satterley Property Group is a private West Australian based company with a focus on urban renewal and developing iconic community focused developments, and currently Satterley is developing communities from South Yunderup to Brighton in the north (Satterley Project Manager, Personal Communication).

5.2.3.2 The Development

Evermore Heights has been developed with a number of key objectives including: waterwise gardening principles on public reserves throughout the development (including the introduction of a third pipe to deal with recycled groundwater from rain gardens), solar passive design principles to maximise energy efficiency, and general energy efficiency design principles in homes. All lots have been designed to capture as much solar orientation as possible and every house will be fitted with a PV cell included in the price.

Photo 14: Evermore Heights Houses



Source: Kate Ringvall, 2011

Photo 15: Evermore Heights Solar Panels



Source: Kate Ringvall, 2011

5.2.4 Rivergums Case Study

Box 8: Rivergums Case Study Fact Sheet

Suburb Name: Rivergums

Developed By: Cedar Woods

Year of Development: 2005

Sustainability/Environmental Awards: UDIA Enviro & HIA Green Smart

Number of houses/residents: 1000

Distance from Perth and location: in the South West Metropolitan region of Baldivis/Rockingham 45kms to Perth.

Census Data for the suburb of Baldivis:

- Median age of persons - 37
- Median individual income (\$/weekly) - \$522.00
- Median family income (\$/weekly) - \$1,322.00
- Median household income (\$/weekly) - \$1,188.40
- Median housing loan repayment (\$/monthly) - \$1,100.00
- Median rent (\$/weekly) - \$180.00
- Average number of persons per bedroom – 1.1
- Average household size – 2.8
- Average water use -
- Average energy use - (Australian Bureau of Statistics 2008a).

Sustainability Marketing: “Back to Nature”; Sustainability Incentives: none offered.

Sustainability Features:

- A residential environment that celebrates existing landform and minimises cut-to-fill;
- Retention of remnant mature pine, paperbark and gum trees;
- Generous network of green spaces that accommodates best-practice urban water initiatives;
- The first 5 star Energy Efficient display village and design guidelines to reduce energy and water consumption; and
- Integration of residential with commercial/retail, educational and recreational uses (Stockland 2008).

Sustainability Features Focused on: ‘protecting and enhancing the existing environment and encouraging water and energy efficiency’

‘Green’ Focused Covenants: *No black roofs and must have eaves.

Photo 16: Rivergums Entry



Source: K.Ringvall 2010.

Photo 17: Rivergums Cottage Blocks



Source: K.Ringvall 2010.

5.2.4.1 The Developer

The Developer, Cedar Woods is a small niche-market developer with a focus on environmental and community interests and manages developments in Mandurah, Halls Head, Baldivis, Tapping, Canning Vale, Carine and Forrestdale, as well as Victoria (Cedar Woods Project Manager, personal communication 2010).

5.2.4.2 The Development

Rivergums is a master planned suburb that has focused on retaining the natural vegetation and wetlands around it, namely the Rivergum trees around the estate and seasonal wetland that is now a small lake used support the water sensitive urban design of the suburb (Cedar Woods Project Manager, personal communication 2010).

Photo 18: Rivergums house being built



Source: K.Ringvall 2010.

Lots are designed so that the majority are on the north/south axis to access good solar orientation, the building guidelines (design and construction requirements) for the estate encourages energy efficient design and the ability to use the south-westerly prevailing breezes, and waterwise planting in gardens and in the public open spaces has been a priority for Cedar Woods at Rivergums (Cedar Woods Project Manager, personal communication 2010).

This chapter provides more of the substantive background required to address the three research questions:

- Do policy, institutional or other barriers to the mainstream planning and development of sustainable settlements in Perth exist, in particular in sustainable housing?
- Are 'green' marketed suburbs creating a more sustainable alternative to mainstream, modern suburban housing?

- Do the sustainability features used by developers match those found in the literature?

The Project Manager from each case study suburb developer was interviewed to ascertain their impressions, opinions and experiences of integrating sustainability features into their particular suburb. The questions asked were the same that the UDIA WA members were asked, in order to ensure continuity of the data collection. Three of the interviews were one-on-one semi-structured, and conducted at each interviewee's place of work, whilst one project manager only provided an emailed response to two of the questions. Case study suburbs have been de-identified to ensure anonymity. The list of questions asked is at Appendix A. A number of obvious themes emerged from the interviews with the Project Managers of each suburb, and these were also reflected in the online survey of the members of the UDIA WA's Environment Committee and Sustainability Committee. These themes included issues about the delays in getting approvals for new sustainability innovations, difficulties in getting sign up generally from all sectors, issues of compliance among residents to building guidelines, and the general disinterest for most homebuyers about the sustainability features and the limited capacity of star ratings to create more energy efficient housing and are discussed in great detail in Chapter 6.

CHAPTER 6 Results and Findings

6.1 Introduction

A number of different research methods have been used to investigate the state of 'green' marketed suburbs in Perth, and to ultimately answer the research questions highlighted earlier. The use of qualitative research has meant that a much broader understanding of the social, cultural, emotional constructs inherent in the experience of choosing to develop or live in a 'green' marketed suburb has been able to be gained. The sustainability indicator tool has been able to clearly highlight the areas where there are clear gaps in implementation of the developer's sustainability criteria; the interviews have allowed a more in-depth discussion of the highlights and the problems associated with developing 'green' marketed suburbs to occur; the focus groups have provided a medium to more clearly understand the motivations, limitations and benefits of designing, buying into and living in a 'green' marketed suburb; and the online survey has enabled specific answers to questions related directly to the choices and decisions around building and buying a house in 'green' marketed suburb.

6.1.1 Data Sources

All of these methods together have enabled a deeper understanding of the integration of sustainability into 'green' marketed suburbs, than either method could have done in isolation. Using the full range of methods in this research has enabled the data to be triangulated, and the data collected has shown that the

findings are very similar throughout leading to more credible findings on which to develop recommendations.

6.1.1.1 Interviews

Once the case study suburb were chosen, the developer for each one was approached and the Project Manager was asked to participate in an interview. These one-on-one structured interviews were conducted at the Project Manager's office and the questions asked were associated with their understanding of sustainability and how it had been integrated into their respective suburbs.

6.1.1.2 Focus Groups

The building sector focus group participants were involved in the design of residential housing that would to be available for development in the four case study suburbs. The questions were matched to what was asked in the developer/project manager interviews with a focus on establishing what is the understanding of sustainability; how does it manifest in the building industry; and exploring some of the main issues that have emerged from the data collected from residents, interviews with the local government, and the issues that the literature review has highlighted.

A small group of residents of one of the case study suburbs, and an adjacent non-green marketed suburb, were also invited to be part of a focus group exercise. The residents were long-term residents of one of the older case study suburbs, and also of the adjacent suburb, and were known to each other. The range of questions was related to decisions and choices about living in their suburb and house, and sought

to gain an understanding of the values that residents associate with sustainability and the values they hold and practice as a result.

6.1.1.3 Online Survey

The online survey for residents was piloted prior to it going live, with a small number of non-case study residents of new suburbs, to ensure the questions were easy to understand, and weren't misleading in any way. Three of the four case study suburbs were surveyed for a range of quantitative and qualitative data relating to their experience of buying into and living in a 'green' marketed suburb. The online survey asked a range of multiple choice and open-ended questions, to gain an understanding of the motivations for buying into their particular suburb, their household structure, and their energy and water consumption habits in particular.

6.1.1.4 Sustainability Indicator Tool

The term sustainability has been used in relation to environmental consciousness since at least the late 80s where it has been widely used to describe the amorphous and generalised awareness of 'looking after the environment' (Roseland 2000; Robinson 2004). However as Robinson (2004, :369) suggests it has been seen by "some as amounting essentially to a contradiction in terms, between the opposing imperatives of growth and development, on the one hand, and ecological (and perhaps social and economic) sustainability on the other".

To explore this and to address the research questions the sustainability indicator tool (see Table 12) was developed using multi-criteria analysis and Sustainability Impact Assessment guidelines to enable an assessment of sustainability in suburb

design, as found in the literature review in Chapter Three. The tool compared each suburb against the presence of indicators of sustainability that had been found in the literature to be present in a suburb or neighbourhood that was sustainable. Using multi-criteria analysis methodology (discussed in more detail in Chapter Four) the indicator tool has been constructed to highlight the sustainability factors that would be expected to be found in the planning and development of each suburb and the houses built in them. Given that the houses have been built in 'green' marketed suburbs it was reasonable to expect that some commitment, on the part of the builders, have been taken to match the expectations and marketing of the suburb.

In every case study suburb there are a range of builders that vary from the small boutique one off builders to the larger project builders and other building companies in between. The builders also vary in the price range of homebuyers that they are predominantly targeting, and each suburb has the full range of builders from low budget first home buyers to the second or third upgrade of established family home buyers, to empty nesters, to the high end builders of architect designed houses. This is a situation that is commonly found in new suburban development projects, and creates new suburbs that have a mix of budget conscious first home buyers building houses that are among the least expensive available; to established households upgrading their second or third home with a larger budget and equity; and more recently 'empty-nesters' downgrading their homes to cater to their decreased space needs with much greater budgets for choosing optional extras.

6.1.2 Results of the Sustainability Indicator Tools

In all the case studies parts of the suburbs were still being built, and the long-term infrastructure and services were yet to be included. In Table 4 'Y' was used to denote the presence of a criteria, 'N' denoted the absence of a criteria, 'Not Yet' denoted that something was planned but had yet to be built and 'unknown' denoted that the particular criteria's presence or not was unknown or not able to be known at that time. For the planning and design of each suburb, indicators of sustainability in suburb design include the presence of:

- Walking/cycling access,
- Preserved bushland/wetlands,
- Restraint on car use,
- Mix use developments
- Services within walking/cycling distance 400m/800m,
- Use of Native vegetation landscaping,
- Water reuse for irrigation,
- Close to public transport,
- Mix of housing types,
- Local employment potential,
- Emphasis on 'place making',
- Recycling program,
- Community space,
- Affordable housing, and
- 'Eyes on the street' design.

These criteria have been taken from the literature review and a more detailed explanation of these can be found in Chapter 3.

Table 3: Case Study Suburbs Sustainability Indicators Tool

Sustainability Indicators	Suburb 1	Suburb 2	Suburb 3	Suburb 4
Walking/cycling access	Y	Y	Y	Y
Preserved bushland/wetlands	Y	Y	Y	Some
Discourages car use	Y	Unknown yet	Y	N
Mix use developments	N	Not yet	Not yet	Not yet
Services within walking/cycling distance 400m/800m	Y	Not yet	Not yet	In development
Native vegetation	Y	Y	Y	Y
Water reuse for irrigation	Y	Y	Y	Y
Close to PT	N Within 5kms of Sth Rail Line	Y	Y	Y Bus network
Mix of house types	Y	Y	Y	Y
Local employment potential	Close to major employment hub	Y	Y	Y
Emphasis on 'place making'	Y	Y	Y	Y
Recycling program	Y	Y	Y	Y
Community space	Y	Y	Y	Y
Affordable housing	No specific program	Y	No specific program	No specific program
Eyes on the Street	Y	Y	Y	Y

Legend:

Y = yes and N = no

Table 3 highlights the aspects developers have focused on to showcase the respective sustainability features, in relation to what the literature has showed makes a suburb more sustainable. For developers the predominant sustainability features they concentrated on were water-wise urban design, retainment of natural/original vegetation and the creation of community/sense of place through developing pedestrian friendly environments, community bbqs, playgrounds and grassed areas, and the support of resident's associations and local events. Whilst these features are arguably very important, and according to the most recent ABS research, the water-wise aspects have had a significant positive effect on reduced water use in particular (see (Australian Bureau of Statistics 2010a), on their own they don't make a suburb more sustainable. This finding is also reflected in the research of Mapes and Wolch (2010) in Northern America.

Photo 19: Impressions the Builders 8 Star House



Source: Kate Ringvall, 2011

Table 4: Case Study Resident's Houses Sustainability Indicator Tool –

Sustainability Indicators	Suburb 1	Suburb 2	Suburb 3	Suburb 4
Water tanks	n/a	Y	n/a	n/a
Solar hot water or equivalent	Y	Y	Y	20%
Solar panels	N	Y	n/a	N
Water wise gardens	Y	Y	Y	Y
Nth/Sth Solar orientation	50%	70%	70%	50%
Insulation	Roof/ceiling	Roof/ceiling	Roof/ceiling	Roof/ceiling
Grey water system	n/a	Y	n/a	n/a
East/West shading	N	n/a	30%	N
Use of thermal mass	DBC	DBC	DBC	DBC
Surrounding Eaves	50%	Y	50%	50%
Light Roof	50%	70%	50%	50%

Legend: **Y** = yes and **N** = no

Table 5: Case Study Display Homes Sustainability Indicator Tool -

Criteria	Suburb 1	Suburb 1	Suburb 2	Suburb 2	Suburb 3	Suburb 3	Suburb 4	Suburb 4
House Type	4 Bd 2 Bth	N/A	8*3bd2bth	4bd2bth	4bd2bth	4bd2bth	4bd2bth	4bd2bth
Solar hot water	Y		Y	Y	Y	Y	Y	Y
Solar panels (Not Mandatory)	N		Y	Y	N	N	N	N
Water wise gardens	Y		Y	Y	Y	Y	Y	Y
Nth/Sth Solar orientation	Y		N	N	N	Y	Y	Y
Insulation	Y		Y & in walls	Y	Y	Y	Y	Y
Greywater system	?		Third Pipe	Third Pipe	?	?	?	?
East/West shading	Y		Y	Y	N	N	N	N
Use of thermal mass	N		Y	N	N	N	N	N
Surrounding Eaves	Y		Y	Y	N	N	N	N
Light Colour Roof	Y		Y	N	N	N	N	N
Water tanks	N		Y	N	N	N	N	N

Legend: **Y** = yes; **N** = no; **?** = Unknown or not able to be known

Table 4 and 5 highlight the sustainability features that houses that residents in each case study suburb chose to build or buy, and what building companies built as examples of the house designs they had. The presence of features such as roof insulation and window placement is mandated by the BCA, so are not unusual; other features such as surrounding eaves, light coloured roofs, thermal mass in addition to standard brick, east/west shading however are yet to be mandated by the BCA. As can be seen in Tables 4 and 5 those features that are mandated by the BCA are present, while those features that aren't mandated by the BCA are predominantly not present. The features that were prohibited in the building guidelines (dark coloured roofs and limited eaves) are found in approximately 70% of the 3 suburbs that had included limitations in their building guidelines.

6.2 Overview of Interview, Focus Group and Survey Findings

Once the interview and questionnaire data had been collected, it became abundantly clear that there were a number of different but common themes that emerged, and the analysis has been organised under the most relevant themes from the collected data, which were:

- Issues working with government
- Difficulties understanding and applying sustainability principles and practices
- Perceptions of sustainable suburbs
- Non-compliance with building guidelines
- Quantitative measures of sustainable living

6.2.1 Issues working between Government, Agencies and Developers

Interviews were undertaken with each Project Manager of the four case study suburbs, and an online survey asking the same questions was also provided to the UDIA's Environment Committee and the following is a brief outline of the issues that were mentioned in relation to working with government. The Project Manager of Evermore Heights suggested that there was initially some difficulty in getting some of the more innovative aspects of the storm water recycling features of the development accepted. "The third pipe system was a monumental effort to get all the relevant departments on board and it has culminated in a Memorandum of Understanding being signed by the developers and WaterCorp, the Health Department and the local council. So we had to get all of those parties on board in order to implement it and also to talk about who would take care of the care and maintenance in perpetuity of the infrastructure. They all have different opinions and different priorities and they are all concerned about different things, and they are all very conservative. The local council were very reluctant to adopt the rain gardens in the road reserves because of what they perceived as future maintenance issues so we had to get over that and that initiative was cut down substantially due to their conservatism. The other initiatives are a cost impost to us; solar panels, the rainwater tanks so that is easy to deal because if we bear the costs and certainly the developer was a willing participant in adopting those initiatives".

Whereas the Rivergums Project Manager suggested that while the local authority wasn't obstructive they weren't particularly helpful "...the local authority at the time was quite sceptical about the development. I wouldn't say they were difficult

in that they were trying to obstruct what you were trying to do. In the early stages we got excited about it and we wanted to get as many people involved with it at as possible and try and make sure that it didn't go off the rails. So we wanted to make sure the planning authorities were all on board. For example, if somebody lodged a building licence and it didn't comply with all of our requirements we wanted them to let us know and say look you have a customer who is doing the wrong thing/ but none of them wanted to know...Back then the council thought that: "Sustainability, that's someone else's problem we don't want to know about. Sustainability needs to be dealt with by either federal or state governments. Local councils have no interest in sustainability".

These sentiments were also acknowledged by the Project Manager of Newhaven..."they weren't unco-operative, they just weren't interested to assist in any way. They probably didn't have the internal capacity either. They just thought it was all too hard. I guess there is another debate that people have – you're just one small development, really what is the sort of net benefit that is going to happen to the wider community just because you are doing a wonderful thing. The whole thing has changed since the six years we began with our development. Now we are getting the next areas planned and now the authorities come and ask and say 'look we need you to address all of these sustainability issues and we have check list and criteria and you need to answer all these questions before we are going to give you a tick and get to the next stage".

All the Project Managers suggested that initially there was significant difficulty in bringing all the parties together: "the main issue came from co-operation within the

organisations external to us so Department of Water, Department of Environment & Conservation and WaterCorp. Commencement I think was in 2004. Planning commenced 2000, suburb 2004, construction commenced early 2005 and it was little while ago that we did start and I guess if you need one department to stand up and to take some charge and say we can see this is going to work to lets work together but apparently it was a real struggle to be able to get them all to co-operate. One would say one thing and it would impact on another and they would say no. The Local Government were involved, but it was the water management that was the key element to starting the whole project. Local Government was involved but they were just saying/getting the advice from the other authorities to see if this can go ahead”.

A view that was shared by another Project Manager...“the Councils view point on a lot of sustainable or environmental things that we do, they look at the maintenance cost of it. That is a key to them to implement certain things. I think we did try for a particular type of reticulation system, which was a waterwise system for all the parks, which we said this is what we want to include, but the local government said it is too expensive for us to maintain. So no one else was doing it so it was a no. So they looked at it from that point of view. How much is this going to cost us later down the track? And then obviously getting them up skilled in the engineering behind certain things as well”.

The UDIA WA Environment Committee and Sustainability Committee members, made up of representatives from the Development Industry, had similar comments including:

- “In the first instance, because of the consciousness of sustainability, there is an acceptance, however when the practical application requires concessions to density and height to achieve sustainable development there is a reluctance to modify the regulatory controls”
- “Sometimes councils oppose the retention of natural landscape features (dunes, bush) if they think it will cost them too much to look after”
- “Approval for new concepts beyond standard requirements, additional costs for maintenance of POS in higher standard developments, reluctance of Local government to take over assets without a future funding program”

One of the more important points that emerged in the interviews with the local government officers, and is echoed in the project manager interviews, was in regards to support for sustainability generally by local government. When asked whether the Council’s planning frameworks and policies currently support or inhibit the integration of sustainability into suburbs or homes, the local government reported that:

- “We don’t have a lot of established Council adopted policies, so consequently we can’t really say that we are proactive but nor are we negative to the idea. So it’s pretty much developer driven in that a developer will come in with an idea and as officers we’ll try to support it and ‘ship’ it through the planning process but there’s no grand policy suggesting or directing us to do so. It’s unfortunate

because without the policy in place, with the next change of officers and we're back to doing the opposite...We don't have a sustainability policy, but we did undertake a review of sustainability in the organisation, and out of that came a study that gave us a way forward. The issue has always been that executive management don't understand how we can implement it at a general organisational level, and at a community and development level. So no, we don't have a policy and until they are comfortable with 'well what does it really mean?' we're going to have difficulty in getting it through. As officers we've got a few things on the side but as a City no policy"

The City of Cockburn (where Harvest Lakes is located) is the only local government authority that has a comprehensive Sustainability Policy that has been fully implemented (see http://www.cockburn.wa.gov.au/Council_Services/Environment/Sustainability/), however it had yet to be fully implemented at the time that Harvest Lakes would have been proposed so it's unclear whether this had any impact on the development of Harvest Lakes.

One of the local government officers suggested that the development application process for Evermore Heights and Rivergums wasn't unusual, other than:

- "...there were more meetings between the developers, council and the builders to explain what they were doing that was different.

Some planners and particularly builders were very cautious about what may or may not be suggested or proposed. The whole process for advertising and approvals was the same, it just required more meetings to make sure everything fit". When asked if the Evermore Heights development had posed any particular issues (because it was very innovative in 'green' design etc): "It was only an issue in that the Parks department would have to eventually take over management of it, so it wasn't an issue in that it was a deal stopper, it was more a situation of meetings and discussions and reassurances, and who was going to look after in the end. And the cost of water had to be decided with the Water Corporation. And with Rivergums it's just been an issue of with respect to drainage and higher sulphates in clay. Rivergums was a bit different because there was a couple of restricted areas, but with Evermore Heights it was just the first third pipe we'd come across"

In the Evermore Heights suburb, a strict building schedule process is supposed to eradicate this issue of non-compliance with the covenant requirements. Yet as the sustainability indicator tool (see Chapter 4 section 3) has shown, houses are still being built with black roofs and limited eaves in Evermore Heights. The local government suggested that:

- "Whenever there's a condition in place like that then the building department would be involved. And the issue for them is how do they make compliance, so they're reluctant not because they can't

ask for it, it's more a question of they know they can't police it... and that in itself is a big stigma. Local Government will always be considered to never have enough resources”

For one local government there were questions as to how the process of approving ongoing changes individual residents might want once the developer had handed over the suburb after it was completed:

- “One of the things is making sure that they're still sticking to and maintaining the design guidelines, because the development has been going for nearly 10 years now. So how does the City deal with any requests for a new fence, for instance if it's different to the guidelines, and do we still deal with LandCorp or do we assess it on its own merits?”

Both interviews with the developers and the local government have highlighted that there are significant impediments in communication between the different sectors and there is a clear mismatch in some cases between the developers intentions towards increasing the sustainability of the suburb and the local government's capacity to support that.

6.2.2 Difficulties understanding and then implementing sustainability

Project Managers of the case study suburbs, building designers in the building company interviewed, and residents were all asked about their understanding and perception of sustainability, as it related to their life and work and the following is an example of their responses. Three of the four project managers who were

interviewed reported that there were significant problems with introducing new sustainability innovations into their respective suburbs. Three project managers reported that the main area of concern was getting sign off from the local governments and the relevant government authority, particularly for innovative approaches to storm water (rain gardens etc) and the introduction of a 'third pipe' to deal with grey water and rain water. In addition all the project managers reported that in the early days of the 'sustainability' push in developments, it was very difficult to get local government sign off to some of the more basic sustainability features that are now taken for granted as 'normal'.

6.2.2.1 Understanding of Sustainability

Interestingly the building designers in particular were especially critical of the EER Star Rating tool's capacity to achieve energy efficient design, despite it's intention of doing just that. In addition the architects were pessimistic about the capacity of average Perth consumers to move away from the standard uninsulated double cavity brick, 4 bedrooms, 2 bathrooms with theatre room and double garage house. Although they did say that to achieve higher star ratings more innovative design would have to be employed, and insulating the cavity in double brick would be a necessity.

The building industry representatives in particular defined sustainability as:

“Designing a structure that is enviro friendly, preserves resources, while meeting need”

“Design around energy efficiency, less energy consumption, less resources”

“Trying to design a home that is self reliant”

“Economic/social aspects and enviro side - lots orientated, northern aspect/match with house design”

“Designing a structure or a cluster of structures that is environmental friendly and preserves natural resources to meet the needs of it's occupants and will meet the needs of future generations to come”

“For homes to be designed in a way that is better for the environment and can produce energy for itself so it is sustainable on its own rather than relying on the energy networks provided by the government. Homes that require less energy to function are better for the environment”

The focus group members were made up of a planner, a building designer and two architects that work in different capacities within the building company. These comments are what would be expected from those educated in house design, at a time when government and community focus is increasingly on sustainability and increasing energy efficiency of the housing stock. Moreover it highlights once again that there is no paucity of understanding about what sustainability in the built form encompasses.

6.2.2.2 Residents Understanding of Sustainability in Relation to Housing and Suburb Design

The resident's focus group participants were asked to share their understanding of what sustainability, in the context of house and suburb design means to them and also about the contested nature of the term 'sustainability'. Responses from participants generally displayed a good working knowledge of energy efficiency in

housing design, and a basic understanding of sustainability more generally and included:

Technology solutions such as:

- “Insulation, solar passive design, and orientation of the house, wall insulation, thermal mass; eaves around the house, portico in the building guidelines and cross-ventilation
- Renewable power generation, solar energy and wind energy
- Water recycling and more sustainable use of water and waste products, water tank systems, pool blankets and filter systems on pool pumps that do not require flushing once a week; all showers to be fitted with water saving fittings; grey water systems and underground reticulation
- Solar hot water and 5 star energy rating
- Construction materials are recycled; recycle water, rubbish etc
- Placing into electrical systems a cut off switch to the house when you leave the house all unnecessary switches turn off, to design your house to use the least amount of lighting
- Double glazed windows, sky lights; energy efficient lighting and putting in ceiling fans over air-conditioning
- Features or appliances included in or around the house that reduce energy output or negative impact on the environment

- Features that will reduce the need for artificial heating/cooling of the house eg north facing windows allowing sun in winter, but shaded in summer
- Waterwise gardens

Changes in behaviour such as:

- Being enviro friendly
- Including parks, green spaces to reduce heat, and wetlands
- Balance between taking and putting back to the earth

As the literature around common understandings of sustainability in the residential sector has suggested the residents in this focus group's understanding of sustainability is generally limited to that of environmental concern, rather than incorporating the full economic, social and environmental understanding of sustainability (Robinson 2004; Crabtree and Hes 2009). The residents in this focus group also show the range of concerns within the realm of such a contested term as sustainability, from full embracement, through vague concern to outright dislike and disagreement with the term and its inherent values (Robinson 2004). That said, the residents in this group clearly understand the foundation of energy efficient aspects in a house and how this connects to the wider understanding of sustainability in the housing sector.

6.2.2.3 Difficulties in Including Sustainability Features

The building sector focus group were unanimous in agreeing that when the house was designed according to the client's wishes, rather than a standard project home

there was a much greater capacity to include energy efficiency through improved design and better uses of spaces. The limited budgets that project home client's tended to have drove their desire for the luxury additions over energy efficient design, and they tended not to be engaged about sustainability, or energy efficiency and were generally disengaged about improving the energy efficiency of their house design to make it cheaper to maintain. In particular they highlighted:

“In Harvest Lakes the houses are all 5/6 stars, yet the house design is all wrong – it doesn't get actual energy efficient outcomes, we need to be using new materials that are better for energy efficiency but Perth consumers are stuck with double brick, so instead we're trying to rectify bad designs, when we need to go back to basics and good design”

“We made sure the homes had the best solar orientation possible for the blocks. We added in skylights, provided locations for rainwater tanks, cavity insulation to most external cavity walls. We also tried to add doors in places where there would usually just be openings to try and avoid larger areas”

“It's all up to what the client wants rather than enviro effect and investors are very apathetic towards whatever energy efficiency feature is available; they just want a house, any design and quickly for as cheaply as they can”

In particular what the building sector focus group highlighted was that in the majority home buyers were initially enthusiastic about including more energy efficient features into their house design, but in the end they were predominantly more keen to have the added 'luxuries' than an increase in energy efficiency.

“Eaves are important, and usually flipping the building to improve orientation etc can be done easily, the market is really conservative and this makes focusing on energy efficiency over the ‘fruit’ almost impossible, the developers usually have someone to talk to about the building guidelines”

This is an outcome that was echoed in the survey of residents of the case study suburbs, with 66.7% saying they had included environmental/sustainability features in the design of the house predominantly because the developer had mandated it; and 33.3% residents said they had not included any extra environmental/sustainability features at all. Many residents felt that on balance the perceived savings that increasing energy efficiency might achieve were not worth the initial upfront cost and preferred to spend their money on the luxury items they could afford then. For many the cost was felt to be inhibiting (the upfront cost rather than the reduced cost to living expenses once installed), or the builder was unhelpful or at worst actively discouraging including any further energy efficiency features other than what was mandated by legislation. The developers in 3 of the case study suburbs had included covenants on the land to encourage light coloured rooves, large eaves, placement of living areas, waterwise gardens, water wise appliances; orientation, insulation, native garden, window placement, 5star gas hot water systems; solar hot water, and solar panels and for many this was the sole motivation for including such features, which for some had been an onerous exercise.

6.2.2.4 Experience of building or renovating and including sustainability features

Respondents to the survey of people building in places other than the case study suburb were questioned about their experience of building or renovating, and were asked if it was a new build, what type of lot was the house built on and 57.1% respondents had built in a new suburb/estate; 42.9% of respondents had built in an existing suburb, whilst none of the respondents had built on a subdivided block. Respondents were also asked whether they had wanted to include energy efficiency/environmental features into the new house design or renovation. 87.5% of respondents reported they had included energy efficient features into their new build or renovation; and 12.5% reported that they had not. The respondents were given space to make other comments and they included:

“Required for EER 6, included water recapture, etc by local government as a building condition”

“I wanted to include energy efficient features however the information isn't readily available, and some features can be costly. Sometimes doing thorough research delays the planning and building process”

Across the two surveys it was clear that irrespective of where people had built their new house, their experience, intentions and outcomes regarding including energy efficiency features into their house design were similar. That is that those features that were mandated by law were included as a matter of course, and in most cases people opted not to include any further energy efficient features as it was perceived to be too expensive, especially without government rebates, the payback time was perceived to be uneconomical, the builder actively discouraged it,

information about particular products or design were hard to find, and the long term economic benefits of reduced living costs from including more energy efficient features were predominantly ignored.

6.2.2.5 Importance of Sustainability/Environmental features in a House Design

There was strong support by survey respondents for including environmental/sustainability features into housing designs but less willingness to pay for it, with comments including:

“...but a lot is expensive, ie solar power, I would like to have it but the initial outlay is a bit steep. It would help if builders or the government made it cheaper. After all it is benefiting everyone”

“It needs to be made mandatory so everyone is on the same playing field when it comes to selling. Once its a normal feature of a modern home people accept then demand certain features, just like we would not buy a house without flushing toilets”

“It’s because today’s government does not seem to have a say on electricity, water and gas prices, they just keep going up. The solar PV system is something that can help balance such price increases. Is also very shameful that we hear WA has a new gas industry but hey why is LPG still going up? Sometimes it’s not about going green, it’s about keeping your cost down. If the government is serious, every new household should have a wind generator and solar PV systems installed. Water tanks should be involved when building a new house rather than after. There should be incentives for buying energy efficient products”

Again this gap between intention and action, otherwise called a ‘cognitive dissonance’ was also found to be the case in other research, in particular the work of Crabtree and Hes (2005, 2006; 2009) and Mapes and Wolch (Mapes and Wolch 2010). Where people felt strongly about a certain aspect, in this case sustainability and care for the environment but were far less keen to spend any of their own money to absolve their concern. Furthermore there was far less understanding of some of the very sound economic reasons for including more energy efficient features into their house design.

6.2.2.6 Changes to the house design post-occupancy

One of the things that a few of the resident’s focus group participants were particularly surprised about was the lack of thermal comfort in their houses, without putting the air-conditioner on. When they were building the house, participants shared that there was very little education provided about energy efficient design principles, and a lack of choice in materials to enhance that. Some of the residents in the focus group said that:

“The design of the layout of the kitchen was not great, we have unexpectedly high power bills, the house is hot in summer, and cold in winter, the front of the houses are deceiving as far as size”

“We use the house in such a way that the spaces are being used, the power increases have influenced the change in behaviour, so has solar power, heaps”

“The house is hot in summer and cold in winter for the most part but it’s a long house and the front rooms are cool in summer, because of the orientation of the house”

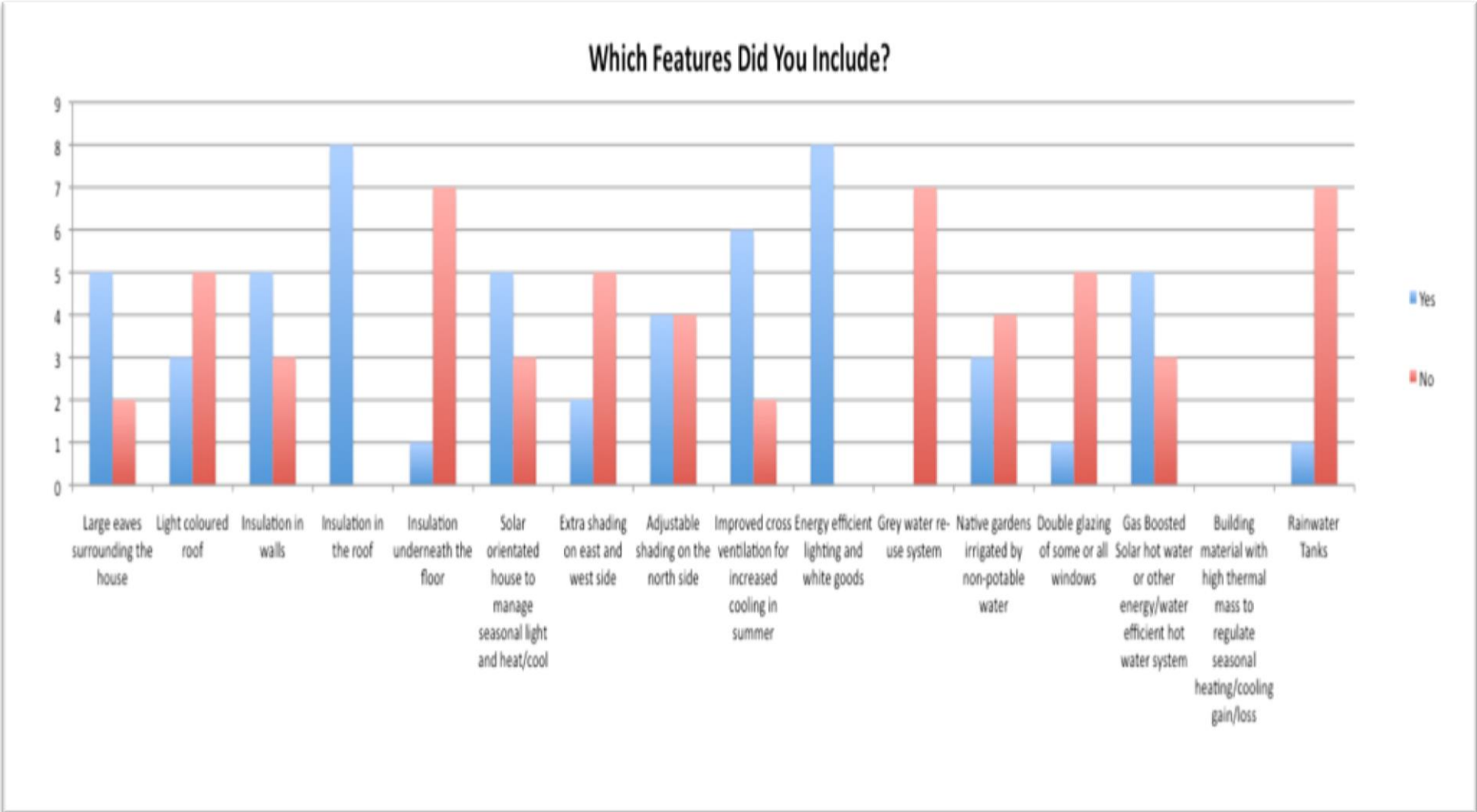
“Access to the garden could be improved, and the layout of the house in relation to the block, would add doors to close off the house to improve heating and cooling”

So despite the house design being rated to 5Star EER the house remained predominantly hot in summer and cold in winter, for most people. Those participants that were educated about energy efficient design found the negotiation process with the building companies to be fraught with frustration, and misinformation in many cases, a finding that Crabtree and Hes’s (2009) research concurs with. That said Crabtree and Hes’s (2009) research and the results from the Residents Online Survey in this thesis also suggests that there is a significant gap in the alleged willingness of residents to pay for energy efficient features in their houses and them actually purchasing them, a finding that suggests a significant ‘cognitive dissonance’ (Marchand, Walker, and Cooper 2010).

6.2.2.7 Energy efficient features in house design

Survey respondents were asked what particular energy efficiency features they did end up including in the final built design of their house (see Figure 17):

Figure 17: Energy Efficient Features Residents Chose to Include in House Designs



The energy efficiency features that all respondents included was roof insulation and energy efficient lighting and white goods, which are features that are mandated by the BCA's EE criteria. Interestingly however only 62.5% respondents reported including a gas boosted solar hot water or equivalent energy efficient hot water system while 35.5% said they did not. 71.4% respondents said they had included large eaves surrounding the house, while 28.6% said they had not. A light coloured roof was included by 37.5% respondents and was not included by 62.5% respondents. Insulation in the walls was included by 62.5% of the respondents and not by 37.5%, whilst only 12.5% included insulation under the floor. Solar orientation was only included by 62.5%; extra shading on the east and west sides was added by 28.6% respondents; adjustable shading on the north side was included by half the respondents 50%; improved cross-ventilation was included by 75% of respondents; and only half the respondents reported building their house with a material that had high thermal mass 50%.

6.2.2.8 Experience of including energy efficient features

Respondents were asked about their experience of including energy efficiency features into their new build or renovation, and a typical response included:

“It is harder 5 years ago in renovating to an environmental design than it is today. We are building a new home in one years time and the new home is completely environmentally friendly. It is easier to do it today than say 5 years ago when it was not an affordable option”

6.2.2.9 Whether sustainability features in their suburb influenced purchase.

Question 8 asked respondents – ‘if you bought into a suburb with environmental/sustainability features that were advertised by the developers, did such features have anything to do with your decision to buy in the area?’ – 62.5% of the respondents said the environmental/sustainability features did influence their decision, and some of the responses included the following:

“Orientation of blocks, lots of trees retained, building guidelines”

“Trees and walkways”

“Booklets on maximising house construction in regards to environment/sustainability, landscaping advice. Covenants with house design, positioning to maximise sunlight. The green focus on waterways and parklands. Enviro conscious newsletters emailed monthly by the estate”

Of the 31% of the residents that said the environmental/sustainability features did not influence their decisions to buy into their ‘green’ marketed suburb, the majority said that the location was more important than anything else was, while 2 people said that sustainability/environmental features were not advertised or mentioned at all.

The range of understandings and opinions regarding sustainability more generally, and energy efficiency in housing in particular, gathered in this research has highlighted a clear gap between intention and action. There is no lack of understanding of what such energy efficient features and products might be, but a lot less capacity or action in actually including them in the final build of the house. To be fair this research has also highlighted that builders have been an inhibiting force

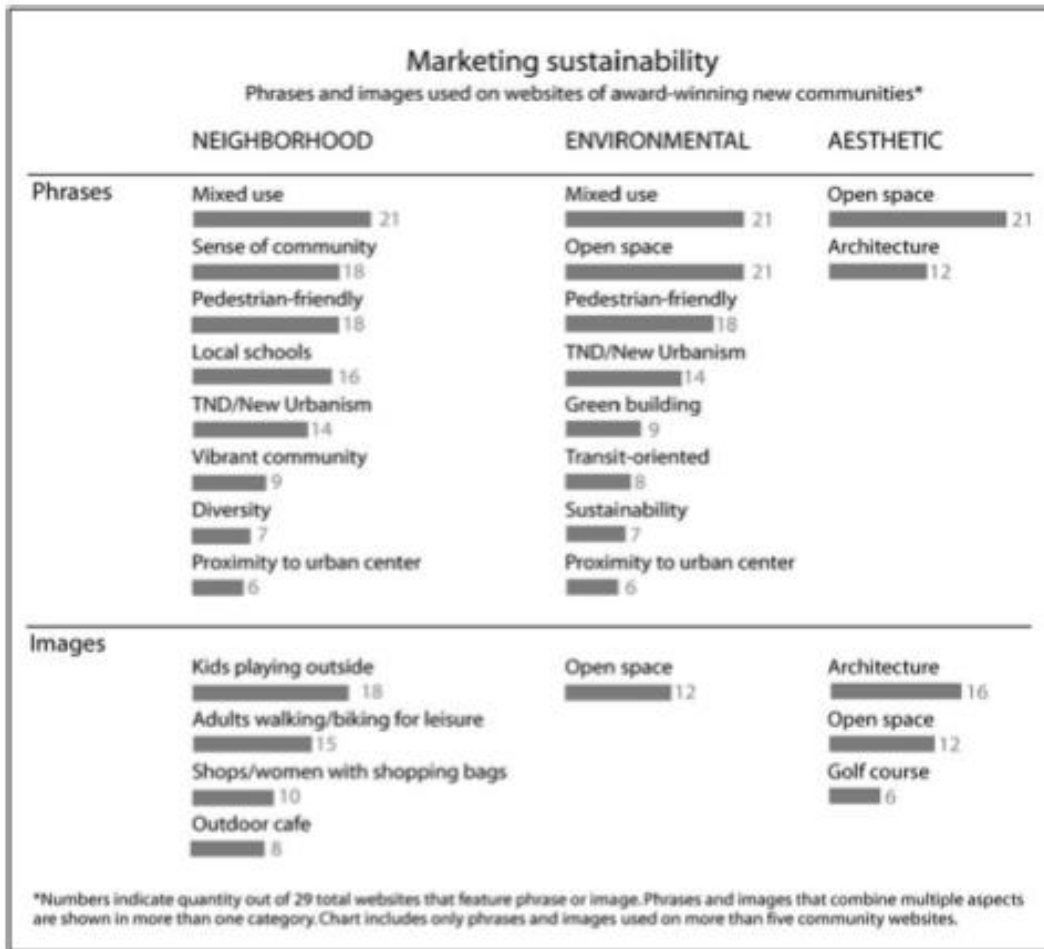
in this happening more readily; however clearly other aspects of the house design are far more important drivers than sustainability.

6.2.3 Perceptions of 'Green' Marketed Suburbs

The understanding and perceptions of sustainability has been an important aspect of this research's investigation. The recent research of Mapes and Wolch (2010) found three overall common themes when developers marketed 'green' suburbs/communities (see Figure 4). Across all 29 of the 'green' marketed communities that the authors studied, neighbourhood/place-making, environment and the aesthetic of the community were found to be common themes in their marketing. From the data collected for this thesis, it is clear that developers in Perth, are using similar themes to Mapes and Wolch's (2010) to market their 'green' suburbs and are concentrating on emphasising 'community', 'environment' and the 'the feel' of the place, moreover residents are talking about sustainability using similar themes.

Whilst this research did not use this particular research technique, during the interview process some informal gathering of advertising themes was conducted. An examination of each case study developer's advertising materials for this research revealed very similar words and images to portray 'sustainability' or 'green-ness'.

Figure 18: Phrases to Market Sustainability



Source: (Mapes and Wolch 2010, :112).

6.2.3.1 Lifestyle Changes to Match New Environmental Understandings

Respondents in the residents survey and focus group, were asked if they had made any other lifestyle changes to match their new understanding of energy efficiency and considerations for the environment, and some of the comments included:

“I did not explicitly consider environment/energy efficient features as requirements for building my home and therefore, it was unlikely that I would change my behaviour based on the standard environment/energy efficiency aspects of design. In general, environment/energy efficiency are not now, nor have they been in the past, a concern for me”

“We only have one car and my husband rides his bike to work everyday”

“We are planning to install PV cells in the near future. - We are using more eco-friendly cleaning and personal products. - Making more of an effort to buy groceries locally produced where possible, and those with less packaging”

40% respondents said that they had changed their behaviour through walking /riding children to school instead of driving them; and 60% suggested that they were already living a more sustainable lifestyle so they hadn't made too many more changes.

In the residents focus group participants were more likely to be positively influenced by the environmental features advertised for the suburb, and some residents even admitted to camping out overnight to secure a block for purchase. For the most part the features that participants noted as influencers were the physical design aspects and the more pragmatic notions of price, even though some of those design features were also what the suburb was highlighting as what made them more 'sustainable'. The literature has already suggested that the implementation of sustainability features is a high risk activity in a tight residential housing market, and that there is a significant lag in uptake time of such features (Crabtree and Hes 2009; Nielsen et al. 2009). However as Nielsen et al. (2009) suggest there is also a considerable impasse between building companies and consumers as to the uptake of more sustainable/energy efficient features, as each waits for the other to take the lead. Furthermore once again, Crabtree and Hes's (2009) research indicates that there is a gap in potential consumer intentions to

include more sustainable options in their housing and what they actually do in practice.

6.2.3.2 Lifestyle changes since buying into their suburb

Despite the criticisms of the Liveable Neighbourhood Policy that has influenced the design of these green marketed suburbs (see (Fainstein 2000; Falconer, Newman, and Giles-Corti 2010)), every participant agreed that their lifestyle had changed since moving to their suburb. For the majority of participants that change incorporated a reduction in driving to ancillary family activities such as schools, convenience shops and medical centres, in addition to the community bonds that they had been able to create among neighbours that they hadn't experienced in other areas. This phenomenon was also found to be present in the adjacent non-green marketed suburb. Comments included:

“...hanging out as neighbours, children get along, kids can rock up in their pjs”

“...we're all close and we spend lots of time together but we don't live in each other's pockets, but its great to be able to walk to school etc, car costs are reduced, no poles they're all underground”

“...it's not the suburb it's the people, but we have connections with families around the suburb, at the park etc...the amenities are excellent, being able to walk to the shop and drs”

“...it's the perfect balance – and it happens in other streets in the suburb”

This was a surprising finding as much of the research around New Urbanism and in particular the government's Liveable Neighbourhood's Policy has suggested that new suburbs aren't getting the kinds of outcomes that they were intending to get as

far as reduced car use and community interaction (Fainstein 2000; Falconer, Newman, and Giles-Corti 2010).

6.2.3.3 Importance of the Sustainability Marketing to the Consumer

There was a unified agreement among the Project Managers during the interviews, regarding the importance of having sustainability features in their suburbs. Project Managers were asked how important was environmental sustainability features in their development and their comments included:

“They are key for differentiating this development with the other ten developments or 12 in Baldivis. It is very important to our organisation in terms of implementing initiatives and testing initiatives to see one whether they make a difference to the environment and two, if the purchasers embrace them. It’s important to our organisation and our partners in terms of showing that we don’t just talk the talk, we walk the walk”

“From a marketing point of view sustainability was the focus. Even now you will see we have used the frogs on all the marketing information and in fact we are just about to launch a new presentation about our marketing for the estate, which is gum nuts. It has some existing river gum trees, which are not endemic to the area - they were planted – we kept those. It has some limited amount of bushland, which we have tried to keep elements of, but there were only small bits of bush. I think it is important in terms of marketing of the differentiation of the product”

“When you look at sales – if we didn’t have any ‘green’ focused marketing we would still get sales but we wouldn’t get anywhere near the volume that we get...They probably don’t come in and say they are buying because of this but when they drive

in they will just get a feel for what it is like and they might not specifically think it's the environment that they are protecting so from that side of things it is of key importance. I think people realise that if they buy in our suburb then their property may be a little more valuable than those people across the road simply because the quality is of such a high standard. And I think the growth would be a lot higher potentially over time. And I guess it is fairly obvious straight away that some thought has gone into the whole development as opposed to the other examples"

The UDIA's Environment and Sustainability Committee members returned a range of comments regarding the importance of environmental/sustainability features in their respective developments:

- "We plan to market the development as an eco resort"
- "Not a huge selling feature as far as I can recall"
- "Important - people are more prepared to live on smaller blocks, although the houses are getting bigger - need to find a good balance for different size lots"

Interestingly though, the Project Managers all agreed that whilst those features were important in differentiating their product, and ultimately selling their product, it was of minimal importance to the consumer. This was a finding that has also been reflected in the research of Mapes and Wolch (2010) in North America, where it was also found that those homebuyers interested in 'green' marketed housing developments were not at all interested in the sustainability features.

6.2.3.4 General Opinions on Sustainability in Suburbs

Not surprisingly perhaps, there was full support from the Project Managers and the UDIA Committee for including sustainability features into suburbs and developments; however with some acknowledgement of the need to balance the business case to the consumer and the overall desire to be a good corporate citizen in the community. Project Managers were asked whether they thought including environmental and sustainability features in housing developments is important?

“Of course it is very important. I think if the purchasers don’t want to embrace them then we have to do it on their behalf. But what we need to see, we need to see regulation catching up with initiatives of these developments because embracing them, because the purchasers are not embracing them we are and then some of our competitors are not is putting us at a competitive disadvantage. And that disadvantage is being borne at the moment because we see the long-term benefits of differentiating ourselves but that will only last so long. It will wear to thin eventually, not yet but the day will happen so we need to drag everyone up with us”

“Yes, without question it is. And I think it is just a question of how far do you go at each point in time. How far can you go? One of the observations we’ve got is that we have won some Government projects and you actually have to tell them what you are going to do from an environmental and sustainability point of view. By the time you actually get to build the project, what you have actually offered to them is like yesterday’s stuff – no one is interested. So you then have to basically come up with a whole bunch of new ideas that weren’t part of the submission when you won the project”

“So you can sit round as a developer and go well we don’t really want to offer all this because this is really making things hard and we don’t know whether the market will accept it. But then you look at it and say it’s going to take 2, 3, 4 years before we get there and by that time this will be yesterday’s stuff, no one will be interested in that. And then we will have to do something else”

“I think there is bit of a point you get to where people don’t start seeing the value in it. You can do so many things and people go I like that and they get to a point when they say I’m going to have to pay for that and I’m not really willing to. I think there is an estate, I’m not sure which one it is, that you aren’t allowed to have turf in your front yard, just all mulch, so they have gone really water sensitive, rain tanks, everything like that, and they just see it as I don’t want this mulch in my front yard, I don’t want a water tank, it’s going to cost me more money, I’m not prepared to pay for it. So there is a certain point you get to when you say it is not really going to generate more sales so it is probably not worth the extra outlay”.

The members of the UDIA’s Environmental and Sustainability Committee reported that including sustainability features into a development was important because:

- “Overall because our practice philosophy is we should become producers and not consumers”
- “Environmental features - Better sense of place for residents.
Sustainability Features - more efficient energy and water use”
- “Yes - we all have to make a contribution to more efficient living and reduce our carbon footprint”

The issues that have been highlighted previously in this chapter highlight a common problem within the sustainability field. That is: what is sustainability and what is guiding us do? In addition such comments highlight and reflect much of what the literature has suggested, that sustainability has a significant marketing cache and people and developers are keen to take advantage of the creation of a new niche market, and residents are keen to get on board such new developments. While some of the developers have a sustainability focus that is echoed in their policies, and the developments that have been created are showing potential to be a more sustainable alternative to standard suburb developments, they must still exist within a political and policy environment that to date has yet to achieve the actual sustainability outcomes it professes it wants. Clearly there is also a significant 'attitude-behaviour gap' within the development sector too – what developers say they want to do in a development in regard to sustainability and what actually happens in practice is usually very different (Marchand, Walker, and Cooper 2010; Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010).

6.2.3.5 Resident's understanding of their 'green' marketed suburb

Question 4 asked respondents whether they had built their house in a suburb or estate that had won awards for being 'green' or whether it been specifically marketed as a 'green' alternative. Interestingly, 38.1% of respondents said that either they did not know or they definitely did not build in a 'green' marketed suburb! Admittedly the most obvious 'green' marketing was in the Evermore Heights suburb, whose residents were unable to be surveyed at the time of data collection as the houses were yet to be even built, and they may have exhibited greater knowledge of their suburb's more obvious 'greenness'.

6.2.3.6 Reasons for Buying into their Suburb

When respondents were asked why they had bought/built in the suburb, some residents mentioned 'environmental consciousness' of the estate as one of the reasons for building in the suburb. Some of the answers included:

"I built in the first release of the estate and it looked like it was going to be an exclusive estate with all its high building covenants; I liked the outlook over the lake and the entrance into Rivergums Estate; Semi-rural appeal, environmentally friendly estate, easy access to Perth, Mandurah & beaches; attractive sub-division with ample parks and walkways; the trees at the front of the estate and the location; good landscaping, good land packages"

"Close to family; growing area; location plenty parks and gardens; it's a beautiful place to bring children up in; very nice location - very good looking estate – cheap; aesthetically pleasing, environment conscious, parklands, family atmosphere, amenities, awards, value for money; looks green, have a park, play ground and school; Nice feel to the suburb; good access to main roads. e.g Freeway. - Planned development within estate e.g shopping centre, primary school, sports oval - location - It was a nice looking estate; Just really like the feel and layout of the area"

Some other comments included:

" ...Trying to teach kids about – some of resources are currently in abundance but not for long, you don't need to blatantly waste things, and use the house energy efficient, don't use the air-conditioning all the time, pull out the plugs and turn off appliances, low chemistry"

“...Very concerned but frustrated because I don’t have time, and having to live with lots of people in the house who don’t all feel the temp in the same way, use the air con to cool or heat the house”

“We’re teaching about consequences, about being educated, and everyone doing a little bit, and controlling what we do ourselves”

All but one resident in the focus group suggested that sustainability and environmental consciousness was important to them and teaching that to their family was a priority.

6.2.3.7 Government action to achieve environment/sustainability

Nielsen et al. (2009) make the point that governments can be an integral part of promoting and the take up of more sustainable design options, and more energy efficient design features. There was certainly an expectation by the residents that governments could be doing more to encourage increasing sustainability within housing and suburb design, especially around the issue of solar panels and their associated rebates, and some of their comments included:

“Government’s should provide solar panels through a payment scheme so that more people can afford it”

“Government could be investing in a public forum, drop the price of the solar panel”

“More incentives for solar panels etc, the education for everyone”

“Education for kids and adults about sustainability and resources use, when they allow the suburb so that houses are passive solar, not pulling out of the rebates for solar panels etc”

So despite the perceived difficulty with including more energy efficient features into their houses, focus group participants reported actively teaching/demonstrating more sustainable living choices to their families; however it was suggested that one of the difficulties with being more energy efficient in their houses was the lack of real time feedback about usage and a general lack of awareness or perceived care by builders to increase the energy efficiency of the houses.

One of the main issues that the research of Crabtree and Hes (2009, :223) highlights, and is confirmed in this research, is that the “barriers to the integration of sustainability into the housing markets are mainly institutional ones rather than technological ones” and that “sustainable housing technologies are being successfully developed, but their rolling out is being stymied by issues of awareness and communication”. Moreover, among residents there is an implied expectation that governments should be providing more support for the more expensive sustainability features such as solar panels.

So while in general resident’s views from the online survey and the focus group showed a concern for the environment and a basic understanding of sustainability, the respondents to the online survey were far less engaged in changing their behaviour to align with the sustainability principles marketed in their suburb. The focus group members however demonstrated a more sophisticated understanding of sustainability in their suburb and how it influenced their change in behaviour.

6.2.4 Non-compliance to Building Guidelines and BCA Issues

In all of the case study suburbs, a strict building schedule process is supposed to eradicate this issue of non-compliance with the covenant requirements. Yet as the

sustainability indicator tool has shown, houses are still being built with black roofs and limited eaves in all the case study suburbs. One of the local governments suggested that:

“Whenever there’s a condition in place like that then the building department would be involved. And the issue for them is how do they make compliance, so they’re reluctant not because they can’t ask for it, it’s more a question of they know they can’t police it... and that in itself is a big stigma. Local Government will always be considered to never have enough resources”

Whereas another local government suggested that:

“A lot of the designs come through our building department for approval, and they had quite a lot of resistance from the builders about them. Some of the applicants were first home buyers and had to get their approvals in first and any changes to the basic design templates caused problems because the builders would say they were building to a budget and they can’t meet these guidelines”

The building sector focus group all reported that they hadn’t experienced any issues in meeting the building guidelines of any of the case study suburbs, that all of their house designs met those and usually exceeded them. That said this particular builder has a number of house designs that exceed the minimum star ratings as standard, unlike the majority of other building company house designs available in the project home displays in each of the case studies, the majority of which displayed either a dark roof or minimal or no eaves.

6.2.4.1 Perception of the BCA's Energy Star Rating tool's effect on actual energy efficiency of current house designs

It was also surprising to hear that the building designers were unanimous in their criticism of the effectiveness of the EER Star Rating tool in achieving actual energy efficiency outcomes. While they did suggest that insulating the walls would make a difference, the fact that how the house was used had a far greater bearing on the actual energy efficiency of the design meant that whatever measures were taken to increase the star rating would only be worthwhile if the house was used properly. The participants all agreed that the conservative nature of project home buyers, and their lack of engagement in energy efficient design meant that they relied on air-conditioning to moderate the thermal comfort of their house rather than through their behaviour in using the house. Some of the comments included:

“It has no effect on actual energy efficiency what so ever”

“Can make any house comply with rating - by insulation in walls but once it goes to 7 star will have to be more creative; it's added another layer of complexity to get just the admin for the star rating, the legislation was in need of fixing/changing but the double load of the extra star rating and additional layer of administration made it significantly more difficult with no increase in actual environmental outcomes”

“...it loses out in terms of the way it expects you to run the house perfectly to achieve this star rating i.e. leaving doors open throughout the house changes everything, along with what windows are open, whether or not you have blinds always open or closed etc. There are many variables in the house that can change. The 6 star rating is based on the house being run perfectly. Once the

house is actually occupied in many cases the house may be getting ran at a 3 star rating. It all depends on the occupants of the home to what star rating the house is actually ran at”

This reflects the findings of Williamson et al. (2010) whose research has highlighted that there is a significant flaw in the way in which the star rating system (EER tool) for house designs deals with the actual lived experience in a house. Moreover because the EER tool rewards house designs that have air conditioners at the expense of those that don't (including passive solar designed houses), Williamson et al. (2010) argue that houses are being built that actually require air conditioning to be habitable rather than it remaining as a luxury add on. This phenomenon has also been reflected in the everyday experience of residents living in their 5Star rated houses, with limited understanding of how to be an active participant in establishing the thermal comfort within the house without relying on air conditioners, and finding that the running costs of such houses are significantly more than they expected.

6.2.4.2 Take up of Developer Incentives

60% of residents surveyed said they had not been offered any incentives by either the developer or the builder to incorporate environmental/sustainability features into the design of their house; yet all respondents said they would have taken up those incentives if they'd been offered. A number of respondents came from Newhaven where the developer had elected not to offer incentives because of the difficulty with compliance, however a number of the residents from the other two suburbs that were offered the incentives did not know about the offered incentives. For the residents who were offered incentives, the main incentives taken up

included waterwise landscaping and a \$1200 rebate if the building guidelines were complied with.

The issue of non-compliance to some of the more important building guidelines highlights a major gap in implementation of sustainability and energy efficiency in suburbs. Despite the efforts of developers to establish clear guidelines for energy efficiency and sustainability in house and suburb design, consumers are opting to go against those guidelines and there appears to be very limited compliance protocols in place to prevent this, and local governments have no power to force compliance unless it contravenes the BCA or their own local planning strategy. Whether consumers are opting for dark roofs and limited eaves from a lack of understanding of the influence they have on energy efficiency or purely on aesthetics is unknown. The main problem with these two features being overlooked is that they have been shown in the literature to have a significant influence on energy efficiency and thermal comfort levels, yet while the BCA energy efficiency ratings fail to address these two important aspects of design energy efficiency in average project homes will be far less than it could be.

6.2.5 Quantitative Measures of Sustainable Living

In the online survey of residents of the case study suburbs, a number of questions focused on the more practical lived experience, in particular on the use of resources within the house. 50% of respondents have 2 people living in their house, 10% of respondents said they lived alone, whilst 40% had 3 or more people in their house. 47% said that they use between 0-100 litres of water a day, while 40% said they used between 101-400 litres of water a day and 14% people used more than 501

litres of water a day. 43% respondents reported using 6-10 units of gas per day on average, while 35.7% reported using between 1-5 units of gas per day. 22% respondents reported using more than 16 units per day on average. Recent ABS data suggests that household energy user person (electricity, gas, wood, petrol etc) increased between 2001-02 and 2005-06, but fell from 2005-06 to 2006-07 which was attributed to the national drop in the used of refined products such as petrol and diesel despite a rising population (this would relate to the period prior to the GFC) (Australian Bureau of Statistics 2010b).

53% reported having a house that was between 201-250 square metres in size, a figure that is also reflected in recent ABS data that is suggesting that the average size of houses in Australia is now close to 250sqms (Australian Bureau of Statistics 2007). The number of cars owned per household again reflects similar data found by the ABS, in that most houses have at least 2 cars, in the case of the respondents 72% had 2 cars and 29% households have more than 3 cars. Again reflecting ABS data about the average commuter mode of transport, the private car is used by the majority of respondents, in this case 80% (Australian Bureau of Statistics 2008d). Public transport was used by 30% of residents. Given that the majority of households had 2 or less people in them, it's not surprising that this question didn't apply to so many respondents. However of those households that do have children the majority of them are driven to school, and again this is probably not surprising given that Harvest Lakes is the only suburb with a primary and high school that is open and within the district. All respondents said they used their car to do the household shopping, and given that for the entire case study suburb the grocery shops are all at least a few kilometres away this is not surprising. Interestingly public

transport and active transport use was comparatively high, with 50% of residents saying they used public transport, walked or cycled to their activities and destinations at least once or twice a week, whilst 8 residents said they never or hardly ever walked, cycled or used public transport.

6.3 Conclusions

In Chapter Five the development sector was explored to understand how developers incorporate sustainability features into suburbs that have been explicitly advertised as 'green', 'eco' or 'sustainable'; and it was made abundantly clear through the data collected that while developers of 'green' marketed suburbs have achieved some of the sustainability outcomes that they marketed, many of the basic energy efficient building guidelines were not complied with in the design and development of the residential houses. In this chapter the focus has been on understanding the built form examples that are provided in the project home display villages (or designs made available by particular builders), and the range of housing designs that are available in the case study suburbs, and particularly how they incorporate or not sustainability features. What has been overwhelmingly agreed by designers in the building company that were interviewed, is that the time is well overdue for the building industry to be doing something different in housing design and marketing. There was a certain amount of cynicism on the part of the professionals in believing that Perth consumers are willing or educated enough to grasp the necessity of building houses that are more energy efficient, or in using their houses in ways that are more energy efficient. The designers all suggested that the average project home consumer is not engaged or interested in making sure

their house is as energy efficient as possible, that in fact clients are far more interested in getting the most they can for the least amount of money. In addition it was also widely agreed that while the intent of the EER Star Rating tool was necessary and important, that is to increase the energy efficiency of the building stock, it was not achieving that and couldn't the way that it was currently administered and designed.

An issue that wasn't directly covered by the focus group or email interview questions was the difficulties that occurred for the building industry at the time of the change from five to six stars for the EER. Up until this discussion the anecdotal suggestion has been that the building industry is lax about improving energy efficiency in housing designs generally, actively resists change towards this and have been a barrier to more sustainable, energy efficient designs becoming mainstream. However this view would seem to not be the rule, or at least the building companies that responded were the exception to the rule. That said, the period that ensued the change of increasing star ratings culminated in a change in legislation in WA that had far reaching effects for the building industry. According to the members of the focus group it wasn't the increase in stars per se, nor the change in legislation, it was the fact that the changes implemented an additional layer of administrative complexity to what was previously an in house capacity for most building companies. In other words the change from the star rating being able to be 'deemed to apply', where the requirements for a particular star rating could be determined in house with certified staff members already on hand, became one where an outside contractor was required to gain certification for a particular star rating. Thereby adding another layer of administration and cost on to what had

previously been a comparatively simple and inexpensive exercise. All of the focus group participants suggested that such a change could have been willingly taken on if the additional burden of cost and administrative complexity had achieved an actual increase in the energy efficiency of the building stock, but to date the participants felt that this was not the case.

As far as the four case study suburbs are concerned, the developers would like buyers to make the connection between 'green', 'eco', 'sustainable', 'back to nature', 'live naturally' and other similar phrases, and sustainability and environmental awareness as the literature would define it. The difficulty in this context with making an outright analysis between what is marketed and what is fact in practice is that all of these suburbs are still in development, with essential services still to be incorporated and the sustainability of the suburb is ultimately influenced by consumer decisions. Moreover, because these suburbs are embedded within a much larger planning framework, their ability to influence wider infrastructure decisions to be more sustainable is limited. Quite naturally the developers of the four case study suburbs have concentrated on those sustainability features that are easiest to do, quantifiable to a certain extent and most obvious – namely: water sensitive design, prioritising for solar orientation, retaining remnant trees and creating a sense of 'place' and 'community'. To a lesser extent, and with much less obvious marketing, all the suburbs are walkable and with greater access to public transit systems could provide residents with a real alternative to the private car. Once essential services are in place there will be much more opportunity to walk or cycle there, and potentially work closer to home. However all of this is ultimately influenced by the capacity of residents to change their

behaviour towards living a more sustainable lifestyle and that again is not something developers can control.

Overall, the sustainability indicator tool established that as far as the design of each suburb is concerned, the case study suburbs have the potential of being more sustainable than older suburban design. They are all walkable, with good access and excellent community spaces, and they have all concentrated on retaining remnant bushland and tree species to balance the usual tree loss for developments. The two oldest suburbs, Harvest Lakes and Rivergums have residents associations and all the developers have retained a strong supportive presence in the suburbs – all factors that the literature suggested were important for creating more sustainable settlements.

By virtue of the influence of the Department of Planning's Liveable Neighbourhoods Policy, many of the sustainability features agreed upon in the literature as important, are now mandatory, such as encouraging active transport over motor transport through improved urban design, public transport access within an 800m radius wherever possible, emphasis on place making, community spaces, mixed housing types and mixed use land uses, and 'eyes on the street' to design out crime potential (Department of Planning 2008; Falconer, Newman, and Giles-Corti 2010). That said the developers in each of the case studies have certainly created communities that are liked by their residents as evidenced in the resident's online survey conducted for this research, and given better support by government and industry each suburb at the very least has the potential to be more sustainable than the average suburb. Unfortunately there are a number of indicators of sustainability

that the developers have very limited influence or control over and they include: environmentally conscious waste disposal and recycling, reusing and recycling everything, energy efficient buildings, minimising waste, reducing latent heat, mass transit/transport management and reducing pollution. However despite this developers can potentially create the right atmosphere and environment for such indicators of sustainability to be implemented in the longer term by: having built in space or room for infrastructure to allow for a community wide waste recycling/reusing process, connecting and working with local government to enhance the recycling program already in place in most suburbs, working to educate builders and consumers about the need and benefits to creating low-emission, energy-efficient houses.

The resident's lack of compliance to the building guidelines in three of the four suburbs has significantly inhibited the ability of the developers to create communities that are a more sustainable alternative to traditional suburb design. Unfortunately currently there is an aesthetic value being placed on dark roofs and walls and limited or no eaves by consumers and designers that developers have limited influence on. Arguably, with more stringent EER tools, the building sector will be obliged to provide a more sustainable product and limited eaves and dark roofs will be a thing of the past. Overall it can be seen that there are some significant gaps in the capacity of developers being able to provide a suburb alternative that is completely 'sustainable', although the case study suburbs have certainly highlighted that there are some significant changes to the way in which 'green' suburbs are being developed and subsequently used compared to the standard suburb offering. That said what is also abundantly clear is that there are

some serious issues in the implementation of policies from the federal, state or local government and few policy or regulatory mechanisms to assist in these actually working together.

CHAPTER 7 Discussion and Planning Implications

7.1 Introduction

Suburbs are part of the current mainstream expression of the built environment, in and around the metropolitan area of most cities and urbanised regional areas in Australia (Department of Housing and Works 2007; Grace 2007; Ambrose 2008; Crabtree and Hes 2009). They tend to be multi-lot developments, with 4 bedroom 2 bathroom single-family homes making up the majority of the built form in each suburb, although that is beginning to change (Australian Bureau of Statistics 2007; Department of Housing and Works 2007). In recent years the style and range of houses available has begun to reflect new understandings of the impact the built form or land uses has on the environment in particular, and the economic and social sustainability of suburbs and cities more generally (Newman and Kenworthy 1999; Australian Council for New Urbanism 2006; Beatley and Newman 2009; Newman, Beatley, and Boyer 2009; Beard 2009). For the most part this is being expressed through a trend towards more pedestrian friendly communities, a wider diversity of housing from small villa/townhouse developments to low rise apartments and the availability of shop top housing (Keilar 2008; Birch and Wachter 2008; Curtis 2008; Council of Australian Governments 2009; Falk 2009b; Frey et al. 2009; Rees 2009; Marshall 2010).

This research has sought to understand the actual sustainability outcomes of 'green' marketed suburbs in Perth, as a way of exploring the capacity of developers and governments to deliver a more sustainable alternative to the way suburbs and communities have been developed in the past.

7.1.1 Research Outcomes

The early chapters in this thesis established the background and the need for research into 'green' marketed suburbs, highlighted the reasons why this research is important, and explored the literature about sustainability in urban design and the built environment. The Department of Planning's Liveable Neighbourhood Policy has changed the way suburbs have been designed and implemented in recent years ((Department of Planning 2008; Western Australian Planning Commission 2007). Whilst there is little available research on the impact on the built form of these changes in the design and execution of suburbs, there has been a move towards providing more choice in house size and styles with the availability of 'cottage' and townhouse developments (Australian Bureau of Statistics 2010b). Despite this, a cursory look in the weekend papers will show that the large 4/5 bedroom house with two bathrooms, a theatre room, a living/dining/kitchen area, two bathrooms and two garages is still very common. Given that more than 30% of homes in Perth house couples or individuals there is a serious question about the investment implications in the future of such over capacity in the Australian housing stock (Grace 2007). The building sector focus group were unanimous in agreeing that when the house was designed according to the client's wishes, rather than a standard project home there was a much greater capacity to include energy efficiency through improved design and better uses of spaces. The limited budgets that project home client's tended to have drove their desire for the 'luxury' additions over energy efficient design, and they tended not to be engaged about sustainability, or energy efficiency and were generally unengaged about improving the energy efficiency of their house design to make it cheaper to maintain.

7.1.1 Indicators of Sustainability in the Case Study Suburbs

In Chapter Three it was identified in the literature that there were a number of criteria that made suburbs sustainable. Overall, the sustainability indicator tool established that as far as the design of each suburb is concerned, the case study suburbs have the potential of being more sustainable than older designed suburbs. They are all walkable, with good access and excellent community spaces, and they have all concentrated on retaining remnant bushland and tree species to balance the usual tree loss following developments, and some have strong residents groups supported by the developer.

By virtue of the influence of the Department of Planning's Liveable Neighbourhoods Policy, many of the sustainability features agreed upon in the literature as important, are now mandatory, such as encouraging active transport over motor transport through improved urban design, public transport access within an 800m radius wherever possible, emphasis on place making, community spaces, mixed housing types and mixed use land uses, and 'eyes on the street' to design out crime potential (Department of Planning 2008; State of WA 2009; Falconer, Newman, and Giles-Corti 2010). That said the developers in each of the case studies have created communities that are liked by their residents as evidenced in the resident's online survey conducted for this research, and given better support by government and industry each suburb at the very least has the potential to be more sustainable than the average suburb. Developers can potentially create the right atmosphere and environment for such indicators of sustainability to happen in the longer term by: having built in space or room for infrastructure to allow for a community wide

waste recycling/reusing process, connecting and working with local government to enhance the recycling program already in place in most suburbs, working to educate builders and consumers about the need and benefits to creating low-emission, energy-efficient houses. The following list of indicators obtained from the literature review of sustainability in suburbs is addressed with reference to the case study suburbs, and as a way of answering the third research question.

7.1.1.1 Open space and public parks

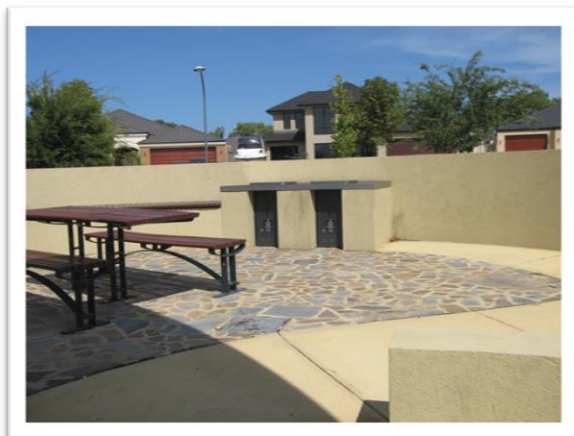
All four case study suburbs have concentrated on providing community spaces, places for barbecues and gatherings, play areas and walkable thoroughfares to encourage people to be active. In the case of Harvest Lakes and Rivergums the developers have supported the establishment of Residents Associations that meet regularly to deal with the ongoing issues of living in the respective suburbs; as well as community gatherings on important dates such as Australia Day, the Festive Season and casual get togethers. These activities help to create a sense of 'place' and 'community' that make living in such suburbs more attractive than the traditional suburban community (Bealey 2004; Mapes and Wolch 2010).

Photo 20: Harvest Lakes Open Space



Source: K.Ringvall 2010.

Photo 21: Newhaven Open Space



Source: Kate Ringvall, 2011.

The Liveable Neighbourhoods Policy emphasises ‘place-making’ (see Chapter Three for a discussion of this) as an important and vital aspect of any sustainable settlement (Department of Planning 2008). Creating walkable community spaces and public open spaces helps people to connect and establishes a sense of ‘community’ and a ‘place’ and once the subsidiary services are in place it encourages people to walk there rather than drive (Marshall 2010; Mapes and Wolch 2010). This aspect encompasses the meanings inherent in social sustainability, where communities are being created that encourage inclusion and social capital.

Photo 22: Evermore Heights Open Space



Source: K.Ringvall 2010.

Photo 23: Rivergums Open Space



Source: Kate Ringvall, 2011.

In Newhaven Stockland has retained stands of remnant trees in random places around the suburb, which helps bring shade and perhaps in some small way retain the habitat for native species.

7.1.1.2 Urban forestry or bushland

The Developers in all four suburbs have also concentrated their focus on retaining remnant bushland or stands of original trees in the suburb, and have used this aspect strongly in the advertising of their suburb product (see Fact Sheets). In particular, Newhaven and Evermore Heights have retained the natural topography of the land, and used it to create interest in the visual aspect of the design of the suburb.

Photo 24: Topography of Newhaven and Evermore Heights



Source: K.Ringvall 2010.

Photo 25: Harvest Lakes Open Space



Source: Kate Ringvall, 2011

Photo 26: Newhaven Open Space



Source: Kate Ringvall, 2011

7.1.1.3 Water management

The use of drought tolerant plantings around the suburb and the now ubiquitous Water Sensitive Urban Design (WSUD) is an important aspect of all four suburbs (see Fact Sheets and Interview Transcripts). Evermore Heights and Newhaven have both won Water Corporation awards for the innovations in the management of storm water and run-off.

Photo 27: Evermore Heights Raingarden



Source: K.Ringvall 2010.

Photo 28: Evermore Heights Curb Raingarden

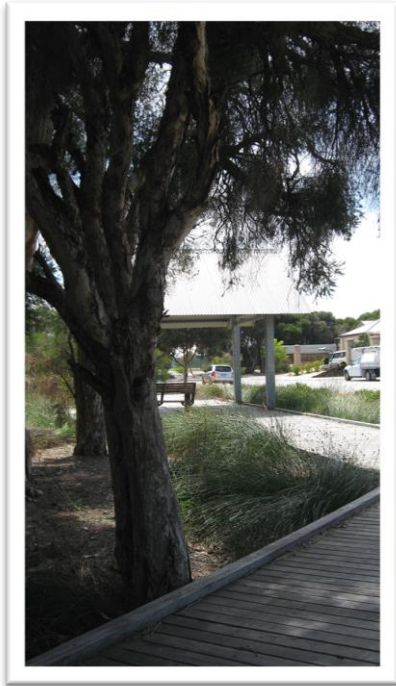


Source: Kate Ringvall, 2011.

Evermore Heights in particular, has developed what they term a 'rain garden' to channel and filter storm water and residential irrigation before it soaks through to the ground water. This system uses indirect reuse of storm water through a process called 'managed aquifer recharge', which involves the 'infiltration of injection of treated wastewater into superficial aquifer, and its recovery from bores down gradient of the infiltration system' (Grace 2007).

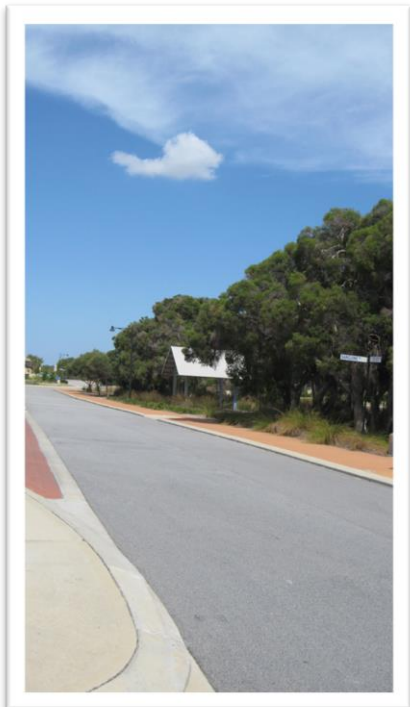
All four suburbs have encouraged residents, through either education or incentives, to plant predominantly drought tolerant plants to minimise the need for unnecessary watering. Once again the Liveable Neighbourhoods Policy mandates the strategic management of storm water and run-off, and the use of WSUD in suburb design (Department of Planning 2008).

Photo 29: Harvest Lakes Stormwater Wetland



Source: K.Ringvall 2010.

Photo 30: Harvest Lakes Created Wetland



Source: Kate Ringvall, 2011

*7.1.1.4 Environmentally
conscious waste disposal
and recycling*

Whilst residential recycling has been a common practice in local governments throughout Australia for many years, the recycling of construction waste is less common. This issue was highlighted by one of the Project Managers as an issue that had been difficult to manage –

“There was also a waste management initiative... We did that at the request of the HIA but the initiative became difficult and it all unravelled despite the HIA having done a lot of work with the builders about how they could better manage waste on a building site. They had asked us to try and implement this and we did and we had a company that managed a depot.

All the builders were meant to co-operate with this fellow and he would go round and get building waste from on site. They were meant separate out what was recyclable and what was not and they would have a couple of bins and then he would come along each week and pick up the recyclable things and take them back to the compound where the recyclable component and all the rest was collected and go off. It fell afoul of the builders' sub-contractors with their bobcat companies and so forth. They all had existing relationships with other suppliers of waste bins etc. so the builders sub-contractors all jacked up against the builders then the builders jacked up against the whole system so the whole system unravelled and the fellow who was commissioned to do this work ended up walking away from it because it all got too hard. So what we have now is very much a limited/half-hearted system whereby we insist they have a waste bin on site that actually goes off and there is a recycling component to it. Most of them have it anyway but if not we go round and chase them if they don't".

None of the case study suburbs have a specific process for recycling construction waste, other than what already happens through the normal process of construction and Builder's obligations to the Health and Safety regulations of the local government.

7.1.1.5 Energy efficient buildings

Unfortunately this is the one area that despite their best efforts to the contrary (via Building Guidelines and Covenants), developers have had very limited impact on the extent that houses in each suburb are 'green' or even energy efficient. Whilst the BCA's EER tools only assess the 'conditioned' space of a building, regardless of its passive solar capacity or the ability of the occupants to manage the thermal comfort

naturally, 'green' residential buildings in the mainstream market are likely to be unachievable in the medium term (Thomas 2010d, 2010b, 2010c; Williamson, Soebarto, and Radford 2010; Stevenson and Leaman 2010; Gibson et al. 2010; Gram-Hanssen 2010; Guerra-Santin and Itard 2010; Hendrickson 2010; Isaacs et al. 2010). Despite the rhetoric of the BCA's EER guidelines, and some recent research, the EER tools do not reward passive solar design (Peterkin 2009; Australian Building Code Board 2010a).

7.1.1.6 Compliance with Covenants

One of the most significant issues that became obvious from analysing the data collected in the sustainability indicator tool (and from the Project Manager interviews), is that there is no, or at the very least limited, compliance by house buyers to the stated covenants and building guidelines that three of the four developers have attached to the land in their respective suburbs. In the interviews with each project manager of the case study suburbs (see Appendix A for the list of questions and section 3 for detailed discussion), it was highlighted that the issue of house buyers' compliance with such covenants was a major problem.

Moreover, Stockland's Newhaven suburb had purposely not identified any specific covenants or guidelines regarding specific features, other than to encourage through education the benefits of climate responsive design, because the difficulty of compliance was beyond their resources. They had also not provided specific incentives for the same reason. The interview with the local government representative of the Council (see transcript at Appendix B) confirmed that local government doesn't have the capacity to police such covenants, and the only regulations that they can seek compliance for, with any level of certainty is those of

the Building Code. In addition, as can be seen in the black roofs (in Photo 14 and 15) that are also features of the display village at Newhaven and Evermore, they are being built despite the discouragement from the developer. Not surprisingly, each developer and builder has very different ideas of what makes a suburb or house sustainable. This is probably not unexpected given the difficulty defining 'sustainability' and as far as suburb design is concerned, an absence of minimum benchmarks. Data collected from the online survey of the UDIA's Environment Committee and interviews of each case study suburb developer's project manager, highlighted that developers were more likely to nominate a small number of criteria that they felt made their suburb more sustainable than the mainstream, rather than the full suite of sustainability criteria found in the sustainability indicators tool.

For three of the four case study suburbs the developers had provided incentives to encourage people to include eaves and light coloured roofs and other energy efficient design criteria, however there was mixed opinions and results from these efforts. One of the Project Managers suggested: "...the incentives are front and rear water sensitive landscaping, rainwater tank. Minimum areas of turf, and the front and rear landscaping are sub surface irrigation to the garden beds on drip lines. Maximum areas of turf 75 metres front and rear with a majority water tolerant species. So the incentive package includes solar panels, front and rear landscaping, rainwater tank, and the Telstra velocity package with fibre optic cabling and with this estate they get a \$1,500 credit through their Telstra bill once they sign up and start paying their bills...In terms of what I see people adopting, the design guidelines, people are certainly starting to install more eaves, because of what we had said it was very difficult in the first instance but they are starting to embrace

that. In other words, builders know now that if they have a purchaser in Evermore they have to provide eaves to the house. So there is a higher compliance rate”.

However another Project Manager felt that gaining compliance to building codes was difficult and that the “...the most important ones are in the restricted covenant placed on the title. At the end of the day it is physically impossible to make someone comply with the restricted covenant, technically its possible but physically it’s almost impossible. But we enforce them through the use of our packages. If people don’t comply then we can say we are not going to put your rear landscaping in or we aren’t going to put your solar panel in, but to date we haven’t had to do that”.

Whereas another Project Manager felt that having restricting covenants about sustainable design was too difficult to get compliances even with an incentive...“we don’t offer cash incentives per se. We do with every block provide a landscaping package, which is water wise so, we go out and do the front yards we incorporate native and rain sensitive plants. We reduce the amount of lawn we put down. We do have design covenants, which encourage people to incorporate energy efficient and water wise initiatives into the home and design as well. We try to educate and inform them but we don’t restrict them because you are obviously going to lessen your market, but we do encourage as much as we can and then give advice on the best layout for the house and the orientation and all that sort of stuff and that is why, starting with the display village we wanted to build a five star energy rating display village to demonstrate that you can do this. You are actually going to have a home that is going to save you money in the long run. We have welcome packs,

which include information about how they can design the home in a certain way so it is more sustainable. We provide them with information on our website and things like that. But in terms of actual cash incentives we don't actually do that".

For the three case study suburbs that have strict energy efficiency covenants connected to incentives compliance remains difficult to attain..."with these incentives people build a house then they come to us and we go round and check all the things they were meant to do. Does the house have solar hot water system, does it face north/south. Before they can build they have to submit their plans to us, so we have to approve their plans before they start. But no system is perfect and we do get people building without submitting their plans first. So if they do that, they build then come to us and say we want our landscaping and fencing and we say have you submitted your plans, no? Well do your plans comply with our requirements? If they don't, they don't get the incentives".

The issue of residents including prohibited features despite the design guidelines discouraging it remains an issue..."it is very difficult to force people other than through an incentive based system to actually comply. So most people comply but we do get a few who find their way, our guys go round and try and identify those under construction and see if we have plans so they chase them up. You've started construction without sending us plans so there is a bit of process but once again not perfect. Vetting of the plans, see if people have passive solar homes. That over the period of time has got a little more difficult as the market gets more competitive. There have been issues there about dictating to people too strongly, about how much passive solar homes they need to have... Black roofs were an issue early on.

We banned black roofs and we had a couple of people put on black roofs early on and said they were going to do whether you liked it or not then we had everyone else complaining because we had some black roofs. So we have had to let that go, as it has all got too difficult to enforce. As a commercial organisation, we still need to be tuned into what our customers are prepared to accept. And where we are providing an additional level of regulation over and above I guess the government and authorities, we are trying to push it up another level but it's a question of where you can draw that line before customers start saying well that's too much for me I will go somewhere else".

The issue of compliance was a common theme for all four suburbs, although only three project managers provided a response to this question. The issue has mostly been connected with the covenants that the Developers place on the land to ensure uniform building guidelines throughout the estate and to back up any sustainability criteria. Project Managers reported that getting people to follow the guidelines, particularly where it concerned the provision of eaves and light coloured roofs, was very difficult because if someone didn't want to comply it was physically difficult to prosecute them once the black roof had been installed.

Photo 31: Newhaven Black Roofs



Source: K.Ringvall 2010.

Photo 32: Evermore Heights Dark Roof with PV cell and minimal eaves



Source: Kate Ringvall, 2011

This research has been unable to ascertain how it is that developers are able to get compliance on a range of minor and ostensibly aesthetic building guidelines such as materials use, colours and building styles, and number and style of garages, yet the presence of eaves surrounding a house and light coloured roofs seem to be difficult to gain compliance.

7.1.1.7 Issues with getting sign up from the Building Industry

Photo 33: Rivergums Project Display Homes



Source: Kate Ringvall, 2010

The building sector was also criticised by the Project Managers for slowing the integration of sustainability features in the built environment, through a lack of knowledge, experience and a desire to always keep costs down (see Appendix B).

Project managers suggested that builders were a lot more conservative towards change and innovation because of the very restricted business models that builders work within, that is, the economies of scale and therefore cost savings that can be achieved if the building process is the same for each house across the metropolitan area (see Appendix B).

Again for Project Managers the issue of the entrenched conservatism of the building industry to design and build houses that encourage more energy efficiency came up (see Appendix B). They cite the limitations of the building model that the building sector works within as a barrier to more energy efficient housing being built, and further that builders are focused on meeting the demand of the consumer rather than creating demand for a better product...“from a builder point of view, our suburb actually had the first five star energy display village in Western Australia and that was developed in collaboration with the local government and the South East

Regional Energy Group. But that was really difficult to get off the ground initially. Builders were very opposed to it because there would obviously be additional costs involved and we still come up against that quite often because they don't want to fork out the additional money. But that display village – we are onto the second display village now – but when it was built we had great opposition by the builders but then the amount of positive responses that we got was just phenomenal. So I think the additional money outlayed, paid off in the end”.

Project Managers cited the difficulties in getting builders to comply with the design guidelines was also a constraint...“there is a difficulty in having to explain to a builder – look this particular development has got these sustainability guidelines and you need to design your house to accommodate this and there is quite a bit of resistance from some builders where they see every development out there as being the same and if they build a house in that development they should be able to build the same house in that development. Why should they have to spend a little more time trying to design something to suit that developer? That has been an ongoing issue since say time began in terms of the development industry. Developers have to go through a long-winded process to get an approval for a development. So to do that they are generally quite happy to work with authorities and try and sort and they probably live with conditions that maybe builders are not particularly familiar with. Builders tend to look at every house as being able to produce another widget and I just want the widget to be the same as the widget I produced yesterday, so why should I have to produce one that looks different? So we go through the issue of trying to make it easy for them. I think it is their business model in a sense of...they just want to produce something efficiently and if

developers keep coming up with new rules all the time it is quite complex for them as not only do they have to know the rules that apply from local authority to local authority and the building code and all of that they then need to know what the rules are from development to development. So you can see it is a difficult area for them. The bigger builders have found their way with that and they have worked out a system where they can cope with it. But some of the smaller guys I think tend to find that quite difficult. The smaller ones tend to have more of a view of 'if we can cut corners then we have an advantage over those guys because we can actually produce something cheaper because we can cut corners'. They don't have to employ somebody to know all of these rules or to manage the process. So they see that as an opportunity if they can bend the rules they can do a bit better than maybe some of the bigger builders that have to deal with that..."

7.1.1.8 Issues with the Star Rating System

The comments below of the Project Managers about the Star Rating are borne out both by the research of Williamson et. al (2010) and the results from the housing sustainability indicator tool; in that a star rating does not necessarily mean the house is more energy efficient in practice. The star rating process would also seem to skew housing design towards those that achieve the relevant star rating rather than a focus on an energy efficient design, and which further explain the results from the sustainability indicator tool..."the problem with the star rating software as I understand it is that you can get a house to comply with a star rating that may not be a passive solar home and we have had this debate about how much weight do you put on the star rating versus shouldn't you make the customer design a solar passive home. Everyone has bit of a different view of this. We have some staff who

feels it complies with five stars so why give the customer a hard time that has a lovely five star home, which happens to have windows facing the wrong way and black roofs". One Project Manager was particular scathing about the star rating system..."five star is nothing. If you see a building that complies with five stars there is no impost on these purchasers, zero. The builders squealed like you would not believe when this first started being mooted but it is absolutely nothing and I don't think six will be any impost either".

7.1.1.9 Mass transit/transport management

Having nearby access to public transit enables residents to leave their cars at home for the daily commute to work (Frey et al. 2009; Falconer, Newman, and Giles-Corti 2010). However, this relies heavily on the government prioritising public transport services in the area, and that is not something that developers have a lot of control over. Unfortunately whilst the transport infrastructure decisions are made in isolation from the urban/suburban land use decisions it will be difficult to join these two very important aspects of sustainable communities together (Curtis 2008, 2009). Falconer et.al (2010) have criticised the Liveable Neighbourhoods Policy for not actually enabling people to be less car dependant, which may well be true but such decisions are out of the hands of developers and ultimately not the responsibility of the Department of Planning either. What developers can do is provide the appropriate suburb design that encourages walking within the community, and once public transport services are introduced, encourages people to take public transport whenever they can (Curtis 2008).

7.1.1.10 Promoting accessibility instead of mobility

Researchers have been debating the need for integrating transport planning with land use planning for decades, and Transit Orientated Developments (TOD) are in some ways a response to that debate (Newman and Kenworthy 1999; Levine and Garb 2002; Halden 2002; Curtis 2008, 2009). Prioritising accessibility to a choice of transport options including active transport (walking, cycling) over the mobility of the private vehicle implies a radical change in the way in which cities and their infrastructure are planned and implemented (Curtis 2008, 2009). Curtis (2008, :1) suggests that there is a 'need for public transport planning and development change to be mutually supportive; the need for road network planning and road design to place land use-transport integration as the core objective rather than traffic efficiency and for the need to stage development according to planning population and employment targets'. So whilst developers of the case study suburbs have prioritised walkability and accessibility within the community, their capacity to influence transport infrastructure decisions is limited until transport and land use decisions are made together by governments (Curtis 2009).

7.1.1.11 Transport Related Information

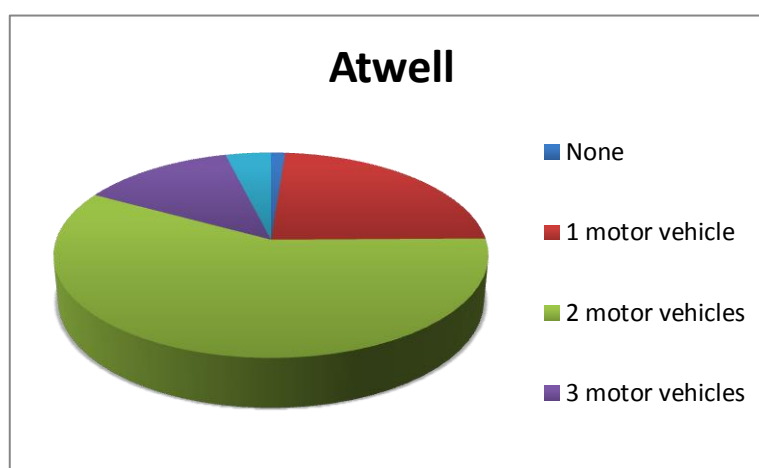
There are a number of transport related statistics that can give an understanding of the habits and behaviours of people. The numbers of vehicles per household and the journey to work are two data sets that are particularly important at showing the potential vehicle dependence of a population (Australian Bureau of Statistics 2008d). Transport for more sustainable suburbs is weighted towards public transport and active transport, a notion that was found to be indispensable in the literature (Low et al. 2005; Newton 2008; Newman, Beatley, and Boyer 2009). For

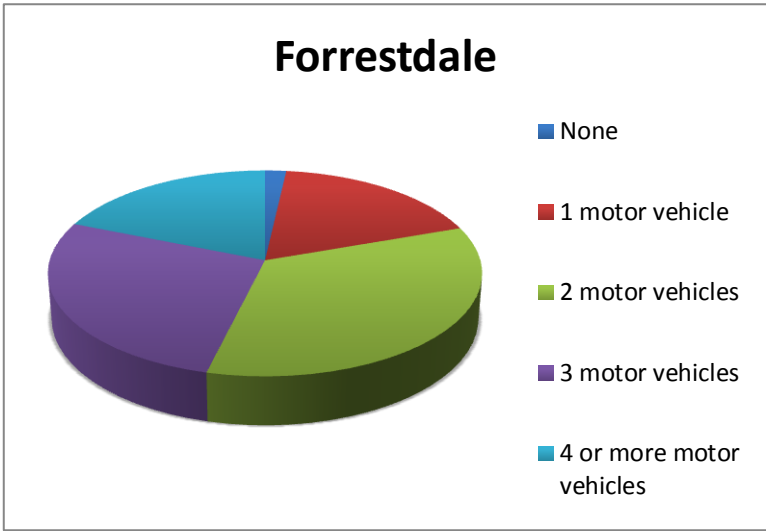
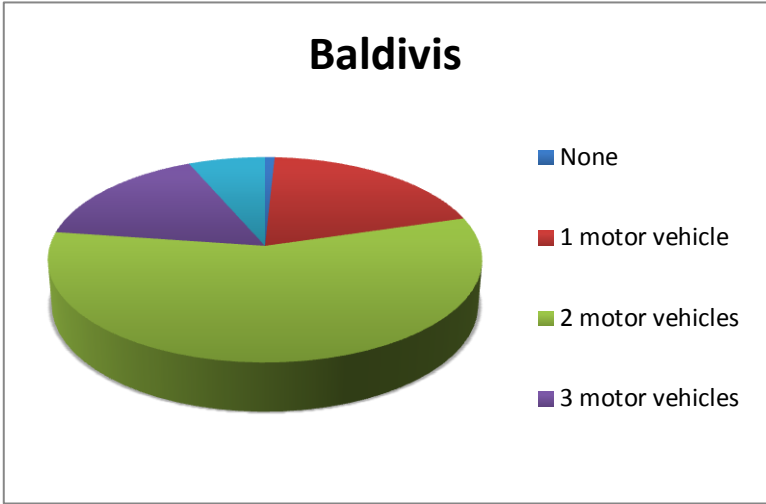
'green' marketed suburbs to really be taken as sustainable, in accordance with the literature they should also be encouraging more sustainable forms of transport over the private vehicle (Newman, Beatley, and Boyer 2009; Falconer, Newman, and Giles-Corti 2010; Mapes and Wolch 2010).

Unfortunately ABS statistics give no indication of the level of support from government, through complementary policies to encourage people to leave their cars at home for the majority of commuter trips, and trips less than 2 kilometres. As Mapes and Wolch (2010) remind us suburbs, whether 'green' or not are still obliged to work within the parameters of the embedded social, cultural, political and economic dynamics and frameworks around them. People living in such suburbs cannot be less dependent on the private car if public transport is not a priority for the government for their neighbourhood. Likewise, if the cycling and walking infrastructure is not in place, active transport will not be a convenient option either.

Number of Cars per Household:

Figure 19: Number of Vehicles per Dwelling





Source: (Australian Bureau of Statistics 2008c, 2008a, 2008b).

Interestingly, according to the ABS (2008d) public transport use is associated inversely with the number of cars per household, in that those people who lived in households with two or more cars had significantly less public transport use. For the suburbs in which the case study suburbs are located, houses with two cars are the majority.

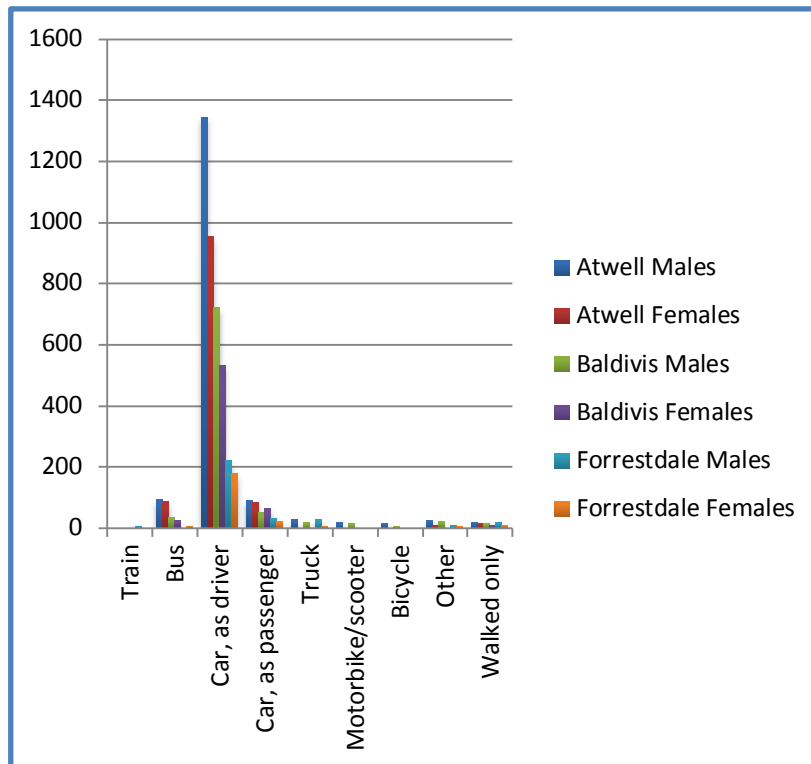
7.1.1.12 The Journey to work

Information about the journey to work is interesting as it illustrates how many people are driving their private vehicles and how many are taking public transport.

Naturally public transport use is higher in capital cities of Australia because of the extensive bus and train infrastructure, and proximity to public transport stops is a high predictor for usage (Australian Bureau of Statistics 2008d). In the last 30 years since the end of World War II car usage for the journey to work has increased nearly 50%, and now more than 80% of people use the private car to drive to work costing approximately \$9.4 billion in avoidable traffic congestion costs (Australian Bureau of Statistics 2008d).

Although the data was formulated before the opening of the southern link of the train line (located along the Kwinana Freeway) and does not represent the most current information, the majority of people are driving to work. Chapter 7 will highlight the data that was collected from householders in each case study suburb, and a comparison will be made between the data collected here from the ABS 2006 Census, and the online survey of householders. According to the ABS (2008d) household composition has a significant influence on the use of public transport, lone parents with dependent children were the most likely to use public transport at 24%, compared to 16% of couples with dependent children, 20% of single person households and 17% for couple only households.

Figure 20: Journey to Work Method of Travel



Source: (Australian Bureau of Statistics 2008c, 2008a, 2008b).

7.1.1.13 Minimising waste

This criterion has been used by the case study suburbs as a lesser selling point, but an important one none the less. In Newhaven in particular, trees that were cut down during site works were reused in the creation of the community spaces and public open spaces. Obviously in the case of the four suburbs studied in this research, all have access to the recycling programs of their local governments. The case study suburbs could have done more to actively reuse and recycle everything, but as was highlighted by one Project Manager getting builders on side to recycle and sort waste in situ is a difficult proposition. Other than ensuring that residents are aware of the local government recycling programs, and making attempts to influence builders about the need to minimise waste, there is very little impact that

developers can realistically make on their own to minimise waste in suburbs. The Project Manager of Rivergums highlighted in the interview that it was a big issue but one that had entrenched supply arrangements in place that inhibited better recycling and waste minimisation (see Appendix B).

7.1.1.14 Reducing latent heat

In the context of suburb design latent heat refers to the creation of heat islands. Zinzi (2010, :203) defines the urban heat island (UHI) as ‘an increase in urban air temperatures compared with cooler surrounding rural areas’. Black or dark surfaces are highly solar absorbent; in other words they retain the heat of the sun and reflect it back out into the surrounding atmosphere making the local area much hotter than it would otherwise be (Levinson and Akbari 2009; Rudolf 2010; Volland 2010; Zinzi 2010). For the case study suburbs the biggest issues in regards to latent heat is the use of dark roofing and building envelope materials, which make not only the building hotter but the surrounding area hotter than necessary. Levinson and Akbari’s (2009, :53) research shows that ‘cool roofs – roofs that stay cool in the sun by minimising solar absorption and maximising thermal emission – lessen the flow of heat from the roof into the building, reducing the need for space cooling energy in conditioned buildings’. The use of large expanses of bitumen is already well known to increase the UHI effect, and with the addition of black roofs and dark building envelope materials the increased heat in the area would be significant (Rudolf 2010; Zinzi 2010).

Photo 34: Evermore Heights Curb Raingardens



Source: K.Ringvall 2010.

*7.1.1.15 – Capturing
and retaining
water*

Evermore Heights has been the most innovative in capturing rain and storm water runoff, however all four suburbs have made water capture and harvesting a priority in the urban design of their developments. With Perth's increasingly limited rainfall and decreased dam levels approaching a new 'normal', storm water filtration and rainwater capture will become increasingly more important.

Evermore Heights has particularly focused on the development of what they are calling 'raingardens' (where rain and storm water is captured and recycled for irrigation) a concept that is becoming familiar across Australia, with examples found most recently in Canberra.

7.1.1.16 Reducing pollution

This criterion is a little more difficult to quantify without assessing pollution levels in a traditional suburb compared to 'green' marketed suburbs. That said, any development that includes in its building guidelines that homebuyers must have a double garage or bigger, and that the garage must be within the same roof line as the rest of the dwelling, is not providing any encouragement to people to reduce their dependence on the private car (Thull 2009). All four suburbs stipulate to the homebuyer that they must have a double or larger garage within the same roof span as the house. Such guidelines locks people into a house that may have more space than they actually need, and the added cost of a garage under the same roofline. Interestingly every house within all four suburbs had at least a two-car garage, and in some cases a three-car garage.

5.3 Indicators of Sustainability in the Built Form

The review of the literature in Chapter Three identified a number of criteria that suggested contemporary housing was more sustainable than its mid-century counterpart. Researchers suggested that houses that include the following criterion are more sustainable:

- Designed for the local climate and prevailing breezes;
- Orientated so that main windows face north (south in the northern hemisphere);
- Makes good use of thermal mass; provides high insulation;
- Designed for good ventilation but minimising leakage of air or heat;
- Manages water wisely;

- Limited or no need for extra heating and cooling (Low et al. 2005; Friedman 2007; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008).

Crabtree and Hes (2009) describe the issues related to integrating more sustainable housing into cities as an institutional problem rather than a technological one. The authors suggest that there is sufficient technology now to make all new housing more sustainable, but there exists considerable delays both within the building industry and the regulation sector to these technologies being adopted more readily (Crabtree and Hes 2009). The research of Williamson et al. (2010) suggests that more than being about delays in uptake of more sustainable housing options, the 5/6Star EER tools actively skew house designs towards those that are not passive solar because of the assumed air-conditioning use and as a consequence are energy inefficient and require mechanical heating and cooling to be comfortable.

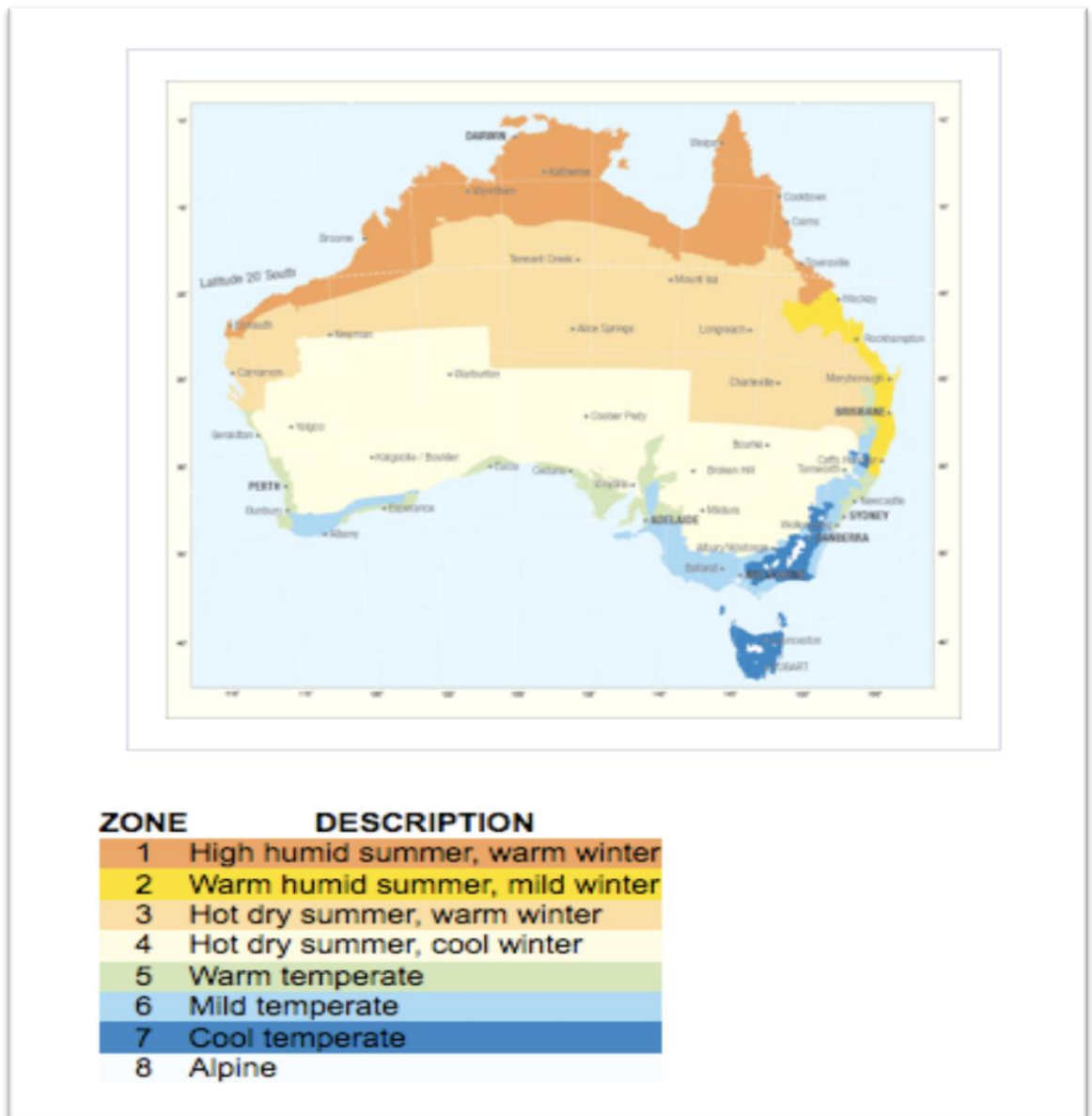
The review of the literature explored the context and background of these same research questions, that is – how have suburbs evolved? What do they look like now? What are the drivers for their growing evolution? What does a sustainable suburb look like? A number of significant issues have become apparent in the review of the literature. The recent research on the efficacy of the current suite of residential housing energy efficiency software tools, suggests that there are considerable flaws in the way that data is processed and what the data actually means in practice (Thomas 2010d, 2010b, 2010c; Williamson, Soebarto, and Radford 2010). In addition, the anomaly of Perth being the only city in Australia,

that continues to predominantly build with double brick, is a considerable barrier to creating energy efficient homes and places a significant cost impost on those that can least afford it (Reardon, McGee, and Milne 2008). This is despite uninsulated double brick cavity wall construction being shown overall to be of similar energy efficiency as single brick, and in fact because it cools down more slowly creates houses that remain hot, in weeks of post 30 degree days – a weather phenomenon that is becoming much more prevalent in Perth in summer (Sugo, Page, and Moghtaderi 2004; Gregory et al. N.D; McGee, Mosher, and Clarke 2008). This phenomena is exacerbated by heavy roof insulation and insufficient wall shading and cross-ventilation, creating an ‘oven’ affect where the house literally continues to heat up without being able to expel the heat because of poor design (Reardon and Clarke 2008; Reardon and Downton 2008; McGee, Mosher, and Clarke 2008).

7.1.2 Designed for the local climate and prevailing breezes

There are eight different climate zones in Australia that determine the predominant weather patterns for each area. They pose significantly different priorities for passive solar design when considering human thermal comfort. The BCA has defined eight separate climate zones for simplicity and ease of classification. Perth is classified in the warm temperate climate zone where no extra heating or cooling should be necessary with good passive solar design.

Figure 21: Climate Zones in Australia



Source: (Reardon and Downton 2008).

Reardon and Downton (2008) highlight a number of key design responses for this climate zone and they include:

- Use of passive solar design principles
- Use insulated thermal mass
- Use high insulation levels
- Maximise solar access in winter
- Minimise all east and west walls areas
- Use cross ventilation and passive cooling in summer
- Use convective ventilation and circulation
- Site homes for solar access and exposure to cooling breezes
- Draught seal and use airlock entries
- Use reflective insulation for summer heat
- Use bulk insulation to walls, ceilings and exposed floors

Passive solar design is a simple way of utilising the benefits of solar access (sunlight) and blocking the negative aspects like heat in summer. It incorporates the northerly orientation of daytime living areas; more energy efficient uses of glass on the northern areas to capture sunlight and warmth in the winter; passive shading in summer on the northern and eastern, western sides (removed in winter); thermal mass in the roof and building envelope to store heat (like reverse brick veneer); insulation and draught sealing; floor plan zoning based on heating needs; advanced glazing solutions to minimise heat loss and gain depending on the season (Grace 2007; Reardon and Downton 2008). Whilst the developers in each suburb have worked very hard to orientate as many of the blocks as possible along the

north/south access, the house designs provided by the builders in each suburb are not necessarily taking advantage of this. Builders could be providing designs that differ according to whether the block is east/west or north/south orientated, and this does not appear to be happening.

7.1.3 Orientated so that main windows and living areas face north

Passive solar floor planning requires that living areas that are used during the day such as kitchens, dining and living areas need to be facing north to ensure passive solar gain. Bedrooms and rooms not used frequently need to be along the southern façade where they won't receive the solar gain when it's not required. Having one wall that has high thermal mass such as brick internally, where it will be heated from the winter solar gain through north façade windows, can mean the room stays warm even after dark because of the thermal lag in heat transfer (Reardon, Mosher, and Clarke 2008). For passive cooling it is essential to reduce or entirely eliminate external heat gains during the day, which can be achieved through good building envelope design (Reardon and Clarke 2008). Assisting prevailing breezes to filter through the house unhindered is also important for keeping the indoor temperature comfortable. Again, although the developers in the four case study suburbs have provided as many north/south orientated blocks as possible, the building designs offered by the builders have been found not to change according to the orientation.

7.1.4 Makes good use of thermal mass; provides high insulation

Thermal mass is defined as the ability of a material to absorb heat, and large quantities of energy are required to change the temperature of high density

materials like concrete, bricks and tiles which give them their high thermal mass (Reardon, McGee, and Milne 2008). When thermal mass is used appropriately throughout a building the indoor thermal comfort can be more stable, however the key to it being effective is when it's integrated with good passive design techniques i.e. in summer it needs to be shaded (Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008). A material with high thermal mass acts as a battery (heat or cool soak), absorbing heat during the day thereby keeping the house cooler during the day, and with good passive design and cross ventilation the heat can leave the building at night (Reardon, McGee, and Milne 2008).

However thermal mass is not a replacement for good insulation, while thermal mass 'stores and re-radiates heat' insulation actually stops the heat loss or gain (Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008). Reardon et.al (2008) suggest that the poor use of thermal mass can 'exacerbate the worst extremes of the climate and can be a huge energy and comfort liability. It can radiate heat all night during a summer heatwave, or absorb all the heat you produce on a winter night' – a situation that occurs when whole buildings are built with uninsulated DBC (Milne 2008; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008). Thermal mass is best placed inside the insulated building envelope as it is for reverse brick veneer (RBV) construction, where the thermal mass can store heat and re-radiate it back into the room when it's most needed (Reardon, McGee, and Milne 2008). Unfortunately in Perth most houses are built with uninsulated double brick construction (DBC) construction, a situation that has likely occurred because

of the ready availability of clay in the Perth area, the small market compared to the eastern States, the highly competitive price/supply arrangements between builders and brick companies, the economies of scale that building companies that own brick companies can achieve to drive the price of bricks down artificially, and a very aggressive marketing campaign by the brick industry that anecdotally began after Cyclone Tracey came through Perth in the mid-70s (unfortunately a paucity of research on this issue makes this difficult to verify) (Grace 2007).

Without insulation in the cavity of double brick construction, during a prolonged heat wave or cold snap the house becomes “too cold in winter, and often too hot in summer if exposed to prolonged heat wave conditions. If the cavity is insulated, the internal thermal mass (ie. the internal brick skin) is protected from external temperature changes, and becomes highly effective at regulating temperatures within the home” (McGee, Mosher, and Clarke 2008). Houses with uninsulated DBC construction do well when the outside temperature is within a small band of thermal comfort, such as would be experienced during Autumn or Spring in Perth, however outside of those seasons the comfort level within such a house would require mechanical cooling or heating to such an extent that the energy use is greatly increased (Grace 2007; McGee, Mosher, and Clarke 2008; Milne 2008; Milne and Riedy 2008; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008; Reidy, Reardon, and Milne 2008).

The most significant issue for Perth, and particularly houses in the four case study suburbs, is that when a house is constructed with uninsulated DBC without

sufficient shading from eaves or pergolas, and with dark colours on the walls or roof materials the energy efficiency of the building envelope (and therefore the whole house) becomes significantly reduced (Grace 2007). Such a pattern of construction creates houses that will not be thermally comfortable during the extremes of heat and cold that Perth is increasingly experiencing, without mechanical heating and cooling (Grace 2007; McGee, Mosher, and Clarke 2008; Milne 2008; Milne and Riedy 2008). The sustainability indicator tool highlighted that a large number of houses and building company display homes, in each case study suburb, exhibit dark coloured roofs and limited or no eaves surrounding the houses, and double brick construction. These houses will undoubtedly require air-conditioning to be thermally comfortable for most of the year, rendering the efficacy of the other energy efficiency options within the house as questionable.

Photo 35: Evermore Display Home with Black Roof and Photo 35: Rivergums Display Home



Source: Kate Ringvall, 2011

Photo 36: Rivergums Display Home

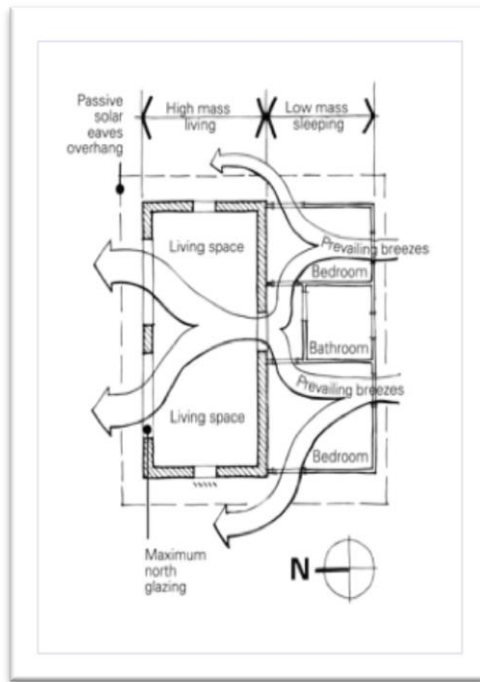


Source: Kate Ringvall, 2011

7.1.5 Designed for good ventilation but minimising leakage of air or heat

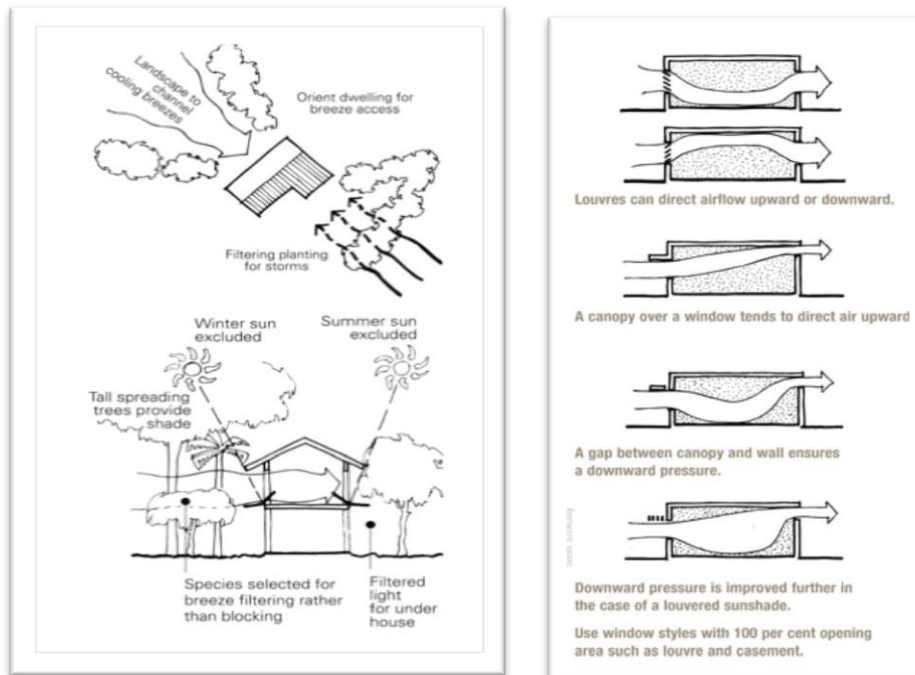
The movement of air in a house is the most important part of a passive designed house. The effective use of cross ventilation ensures that air exchange cools the building in summer, and the strategic use of fans in living and sleeping areas ensures air movement cools the inhabitants (Reardon and Clarke 2008; Grace 2007).

Figure 22: Capturing Prevailing Breezes with Passive Solar Design



Source: (Reardon and Clarke 2008).

Figure 23: Channelling Prevailing Breezes and the Pattern of Air Movement into Open Windows



Source: (Reardon and Clarke 2008).

In Perth the prevalence of coastal breezes, assist in bringing cooling winds across the coastal areas of the metropolitan area (Grace 2007). By using windows and doors to allow breezes to flow through the house to where they are most needed, the building can be cooled significantly (Reardon and Clarke 2008). If the building company display homes are used as examples of the types of houses that are being built in each suburb, which is generally the case, the majority of the house designs do not cater for good cross ventilation. For one display home in particular, the assumption of the installation of ducted air-conditioning was already built in to the design and cost. Whilst the houses are designed to only sit in one direction, without consideration of good orientation for passive solar design, they will not be able to take advantage of prevailing breezes and will be obliged to rely on mechanical air-conditioning.

7.1.6 Manages water wisely

Water sensitive urban design (WSUD) has been a prevalent and obvious design criterion for the last five years or more (Department of Climate Change and Energy Efficiency 2008). Given Western Australia's low rainfall patterns in the last two decades, and the expected decline in those rainfall patterns, urban development has had to be a lot more careful about the use of potable water (Department of Climate Change and Energy Efficiency 2008). The BCA introduced more stringent requirements to the design and use of water within residential housing, and now all new houses built in the last five years have water efficient (Water Efficiency Labelling Standards (WELS)) dual flush toilets, and 3 or 4 Star WELS rated showerheads and taps (Australian Building Code Board 2007). In Perth the Water

Corporation's Waterwise initiative has incorporated water saving habits into many homes, schools, councils and businesses, and involves the promotion of incentives through rebates (Grace 2007). According to the most recent research by the ABS these measures have made a significant difference to the amount of water used in the residential sector (Australian Bureau of Statistics 2009). Yet, in Perth more than 50% of potable water is used to water gardens and lawns. Unfortunately the use of rainwater tanks in Perth has been seen to be of limited benefit because of the small rainfall that occurs predominantly in winter, yet Grace (2007) has shown that a 3000 litre rainwater tank incorporated into the scheme supply, for use in toilets, laundry and hot water can save nearly 38% of potable water. Since the water saving techniques have been integrated into house design since they become a mandatory part of the BCA, it can be safely assumed that all houses within the case study suburbs have waterwise water appliances in their original design. However there is nothing stopping residents from changing those appliances to a less waterwise product after the house has been checked by the regulatory authority.

7.1.7 Limited or no need for extra heating and cooling

Perth is ideally suited to passive solar design in residential housing, with mild winters and cooling breezes from the south west in summer that usually moderate the higher temperatures, stabilising the internal thermal comfort with a well-designed passive solar house is comparatively easy (Grace 2007). More recently Perth has experienced hotter, drier summers and colder winters, but even these changes in temperature can still for the most part, be moderated by good design and the judicious use of fans and the occasional use of mechanical cooling and

heating during a period of prolonged extremes in temperature (Grace 2007). Due to the inability of the builders in the case study suburbs to complement the sustainability ethos of each of the suburbs, there is likely to be very few houses within the case studies that do not require mechanical heating and cooling.

5.4 Discussion

While it was found in Chapter Five that the developers of the case study suburbs have gone some way to integrating sustainability, the same cannot be said for the builders in the case study suburbs. The BCA mandates a number of criteria, since the inclusion of energy efficiency considerations in 2006 into the Code, and they include roof insulation, gas boosted solar hot water or equivalent, minimum glazing on the east and west sides and living areas located to the north (see the discussion regarding the BCA EER in Chapter 4). The presence of these features is therefore not remarkable, and these features in particular were not easily noted from the street. What are more important in Chapter 6 are the mixed results within the houses in each suburb, in relation to the indicators of sustainability. The presence of surrounding eaves and light roofs, highlighted in the literature review as necessary for energy efficiency, were not found to be widespread and in all suburbs were found to be in the minority, despite the fact that in three of the four case study suburbs specific building guidelines or covenants prohibited one or both. Given that most new houses in Perth are built using double brick, the houses within each case study suburb were likely built using double brick uninsulated cavity walls, which have been shown in the literature as only being energy efficient if the cavity is insulated, has good cross-ventilation and sufficiently shaded by eaves or other

means of shade in the hotter months (Sustainable Energy Authority Vict. 2002; Grace 2007).

The data from the sustainability indicator tool in Chapter 6, whilst basic and an approximation, supports a significant issue that has recently become obvious in the mainstream media and research literature; namely that the energy efficiency rating tools used by builders to ensure their designs are compliant to the energy efficiency requirements of the BCA, and any additional State Government requirements, are seriously and fundamentally flawed (Thomas 2010d, 2010b, 2010c; Thomas 2010a; Williamson, Soebarto, and Radford 2010). The most serious issues that appear in the data are the lack of sufficient eaves and the existence of dark roofing materials on houses in these 'green' marketed suburbs. Throughout the literature these two criteria (i.e having sufficient eaves and a light coloured roof), in particular, were seen as vital to managing the thermal temperature so that a house is cool in summer and warm in winter – in other words energy efficient (Chiras and Wann 2003; Low et al. 2005; Miller, Ambrose, and Ball 2006; Wiland, Bell, and D'Agnese 2006; Department of Housing and Works 2007; Friedman 2007; Grace 2007; Ambrose 2008; Farr 2008; Hahn 2008; Newton 2008). Yet, a large majority of houses in all of the case study suburbs exhibited one or both of these energy inefficient design features. This highlights the gap in application of basic sustainability considerations by the builders in the case study suburbs. Only two display homes in two of the suburbs had both surrounding eaves and light coloured roofs, despite the covenants and the building guidelines. It was suggested by the building sector focus group that because the EER tool essentially assessed thermal comfort against an artificially achievable comfort rating (i.e a level of indoor

temperature comfort that could only be achieved via air conditioning) that this was creating houses that actually required air-conditioning as opposed to houses that were made more comfortable through their use. This is a finding that would back up the research of Williamson et. al (2010) significantly, and this research and the outcome of the focus group also suggests strongly that the way in which a house is actually used has a far greater impact on its actual energy efficiency irrespective of its star rating.

This chapter has been exploring consumers of 'green' marketed suburbs namely householders in three case study suburbs, for their general understanding of sustainability, and their capacity to integrate sustainability principles and practices into their houses and by implication their lifestyles since buying into a 'green' marketed suburb. Residents the case study suburbs were surveyed to ascertain how the sustainability aspects that had been advertised in their respective suburb had influenced them. In addition this chapter, whilst providing more necessary background to answer the research questions, also provided further background to support the hypothesis that within Perth's housing industry, there are significant barriers to the mainstream development of sustainable settlements, in particular sustainable housing.

Surprisingly many of the respondents to the resident's online survey said that either they 'did not know or they definitely did not build in a 'green' marketed suburb', despite the fact that they all resided in suburbs that have been awarded and strongly marketed for their 'green' credentials. Yet, a minority of residents surveyed mentioned 'environmental consciousness' of the estate as one of the reasons for

building in their respective suburb, while a number said they had included environmental/sustainability features in the design of the house; a result that was also found in the focus group. Moreover, half of the respondents said the environmental/sustainability features did influence their decision. This result seems to be contradictory but it may reflect the average consumer's misunderstanding with exactly what environmental/energy efficiency features are (even though a list was provided in the survey), and the existence of an 'attitude-behaviour gap' (Marchand, Walker, and Cooper 2010; Mont and Power 2010; Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010; Power and Mont 2010; Gibson et al. 2010).

These results would appear to reflect the inhibitors of sustainability behaviours that were found by Partidario et.al (2010). The authors report on a United States (U.S) business survey that surveyed global consumers for their willingness to pay for products with environmental and social benefits. As 53% of people surveyed said they were concerned about the environment but were unwilling to pay more whilst only 21% said they were willing and did pay more for products that had an environmental or social benefit (2010, :2855). Of those 53% surveyed who said, they were concerned but unwilling to pay, Partidario et.al (2010, :2855) report that some of the reasons behind the 'unwillingness to pay' is related to a 'lack of understanding, resigned lifestyles, selfishness, and associated costs and taxes'. Within the 53% of people surveyed, who reported feeling concerned but unwilling to pay more, 13% of people suggested that lack of knowledge was a barrier, 13% weren't willing to compromise perceived quality, 9% suggested price and convenience was a barrier, 9% said they were unwilling to compromise

convenience, whilst 8% said they couldn't afford products with environmental or social benefits (Partidario, Vicente, and Belchior 2010).

Confirming the ABS (2007) research on dwelling size and number of occupants, 50% of respondents of the first survey have 2 people living in their house, 10% of respondents said they lived alone, whilst 40% had 3 or more people in their house. In addition, 52.4% reported having a house that was between 201-250 square metres in size, a figure that is also reflected in recent ABS data that is suggesting that the average size of houses in Australia is now close to 250sqm (Australian Bureau of Statistics 2007). Other ABS (2008d) research also confirm similar results from the survey of householders in the case study suburbs, in that the number of cars owned per household has now averaged to at least 2 cars. Respondents in the first survey reported that 71.4% had 2 cars and 28.6% households had more than 3 cars. The ABS (2008d) research highlighted that the number of cars per household is strongly associated with public transport use, with 12% of people with two or more cars using public transport compared to 28% of people with only one car per household. These results are further confirmed by the private car being used by the majority of respondents, in this case 80% and public transport being used by 30% of residents (Australian Bureau of Statistics 2008d).

The results from the surveys carried out for this thesis are similar to those found in similar research conducted by Mapes and Wolch (2010), Crabtree and Hes (2009), Partidario et.al (2010) and Paco and Varejao (2010) and more recent research from the Organisation for Economic Co-operation and Development (OECD) (2011), in that research into the factors affecting energy saving (sustainability) behaviours

suggest that there is a gap, sometimes significant, between what so called 'green' consumers say about the environment and their concerns for sustainability and what they actually choose to do about that concern (Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010). In other words, 'regardless of significant changes in people's choices, consumer willingness is not always converted into shifts in lifestyles' (Partidario, Vicente, and Belchior 2010, :2854). This 'attitude-behaviour gap' is the reason why although a consumer might say that they are 'keen to be green', that keenness does not always translate into more sustainable behaviour without perceived benefits such as cost savings or greater personal well-being (Marchand, Walker, and Cooper 2010; Mont and Power 2010; Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010; Power and Mont 2010; Gibson et al. 2010).

As was highlighted in the results from the second survey, (that surveyed people building new houses or conducting a major renovation), unless the energy efficiency feature is mandated people are far less likely to include it in their house design, because budget and aesthetic considerations will always be uppermost for the majority of people. Unless the consumer is already a 'green' consumer and is willing to pay more to be actually 'green', other considerations will be more important (Gibson et al. 2010; Mapes and Wolch 2010; Marchand, Walker, and Cooper 2010; Mont and Power 2010; Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010; Power and Mont 2010). The OECD's (2011) recent research has looked at environmental issues and households (across 10 000 households in ten OECD countries, including Australia).The research looked specifically at how concerned people are about the environment and how that translates to their behaviour, to

enable better policy options to be developed. The OECD's survey found that when people are charged for the energy or water use (metered) they are more likely to be influenced to conserve energy and water, even more so if they are concerned about the environment (Organisation for Economic Co-operation and Development 2011). In addition the survey found that if people are metered for the energy or water use they are more likely to purchase energy and water efficient appliances to enhance the savings. However it was found that nearly 50% of respondents were unwilling to pay anything more for renewable energy, while nearly 30% are only willing to pay 5% more (Organisation for Economic Co-operation and Development 2011). Partidario et.al (2010) suggest that whilst economic benefits of more sustainable behaviour can be a significant motivator, because consumption behaviours are complex and consumers are not always 'rational' when purchasing, other barriers and facilitators for 'green' purchasing need to be accounted for. The barriers included: lack of time for research, high prices, lack of information, and cognitive effort; whilst the facilitators included: green labels, specialist information, availability of green products in mainstream retail and personal guilt (Partidario, Vicente, and Belchior 2010).

Furthermore, MacKenzie-Mohr (2000, :544) suggests that different behaviours derive different barriers, so that 'what impedes an individual...from walking to work is distinct from what might preclude him/her from closing the blinds each morning'. However, before sustainable behaviour can be approached further, Gibson et.al (2010) recommend addressing some significant 'sustainability dilemmas' before household behaviour can be motivated to change. Sustainable consumption involves making choices about products that mean purchasing products and

services that are 'environmentally-friendly' or have a 'green identity' but without actually reducing the level of consumption in the first place; and there are significant trade-offs even in behaviour that is considered 'sustainable' such as wasting water rinsing out tins or putting dirty tins in the recycling, and using plastic bags for bin liners or taking reusable bags to do the shopping and buying bin liners (Gibson et al. 2010). That said, one of the most important factors found in the research on energy conservation behaviours, is the consumer's need for clear and unambiguous information about the actual benefits of more sustainable choices and the personal impacts their current 'unsustainable' choices are having on them and the community (Attari et al. 2010). Understanding consumption behaviour, particularly as it relates to householders in the case study suburbs, gives some context to the results from the data collection that has been undertaken for this thesis and provides some basis for recommendations for policy change.

The data collected in the household sector has highlighted a number of issues; namely that for many residents in 'green' marketed suburbs sustainability and energy efficiency are not factors that are greatly considered when purchasing/building a new house; for those residents who were engaged with sustainability and energy efficiency while some of the behaviour choices were easy enough to introduce, it was agreed that trying to get their particular builder to include more energy efficient design had been difficult.

5.5 Conclusions

This research has examined the capacity of developers and builders of 'green' marketed suburbs to create more sustainable residential suburbs than mainstream

traditional suburban development. In particular this chapter has provided some of the necessary complementary data to Chapter Six that is, the building sector was examined for its ability to integrate sustainability into their house designs that were made available in each case study suburb. The sustainability indicator tool used sustainability criteria that were found in the review of the literature in Chapter Three, as those that contributed to a sustainable house design.

This Chapter has also identified that there are some serious flaws in the way in which the energy efficiency of a building design is evaluated, via energy efficiency rating tools. The research of Williamson et al. (2010) highlighted clearly that because the current 5/6Star EER tools assume that a space will be air-conditioned, the star rating system has been skewed towards building designs that are energy inefficient, and as a consequence passive solar design houses can be much more expensive to build. Chapter Six has identified that the unique situation in Perth of a predominance of double brick residential construction has meant that the more recent housing stock, in addition to being already energy inefficient with the use of un-insulated double brick in particular, is made more so because of the inequities of the EER tools (Sugo, Page, and Moghtaderi 2004; Gregory et al. N.D; Williamson, Soebarto, and Radford 2010).

Moreover the Local Government interviews have highlighted that some of the issues related to working with developers of 'green' marketed suburbs are common across the three local government areas. In particular the concern with managing the ongoing compliance to the prescriptive building guidelines that the Council can influence, such as fencing etc. and the lack of authority to enforce building

guidelines that prohibit dark roofing materials and no eaves. Only one of the local governments interviewed has a sustainability policy, or is in the process of integrating sustainability principles and practices into their activities. From the results of the sustainability indicator tool it is clear that barriers do indeed exist to more sustainable housing being developed in 'green' marketed suburbs, let alone mainstream traditional suburb developments. What those barriers are is less clear however.

It might be easy to assume that the major barrier to more sustainable housing being developed is the building sector, but if one builder has managed to build an 8 Star house then it's fair to suggest that the barrier isn't significant. Again given the flaws with the EER tools this may not be to do. That said there is a surprising paucity of research into the building industry generally, and in particular as it relates to Perth. The preponderance of uninsulated DBC construction in Perth, is seen by many researchers (see (Grace 2007; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008) as a serious barrier to energy efficiency in the built form. Yet there appears to be no research into the history of this anomaly of building in Perth, where it remains the only place in Australia that builds with double brick. Anecdotally it is understood by consumers building new houses, that to build with anything other than double brick in Perth is prohibitively expensive. Unfortunately, without the available research on why double brick construction is cheaper than single brick veneer or reverse brick construction, this can only remain as hearsay rather than fact.

From the discussion in the building industry focus group it was clear that one of the significant barriers to the creation of more energy efficient housing, both in theory and practice, is the consumer. In Perth at least, sustainability through energy efficient design remains the consideration of the budget unlimited client who is self-motivated to ask for such design considerations rather than the average project home buyer.

CHAPTER 8 Conclusions and Recommendations

8.1 Introduction

A number of wider sectoral issues have been identified in this thesis, whilst exploring the capacity of developers of 'green' marketed suburbs to create more sustainable residential alternatives in the market place. This thesis has covered the sustainability connection between urban form (suburb design) and the built form (house design), and has discovered that to support sustainability in the urban form there also needs to be sustainability in the built form and the lifestyles of the residents. This thesis has explored the capacity of developers to integrate sustainability principles and practices into their 'green' marketed suburbs. Through answering the three research questions in Chapters Five to Seven, the research has explored suburb development in Australia and particularly WA; the developers of 'green' marketed suburbs and four case study suburbs in Perth; the builders of houses in 'green' marketed suburbs and the consumers and householders of 'green' marketed suburbs. The overall research objective of 'how to create sustainable suburbs, from urban design through to housing and sustainable lifestyles and how it is applied in practice in our suburbs' - has been addressed through the exploration of the literature on sustainable settlements, especially those that are currently available around Australia; through the examination and identification of the many energy efficient technologies in the design of houses that are now available in Australia; and through the exploration of the policies and regulation that currently regulate and manage sustainability and energy efficiency in house design in Australia.

8.1.1 Research Questions Addressed

Each chapter has explored these research questions from four very different perspectives, namely the governance framework, the land developer, the builder and finally the householder or consumer of 'green' marketed suburbs in order to answer the following:

- 1 Do policy, institutional or other barriers to the mainstream planning and development of sustainable settlements in Perth exist, in particular in sustainable housing?
- 2 Are 'green' marketed suburbs creating a more sustainable alternative to mainstream, modern suburban housing?
- 3 Do the sustainability features used by developers match those found in the literature?

The first question was answered through the exploration of the literature and the governance frameworks supporting or inhibiting sustainability in suburbs, and through an examination of four case study 'green' marketed suburbs in Perth, WA. The overall 'green' marketing that case study suburbs have used range from 'A Sustainable Community', 'Change your world', 'WA's first GreenSmart Village', "Back to Nature", and "Live for Today and Tomorrow". These marketing slogans have been developed within a context of a policy environment that initially encouraged and then eventually mandated the inclusion of sustainability principles and practices into the planning and development of suburbs in Perth. A sustainability indicator tool was developed that has used the indicators of sustainability, found in the review of the literature, namely Wiland, Bell and

D'Agnese's (2006) description of six tools used as a measure of a suburb's or suburb's sustainability, and they include the provision of:

- Open space and public parks
- Urban forestry or bushland
- Watershed management
- Environmentally conscious waste disposal and recycling
- Energy efficient buildings
- Mass transit/transport management
- Promoting accessibility instead of mobility
- Minimising waste
- Reducing latent heat
- Capturing and retaining water
- Reducing pollution
- Reusing and recycling everything possible

These criteria were agreed by other researchers as vital ingredients for a sustainable suburb or subdivision; that is that there is a mix of activities and house types and where services, employment and recreation are within walking distance (Green, Grimsley, and Stafford 2005; Langdon 2005; Low et al. 2005; Girling and Kellett 2005; Zetter and Watson 2006; Mander, Brebbia, and Tiezzi 2006; Frey and Yaneske 2007; Friedman 2007; Gause, Franko, and Urban Land Institute. 2007; Crabtree and Hes 2009). Overall, the sustainability indicator tool establishes that as far as the design of each suburb is concerned, the case study suburbs have the potential of being more sustainable than traditional suburban design. They are all

walkable, with good pedestrian access and excellent community spaces, and they have all concentrated on retaining remnant bushland and tree species to balance the usual tree loss experienced in the development process. The two oldest suburbs, Harvest Lakes and Rivergums have well established residents associations and all the developers have retained a strong supportive presence in the suburbs – all factors that the literature suggested were important for creating more sustainable settlements.

The third research question was answered through the examination of sustainability features in each case study suburb, via the sustainability indicator tool and other data methods. Therefore, as much as developers of the case study 'green' marketed suburbs are able to they have created suburbs that:

- Are walkable;
- Have a strong sense of community through shared spaces, activities and news sharing;
- Are better connected to nature through the retainment of remnant vegetation;
- Are water wise through using water wise plantings and using innovative storm water vegetation drains and 'raingardens';
- Are attempting to encourage excellence in energy efficient house design through orientating blocks along the north/south axis and through building guidelines that attempt to inhibit energy inefficient design features.

Once services and improved public transport connections become a priority of local and state governments, these case study suburbs could provide residents with viable alternatives to the use of the private car for every trip. Yet, as was highlighted any suburb is ultimately embedded within local policy and regulation environments, and is limited in its capacity to either influence or change government policy there is only so much that a developer has control over.

8.2 Overall Findings and Arguments

In the housing sector the primary measure of sustainability is energy efficiency, and this was found to be regulated through the National BCA and implemented by Local Government, and more specifically the EER is implemented through accredited EER assessors. The exploration of energy efficiency in the built form highlighted that there is a considerable flaw in the way in which energy efficiency is operationalised in housing design through the use of EER tools. Whilst the EER tool assumes that all spaces will be mechanically air-conditioned, and penalises designs that will not be conditioned irrespective of the passive solar design, houses will only have limited energy efficiency. In Perth, this anomaly of the EER tool is seriously exacerbated with the preponderance of uninsulated double-brick cavity construction, that is coupled more recently with high levels of roof insulation, limited eaves or summer shading, black or dark coloured roofs and limited cross-ventilation.

8.2.1 Background and Context

Chapter One established that there exists a considerable impetus for improving the sustainability of suburban development in Australia. Growing house size and residential energy use despite smaller families is negating government efforts to

reduce greenhouse gas emissions in Australia (Australian Bureau of Statistics 2007; Australian Conservation Foundation 2007). It was suggested in Chapter One that the context of sustainability in the housing sector is about energy efficiency, both in how suburbs and suburbs are designed and in the design of houses; and it was established that there was a clear pressure to increase the energy efficiency of suburban development, particularly in the built environment, and the research questions were posed as a guide to explore the literature and the collection of data.

8.2.2 *Legislative Framework*

In Chapter Two it was found that given the many layers of government in Australia, a planning and development context has been created that is complicated and highly bureaucratized (Davison 1993; Forbes 1994; Troy 1995; Gleeson and Low 2000; Hamnett and Freestone 2000). The implementation of planning decisions is predominantly left to local governments, through their capacity to sign off on building designs in accordance with the BCA and through local planning development codes to enact the higher order State Planning Legislation. The analysis found that as far as the development of 'green' marketed suburbs in Perth is concerned, the overarching legislative and regulatory context is the implementation of the national BCA, its subsidiary energy efficiency requirements, and the WA Liveable Neighbourhoods Policy. These two government policies significantly influence and drive the eventual development and design of houses and suburbs in WA. More importantly, it was identified that there are serious flaws in the way in which the energy efficiency of a building design is evaluated, via EER tools. It was found that the recent research of Williamson et al. (2010) highlights

clearly that because the current EER tools assume that a space will be air-conditioned, the star rating system has been skewed towards building designs that are energy inefficient, and as a consequence passive solar design houses can be much more expensive to build.

8.2.3 Planning and Building Issues

It was identified that the unique situation in Perth of a predominance of double brick uninsulated cavity residential construction has meant that the more recent housing stock, in addition to being already energy inefficient with the use of uninsulated double brick in particular, is made more so because of the inequities of the EER tools, and the addition of insulation creating an 'oven' affect (Sugo, Page, and Moghtaderi 2004; Gregory et al. N.D; Williamson, Soebarto, and Radford 2010; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008; Reidy, Reardon, and Milne 2008; McGee, Mosher, and Clarke 2008). The review of the literature established that there is a definite gap in the research of the sustainability performance of 'green' marketed suburbs, despite their growing prevalence in the real estate market, and that there is a significant need for suburbs to be more sustainable. It was also highlighted the development history of suburban settlements, and traced some of the early motivations for suburban residential development; and explored how sustainability is contextualised in the built form. The economic and social costs of the current urban form were explored, as well as the issues of consumption and the consumption of 'green' marketed products.

It was also found that having built in space or room for infrastructure to allow for a community wide waste recycling/reusing process, connecting and working with local government to enhance the recycling program already in place in most suburbs, working to educate builders and consumers about the need and benefits of creating low-emission, energy-efficient houses can go some way to enhancing sustainability in suburbs. It was found that researchers suggested that houses that include the following criteria are more sustainable than those that do not:

- Designed for the local climate and prevailing breezes;
- Orientated so that main windows face north (south in the northern hemisphere);
- Makes good use of thermal mass; provides high insulation;
- Designed for good ventilation but minimising leakage of air or heat;
- Manages water wisely;
- Limited or no need for extra heating and cooling (Low et al. 2005; Friedman 2007; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008).

In addition, it was suggested by Horne (2006) and Friedman (2007) that a sustainable house, developed along Environmental Sustainable Design (ESD) principles, will function well in conserving water and energy and utilise low-impact materials compared to the typical four-bedroom, two-bathroom suburban house that is currently the mainstream housing option.

8.2.4 Case Study Findings

The research has found that as far as the four case study suburbs are concerned, the developers would like buyers to make the connection between ‘green’, ‘eco’, ‘sustainable’, ‘back to nature’, ‘live naturally’ and other similar phrases used in their marketing, and sustainability and environmental awareness as the literature would define it. The sustainability indicator tool, and the interview of the project managers of the four case study suburbs, found that the developers of the four case study suburbs have concentrated on marketing more generally those sustainability features that are easiest to achieve, quantifiable and most obvious – namely: water sensitive design, prioritising for solar orientation, retaining remnant trees and creating a sense of ‘place’ and ‘community’. While it is possible to find the general meaning of sustainability or environmental awareness implied in such vague terms as ‘A Sustainable Community’, ‘Change your world’, ‘WA’s first GreenSmart Village’, “Back to Nature”, and “Live for Today and Tomorrow” or terms such as ‘green’, ‘eco’, ‘sustainable’, ‘back to nature’, ‘live naturally’; it is more difficult to determine whether it is actually achieved. As has also been highlighted, there is a difficulty with making an analysis between what has been marketed and what is in practice as the case studies suburbs are still in the development stage, with still some essential services yet to be incorporated.

Moreover, because these suburbs are embedded within a much larger planning framework, their ability to influence wider infrastructure decisions to be more sustainable is limited. However, the research did identify that the case studies were all walkable and with greater access to public transit systems they could provide

residents with a viable alternative to the private car; and once essential services are in place this will be more likely.

It was found that there were a number of indicators of sustainability that the developers have very limited influence or control over and they include: environmentally conscious waste disposal and recycling, reusing and recycling everything, energy efficient buildings, minimising waste, reducing latent heat, mass transit/transport management and reducing pollution. However despite this, developers can potentially create the right atmosphere and environment for such indicators of sustainability to be achieved in the longer term. It was discovered, through the sustainability indicator tool, that residents had a high level of non-compliance to some of the building guidelines in three of the four suburbs and that this significantly inhibited the ability of the developers to create communities that are a more sustainable alternative to traditional suburb design. It was noted that whilst the design of the suburb could be said to be more sustainable than traditional mainstream suburbs, the majority of houses in each suburb were not. Using the Sustainability Indicator Tool for display homes in each suburb, it was found that although all the display homes managed water wisely, against all other sustainability criteria (other than the 2 commissioned 'green' marketed houses and the one 8 Star house) the display homes failed. Moreover it was found that, unexpectedly the number of display homes that failed to comply with the building guidelines dealing with energy efficiency in three of the four suburbs was significant.

8.2.5 Respondent Perspectives

It was found that, surprisingly, 38.1% of respondents of the residents survey said that either they 'did not know or they definitely did not build in a 'green' marketed suburb', despite the fact that they all resided in suburbs that have been awarded and strongly marketed for their 'green' credentials. Although a few respondents mentioned 'environmental consciousness' of the estate as one of the reasons for building in their respective suburb, 66.7% said they had included environmental/sustainability features in the design of the house. It was highlighted that although this seems to be contradictory the result may be reflect the average consumer's misunderstanding as to what environmental/energy efficiency features are, and the existence of an 'attitude-behaviour gap' (Marchand, Walker, and Cooper 2010; Mont and Power 2010; Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010; Power and Mont 2010; Gibson et al. 2010).

It was also highlighted that the resident's survey results would appear to reflect the inhibitors of sustainability behaviours that were found by Partidario et.al (2010), that is, that lack of education and a perception of the high cost of 'green' marketed products were two of the things that prevented them from buying. It was also identified that the results from the resident's survey appear to confirm ABS (2007) research on dwelling size and number of occupants, with 50% of respondents of the resident's survey have 2 people living in their house, 10% said they lived alone, whilst 40% had 3 or more people in their house. In addition, 52.4% of resident's reported having a house that was between 201-250 square metres in size, a figure that is also reflected in recent ABS data that is suggesting that the average size of

houses in Australia is now close to 250sqms (Australian Bureau of Statistics 2007). In Chapter Six it was found that additional ABS (2008d) research also seems to confirm similar results from the survey of residents where the number of cars owned per household is now averaged at 2 cars. Respondents in the resident's survey reported that 71.4% had 2 cars and 28.6% households had more than 3 cars. In addition the ABS (2008d) research highlighted that the number of cars per household is strongly associated with public transport use, with 12% of people with two or more cars using public transport compared to 28% of people with only one car per household; and these results are further confirmed by the private car being used by the majority of residents, in this case 80% and public transport being used by 30% of residents (Australian Bureau of Statistics 2008d).

8.3 Research Perspectives

This research has highlighted unequivocally that a major missing link exists between good sustainability policy development and its eventual implementation. Residents and the building sector were all, for the most part, well aware of the energy efficiency features available in house design and how they could assist living costs, however there was less understanding of how to apply them and far less understanding of the very real lifecycle cost savings that designing an energy efficient creates nor a willingness to prioritise such features ahead of perceived 'luxury' items.

This research argues that the current 'unsustainability' has come about because of a whole range of competing agendas and decisions that have been, for the most part, based on erroneous commercial and policy understandings. In other words, that

while land, energy and materials are abundant, infinite and cheap, and the structure of families has not changed since the 1950s and will not in the future (Meadows, Meadows, and Randers 2005; Davison 2006; Lovelock 2006; Bernstein et al. 2007; Costanza et al. 2007; Grace 2007; Monbiot 2007; Ehrenfeld 2008; Garnaut 2008; Gurrán et al. 2008; Newton 2008; Newman, Beatley, and Boyer 2009). In the case of sustainable suburbs, consumer behaviour and the inadequacies of the EER tool has meant that efforts to increase sustainability in the built environment, despite government efforts, are creating outcomes that are quite the opposite.

According to Ehrenfeld (2008) the search to find the solution to our currently 'unsustainable' lifestyles has predominantly led researchers, politicians and policy makers to seek what are ultimately 'band-aid solutions' to attempt to fix complex fundamental problems. As Ehrenfeld (2008, :7) suggests 'almost everything being done in the name of sustainable development addresses and attempts to reduce unsustainability yet reducing unsustainability, although critical, does not and will not create sustainability' because it fails to address overconsumption and the current inability to price environmental damage. Sustainable development is, according to many researchers (see (Edwards 2005; Filho 2005; Meadows, Meadows, and Randers 2005; Lovelock 2006; Hawken 2007; Suzuki, McConnell, and Mason 2007; Ehrenfeld 2008; Patton 2008; Speth 2008)) is premised on the assumption that the current status quo of 'progress' is successful (in other words that the economic growth that the world experiences over time is successful despite the environmental, social and financial cost). For those researchers that see 'sustainability' in radically different terms to the WCED (1987) version of 'sustainable development' (where human economic progress has primacy over

environmental or social progress), there is friction as to how to address the world's current unsustainability given the overwhelming dominance of the WCED 'sustainable development' model (Goldsmith 1972; Meadows and Club of Rome 1972). The 'sustainability' movement (strong sustainability) as opposed to the 'sustainable development' (weak sustainability) movement seeks to address the overlying symptoms of environmental and social damage through a radically different vision of the future, which involves engagement with humanity's deep and inherent connection to nature, its natural place in nature and the need for humanity to revise its consumption patterns to better fit the resources available in a fair and equitable way (Scheurer 2000; Dresner 2002; O'Riordan and Stoll-Kleemann 2002; Edwards 2005; Filho 2005; Gonzalez 2005; Green, Grimsley, and Stafford 2005; Low et al. 2005; Costanza et al. 2007; Frey and Yaneske 2007; Grace 2007; Hawken 2007; Ehrenfeld 2008; Speth 2008).

Furthermore this research also argues that despite the inclusion of sustainability criteria into the BCA, framed through increasing energy efficiency in the building stock, there remains a number of issues related to actual energy efficiency performance of suburban residential development in Australia. Consumer behaviour, particularly in the context of rising expectations of comfort and increasing use of electrical household appliances, is having a significant impact on energy use in the residential sector. The more recent development phenomena of the 'green' marketed suburb is moving the residential market towards what government policy (WA LN Policy) sees as the future of residential development, and this thesis has ultimately questioned whether they are actually achieving the sustainability goals they are advertising.

8.4 Key Findings

A number of significant findings have emerged from the data sources namely, interviews, focus groups, online surveys and the sustainability indicator tool. These include such complex issues as barriers to implementation of government policies and legislation, knowledge gaps in relation to sustainability; gaps in implementation of government policies and the presence of new government policy that may support increased capacity in governments to implement sustainability more successfully.

8.4.1 Barriers to Implementation

Unfortunately, through exploring the research and collecting data to answer the two research questions, it has become apparent that in the context of 'green' marketed suburbs, the building and consumer sectors currently exhibit a considerable barrier to increasing sustainability in suburbs. More specifically, the results from the site observation tool in Chapter Six (of resident's houses and display homes), and the results of the survey of residents of the case study suburbs, has clearly highlighted that the building sector is yet to incorporate any significant energy efficiency into their house designs other than what is the minimum mandated requirement (or even comply with building guidelines), and the majority of residents of the case study suburbs are yet to include any significant energy efficiency features into their house designs (or comply with building guidelines) and are inhibited by the 'attitude-behaviour' gap (see the discussion of this issue in Chapter Seven) to a large extent.

The overall conclusions from the data collected and review of the literature is suggesting very clearly that there is a considerable gap in the overall design of 'green' marketed suburbs, which in all the case studies could be said to have the potential of being sustainable, and the design of the houses in them in relation to energy efficiency and sustainability. The recent media attention regarding the efficacy of the energy efficiency ratings tools and the most recent research from Williamson, Soebarto, and Radford (2010), would appear to back up this research finding.

In other words the rating tools used to ultimately operationalise the energy efficiency requirements of the BCA don't appear to be enabling energy efficiency outcomes in the urban built form. What the research of Williamson, Soebarto, and Radford (2010) highlights is that the baseline assumption made by the national EER tools, used to assess the performance of a house design, is that every house will supplement the heating and cooling of the space with artificial air-conditioning. Which would appear to counteract the stated goals of the BCA to reduce household carbon emissions through energy efficient design, as houses are being designed to be artificially air-conditioned rather than be passive solar and are therefore using more energy. There are also some serious flaws in the way in which the energy efficiency of a building design is evaluated, via energy efficiency rating tools. The research of Williamson et. al. (2010) highlighted clearly that because the current EER tools assume that a space will be air-conditioned, the star rating system has been skewed towards building designs that are energy inefficient, and as a consequence passive solar design houses can be much more expensive to build. In addition, both surveys highlighted that for those people who professed a

willingness to include energy efficient features into their house design, they reported that their builders were unwilling or lacked the capacity to do so. However, in fairness, these sectors are predominantly influenced by government policy and regulation. Given the obvious anomalies that the BCA's EER tool is currently exhibiting this is perhaps not surprising. Moreover, whilst developers in WA are now heavily influenced by the LN Policy, as Falconer et al. suggest (2010) there is no indication that all developers are creating more sustainable suburbs, in fact quite the opposite. National and international research would seem to concur with these findings as well, with Crabtree and Hes (2009) finding that the barriers to sustainability integration in the housing sector was an institutional problem rather than a technological one; and Mapes and Wolch (2010) finding that developers of 'green' marketed housing estates are focusing on marketing the features that increase community attractiveness rather than the full range of attributes to enhance the sustainability, with builders and consumers not necessarily complementing the sustainability aims either.

For the Perth metropolitan area, the situation is made even more complex because of the brick industry monopoly on building materials, to such an extent that it is known anecdotally that building with double brick is cheaper than with single brick (although there is no known research on this issue).

8.4.2 Sustainability Knowledge Gaps

The research for this thesis has identified a number of further barriers to the implementation of sustainability principles and practices into the design of suburbs and houses, and additionally in the capacity of residents to change their behaviours

towards a more sustainable lifestyle. One of the Local Government interviewees highlighted in the interview that the 'what' and 'how' of sustainability is difficult for councillors and staff to understand in the context of local government. It was also obvious in the two householder surveys conducted for this thesis, that the majority of people had a limited understanding of what sustainability actually means and how they might apply it to their lifestyles or their house designs. The research of Crabtree and Hes (2009), Partidario et al. (2010) and Mapes and Wolch (2010) (see the discussion in Chapter Seven) has also identified that lack of knowledge about sustainability and in particular in energy efficiency in housing design, is a significant barrier to people adopting more 'green' products and services.

Despite the wealth of knowledge available on Australian government sites like www.yourhome.gov.au and www.yourdevelopment.gov.au; unless people are already engaged by environmental or sustainability awareness they are less likely to be early uptakers of new 'green' products and services, unless they become mainstream or regulated (Crabtree and Hes 2009; Stevenson and Leaman 2010; Paco and Varejao 2010; Nielsen et al. 2009; Partidario, Vicente, and Belchior 2010). Crabtree and Hes (2009) identified in their research that builders were yet to be engaged in creating more energy efficient houses, despite the stewardship from the Housing Industry Association's GreenSmart houses program, and other state based programs around Australia to educate builders about sustainability. So it's likely then, that until there is an economic imperative to build more sustainably, builders will continue to be motivated by price alone rather than also educating their consumers about better passive solar design.

8.4.3 *Passive Design Requires Active Households*

One issue that Williamson et al (2010) identified in their research is that passive solar designed houses, by their very definition, require their inhabitants to be active in managing the internal environment for thermal comfort. Being active in a passive solar house means opening and closing sun block blinds to either let in the warmth of the morning sun in winter or keep out the heat on a hot summer day; it means putting up solar pergolas with deciduous creepers or planting deciduous trees on the north western side of the house to regulate the summer sun from heating up the building envelope; opening windows and doors to allow the prevailing breezes to cool the inside of the house and turning on fans to assist the air to move inside a room when the breezes aren't strong enough (Williamson, Soebarto, and Radford 2010; McGee, Mosher, and Clarke 2010; Reardon and Clarke 2008; Reardon and Downton 2008; Reardon, McGee, and Milne 2008; Reardon, Mosher, and Clarke 2008). Passive solar houses require engaged and participative inhabitants, and ones that aren't necessarily quick to turn the switch on an air-conditioner (Thomas 2010d, 2010b, 2010c; Stevenson and Leaman 2010; Paco and Varejao 2010; Isaacs et al. 2010; Gram-Hanssen 2010; Guerra-Santin and Itard 2010; Hendrickson 2010). Clearly education in how to be an active resident in a house to increase the energy efficiency and reduce living costs is a vital component of any sustainability policy in the housing sector, and this research has highlighted the obvious outcomes from a lack of education. Blind faith in regulations being successful and achieving desired outcomes is insufficient.

8.4.4 Limited Capacity in Local Government and Building Sector

The LG interviews highlighted that only one local government had a comprehensive Sustainability Policy that they had begun to integrate into the rest of their activities. It was identified that the meaning of sustainability does not change (even aside from the arguments about the subtle difference in meaning between the two most common definitions), the context of how it is applied and operationalised does. Yet, in the local government and business context, the application of sustainability needs to be through the policy and business planning process (Bell and Morse 1999; Epstein 2008). Unless there is a strategic objective of integrating sustainability into all the organisation's principles and practices, it runs the risk of not succeeding or being an ad hoc idea that isn't fully implemented across the board, which the LG highlighted as a potential problem (see Chapter Five) (Epstein 2008). Without a strategic Sustainability Policy that is fully integrated into lower order and complementary policies, (such as has occurred at the City of Cockburn), the policy will not assist in the integration of sustainability (Epstein 2008).

8.4.5 Energy Efficiency in Project Home Design

Energy efficient passive solar design requires the house designs to adapt to the orientation of the site so that the living areas can face the north to access the solar heat gain in winter and the light in summer (blocking summer heat by seasonal shading), yet this is not currently factored into designs that are offered in display homes and builder's websites at the case study suburbs. At the moment, house designs are offered to consumers irrespective of orientation, and in most cases any changes to the design increases the cost. The Project Managers of the case studies

reported that a lot of time had been spent in ensuring as many of the lots were orientated along the north/south axis to enable good passive solar orientation for the houses; however this opportunity has not always been taken advantage of by the case study builders.

8.4.6 Assumed Air-conditioning in the EER Tool

The recent research of Williamson et al. (2010) found five houses (built before mandatory star ratings) that had been awarded by the Australian Institute of Architects for environmental design, would not have gained the minimum five star EER to comply with the BCA. Williamson et al. (2010, :509) suggest that the 'assessment processes underpinning regulations do not correlate well with measured environmental performance, the perceptions of occupiers, and how these houses are actually designed and operated. The regulatory concept of 'meeting generic needs' fails to account for the diversity of socio-cultural understandings, the inhabitant's expectations and their behaviours'. In particular the authors found that the standards and regulations, that underpin the EER tool, were unable to predict adaptive comfort as well as the low-energy consumption of the five case study houses, because the EER tools assume that a house will always be mechanically air-conditioned (Williamson, Soebarto, and Radford 2010). Williamson et al. (2010, :509) highlight that the 'governance challenge' will be to include the evaluation of the 'interaction of individual preferences, technical concerns, bio-climatic matters, and the socio-cultural context', particularly in recognising and rewarding the energy efficient goals and behaviours of inhabitants. Given that the intentions of the BCA is to decrease greenhouse gas emissions from

the residential sector through increasing the energy efficiency of the housing stock, and by implication ensuring that the 'process of occupying the building does not entail the excessive use of energy and/or CO₂ emissions...and at the same time ensure that the building is comfortable for its occupants'; assuming that a space will always need air-conditioning is clearly counter-productive to that intention (Williamson, Soebarto, and Radford 2010).

8.4.7 Inefficient Price/Policy Signals for Desired Outcomes

The survey results for this thesis and other research including OECD (2011), Partidario et al. (2010), Paco and Varejao (2010), and Crabtree and Hes (2009) all suggest that correct price and policy signals that influence desired behaviour outcomes are the most effective at changing behaviour towards more energy and resource conservation. Without the pressure of regulatory compliance and the incentive of cost savings, and more subtle benefits such as increases in the value of a dwelling, people will choose the behaviour that is most convenient and self-satisfying over being 'green' unless they are significantly engaged in doing that already (Organisation for Economic Co-operation and Development 2002; Crabtree and Hes 2009; Nielsen et al. 2009; Australian Government 2010; Council of Australian Governments 2010; Gram-Hanssen 2010; Guerra-Santin and Itard 2010; Hendrickson 2010; Isaacs et al. 2010; Paco and Varejao 2010; Partidario, Vicente, and Belchior 2010; Stevenson and Leaman 2010; Organisation for Economic Co-operation and Development 2011). Given this understanding about consumption behaviour, policy attention on regulation and pricing resources according to their actual value and finite nature would seem imperative.

8.4.8 Compliance with Building Guidelines

The sustainability criteria that developers and governments would appear to have had the least amount of influence on, despite building covenants, is more energy efficient housing. Granted the majority of this issue is mandated by the Federal Government's BCA, and the recent research has identified that there are some problems with how the EER tools measure energy efficiency in house designs (see (Williamson, Soebarto, and Radford 2010)). However, the lack of compliance to basic building guidelines that would have ensured greater energy efficiency in three of the four case studies, by either the builders or householders, is concerning.

As far as the developer is concerned, at some point during the building design process there is clearly a loop hole that is allowing consumers to choose energy inefficient designs instead of more energy efficient options after the original complying design has been signed off, without it having to go back for sign off from the developer. The project managers in the interviews did intimate that gaining compliance to some guidelines had been problematic, and that they lacked the capacity to force compliance even though technically they had the legal right to do so. The interview with the LG confirmed that they had no regulatory authority unless it was enforceable under the BCA. Unfortunately, the limited amount of data that was able to be collected on the building sector in this thesis has inhibited the exploration of this issue, but it is an issue where further research is clearly required.

It is likely that building guidelines non-compliance is occurring for two reasons, firstly the consumer and building sector are not as engaged with the necessity or benefits of energy efficient design as the developers of 'green' marketed suburbs

appear to be, or for that matter governments. This was made abundantly clear throughout this research and in other recent research (see Crabtree and Hes (2009), Partidario et al. (2010) and Mapes and Wolch (2010)). Unless people are aware of the actual benefits of energy efficient design (particularly the cost savings), are comparatively informed about those benefits and are engaged by the perceived benefits as well (particularly with incentives), they are unlikely to make the leap to action from the 'attitude-behaviour gap' (Organisation for Economic Co-operation and Development 2002; Partidario, Vicente, and Belchior 2010). Secondly the building sector has been identified by the case study developers (see Chapter Four) and in Crabtree and Hes's (2009) research, as a very conservative industry, made up of many different 'players', that are predominantly incentivised to build as efficiently and cost effectively as possible (for them rather than the consumer). Unless a criterion is regulated by the BCA a builder has limited economic incentive to do anything more (as was highlighted in the Project Manager interviews in Chapter Four), unless that builder is interested in creating a niche market.

8.4.9 New Government Policy

There are a number of Federal and State Government policies that may provide further support to the continued development of more sustainable suburbs and houses in the residential sector and they include:

1. COAG's National Strategy on Energy Efficiency (NSEE) (2010) and the National Framework on Energy Efficiency (NFEE) (2010) which will introduce mandatory disclosure of EER for all residential houses that will be sold or leased. Mandatory disclosure of EER has been government policy in the ACT for many years and has

been very successful in increasing the energy efficiency of the building stock (see (Reidy, Reardon, and Milne 2008). The Strategy's (2010) four key themes are:

- Assisting households and businesses to transition to a low-carbon future;
- Reducing impediments to the uptake of energy efficiency;
- Making buildings more energy efficient; and
- Government working in partnership and leading the way.

2. BCA EER 6 Stars mandated for 2011 (Australian Building Code Board 2010b, 2010a). Even though there are considerable flaws in the rating tools, increasing the stringency of the required energy efficiency is important.

8.4 Conclusions

What this thesis research has highlighted is that there is a significant gap in what residents suggested were motivating reasons for moving to 'green' marketed suburbs and how they actually lived their lives once moving; and that there is also a significant gap in what people say they feel concern about and what they are actually willing in practice to do about that concern. In the underlying and pervading theoretical foundations for the decision making frameworks that exist in the planning and development of suburbs in Perth, WA, and it has become clear throughout this research that the dominance of rationalist ideologies at the expense of more collaborative planning approaches have created a policy environment that is 'top-down' rather than incorporating more 'bottom-up' policy approaches. What this means for 'green' marketed suburbs is that this over riding 'top-down' policy approach has worked to effectively 'water-down' the real

sustainability opportunities that have been espoused in much of the policies affecting the planning and development of suburbs in Perth. Rationalist planning ideologies have taken precedence over more collaborative planning principles that would seek to gain an understanding of resident's needs and intentions, meaning that the planner becomes the 'expert' and assumes an understanding of what resident's needs (Hillier 2000, 2002). While rationalist planning is the underlying force behind the development of sustainability policies and their implementation, there will be limitations/resistance to such policies being fully and properly implemented because they rarely take consideration for how people actually behave and what they need. What is apparent from this research is that governments cannot continue to use rationalist planning approaches and expect a different result to the ongoing sustainability policy implementation gaps that have become apparent.

Chapter Two identified that the subtle differences in meaning between the WCED (1987) version of 'sustainable development' and the Club of Rome's (1972) 'within the limits of the planet' ethos of sustainability was an important differentiation for this thesis. Up till now the version of 'sustainable development' that most governments and businesses have been using is the WCED/Bruntland Commission's (1987) Our Common Future version of sustainable development (as evidenced on their websites, and their definitions of sustainability), rather than the less common Club of Rome's (1972) version of sustainability that incorporates a concept of the planetary services having untenable limits. This subtle yet important difference in the meaning of sustainability has meant that the search to find the solution to our currently 'unsustainable' lifestyles has predominantly led researchers, politicians

and policy makers to seek what Ehrenfeld (2008) calls 'band-aid solutions' to attempt to fix complex fundamental problems. Ehrenfeld (2008, :7) in particular suggests this is the case because 'almost everything being done in the name of sustainable development addresses and attempts to reduce unsustainability yet reducing unsustainability, although critical, does not and will not create sustainability' because it fails to address overconsumption and the current inability to price environmental damage.

The results found in Chapter Six, point to a way of life that is ultimately 'unsustainable'. In Chapter Two and Three, it was suggested that this unsustainability has occurred because humans have lost touch with their 'natural' selves and their intrinsic place within and of nature, and that this separation and disconnection has led indirectly to our society creating settlements and lifestyles that are ultimately 'un-natural' and in the long term unsustainable (Carson 1962; Goldsmith 1972; Meadows and Club of Rome 1972; Lovelock 1988; Gottlieb 1996; Beatley and Manning 1997; Nasr 1997; Dryzek and Schlosberg 1998; Suzuki, McConnell, and Mason 2007; Ehrenfeld 2008; Speth 2008; Suzuki 2010). A number of recommendations for further research and changes to policy development and implementation have emerged out of this thesis research including:

1. Modifying the BCA's EER tool so that it does not assume the use of an air-conditioner but rather rewards actual passive solar design and use.

2. Reduce the separation of land development from housing development to increase energy efficiency outcomes through the use of planning controls on housing design
3. Provide 'passive solar house-active resident' education for new home buyers
4. Provide more accurate price signals to motivate sustainability and energy efficiency outcomes
5. Remove subsidies and support for fossil fuels and energy inefficient activities
6. Mandate the inclusion of solar panels for electricity generation in households, funded by government subsidies and increase the tariff price for back-to-grid power generation
7. Better research into building materials other than double-brick

In Perth, the cheapest land is on the fringes of the metropolitan area, reflecting the anomaly that Gonzalez (2005), Grace (2007), Newton (2008), and Newman (2009) refer to of over subsidised and artificially cheap land and inputs driven by these seemingly cheap and unlimited resources. Perhaps even more importantly for the wider perspective of sustainability in the residential sector, if Governments continue to allow new suburbs to be built further and further from services and public transport networks, (and in the absence of a level playing field for renewable energy sources and more sustainable development generally), the people that can least afford to manage the impacts of climate change and peak oil will be hit the hardest (Trubka, Newman, and Bilsborough 2010).

One of the more positive aspects that this research has found, in this exploration of 'green' marketed suburbs, is that thoughtful design has the potential to create suburbs that have a much greater opportunity to be sustainable and assist residents to live more sustainable lives. Residents overwhelmingly supported the inclusion of high quality community spaces that encouraged social interaction and a connection to nature, they appreciated the closeness of schools and services so that they could leave their cars at home; and they also valued the active participation of the developer and the local governments in helping their community to interact and feel welcome. These are aspects that deserve to be fostered and when included alongside houses that are actually energy efficient, suburbs will have a much greater potential of supporting people to live more sustainably.

9 References

- ACT Govt. 2001a. *The Canberra Spatial Plan*. Canberra.
- . 2001b. Territory Plan. Urban Services. Accessed April, www.act.gov.au/urbanservices.
- . N.D. "Cavity Wall Insulation." edited by ACT Government Home Energy Advice Team, Canberra: ACT Govt.
- Adhikary, Rajib. 2008. "The Promise of Green Design." *Design Management Review* Fall.
- Allmendinger, Philip. 2009. *Planning Theory*. Edited by Yvonne Rydin and Andrew Thornley. Vol. 2, *Planning, Environment, Cities*. Basingstoke, England: Palgrave Macmillan.
- Ambrose, M., E.; Mead, and A. Miller. 2006. "Sustainable Suburbs - the Developer's Challenge." In *Clients Driving Innovation International Conference*.
- Ambrose, M., and A. Miller. 2005. "How to Achieve Sustainability - Regulatory Challenges." In *Conference on Sustainable Building South East Asia, Malaysia*. CSIRO, Queensland.
- Ambrose, Michael. 2008. "Energy Efficient Housing Design and Sub-Division Design." In *Transitions*, ed. Peter Newton. Collingwood, Vict. Australia: CSIRO Publishing.
- Anderson, Ray C. 2011. More Happiness, Less Stuff. (Guest Column). *Environmental Leadership*. Accessed 26/05/11,
- Anfara, Jr. Vincent A.; , and Norma T.; Mertz. 2006. *Theoretical Frameworks in Qualitative Research*. Thousand Oaks, CA: Sage.
- Attari, Shahzeen Z., Michael L. DeKay, Cliff I. Davidson, and Wandi Bruine de Bruin. 2010. "Public Perceptions of Energy Consumption and Savings." *Proceedings of the National Academy of Sciences of the United States of America* 107 (37): 16054-16059.
- Australian Building Code Board. 2007. *Bca 2007*. Two vols. Vol. Two, *Buidling Code of Australia*. Canberra: ABCB.
- . 2010a. 2010 Energy Efficiency General Information Update. ABCB. Accessed 08/12/10, <http://www.abcb.gov.au/index.cfm?objectid=7384D70A-28B9-11DE-835E001B2FB900AA>.
- . 2010b. "Bca 2010." edited by Australian Building Code Board, Canberra: ABCB.
- Australian Bureau of Agriculture and Resource Economics. 2003. *Australian Energy; National and State Projections to 2019-20*,. Canberra.

- Australian Bureau of Statistics. 2006. 4102.0 - Australian Social Trends, 2006 ABS. Accessed 14/01/08, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/bb8db737e2af84b8ca2571780015701e/a300c2a2b4e0b91fca2571b000197552!OpenDocument>.
- . 2007. "Larger Dwellings, Smaller Households." edited by Australian Bureau of Statistics, Canberra: ABS.
- . 2008a. "2006 Census Community Profile Series: Atwell (State Suburb)." edited by Australian Bureau of Statistics, Canberra: ABS.
- . 2008b. "2006 Census Community Profile Series: Baldivis." edited by Australian Bureau of Statistics, Canberra: ABS.
- . 2008c. "2006 Census Community Profile Series: Forrestdale (State Suburb)." edited by Australian Bureau of Statistics, Canberra: ABS.
- . 2008d. "4102.0 Australian Social Trends, Public Transport Use for Work and Study." edited by ABS, Canberra: ABS.
- . 2008e. "Energy Use by Households." edited by Australian Bureau of Statistics, Canberra: Australian Bureau of Statistics,.
- . 2009. "4626.0.55.001 Environmental Views and Behaviour, 2007-08 (2nd Issue)." edited by Australian Bureau of Statistics, Canberra: ABS.
- . 2010a. "4613.0 - Australia's Environment: Issues and Trends." edited by Australian Bureau of Statistics Centre of Environment and Energy Statistics, Canberra: Australian Bureau of Statistics.
- . 2010b. "4614.0.55.001 - Energy in Focus: Energy Use in Australian Homes." edited by ABS, Canberra: ABS.
- . 2010c. "4614.0.55.002 - Energy in Focus: Energy Efficiency of Australian Homes." edited by ABS, Canberra: ABS.
- . 2011. "4602.0.55.001 - Environmental Issues: Energy Use and Conservation " edited by ABS, Canberra: ABS.
- . 2012. "Household Energy Use and Costs." edited by ABS, Canberra, ACT: ABS.
- , ed. 2001. *Census 2001*. Canberra: Australian Government Publisher.
- Australian Conservation Foundation. 2007. *Consuming Australia: Main Findings Report*. Accessed January 31, <http://www.acfonline.org.au>.
- Australian Council for New Urbanism. 2006. *Australian New Urbanism a Guide to Projects*.
- Australian Government. 2010. "National Partnership Agreement on Energy Efficiency. Incorporating the National Strategy on Energy Efficiency." edited by COAG, Canberra: Australian Government.
- Australian Local Government Association. 2002. *Sustainability Local Government Association*. Australian Local Government Association. Accessed 03/02/09, <http://www.alga.asn.au/policy/environment/sustainability/>.

- Australian State of the Environment Committee. 2001. "State of the Environment." edited by Water Department of the Environment, Heritage and the Arts, Canberra: CSIRO.
- . 2006. "State of the Environment Report 2006." edited by Water Department of the Environment, Heritage and the Arts, Canberra: CSIRO.
- Australian Urban and Regional Development Review. 1995. "Urban Australia: Trends and Prospects." edited by Australian Urban and Regional Development Review, Canberra: The Australian Urban and Regional Development Review.
- Ausubel, J., and R. Herman. 1988. *Cities and Their Vital Systems: Infrastructure Past, Present, and Future*. Washington, D.C.
- Bang, Jan Martin; . 2005. *Ecovillages a Practical Guide to Sustainable Communities*. Edinburgh: Floris Books.
- Barton, Hugh. 1998. "Eco-Neighbourhoods: A Review of Projects." *Local Environment* 3 (2): 160-176.
- Bates, Mark, and Grant Kristofek. 2008. "Colorblind: How Consumers See Green." *Design Management Review* Fall.
- Beard, George. 2009. "The Sustainable Cities Imperative." *Nation's Cities Weekly* 32 (10): 4.
- Beatley, Timothy. 2004. *Native to Nowhere: Sustaining Home and Community in a Global Age*. Washington DC: Island Press.
- Beatley, Timothy, and Kirsty Manning. 1997. *The Ecology of Place*. Washington D.C: Island Press.
- Beatley, Timothy, and Peter Newman. 2009. *Green Urbanism Down Under*. Washington: Island Press.
- Beckerman, W. 1994. "Sustainable Development: Is It a Useful Concept?" *Environmental Values* 3: 191-209.
- Bell, Simon, and Stephen Morse. 1999. *Sustainability Indicators : Measuring the Immeasurable?* London: Earthscan Publications.
- . 2005. "Holism and Understanding Sustainability." *Systemic Practice and Action Research* 18 (4): 409-426.
- Bernstein, Lenny;, Peter; Bosch, Osvaldo; Canziani, and Zhenlin; Chen. 2007. *Intergovernmental Panel on Climate Change Fourth Assessment Report, Climate Change 2007: Synthesis Report*.
- Berry, Brian. 2009. "Dissatisfaction with City Life: A New Look at Some Old Questions." *Cities* 26 (3): 117-124.
- Berry, Mike. 1999. "Unravelling the "Australian Housing Solution"; the Post-War Years." *Scandinavian University Press* 16: 106-123.
- Bert, Ray. 2009. "The Ancient City: New Perspectives on Urbanism in the Old and New World." *Civil Engineering* 79 (5): 83.

- Birch, Eugenie L., and Susan M. Wachter, eds. 2008. *Growing Greener Cities: Urban Sustainability in the Twenty-First Century*. Philadelphia: University of Pennsylvania Press.
- Bond, Alan, Angus Morrison-Saunders, and Jenny Pope. 2012. "Sustainability Assessment: The State of the Art." *Impact Assessment and Project Appraisal* 2012 (1-11): 1-11.
- Bookchin, Murray. 2005. "Society and Ecology." In *Debating the Earth: The Environmental Politics Reader*, eds John S.; Dryzek and David; Schlosberg, 385-398. Oxford: Oxford University Press.
- Burke, G. 1975. *Towns in the Making*. London: Edward Arnold,.
- Carson, Rachael Louise. 1962. *Silent Spring*. Greenwich, Conn. Harmondsworth London: Fawcett Publications Penguin Hamish Hamilton.
- Chiras, Dan, and Dave Wann. 2003. *Superbia! 31 Ways to Create Sustainable Neighbourhoods, A Book for Wiser Living from Mother Earth News*. Canada: New Society Publishers.
- Cole, Raymond J., John Robinson, Zosia Brown, and Meg O'Shea. 2008. "Re-Contextualising the Notion of Comfort." *Building Research & Information* 36 (4): 323-336.
- Commonwealth Scientific and Industrial Research Organisation. 2004. "Accurate Manual." edited by CSIRO, Canberra: CSIRO.
- Connolly, John; Pierre; McDonagh, Michael; Polonsky, and Andrea; Prothero. 2006. "Green Marketing and Green Consumers: Exploring the Myths." In *The International Handbook on Environmental Technology Management*, eds Dora; Marinova, David; Annandale and John; Phillimore. Cornwall, Britain: Edward Elgar Publishing Limited.
- Costanza, Robert, Lisa Graumlich, W. L. Steffen, and Dahlem Konferenzen. 2007. *Sustainability or Collapse? : An Integrated History and Future of People on Earth, Dahlem Workshop Reports*. Cambridge, Mass.: MIT Press in cooperation with Dahlem University Press.
- Costanza, Robert; Graumlich, Lisa J.; Steffen, Will;. 2007. "Sustainability or Collapse - Lessons from Integrating History of Humans and the Rest of Nature." In *Sustainability or Collapse - an Integrated History and Future of People on Earth*, ed. Robert; Graumlich Costanza, Lisa J.; Steffen, Will;. Cambridge, Massachusetts: The MIT Press.
- Council of Australian Governments. 2009. "National Strategy on Energy Efficiency." edited by COAG, Canberra: Australian Government.
- . 2010. "National Strategy on Energy Efficiency." edited by COAG, Canberra: Australian Government.
- Crabtree, Louise. 2005. "Sustainability Begins at Home? An Ecological Exploration of Sub/Urban Australian Community-Focused Housing Initiatives. ." *Geoforum* 37 (2006): 519-535.

- . 2006. "Sustainable Housing Development in Urban Australia: Exploring Obstacles to and Opportunities for Ecocity Efforts." *Australian Geographer* 36 (3): 333-350.
- Crabtree, Louise, and Dominique Hes. 2009. "Sustainability Uptake on Housing in Metropolitan Australia: An Institutional Problem, Not a Technical One." *Housing Studies* 24 (2): 203-224.
- Curtis, Carey. 2006. "Network City: Retrofitting the Perth Metropolitan Region to Facilitate Sustainable Travel." *Urban Policy and Research* 24 (2): 159-180.
- . 2008. "Planning for Sustainable Accessibility: The Implementation Challenge." *Transport Policy* 15: 104-112.
- . 2009. "The Capacity of Government to Deliver Sustainable and Integrated Transport: The Case of Transit Orientated Development in Perth: Australia." In *International Conference on Urban, Regional Planning and Transportation, Paris, France*.
- Dahl, Richard. 2010. "Greenwashing. Do You Know What You're Buying?" *Environmental Health Perspectives* 118 (6): 247-252.
- Davison, Aidan. 2006. "Stuck in a Cul-De-Sac? Suburban History and Urban Sustainability in Australia." *Urban Policy and Research* 24 (2): 201-216.
- Davison, G. 1993. "The Past and the Future of the Australian Suburb." *Australian Planner* 31 (2): 63-69.
- Denzin, Norman K., and Yvonna S. Lincoln, eds. 2000. *Handbook of Qualitative Research Second Edition*. Vol. Second Edition. Thousand Oaks, California: Sage Publications.
- , eds. 2005. *The Sage Handbook of Qualitative Research* Vol. Third Edition. Thousand Oaks, California: Sage Publications.
- Department of Climate Change and Energy Efficiency. 2008. 7.1 Water Use. Australian Government. Accessed 25/02/11, <http://www.yourhome.gov.au/technical/fs71.html>.
- Department of Housing and Works. 2007. 5 Star Plus - What Is It? Department of Housing and Works, . Accessed 15/01/08, <http://www.5starplus.wa.gov.au/>.
- Department of Planning. 2008. "Liveable Neighbourhoods Policy." edited by Department of Planning, Perth, WA: Department of Planning.
- Doney, Willis. 1983. "Rationalism." *The Southern Journal of Philosophy* 21 (S1): 1-14.
- Dresner, Simon; . 2002. *The Principles of Sustainability*. London: Earthscan.
- Dryzek, John S. 2005. *The Politics of the Earth : Environmental Discourses*. 2nd ed. New York: Oxford University Press.
- Dryzek, John S., and David Schlosberg. 1998. *Debating the Earth : The Environmental Politics Reader*. Oxford [England] ; New York: Oxford University Press.
- . 2005. *Debating the Earth : The Environmental Politics Reader*. 2nd ed. Oxford ;: Oxford University Press.

- Dubuisson-Quellier, Sophie. 2010. "From Consumerism to the Empowerment of Consumers: The Case of Consumer Orientated Movements in France." *Sustainability* 2 (1849-1868).
- Edwards, Andres R. 2005. *The Sustainability Revolution : Portrait of a Paradigm Shift*. Gabriola, BC: New Society Publishers.
- Edwards, Brian. 2001. *Green Architecture: An International Comparison*. Edited by Helen Castle. Vol. 71, *Architectural Design*. London, UK: Wiley and Sons Ltd.
- Ehrenfeld, John. 2008. *Sustainability by Design : A Subversive Strategy for Transforming Our Consumer Culture*. New Haven: Yale University Press.
- Epstein, Marc J. 2008. *Making Sustainability Work : Best Practices in Managing and Measuring Corporate Social, Environmental and Economic Impacts*. 1st ed. Sheffield, UK Greenleaf Pub. ; San Francisco: Berrett-Koehler Publishers.
- Fainstein, Susan. 2000. "New Directions in Planning Theory." *Urban Affairs Review* 35 (4): 451-478.
- Falconer, Ryan, Peter Newman, and Billie Giles-Corti. 2010. "Is Practice Aligned with the Principles? Implementing New Urbanism in Perth, Western Australia." *Transport Policy* 17 (2010): 287-294.
- Falk, Nicholas. 2009a. "Smarter Growth and Sustainable Suburbs." *Built Environment* 32 (3).
- . 2009b. "Towards Sustainable Suburbs." *Built Environment* 32 (3): 225-234.
- Faludi, Andreas. 1973. *Planning Theory, Urban and Regional Planning Series*. Oxford, England: Pergamon.
- . 1986. *Critical Rationalism and Planning Methodology*. Edited by Allen J. Scott, *Research in Planning and Design*. London, England: Pion Limited.
- Fane, Simon, and Chris Reardon. 2008. 7.4 Wastewater Re-Use. Australian Government. Accessed 05/02/11, <http://www.yourhome.gov.au/technical/fs74.html#outdoors>.
- Farmer, Graham, and Simon Guy. 2010. "Making Morality: Sustainable Architecture and the Pragmatic Imagination." *Building Research & Information* 38 (4): 368-378.
- Farmer, Graham, and Antony Radford. 2010. "Building with Uncertain Ethics." *Building Research & Information* 38 (4): 363-367.
- Farr, Douglas. 2008. *Sustainable Urbanism: Urban Design with Nature*. New Jersey: John Wiley and Sons.
- Fernie, Scott, Stuart D. Green, Stephanie J. Weller, and Robert Newcombe. 2003. "Knowledge Sharing: Context, Confusion and Controversy." *International Journal of Project Management* 21 (2003): 177-187.
- Fewings, Peter. 2009. *Ethics for the Built Environment*. New York: Taylor & Francis.

- Fielding, Kelly S, Alice Thompson, Winnifred R Louis, and Clive Warren. 2010. *Environmental Sustainability: Understanding the Attitudes and Behaviour of Australian Households*. Queensland.
- Filho, Walter Leal, ed. 2005. *Handbook of Sustainability*. Vol. 20, *Environmental Education, Communication and Sustainability*. Frankfurt, Germany: Peter Lang.
- Flyvbjerg, Bent. 1998. *Rationality and Power: Democracy in Practice*. 3 vols. Vol. 3, *Morality and Society*. Chicago: The University of Chicago Press.
- Forbes, John. 1994. "Western Australia." In *Metropolitan Planning in Australia*, ed. The National Capital Authority. Melbourne, Australia: Australian Urban and Regional Development Review.
- Fox, Warwick, ed. 2000. *Ethics and the Built Environment*. New York: Taylor and Francis.
- Freestone, Robert. 2007. *Designing Australia's Cities*. Sydney: UNSW Press.
- Frey, Hildebrand, and Paul Yaneske. 2007. *Visions of Sustainability : Cities and Regions*. Abingdon, London ; New York, NY: Taylor & Francis.
- Frey, Hilderbrand W., Neil S. Ferguson, Samer G. Bagafeen, and Lee Woods. 2009. "Suburbs Reconsidered: Form, Mobility and Sustainability." *Built Environment* 32 (3): 250-266.
- Friedman, Avi. 2007. *Sustainable Residential Development, Planning and Design for Green Neighbourhoods*. New York: McGraw-Hill Companies.
- Gardiner, Stephen M. 2004. "Ethics and Global Climate Change." *Ethics* 114 (April): 555-600.
- Garnaut, Ross. 2008. *The Garnaut Climate Change Review : Final Report*. Port Melbourne, Vic.: Cambridge University Press.
- Gause, Jo Allen, Richard Franko, and Urban Land Institute. 2007. *Developing Sustainable Planned Communities*. Washington, D.C.: Urban Land Institute.
- Gerring, John. 2007. *Case Study Research Principles and Practices*. New York: Cambridge University Press.
- Gibson, Chris, Lesley Head, Nick Gill, and Gordon Waitt. 2010. "Climate Change and Household Dynamics: Beyond Consumption, Unbouding Sustainability." *Transactions of the Institute of British Geographers* 36 (June): 3-8.
- Gibson, R. 2001. *Specification of Sustainability-Based Environmental Assessment Decision Criteria and Implications for Determining "Significance" in Environmental Assessment*.
<http://www.sustreport.org/downloads/SustainabilityEA.doc>
- . 2006. "Sustainability Assessment: Basic Components of a Practical Approach. ." *Journal of Impact Assessment and Project Appraisal* 24 (3): 170-82.
- Girardet, Herbert. 2000. "Greening Urban Society." In *Ethics and the Built Environment*, ed. Warwick Fox. New York: Taylor & Francis.

- Girling, Cynthia L., and Ronald Kellett. 2005. *Skinny Streets and Green Neighborhoods : Design for Environment and Community*. Washington D.C.: Island Press.
- Gleeson, Brendan, and Nicholas Low. 2000. *Australian Urban Planning : New Challenges, New Agendas*. St Leonards, N.S.W.: Allen & Unwin.
- Goldsmith, Edward. 1972. *Blueprint for Survival*. Boston: Houghton Mifflin.
- Gonzalez, George A. . 2005. "Urban Sprawl, Global Warming and the Limits of Ecological Modernisation." *Environmental Politics* 14 (3): 344-362.
- Gottlieb, Roger S.; , ed. 1996. *This Sacred Earth, Religion, Nature, Environment*. New York: Routledge.
- Grace, W. 2007. "Sustainable Urban Living - a Perth Perspective." *Australain Journal of Multi-disciplinary Engineering* 5 (1).
- Gram-Hanssen, Kirsten. 2010. "Residential Heat Comfort Practices: Understanding Users." *Building Research & Information* 38 (2): 175-186.
- Green, Geoff;, Mike; Grimsley, and Bernard; Stafford. 2005. *The Dynamics of Neighbourhood Sustainability*. York: Joseph Rowntree Foundation.
- Gregory, K.E., B.Moghtaderi, H.Sugo, and A. Page. N.D. A Thermal Performance Study of Common Australian Residential Construction Systems in Hypothetical Modules. ThinkBrick/University of Newcastle. Accessed 21 October, http://www.thinkbrick.com.au/shadomx/apps/fms/fmsdownload.cfm?file_uid=841443FC-123F-20E8-3ED1-8F5AFEDA6F47
- Gremmen, Bart, and Josette Jacobs. 1997. "Understanding Sustainability." *Man and World* 30: 315-327.
- Guerra-Santin, and Laure Itard. 2010. "Occupants Behaviour: Determinants and Effects on Residential Heating." *Building Research & Information* 38 (3): 318-338.
- Gurran, Nicole, Kristian Ruming, Bill Randolph, and Dana Quintal. 2008. *Planning, Government Charges, and the Costs of Land and Housing*. Sydney.
- Guy, Simon, and Graham Farmer. 2000. "Contested Constructions: The Competing Logics of Green Buildings and Ethics." In *Ethics and the Built Environment*, ed. Warwick Fox. New York: Taylor & Francis.
- Habermas, J. 1984. *The Theory of Communicative Action: Vol 1: Reason and the Rationalisation of Society*. Vol. Vol 1. London: Polity Press.
- Hahn, Thomas J. 2008. "Leed-Ing Away from Sustainability: Toward a Green Building System Using Nature's Design." *Sustainability* 1 (3): 196-201.
- Halden, Derek. 2002. "Using Accessibility Measures to Integrate Land Use and Transport Policy in Edinburgh and the Lothians." *Transport Policy* 9: 313-324.
- Hamilton, Clive;, and Richard; Denniss. 2005. *Affluenza When Too Much Is Never Enough*. Crows Nest, Sydney: Allen and Unwin.

- Hamnett, Stephen, and Raymond Bunker, eds. 1987. *Urban Australia: Planning Issues and Policies*. London, England: Mansell Publishing Ltd.
- Hamnett, Stephen, and Robert Freestone, eds. 2000. *The Australian Metropolis. A Planning History*. Edited by Professor Anthony Sutcliffe, *Studies in History, Planning and the Environment*. London, UK: E&FN Spon.
- Hartz-Karp, Janette. 2005. "A Case Study in Deliberative Democracy: Dialogue with the City." *Journal of Public Deliberation* 4 (6): 1-15.
- . 2007. "How and Why Deliberative Democracy Enables Co-Intelligence and Brings Wisdom to Governance." *Journal of Public Deliberation* 2 (1): 1-11.
- Harvey, David. 1985. "On Planning the Ideology of Planning." In *Planning Theory in the 1980's: A Search for Future Directions* ed. R.W. Burchell, 213-233.
- Hawken, Paul. 2007. *Blessed Unrest : How the Largest Movement in the World Came into Being and Why No One Saw It Coming*. New York: Viking.
- Hawken, Paul, L. Hunter Lovins, and Amory B. Lovins. 1999. *Natural Capitalism : The Next Industrial Revolution*. London: Earthscan.
- Healey, Patsy. 2002. "On Creating the 'City' as a Collective Resource." *Urban Studies* 39 (10): 1777-1792.
- . 2006. *Collaborative Planning*. Vol. 2nd. Hampshire, England: Palgrave Macmillan.
- Healey, Patsy, Stuart Cameron, Simin Davoudi, Stephen Graham, and Ali Madani-Pour, eds. 1995. *Managing Cities: The New Urban Context*. Chichester, England: John Wiley and Sons.
- Heinen, J.T. 1994. "Emerging, Diverging and Converging Paradigms on Sustainable Development." *International Journal of Sustainable Development and World Ecology* 1: 22-33.
- Hendrickson, David. 2010. "Post-Occupancy Assessment: Building Design, Governance and Household Consumption." *Building Research & Information* 38 (5): 481-490.
- Hillier, Jean. 2000. "Going Round the Back? Complex Networks and Informal Action in Local Planning Processes." *Environment and Planning A* 32: 33-54.
- . 2002. "Planners as Missionaries or Chameleons?" In *Shadows of Power: Allegory of Prudence in Land-Use Planning* 193-217. New York: Routledge.
- Hillier, Jean, and Patsy Healey, eds. 2010. *The Ashgate Research Companion to Planning Theory: Conceptual Challenges for Spatial Planning, The Ashgate Research Companions*. Surrey, England: Ashgate Publishing Ltd.
- Hoch, Charles. 2011. "The Planning Research Agenda: Planning Theory for Practice." *Town Planning Review* 82 (2): vii-xv.
- Hollick, Malcolm, and Christine Connelly. 1998. *Sustainable Communities: Lessons from Aspiring Eco-Villages*. Edited by Terence Love: Praxis Education.

- Hopkins, Rob. 2008. *The Transition Handbook: Creating Local Sustainable Communities Beyond Oil Dependency*. Lane Cove: Finch Publishing.
- Horne, R. 2006. "International Assessment of the Environmental Performance of Housing, and Prospects for Sustainable Cities." In *The Sustainable City Urban Regeneration and Sustainability*, eds U. Mander, C.A. Brebbia and E. Tiezzi, 29-38. Southhampton, Boston: WITPress.
- HRSC LTS. 1992. *Patterns of Urban Settlement: Consolidating the Future?* Canberra.
- Hudnut, William H. 2008. *Changing Metropolitan America : Planning for a Sustainable Future*. Washington, D.C.: Urban Land Institute.
- Hudson, Barclay, Thomas Galloway, and Jerome Kaufman. 1979. "Comparison of Current Planning Theories: Counterparts and Contradictions." *Journal of the American Planning Association* 45 (3): 387-398.
- Isaacs, Nigel, Kay Saville-Smith, Michael Camilleri, and Lisa Burrough. 2010. "Energy in New Zealand Houses: Comfort, Physics and Consumption." *Building Research and Information* 38 (5): 470-480.
- Jacobs, Jane. 1964. *The Death and Life of Great American Cities*. London: Penguin Books.
- . 1984. *Cities and the Wealth of Nations: Principles of Economic Life*: Harmondsworth: Viking.
- . 1992. *The Death and Life of Great American Cities*. Second Edition ed. USA: Vintage Books.
- Jann, Werner, and Kai Wegrich;. 2007. "Theories of the Policy Cycle." In *Handbook of Public Policy Analysis: Theory, Politics, and Methods*, eds Gerald J. Miller;, Mara S. Sidney; and Frank Fischer;. Baco Baton, FL: CRC Press.
- Karol, Elizabeth. 2007. "Energy Performance of New Project Homes, Perth, Western Australia." *BDP Environment Design Guide* 44 (February): 1.
- Keilar, Lew. 2008. Village Green. *GMagazine*.
- Kidd, C.V;. 1992. "The Evolution of Sustainability." *Journal of Agricultural and Environmental Ethics* Vol. 15 (No. 1): pp. 1-26.
- Kvale, Steinar. 2007. *Doing Interviews, The Sage Qualitative Research Kit*. London: Sage Publications.
- LandCorp. 2004. *Udia National Awards for Excellence 2004/05, Category 7 Environmental Excellence Awards*. Perth, WA.
- . 2010a. Demonstration Projects. LandCorp. Accessed 19 October, <http://www.landcorp.com.au/sustainability/Demonstration-Projects/>.
- . 2010b. Our Framework. LandCorp. Accessed 19 October, <http://www.landcorp.com.au/sustainability/Our-framework/>
- . 2010c. Public Information. LandCorp. Accessed 19 October, <http://www.landcorp.com.au/About-Us/Public-Information/>.

- Langdon, Phillip; . 2005. *A Better Place to Live - Reshaping the American Suburb*. Amherst: The University of Massachusetts Press.
- Laufer, William S. 2008. "Social Accountability and Corporate Greenwashing." *Journal of Business Ethics* 43: 253-261.
- Levine, Jonathan, and Yaakov Garb. 2002. "Congestion Pricing's Conditional Promise: Promotion of Accessibility or Mobility?" *Transport Policy* 9: 179-188.
- Levinson, Ronnen, and Hashem Akbari. 2009. "Potential Benefits of Cool Roofs on Commercial Buildings: Conserving Energy, Saving Money, and Reducing Emission of Greenhouse Gases and Air Pollutants." *Energy Efficiency* 3 (1): 53-109.
- Lovelock, James. 1979. *Gaia, a New Look at Life on Earth*. Oxford ; New York: Oxford University Press.
- . 1988. "The Ages of Gaia : A Biography of Our Living Earth." *The Commonwealth Fund Book Program*: xx, 252 p.
- . 2006. "The Revenge of Gaia : Earth's Climate in Crisis and the Fate of Humanity." xvii, 176 p., 8 p. of plates.
- Low, Nicholas, Brendan Gleeson, Ray Green, and Darko Radovic`. 2005. *The Green City - Sustainable Homes Sustainable Suburbs*. Sydney: University of New South Wales Press Ltd.
- Lynch, Kevin. 1981. *A Theory of Good City Form*. Cambridge, MA.: MIT Press.
- MacCallum, Diana, and Diane Hopkins. 2012. "The Changing Discourse of City Plans: Rationalities of Planning in Perth, 1955-2010." *Planning Theory and Practice* 12 (4): 485-510.
- Maginn, Paul. 2007. "Deliberative Democracy or Discursively Biased? Perth's Dialogue with the City Initiative." *Space and Polity* 11 (3): 331-352.
- Major Cities Unit. 2010. "State of Australian Cities 2010." edited by Infrastructure Australia, Canberra: Australian Government.
- Mander, U., C.A. Brebbia, and E. Tiezzi, eds. 2006. *The Sustainable City Iv Urban Regeneration and Sustainability*. Southampton, U.K: WITpress.
- Mapes, Jennifer, and Jennifer Wolch. 2010. "'Living Green': The Promise and Pitfalls of New Sustainable Communities." *Journal of Urban Design* 16 (1): 105-126.
- Marchand, Anne, Stuart Walker, and Tim Cooper. 2010. "Beyond Abundance: Self-Interest Motives for Sustainable Consumption in Relation to Product Perception and Preferences." *Sustainability* 2 (1431-1447).
- Marden, Peter, and David Mercer. 2005. "Ethics and Sustainability - Exploring the Issues." *Geographical Education* 18.
- Marsden, Terry, ed. 2008. *Sustainable Communities New Spaces for Planning, Participation and Engagement*. Amsterdam: Elsevier.

- Marshall, Catherine, and Gretchen B. Rossman. 1995. *Designing Qualitative Research*. Second Edition ed. Thousand Oaks, California: Sage Publications.
- Marshall, Stephen. 2010. "New Urbanism: An Introduction." *Built Environment* 29 (3).
- Maxcy, Spencer J. 2003. "Pragmatic Threads in Mixed Methods Research in the Social Sciences: The Search for Multiple Modes of Inquiry and the End of the Philosophy of Formalism." In *Handbook of Mixed Methods in Social and Behavioral Research*, eds Abbas Tashakkori and Charles Teddlie. Thousand Oaks, California: Sage Publications Inc.
- McGee, Caitlin, Max Mosher, and Dick Clarke. 2008. 4.7 Insulation. Australian Government. Accessed 25/02/11, <http://www.yourhome.gov.au/technical/fs47.html>.
- . 2010. 4.7 Insulation. Australian Government. Accessed 04/02/11, <http://www.yourhome.gov.au/technical/fs47.html>
- McKenzie-Mohr, D. 2000. "Promoting Sustainable Behaviour: An Introduction to Community-Based Social Marketing." *Journal of Social Issues* 56 (3): 543-554.
- McLoughlin, J. Brian, and Margo Huxley, eds. 1986. *Urban Planning in Australia: Critical Readings Australian Studies*. Melbourne, Australia: Longman Cheshire Pty Ltd.
- Meadows, Donella H., and Club of Rome. 1972. *The Limits to Growth : A Report for the Club of Rome's Project on the Predicament of Mankind*. London New York: Pan Universe Books.
- Meadows, Donella H., Dennis L. Meadows, and Jorgen Randers. 2005. *Limits to Growth : The 30-Year Update*. [Rev. ed. London ;: Earthscan.
- Miller, A., M.; Ambrose, and M. Ball. 2006. "Benchmarking Sustainable Residential Dwelling." In *Conference on Clients Driving Innovation: Moving Ideas into Practice*. CRC for Construction Innovation.
- Millett, Stephan. 2011. Edited by Peter Lang.
- Milne, Geoff. 2008. 1.3 Common Myths. Australian Government. Accessed 25/02/11, <http://www.yourhome.gov.au/technical/fs13.html>.
- Milne, Geoff, and Chris Reardon. 2008. 5.2 Embodied Energy. Australian Government. Accessed 05/02/11, <http://www.yourhome.gov.au/technical/fs52.html>.
- Milne, Geoff, and Chris Riedy. 2008. 6.1 Energy Use. Australian Government. www.yourhome.gov.au/technical/fs61.html.
- Minogue, K. 2001. "Rationalism." In *International Encyclopedia of the Social & Behavioral Sciences*, New York: Elsevier Science.
- Monbiot, George. 2007. "Only Full Decarbonisation Can Save the Earth." *The Gaurdian Weekly*, 14.12.07. 16

- Mont, Oksana, and Kate Power. 2010. "The Role of Formal and Informal Forces in Shaping Consumption and Implications for a Sustainable Society. Part I." *Sustainability* 2 (2232-2252).
- Morrison-Saunders, Angus, and Jenny Pope. 2012. "Conceptualising and Managing Trade-Offs in Sustainability Assessment." *Environmental Impact Assessment Review* 38 (2013): 54-63.
- Morse, Janice M. 2003. "Principles of Mixed Methods and Multimethod Research Design." In *Handbook of Mixed Methods Research in Social and Behavioral Research*, eds Abbas Tashakkori and Charles Teddlie. Thousand Oaks, California: Sage Publications.
- Moskow, Keith G. 2008. *Sustainable Facilities: Green Design, Construction and Operations*. U.S.A: McGraw-Hill Professional.
- Mumford, Lewis. 1961. *The City in History*. San Diego: Harvest Book, Harcourt Inc.
- Nasr, H. S. 1997. *Man and Nature: The Spiritual Crisis in Modern Man*. Chicago: ABC International Group.
- Nelson, Anitra. 2007. *Steering Sustainability in an Urbanizing World : Policy, Practice and Performance*. Aldershot, England: Ashgate.
- Newman, Peter, Timothy Beatley, and Heather Boyer. 2009. *Resilient Cities : Responding to Peak Oil and Climate Change*. Washington, DC: Island Press.
- Newman, Peter; , and Jeffrey; Kenworthy. 1999. *Sustainability and Cities - Overcoming Automobile Dependence*. Washington: Island Press.
- Newton, Peter W., ed. 2008. *Transitions, Pathways Towards Sustainable Urban Development*. Collingwood, Victoria: CSIRO Publishing.
- Nielsen, Susanne Balslev, Brigitte Hoffman, Maj-Britt Quitzau, and Morten Elle. 2009. "Mobilising the Courage to Implement Sustainable Design Solutions: Danish Experiences." *Architectural Engineering and Design Management* 5 (2009): 53-61.
- O'Riordan, Tim; , and Susanne; Stoll-Kleemann, eds. 2002. *Biodiversity, Sustainability and Human Communities - Protecting Beyond the Protected*. Cambridge: Cambridge University Press.
- Organisation for Economic Co-operation and Development. 2002. *Policies to Promote Sustainable Consumption: An Overview*. Paris, France.
- . 2011. *Greening Household Behaviour: The Role of Public Policy*. Washington D.C, U.S.A: OECD. http://www.oecd.org/document/49/0,3746,en_2649_37465_47256369_1_1_1_37465,00.html.
- Ornetzeder, Michael, Edgar G. Hertwich, Klaus Hubacek, Katarina Korytarova, and Willi Haas. 2008. "The Environmental Effect of Car-Free Housing: A Case in Vienna." *Ecological Economics* 65: 516-530.
- Ottman, Jacquelyn A. 2008. "The Five Simple Rules of Green Marketing." *Design Management Review* Fall.

- Paco, Arminda do, and Lilia Varejao. 2010. "Factors Affecting Energy Saving Behaviour: A Prospective Research." *Journal of Environmental Planning and Management* 53 (8): 963-976.
- Partidario, Maria R., Gustavo Vicente, and Constant ca Belchior. 2010. "Can New Perspectives on Sustainability Drive Lifestyles?" *Sustainability* 2: 2849-2872.
- Patton, J.; . 2008. "'What's Left of Sustainable Development'." *Journal of Australian Political Economy*
- Peterkin, Neville. 2009. "Rewards for Passive Solar Design in the Building Code of Australia." *Renewable Energy* 34 (2): 440-443.
- Pope, Jenny, David Annandale, and Angus Morrison-Saunders. 2004. "Conceptualising Sustainability Assessment." *Environmental Impact Assessment Review* 24 (2004): 595-616.
- Power, Kate, and Oksana Mont. 2010. "The Role of Formal and Informal Forces in Shaping Consumption and Implications for Sustainable Society: Part II." *Sustainability* 2 (August): 2573-2592.
- Productivity Comission of Australia. 2005. "The Private Cost Effectiveness of Improving Energy Efficiency." edited by Productivity Commission, Canberra.
- Pulzl, Helga, and Oliver Treib;. 2007. "Implementing Public Policy." In *Handbook of Public Policy Analysis: Theory, Politics and Methods*, eds Frank Fischer;, Gerald J. Miller; and Mara S. Sidney;. Boca Baton, FI USA: CRC Press.
- Randolph, Bill, Margaret Kam, and Peter Graham. 2007. "Who Can Afford Sustainable Housing?" In *Steering Sustainability in an Urbanizing World*, ed. Anitra Nelson, 203-215. Hampshire, England: Ashgate.
- Randolph, Bill, and Patrick Troy. 2008. "Attitudes to Conservation and Water Consumption." *Environmental Science and Management* 11 (2008): 441-455.
- Ravetz, Joe. 1999. "Integrated Assessment for Sustainability Appraisal in Cities and Regions." *Environmental Impact Assessment Review* 20 (2000): 31-64.
- Reardon, Chris, and Dick Clarke. 2008. 4.6 Passive Cooling Australian Government. Accessed 24/02/11, www.yourhome.gov.au/technical/fs46.html.
- Reardon, Chris, and Paul Downton. 2008. 4.2 Design for Climate. Australian Government. Accessed 24/02/11, www.yourhome.gov.au/technical/fs42.html#zones.
- Reardon, Chris, Emily Fewster, and Ted Harkeness. 2008. 5.3 Waste Minimisation. Australian Government. Accessed 05/02/11, <http://www.yourhome.gov.au/technical/fs53.html>.
- Reardon, Chris, Caitlin McGee, and Geoff Milne. 2008. 4.9 Thermal Mass. Australian Government. Accessed 24/02/11, www.yourhome.gov.au/technical/fs49.html.
- Reardon, Chris, Max Mosher, and Dick Clarke. 2008. 4.5 Passive Solar Heating. Australian Government. Accessed 24/02/11, www.yourhome.gov.au/technical/fs45.html.

- Rees, William E. 1992. "Ecological Footprints and Appropriated Carrying Capacity: What Urban Economics Leaves Out." *Environment and Urbanisation* 4 (121).
- . 2009. "The Ecological Crisis and Self-Delusion: Implications for the Building Sector." *Building Research & Information* 37 (3): 300-311.
- Register, Richard. 2006. *Ecocities*. Gabriola Island, Canada: New Society Publishers.
- Reidy, Chris, Chris Reardon, and Geoff Milne. 2008. 1.5 Rating Tools. Australian Government. Accessed 25/02/11, <http://www.yourhome.gov.au/technical/fs15.html>.
- Richardson, Tim. 2004. "Environmental Assessment and Planning Theory: Four Short Stories About Power, Multiple Rationality, and Ethics." *Environmental Impact Assessment Review* 25 (2005): 341-365.
- Riedy, Chris, Geoff Milne, and Chris Reardon. 2010. 6.5 Hot Water Service. Australian Government. Accessed 05/02/11, <http://www.yourhome.gov.au/technical/fs65.html#solar>.
- Robinson, John. 2004. "Squaring the Circle? Some Thoughts on the Idea of Sustainable Development." *Ecological Economics* 48 (2004): 369-384.
- Robinson, Nicola. 1999. "The Use of Focus Group Methodology - with Selected Examples from Sexual Health Research." *Journal of Advanced Nursing* 29 (4): 905-913.
- Roseland, Mark. 2000. "Sustainable Community Development: Integrating Environmental, Economic and Social Objectives." *Progress in Planning* 54 (2000): 73-132.
- Rudolf, John Collins. 2010. "In a Climate Quest, the Roof as White Knight." *New York Times*, July 21 2010.
- Sandercock, Leonie. 1990. *Property, Politics & Urban Planning. A History of Australian City Planning 1890 - 1990*. Second Edition ed. New Brunswick (U.S.A): Transaction Publishers.
- . 1998. *Towards Cosmopolis*. Chichester, UK: John Wiley and Sons.
- Scheurer, Jan. 2000. Urban Form, Sustainability and Lifestyles. Urban Perspectives on the Life of 21st Century Cities *14th AESOP Congress, Brno, Czech Republic*: Murdoch University Australia.
- . 2007. "Sustainable Transport in Urban Neighbourhoods: Policy Approaches, User Responses." In *Steering Sustainability in an Urbanizing World: Policy, Practice and Performance*, ed. Anitra Nelson. Aldershot, England: Ashgate.
- . 2008. "A Brief History of Carfree Housing." In *Sustainability in Communities* Melbourne: RMIT.
- Scheurer, Jan; . 2001. *Urban Ecology, Innovations in Housing Policy and the Future of Cities. Towards Sustainability in Neighbourhood Communities. , Phd Thesis*. Perth: Murdoch University.
- Schuyler, David. 1997. "The New Urbanism and the Modern Metropolis." *Urban History* 24 (3).

- Searle, Glen, and Raymond Bunker. 2010. "Metropolitan Strategic Planning: An Australian Paradigm?" *Planning Theory* 9 (3): 163-180.
- Sen, Amartya. 1995. "Rationality and Social Choice." *The American Economic Review* 85 (1).
- Seyfang, Gill. 2004. "Consuming Values and Contested Cultures: A Critical Analysis of the Uk Strategy for Sustainable Consumption and Production." *Review of Social Economy* 62 (3): 323-338.
- SGS Economics. 2003. "Costs of Urban Form Discussion Paper." edited by Western Australian Planning Commission, Perth: Western Australian Planning Commission.
- Shearman, Richard. 1990. "The Meaning and Ethics of Sustainability." *Environmental Management* 14 (1): 1-8.
- Simon, H.A. 1964. "Rationality." In *A Dictionary of the Social Sciences*, eds J. Gould and W.L. Kolb. New-York: Mac Millan Publishing Company.
- Siracusa, Giuseppe, Angela D. La Rosa, Paolo Palma, and Emiliano La Mola. 2008. "New Frontiers for Sustainability: Emergy Evaluation of an Eco-Village." *Environmental Development and Sustainability* 10 (2008): 845-855. doi: [10.1007/s10668-007-9087-2](https://doi.org/10.1007/s10668-007-9087-2).
- Speth, James Gustave. 2008. *The Bridge at the Edge of the World : Capitalism, the Environment, and Crossing from Crisis to Sustainability*. New Haven: Yale University Press.
- Stapleton, Geoff, Geoff Milne, Chris Reardon, and Chris Riedy. 2008. 6.7 Photovoltaic Systems. Australian Government. Accessed 05/02/11, <http://www.yourhome.gov.au/technical/fs67.html>.
- Stapleton, Geoff, Geoff Milne, and Chris Riedy. 2008. 6.8 Wind Systems. Australian Government. Accessed 05/02/11, <http://www.yourhome.gov.au/technical/fs68.html>.
- State of the Environment Committee. 2011. "State of the Environment 2011." edited by Environment Department of Sustainability, Water, Population and Communities,, Canberra: Australian Government.
- State of WA. 2009. "Directions 2031: Draft Spatial Framework for Perth and Peel " edited by WAPC, Perth, WA: Department of Planning.
- . 2010. "Directions 2010 and Beyond: Metropolitan Planning Beyond the Horizon." edited by WAPC, Perth, WA: Department of Planning.
- Stern, Sir Nicholas. 2007. *The Stern Review - the Economics of Climate Change*. London: HM Treasury UK.
- Stevenson, Fionn, and Adrian Leaman. 2010. "Evaluating Housing Performance in Relation to Human Behaviour: New Challenges." *Building Research and Information* 38 (5): 437-441.
- Stockland. 2008. *Udia Awards for Excellent 2008: Environmental Excellence*. Perth, WA.

- Sugo, H.O, A.W. Page, and B. Moghtaderi. 2004. "A Comparative Study of the Thermal Performance of Cavity and Brick Veneer Construction." In *13th International Brick and Block Masonry Conference, Amsterdam*.
- Sustainable Energy Authority Vict. 2002. "Thermal Mass, Chapter 6." edited by Sustainable Energy Authority, Melbourne: Victorian Government.
- Suzuki, David. 2010. *The Legacy an Elder's Vision for Our Sustainable Future*. Vancouver, Ca.: Greystone Books.
- Suzuki, David, Amanda McConnell, and Adrienne Mason. 2007. *Sacred Balance: Rediscovering Our Place in Nature*. Vancouver, Canada: The David Suzuki Foundation.
- Tashakkori, Abbas, and Charles Teddlie, eds. 2003. *Handbook of Mixed Methods in Social and Behavioral Research*. Thousand Oaks, California: Sage Publications Inc. .
- TerraChoice. 2009. *The Seven Sins of Greenwashing. Environmental Claims in Consumer Markets Summary Report: North America*. terrachoice.
- . 2010. *The Sins of Greenwashing Home and Family Edition*. Underwriters Laboratories.
- The Green Swing. 2010. The Green Swing: Towards a Sustainable Community. The green swing. Accessed 31 May, <http://www.thegreenswing.net/pages/96rutlandave/96rutlandave.html>.
- Thomas, H. . 2010a. "Green Houses Expose Flaws in Ratings." *The Weekend Australian*
- Thomas, Hedley. 2010b. "Energy Ratings Come under Fire." *The Australian*
- . 2010c. "Energy Star Ratings in Disarray." *The Australian*
- . 2010d. "Home Building Guided by Stars." *The Australian* <http://www.theaustralian.com.au/national-affairs/commentary/home-building-guided-by-stars/story-e6frgd0x-1225899245461>.
- Thull, Jean-Paul. 2009. "Transport and Urban Planning in New Zealand: A Constant Balance of Conflict of Interests." *Lincoln University Planning Review* 1 (2, July): 20-23.
- Troy, Patrick, ed. 1995. *Australian Cities - Issues, Strategies and Policies for Urban Australia in the 1990s*. Edited by John Braithwaite and Geoffrey Brennan. Cambridge, UK: Press Syndicate of the University of Cambridge.
- Trubka, Roman, Peter Newman, and Darren Bilsborough. 2010. *Assessing the Costs of Alternative Development Paths in Australian Cities*. Perth, WA.
- United Nations. 1992. "Earth Summit: Agenda 21 " edited by United Nations Conference on Environment and Development (UNCED), United States: United Nations.
- Urban Development Institute of Australia. ND. Udia National Awards for Excellence. UDIA. Accessed 3/02/11, www.udia.com.au/html/national_awards.cfm.

- Volland, Adam. 2010. Satellites Pinpoint Drivers of Urban Heat Islands in the Northeast. NASA. Accessed 18 February, www.nasa.gov/topics/earth/features/heat-island-sprawl.htm.
- Vucetich, John A., and Michael P. Nelson. 2010. "Sustainability: Virtuous or Vulgar?" *BioScience* 60 (7): 539-544.
- WA Govt. 2003. "Hope for the Future: The Western Australian State Sustainability Strategy." edited by Department of the Premier and Cabinet, Perth.
- Wackernagel, Mathis, and William E. Rees. 1996. *Our Ecological Footprint : Reducing Human Impact on the Earth, The New Catalyst Bioregional Series*. Philadelphia, Pa.: New Society.
- Welsh, Kristie;. 2008. Building Green - Tree Huggers Hype or the Way to a Sustainable Future. *Bond University News* 2008 (January): 1, www.bond.edu.au/news/2008/200801-tree-huggers.html.
- Western Australian Planning Commission. 2007. "An Introduction to the Western Australian Planning System." edited by Department of Planning and Infrastructure, Perth, WA: Western Australian Planning Commission,.
- Western Australian Planning Commission. 2003a. "Greater Perth Planning Context Discussion Paper." edited by Western Australian Planning Commission, Perth.
- . 2003b. "Greater Perth Population and Housing Discussion Paper " edited by Western Australian Planning Commission, Perth.
- Wheeler, Stephen. 2004. *Planning for Sustainability : Creating Livable, Equitable, and Ecological Communities*. New York, NY: Routledge.
- Whitelegg, John. 2000. "Building Ethics into the Built Environment." In *Ethics and the Built Environment*, ed. Warwick Fox. New York: Taylor & Francis.
- Wiland, Harry; , Dale; Bell, and Joseph; D'Agnese. 2006. *Edens Lost & Found*. Vermont: Chelsea Green Publishing Company.
- Williamson, Terry, and Antony Radford. 2000. "Building, Global Warming and Ethics." In *Ethics and the Built Environment*, ed. Warwick Fox. New York: Taylor & Francis.
- Williamson, Terry, Veronica Soebarto, and Antony Radford. 2010. "Comfort and Energy Use in Five Australia Award-Winning Houses: Regulated, Measured and Perceived." *Building Research and Information* 38 (5): 509-529.
- World Commission on Environment and Development. 1987. *Our Common Future*. Oxford, UK: WCED.
- Yin, R. 1984. *Case Study Research*. Beverly Hills, CA: Sage.
- . 2003. *Case Study Research Design and Methods*. 3rd ed. Vol. 5, *Applied Social Research Methods Series*. Thousand Oaks: Sage Publications.
- yourdevelopment.org.au. ND. Case Study Database. Accessed 20/06/09, www.yourdevelopment.org.

Yudelson, Jerry. 2008. *The Green Building Revolution*. Washington DC: Island Press.

Zetter, Roger;, and Georgia Butina; Watson, eds. 2006. *Designing Sustainable Cities in the Developing World*. Hampshire: Ashgate Publishing Ltd.

Zinzi, Michele. 2010. "Cool Materials and Cool Roofs: Potentialities in Mediterranean Buildings." *Advances in Building Energy Research* 4: 201-266.

Every reasonable effort has been made to acknowledge the owners of copyright material. I would be pleased to hear from any copyright owner who has been omitted or incorrectly acknowledged.

Appendix A Survey, Interview and Focus Group Questions

Case Study Residents Online Survey Questions:

- Do you consent to your anonymous information being used in this PhD research?
- Did you build your house or buy one already constructed?
- How old is your house?
- Did you buy/build your house in a suburb or estate that has won awards for environmental or sustainability features, or has been specifically marketed to be a 'green' or more sustainable alternative?
- Why did you buy/build your house in your particular location?
- If you built your house did you consider including environmental/sustainability features in the design of your house? (See the list of features above for suggestions)
- If you built your house did the developer/builder offer you any incentives for including any environmental/sustainability features in your house design?
- If you bought into a suburb with environmental/sustainability features that were advertised by the developers, did such features have anything to do with your decision to buy in the area?
- How many people live in your house? (...for the majority of the time)
- On average how many units of electricity did your household use per day during the winter months (June - Aug 2009)? (Check your bill for this figure)
- On average how many litres of water does your household use per day? (Check the latest bill for this figure)

- On average how many units of gas did your household use per day during the winter months (June-Aug)? (Check your bill for this figure)
- What is the square metre measurement of your house?
- How many motor vehicles does your household own?
- How do you get to work? (...for the majority of the time)
- If you have school age children living with you, how do they get to school? (...for the majority of the time)
- What form of transport do you use to do the household shopping? (...for the majority of the time)
- How many times a week do you use public transport, cycle, or walk to your activities and destinations?
- Do you think environmental/sustainability features are important when designing a house? (See the list above for examples).

Focus Group Questions:

- What is your understanding of the meaning of sustainability in relation to housing and suburb design?
- Did the environmental features that are advertised in Harvest Lakes influence your decision to buy here?
- Has your lifestyle changed in any way since moving to Harvest Lakes?
- If you could design your house differently what would you change?
- Is environmental consciousness/sustainability important to you and your family, and if so what do you do about it?

- What do you think governments should be doing about the environment/sustainability?

UDIA Developers Survey Questions:

- Do you consent to your anonymous information being used in this PhD research?
- Has your organisation developed or been involved in a suburb in Perth where sustainability or environmental considerations have been a focus?
- Was the success of these environmental/sustainability features in the suburb monitored or documented in any way?
- Was there any difficulty experienced (incl: planning opposition/lengthy red tape/Council opposition/Buyer opposition etc) including these environmental/sustainability features in the suburb?
- Were there any incentives offered to encourage buyers to include any environmental/sustainability features in their own homes in the suburb?
- What awards has the suburb you have been involved with won based on these environmental/sustainability features?
- What was the relative significance of these environmental/sustainability features in the marketing of the suburb you have been involved with?
- How important are environmental/sustainability features in the suburb itself?
- What would encourage you, or your company, to incorporate environmental/sustainability features in housing suburbs in Perth?

- Do you think including environmental/sustainability features in housing suburbs is important?

Case Study Local Government Interview Questions:

- How did the City of Rockingham approach the development applications for the Rivergums and Evermore Heights suburbs?
- Were there any significant issues that the City had with the development?
- Does the City have any ongoing connection with these suburbs?
- The Project Managers of the case study suburbs were interviewed and all suggested that one of their biggest issues was the compliance with building guidelines that 3/4 of them had set as covenants to the land, does the City have any involvement in that?
- Does your Planning frameworks and Policies currently support or inhibit the integration of sustainability in to suburbs or homes in the City of Rockingham?
- Does the City of Rockingham have a Sustainability Policy that they are working towards integrating into all of their Policies, activities and business as usual?

General Survey – Inclusion of Environmental Features in New Builds or major renovations in the last 5 years Questions:

- Do you allow your anonymous responses to be used in this research?
- Yes
- No

- What is your postal code? (This helps with identifying which local government your house is in).
- In the context of housing and building design, what do you understand environmental features to be?
- Please share your experience of building a new house or completely renovating an old house
- Did you build or completely renovate your whole house in the last 5 years? If it was a new build, did you build your house in a suburb or on a separate block? Did you want to include environmental features into the new house design or renovation
- If you didn't intend or want to include environmental features into your house design, what was your reason for not doing so?
- When you began looking at possible designs for your new house did you intend to include any environmental features in your building?
- Which environmental features did you include in the final product of your new house?
 - Large eaves surrounding the house
 - Light coloured roof
 - Insulation in walls
 - Insulation in the roof
 - Insulation underneath the floor
 - Solar orientated house to manage seasonal light and heat/cool
 - Extra shading on east and west side
 - Adjustable shading on the north side

- Improved cross ventilation for increased cooling in summer
- Energy efficient lighting and white goods
- Grey water re-use system for potable water
- Native gardens irrigated by non-potable water
- Double glazing of some or all windows
- Gas Boosted Solar hot water or other energy/water efficient hot water system
- Building material with high thermal mass to regulate seasonal heating/cooling gain/loss
- Please rate your agreement with the following statements:
- I found it easy to include environmental features into my house design and final build.
- I prioritised environmental features in my new house higher than a second garage, expensive kitchen and entertainment options, or a pool/spa.
- I wanted to include environmental features into my house design but my builder wasn't very helpful so I ended up not including any
- It required a lot of extra research on my part to include environmental features into my house design
- If you did include some environmental features into your house design, did you also make other lifestyle changes to reflect your environmental awareness? Such as:
 - Installing a Photo Voltaic Cell on the house
 - Buying a more fuel efficient car
 - Offsetting any carbon emissions that I couldn't reduce

- Selling the second car and buying a bicycle, or a motorbike, or taking public transport or walking to work etc.

Appendix B Transcripts from Developer Interviews

Satterleys Interview:

Q. Has your organisation developed a suburb in Perth where sustainability or environmental considerations have been a focus?

A. The obvious answer to that is Evermore has the most emphasis on sustainability of anything that Satterleys have done. There are other developments, Heron Park is an excellent example of water sensitive urban design in a low lying area, that is in, can't remember the suburb, in the south eastern corridor (I can look that up) Thornlie way. The sustainability principles on that are very good, won a water award. But Evermore in terms of encompassing more aspects sustainability than any other certainly is the most sustainable estate we have done. We have also done one in Brighton called The Green which is an operating third pipe system so together with Evermore and The Green they are the only two Green Title developments with third pipe. There are other developments with third pipe but they are strata developments. So for example the development that beat Evermore to win this award had third pipe as did Evermore and also grey water but it is strata community, so we can't do that here. We have gone as far as we think we can here and to get the initiatives we have achieved here took a lot of negotiating and head banging between statutory authorities just to be allowed to implement them despite the fact that we were bearing all the costs.

Q. What were the sustainability features that you have particularly included and how did you incorporate them?

A. The main thing was solar power.

Q. What kilowattage?

A. 1 kilowatt solar power system included with the purchase of every home. We installed that completely, we do take the rebates but the purchaser sees no cost they just send us the form and we do the installation and get the rebate. So from an energy perspective we have got the solar power and also from an energy perspective the design guidelines talk through how people should use natural ventilation, cross ventilation, maximising and minimising windows to catch winter sun and also have shading to windows to minimise energy use through air conditioners so, apart from the active the more passive side is through design guidelines and house design. So that's energy. Water, probably that's where are main focus is, so if we start inside the home, we supply the rainwater tank, 3000 kilolitre rainwater tank with every home and that is plumbed into the toilets and laundry trough and we also encourage them to plumb it into the washing machine as well. The overflow for the rainwater tank (which will overflow in winter) is plumbed into a rain garden as opposed to a soak well and that water should feed the garden and plants and then our landscaping packages include planting around the rainwater gardens.

Then as we move outside the home in terms of the main drainage we have the rain gardens as part of the drainage design, now we have only have one example of that at the moment on site but there are another 5 planned.

Q. So you are calling them a 'rain garden'

A. Yes, that's right.

There were originally 14 of these planned but City of Rockingham was very conservative and we were very lucky to get away with the number that we did and if they see that they are a maintenance issue, which is what they are concerned about.

Q. In which way would it be a maintenance issue?

A. If it gets filled up with sand and that sort of thing.

Also this one here is really well located as it is near a park. Others, for a corner lot; are in a verge. Now people might do silly things you never know what people are going to do. Now this basically captures in winter it is right next to a side entry pit, the water goes straight past this and into the main drainage system. What this will catch is people washing their cars, irrigation runoff when people are watering their lawns so we are capturing these nutrients locally and there is bio filters in the rain gardens which strip the nutrients and we are basically infiltrating those before they get to the main drainage system so there is greater separation between ground water and

more drainage basins are at a very low level we are increasing the separation before it gets into the ground water table.

Then the next level of drainage goes into the main swailles and I know this is nothing special but we have no sumps on site all the swailles are integrated into the public open space and a lot of the estates have this but once again all the swailles have the bio filter which increases nutrient stripping and they are all planted with water tolerant plants in the base of it.

Then if we move on to the next area of water. Once the water hits the ground water table we pump it back out for use in the third pipe system. With the third pipe system, obviously all the parks are fed by ground water, but everyone's front yards and backyards are irrigated through non potable water supply pumped from the ground water table.

We've talked about water,

So you've looked at solar power and Solar orientation, water

Obviously the solar power has an effect on green house gases, retention of native vegetation when you go on site there are pockets of native vegetation which has been retained.

Q. Walkable sort of design?

I guess I am focusing on things that are more particular here but yes there is a community purpose on site. I don't know how the City of Rockingham will develop that. There is over 12% public open spaces on site

Walkability has been a key

Q. Is that connected to liveable neighbourhoods – the policy?

A. Yes, here are some details on that:

Lot layout links back into solar orientation. All blocks are north south and east west.

Storm water disposal.

The estate has 10% affordable housing, I am not sure if you link that into sustainability.

Q. I do. How are you doing that?

A. We have set aside specific sites on the site. 10% of dwellings and our joint venture partner in this is obviously LandCorp and what we are proposing at the moment is that if we build them to meet the affordable housing criterion that has been set by ourselves and Landcorp and we define that as meeting the market that is not currently being met. So it not social housing by any means but it is not housing at full price. So if the median house price is at \$450,000 in the area, if we can produce a house for \$350,000 we think that criteria is met and we have a proposal to commence development of that site there and hopefully roll that model out on to the rest of these sites.

Q. Are these smaller lots

A. Yes

Q. So cottage kind of lots

A. Very much so they will be green title lots so they are only 7.5 metres wide, so you can't sell it and for someone to build on it they are too small, you have to build all of them and then sell them individually.

Q. How have you monitored the success? I guess you are still early in the development. Do you have an intention to I guess monitor how those features have been successful or not?

A. Yes, we do. It has been hard to monitor to date. I can pass on some opinions of what I have seen coming through.

We are in discussions with Murdoch University to get their post graduate and undergraduate students involved in undertaking various similar work to what you are doing in your survey so we can capture what affects people's lifestyles so that's the end user side. The retention swailles I was just talking with our engineers today. They will be monitored bi-annually for the next two years to see whether where the bio filters are being used the ground water quality is better as a result of using that material and then in terms of what I see people adopting, the design guidelines, people are certainly starting to install more eaves, because of what we had said it was very difficult in the first instance but they are starting to embrace that. In other words builders know now that if they have a purchaser in Evermore they have to provide eaves to the house. So there is a higher compliance rate.

Q. Because it is not legislated you can't really force those items can you?

A. Yes we can, the most important ones are in the restricted covenant placed on the title. At the end of the day it is physically impossible to make someone comply with the restricted covenant, technically its possible but physically it's almost impossible. But we enforce them through the use of our packages.

Incentives?

If people don't comply then we can say we are not going to put your rear landscaping in or we aren't going to put your solar panel in, but to date we haven't had to do that. That's the big stick.

So, you are using a bit of leverage?

Yeah.

Q. Did you experience any difficulty including these features in your development?

A. The third pipe system was (I wasn't here at the time) a monumental effort I understand to get all the relevant departments on board and it has culminated in a Memorandum of Understanding being signed by Landcorp, Satterleys, WaterCorp, Health Department and City of Rockingham. So we had to get all of those parties on board in order to implement it and also to talk about who would take care of the care and maintenance in perpetuity

of the infrastructure. And when we negotiated that we got this development also the Green and Brighton off the ground. So that was very very difficult.

Q. Is that because local government and other departments don't have the...

A. They all have different opinions and different priorities and they are all concerned about different things. And they are all very very conservative. The City of Rockingham were very reluctant to adopt the rain gardens in the road reserves because of what they perceived as future maintenance issues so we had to get over that and that initiative was cut down substantially due to their conservatism. The other initiatives are a cost impost to us; solar panels, the rainwater tanks so that is easy to deal because if we bear the costs and certainly Landcorp was a willing participant in adopting those initiatives.

Q. What incentives do you provide to encourage buyers to include such features in their house?

A. The incentives are front and rear landscaping, rainwater tank.

Q. Water sensitive landscaping?

A. Very much so. Minimum areas of turf, I forgot to add that in the sustainability in the first question.

The front and rear landscaping is sub surface irrigation to the garden beds on drip lines. Maximum areas of turf 75 metres front and rear. So we

encourage them to minimise the area of turf. Its majority water tolerant species.

So the incentive package includes solar panels, front and rear landscaping, rainwater tank, and the Telstra velocity package which is I guess another sustainably issue with fibre optic cabling and with this estate they get a \$1,500 credit through their Telstra bill once they sign up and start paying their bills.

Q. Solar hot water?

A. We have backed off from prescribing solar hot water mainly because the heat pump systems and other new technologies, we believe there are just as efficient solar hot water systems and then we don't know what else is going to come along so we specify energy efficient hot water systems.

Q. And appliances presumably in the house?

A. Yeah, well we encourage them and we also encourage the taps and those sorts of things but I can't physically go inside and inspect people's taps.

Q. What awards have you won to date based on these features?

A. It is very much in its infancy so we did enter it in last year's UDI awards but we were only a finalist, we didn't win the award for water excellence and we have won a Water Corporate award for sustainability.

Then the estate is also a recognised Water Corporation operation – Waterwise estate.

Q. Anything from HIA?

A. No.

I should talk about the other thing in terms of the first thing, we built a house on site which is very much a sustainable demonstration home so I guess that goes along with the first question about demonstrating all the things we put in our design guidelines. We went out and built an example of this and this house even on a 40 degree day it is cool. It uses artificial turf, high windows etc. Other sustainability points are reusing of timbers used on site, all the timber that you see in the landscaping is recycled from trees harvested on site. Floor boards and timber used around the house is all harvested on site so there is a fair bit of recycling done.

Q. What was the relative significance of these environmental and sustainability features in your marketing?

A. Well, have you got a marketing pack?

No

We will organise one for you.

You will see from this pack here that the marketing was very heavily leant on sustainability issues. What we have found unfortunately is that has been

ineffective and we don't think people care. We think and we are not sure of this as we haven't substantiated this with research yet, but it has been commissioned. Is, we think people would care if they were buying in Floreat where they can afford to care but at the end of the day this is not a market where maybe they care but they can't afford to care.

Q. It is further down the list of priorities?

A. Yes, these people are wondering if they are going to get their kids out for school. Not how they are going save tonne of carbon.

Yes, this is pretty much what my survey is looking at.

There are exceptions to this rule. There are a couple people who really embraced the sustainability initiatives and there is an excellent example of the home on this corner, but this is in a minority and this really comes out in my conversations with people if their house meets the design guidelines or not.

Q. How important are environmental sustainability features in the development itself?

A. They are key for differentiating this development with the other ten developments or 12 in Baldivis. What do you mean by important? To whom? Us? It is very important to Satterleys in terms of implementing initiatives and testing initiatives to see one whether they make a difference to the environment and two, if they are embraced by the purchasers.

Important to Satterleys and Landcorp in terms of showing that we don't just talk the talk, we walk the walk.

Q. So based on that Justin, does Satterleys have like a sustainability policy or is that somehow embedded in your strategic business planning?

A. Satterleys is probably not like most of the developers you are talking to. Every development is a business in its own right. We have unique investments and syndicates for each development and they will drive and they are led by us but at the end of they say how things are done. But, we are continually building on sustainability initiatives that have been implemented that each time we make a bid for a new development and that was an absolute key to a very big bid we made to Landcorp for the Jindalee project.

Q. Do you think including environmental and sustainability features in housing developments is important?

A. Of course it is very important. I think if the purchasers don't want to embrace them then we have to do it on their behalf. But what we need to see, we need to see regulation catching up with initiatives of these developments because embracing them, because the purchasers are not embracing them we are and then some of our competitors are not is putting us at a competitive disadvantage. And that disadvantage is being borne at the moment because we see the long term benefits of differentiating

ourselves but that will only last so long. It will wear to thin eventually, not yet but the day will happen so we need to drag everyone up with us.

Q. So at the moment we are in five star plus? I think 6 star goes through next year. Okay, so at this stage if that was all you were working on, **not** the criteria that Satterleys is working on, would that still mean houses would be liveable without extra air conditioning or heating. Would they be called sustainable?

A. Five star is nothing. If you see a building that complies with five stars there is no impost on these purchasers, zero. The builders squealed like you wouldn't believe when this first started being muted but it is absolutely nothing and I don't think six will be any impost either.

That has also been my experience looking at stuff.

But that is between the purchaser and the builder. But what we are talking about is more the overall as opposed to what happens in the home.

CEDAR WOODS INTERVIEW

Q. Has your organisation developed a suburb in Perth where sustainability or environmental considerations have been a focus?

A. The short answer is yes.

Q. Can you give us some information about that please?

A. I know you have focused on River Gums but we have got a number of projects, pretty much all of our projects have a focus on environmental and then if you like sustainability issues or initiatives to some extent. Cedar Woods is public company, we've got a smaller portfolio may be than some of the larger developers in town so we see ourselves as being a bit more of a boutique style developer and the company's first projects were in Mandurah and they related to canal developments where there was a very strong environmental element to it and they also involved conservation reserves and giving up land and establishing conservation reserves so there was very much a strong environmental focus for those developments and they have won awards.

Q. Mariners Cove?

A. Yes, Mariners Cove and Port Mandurah, two of the four canal developments in Mandurah and flowing on from that and the one you want to talk about today, River Gums has had environmental and sustainability issues involved with that.

Q. Do you think because Cedar Woods is smaller and I notice on the web site Cedar Woods has made sustainability quite an upfront consideration. Do you think that's had anything to do with how it relates to your developments?

A. I think it the direction as a business we have decided to go in but it does probably help if you are more selective given you have smaller portfolio.

The larger portfolio and when you become constrained by volume and turnover then I think it probably makes it a little more difficult but as the political/environment changes I think all the developers have had to pick up on sustainability issues whether they like it or not. Some do it better than others; some are more genuine about it than others.

The background to River Gums we acquire that site in round about 2001 and around that time there were changes happening with the building code of Australia and there was a lot of discussion about energy efficiency being applied to the design of homes, so the concern was with that development and some of our other developments at the time how did we tune into that so we could produce a product that could make it a lot easier for people to comply with these environmental regulations that applied to building a new home. So we took that up as an opportunity to say well if we have a look at those considerations a bit more closely we might be able to use that as a bit of a marketing opportunity and certainly make it easier for people to build a new home.

Q. How have you incorporated these environmental and sustainability features into your development?

A. With the River Gums, one of the major considerations in going back to energy use in the home was to look at passive solar design. So what we have done we have set up as an urban grid so that all the roads either running north south or east west and basically we went through a process

with the HIA with their green smart accreditation and I think we were one of the first in WA to go through as a private developer to get green smart accreditation for that development. And a lot of that was based around passive solar principles saying that if you set it up north/south east/west it is going to make it a lot easier. If you have east west lots then you make those a little wider that way people have a long boundary to the north so you can maximise northern windows and the narrower frontage is facing east/west and you try and minimise the windows in that regard. North/south with those you've got north either at the back or front of the home and a bit more difficult and so the smaller lots were generally placed on the north/south axis although there was quite a degree of debate with HIA and local council about what was the best way of achieving solar access on smaller lots whether north/south or east/west was the preferred orientation.

Q. So at the early stage it was about setting the design for the estate?

A. Yes, and then there were things that flowed from that so you could probably separate those out - sub-development initiatives and then what applied to the construction of the homes? So you have the passive solar design which we have spoken about. From the suburb point of view we then looked at what we could do in terms of stormwater, Waterwise landscape so in terms of storm water management we've got an irrigation lake so all the storm water flows into the irrigation lake and we use some water harvesting. That

lake was a naturally clay lined lake so prior to us being there it existed in a form and we have used that to our advantage basically one using it as a landscape feature but then secondly using it for water harvesting. So during winter you have a lot of water flowing in there, it is stored and then the ground water irrigation system only kicks in over the summer months to top that lake up when it falls below a certain level. So therefore we have minimised the take on the ground water / all of the planting and design of the parks is done on a Waterwise basis as well as on what we refer to as sustainability principles for public landscape. In the past a lot of developers and even today you will see a lot of highly manicured landscapes in public spaces and they become unsustainable in terms of maintenance and the cost of maintaining the become prohibitive then councils can't keep up they let them go. So we have tried to do something about that by putting in plants that have a longer term view , natives, a lot of areas where have mulched gardens where we might have limited planting. Minimise turf with the right kind of turf species, irrigation systems – you have some sub surface where possible and basically plant selection. One of things we have done that we might be criticised for it is not over plant gardens so you have these garden beds that can't be maintained into the future so people buy in with an expectation that things are going to look like that forever and council comes in and can't look after it so they pull it all out so we were conscious of that. In terms of the lake design there are issues like mosquito management, safety, walkways, lighting that all come into to those public spaces as to the balance. We toyed with the ideas at one and stage and I

know that they did this at Harvest Lake about solar lighting but there were some issues there about how well public spaces can be lit from solar lighting and whether there is adequate security and safety. We have had to make considerations about that. The public facilities that go into that, types of playgrounds, some of the road designs in terms of storm water management we have tried to use some flush kerbing and minimise the amount of storm water drainage that pick up on rubbish and rain fall. That was only done to limited extent due to some issues what councils would allow us to do so generally speaking we would put in flushing kerbing adjacent to parks so we would have the runoff going off into the parks and infiltrating into the ground but where parks on a main boulevard the council wouldn't allow us to have flush kerbing on a boulevard so we had a few issues like that means you don't get the perfect answer.

So that's generally the suburb side of things catered for urban grid design north/south and what we have with done with drainage management and landscape design. They are probably the three elements I can think off the top of my head.

Q. Was the suburb design at all looking at the liveable neighbourhood policy that would have been out at the time?

A. I think that was always in the background. I don't propose as to say I know all about the Liveable Neighbourhood's Policy but we have got planners that certainly use that as I guess the base and it does pick up on the elements

contained in liveable neighbourhoods. I guess the document has been revised several times and changing.

The other part of it is what we do in terms of design guidelines and covenants on homes that get built in the estate and what we have decided to do there is tell people we want them to build a passive solar home so good north orientation in terms of maximising windows minimising the east/west windows, shading the east/west windows. In the early days we looked at hot water systems and insisted on five star hot water systems. Back when we started it was four stars but it has gradually gone up to a minimum of five star gas, we have had solar hot water system rebates which we add to the rebate system. So I think we have a high percentage of solar hot water systems in that estate. At one stage we did try to do a survey to see how many were solar and I have a feeling it was around 50% at that time. It is a little time ago since we did that work so I'm not sure what it would be overall. But that would be an interesting one to have a look at. We had some water initiatives where we said we wanted people to have triple A rated shower heads and toilets and that sort of thing. We didn't go so far as to have water tanks or anything like that and we had Waterwise landscape packages. They were front garden packages so if people complied with our guidelines we provided them with what we would term as a Waterwise landscape garden which has got some issues with it as to the implementation of that because I am not going to kid to you it is a difficult one. We set it up but it has a tendency to go off the rails a bit because the customer and the landscape person get involved and before you know it

ended up being not quite what you intended so we have had some difficulties in the implementation of Waterwise gardens.

Q. Monitoring it – how do you monitor?

A. With these incentives people build a house then they come to us and we go round and check all the things they were meant to do. Does the house have solar hot water system, does it face north/south. Before they can build they have to submit their plans to us, so we have to approve their plans before they start. But no system is perfect and we do get people building without submitting their plans first. So if they do that, they build then come to us and say we want our landscaping and fencing and we say have you submitted your plans, no? Will do your plans comply with our requirements. If they don't, they don't get the incentives.

The difficulty then is, as it isn't legislated...

It is very difficult to force people other than through an incentive based system to actually comply. So most people comply but we do get a few who find their way, our guys go round and try and identify those under construction and see if we have plans so they chase them up. You've started construction without sending us plans so there is a bit of process but once again not perfect.

So you are proactive?

Yes, there was also a waste management initiative. Initially, it's still in there but it has proven difficult. We did that at the request of the HIA but it became difficult what was require there was and they tried it at Harvest

lakes as well, but it all unravelled because the HIA had done a lot of work with the builders about how they could better manage waste on a building site. They had asked us to try and implement this and we did and we had a company that was set where we had a little compound or depot and what was meant to happen was that all the builders were meant to co-operate with this fellow and he would go round and get building waste from on site. They were meant separate out what was recyclable and what was not and they would have a couple of bins and then he would come along each week and pick up the recyclable things and take them back to the compound where the recyclable component and all the rest was collected and go off. It fell foul with the builders' sub-contractors with their bobcat companies and so forth. They all had existing relationships with other suppliers of waste bins etc so the builders sub-contractors all jacked up against the builders then the builders jacked up against the whole system so the whole system unravelled and the fellow who was commissioned to do this work ended up walking away from it because it all got too hard.

So what we have now is very much a limited/half-hearted system whereby we insist they have a waste bin on site that actually goes off and there is a recycling component to it. Most of them have it anyway but if not we go round and chase them if they don't. At Ellenbrook, that guy still operates there. The scale of that development and the fact that they have been able to force builders to comply because it is such a large estate they have greater success. Beetle Environmental, he could only make that development work from a commercial point of view where as Harvest Lakes

and ours, he couldn't make it work commercially. Got too hard and walked away. There wasn't any other player in the market and I don't know whether there is today. I think it is too still all hard.

Vetting of the plans, see if people have passive solar homes. That over the period of time has got a little more difficult as the market gets more competitive. There have been issues there about dictating to people too strongly about how much passive solar homes they need to have.

Surely five star plus must have some...

The problem with the star rating software as i understand it is that you can get a house to comply with a star rating that may not be a passive solar home and we have had this debate about how much weight do you put on the star rating versus shouldn't you make the customer design a solar passive home. Everyone has bit of a different view of this. We have some staff who feels it complies with five stars so why give the customer a hard time that has a lovely five star home which happens to have windows facing the wrong way and black roofs. Black roofs were an issue early on. We banned black roofs and we had a couple of people put on black roofs early on and said they were going to do whether you liked it or not then we had everyone else complaining because we had some black roofs. So we have had to let that go as it has all got too difficult to enforce.

So that consumer sentiment piece..... Sounds like it...

As a commercial organisation we still need to be tuned into what our customers are prepared to accept. And where we are providing an additional level of regulation over and above I guess the government and authorities, we are trying to push it up another level but it's a question of where you can draw that line before customers start saying well that's too much for me I will go somewhere else.

Q. What about the success? Have you been able to monitor the success of some of these features?

A. No, and this is with a lot about the earlier conversation I mentioned with Karl in our office. Really what we have missed is the monitoring and research on how well these have performed, we have tended to focus more on trying to implement and make something happen and look we have tried our best but if spend loads of money on monitoring it might be a nice research project but it is already done. There is not a lot we can do other than maybe improve on the model for next time round. I think also there is also probably a bit of a view that maybe we are starting to reach a bit of the limit. Over the 6 or 7 years regulation in this area has increased slowly and then more rapidly and where there was an opportunity for a developer to say I am going to have some stringent guidelines and make people do more things the regulations have caught up. So the problem for the developer is to say this is a big call where do I go next as to have a differentiation of our product I have to go into an area where I am going to go in and make my product very difficult to market because the marginal cost of increasing the

sustainability agenda is massive. Whereas before it was small little steps and you could actually improve upon what was happening with small little improvements which wasn't costing loads and loads of money. Whereas now all of that is done, that's the base where you are at, what do you do next? You force everyone to have pv cell on their roofs and fill them all up and you have got issues of affordability. The market has changed and affordability when we started on River Gums in 2003 wasn't an issue in 2009 it is a major issue. Affordability is way out of whack. There is then a dampening effect on environmental sustainability tends to be more difficult when you have affordability problems.

Q. Did you experience any difficulty in including some of the environmental sustainability features?

A. We did. Some of the difficulties were, like the local authority at the time was quite sceptical about it. I wouldn't say they were difficult in that they were trying to obstruct what you were trying to do. In the early stages we got excited about it and we wanted to get as many people involved with it at as possible and try and make sure that it didn't go off the rails. So we wanted to make sure the planning authorities were all on board. For example, if somebody lodged a building licence and it didn't comply with all of our requirements we wanted them to let us know and say look you have a customer who is doing the wrong thing/ but none of them wanted to know. This is not our area. It is a great thing you are doing but we really aren't interested. We have too many other things to worry about. And back then

Rockingham was – sustainability, that’s someone else’s problem we don’t want to know about. Sustainability needs to be dealt with by either federal or state governments. Local councils have no interest in sustainability.

They weren’t unco-operative, they just weren’t interested to assist in any way.

They probably didn’t have the internal capacity either.

They just thought it was all too hard. I guess there is another debate that people have – you’re just one small development, really what is the sort of net benefit that is going to happen to the wider community just because you are doing a wonderful thing. There is a lot of that that comes into it.

The whole thing has changed since the six years we began with River Gums. No we are getting the next areas planned and now the authorities come and ask and say ‘look we need you to address all of these sustainability issues and we have check list and criteria and you need to answer all these questions before we are going to give you a tick and get to the next stage. Whereas six years ago it was a bit like, we were saying please help us because we are trying to do all this. Thank/no thanks, not interested.

That’s good but frustrating.

That’s okay, that sort of how it work and the other ones were sort of the building industry issues about trying to say to customers and then them having to explain to a builder – look this particular development has got these sustainability guidelines and you need design your house to accommodate this and there is quite a bit of resistance from some builders

where they see every development out there as being the same and if they build a house in that development they should be able to build the same house in that development. Why should they have to spend a little more time trying to design something to suit that developer? That has been an ongoing issue since say time began in terms of the development industry. Developers have to go through a long winded process to get an approval for a development. So to do that they are generally quite happy to work with authorities and try and sort and they probably live with conditions that maybe builders are not particularly familiar with. Builders tend to look at every house as being able to produce another widget and I just want the widget to be the same as the widget I produced yesterday, so why should I have to produce one that looks different? So we go through the issue of trying to make it easy for them.

Is that well viewed because that is how it has always been done?

I think it is their business model in a sense of..

Economies of scale?

Yes, that is right, they just want to produce something efficiently and if developers keep coming up with new rules all the time it is quite complex for them as not only do they have know the rules that apply from local authority to local authority and the building code and all of that they then need to know what the rules are from development to development. So you can see it is a difficult area for them. The bigger builders have found their

way with that and they have worked out a system where they can cope with it. But some of the smaller guys I think tend to find that quite difficult.

That's logical, that makes sense.

The smaller ones tend to have more of a view of 'if we can cut corners then we have an advantage over those guys because we can actually produce something cheaper because we can cut corners'. They don't have to employ somebody to know all of these rules or to manage the process. So they see that as an opportunity if they can bend the rules they can do a bit better than maybe some of the bigger builders that have to deal with that.

So we have talked about some of the incentives you have provided.

So we had the solar hot water system rebate - \$500 rebate that we add to the rebates that they get from the government.

So that is in addition.

We've had a ground water rebate which was \$500 as well. Can't say we had a lot of people take that up. We did at one stage have some opposition from what is now the Department of Water because of the acid sulphate levels because of the water bores and so forth. So there was a bit of concern expressed about that. I'm not sure if you are familiar with the issues acid sulphate soils and that?

Yes.

So when all that came to be they started to say we shouldn't be promoting the idea of ground water bores because you could lowering the water table and that might have a problem with acid sulphate soils. That seems to have now disappeared. They seem to have moved on from that argument about ground water bores.

We had waterwise landscaping.

Q. With the solar hot water system, was it a gas boost or electricity boost?

A. That's a good question. I think it might have been either. But I think with the electric booster it had to have a timer or whatever they call it so you couldn't just switch it on then leave the electric going all the time. I have to read that rule again to be honest.

That's okay.

Initially in 2003 when we started the rebate were actually for any four stars or above hot water system, because back then it was actually quite hard to get a five star hot water system. Now we have increased it so you have to have a five star hot water system but back then we were giving a rebate just for complying with the rules saying you must have a four star gas hot water system or solar hot water system.

We had fencing as an incentive but it's not really a sustainability incentive but they didn't get it unless they met all of the other requirements in relation to sustainability.

Q. The incentives were received for passive solar design?

A. That's right. So they had to comply with the passive solar design which that had a list of things about minimising or maximising windows, shading windows and so on. The hot water system rebate, the ground water rebate, and so the Waterwise gardens and fences were related to 'have you done your passive solar home?' We didn't have a requirement to say that you had to have it meet five star or anything like that because back then we had a concern that it would mean they would have to go and spend money on getting someone to assess the home. So we didn't want to impose that additional cost for them having to go and get a star rating assessment. Of course now you have to do it by default in a sense. Another development, Kestrals, started up at the same time. A different fellow to me was actually running that one. What he decided was not to go down the path of assessing homes with passive solar heating, he just said you had to have (can't remember) five or four and half star home and said you had to go and we actually paid for it. So we said we will pay and you go and get your house assessed. If it comes back and it is four and a half stars then we give you approval, away you go. The house might be a box with no windows but if it gets four and a half stars we don't care. So they did it a different way. Not sure this is the better way to do it. You might be able to tell me when you get to the end of it all.

I am hoping I am going to be able to tell you.

Q. What awards have you won based on the sustainability features?

A. The only award that River Gums has won is the Urban Water Development of the year. I am not sure what year that was I would have to look it up.

Q. Is that a UDIA?

A. Yes, that was one handed out by the Water Corporation going back a few years now.

That was for the storm water management and the landscape design of the parks and so forth. Retention of trees was all part of that as well.

Question you may like to ask – we haven't spoken much about 'community'.

There is not a great deal we can tell you about the community side of things other than to say we have established a residents association.

You have got a residents association?

And we fund some annual events and that with the community down there. And as part of that we have had a strong environmental feature. So we have actually had very good feedback from residents on that where we have had a number of events where we have actually had a lady who does a bit of consulting work for us and they come along and do little tours out around the wetlands and they bring along frogs and snakes and whatever it might be. A bit of educational type stuff. And it is all done as a bit of a community get together, a bit of a bbq and they go out for a bit of a walk around the wetlands and they look at the birds and all the rest of it, so the experience of doing that and somebody telling them all about what they are having a look at.

Q. The economic side of things. As far as suburbs it has a kind of a reference to people being able to work in the area – local employment, and facilities and amenities.

A. That is a tough one when you haven't got a large master plan to start; you just have a smaller piece of the overall pie. Our people who are living in our estate are either generally working probably Rockingham/Kwinana or they are coming back up to Perth, so local employment – there is probably a question mark there.

I mean there is now a district shopping centre which is getting going, so there's a little bit but generally those employment areas are already in existence with Rockingham, Kwinana and back to the City so it's hard one to address.

Q. What about the connection to the train line? Was that in the early planning?

A. No, it wasn't in the early planning. The train sort of misses us, because the train comes off the freeway, goes through Kwinana to the north and then comes back to the south, so it sort of misses Baldivis. So don't really have the opportunity to much about the rail.

Driving to the train station.

So, of course you have good vehicle access in terms of freeways and major roads, regional centres and that. So there is good access there. But it is a sort of a dormitory suburb if you like. So the opportunities of employment

are pretty hard to address. I found that one hard to get my head around as a developer as to what you can do.

It is difficult

Unless you've got a very large development that you can create your own employment.

It also has connections to local government and various other organisations.

Ellenbrook have tried to do that and they talk about self-sufficiency and increase the level of self-sufficiency. They have land that they have dedicated for business and shopping and all the rest of it so once they get a population base there then they start to get some local employment but for an area like River Gums where you are talking about a 1000 lots or something like that, you think it is very very difficult. Almost impossible to address that side of it.

Q. What was the relative significance of the environmental and sustainability features for the whole development?

A. From a marketing point of view it was the focus. Even now you will see we have used the frogs on all the marketing information and in fact we are just about to launch a new presentation about our marketing for the estate which is gum nuts. So we have a couple of little cartoon character like little gum nuts so again picking up on our environmental theme. You can see the signage and the advertising all has an environmental theme to it. It is interesting in a sense that the land itself doesn't have a lot major environmental constraints to actually lend itself to that. It has some existing

river gum trees which are not endemic to the area they were planted – we kept those. It has some limited amount of bushland which we have tried to keep elements of but there were only small bits of bush. There is what we call the ‘tramway’ reserve along Baldivis Road that basically the estate hides behind it and we have done revegetation and walkways and there is actually a bridal trail for horses – that is a whole other story. Council insisted on that. So there is a bit of an environmental theme associated with the tramway reserve. There was also a series of damp lands or whatever you want to call them. They didn’t have any environmental value associated to them. One of them we have made into a more formal lake and then there is another that sits behind which we are doing some rehabilitation and revegetation work and there are plans in the future to make that into a larger environmental asset. So that is taking a degraded wetland and trying to turn it back into something that is a little closer to what it was once upon a time. So that is all planned for the future to happen. Retention of trees where you can, but the land was basically a big cow paddock. So people might stand and look and ask why are you promoting it with this sort of environmental flavour – well it’s for those elements plus the passive solar and energy efficiency etc.

It is not just the greening environmental stuff.

The competitors around us are targeting themselves a little differently, although you have Evermore Heights that’s gone down a more stronger sustainability path where they’ve got centralised ground water bore that

everyone accesses into and I think they have got \$23,000 of sustainability rebates and I think they have pv cells on roofs and that, so they have gone to another level again. But they have, I think, had a lot of market resistance, so it has happened at the wrong time. They have come on with all of that and then it has sort of hit the market, and the market has sort of got to a level where affordability has become too much of an issue. People have said, hang on, we will take all of that but we are not paying any extra. So you can give us all of that but we are not paying anything more. So they have had to adjust all their prices back to everyone else and they have all these things that they are giving people that others are not.

It would be an interesting analysis to try and identify if you could actually quantify the sustainability items the developers will provide. Say they are saying \$23,000. You would have to question whether they are really \$23,000, but it would be interesting to know what amount of that people are actually prepared to pay for. So they might say that \$23,000, we are happy to pay another \$5,000 of that as extra but that's it. So, we will take the \$23,000 but we are only paying \$5,000. It would be an interesting little economic analysis to say well. We have government joint venture with the Harrisdale Project which is all around sustainability and when we did numbers on that and that's what we tried to do with that, we said they all want all of these things, they add up to \$16,000 worth of sustainability initiatives, we are going to bulk then on to what people are going to get when they buy a block of land but if that block would have sold for say \$200,000 without any of those, we've added \$16,000 on top and we have just said we

think we can get \$205,000 or \$207,000 whereas we would have only got \$200,000 but we have actually had to spend another \$16,000 to bet the extra \$6000 or \$7000. So we have just made a bit of an estimate of what people are prepared to pay for those extra initiatives. I guess we will find out down the track whether we are right or wrong. But I guess that's a question as a developer you ask yourself. Because we still have to pay the same amount as the next door guys for the land and still costs us the same amount to develop, you still have to make a return which you assume that your return is going to be the same as the blokes next door otherwise you go out of business and then you have to say 'how much is the customer going to pay for that?' They are not going to pay the full cost.

Q. How important would you say those features are for development itself?

Could you have done it without them perhaps?

A. I think we could have done it without them. I think it is important in terms of marketing of the differentiation of the product. And I think you need that to be able to market yourself as being different to the guys next door or across the road or around the corner. And when you don't have maybe some other stronger attribute for your development then it becomes a key feature. In other words if we had another attribute, say we compared ourselves with Settlers Hill. Settlers Hill don't need to do this because they have other marketing opportunities that they are a larger established estate, they up on top of the hill, they have more attractive land, they have been there for a while, they have some nice housing that's already there, they

already have an established community, they have a nice oval. So from their point of view they don't have to look at sustainability and environmental initiatives – it doesn't sell their estate. For us, we've got low lying land, we are next to the freeway, more difficult to convince people to say why should you come and buy ours as opposed to the guys up on the hill. Very difficult. So you have to find something else you can hang your hat on. And this is one way of actually being able to do that. But if you then took that forward, do you think people would pay more for it, I guess I sort of answered the question in the previous one. Probably not.

Q. Are you looking for estates that probably you could buy for cheaper because they don't have as good an aspect say, but your enhancing environmental or sustainability features as a ways because it is enhancing the price?

A. I think that is true, I don't say we necessarily write that down and say this is what we do, we go out and actually look for those sorts of things, but I think those opportunities present themselves in that way, you do.

You had the River Gums already there; you had the possibility for a wetland.

I don't look at the other way where every development you should just whack on the top these environmental and sustainability initiatives and then you are going to make a lot more money. I wouldn't argue that but I would say certainly is a way of being able to say, look where you have project that might some issues.

You are cornering the market aren't you? Yeah

Q. And do you think buyers are attracted to those features as opposed to something else?

A. I think so, it's just simple product differentiation. Its bit like if you looked at that everyone likes to relate things to selling cars. You will get a car manufacturer who will say I am not BMW so I don't have the capacity to go and say buy my car because I am BMW, I am Hyundai, so what point of differentiation can I make. Well I'm Hyundai and we make cheap cars or that sort of thing or we make green cars so it's way of differentiating.

Going right back to my earliest days and I think part of the problem with increasing regulations in this area makes it more and more difficult for developers to differentiate their product on an environmental point of view. It has sort of closed that gap.

Which is good in some ways but..

It's a headache in others. It's also a little bit like the argument about in the development industry complaining about increasing regulations and having to jump through hoops, but the other side to that is it makes it really difficult for people to enter into the market. So the more difficult it gets, it's actually better for established players because they know the rules and what they have to do. It gets rid of all the others.

Q. Do you think including environmental and sustainability features in your housing developments is important?

A. Yes, without question it is. And I think it is just a question of how far do you go at each point in time. How far can you go? One of the observations

we've got is that we have won some Government projects and you actually have to tell them what you are going to do from an environmental and sustainability point of view. So today you might be putting your submission in, say look today, the latest technology this is what we think we can do and you put it all in and then it takes so long to go through the process to get approvals and get them to sign off on it, and they give you the job. By the time you actually get to build the project, what you have actually offered to them is like yesterday's stuff – no one is interested. So you then have to basically come up with a whole bunch of new ideas that weren't part of the submission when you won the project.

So you can sit round as a developer and go well we don't really want to offer all this because this is really making things hard and we don't know whether the market will accept it and ra, ra, ra. But then you look at it and say it's going to take 2, 3, 4 years before we get there and by that time this will be yesterday's stuff, no one will be interested in that. And then we will have to do something else.

So, it's the lead times that cause this?

Yeah.

So, I think for Harrisdale we said that all the homes would be six star homes. When we said that we thought why we are saying that. No would be able to build a six star home, it would be impossible. Now we sit there and say 'six star home, no problem'.

Stocklands Interview

Q. Has your organisation developed a suburb in Perth where sustainability or environmental considerations have been a focus?

A. Definitely, yes. Newhaven. The environmental side was a key consideration from the very start of the project and obviously sustainability comes into that but environmental side of it was a real key.

Q. Was that for a particular reason?

A. I guess the natural attributes of the site, so the natural land form, existing vegetation are probably the two things that started it. Very low lying areas. Almost swampland. The water sensitive stuff was really a key as well. Essentially when it first went up for approval the authorities were saying no you can't subdivide that swamp land. You are going to have to put massive amounts of fill in there and that every water sensitive suburb that we have done has allowed us to subdivide it but not to bring it up to maximum levels of infill.

Q. What is the size of the development?

A. Total size is about 184 hectares.

Q. A smallish size?

A. It's quite large for us. It's one of our two master plan communities so the other one you may have heard of is Settlers Hills.

Yes

This has been around for about 11 years or so. So I believe this is going to be slightly larger than that on completion.

Perhaps probably not that big, Settlers Hill is larger, but it is still in comparison to other estates in the area, it is the largest in the area.

Q. How have you incorporated these environmental features that you have talked about into the development?

A. From the start, the main entry road, just hits you straight away, the land form is up quite high and you are dipping down roads, you have massive pine trees either side of you so the experience starts from when you first get there and then it moves into the more sensitive stuff. Within the parks you have obviously got all the bio retention swailles and so forth, the drainage, open swailles throughout the parks rather than closed off typical style. And then utilising a lot of the water sensitive stuff in the parks to try and improve the quality of the ground water or essentially not leave as much of an impact from us developing the land and decreasing the quality of the ground water in the area.

I think just from the stuff I have seen on the website you have made a bit of a connection to the natural areas as well as far as getting people to connect with nature.

We have used some of the fallen logs and stuff and we have put them back into the estate – features for playgrounds and so forth, just little things like that which people can connect to.

Q. As far as the suburb is concerned, your main concentration has been on the water sensitive management of the area?

A. I would say so, yes. That's the key, obviously the tree retention and the land form as well.

I think that's a big one – retention and enhancement. Our design team has worked really carefully in making sure that the road networks work around the existing vegetation. So we incorporate that into what we do. When you go down there you will see that there is a vast difference between what we have done to what others have done on the other side of the road. We have actually tried to work around what was there rather than bulldoze it and start afresh. Which is obviously the cheaper alternative – to bulldoze everything but then you don't get that impact when you first go in. I mean it's easy to see from the height of the trees throughout basically it is no comparison to anything else in the area.

Q. I notice that Stocklands has a sustainability program. Do you think that has anything to do with the decision that you guys have made to enhance that environmental aspects in your development?

A. I guess it is something that we have to look at. It is something that in every project you are obliged to take into account. It is not something we do as an add-on it is just something that everyone has to do as part of the design and the implementation of the project on the ground.

But you know every project we do; sustainability is part of our design philosophy. So we want to make communities that will thrive after we leave so they are actually truly sustainable. There are some projects we haven't been able to achieve that as yet, but we are working on that and from making sure that all the parks connect to one another through walkways and cycleways. That we have where possible, primary schools close by so kids can actually walk or cycle to schools. That we provide shops and other commercial facilities close by so people don't have to travel so far. They can potentially walk there. We also look to have a whole range of different lot sizes available so we are not only catering for your first homebuyers but also those people who are looking to downsize so there is that whole idea of age in place, where people don't necessarily need to leave. So they can grow old in that one community. So there all these different considerations we take in when we are designing the project in the beginning.

Q. Have you monitored the success of these environmental and sustainability features in your development?

A. It's a little bit tricky in some circumstances to monitor certain things. I guess one thing we have looked at is the quality of the ground water. We did some testing a little while ago which indicated that from when we first started to now, the ground water quality is roughly the same as when we started. Given the stuff we have in place that would say we are improving the quality of the stuff that is going back in. Essentially from building site to construction it does deteriorate the ground water quality so I will say, over time once the construction is complete we will continue to, obviously through stripping away all the bad things in the ground water and replenishing the ground water system it will hopefully improve. But in terms of other testing, we haven't really done a lot. I guess our key monitor would be within our sales.

We haven't tested, but the biodiversity – we have enhanced that which is a good thing. We are in the process of starting to test things like that and from my sales and customer point of view a lot of the reasons we get back from customers as to why they chose Newhaven over other estates is because of the infrastructure and because of the amenities. Because of the natural environment. Because of the retention of the vegetation and because it is just a really good community spirit. So I think the fact that people are recognising that goes to show we kind of doing something right.

Q. Did you experience any difficulty in including those features in your development?

A. Now, this was slightly before my time and before Lisa's time as well as for implementing, but I spoke to Stuart who was on the project from the start. He said there was. The main issue came from co-operation within the organisations external to us so Department of Water, Department of Environment & Conservation and Water Corp.

Q. So, how long ago would we be talking about?

A. Commencement I think was in 2004. So planning commenced 2000, suburb 2004, construction commenced early 2005. It was little while ago that we did start and I guess if you need one department to stand up and to take some charge and say we can see this is going to work to lets work together but apparently it was a real struggle to be able to get them all to co-operate. One would say one thing and it would impact on another and they would say no. So that was the main red tape sort of speak that would influence.

Q. The Local Government was also part of that?

A. Yes, they were involved, but it was the water management was the key element to starting the whole project. Local Government was involved but they were just saying- getting the advice from the other authorities to see if this can go ahead.

Just on that one from a builder point of view. Newhaven actually had the first five star energy display village in Western Australia and that was developed in collaboration with the City of Armadale and the South East Regional Energy Group. But that was really difficult to get off the ground initially. Builders were very opposed to it because there would obviously be additional costs involved and we still come up against that quite often because they don't want to fork out the additional money. But that display village – we are onto the second display village now – but when it was built we had great opposition by the builders but then the amount of positive responses that we got was just phenomenal. So I think the additional money out laid, payed off in the end.

On the council, the Councils view point on a lot of sustainable or environmental things that we do, they look at the maintenance cost of it. That is a key to them to implement certain things. I think we did try for a particular type of retic system which was a waterwise retic system for all the parks which we said this is what we want to include, but the City of Armadale said it is too expensive for us to maintain. So no-one else was doing it so it was like it was a no. So they looked at it from that point of view. How much is this going to cost us later down the track? And then obviously getting them upskilled in the engineering behind certain things as well. Does obviously cause delays as well.

Q. What incentives did you include to encourage buyers to include environmental or sustainability features in their own homes?

A. We don't offer cash incentives per say. We do with every block provide a landscaping package which is water wise so we go out and do the front yards we incorporate native and rain sensitive plants. We reduce the amount of lawn we put down. As I mentioned we also work with SERWEG in the area which means that Newhaven residents are eligible for additional discounts on top of federal and state grants. So to incorporate different sustainable initiatives in the home.

Q. So there is nothing that is linked to covenants on the contract?

A. We do have design covenants which encourage people to incorporate energy efficient and water wise initiatives into the home and design as well. We try to educate and inform them but we don't restrict them because you are obviously going to lessen your market, but we do encourage as much as we can and then give advice on the best layout for the house and the orientation and all that sort of stuff and that is why, starting with the display village we wanted to build a five star energy rating display village to demonstrate that you can do this. You are actually going to have a home that is going to save you money in the long run. We have welcome packs which include information about how they can design the home in a certain way so it is more sustainable. We provide them with information on our

website and things like that. But in terms of actual cash incentives we don't actually do that.

Q. You have laid out the design of the suburb so that you can get the best solar orientation?

A. Essentially yes. Obviously working with the existing vegetation does limit us somewhat and the landform and so forth but we do where we can to get the orientation on the majority of our lots into the size that you need.

Q. So, what awards have you won based on these features?

A. The main award would be the Environmental Excellence Video in 2008. The year before we received the Judges Award from UDIA which is an overall award the judges who come out and view all the estates in all the different categories select the particular innovation in a particular area. They gave it to us for I presume environmental excellence as that was our key selling point. This year we have won the Best Residential Development Over 50 lots in WA. So again that is not specifically for environmental excellence but within the submission one of the key points is the environmental side.

For our industry they are quite a good thing to win.

Q. What was the relative significance of these environmental features in your marketing?

A. Pretty much the authenticity of Newhaven is our key selling point. And when you go out there you will realise how different it is compared to the other projects. People love the fact that we've incorporated the native

vegetation and we've created playground equipment out it. We've incorporated walk and cycle paths so we really draw on these features and use them to sell the project. Everything is around the fact that we have incorporated the natural environment and enhanced it. Every piece of marketing that I do uses this. Newhaven, out of all our developments is the one that we promote as being the most sustainable in this point in time.

Q. How important are environmental and sustainability features in the development itself?

A. When you look at sales – if we didn't have any we would still get sales but we wouldn't get anywhere near the volume that we get.

Q. So people are specifically buying Newhaven because of the environmental features?

A. They probably don't come in and say they are buying because of this but when they drive in they will just get a feel for what it is like and they might not specifically think it's the environment that they are protecting so from that side of things it is of key importance.

But the quality as well. I think people realise that if they buy in Newhaven then their property may be a little more valuable than those people across the road simply because the quality is of such a high standard. And I think the growth would be a lot higher potentially over time.

And I guess it is fairly obvious straight away that some thought has gone into the whole development as opposed to the other examples.

I mean years and years of planning with top consultants from WA getting involved. Some of the key planning people and some of the key engineering people on the project looking at what's the best way we can move forward on this project. So it's turned out quite well.

Q. Do you think including environmental and sustainability features in housing developments is important?

A. Definitely yes. I think there is bit of a point you get to where people don't start seeing the value in it. You can do so many things and people go I like that and they get to a point when they say I'm going to have to pay for that and I'm not really willing to. I think there is an estate, I'm not sure which one it is, that you aren't allowed to have turf in your front yard, just all mulch, so they have gone really water sensitive, rain tanks, everything like that, and they just see it as I don't want this mulch in my front yard, I don't want a water tank, it's going to cost me more money, I'm not prepared to pay for it. So there is a certain point you get to when you say it is not really going to generate more sales so it is probably not worth the extra outlay.

Q. I know that we are going to six star next year. Will it have any difference in how you produce future developments?

A. Not really, no. Our current display village is a six star so that's now just a standard built form product. That's really for the builders to work with the clients, so we get the land ready. I mean if that's if we do some house and lands which we haven't done a lot of in.

Personally, I think that in response to these questions we are a responsible developer and it is our responsibility to develop communities that are going to be sustainable in the long run and in that respect it is incredibly important that we make sure that we consider everything, incorporate infrastructure and amenities that are going to make these communities thrive. If we didn't do that I don't think we would be being very responsible.

No, and especially since you have sustainability program.

And, also from a whole company point of view people do look to your past projects that you have done and if you can create something that they enjoy somewhere else you are obviously going to be able to create it elsewhere. Whereas if you cut everything out then it leaves a black mark against your name and people remember and you get repeat purchasers as well who remember what the developer does for them.

Apart from just the government mandatory requirements we as an organisation already also have certain requirements we like to maintain and I think we are rolling over and above in implementing a new sustainability policy for the organisation which will mean that every project will have to meet this certain standard and I think that is a really good thing to do.

1. What 'Green/Eco/Sustainable' features have you used to identify your development as 'Green', 'Eco' or 'Sustainable'?

- Energy-conserving design guidelines – such as maximum winter solar orientation and maximum summer shading, siting and other passive means of harnessing natural breezes, and landscape elements that stabilize temperatures inside the houses.
- Restored wetlands integrated with the stormwater management system.
- Community facilities that have been designed and built to sustainability criteria, including a primary school and a community centre.
- Transport oriented design – linking the community intelligently with transport infrastructure.
- A number of key sustainability design criteria incorporated into each home to achieve a 5 star energy rating.
- Investment in artworks as a creative expression of sustainability.

2. How have you incorporated these 'Green/Eco/Sustainable' features into the development?



- A key location associated drawcard was Harvest Lakes' proximity to the city (20 minutes to the Perth CBD) and to public transport (it is served by an interchange of the Kwinana Freeway and a dedicated station on the Perth/Mandurah commuter-rail line).
- Harvest Lakes offers a number of community facilities that have been designed and built to sustainability criteria. These include a \$1.5m community centre and a primary school, both of which make use of passive solar orientation and temperature responsive louvers (eliminating the need for air conditioning and requiring only minimal heating); rainwater flush toilets; and grey water recycling.
- Other community based initiatives that struck a chord with home owners included:
- Waterwise Mosaic Project

- Sustainable Living Projects
- Frog Friendly Garden Workshops
- Frog Watch Night Stalks
- Community celebration events
- Welcome events for new resident
- Harvest Lakes' position as Western Australia's first large-scale GreenSmart Estate gave the developers a point of difference on which to base their "change your world" marketing campaign, focusing on purchasers making a personal contribution towards sustainability.
- Additionally, sustainability was behind many of the decisions that made Harvest Lakes appealing in the areas of presentation and community.

Appendix C Raw Data from the case study residents online survey



1. Do you consent to your anonymous information being used in this PhD research?

[Create Chart](#) [Download](#)

		Response Percent	Response Count
Yes		95.2%	20
No		4.8%	1
My postcode is:			19
Show Responses			
answered question			21
skipped question			0





2. Did you build your house or buy one already constructed?

[Create Chart](#) [Download](#)

		Response Percent	Response Count
I built my house		95.2%	20
I bought my house already constructed		4.8%	1
answered question			21
skipped question			0




3. How old is your house?

[Create Chart](#) [Download](#)

		Response Percent	Response Count
1 yr old		36.4%	4
2 yrs old		0.0%	0
3 yrs old		36.4%	4
4 yrs old		9.1%	1
5 yrs old		18.2%	2
6 yrs old		0.0%	0
7 yrs old		0.0%	0
8 yrs old		0.0%	0
9 yrs old		0.0%	0
10 yrs old		0.0%	0
11+ yrs old		0.0%	0
Other (please specify) Hide Responses			10

1. 3 months Mon, Mar 15, 2010 3:51 PM [Find...](#)
2. Not finished being built as yet Fri, Mar 12, 2010 10:08 PM [Find...](#)
3. 6 months old Tue, Mar 9, 2010 9:04 PM [Find...](#)
4. Still Building Mon, Mar 8, 2010 4:36 PM [Find...](#)
5. Almost finished construction Mon, Jan 4, 2010 2:13 PM [Find...](#)
6. Not finished building yet Sun, Dec 20, 2009 1:00 AM [Find...](#)
7. not yet completed Sat, Dec 19, 2009 2:00 PM [Find...](#)
8. Not built Sat, Dec 19, 2009 1:30 PM [Find...](#)
9. not built yet Fri, Dec 18, 2009 5:20 PM [Find...](#)
10. 1 month Fri, Dec 18, 2009 3:25 PM [Find...](#)

4. Did you buy/build your house in a subdivision or estate that has won awards for environmental or sustainability features, or has been specifically marketed to be a 'green' or more sustainable alternative? [Create Chart](#) [Download](#)

		Response Percent	Response Count
Yes		61.9%	13
No		9.5%	2
Don't Know		28.6%	6
The subdivision I bought/built my house in is:			13
Show Responses			
answered question			21
skipped question			0

5. Why did you buy/build your house in your particular location? [Download](#)

	Response Count
Show Responses	21
answered question	21
skipped question	0



6. If you built your house did you consider including environmental/sustainability features in the design of your house? (see the list of features above for suggestions) [Download](#)

	Response Percent	Response Count
If yes, why did you include them, and what did you include? Hide Responses	66.7%	14


- | | | |
|---|----------------------------|-------------------------|
| 1. Developers guidelines, environmental footprint. | Mon, Nov 29, 2010 9:21 AM | Find... |
| 2. yes - it was a requirement of the estate | Fri, Nov 26, 2010 11:59 AM | Find... |
| 3. Insulation increased, and house has a 5 start energy rating. | Fri, Nov 19, 2010 2:43 PM | Find... |
| 4. Cost factor and to reduce the impact on the climate | Mon, Mar 15, 2010 3:51 PM | Find... |
| 5. Enviromentally friendly appliances | Fri, Mar 12, 2010 10:08 PM | Find... |
| 6. solar hot water - was included with house and would save on energy bills | Tue, Mar 9, 2010 9:04 PM | Find... |
| 7. maximising sunlight, solar panels, position of windows/house vs sun | Tue, Dec 29, 2009 7:16 PM | Find... |
| 8. Yes but price was alot more \$\$\$ | Mon, Dec 21, 2009 12:30 PM | Find... |
| 9. light coloured roofs,insulation- to reduce inside temperature | Sat, Dec 19, 2009 2:00 PM | Find... |
| 10. Solar Hot water, Solar PV | Sat, Dec 19, 2009 9:23 AM | Find... |
| 11. environmentally conscious | Fri, Dec 18, 2009 3:25 PM | Find... |
| 12. orientation, colour of roof, insulation, native garden, window placement, 5* gas hws | Wed, Dec 9, 2009 1:36 PM | Find... |
| 13. No | Tue, Dec 8, 2009 12:58 PM | Find... |
| 14. yes we had to due to covenants. Light coloured roof, large eaves, placement of living areas, waterwise gardens, water wise appliances | Tue, Dec 8, 2009 7:08 AM | Find... |
- 25 responses per page

If no, why didn't you? Show Responses	33.3%	7
I bought my house already constructed Show Responses	4.8%	1
answered question		21
skipped question		0


6. If you built your house did you consider including environmental/sustainability features in the design of your house? (see the list of features above for suggestions) [Download](#)

		Response Percent	Response Count
If yes, why did you include them, and what did you include? Show Responses		66.7%	14
If no, why didn't you? Hide Responses		33.3%	7

- | | | |
|--|---------------------------|-------------------------|
| 1. Materials to be used depends on Builder | Mon, Mar 8, 2010 4:36 PM | Find... |
| 2. was not talked about at consultation, was a pre packaged pack and adding alterations was not encouraged | Wed, Jan 6, 2010 6:26 PM | Find... |
| 3. Cost & budget constraints | Mon, Jan 4, 2010 2:13 PM | Find... |
| 4. Had to keep to a budget. | Sun, Dec 20, 2009 1:00 AM | Find... |
| 5. No, wasn't made aware of suggestions by builder | Sat, Dec 19, 2009 1:30 PM | Find... |
| 6. too expensive | Fri, Dec 18, 2009 5:20 PM | Find... |
| 7. Cost comes into the decision and re sale | Tue, Dec 8, 2009 12:58 PM | Find... |

I bought my house already constructed Show Responses		4.8%	1
		answered question	21
		skipped question	0


7. If you built your house did the developer/builder offer you any incentives for including any environmental/sustainability features in your house design? [Download](#)

		Response Percent	Response Count
If yes, which incentives did you take up and why? Hide Responses		40.0%	8

1. \$1200 rebate - provided if guidelines complied with. Mon, Nov 29, 2010 9:21 AM [Find...](#)
2. We had no choice, it was part of th covenances Fri, Nov 26, 2010 11:59 AM [Find...](#)
3. water restrictive taps, northern aspect taken into consideration, insulation properties. Fri, Nov 19, 2010 2:43 PM [Find...](#)
4. No Mon, Mar 15, 2010 3:51 PM [Find...](#)
5. will be taking up the water wise garden incentive Fri, Mar 12, 2010 10:08 PM [Find...](#)
6. waterwise rated gas hot water system, insulation Wed, Dec 9, 2009 1:36 PM [Find...](#)
7. No Tue, Dec 8, 2009 12:58 PM [Find...](#)
8. I can't remeber Tue, Dec 8, 2009 7:08 AM [Find...](#)



If yes, but you didn't take them up, why not?		0.0%	0
--	--	------	---

If no, would you have taken them up if they'd been provided? Show Responses		60.0%	12
---	--	-------	----

I bought my house already constructed Show Responses		5.0%	1
--	--	------	---


	answered question	20
	skipped question	1

7. If you built your house did the developer/builder offer you any incentives for including any environmental/sustainability features in your house design? [Download](#)




		Response Percent	Response Count
If yes, which incentives did you take up and why? Show Responses		40.0%	8
If yes, but you didn't take them up, why not?		0.0%	0
If no, would you have taken them up if they'd been provided? Hide Responses		60.0%	12

1. Only if there were not over priced.	Tue, Mar 9, 2010 9:04 PM	Find...
2. Yes, Of Course	Mon, Mar 8, 2010 4:36 PM	Find...
3. yes they would have been considered	Wed, Jan 6, 2010 6:26 PM	Find...
4. Yes	Mon, Jan 4, 2010 2:13 PM	Find...
5. Yes. Im very concious of the environment and would have loved to be offered features	Tue, Dec 29, 2009 7:16 PM	Find...
6. Yes i would of accepted	Mon, Dec 21, 2009 12:30 PM	Find...
7. Yes	Sun, Dec 20, 2009 1:00 AM	Find...
8. yes	Sat, Dec 19, 2009 2:00 PM	Find...
9. Yes	Sat, Dec 19, 2009 1:30 PM	Find...
10. Is a bit shame that the government did not combine incentives as such for new homes. Most builders only take the responsibility of trying to able to provide what the customer wants but do not deal with the rebates at all.	Sat, Dec 19, 2009 9:23 AM	Find...
11. yes, if they were cheap	Fri, Dec 18, 2009 5:20 PM	Find...
12. Yes if it was viable	Tue, Dec 8, 2009 12:58 PM	Find...



25 responses per page

I bought my house already constructed Show Responses		5.0%	1
		answered question	20
		skipped question	1

8. If you bought into a subdivision with environmental/sustainability features that were advertised by the developers, did such features have anything to do with your decision to buy in the area? [Download](#)

		Response Percent	Response Count																														
If yes, which features attracted you? Hide Responses		62.5%	10																														
<table border="1"> <tbody> <tr> <td>1. greensmart initiatives.</td> <td>Mon, Nov 29, 2010 9:21 AM</td> <td>Find...</td> </tr> <tr> <td>2. A little. It's nice to know you are doing something for the planet</td> <td>Fri, Nov 26, 2010 11:59 AM</td> <td>Find...</td> </tr> <tr> <td>3. none</td> <td>Fri, Nov 19, 2010 2:43 PM</td> <td>Find...</td> </tr> <tr> <td>4. The parks and facilities available in the subdivision</td> <td>Mon, Mar 15, 2010 3:51 PM</td> <td>Find...</td> </tr> <tr> <td>5. native gardens</td> <td>Fri, Mar 12, 2010 10:08 PM</td> <td>Find...</td> </tr> <tr> <td>6. lake, Tall Trees, Park, Play ground</td> <td>Mon, Mar 8, 2010 4:36 PM</td> <td>Find...</td> </tr> <tr> <td>7. booklets on maximising house construction in regards to environment/sustainability, landscaping advice. Convenants with house design, positioning to maximise sunlight. Green focus on waterways and parklands. Enviro concious newsletters emailed monthly by the estate</td> <td>Tue, Dec 29, 2009 7:16 PM</td> <td>Find...</td> </tr> <tr> <td>8. trees and walkways</td> <td>Fri, Dec 18, 2009 5:20 PM</td> <td>Find...</td> </tr> <tr> <td>9. orientation of blocks, lots of trees retained, building guidelines</td> <td>Wed, Dec 9, 2009 1:36 PM</td> <td>Find...</td> </tr> <tr> <td>10. no</td> <td>Tue, Dec 8, 2009 12:58 PM</td> <td>Find...</td> </tr> </tbody> </table>				1. greensmart initiatives.	Mon, Nov 29, 2010 9:21 AM	Find...	2. A little. It's nice to know you are doing something for the planet	Fri, Nov 26, 2010 11:59 AM	Find...	3. none	Fri, Nov 19, 2010 2:43 PM	Find...	4. The parks and facilities available in the subdivision	Mon, Mar 15, 2010 3:51 PM	Find...	5. native gardens	Fri, Mar 12, 2010 10:08 PM	Find...	6. lake, Tall Trees, Park, Play ground	Mon, Mar 8, 2010 4:36 PM	Find...	7. booklets on maximising house construction in regards to environment/sustainability, landscaping advice. Convenants with house design, positioning to maximise sunlight. Green focus on waterways and parklands. Enviro concious newsletters emailed monthly by the estate	Tue, Dec 29, 2009 7:16 PM	Find...	8. trees and walkways	Fri, Dec 18, 2009 5:20 PM	Find...	9. orientation of blocks, lots of trees retained, building guidelines	Wed, Dec 9, 2009 1:36 PM	Find...	10. no	Tue, Dec 8, 2009 12:58 PM	Find...
1. greensmart initiatives.	Mon, Nov 29, 2010 9:21 AM	Find...																															
2. A little. It's nice to know you are doing something for the planet	Fri, Nov 26, 2010 11:59 AM	Find...																															
3. none	Fri, Nov 19, 2010 2:43 PM	Find...																															
4. The parks and facilities available in the subdivision	Mon, Mar 15, 2010 3:51 PM	Find...																															
5. native gardens	Fri, Mar 12, 2010 10:08 PM	Find...																															
6. lake, Tall Trees, Park, Play ground	Mon, Mar 8, 2010 4:36 PM	Find...																															
7. booklets on maximising house construction in regards to environment/sustainability, landscaping advice. Convenants with house design, positioning to maximise sunlight. Green focus on waterways and parklands. Enviro concious newsletters emailed monthly by the estate	Tue, Dec 29, 2009 7:16 PM	Find...																															
8. trees and walkways	Fri, Dec 18, 2009 5:20 PM	Find...																															
9. orientation of blocks, lots of trees retained, building guidelines	Wed, Dec 9, 2009 1:36 PM	Find...																															
10. no	Tue, Dec 8, 2009 12:58 PM	Find...																															
If no, why not? Show Responses		31.3%	5																														
I didn't buy my house in a subdivision with any advertised environmental/sustainability features Show Responses		18.8%	3																														
		answered question	16																														
		skipped question	5																														




8. If you bought into a subdivision with environmental/sustainability features that were advertised by the developers, did such features have anything to do with your decision to buy in the area? [Download](#)

		Response Percent	Response Count
If yes, which features attracted you? Show Responses		62.5%	10
If no, why not? Hide Responses		31.3%	5

- 1. cost to include. Fri, Nov 19, 2010 2:43 PM [Find...](#)
- 2. No, I like the location more than the environmental appeal. Sat, Dec 19, 2009 1:30 PM [Find...](#)
- 3. Dont know Sat, Dec 19, 2009 9:23 AM [Find...](#)
- 4. Not high on my reasons, location was more important Tue, Dec 8, 2009 12:58 PM [Find...](#)
- 5. not really Tue, Dec 8, 2009 7:08 AM [Find...](#)

I didn't buy my house in a subdivision with any advertised environmental/sustainability features Show Responses		18.8%	3
		answered question	16
		skipped question	5

8. If you bought into a subdivision with environmental/sustainability features that were advertised by the developers, did such features have anything to do with your decision to buy in the area? [Download](#)

		Response Percent	Response Count
If yes, which features attracted you? Show Responses		62.5%	10
If no, why not? Show Responses		31.3%	5
I didn't buy my house in a subdivision with any advertised environmental/sustainability features Hide Responses		18.8%	3

- 1. we didnt get told about any enviromental features Mon, Dec 21, 2009 12:30 PM [Find...](#)
- 2. wasnt atvertise as far as I was aware Sat, Dec 19, 2009 2:00 PM [Find...](#)
- 3. x Wed, Dec 9, 2009 8:34 AM [Find...](#)

		answered question	16
		skipped question	5

9. How many people live in your house? (...for the majority of the time)		Create Chart	Download
		Response Percent	Response Count
1		10.0%	2
2		50.0%	10
3		25.0%	5
4		10.0%	2
5+		5.0%	1
		answered question	20
		skipped question	1

10. On average how many units of electricity did your household use per day during the winter months (June - Aug 2009)? (Check your bill for this figure)		Create Chart	Download
		Response Percent	Response Count
0 - 10 units per day		38.5%	5
11 - 20 units per day		30.8%	4
21 - 30 units per day		0.0%	0
31 - 40 units per day		30.8%	4
41 - 50 units per day		0.0%	0
51 - 60 units per day		0.0%	0
More than 61 units per day		0.0%	0
		Other (please specify) Hide Responses	10

1. unknown.	Mon, Nov 29, 2010 9:21 AM	Find...
2. house still under construction	Fri, Mar 12, 2010 10:08 PM	Find...
3. Haven't lived in the home between June and Aug yet.	Tue, Mar 9, 2010 9:04 PM	Find...
4. unsure have not moved in yet	Wed, Jan 6, 2010 6:26 PM	Find...
5. Not living there yet	Mon, Jan 4, 2010 2:13 PM	Find...
6. House hasn't been fully built yet	Sun, Dec 20, 2009 1:00 AM	Find...
7. house still under construction	Sat, Dec 19, 2009 2:00 PM	Find...
8. not built yet	Fri, Dec 18, 2009 5:20 PM	Find...
9. House only completed in November 2009.	Fri, Dec 18, 2009 3:25 PM	Find...
10. Away up north for the winter	Tue, Dec 8, 2009 12:58 PM	Find...

		answered question	13
		skipped question	8

10. On average how many units of electricity did your household use per day during the winter months (June - Aug 2009)? (Check your bill for this figure) [Create Chart](#) [Download](#)

	Response Percent	Response Count
0 - 10 units per day	38.5%	5
11 - 20 units per day	30.8%	4
21 - 30 units per day	0.0%	0
31 - 40 units per day	30.8%	4
41 - 50 units per day	0.0%	0
51 - 60 units per day	0.0%	0
More than 61 units per day	0.0%	0
Other (please specify) Hide Responses		10

1. unknown.	Mon, Nov 29, 2010 9:21 AM	Find...
2. house still under construction	Fri, Mar 12, 2010 10:08 PM	Find...
3. Haven't lived in the home between June and Aug yet.	Tue, Mar 9, 2010 9:04 PM	Find...
4. unsure have not moved in yet	Wed, Jan 6, 2010 6:26 PM	Find...
5. Not living there yet	Mon, Jan 4, 2010 2:13 PM	Find...
6. House hasn't been fully built yet	Sun, Dec 20, 2009 1:00 AM	Find...
7. house still under construction	Sat, Dec 19, 2009 2:00 PM	Find...
8. not built yet	Fri, Dec 18, 2009 5:20 PM	Find...
9. House only completed in November 2009.	Fri, Dec 18, 2009 3:25 PM	Find...
10. Away up north for the winter	Tue, Dec 8, 2009 12:58 PM	Find...

answered question	13
skipped question	8

10. On average how many units of electricity did your household use per day during the winter months (June - Aug 2009)? (Check your bill for this figure)

[Create Chart](#) [Download](#)







	Response Percent	Response Count
0 - 10 units per day	38.5%	5
11 - 20 units per day	30.8%	4
21 - 30 units per day	0.0%	0
31 - 40 units per day	30.8%	4
41 - 50 units per day	0.0%	0
51 - 60 units per day	0.0%	0
More than 61 units per day	0.0%	0
Other (please specify) Hide Responses		10

1. unknown.	Mon, Nov 29, 2010 9:21 AM	Find...
2. house still under construction	Fri, Mar 12, 2010 10:08 PM	Find...
3. Haven't lived in the home between June and Aug yet.	Tue, Mar 9, 2010 9:04 PM	Find...
4. unsure have not moved in yet	Wed, Jan 6, 2010 6:26 PM	Find...
5. Not living there yet	Mon, Jan 4, 2010 2:13 PM	Find...
6. House hasn't been fully built yet	Sun, Dec 20, 2009 1:00 AM	Find...
7. house still under construction	Sat, Dec 19, 2009 2:00 PM	Find...
8. not built yet	Fri, Dec 18, 2009 5:20 PM	Find...
9. House only completed in November 2009.	Fri, Dec 18, 2009 3:25 PM	Find...
10. Away up north for the winter	Tue, Dec 8, 2009 12:58 PM	Find...

answered question	13
skipped question	8

11. On average how many litres of water does your household use per day?
(Check the latest bill for this figure)

[Create Chart](#) [Download](#)





		Response Percent	Response Count
0 - 100 litres per day		46.7%	7
101 - 200 litres per day		20.0%	3
201 - 300 litres per day		13.3%	2
301 - 400 litres per day		6.7%	1
401 - 500 litres per day		0.0%	0
501 - 1000 litres per day		6.7%	1
1001+ litres per day		6.7%	1
		Other (please specify) Hide Responses	7

1. unknown.	Mon, Nov 29, 2010 9:21 AM	Find...
2. house still under construction	Fri, Mar 12, 2010 10:08 PM	Find...
3. unsure have not moved in yet	Wed, Jan 6, 2010 6:26 PM	Find...
4. Not living there yet	Mon, Jan 4, 2010 2:13 PM	Find...
5. As above	Sun, Dec 20, 2009 1:00 AM	Find...
6. house still under construction	Sat, Dec 19, 2009 2:00 PM	Find...
7. not built yet	Fri, Dec 18, 2009 5:20 PM	Find...

answered question 15
skipped question 6

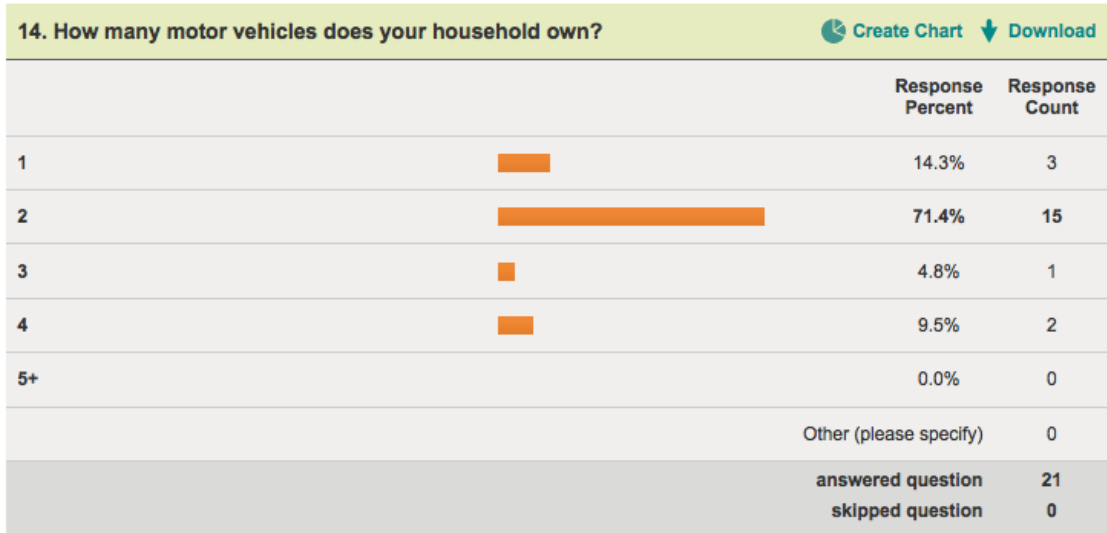
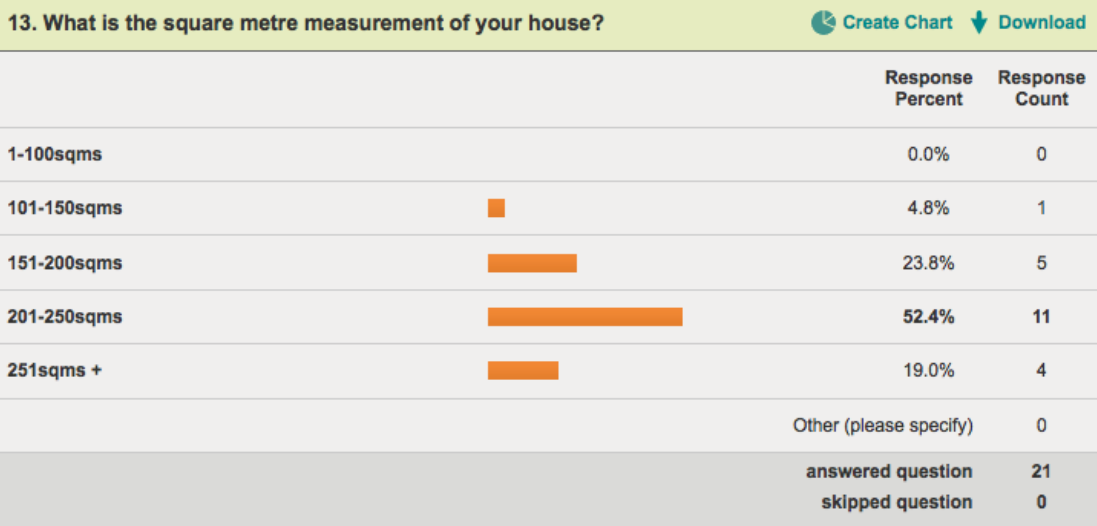
12. On average how many units of gas did your household use per day during the winter months (June-Aug)? (check your bill for this figure)

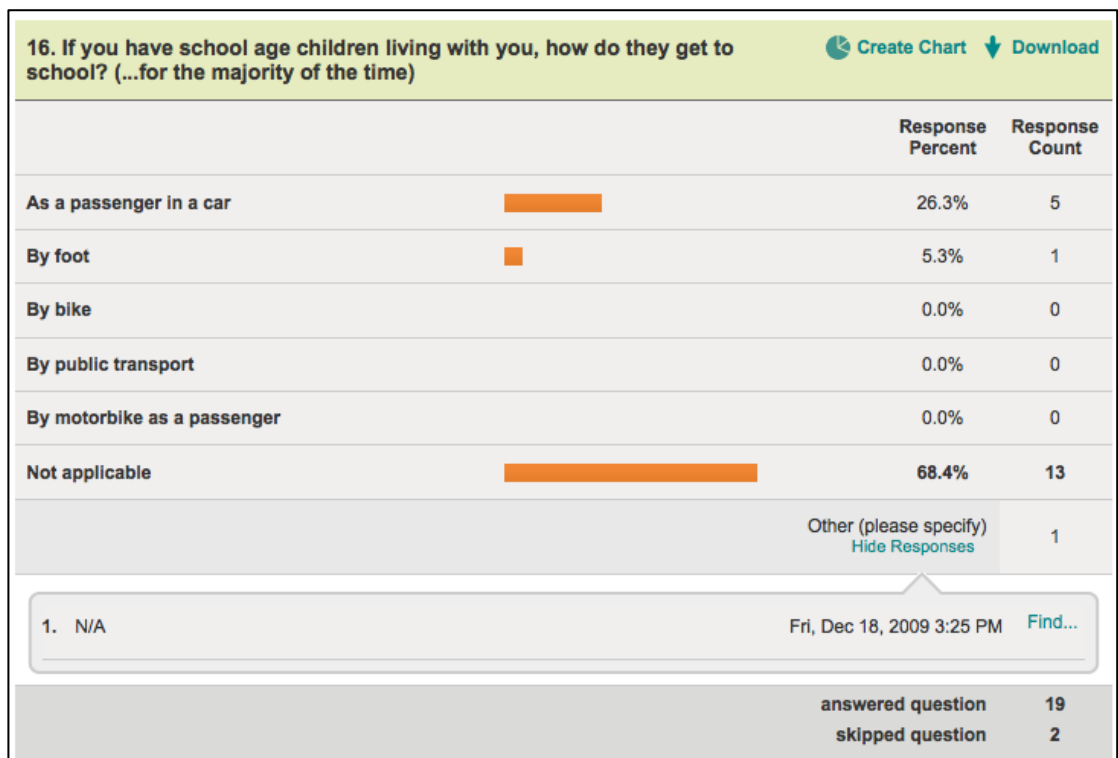
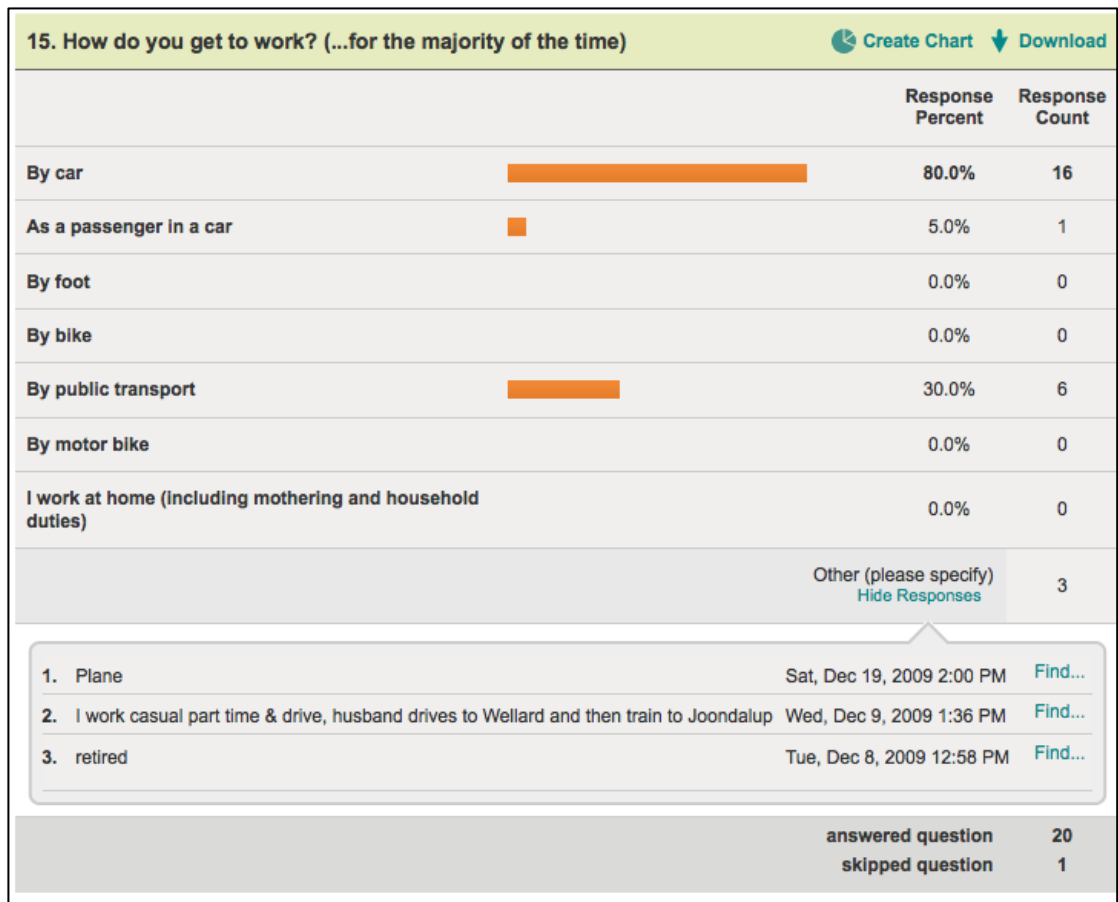
[Create Chart](#) [Download](#)

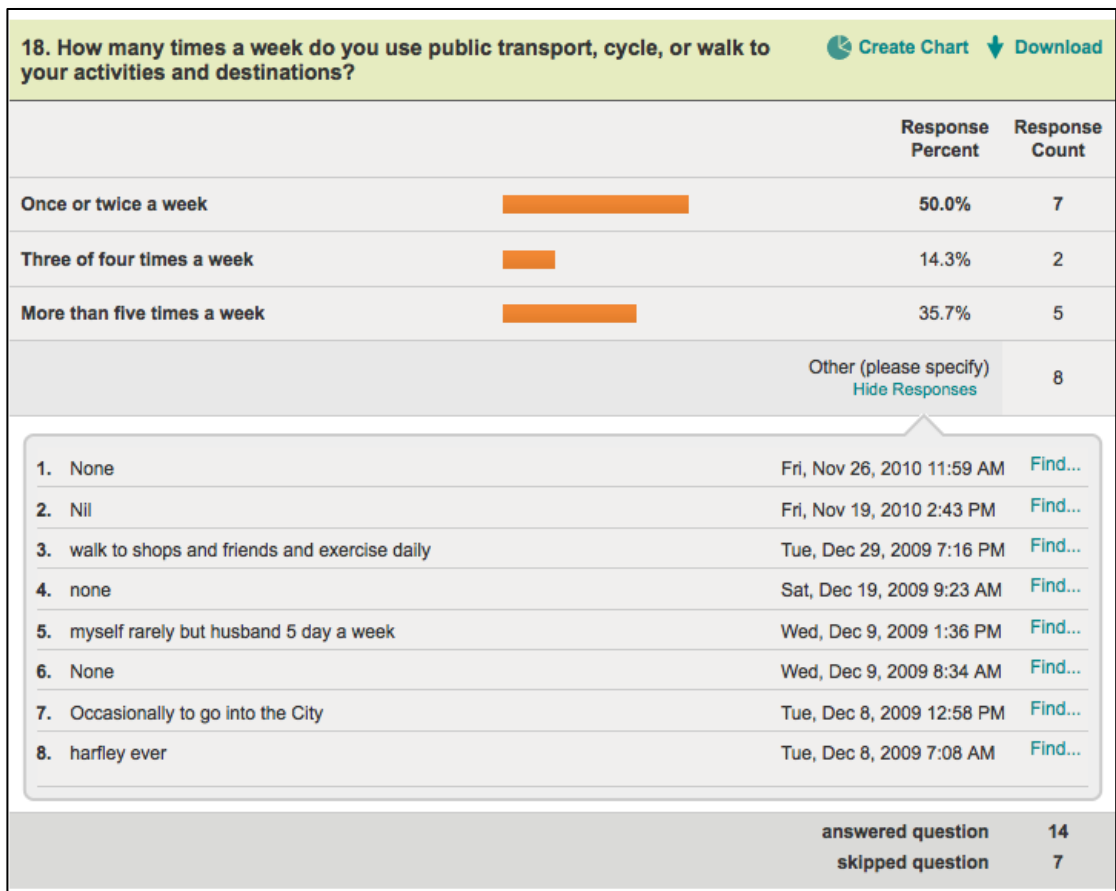
		Response Percent	Response Count
1-5 units per day		35.7%	5
6-10 units per day		42.9%	6
11-15 units per day		0.0%	0
16-20 units per day		14.3%	2
21-25 units per day		0.0%	0
26-30 units per day		0.0%	0
31-35 units per day		0.0%	0
36+ units per day		7.1%	1
		Other (please specify) Hide Responses	8

- | | | |
|--|----------------------------|-------------------------|
| 1. unknown. | Mon, Nov 29, 2010 9:21 AM | Find... |
| 2. house still under construction | Fri, Mar 12, 2010 10:08 PM | Find... |
| 3. Haven't lived in the home between June and Aug yet. | Tue, Mar 9, 2010 9:04 PM | Find... |
| 4. unsure have not moved in yet | Wed, Jan 6, 2010 6:26 PM | Find... |
| 5. Not living there yet | Mon, Jan 4, 2010 2:13 PM | Find... |
| 6. As above | Sun, Dec 20, 2009 1:00 AM | Find... |
| 7. house still under construction | Sat, Dec 19, 2009 2:00 PM | Find... |
| 8. not built yet | Fri, Dec 18, 2009 5:20 PM | Find... |

answered question	14
skipped question	7







Question 19. Do you think environmental/sustainability features are important when designing a house?

1. yes - cost efficient and future smart
2. yes. It is nice to also consider the environment and utility costs.
3. Yes, to lower immisions and hopefully reduce costs of services such as electricity etc.
4. To protect the climate and environment
5. anything longterm is good
6. They provide some solution to ensure sustainability.
7. Yes, To become Sustainable for the Future Generation
8. better life for the future
9. Yes
10. reduce wastage, excess consumption, and bills. Help the environment. Better housing designs maximise natural sunlight and waterwise gardens ensure nice looking gardens year long
11. yes they are very good idea but more needs to be done to make them cost effective
12. Plan for the future
13. yes to reduce running costs
14. Yes. Less pollution = healthier lifestyles
15. Its because today's government dont seem to have a say on electricity, water and gas prices, they just keep going up. The solar PV system is something that can help balance such price increases. Is also very shameful that we hear WA has a new gas industry but hey why is LPG still going up? Sometimes is not about going green, is about keeping your cost down. If the government is serious, every new house hold should have a wind generator and solar PV systems installed. Water tanks should be involved when building a new house rather than after. There should be incentives for buying energy efficient products.
16. sometimes
17. To protect the climate and environment
18. for future of our planet, to be energy efficient, reduce wastage and environmental impact
19. Yes
20. It needs to be made mandatory so everyone is on the same playing field when it comes to selling. Once its a normal feature of a modern home people accept then demand certain features, just like we would not buy a house without flushing toilets.
21. Yes I guess but ma lot are expensiv e, ie solar power, I would like to have it but the initial outlay is a bit steep. It would help if builders or the government made it cheaper. Afterall it is benefiting everyone
If no, why not?

Raw Data from the non case study online survey

Response Summary

Total Started Survey: 8
Total Completed Survey: 8 (100%)

PAGE: ENERGY EFFICIENCY/ENVIRONMENTAL FEATURES IN HOUSING

1. Do you allow your anonymous responses to be used in this research?

[Create Chart](#) [Download](#)

	Response Percent	Response Count
Yes	100.0%	8
No	0.0%	0
	answered question	8
	skipped question	0

2. Have you built or completely renovated your house in the last 5 years?

[Create Chart](#) [Download](#)

	Response Percent	Response Count
Yes	100.0%	8
No	0.0%	0
	answered question	8
	skipped question	0

4. In the context of housing and building design, what do you understand energy efficiency or environmental features to be? [Download](#)

	Response Count
Hide Responses	8

1. Features that will reduce the need for artificial heating/cooling of the house. eg north facing windows allowing sun in winter, but shaded in summer. Thermal mass, insulation and cross-ventilation.	Tue, Dec 7, 2010 10:20 PM	Find...
2. To design your house to use the least amount of lighting etc and to recycle water, rubbish etc	Mon, Jul 26, 2010 6:33 PM	Find...
3. I have a limited understanding.	Thu, Jul 1, 2010 7:57 AM	Find...
4. features or appliances included in or around the house that reduce energy output or negative impact on the environment.	Wed, Jun 30, 2010 9:27 PM	Find...
5. The implementation of your house to include: solar energy, wind energy, water tank systems, correct position of housing (north facing house), pool blankets and filter systems on pool pumps that do not require flushing once a week, grey water systems, placing into electrical systems a cut off switch to the house when you leave the house all unnecessary switches turn off, double glazed windows, all showers to be fitted with water saving fittings, insulation at a high level, correct design of gardens, underground reticulation, sky lights, energy efficient lighting (includes not going over the top with lighting) and putting in ceiling fans over airconditioning. Wall insulation.	Wed, Jun 30, 2010 8:13 PM	Find...
6. Reducing energy use by heating methods, insulation, orientation, lighting. More sustainable use of water and waste products. Construction materials are recycled etc...	Wed, Jun 30, 2010 4:53 PM	Find...
7. solar hot water, 5 star energy rating (apparently more efficient but I have no idea why)	Wed, Jun 30, 2010 4:22 PM	Find...
8. Insulation, window orientation, power generation, water recycling.	Wed, Jun 30, 2010 4:17 PM	Find...

answered question	8
skipped question	0

5. Please share your experience of building a new house or completely renovating an older house in the last 5 years [Download](#)

Did you build or completely renovate your whole house?			
	Yes	No	Response Count
1	100.0% (8)	0.0% (0)	8

If it was a new build, what type of lot did you build your house on?				
	In a new suburb/estate	In an existing suburb	On a subdivided block	Response Count
1	57.1% (4)	42.9% (3)	0.0% (0)	7



Did you want to include energy efficiency/environmental features into the new house design or renovation?			
	Yes	No	Response Count
1	87.5% (7)	12.5% (1)	8

Further Comment or Detail [Hide Responses](#) 3


1. I wanted to include energy efficient features however the information isn't readily available, and some features can be costly. Sometimes doing thorough research delays the planning and building process. Thu, Jul 1, 2010 7:57 AM [Find...](#)
2. Would have stuck more energy efficiency products but at the time it was way too expensive with no government grants. The cost was x amount and wouldn't pay for itself when it needed replacing. Wed, Jun 30, 2010 8:13 PM [Find...](#)
3. Required eer6, water recapture, etc by local govt as building condition. Wed, Jun 30, 2010 4:17 PM [Find...](#)

answered question 8
skipped question 0

6. When you began looking at possible designs for your new house did you intend to include any energy efficiency/environmental features in your building? [Create Chart](#) [Download](#)

		Response Percent	Response Count
Yes		87.5%	7
No		12.5%	1
		Further Comment or Detail Show Responses	2
		answered question	8
		skipped question	0

7. In the final built design of your new home or major renovation did you include any energy efficiency/environmental features? [Create Chart](#) [Download](#)

		Response Percent	Response Count
Yes		100.0%	8
No		0.0%	0
		Please explain why: Show Responses	4
		answered question	8
		skipped question	0

Question 8.



	Yes	No	Response Count
Large eaves surrounding the house	71.4% (5)	28.6% (2)	7
Light coloured roof	37.5% (3)	62.5% (5)	8
Insulation in walls	62.5% (5)	37.5% (3)	8
Insulation in the roof	100.0% (8)	0.0% (0)	8
Insulation underneath the floor	12.5% (1)	87.5% (7)	8
Solar orientated house to manage seasonal light and heat/cool	62.5% (5)	37.5% (3)	8
Extra shading on east and west side	28.6% (2)	71.4% (5)	7
Adjustable shading on the north side	50.0% (4)	50.0% (4)	8
Improved cross ventilation for increased cooling in summer	75.0% (6)	25.0% (2)	8
Energy efficient lighting and white goods	100.0% (8)	0.0% (0)	8
Grey water re-use system	0.0% (0)	100.0% (7)	7
Native gardens irrigated by non-potable water	42.9% (3)	57.1% (4)	7
Double glazing of some or all windows	16.7% (1)	83.3% (5)	6
Gas Boosted Solar hot water or other energy/water efficient hot water system	62.5% (5)	37.5% (3)	8
Building material with high thermal mass to regulate seasonal heating/cooling gain/loss	50.0% (4)	50.0% (4)	8
		Other (please specify) Hide Responses	1

1. Rain water tank

Wed, Jun 30, 2010 4:17 PM

[Find...](#)

9. Please rate your agreement with the following statements:					Create Chart	Download
	Strongly Disagree	Somewhat Disagree	Somewhat Agree	Strongly Agree	Rating Average	Response Count
I found it easy to include environmental/energy efficiency features into my house design and final build.	12.5% (1)	0.0% (0)	50.0% (4)	37.5% (3)	3.13	8
I prioritised environmental/energy efficiency features in my new house higher than luxury additions such as a double garage, expensive kitchen and entertainment options, air-conditioning, or a pool/spa.	25.0% (2)	37.5% (3)	25.0% (2)	12.5% (1)	2.25	8
I wanted to include environmental/energy efficiency features into my house design but my builder wasn't very helpful so I ended up not including any.	28.6% (2)	42.9% (3)	28.6% (2)	0.0% (0)	2.00	7
It required a lot of extra research on my part to include environmental/energy efficiency features into my house design.	25.0% (2)	12.5% (1)	37.5% (3)	25.0% (2)	2.63	8
Further Comment or Detail Show Responses						2
answered question						8
skipped question						0

10. If you did include some environmental/energy efficiency features into your house design, did you also make other lifestyle changes to reflect your environmental awareness? Such as:			Create Chart	Download
		Response Percent	Response Count	
Selling an extra vehicle		0.0%	0	
Buying a bicycle, or a motor bike/scooter to use instead of a car		0.0%	0	
Taking public transport or walking to work more often		0.0%	0	
Walking/riding children to school instead of driving them		40.0%	2	
Installing a Photo Voltaic Cell on the house		0.0%	0	
Buying a more fuel efficient car		0.0%	0	
Offsetting any carbon emissions that I couldn't reduce		0.0%	0	
We were already living a more sustainable lifestyle so we haven't made too many changes		60.0%	3	
Further Comment or Detail Show Responses			4	
answered question			5	
skipped question			3	

Appendix D Local Government Interview Transcripts

1. How did the City approach the development applications for the Rivergums and Evermore Heights suburbs?

LG - Regarding those two suburbs, it was probably that there were more meetings between the developers, council and the builders to explain what they were doing that was different. Some planners and particularly builders were very cautious about what may or may not be suggested or proposed. The whole process for advertising and approvals was the same, it just required more meetings to make sure everything fit.

2. Were there any significant issues that the City had with the Rivergums and Evermore Heights development?

LG – Evermore Heights has the third pipe? Is that right?

KR – Yes, that's right.

LG – It was only an issue in that the Parks department would have to eventually take over management of it, so it wasn't an issue in that it was a deal stopper, it was more a situation of meetings and discussions and reassurances, and who was going to look after in the end. And the cost of water had to be decided with the Water Corporation. And with Rivergums it's just been an issue of with respect to drainage and higher sulphates in clay. Rivergums was a bit different because there

was a couple of restricted areas, but with Evermore Heights it was just the first third pipe we'd come across.

KR – Evermore Heights is really pushing the boundaries of what the market will accept as well for sustainable design in the houses as well as in the design of the suburb, was that a difficulty? For example they've included a PV cell on every house?

LG – Difficulty in respect to approvals?

KR – Yes

LG – No not that I'm aware of.

3. The project managers of the case study suburbs were interviewed and one of the biggest issues they reported was the compliance with building guidelines, that three out of four of them had set as covenants to the land. Does the City have any involvement in that?

LG – That would relate to the building department I guess?

KR – Yes, I guess so...so the building guidelines were particularly about not having dark or black roofs and having sufficient eaves around the house.

LG – Whenever there's a condition in place like that then the building department would be involved. And the issue for them is how do they make compliance, so they're reluctant not because they can't ask for it, it's more a question of they know they can't police it.

KR – Yes, so the Local Government doesn't have the resources to facilitate the compliance?

LG – Yes pretty much and that in itself is a big stigma. Local Government will always be considered to never have enough resources.

KR – Yes, and obviously because the project managers said they don't have the resources to police that either. That once the house is built they don't really have the policing power to go back and ask them to change it.

4. Does your planning frameworks and policies currently support or inhibit the integration of sustainability into suburbs or homes in the City?

LG – We don't have a lot of established Council adopted policies, so consequently we can't really say that we are proactive but nor are negative to the idea. So its pretty much developer driven in that a developer will come in with an idea and as officers we'll try to support it and 'ship' it through the planning process but there's no grand policy suggesting or directing us to do so. It's unfortunate because without the policy in place, the next change of officers and we're back to doing the opposite.

KR – Yep that's right. So does the City have a Sustainability Policy that they are working towards integrating into all of their activities, policies and business as usual?

LG – We don't have a sustainability policy, but we did undertake a review of sustainability in the organisation, and out of that came a study that gave us a way forward. The issue has always been that executive management don't understand how we can implement it at a general organisational level, and at a community and development level. So no we don't have a policy and until they are comfortable

with 'well what does it really mean?' we're going to have difficulty in getting it through. As officers we've got a few things on the side but as a City no policy.

Local Government Number Two

1. How did the City approach the development applications for the Harvest Lakes Suburbs?

Given that it was a Landcorp project, there was a fair degree of collaboration between the City and Landcorp to establish the suburb. Obviously because Landcorp were involved sustainability was a key driver in the project, in the earlier stages and was used as a marketing tool. Now as the project is getting to the end stages and the sustainability niche market has been well established, the sustainability aspects of the project aren't likely to be as much of a focus. At the time when the suburb was first established there was going to be a train station adjacent to the development, and that is reflected in some of the densities in the suburb, and it's unfortunate that this didn't go ahead. The City was also happy to go along with quite prescriptive building guidelines to get a good form outcome and get good standard of dwelling design and streetscape. The developer came to us and said they'd like to do all these things, and the city was happy to work with them, and the developer was definitely proactive in getting design guidelines. The Harvest Lakes development has one of the most proscriptive design guidelines for a development of this size, but whether they've been implemented fully is another thing. Implementation of the design guidelines has been problematic, hypothetically they're great ideas but in practice it's another thing entirely.

LandCorp have contracted the implementation of the design guidelines to an external planning firm, who've put their junior planners on to the job and don't have much time to deal with it, and so if it nearly complies they tick it off. We don't get involved with any of the incentives that developers might offer residents.

2. Were there any significant issues that the City had with the Harvest Lakes development?

One of the things is making sure that they're still sticking to and maintaining the design guidelines, because the development has been going for nearly 10 years now. So how does the City deal with any requests for a new fence, for instance if it's different to the guidelines, and do we still deal with LandCorp or do we assess it on its own merits? The process of compliance to those original design guidelines, now that the development has been around for so long, and once LandCorp signs off on it isn't so clear. It was easier to deal with in the beginning because the process was clear when they were approving the original designs, whereas now it just adds another layer of work for us that we don't necessarily have the capacity for. The people that have bought into the suburb have a high expectation that it will stay that way, but it is quite time consuming for us. We're still dealing with the final stages, which is the centre, and there's still some stages being developed in Aubin Grove. We're also now dealing with the Harvest Lakes village shopping centre that is going out for tender, and a few a other commercial land uses including a child care centre. They were quite proscriptive as far as the design requirements for the buildings, including sustainability targets and LandCorp sought our opinion on some of the potential tenants.

We're just starting to have some problems in respect to their lined ponds, with midge issues. So people are starting to complain about the midge in the area, as it's also a drainage sump and the pond is lined so that it retains water. It's used mainly for irrigation and it's replenished by bore water.

3. The project managers of the case study suburbs were interviewed and one of the biggest issues they reported was the compliance with building guidelines, that three out of four of them had set as covenants to the land. Does the City have any involvement in that?

A lot of the designs come through our building department for approval, and they had quite a lot of resistance from the builders about them. Some of the applicants were first home buyers and had to get their approvals in first and any changes to the basic design templates caused problems because the builders would say they were building to a budget and they can't meet these guidelines. Some of the Detailed Area Plans limited density even though the land was zoned for higher densities, so then people would buy the land and sit on it and then want to subdivide but they could because of the restrictions for one house in the DAP. So in some occasions the DAP is not matching the zoning set out by Council, and there is conflict between what people have bought considering the DAP and the actual zoning allowances.

The City has no authority to police building guidelines that aren't included in the BCA, for instance black roofs and no eaves, if it's regulated within the BCA energy efficiency requirements there is no capacity to seek compliance.

4. Does your planning frameworks and policies currently support or inhibit the integration of sustainability into suburbs or homes in the City?

We have a new sustainable design policy that we are trying to implement that deals with group dwellings and lots under 350sq mtrs, that we are having varying success with. It has been adopted under the Local Area Plan so it has some legislative backing. Although people can apply for variations to the Local Planning Policy, we are focused on encouraging more sustainable design. It is adding an extra layer on top of the minimum requirements of the BCA. The City has a Sustainable Policy that has been fully implemented and is in the process of being integrated into the rest of the City's processes. We now have a Sustainability Framework that each of the managers have to report against on annual basis, that is based on GRIs and specific KPI's that we've come up with in consultation with each manager. This will be integrated into a State of Sustainability report that will be produced annually and summarised in the Annual Report. We've also got a draft Renewable Energy Policy that we have become working at.