

CLIMATE CHANGE AND SUSTAINABLE URBAN PLANNING POLICIES: CASE STUDY, SOUTHEAST QUEENSLAND, AUSTRALIA

Kozlowski, K.*

Urban design and planning consultant, visiting lecturer and urban researcher
Former senior urban designer at Gold Coast City Council, Queensland, Australia

*Corresponding author: m.kozlowski2008@gmail.com

Abstract

The phenomena of climate change can be defined as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. The impacts of climate change in urban areas can result in the increase of the urban 'heat island' effect, heatwaves and colder periods, flooding, intensified storm frequency and storm surge, draught and increased bushfire risk (Gold Coast City Council 2009). Climate change has already affected large urban agglomerations. Unexpected heatwaves in Paris and Moscow, unusual intensity of Hurricane Katrina and the recent super storm Sandy are only a few examples of adverse impacts of climate change. In the European Union and North America urban planning policies and strategies targeting climate change have been introduced at the interstate, state, regional, municipal and local levels. The Australian continent has been regarded as one of the most affected regions of the world in terms of climate change implications. Combating the implications of climate change has been priority policy of every state in Australia. For the past decades Queensland's economy was largely based on property led development, The recent 2010-2011 Queensland floods of historic proportion, which came after a decade of extreme draught, raised many questions about the future development of

cities and urban areas. This paper will discuss the planning instruments at regional, municipal and local neighbourhood levels that address the issues of climate change in the Southeast Queensland Region. They vary from general directions, regional plans and guidelines, city wide planning schemes to local and neighbourhood plans and development codes. Effective enforcement of sustainable planning regulations and design guidelines in new developments is the key to smart growth and creating climate responsive urban environments.

Key words: *adverse impacts of climate change, urban planning policies*

1 INTRODUCTION

Over the past years there has been an on-going discourse on whether climate change and global warming are a natural phenomenon or a product of human induced activities. Global warming has been taking place on a cyclic basis over the last 20,000 years. During the Holocene period (10,000 BC) the world experienced a warmer climate which resulted in a rapid increase of human activities which triggered the development of agriculture, domestication of animals and genesis of early settlements and cities (Savage 2010). However a large majority of scholars and scientists believe that the

humankind has changed the environment radically and factors such as globalisation and urban growth accelerate the pace of global warming (Savage 2010). According to experts on climate change, the repercussions of changing weather patterns can be severe however, there is still time to reverse the worst impacts and set the stage for a long but successful recovery (Gore 2009). The global warming sceptics, although they do not deny the climate change phenomenon, argue that the implications on the environment will not be as severe as portrayed in the media and scientific literature (Lomborg 2010).

This paper will not endeavour into another discussion on the reasons behind current global warming but concentrate on the consequences of climate change in the urban areas. The problem of climate change phenomenon impacting urban areas in the last decade has become more visible and frequent (Miller 2012). The major objective of this paper is to identify how urban planning is addressing the implications of climate change at different scales of intervention and further determine how effective the planning policies are.

Examples will be given of how climate change has affected major cities in the world and briefly indicate how decision makers, urban planners and designers are combating its implications in Europe, and North America. The main part of this study will focus on Southeast Queensland; Australia which is in terms of climate change is regarded as one of the most affected region's in the world.

2 RESEARCH METHODOLOGY

The research methodology is based on identification of the problem and the major objective of this study. In order to address the objective this study will concentrate mainly on the use of qualitative research methods. The major qualitative research methods will include literature review, qualitative analysis, and observations. Southeast Queensland, Australia has been selected as the case study area. This case study approach is partially based on Yin (2003) including definition of the problem and main objective, data

collection and qualitative data analysis. This study will seek to determine how effective are regional, city-wide and local urban planning policies in addressing the impacts of climate throughout the Southeast Queensland Region. The major portion of this study is based on secondary data sources, such as, planning documents and research papers, and on information from professional literature and journals.

2.1 Problem Identification: Climate Change in Urban Areas

The last decade has witnessed a spate of extreme weather patterns which had an impact on the major urban centres around the world. Severe draughts have taken place in Texas, Australia, Russia and East Africa. Deadly heatwaves have hit Western Europe in 2003 and Russia in 2010 and hundreds of tornadoes have swept across the United States. Nashville, Tennessee has recently experienced a 'millennium flood' bringing twice as much rain as any recorded figure. Extreme rains have caused flooding in Pakistan, Thailand, Queensland and the Philippines submerging parts of Bangkok, Brisbane and Manilla. In July 2011 the biggest dust storm ever recorded rolled into Phoenix Arizona, reducing visibility to zero and creating a mile high wall of dust. In 2011 the cost of weather disasters were estimated at \$150 billion worldwide a 25 percent jump from the previous year. The amount of the weather disasters recorded in the 15 year period (1996-2011) has doubled in comparison with an identical 15 year long period (1980-1995) (Miller 2012).

Hurricane Katrina in 2005 has shown how little resilience a city the size of New Orleans has when confronted by extreme weather. The resilience of New Orleans to withstand winds and waves from Katrina was reduced by the loss of wetlands and mangroves around the Gulf shores and by inadequate infrastructure provided by the levees. New Orleans was one of the first modern cities to be destroyed by climate changed induced phenomenon (Newman, Beatley and Boyer 2009).

The heatwave experienced in Western Europe in 2003 killed 35,000 people and the agriculture losses were estimated at \$15 billion (Newman et al. 2003), However, the heatwave that hit the Russian capital Moscow in July

2010 was absolutely unprecedented. In this city, known for its cold and severe winters, the temperatures soared to 40 degrees Celsius triggering hundreds of forest fires on the fringes of the urban footprint. As a result the unprepared city was in chaos for over a week (BBC News, Bloomberg News 2010). The mega heatwave of 2010 broke all the previous records by exceeding the 2003 heatwave by spatial context and amplitude. The estimate death toll in Russia as a result of the 2010 heatwave was 55,000 and the annual crop failure covered an area of 1 million hectares. The overall economic losses were assessed at 15 billion US dollars (1% of Russia's GDP). According to regional multi-model experiments the probability of a summer experiencing 'mega heat waves' will increase by a factor of 5 to 10 within the next 40 years (Barriopedro, D., Fischer, E., Luterbacher, J., Ricardo M. Trigo, R., Herrera-Garcia, R. 2011).

The recent unprecedented tropical super-hurricane Sandy that hit the entire eastern seaboard of the USA brought massive devastations to many cities and towns affecting almost 50 million people. Sandy caused a record surge of seawater in New York City, flooding subways and road tunnels and plunging much of Lower Manhattan into darkness. The hurricane force winds brought power cuts and flooding to many urban centres. All airports, public transport networks, schools, offices were closed down. Even the New York Stock Exchange was closed for two consecutive days (BBC News 2012).

2.2 *Response from Urban Planning: Scales of Intervention*

Although slowing the growth rate of greenhouse gas emissions and then reversing it in the next decade will require a concentrated global effort, urban planning and design will play a key role in combating climate change. Addressing the impacts of climate has become one of the major challenges for professionals' urban planners and designers, architects, landscape architects as well as scholars and academics in design and planning. Development and planning of cities in the age of climate change requires innovative thinking and holistic approach to policy making as well as implementation of sustainable planning, design and development principles. (Droege 2010, Brown 2010).

Based on literature review, primary and secondary data sources the urban planning policies address climate change at the three different scales of intervention:

- Interstate and national scale including preparation of interstate and national urban policies, strategies, directives and guidelines for government agencies and the private development industry that endure social, economic and environmental sustainability, propagate constructive transformation of renewable energy, encourage public transport and sustainable urban infrastructure (Queensland Government 2008, European Commission 2001, European Conference on Sustainable Cities and Towns 1994):
- Regional and city-wide scale including the preparation of regional and municipal strategies for selected cities and urban agglomerations that promote urban consolidation and integration of land use and transport planning and giving preference to physical, economic and social urban regeneration schemes (Department of Infrastructure and Planning, Queensland Government 2009, Droege 2010, Cheesbrough 2010, Beatley 2000)
- Local and neighbourhood scale including the preparation of local and neighbourhood plans and policies that promote mixed uses, increased densities around transport modes, greening of cities, re-use of building materials, climate responsive building design, and pedestrian/cycling friendly environments (Droege 2010, Cheesbrough 2010, Beatley 2000).

Preparation of policies guidelines and strategies addressing climate change and convincing public and private clients of importance to introduce a more intelligent and sustainable approach to urban development has been high on the agenda for the past two decades in the European Union. The EU institutions can adopt environmental legislation binding on all Member States without their unanimous consent where a 'qualified majority' of Member State votes is sufficient (Institute for European Environmental Policy and USA Natural Resources Defence Council (2010).

In 2001 The European Union has formulated a long-term strategy to dovetail the policies for economically, socially and environmentally sustainable development, its goal being sustainable improvement of the well-being and standard of living of current and future generations. The Strategy provides an EU-wide policy framework to deliver sustainable development and as a result address climate change (The European Commission 2001). Another example of European interstate directive is the European Sustainable Cities & Towns Campaign which was launched at the First European Conference on Sustainable Cities & Towns, in Aalborg, Denmark in May 1994. Until today over 2000 local and regional authorities (metropolitan areas, cities, towns, counties, etc.) from 42 countries have signed up to the Aalborg Charter. With this number of participants, the Campaign is the biggest European initiative for local sustainable development and Local Agenda 21 (European Conference on Sustainable Cities and Towns 1994), European Sustainable Cities & Towns Campaign (2012). Hundreds of Actions Plans for Sustainable Development have been produced and implemented in municipalities across Europe (Beatley 2000). In response to interstate and national directives and guidelines, city wide strategies, local and neighbourhood developments plans have been prepared across Europe promoting more compact and sustainable development, pedestrian and cycling friendly environments, quality public realm, efficient public transport and sustainable urban infrastructure. Private developers are subject to rigorous planning requirements regarding provision of quality public realm, good access to public transport and sustainable building design. (Beatley 2000).

There is strong community awareness in the European Union with regard to environmental and climate change issues. Based on the Eurobarometer surveys the European public is supportive of EU leadership to help tackle environmental problems with 86% of respondents seeing them as having a role to play in this campaign. The results from Europe are encouraging where according to UN data published in 2007; the GHG (green-house gas) overall emission level had fallen by 1.5 % compared to 1990 levels, while in the U.S.A it had risen by 16.3 % over the same time period. European cities demonstrate significant knowledge and on-the-ground experience in how to manage climate change at the local level. A good example is Amsterdam

where 99% of the waste is recycled, the majority of people use public transport, bicycle or walk to work and the city's objective is to have 10,000 electrical cars by 2015 (Carbon Disclosure Project 2012, Institute for European Environmental Policy and USA Natural Resources Defence Council 2010).

The American public is also becoming increasingly aware of the threat of global warming as a consequence of the extreme weather patterns they have experienced in recent years as well as more frequent domestic media coverage of the issue. This increased concern is reflected in the more prominent role environmental issues are playing in the federal election campaigns.

A good example of a direct response by state politicians to the adverse impacts of climate change can be the reaction to the devastation caused by Hurricane Katrina in 2005. As a response to this tragic weather event, the Governor of Mississippi established the Commission on Recovery, Rebuilding and Renewal. One of the first initiatives of the Commission was to organise a week long charette, where prominent architects, urban planners and designers and engineers met with community leaders and local developers and produced a set of policies, strategies and smart design codes for future development in coastal towns ravaged by Katrina. The design codes were also prepared for immediate-housing for workers and the displaced residents. A Planning Framework for the Mississippi Gulf Coast was based on a Transect concept (Mississippi Renewal Forum 2008)

Another important state initiative to the devastation of hurricane Katrina was the Louisiana Speaks: Pattern Book. The Pattern Book follows the tradition of American town planning and building by providing a practical tool for home owners, small builders, designers and planners. It illustrates detailed design guidance for climate responsive traditional residential development in the south-eastern corner of the United States (Louisiana Recovery Authority 2008).

2.3 Addressing Climate in the Australian Urban Environment

Throughout the 20th century Australian cities has been growing rapidly. Suburbs have sprawled into the former bushland areas significantly increasing the chance of bushfires and residential development has been encouraged along waterways and canals raising the vulnerability of new neighbourhoods to floods, wave surges and sea storms.

For the last two decades management of the urban environment in Australian cities has been on priority list for all levels of government including the federal, state and local (Smith and Scott 2006). In the recent years much attentions has been given to climate change and its possible implications on major Australian urban centres. The Australian federal election of 2007 was the first election ever to be held in which climate change was the main topic. The victory of the Labour Party under the leadership of Kevin Rudd led directly to the new cabinet signing the Kyoto Protocol and addressing major issues concerning climate change (Newman, Beatley and Boyer 2009). The significance of climate change was recently accelerated in the last years as a direct response to the tragic bushfires that swept the outskirts of Melbourne and the devastating Queensland floods of 2011. The Federal Australian Government also established the National Climate Change Adaptation Research Facility (NCCARF) in early 2008. The Facility is hosted by Griffith University in partnership with seven other universities and the Queensland Government (National Climate Change Adaptation Research Facility 2012). Recently the Australian Labour -Green Party Coalition Federal Government is progressing ahead by introducing the controversial Carbon Tax. The new law forces about 300 of the worst-polluting firms to pay a A\$23 levy for every ton of greenhouse gases they produce. The government says the tax is needed to meet climate-change obligations of Australia - the highest emitter of greenhouse gases per-head in the developed world (BBC 2012)

Every state in Australia has developed regional, municipal and local planning policies addressing climate change. For example, the Government of New South Wales by introducing the Building Sustainability Index ensured that a state-wide policy is implemented at a local street and site

level. The Building Sustainability Index, ensures single and multiple dwelling units are designed to use less potable water and be responsible for fewer greenhouse gas emissions. This is enforced by setting energy and water reduction targets for houses and residential apartments. BASIX is an online program that is accessible to all users. The building designer or builder enters data relating to the house or unit design - such as location, size, building materials etc - into the BASIX tool. BASIX analyses this data and determines how it scores against the energy and water targets. The design must pass specific targets (which vary according to location and building type) before the user can print the BASIX Certificate. One cannot commence with building a house or residential apartment building without a BASIX certificate. BASIX overrules the requirements for residential building listed under the Building Code of Australia. (New South Wales Government 2012) BASIX is one of the most robust sustainable planning/design measures in Australia, delivering equitable and effective water and greenhouse gas reductions across NSW. As a result not only big development corporations but also, medium and small developers and owner builders contribute in creating a more climate responsive built environment.

Australian Cities have been using a variety of planning instruments including land use policies, structure plans, strategic plans that strongly promote sustainable development, integration of land use planning and public transport, strongly state sustainability targets addressing the impacts of climate change and future development. For example sustainability is the key theme in the Melbourne's City Plan 2010. In 2007 the city of Sydney has adopted the Environmental Management Plan that establishes the environmental vision, goals and targets to create a fully sustainable city (Beatley 2000).

Queensland, among Australian states is the most vulnerable to the impacts of climate change (Garnaut 2008). This has been accentuated in recent years by natural phenomenon's such the seven year long drought in the southeast corner of the state, the 2010-2011 Flood and Cyclone Yasi in the northern coastal regions (Department of Natural Resources and Water 2007).

The Floods of 2010-2011 which ravaged the entire state of Queensland were unprecedented creating a multi-billion dollar infrastructure catastrophe.

According to a report prepared by Price Water Coopers (2011), the 2011 Floods in Queensland, impacted around 70% of the State and affected almost 60% of Queensland's population. The total damage to the State's public infrastructure, businesses and buildings was estimated at around 5 billion dollars. Many urban areas were inundated including the central parts of Queensland's capital city Brisbane (Price Waters Coopers 2011). As a result of the intense rains that followed the drought, brought about by a strong La Niña, flooding affected the central parts Brisbane inundating 22,000 homes, 7600 businesses, damaged the infrastructure, transport, assets, waterways and community facilities (Brisbane City Council 2012a, Barry 2011).

Property led development has been for decades the backbone of Queensland's economy. Therefore it is critical to identify sustainable planning and design principles at the state, regional-municipal and local levels and ensure that future development addresses the impacts of climate change.

Since 1994 sustainable development principles have been included into a range of Queensland legislative and planning instruments (Department of Infrastructure and Planning 2009). In addition the Queensland Government has prepared several state-wide strategies dealing with climate change. They include ClimateSmart 2050, Queensland Climate Change Strategy 2007, a Low Carbon Future (ClimateSmart2050) and Queensland's ClimateSmart Adaptation 2007–12 (Queensland Government 2008). All documents identify the climate change challenges in Queensland and list the future strategies and actions that need to be undertaken. The previous Queensland Labour Government has even set up the Office of Climate Change.

2.4 Case Study: Southeast Queensland, Australia

Southeast Queensland (SEQ) is the fastest growing region in Queensland and Australia attracting an average of 55,000 new residents per annum. The population of Southeast Queensland is around 2.5 million covering an area of 22,000 km² and including 11 regional and city councils. The current climate in SEQ is sub-tropical and typically features hot rainy summers and

mild, dry winters (Department of Infrastructure and Planning 2009). The coastal zone of the region is characterised by sandy beaches and sand islands scattered across Moreton Bay. The region also features 18 river catchment areas and mountain ranges in the western part. Major cities of the region include Brisbane with a population of 1.6 million (Brisbane Statistical Division) and Gold Coast with a population of 500,000. This rapid growth and the impacts of climate change require sustainable urban development which responds to local climatic conditions and character. Urban policies addressing climate change and promoting low energy urban form and low energy building design, requiring an integrated approach to urban planning and design, have been adopted at regional, municipal and local levels (Centre for Subtropical Design 2010).

Intervention at the Regional Scale

There are several regional wide strategies and plans in Southeast Queensland that address the issue of climate change. Recently the Southeast Queensland Council of Mayors together with the State Government has published The Next Generation Planning which is guidance for local authorities on how to achieve sustainable outcomes and smart growth. The guidance contains for rural places and townships, suburban areas, urban neighbourhoods, major activity centres, and central business areas. It promotes quality streetscapes, pedestrian friendly environments, and vernacular architecture that add visual interest to the surrounding areas. It identifies a set of form based codes governing building design and the relationship between building and the street. The guidance also emphasises on the necessity of including Water Sensitive Urban Design (WSUD) measures in all new residential developments. WSUD focuses on the efficient and effective management of urban water cycle and ensures that natural water systems within the urban environment are protected. The recommendations listed in the Next Generation Planning guidance will inform all future planning schemes in the region (Queensland Government and Southeast Queensland Council of Mayors 2011)

The Southeast Queensland Regional Plan contains a whole section dedicated to sustainability and climate change. One of the priority objectives of the Regional Plan is to reduce Southeast Queensland's carbon footprint by one third by 2020 mainly through reduced car and electricity use. Regional

policies addressing the impacts of climate change focus on strict development control of areas exposed to flooding, storm tide, coastal erosion, bushfires and landslides. The policies also require the preparation of local strategies aimed at minimising vulnerability to heatwaves and high temperatures, intensive rainfall, cyclones, severe winds and storms. (Department of Infrastructure and Planning, Queensland Government 2009)

The Southeast Queensland Climate Change Management Plan provides an integrated framework for implementing regional policies to reduce greenhouse gases and build resilience to natural hazards. The main objective of the SEQ Climate Change Management Plan is to align and coordinate the implementation of regional policies to reduce greenhouse gas emissions and increase resilience to, and reduce risks from, natural hazards, including the projected effects of climate change. Direct actions deriving from the SEQ Climate Change Management Plan include transport and settlement pattern, energy efficiency, renewable energy, carbon storage, waste emissions and community awareness (Department of Infrastructure and Planning 2009).

A number of research studies addressing the impacts of climate change have been conducted at research centres and universities across Queensland. One of the most successful studies has been prepared by the Centre for Sub-Tropical Design at the Queensland University of Technology. The major objective of the research was to identify the local subtropical character of the region and based on the major findings develop a set of design and planning guidelines for subtropical design of buildings and spaces between buildings. The guidelines take into consideration issues such as topography, open space diversity, local building traditions, and the use of native vegetation. It also includes design features such as good shelter and shade, indoor/outdoor living relationships, lightweight construction, prominent roof forms, and overhangs, hoods on windows and design for sun and breezes. The major findings of the research were published in form of a handbook design manual targeting local planners, designers; large, medium and small scale developers and decision makers (Centre for Subtropical Design 2010).

2.5 Intervention at the City-Wide Scale

The regional plans policies and research studies are effective in sending their clear message aimed at addressing climate change at the city wide level. Local and regional councils across the Southeast Queensland have responded to requirements of the Regional Plan. The Next Generation Planning and the Climate Change Management Plan by addressing the issue of climate change in planning schemes and local planning instruments and by drafting local climate change strategies. For example, Gold Coast City Council, the second largest municipality in Queensland, has prepared a Climate Change Strategy. The Strategy has identified key actions for governance and leadership, urban infrastructure, advocacy and awareness, and planning regulations. Responsibilities and timings have been allocated to each action. The actions listed under the planning regulations component call for the incorporation of climate change considerations in the Transport Plan, provision of carbon sinks into the new Gold Coast Planning Scheme and developing a scoping study for a local food production centre (Gold Coast City Council 2009).

Brisbane, the capital of Queensland has developed a peak oil and climate change strategy that could be a benchmark for similar studies. The strategy was developed by a taskforce comprising university scholars, business representatives and NGO leaders. The Taskforce conducted a series of community engagements before presenting its final report. The final report includes thirty one recommendations across eight strategy areas including leadership and partnering, decision making, communication, planning, sustainable transport, preparedness for change, diversification of natural resources and research. It sets a goal of zero greenhouse emissions by 2050 with households being carbon neutral by 2020. The steps to achieve this include strong regulations on energy efficiency, investment in renewable materials, very strong emphasis on transit oriented development (TOD) (Newman et al.2009).

One of the most effective city wide documents in addressing climate change is the Brisbane Streetscape Design Guidelines. The Brisbane Streetscape Design Guidelines provides advice to a range of users for streetscape

upgrades across the city. As part of the guidelines a hierarchy of streetscape types has been developed to suit the predominant land use type and anticipated pedestrian usage. The document provides guidance on elements and materials for footpath upgrades and landscaping treatment along the frontages for all new developments. The long term aim is to create, through development contributions, a climate responsive sub-tropical street environment in Brisbane (Brisbane City Council 2011)).

The municipalities across the region are preparing new city-wide statutory town planning schemes. The planning schemes are committed to facilitate smart growth and prosperity through sustainable development and the provision of quality public transport. The planning schemes will introduce a set of sustainable development requirements targeting large and small scale developers (Brisbane City Council 2012 b, Gold Coast City Council 2012).

2.6 Intervention at the Local-Neighbourhood Level

A cursory review of selected local and neighbourhood planning instruments revealed that unlike in the case of regional plans and city-wide strategies design and planning for climate change does not play a significant role at the local-neighbourhood level. For example, parts of Brisbane battered by a natural phenomenon that caused severe implications on the economic, social and cultural scales need more comprehensive long term and bold solutions, strategies and policies that address the natural setting and features, specific local conditions, the unique topography and scenic amenity of the city. The current neighbourhood plans such as the Taringa-St Lucia Neighbourhood Plan, Toowong-Auchenflower Neighbourhood Plan and the Bulimba District Neighbourhood Plan do not sufficiently address the impacts of climate change and emphasis on the possible implications of another flood event. The design solutions are limited to the propagation of additional public open space along Brisbane River. The design solutions for residential dwellings situated on flood prone land under the Taringa-St Lucia Neighbourhood Plan merely duplicate the provisions of the Temporary Local Planning Instruments (TLPI) introduced by Brisbane City Council after the 2011 Flood. (Brisbane City Council 2012c, Brisbane City Council 2012d, Brisbane City Council 2012e, Brisbane City Council 2012f).

Recently, Brisbane City Council has embarked on the River's Edge Strategy that will guide Council's planning for enhancing the river's recreational and economic development opportunities for the next 10 years. The River's Edge Strategy catchment area includes the stretch of the Brisbane River from the University of Queensland at St Lucia through to North-shore Hamilton, encompassing both sides of the river. The community has been invited to provide their opinions and ideas and contribute to the final version of the Strategy (Brisbane City Council 2012g). If successfully endorsed, this strategy can become another milestone in creating a more sustainable and climate responsive built environment.

3 CASE STUDY: MAJOR FINDINGS

The review of the regional, city-wide and local-neighbourhood planning documents in the Southeast Queensland Region revealed that there is a strong emphasis on climate change at the regional level, and effective climate change strategies are being prepared at the city-wide level. However, the climate change theme in the local and neighbourhood plans is rather superficial and the issue is addressed in a rudimentary manner. Table 1.1 identifies all major regional, city-wide and local-neighbourhood planning documents and strategies and indicates their effectiveness in combating the implications of climate change.

4 Conclusion

Regional and city-wide municipal plans must address climate change by identifying preferred land uses, transport corridors, interconnected network of green spaces. Strategies for areas sensitive to climate variations should be formulated at this scale. Addressing climate change at regional and city wide level with urban planning tools is important as it provides long-term strategies, guidance and directions for the region and the city. However, enforcing climate change initiatives is critical at the local and neighbourhood levels including, the street and site level. At the local and neighbourhood level the plans contain all detailed design guidelines, codes and policies that have a profound impact on the future built form and public

realm. Creating climate responsive buildings and public places can be only achieved only through effective local and neighbourhood planning tools. Local and neighbourhood plans must respond to regional and municipal plans by listing implementation actions aimed at greening the city and enhancing the public realm. They should include smart form based codes for development addressing issues such as thermal comfort, energy efficiency and water conservation. Separate detailed master plans should be prepared for areas susceptible to extreme weather conditions. Detailed sustainable

design and planning requirements must be imposed on the private developers at the local and neighbourhood, street and site level. Future design solutions must be flexible and be able to adapt to the pressures of climate change ensuring stability and robustness in the environmental, economic and social infrastructures. Combating climate change with planning and design measures must be conducted through consensus, mutual understanding and cooperation among all stakeholders including the community and the development industry.

Table 1.1 Effectiveness of Planning Documents, Guidelines and Strategies in Addressing Climate Change

Planning Document, Strategy, Guidelines	Scale of Intervention and Type of Document	Scope of Policies Addressing Climate Change	Effectiveness in Addressing Climate Change
The Next Generation Planning	Regional Guidelines	Provides guidance for sustainable development including form based smart codes and water sensitive urban design	Effective as it is a document informing future design codes in the city-wide planning schemes
Southeast Queensland Regional Plan	Regional Plan	There is a whole section dedicated to addressing climate change in the region	Effective as it provides guidelines for all local authorities in the region
The Southeast Queensland Climate Change Management Plan	Regional Strategy	The whole document develops a regional framework for reducing greenhouse gases and building resilience to natural hazards	Effective as it informs the city-wide climate change strategies
Subtropical Design in Southeast Queensland: A Handbook for Planners, Developers and Decision Makers	Regional Guidelines	The whole document based solely on a university research project provides subtropical guidelines for the built form and public realm in the SEQ Region	Very effective document in sending a message to the development industry on the necessity of addressing climate change in future developments,
Gold Coast Climate Change Strategy	City-wide Strategy	Identifies key actions targeting climate change in the city	Effective document as it informs the city wide planning scheme currently under preparation
Brisbane Peak Oil and Climate Change Strategy	City-wide Strategy	The document prepared with a task force of experts sets a target for zero carbon emissions by 2050	Effective document as it informs the city wide planning scheme currently under preparation and other city-wide strategies
Brisbane Street Design Guidelines	City-wide Guidelines	The whole document provides detailed guidelines for subtropical landscaping of streets in Brisbane	Very effective document as it will significantly contribute in greening the streets of sub-tropical Brisbane
Taringa – St Lucia Neighbourhood Plan	Local-neighbourhood Plan	Although targeting flood prone land climate change theme is not the main driver of the document. Design requirements for dwellings on flood prone land merely duplicate the provisions of the TLPI	Weak in addressing climate change. Acknowledges the fact that part of area was affected by the 2011 Flood but does not provide sufficient detailed guidelines for climate responsive built form and public realm
Toowong-Auchenflower Neighbourhood Plan	Local-neighbourhood Plan	Although targeting flood prone land climate change theme is not the main driver of the document	Weak in addressing climate change. Promotes more public space along the River however lacks in specific guidelines
Bulimba Neighbourhood Plan	Local-neighbourhood Plan	Although targeting flood prone land climate change theme is not the main driver of the document	Weak in addressing climate change. Promotes more public space along the River however lacks in specific guidelines

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ENDNOTES

i. Transect is a geographical cross section of a region that reveals the sequence of environments.

ii. Nowadays, the term El Niño refers to the extensive warming of the central and eastern Pacific that leads to a major shift in weather patterns across the Pacific. In Australia (particularly eastern Australia), El Niño events are associated with an increased probability of drier conditions. In contrast To El Nino the term La Niña refers to the extensive cooling of the central and eastern Pacific Ocean. In Australia (particularly eastern Australia), La Niña events are associated with increased probability of wetter conditions. (Bureau of Meteorology : Climate Glossary)
<http://www.bom.gov.au/climate/glossary/elnino.shtml>