Planning by Design
Landscape architectural scenarios for a rapidly growing city

Richard Weller, Faculty of Architecture, Landscape and Visual Arts,
University of Western Australia

Abstract
The Australian government predicts that Perth's population will increase from 1.5 million people to 3 million by 2050. Demand from China for Western Australia's massive mineral resources has caused the local economy to boom and over 700 newcomers are entering the state each week. This paper reports on the method, the theory and the outcomes of a landscape architectural research project conducted at the University of Western Australia to consider how Perth can accommodate this rapid growth in population. Rather than producing one masterplan, the methodology leads to the production of seven scenarios: four of them spread the city further into its landscape (horizontal scenarios) and three present infill development (vertical scenarios) within the existing city boundary. Thus the study even–handedly addresses both sides of the international sprawl debate. These development scenarios are related to the existing city from a regional landscape perspective. The horizontal scenarios are placed in situ according to guidelines derived from a McHargian sieve mapping analysis of existing landscape conditions. The vertical scenarios are placed in situ according to where the landscape of the existing city offers significant amenity value to offset the reduced personal living space that would otherwise lead people to prefer freestanding homes in the conventional suburban sprawl. The paper also briefly compares Ian McHarg's planning method to the contemporary work of the Dutch design practice MVRDV, for it is these two practices that inform the horizontal and vertical scenarios respectively. By occupying a space between these two practices it is suggested that this research represents an appropriate method for large-scale urban planning. This means that urban planning now involves a synthesis of what is traditionally meant by landscape planning on the one hand and urban design on the other. Where relevant, each scenario is related to classic models such as Ebenezer Howard's Garden City, Le Corbusier's Radiant City and Frank Lloyd Wright's Broadacre City. Although focused specifically on the metropolitan region of Perth, the research methodology could be adapted to any city undergoing rapid growth. The research aims to re-position landscape architecture as a discipline capable of holistically directing the future of the city.

Scenarios, landscape, planning, development, density, ecology.

Introduction
The research project [1] summarised in this paper determines and clearly depicts various growth scenarios for the city of Perth in Western Australia. The Australian Bureau of Statistics predicts that Perth will to grow from its current population of 1.5 million to a total of 3 million by the year 2050 . If current rates of migration into Perth continue, this figure will be reached before 2050.[2] Notwithstanding the possibility that predictions can be wrong, this research is conceived to help a community manage growth creatively by recognising the opportunities and constraints for urban development that emerge from a fundamental appreciation of the city's landscape conditions.

If the current population of Perth doubles by 2050 as predicted, then 651,078 new freestanding homes (calculated at 2.3 people per home) or 788,147 apartments (calculated at 1.9 people per unit) will need to be built in the next 42 years. The mass housing industry in Perth claims it can deliver 20,000 homes per annum, but this housing is almost entirely in the form of orthodox low-density suburban sprawl. As well as doubling the present residential mass of the city, logic dictates that the entire infrastructure of the existing city will have to also double in the next 42 years. This situation represents a significant opportunity for landscape architecture to apply its unique capacity to appreciate a city holistically in terms of its regional landscape and, rather than just delineate where development should not occur, creatively set out ways in which the city can grow to achieve a more sophisticated synthesis between urbanism and landscape.

The highly regarded Australian scientist Dr Tim Flannery has said that because of water shortages associated with climate change, "Perth will be the 21st century's first ghost metropolis".[3] In the very long term Flannery may be right: this old, arid landscape is not suitable for large-scale permanent human settlement. In the immediate to short term however, Flannery ignores the construction of new desalination plants, the possibility of new forms of urbanism and recycling systems capturing the 110 gigalitres of waste water that is annually discharged from our sewerage systems and the potential retrofitting of our storm water systems so as to retain runoff and return it to aquifers.

What Flannery does draw attention to is that all the fundamentals of how we will live in 2050 are uncertain. Water, food, energy, transport and cheap housing (things taken largely for granted for so long in Australia) are now all routinely couched in terms of crisis and change. Whilst urban planners alone cannot answer questions of how we will obtain food, water and energy in the future, the scenarios we have developed are, to varying degrees, formed with such issues in mind.

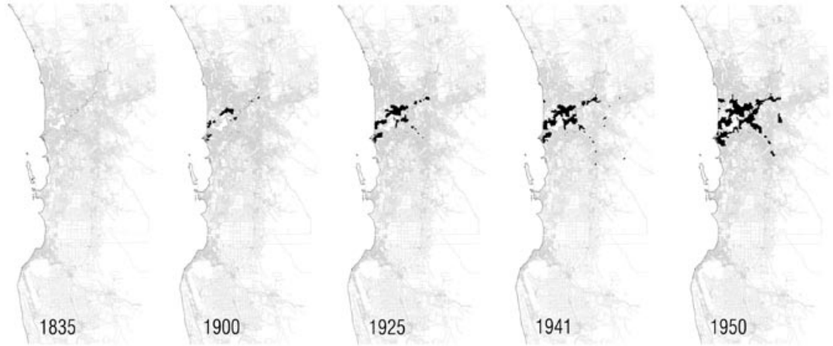


Figure 1 The growth of the city of Perth over time including the 2050 projection if the city continues to develop low density suburbia.

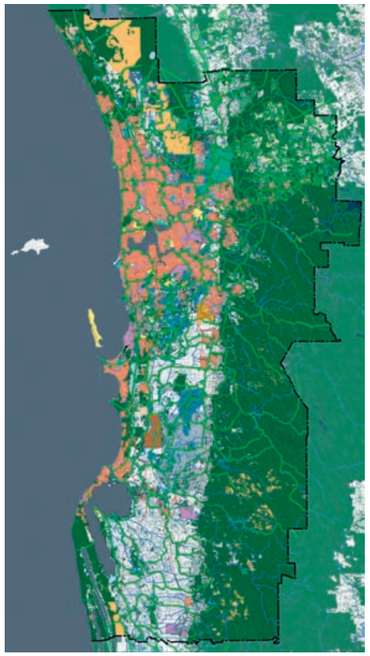
Perceiving itself to be morphing from a town to a metropolis, the time is right for this city to discuss and plan its future. Indeed it has the luxury of doing so: this city is not yet "out of control" (*Corner 2003: 59*) and it has a strong planning tradition and a well-organised planning administration.[4] But in order to fully debate its future, the community requires clear visions of alternatives to conventional suburban sprawl. If alternative forms of urban growth are not conceived and debated it is quite likely that the city will just continue to spread in the form of orthodox, low-density residential development as it has done for the 178 years since its foundation (Fig. 1).

Perth
At an average density of 6 homes per hectare, Perth now covers 100,000 ha^2 of land. For its population size it is one of the most sprawling (or should we say spacious?) cities on earth. The city is now 170 kilometres long and roads are the warp and weft that hold it together. In its present form, Perth can function only so long as we have cars or some kind of individual people movers that run on cheap, abundant energy. And yet, despite the fact that we continue to build peripheral suburbs that are car-dependant, there is no guarantee that we will be able to rely on such mobility in 2050.

A typical Perth house consists of a 3- or 4-bedroom brick and tile home with a double garage, built on a concrete slab. They are generally single freestanding dwellings, built of cheap materials and not solar-oriented. In consequence the homes are expensive to cool and heat. Despite 22.9 per cent of homes containing only one resident, most are built for families and getting bigger.[5] It is this form of suburban life, as well as Perth's isolation from the rest of the world, that contributes to the fact that a single West Australian's ecological footprint is now 14.5 hectares, one the biggest in the world. (*EPA 2006: 12*).[6]

Perth's current plan, known as 'Network City', purports to be an alternative to piecemeal suburban sprawl. Fundamentally, Network City is not a masterplan but a set of principles which, by emphasising Peter Calthorpe's celebrated notion of Transit Oriented Development (TOD), aim to limit sprawl (*Calthorpe 2001*). Network City's authors, the West Australian Planning Commission (WAPC) envisage a polycentric city whereby the new development of higher density enclaves will be clustered around what it calls 'Activity Centres' and 'Activity Corridors' (shopping centres, train stations and main roads) (WAPC 7). This is by now internationally accepted planning theory and not disputed by our research – which does, however, identify some problems with Network City.

There are four interconnected problems with Network City that have motivated our research into alternative planning scenarios. Firstly, predicated on the city reaching a population of 2.2 million (375,000 homes) by the year 2031, Network City is a relatively short-sighted document. Secondly, of the 375,000 homes that will need to be built to house the predict-



Figurs 2 Compilation of all layers of a McHargian landscape analysis of the Perth MRS

Figure 3 Landscape structure plan including habitat corridors

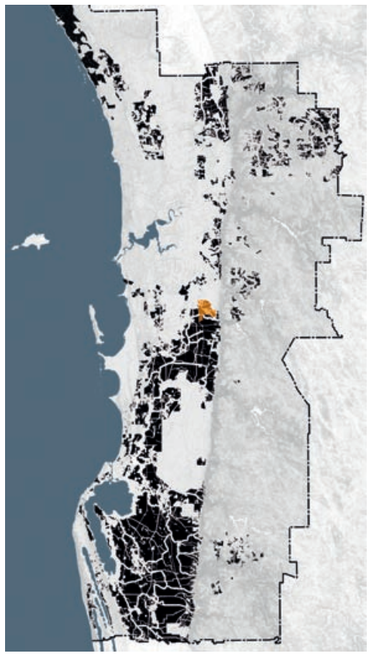


Figure 4 118,000 hectares deemed suited to suburban development from the McHargian analysis

ed 2032 population, Network City recommends that 60% be built within the existing city limits, and 40% (150,000 homes) be assigned to peri-urban (greenfield) land. However, according to our calculations the Perth metropolitan region currently contains 23,000 ha of land already committed for suburbanisation – enough land for 276,000 freestanding homes.[7] Thirdly, Network City is problematic because many of the 120 Activity Centres it has identified for increased density are in many cases unattractive to consumers. They are typically places within the existing suburban fabric of the city that have been designed as service nodes for cars, not people. For these nodes to become the centres of vibrant high density residential development they will require substantial reconstruction, which in turn drives up costs to potentially unaffordable levels compared to greenfield suburban development. The fourth and final problem with the Government's Network City document is that it is just words. Network City offers the public no plans or images of the urbanism it recommends. Despite having originated in serious public consultation (and thus able to claim public endorsement), because it has no imagery Network City has failed to gain traction in the public imagination and there is considerable confusion amongst both professionals and the general public as to how any of its words will be translated into forms.

Our research seeks to transcend the limitations of Network City in three ways. Firstly, our development scenarios are based on 2050, not 2031, population projections. This provides greater long-term depth to large scale planning strategies, which in turn can inform current decisions better. Secondly, all the urban forms that emerge from our scenarios are depicted accurately in panoramic images that can be easily understood by both professionals and the public. And finally, instead of creating one masterplan, or in the case of Network City one policy, we offer multiple scenarios. As Professor Kerry Carrington (a sociologist who has applied the method of scenario construction to the issue of future Australian immigration patterns) says:

"[scenarios] combine the rigour of theory and statistics with the essential flair and imagination necessary to the future of multifaceted issues embracing economy, society and the environment... Decision makers frequently blend scenarios [...] to generate hybrid policies [...] Used in this way the power of evidence based scenarios lies only partially in their accuracy: more significant is their capacity to stimulate ideas" (*Carrington 2007: 161*).

Method and Theory

The scenarios that propose alternative forms of further extension of the city out across the landscape do so within the limits identified by a McHargian landscape analysis of the region. The scenarios which propose forms of (infill) development within the existing city boundary do so by responding to landscape form, exploiting areas of high cultural and visual amenity that would in turn compensate for the reduced personal living space necessarily associated with higher density urbanity. In both cases it is a regional landscape perspective that guides the prospective urban design outcomes.

Such regionalism is part of a tradition in planning that can be traced back to the 1920s when Lewis Mumford advocated that planning proceed with a holistic sense of a bioregion so that

"... all its sites and resources, from forest to city, from highland to water level, may be soundly developed, and so that the population will be distributed so as to utilise, rather than nullify or destroy, its natural advantages. [Regional planning] sees people, industry and the land as a single unit." (*Hall 2002: 161*).

Four decades later, this was almost precisely the vision upon which Ian McHarg based his ecological method (*McHarg 1969*). It also influenced George Seddon's 1972 study of Perth, A Sense of Place, which galvanised and underpinned Australian landscape architecture in the late 20th century. But apart from one sentence in the conclusion of A Sense of Place warning against the rumoured possibility of 10 million people settling in the Perth region by 2072, Seddon only described the landscape as it was, not as what it might become. (*Seddon 2004: 258*)

For McHarg, the pure logic of landscape systems as described by scientists provided the master narrative to correct what he perceived to be a civilisation built on hubris. By putting predominantly ecological data in one end, McHarg arrived somewhat artlessly at the other with one answer – one definitive masterplan. For McHarg, the limits of the existing landscape were absolute guidelines, and to dwell within their limits was, for him, the highest art. Despite postmodernist critiques of McHarg's determinism, his method is still good at determining where, on a large scale, we simply shouldn't build. In particular, existing developed areas, vegetation, wetlands, flood zones, riparian buffers, aquifer recharge zones and slopes greater than 25% have, according to McHargian logic, been exempted from development potential (Fig 2). Along with subtracting these 'no-go' areas, we have added a network of public open space and habitat corridors that weave throughout the entire Perth metropolitan region to create a Landscape Structure Plan for the city. (Fig. 3). When the habitat matrix and the other no-go areas are subtracted from the Perth Metropolitan Region there remain 118,000 hectares of currently undeveloped land suitable for suburban growth, enough land for 1,246,080 dwellings or an additional 2,865,984 people should the city decide to continue sprawling. Almost all of this land is degraded rural land with little to no current agrarian productivity (Fig. 4).

While McHarg's method is still effective at a regional scale for identifying where not to develop, it is not necessarily good at determining how or what to develop. In this regard we have been concerned to avoid what James Corner referred to as the "tyranny of positivism" in regard to McHarg's methodology, by not expecting the method to do any more than identify large scale obstacles from certain natural systems. (*Corner 1991: 117*). [8] We have, therefore, attempted to find not only constraints but also creative opportunities in large-scale landscape assessment. Theoretically and methodologically we have tried to operate on the threshold between what is more traditionally thought of as the utilitarianism of landscape planning on the one hand and the creativity of urban design on the other, and it is the Dutch practice MVRDV that offers inspiration for the latter.[9]

McHarg's philosophical opposition to the city and his preoccupation with constraining it is countered by MVRDV's emphasis on leveraging ecological limits to generate creative opportunities. Conversely, MVRDV's proclivity for engineered excess[10] is tempered by McHarg's reverence for existing ecologies. Where McHarg was profoundly distrustful of modernity's dream of unlimited economic progress and a world re-engineered to meet all our desires, MVRDV, in the spirit of Rem Koolhaas and the tradition of the Dutch landscape and culture from which it emerges, resurrects the modern project with profligate optimism. Where McHarg believed the organism had to fit into its environment with minimal impact, MVRDV's proposals tend to hybridise natural and cultural systems into ingenious new growth trajectories. Although similar to McHarg insofar as it also believes in initially basing the design process on empirical data sets, MVRDV departs from McHarg's singular use of data to arrive at one masterplan by using the data (as we have done) to produce multiple development scenarios.[11] The following scenarios demonstrate the results of combining the methods of both McHarg and MVRDV.

Horizontal Scenarios

Food City

The concept of Food City stems from the North American architect Frank Lloyd Wright's 1930s Broadacre City. Intended as a complete reversal of urban conglomeration, Broadacre City depicted dispersal and interweaving of urban, suburban, industrial and rural landscapes across the breadth of the North American continent. Fed by superhighways and set on a one-mile graticule, Broadacre took everything that comprised the modern metropolis and spread it thinly across the landscape, a condition that landscape urbanists would describe and theorise as SCAPE some 70 years later. Based on a density of 2.5 homes per hectare, Wright's Broadacre City, although intended as an urbanisation of agrarian virtue, can thus be read as a proponent of wasteful sprawl.

Rather than opening the floodgates to low-grade sprawl and thereby destroying the very landscape he sought to commune with, Wright envisaged buildings that were organically of their place: critical regionalism writ large well before the term was invented. According to Wright, all the infrastructure of Broadacre was to be "built in sympathy with nature [so] that a deep feeling for the beauty of the terrain would be a fundamental qualification in the new city-builders." (*Rowe 1995: 61*). By today's reckoning however, Broadacre is problematic: its density is, as Paul Zygas says, "scandalously" low; it is impossibly car dependant; it is expensive to service; it is hard to reconcile with existing land ownership and, given the choice, most people would not work surrounded by agricultural fields (*Zygas 1995: 28*).

Certainly in the past (and today where large backyards still permit) Australians have always supplemented their diets with home grown produce (*Timms 2006: 129-147*). Although such do-it-yourself alternatives to the global agribusiness necessary to sustain contemporary cities are probably puerile, there is growing interest in what Andre Viljoen and Katrin Bohn refer to as 'Continuous Productive Urban Landscapes' as a core component of more sustainable urbanism (*Viljoen and Bohn 2005*). Perth's ecological footprint is currently 21.7 million hectares, almost half of which is related to global food production systems (*EPA 2006: 12*). In terms of reducing a city's ecological footprint as well as physically reconnecting peo-

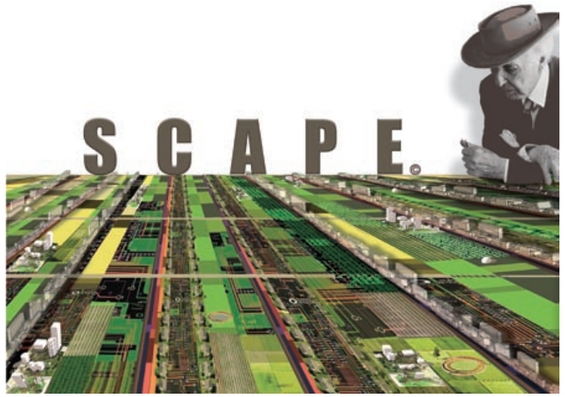


Figure 5 Food City: An integration of agricultural, industrial and residential landscapes

Figure 6 Food city whereby a residential density of 46 dwellings per hectare frame hi-tech agricultural landscapes.

ple with the working landscape, the potential of interweaving hi-tech agricultural and industrial zones with a residential suburbia could become an increasingly relevant 21st-century form of urbanism.

Using contemporary (high technology) European farming methods, it is possible to produce much of the food consumed by a population of 3 million on 60,000 hectares of land. (*MVRDV 2005: 288-289*) Subtracting 60,000 hectares from the 118,000 hectares of degraded rural land that we have identified as suited to suburban growth leaves 58,000 hectares of land on which to house 1.5 million people. The density of Food City therefore becomes 15 homes per hectare, 6 times denser than Wright originally envisaged, 2.5 times denser than Perth's average overall density and only marginally denser than existing suburban developments (Fig. 5). If, however, we test this scenario on a suburban scale and set aside enough land to feed the given number of people that would normally be accommodated on that land in orthodox suburban development, we conclude that residential density must increase to approximately 46 dwellings per hectare (Fig. 6).

Whereas Wright in 1930s America envisaged an automobile utopia, the 21st century is likely to see the car's demise. While there will probably always be some form of individual people movers (for those who can afford them), public transport systems could become the dominant mode of mass movement through the future city. Consequently Food City (as depicted in Figure 6) is structured around an 800-metre grid of public transport. The 800-metre graticule ensures that nobody lives more than five minutes' walk from public transport. We are also examining ways in which this public transportation grid can be retrofitted in existing suburbia.

Garden City (PODs)

Where the American Frank Lloyd Wright saw the dispersal of urbanism across limitless petro-chemical horizons, the Englishman Ebenezer Howard saw compact villages surrounded by agrarian greenbelts. First published in 1898, Howard's original proposal for a Garden City was conceived as a revolutionary social system, an embodiment of equity and a spiritual and material union of the country and the city (*Howard 1898*). [12] Land was held in common ownership and nourished by recycled human waste. Not to be confused with garden suburbs (of which Perth has its own tradition), the Garden City contained 32,000 people living at a density of about 40 homes per hectare on 404 hectares surrounded by a rural estate of 2,020 hectares. These 'cities' were to be linked via rail to others in a vast decentralised mosaic.

For Perth's projected population increase of 1.5 million people we would require 48 such Garden Cities (PODs) (Figures 7 & 8). Sited at advantageous points within the 118,000 ha of available land and linked by new light-rail public transport, the collective footprint of these Garden Cities would be 19,392 hectares. This leaves a land bank of 98,608 hectares, which could become parkland, agricultural land and reforestation zones to offset carbon emissions and as reinstated habitat. The land between the various Garden Cities would contain civic institutions, industrial zones and recreation facilities shared by the otherwise morphologically distinct communities.

'POD' is an acronym for Performance Orientated Development, meaning that these new towns would be not only be transit oriented (TOD), but their overall ecological performance would be the rationale behind their masterplanning and their development codes. In what would be an unprecedented international design event, a cast of multi-disciplinary teams could be short-listed to work on competing concepts for the 48 new PODs of Perth.

Seachange City

While all Australia's cities have expanded dramatically over the last 35 years, during this period more than a million people have also left them for a slower life in sleepy coastal hamlets. This is known as the 'seachange effect' (*Burnley and Murphy 2004*). This scenario asks what would happen if the future 1.5 million people coming to live in Perth seachanged? This scenario is then based on three simple facts: one, the vast majority of Australians want to live as near the coast as possible: two, they also generally prefer a free-standing home and garden in a low-density suburban milieu: and three, no citizen should live further than a 25-minute walk from the beach – so that this city would never reach more than two kilometres inland from the fore-dunes.

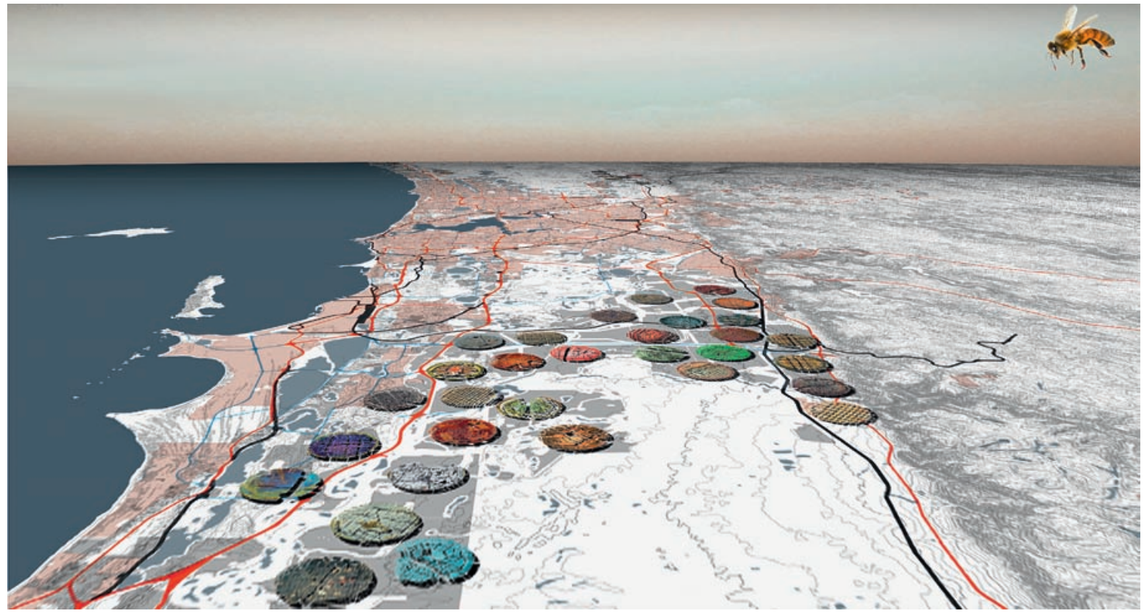


Figure 7 Garden city (PODS).

Figure 8 48 Garden Cities (32,000 people each)

Figure 9 Seachange City

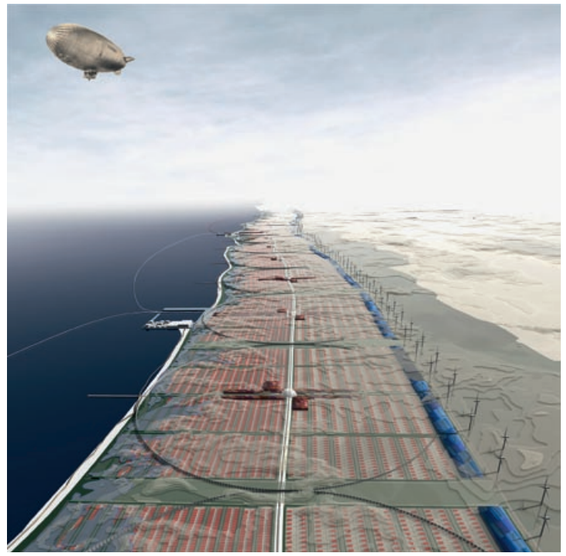


Figure 10 Seachange City

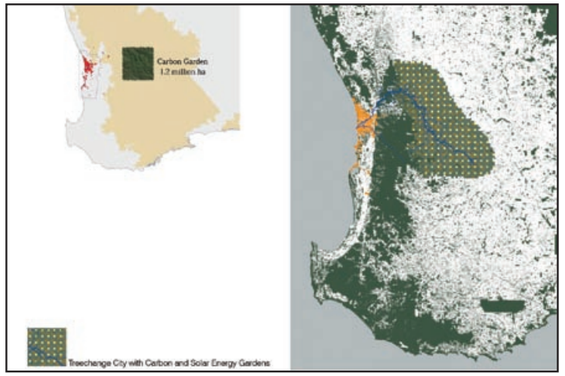


Figure 11 Treechange City

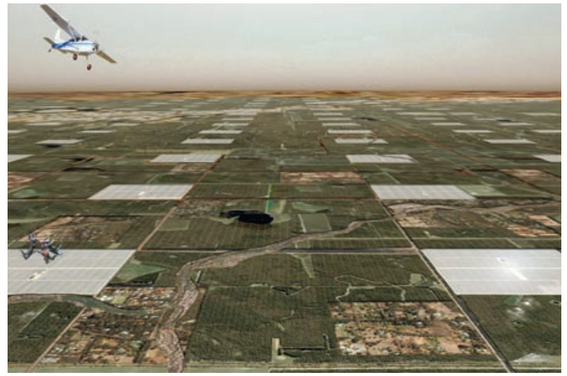


Figure 12 Treechange City

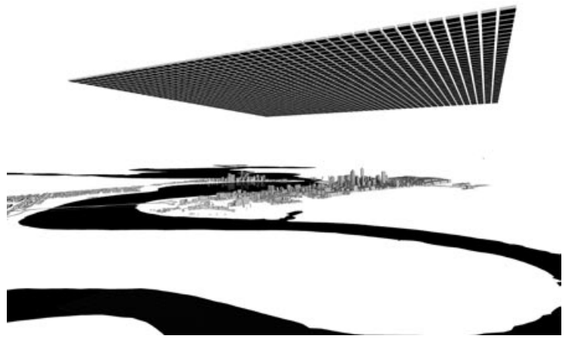


Figure 13 'Density cloud': 865,200 people contained within 5 storey buildings scaled to the existing Perth CBD.

Consequently, if spread out at the orthodox low-density of 12 homes per hectare, Seachange City becomes 600 kilometres long, reaching from Dongara in the north to Dunsborough in the south (Figure 9). This linear city would be serviced by bullet trains and hydrofoils and its water supply supplemented by small wind-powered desalination plants. This coastline is one of the windiest in the world, and wind power would be its main energy source. In the spirit of early 20th-century linear cities, Seachange City can be divided into corridors of different land uses punctuated by transport and retail nodes. A greenbelt and agricultural land form a buffer to prevent inland sprawl. Seachange City derives its final form by only developing above a contour height of +2, an urban Plimsoll line that anticipates rising sea levels associated with climate change (Fig. 10).

Treechange City

Just as many Australians have left major cities for a life in coastal hamlets, so others have left for inland rural landscapes, close to but not directly in the city. This phenomenon has become known as the 'treechange effect'. This scenario suggests that a bandwidth of land within 1.5 hours drive of the existing central business district be identified as a treechange zone (Fig. 11). As part of its allure, and indeed its reason to exist, this area of land would comprise a reforestation project of some 1.2 million hectares: the area required to offset the carbon emissions of a city of 3 million people. (*MVRDV 316*) 8,100 hectares of photovoltaic surfaces , the amount necessary to power the city of Perth, would be integrated with this forest. Treechange City could incorporate new industrial developments and research institutions related to sustainability (Fig. 12).

Whilst absorbing some, but probably not many, newcomers to Western Australia, Treechange City could attract a significant number of people who are facing retirement in small, remote (and often dying) rural towns throughout the Western Australian wheatbelt. Treechange City provides these people with a rural context, yet one with relative proximity to the services of the city.

Vertical Development Scenarios

As already noted, there are currently 23,000 hectares of land on the periphery of Perth zoned for residential development. This land alone will accommodate 634,800 new residents at an average orthodox density of 12 homes per hectare. For the purposes of the vertical development scenarios we assumed that a hypothetical urban growth boundary is applied to the city once these 23,000 hectares are developed. Subtracting these 634,800 people from the 2050 projection of 1.5 million leaves 865,200 people to be accommodated by infill development (376,173 free standing homes or 445,368 apartments) (Fig. 13).

Often, in local debate, the very people who dislike new suburban developments (sprawl) on principle also defend their own low-density residential neighbourhoods against infill development. Accepting this inherent resistance to development, we have developed infill (vertical) scenarios that concentrate development in certain areas. By couching development in terms of the whole city's collective future and its entire landscape, we hope that one of the effects of this research will be a more open-minded attitude to infill development.

To demonstrate the need for concentrations of vertical development to the community we have firstly conducted some basic infill development tests. For example, by distributing 376,173 homes evenly across the existing city we find that an additional three homes have to be added per hectare of existing urban fabric. Or, if we add these 376,173 homes to just the inner ring of older suburbs where there is good public transport and good cultural and landscape amenity, then we need to add ten new homes per hectare of existing fabric. Alternatively, if the additional 865,200 people were to be accommodated within walking distance of the 'activity centres' identified in the government's Network City plan, then we need to add another 90 homes per hectare to those sites.

Mathematically, these distributions do not seem problematic, but when one examines the addition of three, ten, or 90 homes per hectare to the existing suburban fabric one finds, in most situations, that there is simply no opportunity to meet these quotas without wholesale demolition and reconstruction of the existing urban fabric. And even if it were possible to increase density, the question arises of whether the aforementioned distributions are the best places for infill development? Adding three homes per hectare across the whole city could, for example, be seen as simply adding to an already sprawled and potentially unsustainable form of development. Adding 10 homes per hectare to the inner ring of older suburbs could be seen as detracting from their existing quality and might overload existing infrastructure. Adding 90 homes per hectare around the sites identified by the government as activity centres is, as suggested earlier, unlikely because many of these centres are unattractive for people to live near.

Somewhat contrary to Peter Calthorpe's notion of TODs (Transit Oriented Developments) Perth's most desirable residential areas are close to the ocean, the river and, increasingly, the central business district. Given this, we have established three vertical development scenarios that attempt to capitalise on these major landscape attractors: Sky City, River City and Surf City. While it is beyond the scope of this research to test these scenarios at the level of detailed architectural design, they behove our architects to explore more urgently ways of producing high-density mass housing that is attractive and able to compete economically with the current cost of conventional, low-density suburban housing.

Sky City

High density housing, particularly in the form of high rise buildings, is uncommon in Perth and generally not the favoured form of housing in Australia. The ultimate proponent of such development was, of course, Swiss architect Le Corbusier, whose original Radiant City model was conceived to house 3 million people, precisely the projected 2050 population of Perth (*Le Corbusier 1933*).

Despite its well known utopian ideals, when the principles of Radiant City were translated into generic development it produced some of the twentieth century's worst urbanism. Implicit in the model of Radiant City was a separation of work and living, a lack of public transport, low quality public open space, the obliteration of existing fabric, a mechanistic aesthetic and ultimately a disregard for human frailty. However, if designed with attention to the users' real needs and to public space, transportation links, microclimate, view-sheds and domestic details, then high-rise development close to good cultural and/or natural amenity can be a successful method of housing for certain types of people. As a rule then, Sky City only proposes high-rise infill development in areas of high amenity.

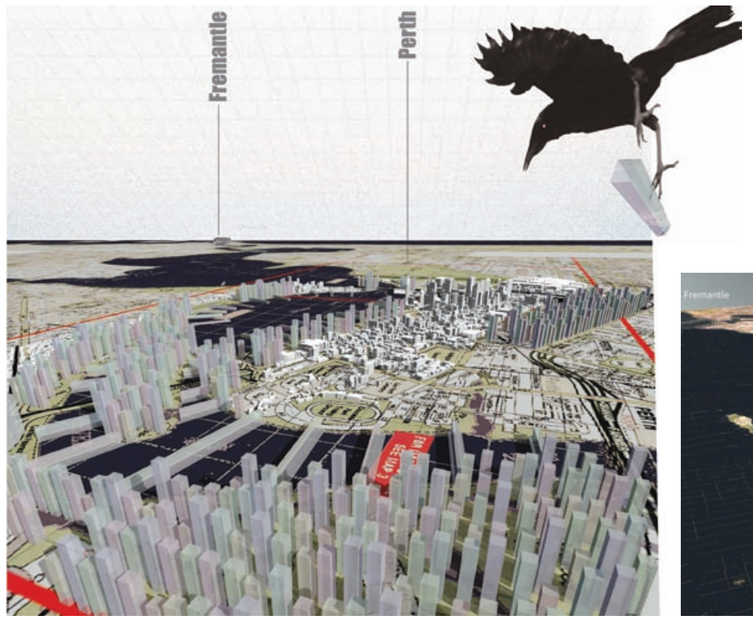


Figure 14 Sky City: Development at a density of 250 units per hectare around the existing CBD of Perth .

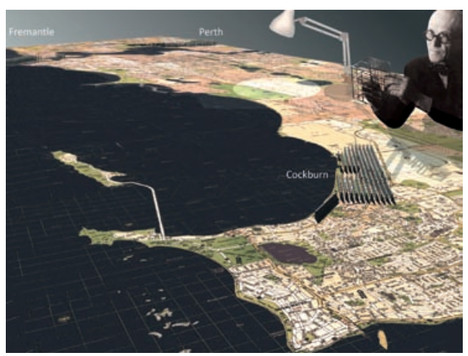


Figure 15 Sky city: Three new mini cities accommodating 450,000 people

The images we put forward of high rise development are not to be misunderstood as designs, they are simply datascapes that register a density of 250 units per hectare, the density which Jane Jacobs, a staunch critic of Radiant City, suggested as ideal for a vibrant urban community (*Hall 2002: 225*). We propose three mini-cities: one located in the Perth central business district (Fig. 14), a second at Fremantle and a third south of the city at Rockingham. These locations offer excellent landscape amenity and can together accommodate up to 450,000 people if developed with 20-storey buildings (Fig. 15).

River City

Perth has over 140 kilometres of riverside and most of it is expensive low-density suburbia flanked by underused open space. Ideally, the way to effect greater density along the river would be to rezone a bandwidth of approximately 500 metres (the distance of a 5 minute walk, including a 100 metre riparian zone) from the river to permit intense infill development. However, our local knowledge of how existing communities (particularly in premium real-estate areas) resist infill development and a detailed search for realistic development opportunities on the river front have persuaded us that significant development on the riverfront is unlikely and in some cases impossible. Consequently, we have pulled back from the river edge and propose developing linearly along two major north-south aligned roads which are parallel with, but some distance from, the river (Figs. 16, 17).

It is feasible to develop the land adjacent to these arterial roads because the existing building fabric is generally of poor quality. As an incentive to development, land along these roads is relatively cheap and housing costs could consequently be kept low. Residents in high-rise apartments built adjacent to these two roads would have good access to public transport and services and also have views of the river. If the entire bandwidths of these arterial roads were developed at a density of 250 units per hectare they could accommodate up to 500,000 people.

Two additional components of the River City scenario are high-density residential finger wharves and 'living' bridges: 6-storey residential developments built into or across the river. These elements help to reconnect the city to the river and increase traffic and pedestrian flows through the city, but are exceptionally expensive forms of development and could not be expected to accommodate more than about 50,000 people (Figs. 18 & 19). We have rejected the possibility of building residential islands in the river for two reasons: the significant ecological impact on the estuary and the unstable geotechnical conditions of the riverbed.

Figure 16 River City: Linear bands of development along existing main roads demarcating the river viewshed.

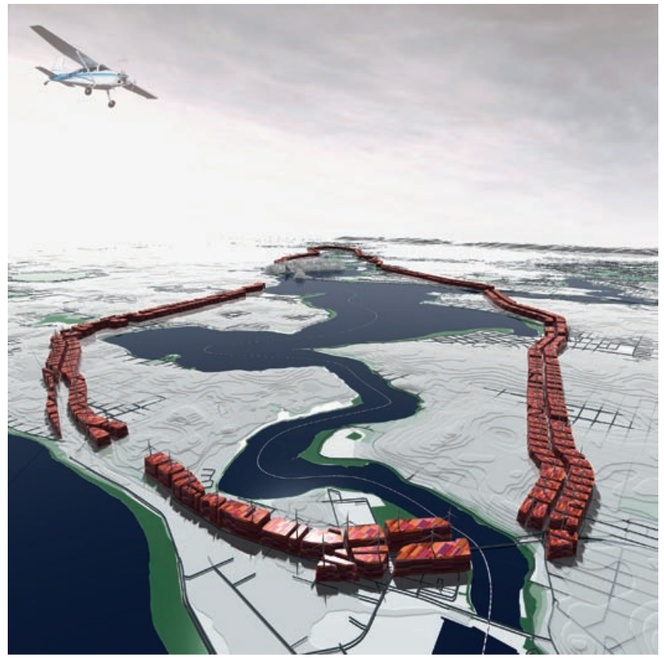


Figure 17 River City view

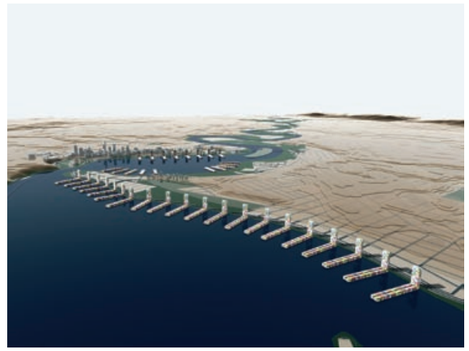


Figure 18 River City: Residential finger wharves

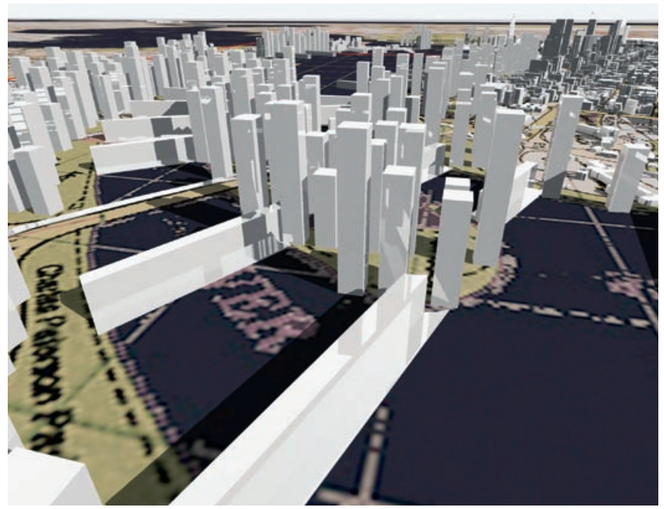
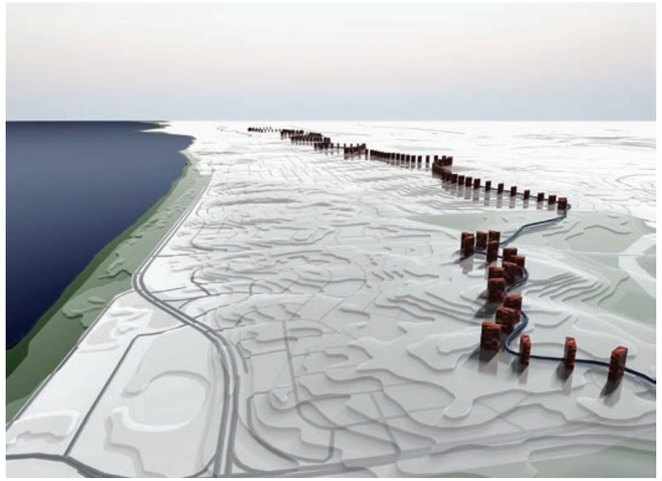


Figure 19 River City: Living bridges across the Swan River



Figures 20 Surf City

Figures 21 Surf City: A bandwidth of high rise development on the first ridge line set back from the coast.

Surf City

Perth has approximately 160 kilometres of beautiful coastline on the Indian Ocean and nearly all of it is developed at very low density. We originally hypothesised that 3,000 new residents could be added per kilometre of developable coastline by building a 12-storey building (based on the density achieved by Le Corbusier's Unite) every 500 metres. This would enable an additional 450,000 people to live directly on the Perth coast.

As with the River City scenario, development close to the water in the midst of existing communities will meet with extreme resistance. Consequently, as in the case of River City, we have pulled back from the coastal edge and shifted attention to the first ridge line following the coast. Here, less controversially, a bandwidth of land could be specifically rezoned for high rise development to replace existing suburban houses (Figs. 20 & 21). In this way the elite preserve of the city coastline could become more democratic and accommodate significant numbers of people with spectacular views of the ocean. The numbers of people these coastal bands of development could accommodate would support new public transport systems, although people living in these new developments would generally be within walking distance of existing public transport systems.

Conclusion

Perhaps what Tim Flannery really meant when he said that Perth, because of the water crisis, would become the 21st Century's first ghost metropolis, was that unless we design our future carefully there will be no future. Although the scenarios described here do not specifically address water management issues (as improved water management would be implicit in any new development) they each, in their various ways, respond to landscape limitations and opportunities and provide a community with choices about how to develop.

None of the scenarios has been created as a singularly correct answer to the problem of housing 1.5 million people. However, they have been presented as singular extremes – not for any dramatic purpose, but because in their singularity they help clarify the potentially positive and negative consequences of certain planning directions. We have also intentionally avoided utopianism and the simplicity of the mega-structure as an instant, but ultimately unrealistic, fix for the problem of large-scale urban growth. All the scenarios strive to work within the limitations of the existing construction industry and an appreciation of the local culture and the local economy.

Ideally the city of Perth should now test fragments of all the scenarios at the human scale. Only through such a detailed process of design and construction can we learn how the scenarios perform socially, environmentally and economically, and only then can we assess which could genuinely thrive in the marketplace and provide genuine alternatives to orthodox suburban sprawl. Until then, the scenarios are currently fulfilling their primary purpose by opening up local public debate about the future of the city.[13] This body of work might also indicate a leading role for landscape architects in the face of large-scale urban challenges.

Acknowledgements

This paper was edited by Dr. Tatum Hands.

Notes

1 This research is funded by the Australian Research Council and conducted by the author, Professor Richard Weller of the University of Western Australia Landscape Architecture program in collaboration with Professor David Hedgcock, Head of the School of Built Environment, Art & Design Curtin University of Technology. The research team includes Research Associates Donna Broun and Karl Kullmann with assistance from Julia Robinson and Phivo Georgiou.

2 The Australian Bureau of Statistics (ABS) offers three figures. We concluded that our study should be predicated on the highest figure as this will in all likelihood be achieved some time in the 21st century if not by 2050. See; www.abs.gov.au/ausstats/abs@.nsf/ProductsbyCatalogue/5A9C0859C5F50C30CA25718C0015182F?OpenDocument ▸

3 Davies, A. (2004) Sydney's Future Eaten: The Flannery Prophecy. Sydney Morning Herald. May 19, 2004.

4 Perth's main 20th-century planning document was the Stephenson–Hepburn plan of 1955. Gordon Stephenson, Professor of Civic Design, University of Liverpool was appointed Town Planner of Perth in 1953. He and Alistair Hepburn from Sydney were both pupils of the famous English planner Sir Patrick Abercrombie. Since 1955, the Corridor Plan of 1970, the Metro Plan of 1990 and now Network City continue a strong local culture of planning.

5 Australian Bureau of Statistics, 2006 Census.

6 According to the EPA this figure is derived from the amount of land necessary both locally and globally to produce the food and other resources consumed by a single citizen. The figure also includes land necessary for landfill and carbon sequestration. For global ecological footprint comparisons see: Australian Conservation Foundation Consumption Atlas, www.acfonline.org.au/consumptionatlas/

7 Although often zoned for twenty homes per hectare, the 2006 State of the Environment Report concludes that the average built suburban density is 12.5 homes per net hectare. EPA. Environmental Protection Authority (WA). 2006. State of the Environment Report Western Australia (Draft). Perth, Western Australian Government. 229.

8 Corner makes a second more recent reference to planning that became slavishly deterministic when he writes: "To many followers of McHarg simply adopted a methodology for practice, and while most shared his ecological ethics and viewpoint, they failed to grasp the larger conceptual, innovative and artistic dimensions of what still lies dormant in the potential of ecological concepts." Corner, J. "Creativity Permeates the Evolution of Matter and Life". The McHarg Event: An Unfinished Project. In Ian McHarg: Conversations with Students. Dwelling in Nature. Margulis, L et al (eds.) Princeton Architectural Press. New York. 2007 99.

9 For MVRDV see: www.mvrdv.nl/_v2/In addition, for critical discussion of the theory and practice of MVRDV see: Reading MVRDV. 2003. NAi Publishers, Rotterdam.

10 As polemic, MVRDV's work is brilliant, but as exemplified by their latest extrapolation, KM3 (a 5 x 5 km cube in which 1 million people could live a life utterly divorced from the land and multiplied across the earth to reach a final global population of 5,100 billion) it is also absurd. See: MVRDV. 2005. KM3 Excursions on Capacities. Barcelona, Actar Publications.

11 A good example of MVRDV's scenario method is available in Eisinger, A & Schneider M (eds.) 2003. Urban-Scape Switzerland: Topology and Regional Development in Switzerland Investigations and Case Studies. Berlin, Avenir Suisse: 212-235.

12 Two texts which explore the history of the Garden City and canvass its ongoing relevance are: Freestone, R. 2002. 'Greenbelts in City and Regional Planning' in Parsons & Schuler (eds) From Garden City to Green City: The Legacy of Ebenezer Howard. Baltimore, The Johns Hopkins University Press; and Hall, P. 2002 (3rd ed.). Cities of Tomorrow : An Intellectual History of Urban Planning and Design in the Twentieth Century. Oxford, Blackwell Publishing.

13 The scenarios described in this paper have been formally presented to over 40 different organisations representing nearly all the major stakeholders in the future urban form of the city. Additionally, the scenarios have been subject to widespread media coverage and attracted large public audiences. The success of the project in terms of public communication has been due, we think, to the scenario method and the fact that we have approached planning issues at the scale of the whole city and its regional landscape. Audiences also seem to appreciate the way that planning proposals are portrayed in easily understood images.

References

Burnley, I and Murphy, P. 2004. *Sea Change: Movement from Metropolitan to Arcadian Australia*. Sydney, University of New South Wales Press.

Calthorpe, P and Fulton, W. 2001. *The Regional City: Planning for the End of Sprawl*. Washington, Island Press.

Carrington, K, McIntosh, A and Walmsley, J. 2007. *The social costs and benefits of migration into Australia*. Canberra, Australian Department of Immigration and Citizenship. www.immi.gov.au/media/publications/research/social-costs-benefits/index.htm (accessed 8 August 2007).

Corner, J. 1991. *Discourse on Theory II, Three Tyrannies of Contemporary Theory and the Alternative of Hermeneutics*. Landscape Journal vol. 10 pp 115-133.

Corner, J. 2003. *Landscape Urbanism*. In Mohsen M & Najle C (eds.) Landscape Urbanism: A Manual for the Machinic Landscape. London, AA Publications

CSRIO. 2002. *Future Dilemmas: Options to 2050 for Australia's population, technology, resources and environment*. Canberra, DIMIA.

Del Marco, A. & Taylor, R. et al, 2004. *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*. Perth, WA Local Government Association.

EPA. Environmental Protection Authority (WA). 2006. *State of the Environment Report Western Australia (Draft)*. Perth, Western Australian Government.

Hall, P. 2002 (3rd ed.). *Cities of Tomorrow : An Intellectual History of Urban Planning and Design in the Twentieth Century*. Oxford, Blackwell Publishing.

Howard, E. 1898. *To-morrow: A Peaceful Path to Real Reform*. London, Swan Sonnenschein.

Le Corbusier. 1967 (1933). *The Radiant City*. London, Faber and Faber.

McHarg, I. 1969. *Design with Nature*. Philadelphia, Natural History Press.

MVRDV. 2005. KM3 *Excursions on Capacities*. Barcelona, Actar Publications.

Rowe, P G. 1995. *Broadacre City and Contemporary Metropolitan Development*. In Zygas, P (ed.) Frank Lloyd Wright: The Phoenix Papers. Arizona, University of Arizona Press.

Seddon, G. 1972. *Sense of Place: A Response to an Environment. The Swan Coastal Plain, Western Australia*. Perth, University of Western Australia Press.

Timms, P. 2006. *Australia's Quarter Acre: The Story of the Ordinary Suburban Garden*. Melbourne, The Miegunyah Press.

Viljoen, A. Bohn, K. & Howe, J. 2005. *Continuous Productive Urban Landscapes: Designing Urban Agriculture for Sustainable Cities*. Oxford, Architectural Press.

WAPC. West Australian Planning Commission. 2004. *Network City: Community Planning Strategy for Perth and Peel*. (WAPC) Perth.

www.dpi.wa.gov.au/networkcity/1214.asp

Zygas, P (ed.). 1995. *Frank Lloyd Wright: The Phoenix Papers*. Arizona, University of Arizona Press.

Biographical Notes

Professor Richard Weller teaches and practices landscape architecture at all scales from his post at the University of Western Australia. He has received many awards in international design competitions and is the author of the book, Room 4.1.3: Innovations in Landscape Architecture published by Penn Press in 2005. Currently he is completing a master plan for a community of 40,000 people and projections for the city of Perth in the year 2050.

Contact

Professor Richard Weller
Faculty of Architecture, Landscape and Visual Arts
University of Western Australia
35 Stirling Highway Crawley, WA, 6009
Telephone: +61 8 6488 7310
Telefax: +61 8 6488 108