

**Running out?  
An environmental history of climate and water in the  
southwest of Western Australia, 1829 to 2006**

Ruth A. Morgan  
B.A., B.Ec.

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## Abstract

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Living between the desert and the sea, people in the southwest of Australia have long experienced anxieties about the ongoing availability of fresh water resources in the region. In recent years, evidence of a drying trend across the region since the mid-1970s has heightened these concerns.

The conditions of the present beg for historical understanding of how and why these anxieties emerged, persisted and developed. In this thesis, I have utilised the ecological concepts of vulnerability and resilience to assess the ways in which people in the southwest have tried to come to terms with its climate and water resources since European colonisation in 1829. I examine the development of understandings of the regional climate and how these have changed over time; and how these understandings have shaped and informed water resource use and management in the southwest. I explore the ways in which approaches to water in the southwest became entangled with understandings of weather, climate and climatic variability, and were shaped by cultural, social and political contexts.

I contend that the settler society in the southwest became inherently vulnerable to running out of water because its patterns of settlement and development were founded upon the Western European model of regular, reliable seasons and water supplies; a model fundamentally at odds with the environmental realities of the southwest. The region's Nyoongar people, in contrast, had developed a way of life that was more resilient to climate variability and water scarcity because of their mobility and land use practices. Yet the forces of colonisation would wear down their resilience.

I argue that the historical application of developmentalist Western science and technology to the 'alien' southwest environment to make it conform to Western expectations has served to reinforce and deepen the vulnerabilities of the southwest's people to running out. These vulnerabilities are therefore largely the product of cultural phenomena. Over time, state and Commonwealth government experts in specific cultural, social and political contexts developed particular understandings of the region's climates and water resources. These guided the design and expansion of the water supply systems for the southwest's sanitary needs and economic development. In turn, the nature of these water supply systems and their management has shaped the approaches of urban and rural Western Australians to episodes of climate variability and water scarcity between 1829 and 2006. I chart a trajectory of approaches to water resources in the region, from a focus on health and sanitation, to the development of a

profligate water culture, and later, to a more conservation-oriented outlook, and examine how climate variability, dryland salinity, technical networks, and economic rationalism have shaped these perspectives.

In this thesis, I deploy the concept of 'Big Water' to study the development of this trajectory. The provision of large networks of public water supplies to suburban and rural Western Australians after the Second World War accelerated the widespread detachment of many water users from the resource itself. This detachment, combined with the easy access to water, served to propagate a fiction of endless water supplies and an expectation that demands for more water would be met. With this mindset, however, scarcity is always nigh, as an unslakable thirst fuels a feedback loop in which demand inevitably outstrips supplies, feeding further anxieties of running out, and leading to escalating demands for additional supplies. Locked in such a cycle, there will never be enough and the region's drying climate looks set to continue to contribute to these challenges in the future.

The study of the different expectations and experiences of water scarcity events, as well as the aftermath of such episodes, reveals the inequitable distributions of socioeconomic, political and geographic vulnerability in the southwest to running out of water. These inequities, I argue, have formed over time between the city of Perth and its rural hinterland, as well as between the more and less affluent members of both constituencies. They have had, and continue to have, significant consequences for the ways that water scarcity is experienced in the southwest. Revealing the roots of the region's vulnerabilities, I contend, challenges the historic reliance on scientific and technological approaches to running out, and leads us to question the human aspects of water scarcity events in the southwest.

The thesis concludes with an exploration of alternative pathways of water resource management in the southwest of Western Australia in the context of a changing regional climate. Through this analysis and investigation of the tangled climate and water histories of southwest Western Australia, this thesis builds on and contributes to the burgeoning field of Australian environmental history.



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## Conversions

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This thesis uses the measurements quoted in primary sources, except where conversions to metric units have been necessary for comparison or clarity.

Conversions are provided below:

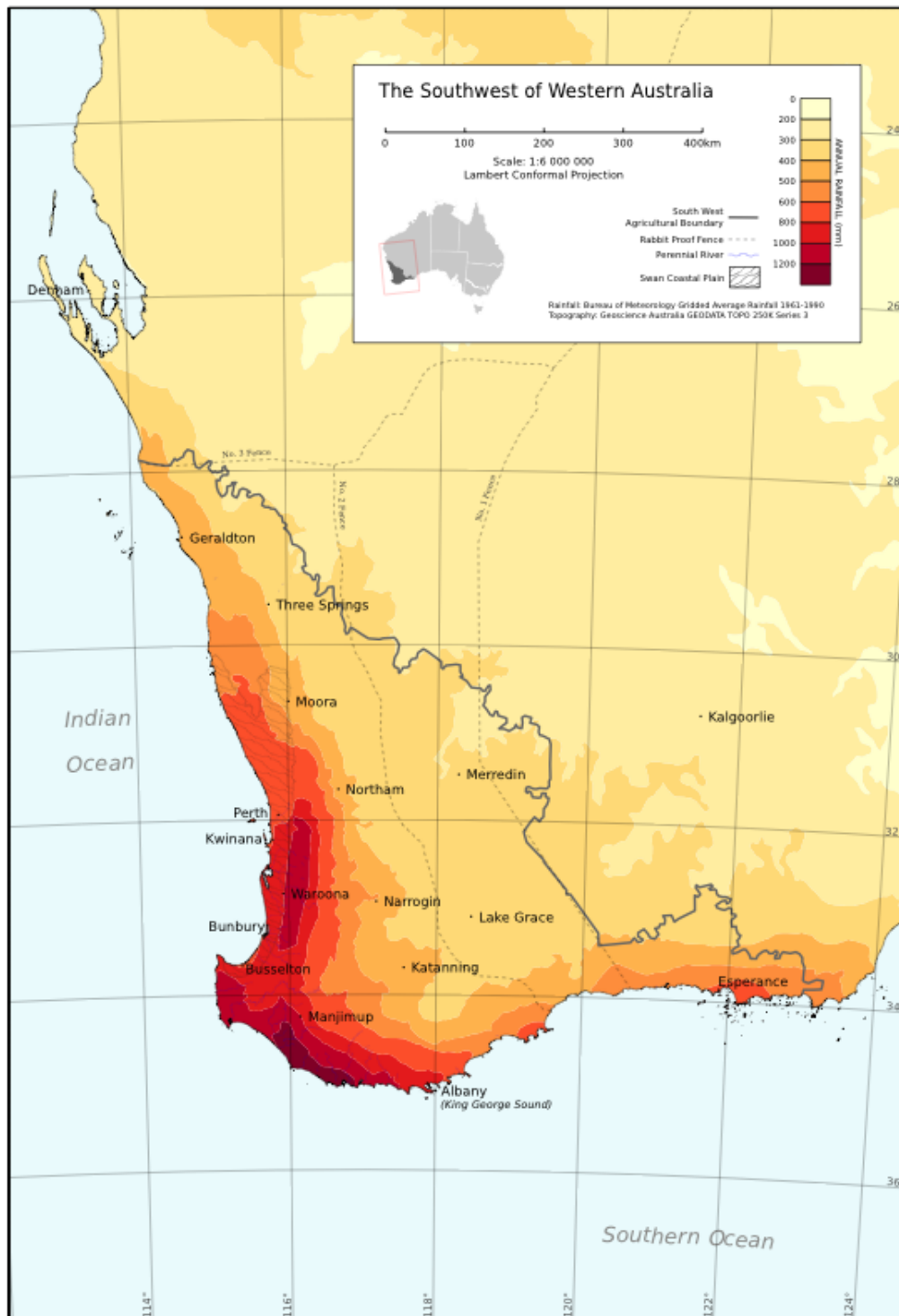
### *Imperial to Metric*

1 acre	=	0.4 hectare (ha)
1 gallon	=	4.5461 litres (L)
1 mile	=	1.6 kilometres (km)
1 yard	=	0.9 metres (m)

### *Other measurements*

1 megalitre (ML)	=	1,000,000 litres
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**Fig. i.1: The Southwest of Western Australia<sup>1</sup>**



<sup>1</sup> Courtesy of Stuart Galton.

## Introduction:

### Water between the desert and the sea

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*The south-west of Western Australia is an island, with sea to the south and west, desert to the north and east, and one cannot leave it without crossing mile after mile of desert.*<sup>1</sup>

- George Seddon, 1972

*Nowhere else on the continent is the sense of being trapped between sea and desert so strong as in Western Australia. ... From the sea you look directly upon red desert and from the wilderness there is the steely shimmer of the Indian Ocean.*<sup>2</sup>

- Tim Winton, 1993

Encircled by ocean and sand, the southwest is a veritable island on the edge of the continent. Combined with the omnipresence of silica and sea, this isolation sustains the fear of running out of water, which has haunted Western Australians since the southwest was colonised, first at King George Sound in 1826 and then at Swan River in 1829.

Although Western Australia holds the unenviable title of the second driest state on the driest inhabited continent, its southwest third was once renowned by European colonists for having the most consistent and reliable winter rainfall in Australia. But as successive waves of settlers found, this distinction bore little resemblance to the reality of uncertainty about the land, water and climate of the southwest. They deployed the expertise of Western science and engineering to discern the weather patterns, the nature of the rivers, the extent of the groundwater reserves, and the lands to be settled, as well as to design and build the systems of water supply. These efforts were vital to the colonial enterprise and continue today. In turn, Western science and engineering have informed land and water managers' efforts to ensure that water supplies are sufficient to meet the needs and aspirations of the community, agriculture, commerce and industry.

By the turn of the twenty-first century, the region's reputation had been dramatically transformed: it had become a national canary in the coalmine of anthropogenic climate change due to the decline of its winter rains since the end of the Second World War. Rising temperatures compounded the effects of less rain, increasing demand for water while reducing the amount of water available due to the associated

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<sup>1</sup> G. Seddon, *Sense of Place: a response to an environment, the Swan Coastal Plain, Western Australia*, Nedlands, UWA Press, 1972, p. xiv.

<sup>2</sup> T. Winton, *Land's Edge*, Chippendale, Pan Macmillan, 1993, p. 22.

increase in evaporation.<sup>3</sup> Scientist Tim Flannery even warned Western Australians in 2004 that their capital, Perth, could become a ‘ghost metropolis’ if global warming continued unabated.<sup>4</sup> Defying the accepted wisdom of the environmental parameters of the southwest, these changing climatic conditions challenged the ability of the region’s land and water managers to understand and to adapt to the drier conditions. In the twenty-first century, perhaps more than ever before, vulnerability, uncertainty, risk and even the fear of running out of water continue to pervade the Western Australian water consciousness.

### ***Water between the desert and the sea***

*[T]he roots of the water problem are deeply historical and can only be addressed by accounting for intersecting technological, cultural, economic and political factors.*<sup>5</sup>

- Patrick Troy, 2008

This environmental history seeks to provide a Western Australian perspective on the water challenges that have faced this nation since European colonisation. It explores how people in the southwest came to understand the region’s climate, its variability and its implications for water supplies and agriculture. It is a history that charts the changing degrees of resilience and vulnerability of the southwest to the risk of water scarcity from the establishment of Swan River Colony in 1829 to the completion of the southwest’s first seawater desalination plant at Kwinana in November 2006.

For the purposes of this thesis, I have limited my analysis to threats to the quantity and quality of public and private water supplies. These are the sources of water in the southwest that provide for the health, cultural, recreational and agricultural activities of the human inhabitants of the region. It is a study that is most interested in ‘water resources’, rather than water *per se*. Water resources are neither entirely human nor entirely natural, straddling the nature-culture divide.<sup>6</sup> This history of the understandings and perceptions of running out of water in the southwest is therefore tied to the political, socioeconomic and cultural dimensions of water resources, as well as

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<sup>3</sup> CSIRO, *Groundwater Yields in South-West Western Australia*, Canberra, CSIRO, 2009, <<http://www.clw.csiro.au/publications/waterforahealthycountry/swsy/pdf/SWSY-Main-Report-Groundwater.pdf>>, (Accessed: 15 May 2011), p. 15.

<sup>4</sup> C. Amalfi, ‘Perth will die, says top scientist’, *West Australian*, 25 June 2004, np.

<sup>5</sup> P. N. Troy, ‘Introduction: the water services problem’, in P. N. Troy (ed.), *Troubled Waters: confronting the water crisis in Australia’s cities*, Canberra, ANU EPress, 2008, p. 1.

<sup>6</sup> E. Swyngedouw, ‘Water: circulating waters, circulating moneys, contested natures’, in S. Harrison, S. Pile and N. Thrift (eds), *Patterned Ground: entanglements of nature and culture*, Chicago, University of Chicago Press, 2004, p. 120.

their development and consumption.<sup>7</sup> Settler understandings and development of Australian water resources since the late eighteenth century also reflect the utilisation of scientific, technological and engineering expertise for economic development, which later forms part of a tradition that Libby Robin calls ‘science for development’.<sup>8</sup> In this thesis, I argue that water scarcity is not only the result of natural forces, but also a product of the socioeconomic and political relationships that have developed between people in the southwest since European colonisation. Where and when scarcity occurs, and who and what it affects, invariably reflects these power dynamics.<sup>9</sup> The settlement and development patterns established in the early colonial period played an important part in the evolution of these relationships and the extended time frame of this thesis allows for the tracing of the ways that these dynamics have unfolded into the twenty-first century.

‘In a dry country, unlike a wet one, rain can be grasped and held’, Donald Worster observed in *Rivers of Empire*. ‘The hands that do the grasping are also powerful shaping hands’.<sup>10</sup> In the southwest at least, they have had at their disposal potent expressions of landscape authorship: diverting and damming rivers, conserving water, purifying it, transporting it through reticulated water systems, and consuming it. By the end of the nineteenth century, these ‘powerful shaping hands’ belonged mostly to the Western Australian government’s water engineers, and with the sanction of most water consumers, their authority to shape the environment has persisted into the twenty-first century.<sup>11</sup> Helping these shaping hands have been generations of colonial and later Commonwealth meteorologists, who developed expertise to interpret and predict the weather. Together, the state’s meteorologists and water engineers have shared the responsibility of predicting and preventing running out of water in the southwest region.<sup>12</sup>

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<sup>7</sup> J. M. Powell, *Environmental management in Australia 1788-1914: guardians, improvers and profit – an introductory survey*, Melbourne, Oxford University Press, 1976, p. 6.

<sup>8</sup> L. Robin, ‘Ecology: a science of empire?’, in T. Griffiths and L. Robin (eds), *Ecology and Empire: environmental history of settler societies*, Carlton South, Melbourne University Press, 1997, p. 64.

<sup>9</sup> D. A. Wilhite and M. Buchanan-Smith, ‘Drought as hazard: understanding the natural and social context’, in D. A. Wilhite (ed.), *Drought and Water Crises: science, technology and management issues*, Boca Raton, Taylor and Francis, 2005, p. 6.

<sup>10</sup> D. Worster, *Rivers of Empire: water, aridity and the growth of the American West*, New York, Pantheon Books, 1985, p. 192.

<sup>11</sup> M. Cathcart, *The Water Dreamers: the remarkable history of our dry continent*, Melbourne, Text Publishing Company, 2009, p. 199. For a brief historical overview of water and engineering, see D. Cosgrove, ‘An elemental division: water control and engineered landscape’, in D. Cosgrove and G. Petts (eds), *Water, Engineering and Landscape: water control and landscape transformation in the modern period*, London, Belhaven Press, 1990, pp. 1-11.

<sup>12</sup> This approach to predicting and preventing water scarcity in the southwest illustrates Hewitt’s view that avoiding disaster is ‘strictly a matter of public policy backed up by the most advanced

Although meteorology and water management have been largely the responsibilities of the state and Federal governments, these public services have not extended the same level of protection from water scarcity to everyone in the southwest region. Historically, certain geographical areas and social groups have been more vulnerable to the risk of running out than others.<sup>13</sup> In the southwest, these patterns of vulnerability have emerged between the suburbs and towns supplied with water by the government, and the agricultural areas that are largely self-reliant and dependent on local supplies. In this thesis, I examine how government policies to promote agricultural settlement during the twentieth century exposed farmers to more variable climate conditions and greater risk of water scarcity than their city cousins.<sup>14</sup> Their vulnerability has been exacerbated by other environmental problems such as dryland salinity, which have affected their capacity to prevent their region from 'running out'. Until the 1990s, the prevailing agrarian mythology led successive governments to compensate farmers experiencing drought and other problems of land and water management.<sup>15</sup> Economic forces and government policy have curtailed this approach, and forced farmers to take measures to improve their ability to withstand water scarcity. The contrasting nature of these water supply systems and their management has influenced the ways in which urban and rural Western Australians have both consumed water and responded to climate variability between 1829 and 2007.

Despite their divergent water and climate histories, the experiences of suburban and rural water users cannot be treated separately. Owing to the physical environment and the Mediterranean climate of the southwest, water managers have historically favoured damming the region's larger rivers to ensure water supplies throughout the year. As the southwest's population has grown and settlement extended, water managers have mined water from the region's underground reserves and sought water supplies

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geophysical, geotechnical and managerial capability'. See, K. Hewitt, 'The idea of calamity in a technocratic age', in K. Hewitt (ed.), *Interpretations of Calamity from the Viewpoint of Human Ecology*, Boston, Allen & Unwin, 1983, p. 6.

<sup>13</sup> G. Bankoff, 'Time is of the essence: disasters, vulnerability and history' *International Journal of Mass Emergencies and Disasters*, vol. 22, no. 3, 2004, p. 25; and M. L. Parry and T. R. Carter, 'Climate impact assessment: a review of some approaches', in D. A. Wilhite and W. E. Easterling (eds), *Planning for Drought: toward a reduction of societal vulnerability*, Boulder, Westview Press, 1987, pp. 175-77.

<sup>14</sup> The works of the following Australian geographers have been especially helpful: R. L. Heathcote, *Back of Bourke: a study of land appraisal and settlement in semi-arid Australia*, Melbourne, Melbourne University Press, 1965; D. W. Meinig, *On the Margins of the Good Earth: the South Australian wheat frontier, 1869-1884*, London, John Murray, 1963; and J. M. Powell, *An Historical Geography of Modern Australia: The Restive Fringe*, Melbourne, Cambridge University Press, 1991.

<sup>15</sup> L. C. Botterill, 'Soap operas, cenotaphs and sacred cows: countrymindedness and rural policy debate in Australia', *Public Policy*, vol. 1, no. 1, 2006, pp. 23-36.

further and further away from the main centre of demand, namely the suburbs of Perth. Water from some areas has therefore been diverted from its place of origin to slake the thirst of suburban households, or to the mining ventures on the eastern goldfields.

In this way, some government policies have deepened socio-economic, political and geographic inequalities within the southwest, resulting in tensions over water access and the appropriate use of water. For those provided with the government's scheme water supplies, water scarcity might precipitate restrictions on household water use. But water continues to flow when the tap is turned on. In areas that are self-reliant for water and turn to government supplies only in emergencies, running out is a real threat to local livelihoods. Yet the connections of urban and rural areas through water resources mean that we can understand neither 'if one neglects to tell their stories together'.<sup>16</sup> In this thesis, I explore the different approaches to water use and water scarcity in the towns and country areas of the southwest, proposing that their differences stem from the same imperative of economic development.

Although the Australian climate is renowned for its extreme variability, drought events have tended to be viewed as departures from the norm and the result of exclusively natural forces.<sup>17</sup> This sentiment might be stronger in the southwest than in other parts of Australia because the region is considered to have a comparatively reliable rainfall.<sup>18</sup> Yet across Australia, as Libby Robin observes, when it comes to the weather, '[a]verages can be very misleading'.<sup>19</sup> In this study of climate change and variability, I examine the climatic fluctuations of the southwest and how dominant perceptions of a climate norm have developed and shifted over time. In light of Australia's variable climate conditions, 'normal' and 'abnormal' conditions cannot be studied apart, for they are both part of the 'underlying natural rhythms of this continent'.<sup>20</sup>

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<sup>16</sup> W. Cronon, *Nature's Metropolis: Chicago and the Great West*, New York, W. W. Norton, 1992, p. 369.

<sup>17</sup> M. H. Glantz, *Climate Affairs: a primer*, Washington, DC, Island Press, 2003, p. 23; and R. Heinsohn, 'White-winged choughs: the social consequences of boom and bust', in L. Robin, R. Heinsohn and L. Joseph (eds), *Boom and Bust: Bird stories for a dry country*, Collingwood, Vic., CSIRO Publishing, 2009, p. 224. See also, G. Bankoff, 'The historical geography of disaster: "vulnerability" and "local knowledge"', in G. Bankoff, G. Frerks and D. Hilhorst (eds), *Mapping Vulnerability: disasters, development and people*, London, Earthscan, 2004, p. 25; T. Steinberg, *Acts of God: the unnatural history of natural disaster in America*, New York, Oxford University Press, 2001, pp. xxi-xxii; and J. Keating, *The Drought Walked Through: a history of water shortage in Victoria*, Melbourne, Dept of Water Resources (Vic.), 1992, pp. 1-15.

<sup>18</sup> L. Robin, 'Migrants and nomads: seasoning zoological knowledge in Australia', in T. Sherratt, T. Griffiths and L. Robin (eds), *A Change in the Weather: climate and culture in Australia*, Canberra, NMA Press, 2005, p. 47.

<sup>19</sup> Robin, 'Migrants and nomads', p. 47.

<sup>20</sup> L. Robin and M. Smith, 'Introduction: boom and bust', in Robin, Joseph and Heinsohn (eds), *Boom and Bust*, p. 4.

But historians must grapple with their sources, which tend to be dominated by accounts of ‘abnormal’ weather at the expense of the ‘normal’.<sup>21</sup> Viewed in this way, drought has been understood as a symptom of a pathological climate that requires the treatment of scientific and engineering expertise.<sup>22</sup> Such conceptions of natural hazards, Greg Bankoff argues, foster a ‘technocratic approach’, which denies the ‘wider historical and social dimensions of hazard’.<sup>23</sup> Such an approach, Bankoff considers, advocates disaster avoidance through scientific and technical solutions, particularly the improvement of ‘scientific prediction, engineering preparedness and the administrative management of hazard’.<sup>24</sup>

It is timely to interrogate the development of this technocratic approach from at least 1914, as the water managers of the southwest have been compared very favourably to their eastern states counterparts in recent years. Commentator Åsa Wahlquist suggested in her 2008 book *Thirsty Country*, that the rest of the nation had a lot to learn from the western third with regard to improving the resilience of water supplies to climate variability.<sup>25</sup> Reflecting the common ground between the fields of environmental history and the history of technology, this thesis examines the host of technocratic solutions that have been advanced since European colonisation to provide what Cameron Muir, Deborah Bird Rose and Phillip Sullivan call an ‘engineered resilience’ for the water resources of the southwest.<sup>26</sup>

But, as the experience of people in the southwest has shown, ‘engineered resilience’ can come at a cost. A technocratic approach neglects the potentially ameliorative roles of socio-economic, cultural and political change for improving a society’s resilience to hazards. Although the collective provision of water supplies provides substantial health and equity benefits for consumers, there are drawbacks to this system. Water consumers, as Maria Kaika argues, become alienated from the

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<sup>21</sup> J. Gergis, D. Garden and C. Fenby, ‘The influence of climate on the first European settlement of Australia: a comparison of weather journals, documentary data and palaeoclimate records, 1788-1793’, *Environmental History*, vol. 15, no. 3, p. 19.

<sup>22</sup> D. Garden, *Droughts, Floods and Cyclones: El Niños that shaped our colonial past*, North Melbourne, Australian Scholarly Publishing, 2009, p. 147; and R. Morgan, ‘Diagnosing the dry: historical case notes from south-west Western Australia, 1945-2007’, *Osiris*, vol. 26, 2011, pp. 89-108.

<sup>23</sup> G. Bankoff, ‘Rendering the world unsafe: “vulnerability as Western discourse”, *Disasters*, vol. 25, no. 1, 2001, pp. 24-25.

<sup>24</sup> Bankoff, ‘Rendering the world unsafe’, pp. 24-25.

<sup>25</sup> Å. Wahlquist, *Thirsty Country: options for Australia*, Crows Nest, Allen and Unwin, 2008, pp. 45-47, 84, 99-102.

<sup>26</sup> J. K. Stine and J. A. Tarr, ‘At the intersection of histories: technology and the environment’, *Technology and Culture*, vol. 39, no. 4, 1998, pp. 601-34; and C. Muir, D. Rose and P. Sullivan, ‘From the other side of the knowledge frontier: Indigenous knowledge, social-ecological relationships and new perspectives’, *Rangeland Journal*, vol. 32, 2010, p. 262.



sources of their water supplies through large reticulated networks.<sup>27</sup> Divorced from the centralised source of supply, they may come to expect more and more affordable water. Such desires underwrote an ‘engineering ascendancy’ in the southwest during the twentieth century.<sup>28</sup>

The dominant means of settler interpretations of the region’s climate and water resources have been the expertise of Western science, engineering and economics, including both local approaches and ideas originating elsewhere and adapted to local conditions. Preparing for periods of water scarcity therefore becomes the exclusive domain of research for a technical elite, the water managers and meteorological community, which serves to ‘quarantine disaster in thought as well as in practice’.<sup>29</sup> These technocratic approaches have created ‘path dependencies’, which continue to limit the ways that we consume, manage and understand water resources in Western Australia.<sup>30</sup> Perhaps more than ever, the southwest remains vulnerable to running out.

As a region held hostage by the desert and the sea, subject to the vagaries of boom and bust, with few estuaries and a nagging thirst, the prospect of running out of water continues to dog the southwest, as it has since its European colonisation in 1826. In its most simple form, running out of water is a problem of supply and demand, of too little water to meet the needs and desires of the region’s human inhabitants. Over time, these needs have evolved from adequate water supplies for health and sanitation, to water for agricultural enterprises, more affluent lifestyles, industry and the environment. Many factors influence the amount of water available for these purposes, such as rainfall and evaporation; dam storage capacities; accessibility, availability and exploitation of groundwater; climate variability; and the extent of salt encroachment and other threats to water quality. How water scarcity is defined, therefore, is historically contingent on the way of life of Western Australians in the southwest, their expectations, the scientific knowledge of the region and its climate, and finally, the changing regional environment. Human responses to the decline in rainfall since the Second World War should therefore be analysed in light of a post-colonisation history

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<sup>27</sup> M. Kaika, ‘Interrogating the geographies of the familiar: domesticating nature and constructing the autonomy of the modern home’, *International Journal of Urban and Regional Research*, vol. 28, no. 2, 2004, pp. 265-86.

<sup>28</sup> J. M. Powell, ‘Australian watermarks: resource-environment transactions in an emergent democracy’, in M. Leybourne and A. Gaynor (eds), *Water: histories, cultures, ecologies*, Crawley, UWA Press, 2006, p. 59. As Powell rightly observes, this ‘engineering ascendancy’ in Australia has not been without its detractors, who have called for restraint and a greater focus on conservation from the nation’s water resource managers. See, J. M. Powell, *Watering the Garden State: Water, Land and Community in Victoria, 1824-1988*, Sydney, Allen and Unwin, 1989, p. 15.

<sup>29</sup> Bankoff, ‘Rendering the world unsafe’, pp. 24-25.

<sup>30</sup> P. Troy, ‘Conclusion’, in Troy (ed.), *Troubled Waters*, p. 196.

of attempts to adapt to the environmental conditions peculiar to the region. This thesis explores how the settler society of the southwest has tried to come to terms with the region's climate, land and water resources using science and technology to overcome the risks and uncertainties of living between the desert and the sea.

### *The making of an island*

The entrapment of the southwest between the ocean and the sand is the product of relatively recent developments in the region's long geological history. Over hundreds of millions of years, the southwest has borne witness to vast geological changes that have shaped its unique climate, rivers, landforms and soils. At present, the Yilgarn Block and its younger siblings, the Perth and Bremer Basins, which are separated by the Darling Fault, dominate the southwest region. The Darling Scarp, a range of about 200 to 300 metres in height, distinguishes this geological fracture. Although the Yilgarn Block was once glaciated and covered in layers of sediment, by the time the Australian continent rifted from Antarctica and the Indian sub-continent, eons of erosion had worn it down to a relatively flat landscape with hills, shallow river valleys, and nutrient-poor soils.<sup>31</sup>

The rifting of the continents, which created the Perth and Bremer Basins, greatly affected the Yilgarn Block's ancient rivers, from which large amounts of sediment had once flowed into these Basins. As the rifting processes thrust the Yilgarn Block higher above sea level, rivers that had once threaded across India and Antarctica were severed, and new rivers and inland drainage patterns were forged. Into these rivers flowed the sediment of the Yilgarn's weathering and this detritus trapped groundwater beneath the surface, a geological feature that would both help and hinder European colonists.<sup>32</sup> Meanwhile, some of these new rivers met with their predecessors so that the oldest stretches of the southwest's larger rivers now lie beyond the Darling Range, and their youngest run through the Scarp.<sup>33</sup> For the colonial explorers of the nineteenth century, this characteristic of the region's rivers was yet another antipodean oddity: in their view, the southwest's rivers ran 'backwards'.<sup>34</sup>

Between the late Cretaceous and early Palaeogene periods, the Perth and Bremer Basins emerged out of the ocean. Following this, sea levels increasingly began to

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<sup>31</sup> L. J. Pen, *Managing Our Rivers: a guide to the nature and management of the streams of south-west Western Australia*, East Perth, Water and Rivers Commission, 1999, pp. 15-16.

<sup>32</sup> Pen, p. 21.

<sup>33</sup> Pen, pp. 12-15.

<sup>34</sup> Pen, p. 12; and A. Brearley, *Ernest Hodgkin's Swanland: estuaries and coastal lagoons of South-western Australia*, Crawley, UWA Press, 2005, p. 17.

fluctuate during the Pliocene and the earth entered a cycle of alternating glacial and interglacial periods lasting thousands of years. During the cool glacial periods, sea levels fell and in the warm interglacial periods, sea levels rose to their present or slightly higher levels. At about this time, the southwest region's characteristic Mediterranean climate of dry summers and wet winters became established.<sup>35</sup> As I will examine further, this particular climate has had implications for the evolution of the region's watercourses, soils and vegetation, and the forms of water and land management that have been developed since European colonisation.

### *The seasons of the southwest*

Today, the southwest region extends roughly from Geraldton (28°S, 114°E) to Esperance (33°S, 121°E), and creeps inland past the Rabbit Proof Fence to embrace the state's agricultural areas (see Fig. i.1). The region is over 300,000 square kilometres in area, which is about four times the size of Tasmania.<sup>36</sup> Forged over millions of years, the region is today a palimpsest, whereby twenty-first century settlement overlays environmental boundaries of rainfall, climate, soil and vegetation, as well as the traditional lands of the Nyoongar Aboriginal people and older European patterns of settlement and use.

The desert and the sea play instrumental roles in the seasonal patterns of this Mediterranean climate and also influence the weather conditions to the east of the region. Cool, moist westerly winds pass from west to east across the south of the continent.<sup>37</sup> During the mild, wet winter months (May to September), these 'westerlies' strengthen as they combine with the lows over the Southern Ocean to bring rain to the southern areas, including the southwest region.<sup>38</sup> How much rain the westerlies bring to the southwest depends upon the interaction of oceanic and atmospheric processes, including the Indian Ocean Dipole, the El Niño-Southern Oscillation, the Southern

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<sup>35</sup> Pen, p. 22; and M. A. J. Williams, 'Palaeoclimates and palaeoenvironments: Quaternary environments', in J. J. Veevers (ed.), *Phanerozoic Earth History of Australia*, Melbourne, Oxford University Press, 1984, pp. 42-47.

<sup>36</sup> WA Water Resources Council, *The State of the Rivers of the South West*, Leederville, WAWRC, 1992, p. 2.

<sup>37</sup> These westerly winds or 'westerlies' are high-pressure systems or anticyclones, which turn anticlockwise in the Southern Hemisphere.

<sup>38</sup> Brearley, p. 13. In winter, these westerlies usually pass over the southern parts of the continent between 26°S and 34°S. In summer, these winds move further south and pass below the south coast between 35°S and 45°S.

Annular Mode, and the Leeuwin Current.<sup>39</sup> Tropical cyclones in the north of the state are responsible for episodes of extreme rainfall during the summer months, which can result in flooding in parts of the southwest.<sup>40</sup> During the hot, dry summer, the westerlies usually pass too far south to bring much rain to the southwest, leaving the region at the mercy of the easterlies that blow across the hot, dry inland. Although summer temperatures are high, the sea breeze (sometimes known in Perth as the ‘Fremantle Doctor’) arrives in the afternoon bringing with it the cool ocean air.<sup>41</sup>

As little rain falls over the southwest in the summer months, the flows and salinities of the region’s rivers are largely seasonal – reflecting this continent’s

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<sup>39</sup> Changes in the sea surface temperatures in the Indian Ocean can influence the rainfall patterns over much of Australia, particularly in the southern parts of the continent. In the late 1990s, climate scientists proposed the Indian Ocean Dipole (IOD) effect as a measure of such changes in sea surface temperature patterns in the northern Indian Ocean. For instance, a positive IOD is seen when waters are warmer than normal near Africa, and cooler than normal near Australia, which results in less rainfall. Conversely, a negative IOD is seen when waters are cooler than normal near Africa, and warmer than normal near Australia, which increases rainfall. Another influence on the climate of the southwest region (and other parts of southern Australia) is the Southern Annular Mode (SAM), which is a north-south movement in the belt of strong westerly winds across the south of the continent. Like the IOD, SAM can be in a positive or negative phase. During a positive phase, the belt of strong westerly winds shifts towards the South Pole. This results in weaker-than-normal westerly winds and higher pressure over southern Australia, which affects rainfall according to the season. Although a positive phase can result in increased rainfall over parts of the southwest in spring, in the autumn and winter months it results in fewer storm systems and less rainfall. A negative phase, which is associated with a northward shift, causes more rainfall in autumn and winter. Although the El Niño – Southern Oscillation (ENSO) is a major influence on Australia’s climate, its effect is less marked over much of Western Australia than for areas further east. ENSO is the irregular oscillation between El Niño and La Niña conditions, which are triggered by variations in sea surface temperature in the central and eastern tropical Pacific Ocean. La Niña is associated with extensive cooling of sea surface temperatures in the central and eastern tropical Pacific, which leads to a warming of the waters to the north of Australia and higher than average winter, spring, and summer rainfall over northern Western Australia. Tropical cyclones are often more frequent during La Niña events. El Niño events tend to have fewer impacts on rainfall in Western Australia. Finally, the Leeuwin Current system plays a dominant role in the marine life and climate of Western Australia. It sweeps down the west coast, from about the North West Cape and can extend as far as the Great Australian Bight and the southwest of Tasmania. The current brings warm tropical water to Western Australia, which contributes to the higher winter air temperatures and rainfall in the region, compared to similar latitudes elsewhere. It is stronger during winter and under La Nina conditions, and weaker during the summer and El Niño events. With a path of over 5,000 kilometres, it is the longest continuous coastal current system in the world. See, ‘Western Australia – weather and climate drivers’, *Climate Kelpie*, Grains Research & Development Corporation, 2008-2010, <<http://www.climatekelpie.com.au/understand-climate/weather-and-climate-drivers/western-australia#IOD>>, (Accessed: 11 May 2011); and C. Pattiaratchi, *Variability in the Leeuwin Current*, Indian Ocean Climate Initiative, 2005, <[http://www.ioici.org.au/pdf/IOCIclimatenotes\\_10.pdf](http://www.ioici.org.au/pdf/IOCIclimatenotes_10.pdf)>, (Accessed: 11 May 2011).

<sup>40</sup> T. J. Hatton, J. Ruprecht and R. J. George, ‘Preclearing hydrology of the Western Australian wheatbelt: target for the future?’, *Plant and Soil*, vol. 257, 2003, p. 349.

<sup>41</sup> The terms ‘Fremantle Doctor’ or ‘Doctor Fremantle’ to describe the cool afternoon sea-breeze in summer were in common usage in Western Australia by 1901. Pamela Statham-Drew considers that Captain James Stirling was the first to record the regularity of the afternoon breeze in his 1827 reports to the Admiralty. See, ‘Australian weather’, *Western Mail*, 23 February 1901, p. 40 and ‘Sunday Salad’, *Sunday Times*, 19 April 1903, p. 4. See also, P. Statham-Drew, *James Stirling: Admiral and founding Governor of Western Australia*, Crawley, UWA Press, 2003, p. 80.

environmental cycles of 'boom and bust'.<sup>42</sup> When the rains eventually come, the moisture in the soil slowly accumulates until the creeks trickle into the rivers, the estuaries and then into the sea.<sup>43</sup> The salinity of these estuaries depends upon the extent to which the rains flush them out. Freshwater conditions only last in the estuaries until the rains end and the tides return marine water to them.<sup>44</sup> During extended periods of dry conditions, some are reduced to shallow salt-pans.<sup>45</sup> Although these rivers are significant to the southwest, they are short and carry little water in comparison to those in south-eastern Australia and overseas.<sup>46</sup> Few of the southwest's rivers extend inland more than 150 kilometres from the coast, truncated by the omnipresent desert.<sup>47</sup>

Across the southwest, the region's reservoirs of underground water are also at the mercy of the boom and bust cycles of the seasons. Wetlands of swamps, lakes and floodplains dominate the Swan Coastal Plain, where Perth and its suburbs now lie. In the wetter months, this region can become locally waterlogged and flooded as water accumulates in the lower sections. During summer, the lack of rainfall and high temperatures combine to evaporate the water from the shallow wetland areas.<sup>48</sup> Similar processes occur across the southwest's agricultural areas, where chains of salt lakes streak the landscape in the hotter months of the year, leaving traces of the groundwater that lies just beneath the undulating hills and valleys of these farming lands.

The region's rains are highest (1,400mm per year) and most reliable in the far southwest corner, where the Indian Ocean meets its neighbour, the Southern Ocean (Fig. i.1).<sup>49</sup> As the landscape rolls towards the north and to the inland, these rains dissipate and become increasingly variable, with higher rates of evaporation. Marooned between the desert and the sea, the region has provided its natural vegetation with an 'island-like ... continental refuge'.<sup>50</sup> Over time, the plant life adapted to the southwest's infertile soils and the Mediterranean climate conditions to create a region that is rich in

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<sup>42</sup> For an exploration of the idea of 'boom and bust' in the Australian environment, see L. Robin and M. Smith, 'Introduction: boom and bust', in Robin, Joseph and Heinsohn (eds), *Boom and Bust*, pp. 1-6.

<sup>43</sup> Brearley, p. 13.

<sup>44</sup> Brearley, p. 14.

<sup>45</sup> Brearley, p. 442.

<sup>46</sup> Pen, p. 33.

<sup>47</sup> Pen, p. 33.

<sup>48</sup> W. A. Davidson, *Hydrogeology and Groundwater Resources of the Perth Region, Western Australia*, Perth, Geological Survey of WA, 1995, pp. 5, 9-10, 153.

<sup>49</sup> Brearley, p. 14.

<sup>50</sup> S. D. Hopper and P. Gioia, 'The Southwest Australian Floristic Region: evolution and conservation of a global hot spot of biodiversity', *Annual Review of Ecology, Evolution and Systematics*, vol. 35, 2004, p. 623.

endemic species.<sup>51</sup> But many of these species are under threat, largely as a result of agricultural practices, and at the turn of the twenty-first century, the region was classified as one of the world's twenty-five 'biodiversity hotspots'.<sup>52</sup>

The preceding descriptions of the geological formation of the southwest, its entrapment between the desert and the sea, and its seasons and vegetation are of course, *wedjela* stories, derived from the findings of Western science.<sup>53</sup> Although archaeological evidence suggests that the Nyoongar people have lived in the southwest for at least fifty thousand years, the Nyoongar have a quite different understanding of the history of the region and their own origins within it.<sup>54</sup>

### *Nyoongar Country*

*This continent ... is a land of many countries – and for every country, there is a people. ... We were formed with the hills and the valleys, the water and the sky, the trees and the plants, the crows and the kangaroos, created by the ancestors who gave meaning and life to our world. And for each of us, our country is not just where we live, but who we are.*<sup>55</sup>

- Ambelin Kwaymullina, 2008

Traditional stories that have been passed down orally from generation to generation explain that the Nyoongar did not originate anywhere else but the southwest.<sup>56</sup> For them, the land is their Mother, forged by the Rainbow Serpent, the *Wagyl* or *Waakal*.<sup>57</sup> Nyoongar scholar Len Collard explains that the *Waakal* 'came out of the earth' and as it

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<sup>51</sup> In the year 2000, the Southwest Australian Floristic Region was listed among 25 global biodiversity hot spots – those regions that are richest in endemic species under threat. See, Hopper and Gioia, p. 625.

<sup>52</sup> N. Myers et al., 'Biodiversity hot spots for conservation priorities', *Nature*, vol. 403, 2000, pp. 803-808; and Hopper and Gioia, p. 625.

<sup>53</sup> *Wedjela* or *wadjala* is a Nyoongar term to describe non-Nyoongars.

<sup>54</sup> C. W. Hassell and J. R. Dodson, 'The fire history of south-west Western Australia prior to European settlement in 1826-1829', in I. Abbott and N. Burrows (eds), *Fire in Ecosystems of Southwest Western Australia: impacts and management*, Leiden, Backhuys, 2003, p. 72. There are variations of the spelling of the 'generic word' that describes the Nyoongar people, including *Nyungar*, *Noongar*, and *Nyoongah*. See, L. Collard and S. Harben, 'Nartj katitj bidi ngulluckiny koorl? (Which knowledge path will we travel?)', *Studies in Western Australian History*, vol. 26, 2010, p. 82.

<sup>55</sup> A. Kwaymullina, 'Introduction: a land of many countries', in S. Morgan, T. Mia and B. Kwaymullina (eds), *Heartsick for Country: stories of love, spirit and creation*, Fremantle, Fremantle Press, 2008, p. 7.

<sup>56</sup> R. Van den Berg, *Nyoongar People of Australia: perspectives on racism and multiculturalism*, Leiden, Brill, 2002, p. 2.

<sup>57</sup> Van den Berg, p. 2. The Wagyl Rainbow Serpent is also spelt Waukal, Waakal, Wakyl and Woggal. See, E. McDonald, B. Coldrick and W. Christensen, 'The green frog and desalination: a Nyungar metaphor for (mis)management of water resources, Swan Coastal Plain, Western Australia', *Oceania*, vol. 78, 2008, p. 63.

travelled above and beneath the ground, it made the rivers, hills and waterholes, as well as the people themselves.<sup>58</sup>

During the Dreaming, the *Waakal* created Nyoongar country and the boundaries of these Nyoongar lands overlap those of the southwest region that has been transformed since European colonisation. According to Collard,

*Nyungar boodjar* (country) lies in the south-western corner of Western Australia. It extends eastward of Esperance (*Wudjari*) moving in an arc to the north-west close to the small wheat-belt town of Nyoongar (*Njakinjaki*) and west-north-west towards Coorow (*Juat*) south of Geraldton across to the west coast.<sup>59</sup>

This country is home to at least twelve language groups, including the *Balaradong*, *Juat*, *Kaneang*, *Koreng*, *Minang*, *Njakinjaki*, *Pibelman*, *Pindjarup*, *Wardandi*, *Whadjuck*, *Wilman* and *Wudjari*.<sup>60</sup> Within these groups are clans or families, which are associated with particular areas of the southwest.<sup>61</sup> The family unit plays a central role in Nyoongar culture, particularly in sharing stories, resources, and the rearing of children.<sup>62</sup> Nyoongar men and Nyoongar women had distinct roles in their society. Women gathered vegetables and roots, hunted small animals, built shelters, made clothes and reared children, while men hunted and were ‘keepers of the law’.<sup>63</sup> Both men and women conducted their men’s and women’s ‘business’ in special areas and neither could learn the content or nature of the other’s business.<sup>64</sup>

Nyoongar Cosmology bound (and often continues to bind) these men and women to their families, to their Creator, to their lands and to their knowledge. ‘[T]he *Waakal* is the Creator, the keeper of the freshwater sources’, explains Collard. ‘He gave

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<sup>58</sup> L. Collard, ‘The Cosmology: the creator of the Trilogy *Waakal* or *Nyungar* Rainbow Serpent’, in Leybourne and Gaynor (eds), *Water*, p. 122.

<sup>59</sup> Collard and Harben, p. 78.

<sup>60</sup> Collard and Harben, pp. 76-77.

<sup>61</sup> Van den Berg, p. 7.

<sup>62</sup> Van den Berg, p. 8.

<sup>63</sup> L. Collard, S. Harben and R. van den Berg, *Nidja Beeljar Boodjar Noonookurt Nyinyiny: a Nyungar interpretative history of the use of boodjar (country) in the vicinity of Murdoch University*, Perth, Murdoch University, 2004, p. 53; and Van den Berg, p. 9. Settler interpretations of the social structures of the Nyoongar peoples depicted a patriarchal society, in which women were enslaved to men. Scholarship since the 1980s, however, has revised this view. Anthropologist Lois Tilbrook was among the first to investigate the veracity of European accounts of Nyoongar society during the mid-nineteenth century. She found that these accounts were more a reflection of European social mores than an accurate description of Nyoongar relationships. Furthermore, the European men who documented their encounters with the Nyoongar were more likely to describe men, as Nyoongar lore prescribes that ‘men usually deal with men’. See, Collard and Harben, p. 94; and L. Tilbrook, ‘A question of access: women, marriage and land ownership in south-western Australia’, *Aboriginal History*, vol. 10, no. 2, 1986, p. 99.

<sup>64</sup> Van den Berg, p. 9.

us life and our trilogy of belief in the *boodjar* – the land – as our mother and nurturer of the Nyungar *moort* – family relations – and our *katitjin* – knowledge so that we could weave that intricate tapestry known as the “web of life”.<sup>65</sup> With the *Waakal* as ‘guardian’ of the ‘freshwater springs and rivers of Nyoongar country’, the people were the ‘keepers of the land’.<sup>66</sup> Nyoongars, like other Aboriginal groups across Australia, were (and remain) spiritually connected to their lands and they were responsible for maintaining all the life that these lands sustained. They moved around their lands according to the six ‘seasons’ not only to fish, hunt and gather food and to conduct law and ceremonies, but also to care for country.<sup>67</sup>

Contrary to what is sometimes assumed, ‘caring for country’ did not require the Nyoongar people to let the land go unchanged.<sup>68</sup> Such an act, Bill Gammage argues, would be tantamount to neglect and would endanger plant, animal and human communities.<sup>69</sup> Caring for country instead required the Nyoongar people, like other Australian Aborigines, to maintain ‘all land’ because land care tied ‘the beginning of creation to the infinite future’.<sup>70</sup> And the primary tool of land care was fire. As Gammage explains, ‘People placed and moved plant and thus animal communities by judicious burning or not burning’, thereby adding a human layer to the natural fire regime.<sup>71</sup> These practices were the essence of what archaeologist Rhys Jones called ‘firestick farming’.<sup>72</sup> The firing of Nyoongar country followed a particular pattern depending upon the season, location and the purpose of the burn. The diaries of European explorers of the west coast of Australia and newspaper accounts from the early colonial period suggest burns were confined to the dry summer months between November and March.<sup>73</sup> The timing, frequency, duration and intensity of the fires

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<sup>65</sup> Collard, Harben and van den Berg, p. 24.

<sup>66</sup> van den Berg, p. 10.

<sup>67</sup> Collard and Harben, p. 79; and B. Gammage, ‘Gardens without fences? Landscape in Aboriginal Australia’, *Australian Humanities Review*, vol. 36, 2005, <[http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#\\_edn21](http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#_edn21)>, (Accessed: 20 January 2012).

<sup>68</sup> Gammage, <[http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#\\_edn21](http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#_edn21)>.

<sup>69</sup> Gammage, <[http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#\\_edn21](http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#_edn21)>.

<sup>70</sup> Gammage, <[http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#\\_edn21](http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#_edn21)>.

<sup>71</sup> Gammage, <[http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#\\_edn21](http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#_edn21)>. See also, J. Dodson, F. Itzstein-Davy, L. Milne and A. Morris, ‘Vegetation and environmental history of southern Western Australia’, in A. Gaynor, M. Trinca, and A. Haebich, (eds), *Country, visions of land and people*, Perth, WA Museum, 2002, pp. 162, 164.

<sup>72</sup> R. Jones, ‘Firestick farming’, *Australian Natural History*, vol. 16, 1969, pp. 224-31.

<sup>73</sup> S. J. Hallam, ‘People landscapes in southwestern Australia in the early 1800s: Aboriginal burning off in the light of Western Australian historical documents’, *Early Days*, 2002, p. 184.



‘changed through the burning season’, with more frequent and controlled burns taking place early in the season.<sup>74</sup> The use of fire across the continent therefore shaped and moulded the Australian landscape over thousands of years and ensured that Aboriginal people ‘controlled their food supply’.<sup>75</sup> They would not run out.

It was a human landscape, therefore, that the Nyoongar had carefully crafted over thousands of years, upon which the European colonists founded their settlements in the western third of the continent in 1826 and 1829. Some Nyoongars believed the first European explorers and colonists, the *wedjela*, were ghosts or spirits of their dead ancestors and referred to them as *djanga*.<sup>76</sup> Many Nyoongar people tried to resist the taking of their country but to no avail – the technology and sheer numbers of colonists overwhelmed their efforts. Nyoongar forged a landscape well-suited to the needs of the colonists, who found pasture for their flocks, good soils for their crops, and enough water for themselves and their stock, and in time, it was wrested from the Nyoongar.<sup>77</sup> Even though the *djanga* still control their lands, the hearts of the Nyoongar people ‘lie within and long for country’ – ‘country never leaves’ them.<sup>78</sup>

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<sup>74</sup> Hallam, p. 184. Archaeologists and ecologists have debated the frequency of Nyoongar fires in the southwest, as they have elsewhere in Australia. Some plant ecologists have examined mature grass-trees (*Xanthorrea*) for evidence of fire and have concluded that the Nyoongar people regularly burnt areas of dry eucalypt forest every two to four years in the century before European colonisation, and continued to do so until the 1870s. These findings agreed with the historical evidence of Aboriginal firing in the region that ecologist Ian Abbott had uncovered as well as the work of historian Bill Gammage in southeastern Australia. But others have questioned this conclusion and the methods from which it was deduced. Fire ecologists led by Neal Enright argue that this frequency of burning would have prevented the survival of many woody species, such as banksias and hakeas, and suggest that further work is required on the grasstree method for reconstruction of fire histories in the southwest. See, D. J. Ward, B. B. Lamont and C. L. Burrows, ‘Grasstrees reveal contrasting fire regimes in eucalypt forest before and after European settlement of southwestern Australia’, *Forest Ecology and Management*, vol. 150, 2001, pp. 323-29; B. B. Lamont, D. Ward et al., ‘Believing the Balga: a new method for gauging the fire history of vegetation using grasstrees’, in I. Abbott and N. Burrows (eds), *Fire in ecosystems of south-west Western Australia: impacts and management*, Leiden, Backhuys, 2003, pp. 147-69; N. J. Enright, B. B. Lamont and B. P. Miller, ‘Anomalies in grasstree fire history reconstructions for south-western Australian vegetation’, *Austral Ecology*, vol. 30, 2005, pp. 668-73; D. J. Ward, ‘Commentary: comment on “Anomalies in grasstree fire history reconstructions for south-western Australian vegetation” by Enright N. J., Lamont B. B. and Miller B. P.’, *Austral Ecology*, vol. 31, 2006, p. 791; and N. J. Enright, B. B. Lamont and B. P. Miller, ‘Commentary: Anomalies in grasstree fire history reconstructions for south-western Australian vegetation: reply from Enright N. J., Lamont B. B. and Miller B. P.’, *Austral Ecology*, vol. 31, 2006, pp. 792-93. See also, I. Abbott, ‘Aboriginal fire regimes in south-west Western Australia: evidence from historical documents’, in Abbott and Burrows (eds), *Fire in Ecosystems of South-West Western Australia*, pp. 119-46; and B. Gammage, *The Biggest Estate on Earth: how Aborigines made Australia*, Sydney, Allen & Unwin, 2011, pp. 325-42.

<sup>75</sup> Gammage, <[http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#\\_edn21](http://www.australianhumanitiesreview.org/archive/Issue-July-2005/02Gammage.html#_edn21)>.

<sup>76</sup> Collard and Harben, p. 85.

<sup>77</sup> Collard and Harben, pp. 87-92; and S. J. Hallam, *Fire and Hearth: a study of Aboriginal usage and European usurpation in south-western Australia*, Canberra, Australian Institute of Aboriginal Studies, 1975, p. 47.

<sup>78</sup> S. Morgan, ‘A balance for the world’, in Morgan, Mia and Kwaymullina (eds), *Heartsick for Country*, p. 263.

## *The worth of water*

The first Europeans to colonise the western third of the Australian continent arrived by sea and progressively settled the southwest region. Although some colonists ventured north and to the east, the southwest was and remains the most populated region in the western third. Within the boundaries of the southwest are Western Australia's largest towns and cities, including the capital Perth. The region is home to over ninety per cent of the state's population as well as important sectors of the state's economy, such as the agriculture, horticulture and viticulture industries as well as some mining operations, service industries and the finance sector.<sup>79</sup> The largest consumers of water in the region is the government's Integrated Water Supply Scheme, followed by horticulturalists and residential bore-owners (Fig. i.2). For the southwest, therefore, the task of water management extends beyond government scientists and engineers; they 'are all water managers'.<sup>80</sup>

Australians have increasingly congregated on the coastal fringes of the continent and 'sandgroppers', as Western Australians are sometimes called, are no exception, preferring their Indian Ocean boundary to the arid inland.<sup>81</sup> Over seventy per cent of them live in Perth and its surrounding suburbs, which are clustered on the sandy stretches of the Swan Coastal Plain (Fig. i.1). The area that Perth's suburbs cover has doubled since the 1970s and they now extend over seventy kilometres along the coast.<sup>82</sup> Although many residents, local councils and businesses benefit from the Swan Coastal Plain's reserves of shallow groundwater, the Water Corporation provides their main supplies of potable water. These private and public water supplies combine to provide the capital with over forty per cent of the southwest's water.<sup>83</sup> The Water Corporation, a public utility, supplies water from dams, groundwater aquifers and seawater

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<sup>79</sup> CSIRO, *Water Yields and Demands in South-West Western Australia*, Canberra, CSIRO, 2009, <<http://www.clw.csiro.au/publications/waterforahealthycountry/swsy/pdf/SWSY-Main-Report-Water-Yields-Demands.pdf>>, (Accessed: 10 April 2011), p. 125.

<sup>80</sup> Powell, 'Australian watermarks', in Leybourne and Gaynor (eds), *Water*, p. 56.

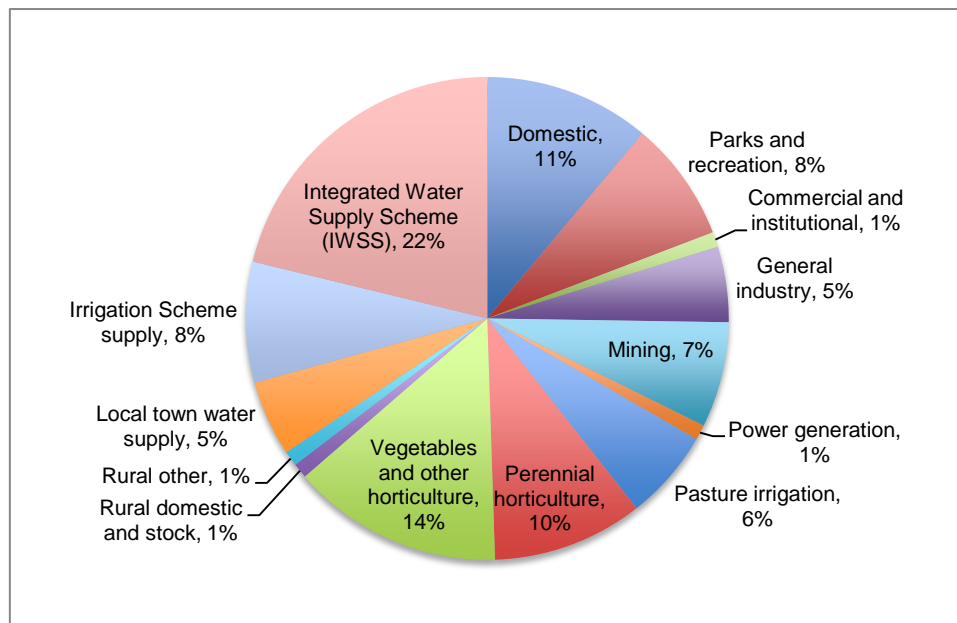
<sup>81</sup> Nicholas Brown explores the drift away from the pastoral inland towards the coast in New South Wales in the decades following the end of the Second World War. See, N. Brown, 'On the margins of the littoral society: the New South Wales South Coast since 1945', *Environment and History*, vol. 4, 1998, pp. 209-237.

<sup>82</sup> Australian Bureau of Statistics, *Population by Age and Sex, Western Australia*, 2005, <<http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/A4D377CAA8B667FCA256D81007EB5B7?opendocument>>, (Accessed: 7 January 2009); and Environmental Protection Authority (EPA), *State of the Environment Report 2007*, EPA, <<http://www.epa.wa.gov.au/AbouttheEPA/SOE/2007/Pages/default.aspx>>, (Accessed: 10 May 2012), p. 195.

<sup>83</sup> CSIRO, *Water Yields and Demands*, p. 130.

desalination to consumers in Perth as well as Mandurah, the central wheatbelt and the goldfields of Kalgoorlie-Boulder through its reticulated network, the Integrated Water Supply Scheme (hence the term ‘scheme water’).<sup>84</sup> Its water supply, sanitation and sewerage networks reach 97 per cent of Western Australians, while smaller water utilities provide scheme supplies to the towns of Bunbury and Busselton, south of Perth.<sup>85</sup>

**Fig. i.2: Water use in the Southwest of Western Australia, 2008 to 2009 (%)**<sup>86</sup>



The southwest region’s plentiful groundwater resources are an important source of water supply for both urban and rural dwellers. These reserves provide about three-quarters of the region’s total water supplies.<sup>87</sup> The Perth Basin in particular, which skirts the west coast from Geraldton to Albany, has plentiful supplies of fresh groundwater. At about 1,000 kilometres long and between 30 and 100 kilometres wide, a recent hydrological survey of this reserve has argued that it contains ‘Australia’s most important groundwater resources’, particularly beneath the suburbs of Perth.<sup>88</sup> Within the Perth Basin are three main aquifers, in which millions of litres of water are stored: the Superficial, the Leederville and the two-kilometre thick Yarragadee.<sup>89</sup> The

<sup>84</sup> Over eighty per cent of the IWSS supplies are delivered to Perth; ten per cent to the goldfields and agricultural region; and five per cent to Mandurah and towns in the southwest region. See, CSIRO, *Groundwater Yields*, p. 40.

<sup>85</sup> Department of Water (DoW), ‘Urban Water Pricing’, *Water Governance*, 2011, <[http://www.water.wa.gov.au/About+us/Water+Governance/Urban+Water+Pricing/u/governance\\_all.pdf?id=266](http://www.water.wa.gov.au/About+us/Water+Governance/Urban+Water+Pricing/u/governance_all.pdf?id=266)>, (Accessed: 20 April 2011).

<sup>86</sup> CSIRO, *Water Yields and Demands*, p. 130. Please note that domestic use includes water abstracted from private bores.

<sup>87</sup> CSIRO, *Water Yields and Demands*, p. 125.

<sup>88</sup> CSIRO, *Groundwater Yields*, pp. 24, 72.

<sup>89</sup> CSIRO, *Groundwater Yields*, p. 49. Hydrological surveys have revealed that the Superficial Aquifer occurs with some exceptions over the entire coastal plain; that the Yarragadee Aquifer

uppermost surface of the Superficial Aquifer forms the watertable, which supplies the wetlands, lakes and swamps around Perth, and is readily accessed for public water supplies, industry, agriculture and backyard irrigation.<sup>90</sup> This aquifer is refilled when rainfall percolates through the Gnangara and Jandakot Mounds, and by suburban stormwater runoff. Water slowly trickles down from this Superficial Aquifer and outcrops into the deeper Leederville Aquifer, which then leaches into the two-kilometre thick Yarragadee Aquifer.<sup>91</sup> Together these resources support the region's wetlands and contribute substantially to the public water supplies of many people in the southwest as well as supporting horticulture, industry, and the irrigation of parks, gardens and sporting grounds.<sup>92</sup>

Yet groundwater can be both a blessing and a curse. The constraints on the southwest posed by the desert and the sea have been amplified by the insidious encroachment of salt. In 2007, the Western Australian government estimated that the salt-affected parts of the southwest region accounted for three-quarters of Australia's dryland salinity problem.<sup>93</sup> This salinity is the legacy of ocean winds and weathered rock, and its rise to the surface results from the disturbance of that 'inseparable trinity' of forest, soil and water.<sup>94</sup> For centuries salt lay below the surface, particularly in areas where rains were too light to flush it away. Salt-tolerant plants grew in these low lying areas, while deep-rooted plants in other areas helped to keep the groundwater at bay and allowed the growth of less-salt-tolerant plants above.<sup>95</sup> The replacement of this deep-rooted salt-tolerant native vegetation with shallow-rooted annual crops and pastures for European agriculture has allowed salt to surface like a 'cataract on the devil's eye'.<sup>96</sup> Over the past hundred years or so, this salty poison has infiltrated the southwest's soils and its water catchments, becoming a relentless scourge to the region's land and water

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is present between Gingin and Rockingham but not in the Peel-Harvey Area; and that the Leederville Aquifer does not occur north of Gingin.

<sup>90</sup> Davidson, p. 117.

<sup>91</sup> CSIRO, *Groundwater Yields*, p. 65.

<sup>92</sup> CSIRO, *Groundwater Yields*, p. 24.

<sup>93</sup> EPA, *State of the Environment Report 2007*, p. 56.

<sup>94</sup> The term 'an inseparable trinity' in regard to the interactions of forests, water and soils appeared in Judge Leonard E. B. Stretton's report of the 1946 Victorian Royal Commission on Forest Grazing. The Victorian 'Save the Forests Campaign' adopted the term for a leaflet published in 1950 to explain the philosophy and history of its efforts during the 1940s. The conservation of forests, they argued, was critical to the health of the state's soils and water resources. Libby Robin argues that this use of the term represents one of the earliest popular references to scientific ecological principles in Victoria. See, L. Robin, *Building a Forest Consciousness: an historical portrait of the Natural Resources Conservation League of Victoria (NRCL) 1944-1990*, Springvale, NRCL, 1991, pp. 22-23.

<sup>95</sup> Brearley, p. 24.

<sup>96</sup> Brearley, p. 24. A 'cataract on the devil's eye' is a line from a John Kinsella poem, titled *Sacre Coeur: a salt tragedy*, Sydney, Vagabond Press, 2006.

managers. In light of the diverse uses of the water resources of the southwest, such threats to their quantity and quality have significant far-ranging ecological, cultural, economic and political consequences for the southwest.

### *Histories of vulnerability and resilience*

*We do not see our hand in what happens, so we call  
certain events melancholy accidents when they are the  
inevitable of our projects.*<sup>97</sup>

- Stanley Cavell, 1992

The ecological concepts of vulnerability and resilience serve to highlight the varied attempts to adapt to the climate, land and water resources of the southwest after British colonisation in 1829. Recently, these concepts have been usefully applied to the study of 'natural' hazards and disasters. Of central significance to such studies is the need to understand the relationships between a society and its changing environment over time, and how these changing relationships affect the vulnerability of both people and place.<sup>98</sup>

The study of a society's vulnerability and resilience to natural hazards requires a keen eye to historical process over the long term. Remarkably, however, few historians have engaged with such analyses until the last decade or so.<sup>99</sup> The contextualisation of natural hazards, argues Ted Steinberg, helps to overcome their interpretation as 'temporally and spatially limited'.<sup>100</sup> The perception of natural hazards and the 'construction' of disasters are shaped by the ongoing interactions between humans and their environments over time. '[H]istory prefigures disaster', according to Greg Bankoff, because particular chains of events situate people in certain times and places; historical processes determine their abilities to withstand the effects of hazards; and prior experience combines with peer perception to shape the ways in which individuals 'construct' disasters.<sup>101</sup> Moreover, memory plays an important role in recasting the experiences of past events to serve the needs of the present.<sup>102</sup> Historians, suggests Steinberg, should be able to contribute to understandings of natural hazards because

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<sup>97</sup> S. Cavell, *The Senses of Walden*, 5<sup>th</sup> ed., Chicago, University of Chicago Press, 1992, p. 82.

<sup>98</sup> Bankoff, 'Time is of the essence', p. 33.

<sup>99</sup> T. Steinberg, 'The secret history of natural disaster', *Environmental Hazards*, vol. 3, 2001, p. 35; and G. H. Endfield, *Climate and Society in Colonial Mexico: a study in vulnerability*, Carlton, Blackwell, 2008, p. 3. For a discussion of the development of historians' interest in disaster studies, see M. Junega and F. Mauelshagen, 'Disasters and pre-industrial societies: historiographical trends and comparative perspectives', *Medieval History Journal*, vol. 10, 2007, pp. 1-31.

<sup>100</sup> Steinberg, 'The secret history of natural disaster', p. 32; and Hewitt, p. 10.

<sup>101</sup> Bankoff, 'Time is of the essence', p. 34.

<sup>102</sup> Bankoff, 'Time is of the essence', p. 36.

their profession is defined around ‘the question of contingency – of why some things happen and some things do not’.<sup>103</sup>

In many instances, the engagement of environmental historians with the concepts of vulnerability and resilience has been implicit but recent attention to the environmental histories of natural hazards has brought these concepts to the fore.<sup>104</sup> The use of these ecological concepts to analyse human-nature relationships over time is consistent with the study of environmental history, a field that finds ‘its foundation, its coherence, its first step’ in the science of ecology.<sup>105</sup> Ecology provides environmental historians with a lens through which to study the complex connections and relationships between humans and their environs and ‘the landscapes they together shape’ as they change over time.<sup>106</sup>

The utility of an ecological outlook for environmental historians has only been possible as a result of a significant shift in thinking within the science of ecology that took place in the 1970s. Coinciding with the emergence of environmental history, ecologists increasingly began to consider that ecosystems were in a state of constant flux, rather than tending towards a specific state.<sup>107</sup> Furthermore, ecosystems were no longer considered to be independent of people and vice versa; instead, ecologists increasingly worked in terms of ‘social-ecological systems’.<sup>108</sup> It was within this new way of understanding ecosystems that the concept of resilience was developed.

In 1973, Canadian ecologist C. S. ‘Buzz’ Holling argued that ecosystems have a property ‘that is a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables’, which he termed ‘resilience’.<sup>109</sup> The vulnerability of a system is therefore ‘inversely related to resilience: the more resilient, the less vulnerable’ it is to

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<sup>103</sup> Steinberg, ‘The secret history of natural disaster’, p. 32.

<sup>104</sup> See for instance, Juneja and Mauelshagen, pp. 1-31; and U. Luebken and C. Mauch, ‘Uncertain environments: natural hazards, risk and insurance in historical perspective’, *Environment and History*, vol. 17, no. 1, 2011, pp. 1-12.

<sup>105</sup> D. Worster, ‘Appendix: doing environmental history’, in D. Worster (ed.), *The Ends of the Earth: perspectives on modern environmental history*, Melbourne, Cambridge University Press, 1988, p. 294.

<sup>106</sup> S. R. Dovers, ‘Sustainability and “pragmatic” environmental history’, *Environmental History Review*, vol. 18, no. 3, 1994, p. 26. See also, T. Griffiths, ‘Ecology and empire: towards an Australian history of the world’, in Griffiths and Robin (eds), *Ecology and Empire*, p. 11.

<sup>107</sup> J. R. McNeill, ‘Observations on the nature and culture of environmental history’, *History and Theory*, vol. 42, no. 4, 2003, p. 39; and R. White, ‘Environmental history, ecology and meaning’, *Journal of American History*, vol. 76, no. 4, 1990, p. 1115.

<sup>108</sup> F. Berkes and C. Folke, ‘Linking social and ecological systems for resilience and sustainability’, in F. Berkes and C. Folke (eds), *Linking Social and Ecological Systems: management practices and social mechanisms for building resilience*, Melbourne, Cambridge University Press, 1998, p. 9.

<sup>109</sup> C. S. Holling, ‘Resilience and stability of ecological systems’, *Annual Review of Ecology and Systematics*, vol. 4, 1973, p. 14.

uncertain and unexpected changes, such as natural hazards.<sup>110</sup> Leading from these ideas is the notion of adaptive capacity, the ability of human or non-human actors to adjust to observed or expected changes in order to manage the social-ecological system's resilience.<sup>111</sup> In terms of human adaptation at least, these adjustments are shaped and informed by historical, cultural, political, socioeconomic and ecological factors.<sup>112</sup> Sustainability, on the other hand, implies 'a steady state system', which is less useful for understanding how different societies respond to change.<sup>113</sup> The dynamism of the concepts of resilience and vulnerability, therefore, offers environmental historians a valuable conceptual framework for studying the ways that people in the past have interacted with changing environments.

The vulnerability or resilience of a society to particular hazards influences the way it perceives and experiences certain risks. The less resilient a society, the more vulnerable it is to environmental change, and the greater its exposure to geophysical extremes and natural processes.<sup>114</sup> As Anthony Oliver-Smith argues,

Disasters, and how well or poorly systems fare in them, are a gauge of the success or failure of the total adaptation of the community. In the way we structure consciously and unconsciously, intentionally and unintentionally, our interactions with the environment, we can frequently be the cause of our own hazardous situation.<sup>115</sup>

But this comprehension of the 'unnatural' dimensions of natural hazards is only a relatively recent development in Western thought.<sup>116</sup> It required a shift in thought from supposing a future predetermined by fate and destiny to one that could change and be changed. This transformation of thought, which activated the agencies of both humans

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<sup>110</sup> J. W. Handmer and S. R. Dovers, 'A typology of resilience: rethinking institutions for sustainable development', *Organisation and Environment*, vol. 9, 1996, p. 487.

<sup>111</sup> F. Berkes, 'Understanding uncertainty and reducing vulnerability: lessons from resilience thinking', *Natural Hazards*, vol. 41, 2007, p. 287; and Endfield, p. 8.

<sup>112</sup> Berkes, p. 287.

<sup>113</sup> L. Robin, 'The Art and Science of Resilience', in *Violent Ends: the arts of environmental anxiety*, National Museum of Australia, 2009, <[http://www.nma.gov.au/research/centre\\_for\\_historical\\_research/conferences\\_and\\_seminars/violent\\_ends2/the\\_art\\_of\\_resilience/](http://www.nma.gov.au/research/centre_for_historical_research/conferences_and_seminars/violent_ends2/the_art_of_resilience/)>, (Accessed: 4 April 2011).

<sup>114</sup> Berkes, p. 285.

<sup>115</sup> A. Oliver-Smith, "'What is a disaster?': anthropological perspectives on a persistent question", in A. Oliver-Smith and S. M. Hoffman (eds), *The Angry Earth: disaster in anthropological perspective*, New York, Routledge, 1999, p. 26. See also, Bankoff, 'Rendering the world unsafe', p. 30; G. H. Endfield, I. F. Tejedo and S. L. O'Hara, 'Conflict and cooperation: water, floods and social response in colonial Guanajuato, Mexico', *Environmental History*, vol. 9, no. 2, 2004, pp. 221-47; and Luebken and Mauch, p. 8;

<sup>116</sup> T. Griffiths, "'An unnatural disaster?'" Remembering and forgetting bushfire', *History Australia*, vol. 6, no. 2, 2009, pp. 35.1-35.7.

and their environments, took place in the West during the early modern period.<sup>117</sup> The emerging worldview allowed for possibility and uncertainty, thereby creating the necessary conditions for the perception of risk.<sup>118</sup> Concurrent with the emergence of this mode of thought has been the rise of science (or ‘the death of nature’, as Carolyn Merchant has described it), as the principal means by which societies have understood and addressed environmental hazards and risks.<sup>119</sup> Since the nineteenth century in particular, Western societies have deployed the social sciences as part of a broader sociological phenomenon of striving for the taming of chance.<sup>120</sup>

In the context of my thesis, the concepts of vulnerability and resilience allow for the analysis of how people in the southwest have experienced running out since colonisation and how these experiences have changed over time. Furthermore, these concepts provide a useful means to compare, contrast, and account for different experiences of running out. Throughout this thesis, I deploy the term ‘hydroresilience’ to describe the extent to which Western Australians are vulnerable to climate variability and water scarcity – to running out.

### ***Histories for an uncertain future***

*The stories we live by determine the future.*<sup>121</sup>  
- Tom Griffiths, 2007

Anthropogenic climate change forces us all to come to terms with climatic conditions potentially quite different from those we have experienced in the past. As such, environmental histories can usefully shed light on how we apprehend risks and move forward into an uncertain future. Moreover, understanding the ‘roots’ of the environmental problems we face offers greater scope for shaping the future as ‘[i]t is possible to make plans for the future without knowing about the past but it is not possible to prevent the past from shaping the fate of those plans’.<sup>122</sup> In this thesis, I argue that we should not only look forward, but also back to the past through the lens of environmental history in order to devise more equitable responses to the climate and water challenges of the twenty-first century.

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<sup>117</sup> Luebken and Mauch, p. 2.

<sup>118</sup> Luebken and Mauch, p. 2.

<sup>119</sup> C. Merchant, *The Death of Nature: women, ecology and the scientific revolution*, New York, Harper Collins, 1980; and Luebken and Mauch, p. 7.

<sup>120</sup> I. Hacking, *The Taming of Chance*, Melbourne, Cambridge University Press, 1990.

<sup>121</sup> T. Griffiths, ‘The Humanities and an environmentally sustainable Australia’, *Australian Humanities Review*, no. 43, 2007, <<http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html>>, (Accessed: 4 April 2011).

<sup>122</sup> D. Connell, *Water Politics in the Murray-Darling Basin*, Sydney, Federation Press, 2007, p. 9.



Reflecting its origins in the new environment movement of the 1970s in North America, the contemporary field of environmental history has provided practitioners with a medium through which to explore the histories of current environmental concerns.<sup>123</sup> In Australia at least, environmental historians have also advocated issues-based approaches to their studies to ensure the longevity and development of their field – to provide ‘a communicable and practical purpose in an age when such things are demanded’.<sup>124</sup> For instance, public debates during the 1980s and 1990s on forest management and urban consolidation provided the impetus for some historians to explore these areas, while others have been motivated to examine Indigenous land management and how Indigenous knowledge (or Traditional Environmental Knowledge) might guide natural resource management in the twenty-first century.<sup>125</sup>

To explore these complex relationships between people and place, environmental historians have endeavoured to bridge the divide between nature and culture, and the disciplinary boundaries of the sciences and humanities, while maintaining the signature skills of the historian, such as narrative storytelling, source analysis and critical thinking.<sup>126</sup> Western science has long spoken for nature in Australia but the ancient land has often resisted being spoken for, demanding from its settlers ‘distinctively local’ understandings of the environment.<sup>127</sup> Our understanding of this process of the development of settler Australian scientific knowledge has become more complex since George Basalla proposed his model of how science was transmitted from Europe to the rest of the world.<sup>128</sup> According to this three-stage model, Europeans

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<sup>123</sup> Rather than a ‘new field’, argues environmental historian Richard Grove, environmental history has its origins in historical geography. See, T. Griffiths, ‘How many trees make a forest? Cultural debates about vegetation change in Australia’, *Australian Journal of Botany*, vol. 50, 2002, p. 376.

<sup>124</sup> Dovers, p. 33.

<sup>125</sup> For instance, former forester John Dargavel has written extensively on forest history in response to political conflicts about the management of Australia’s timber. Similarly, public debates regarding urban consolidation in the 1990s influenced Andrea Gaynor’s work on suburban food production in Australia. See, J. Dargavel (ed.), *Sawing, Selling & Sons: histories of Australian timber firms*, Canberra, ANU, 1988; J. Dargavel, *Fashioning Australia’s forests*, Melbourne, Oxford University Press, 1995; J. Dargavel, ‘The coming of age to Australian forests’, *Environment and History*, vol. 4, no. 2, 1998, pp. 167-90; A. Gaynor, *Harvest of the Suburbs: an environmental history of growing food in Australian cities*, Crawley, UWA Press, 2006; A. Gaynor, ‘Regulation, resistance and the residential area: the keeping of productive animals in twentieth-century Perth, Western Australia’, *Urban Policy and Research*, vol. 17, no. 1, pp. 7-16; and H. Goodall, ‘Riding the tide: Indigenous knowledge, history and water in a changing Australia’, *Environment and History*, vol. 14, 2008, pp. 355-84. See also, L. Robin and T. Griffiths, ‘Environmental history in Australasia’, *Environment and History*, vol. 10, 2004, pp. 439-74.

<sup>126</sup> Griffiths, ‘How many trees make a forest?’, pp. 376-77.

<sup>127</sup> L. Robin, *How a Continent Created a Nation*, Sydney, UNSW Press, 2007, p. 5. See also, D. N. Livingstone, *Putting Science in its Place: geographies of scientific knowledge*, Chicago, University of Chicago Press, 2003, p. 45.

<sup>128</sup> G. Basalla, ‘The spread of Western science’, *Science*, vol. 156, 1967, pp. 611-22.

initially studied ‘new’ lands for sources of wealth or places to settle. Then, locally-based ‘scientists’ engaged in the collection and analysis of specimens from the colonial environment. A European perspective would continue to influence this work, while they slowly developed a more local view, which would culminate in the independent scientific discourse typical of the third and final stage. Since its publication in 1967, Basalla’s model has been the subject of extensive critique, particularly regarding his assumption of a ‘unique western scientific ideology waiting to be diffused into new scientific territories’ and his neglect of the political, economic and social forces that influenced this process.<sup>129</sup> Instead of this ‘core and periphery’ approach, these processes of scientific development are better characterised as interdependent, reflective of the ‘webs of Empire’ that connected Britain and its colonies.<sup>130</sup>

These changing ideas about science and the processes of its production demonstrate that the environmental historian can make ‘a subject of science and its ways of knowing’ by unpacking its methods and designs, and destabilising its edifice of truth.<sup>131</sup> Such inquiries highlight the fluid boundaries between the complementary fields of environmental history and histories of science and technology.<sup>132</sup> It is this engagement with science and technology and their histories that prepares environmental historians to engage with scientists and engineers about current environmental problems, such as anthropogenic climate change, which demand interdisciplinary conversations. With its capacity to negotiate boundaries of time and space, of culture and nature, environmental history is well equipped to delve into the deep past to understand the social-ecological problems we face in the present and the uncertain future.

It is not only the scope and subject of the field of environmental history that positions its practitioners to contribute to improving the resilience of social-ecological

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<sup>129</sup> R. W. Home and S. G. Kohlstedt, ‘Introduction’, in R. W. Home and S. G. Kohlstedt (eds), *International Science and National Scientific Identity*, Dordrecht, Kluwer, 1991, p. 2; R. W. Home, ‘Introduction’, in R. W. Home (ed.), *Australian Science in the Making*, Sydney, Cambridge University Press, 1988, pp. x-xi; R. MacLeod, ‘On visiting the “moving Metropolis”: reflections on the architecture of imperial science’, *Historical Records of Australian Science*, vol. 5, no. 3, 1982, pp. 1-16; and I. Inkster, ‘Scientific enterprise and the colonial “model”: observations on Australian experience in historical context’, *Social Studies of Science*, vol. 15, 1985, pp. 677-704.

<sup>130</sup> T. Ballantyne, *Orientalism and Race: Aryanism in the British Empire*, New York, Palgrave, 2002.

<sup>131</sup> Griffiths, ‘The humanities and a sustainable Australia’, <<http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html>>. See also, K. Asdal, ‘The problematic nature of nature: the post-constructivist challenge to environmental history’, *History and Theory*, vol. 42, no. 4, 2003, pp. 60-74.

<sup>132</sup> S. Soerlin and P. Warde, ‘The problem of the problem of environmental history: a re-reading of the field’, *Environmental History*, vol. 12, no. 1, 2007, p. 113; and Stine and Tarr, pp. 601-40.

systems, but also its method. Environmental historians share a commitment to narrative, to telling stories about the interactions of people and place over time.<sup>133</sup> Historian Tom Griffiths, describes the story as a ‘highly refined science. It is the most powerful educational tool we possess; it is learning distilled in common language. It is also a privileged carrier of truth, a way of allowing for multiplicity and complexity at the same time as guaranteeing memorability’.<sup>134</sup> Through narrative, Griffiths argues, environmental historians can incorporate multiple points of view and ‘enact connectivity’ across peoples, times, disciplines and places.<sup>135</sup> Narrative enables connectivity in the present, sharing knowledge in an accessible form, which can change the ways we approach an uncertain future.

Stories can also remind of us of our agency, that our fate is not historically predetermined, which stands environmental histories apart from the ecological histories of Jared Diamond and Tim Flannery. Although humans figure in their narrative accounts of the past, ecological forces overwhelm human agency in these histories.<sup>136</sup> In contrast, environmental history ‘remains at heart, one of the humanities, concerned with cultural, moral, economic and political questions and founded in narrative’.<sup>137</sup> It is through the stories told by environmental historians that we can understand the cultural roots of the climate and water challenges that confront us today.

Environmental histories can help people understand ‘the natural system as a whole, its patterns and its irregularities, its booms and its busts’, and that uncertainty is normal, particularly in Australia.<sup>138</sup> Attention to change over time is especially pertinent in the Australian context, where a new world settler society all but displaced ancient cultures from their ancient lands. The continent, as George Seddon observed, has had ‘a radically new technology imposed upon it, suddenly, twice’, with the arrival of Aboriginal people over forty thousand years ago and the Europeans in 1788.<sup>139</sup> And with European colonisation came industrialisation, a ‘compressed, double revolution’

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<sup>133</sup> Griffiths, ‘How many trees make a forest?’, p. 377; and W. Cronon, ‘A place for stories: nature, history, and narrative’, *Journal of American History*, vol. 78, no. 4, 1992, pp. 1347-76.

<sup>134</sup> Griffiths, ‘The humanities and an environmentally sustainable Australia’, <[http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html#\\_ednref10](http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html#_ednref10)>.

<sup>135</sup> Griffiths, ‘The humanities and an environmentally sustainable Australia’, <[http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html#\\_ednref10](http://www.australianhumanitiesreview.org/archive/Issue-December-2007/EcoHumanities/EcoGriffiths.html#_ednref10)>.

<sup>136</sup> Robin and Griffiths, ‘Environmental history in Australasia’, p. 460.

<sup>137</sup> Griffiths, ‘How many trees make a forest?’, p. 378.

<sup>138</sup> L. Robin, ‘Living with uncertainty’, *ANU News*, Spring, 2009, <<http://news.anu.edu.au/?p=1454>>, (Accessed: 15 May 2011).

<sup>139</sup> G. Seddon, ‘The man-modified environment’, 1983, cited in L. Robin and W. Steffen, ‘History for the Anthropocene’, *History Compass*, vol. 5, no. 5, 2007, p. 1710.

that brought the Anthropocene to the antipodes.<sup>140</sup> Humans, long agents of biological change in Australia, were now also agents of geological change, not just Down Under but also across the world and into the future.<sup>141</sup> Since Australia's colonisation, then, it has no longer made sense to distinguish between human and natural histories, for over the past two hundred years, humans have had the capacity to collectively change 'the most basic physical processes of the earth'.<sup>142</sup> In terms of geological time, 'We have collectively become a force in climate that is comparable to the astronomical causes of ice ages'.<sup>143</sup>

Yet many environmental historians, including myself, lack the scientific expertise to make sense of the intricacies of climate change science and view the ongoing debates about the veracity of scientific theories of anthropogenic climate change as political in nature. Like Dipesh Chakrabarty, I rely upon the work undertaken by scholars like historian of science Naomi Oreskes, who has surveyed nearly a thousand scholarly articles on global warming published in peer-reviewed journals between 1993 and 2003.<sup>144</sup> What she found then still contrasts strikingly with the tone of media reports and political debate: 'there is a scientific consensus on the reality of anthropogenic climate change'.<sup>145</sup>

Others have confirmed her conclusions. In May 2011, Will Steffen of the Australian Climate Commission reported to the Federal Government that, '[W]e know beyond reasonable doubt that the world is warming and that human emissions of greenhouse gases are the primary cause'.<sup>146</sup> The climatic conditions that we will face in the future will be 'new' to us, but change itself is not new and environmental histories can shed light on how humans have responded to and understood environmental change in the past. In this environmental history, I interrogate the extent to which water scarcity in the southwest is 'natural', and conclude that it has distinctly human dimensions. It is

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<sup>140</sup> Griffiths, 'Ecology and empire', p. 4.

<sup>141</sup> Robin and Steffen, p. 1699. For a historical examination of the acceleration of these trends in the twentieth century and their ecological impacts, see, J. R. McNeill, *Something New Under the Sun: an environmental history of the twentieth-century world*, New York, W. W. Norton, 2001.

<sup>142</sup> N. Oreskes, 'The scientific consensus on climate change: how do we know we're not wrong?', in J. F. C. Dimento and P. Doughman (eds), *Climate Change: what it means for us, our children and our grandchildren*, Cambridge, MA, MIT, 2007, p. 93.

<sup>143</sup> T. Griffiths, 'A humanist on thin ice', *Griffith Review*, no. 29, 2010,

<<http://www.griffithreview.com/edition-29-prosper-or-perish/a-humanist-on-thin-ice>>, (Accessed: 4 April 2011). Undoubtedly, some cultures have been more responsible for this transformation than others and still others will contribute further to geological change in the future. Regardless, it is a 'shared catastrophe that we have fallen into'. See, D. Chakrabarty, 'The climate of history: four theses', *Critical Inquiry*, vol. 35, 2009, p. 218.

<sup>144</sup> Chakrabarty, pp. 197-222.

<sup>145</sup> N. Oreskes, 'The scientific consensus on climate change', *Science*, vol. 306, p. 1686.

<sup>146</sup> W. Steffen, *The Critical Decade: climate science, risks and responses*, Canberra, Climate Commission Secretariat, 2011, p. 60.

these human dimensions of water scarcity, I argue, that account for the uneven distribution of hydroresilience. Furthermore, they account for the ways in which running out of water has been perceived, defined and predicted, and how these have changed over time.

### *Histories of running out*

*Of its nature, and because of ours, water follows both the lie and the lies of the land.*<sup>147</sup>

- Joseph M. Powell, 2002

Water, or the continent's lack of it, figures prominently in the Australian historical consciousness. Australians live on the driest inhabited continent on earth and take pride in the engineering achievements of past generations to conjure water from this dry land. In spite of this water scarcity, we are a nation of profligate water users and grand schemes of landscape authorship, such as C. Y. O'Connor's Golden Pipeline, the Bradfield Scheme and the Snowy Mountains Hydroelectric Scheme, have been supported by, and have perpetuated, our water dreaming.<sup>148</sup> For the southern areas of the continent, scientific projections of climate change predict even drier conditions in the future. But in the southwest, this drying is already underway: in the late 1990s, water managers and climate scientists concluded that the region's rainfall had been lower over the previous twenty years than over the entire meteorological record (Fig. i.3).<sup>149</sup> Tim Flannery would later point to the region as Australia's first area to be affected by anthropogenic climate change – both proof that change was happening and that Australians needed to adapt to these climate changes.<sup>150</sup> More than ever, we need to explore how and why Australians have come to use the continent's water resources as they do today, to help overcome the nation's so-called 'water illiteracy'.<sup>151</sup>

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<sup>147</sup> J. M. Powell, 'Environment and institutions: three episodes in Australian water management, 1880-2000', *Journal of Historical Geography*, vol. 28, no. 1, 2002, p. 112.

<sup>148</sup> J. Williams, 'Can we myth-proof Australia?', *Australasian Science*, vol. 24, no. 1, 2003, p. 40. Economist Bruce Davidson was among the first scholars to dispute the view that Australia suffers from a scarcity of water. Rather, it is in the wrong place and the wrong time. In fact, according to Davidson, Australia is the world's wettest continent, in terms of rainfall per person. See, B. R. Davidson, *Australia: wet or dry?*, Carlton, Melbourne University Press, 1969, pp. 1-35.

<sup>149</sup> J. K. Ruprecht, B. C. Bates and R. A. Stokes, *Climate variability and water resources workshop, a summary of outcomes*, East Perth, Water and Rivers Commission, 1996. p. 9.

<sup>150</sup> T. Flannery, *The Weather Makers: the history and future impact of climate change*, Melbourne, Text Publishing, 2005.

<sup>151</sup> Wahlquist, p. 192.

Yet surprisingly few historians have engaged with the challenges of managing this continent's water resources.<sup>152</sup> These histories chart the development of water supplies for suburban and agricultural use; examine the challenges posed by too much and too little water; and explore the complex cultural influences that shape the ways in which Australians have used water since colonisation. They have left a rich field of inquiry for historical geographers like Joseph M. Powell, whose histories of water management across the nation, including Western Australia, have been especially useful for this study.<sup>153</sup> Powell has argued convincingly that hydrological engineers have long carried out significant acts of 'landscape authorship' across the continent to provide water to settlements and to foster economic development.<sup>154</sup> These form part of a broader history of coming to grips with Australia, of 'environmental enigmas, constraints and opportunities' that have shaped its settlement.<sup>155</sup> Borrowing from this approach, my research examines the socioeconomic, political and cultural relationships that people have formed with the southwest's water resources since colonisation, and how a better understanding of the environmental history of water in this part of the world might inform present-day challenges.

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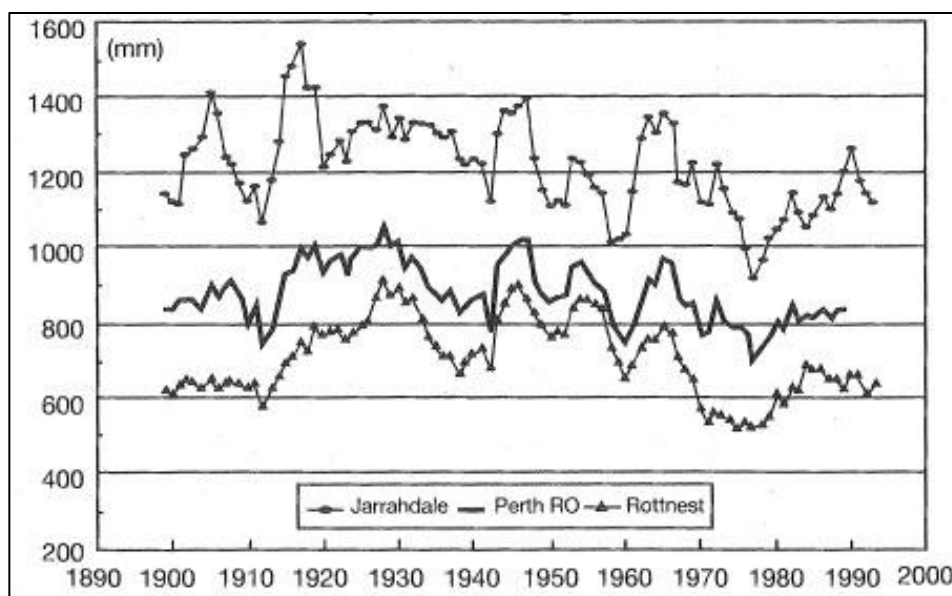
<sup>152</sup> The few histories of Australia's water resources include: Cathcart, *The Water Dreamers*; Connell; T. Fullerton, *Watershed: deciding our water future*, Sydney, ABC Books, 2001; Keating, *The Drought Walked Through*; C. J. Lloyd, *Either Drought or Plenty: water development and management in New South Wales*, Sydney, Dept of Water Resources, 1988; M. McKernan, *Drought: the red marauder*, Crows Nest, Allen & Unwin, 2005; P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australia's cities*, Canberra, ANU EPress, 2008; and Wahlquist.

<sup>153</sup> Powell has studied the historical management of Australia's water resources in several works, including *Watering the Garden State*, 1989; *Plains of Promise, Rivers of Destiny: Water Management and the Development of Queensland, 1824-1990*, Brisbane, Boolarong, 1991; *The Emergence of Bioregionalism in the Murray-Darling Basin*, Canberra, MDB Commission, 1993; and *Watering the Western Third: Water, Land and Community in Western Australia, 1826-1998*, Perth, Water and Rivers Commission, 1998.

<sup>154</sup> For example, see Powell, *An Historical Geography of Modern Australia*, pp. xv, 11, 32, 129, 270, 312.

<sup>155</sup> J. M. Powell, 'Environment-identity convergences in Australia, 1880-1950', in L. J. Proudfoot and M. M. Roche (eds), *(Dis)placing Empire: renegotiating British colonial geographies*, Burlington, Ashgate, 2005, p. 117.

**Fig. i.3: Evidence of the declining annual rainfall in the Perth area, 1897 to 1996, used by water managers and climate scientists in the late 1990s<sup>156</sup>**



There has been far less work on the effects of colonisation on Indigenous water (and drought) management. Richard Broome, a writer of Australian Aboriginal history, recently called for a ‘new perspective on Australian frontier history, one that focuses on changes to Aboriginal land, landscapes and ecologies created by settler colonialism, rather than one simply focussing on settler-Aboriginal relations’.<sup>157</sup> Although work in this direction is underway, it remains a trickle, not a flood. Over the past decade environmental historian Heather Goodall has endeavoured to redress this imbalance through her research on the rivers of New South Wales.<sup>158</sup> She has examined how Indigenous peoples adapted to the rapid changes wrought by colonisation on local landscapes and waterways, with an emphasis on cultural continuities and connections to country.<sup>159</sup>

<sup>156</sup> Ruprecht, Bates and Stokes, p. 5.

<sup>157</sup> Broome, ‘Changing Aboriginal landscapes of pastoral Victoria, 1830-1850’, p. 88.

<sup>158</sup> See for example, H. Goodall, ‘Main streets and riverbanks: the politics of place in an Australian river town’, in S. H. Washington, P. Rosier and H. Goodall (eds), *Echoes From the Poisoned Well: global memories of environmental injustice*, Lanham, Lexington Books, 2006, pp. 255-70; H. Goodall, ‘Riding the tide: Indigenous knowledge, history and water in a changing Australia’, *Environment and History*, vol. 14, no. 3, 2008, pp. 355-84; and H. Goodall and A. Cadzow, *Rivers and Resilience: Aboriginal people on Sydney’s George’s River*, Sydney, UNSW Press, 2009.

<sup>159</sup> H. Goodall, *Invasion to Embassy: land in Aboriginal politics in New South Wales, 1770-1972*, St. Leonards, Allen & Unwin, 1996, p. xxii; and Goodall and Cadzow, *Rivers and Resilience*, p. 13.

Yet histories of water in Western Australia are sparse in comparison to the southeast of the continent.<sup>160</sup> Powell's commissioned history of the state's water management in the late 1990s, and John Le Page's history of the state's Public Works Department are both invaluable.<sup>161</sup> Local histories have also provided valuable insights into the diverse histories and experiences of Western Australians in the southwest, and the historical significance of water resources and climate variability to their towns and regions.<sup>162</sup> Many of these histories, with the addition of transnational and comparative

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<sup>160</sup> In terms of irrigated agriculture and hydroelectricity, histories of the Murray-Darling Basin have sometimes more in common with the American West than with the western third of Australia. See for example, M. Reisner, *Cadillac Desert: the American West and its disappearing water*, New York, Viking, 1986; R. White, *The Organic Machine: the remaking of the Columbia River*, New York, Hill and Wang, 1995; and Worster, *Rivers of Empire*. Comparisons between eastern Australia and the American West have been explored by Ian Tyrrell, *True Gardens of the Gods: Californian-Australian environmental reform, 1860-1930*, Berkeley, University of California Press, 1999; and Tom Dunlap, *Nature and the English Diaspora: environment and history in the United states, Canada, Australia and New Zealand*, Cambridge, Cambridge University Press, 1999.

<sup>161</sup> J. S. H. Le Page, *Building a State: the story of the Public Works Department of Western Australia, 1829-1985*, Leederville, Water Authority of Western Australia; and Powell, *Watering the Western Third*.

<sup>162</sup> Western Australian historians have documented the histories of most of the state's towns, suburbs and areas. Useful examples of histories from the southwest region include, L. Anderson, *Windows on the Wheatbelt*, Bassendean, Access Press, 1999; R. T. Appleyard and D. Couper, *A History of Trayning: the Shire's contribution to the development of Western Australia's eastern wheatbelt*, Crawley, UWAP Custom, 2009; M. A. Bain, *Ancient Landmarks: a social and economic history of the Victoria district of Western Australia, 1839-1894*, Nedlands, UWA Press, 1975; M. A. Bain, *A Life of its Own: a social and economic history of the City of Geraldton and the Shire of Greenough, 1846-1988*, Geraldton, City of Geraldton, 1996; M. Berson, *Cockburn: the making of a community*, Cockburn, City of Cockburn, 1998; M. Bignell, *First the Spring: a history of the Shire of Kojonup, Western Australia*, Nedlands, UWA Press, 1971; G. C. Bolton, *A Fine Country to Starve In*, Nedlands, UWA Press, 1972; Bolton, *Spoils and Spoilers*; M. J. Bourke, *On the Swan: a history of Swan District, Western Australia*, Nedlands, UWA Press, 1987; E. Braid and E. Forbes, *From Afar a People Drifted: the story of Koorda, a wheatbelt settlement*, Peppermint Grove, E. Forbes, 1997; F. G. Carden, *Along the Canning: a history of the Shire of Canning district, Western Australia, covering its progress from Roads Board to Shire, to town, to city*, Cannington, City of Canning, 1991; H. A. Crake, *A History of Dalwallinu: 'a place to wait a while' – 1846-1979*, Dalwallinu, Shire of Dalwallinu, 1985; P. Crawford and I. Crawford, *Contested Country: a history of the Northcliffe area, Western Australia*, Nedlands, UWA Press, 2003; I. Elliot, *Mundaring: a history of the Shire, Mundaring, Shire of Mundaring*, 1983; R. Erickson, *The Victoria Plains*, Osborne Park, Lamb Paterson, 1971; J. P. Gabbedy, *Group Settlement*, 2 vols, Nedlands, UWA Press, 1988; D. S. Garden, *Albany: a panorama of the Sound from 1827*, West Melbourne, Thomas Nelson, 1977; D. S. Garden, *Northam, an Avon Valley history*, Melbourne, Oxford University Press, 1979; B. K. de Garis (ed.), *Portraits of the South West: Aborigines, women and the environment*, Nedlands, UWA Press, 1993; W. E. Greble, *A Bold Yeomanry: social change in a wheatbelt district – Kulin 1848-1970*, Perth, Creative Research, 1979; L. Hunt (ed.), *Yilgarn: good country for hardy people – the landscape and people of the Yilgarn Shire, Western Australia*, Southern Cross, Yilgarn Shire, 1988; A. Lovell, *Bruce Rock: a revised history*, Bruce Rock, Bruce Rock Shire Council, 1993; J. Ludbrook, *The Big Q: a history of Quairading and its surrounding districts*, Quairading, Shire of Quairading, 2003; T. Spence, *Jerramungup: soldiers of the soil*, Maylands, T. Spence, 2002; T. Spence, *A Man, his Dog, and a Dead Kangaroo: Kellerberrin, Doodlakine, Baandee*, Kellerberrin, Shire of Kellerberrin, 2001; C. T. Stannage, *The People of Perth: a social history of Western Australia's capital city*, Perth, Perth City Council, 1979; A. C. Staples, *They Made Their Destiny: history of settlement of the Shire of Harvey, 1829-1929*, Harvey, Shire of Harvey, 1979; J. P. Stokes, *Cunderdin-Meckering, a Wheatlands Story*,



works, usefully detail the application and adaptation of ‘metropolitan’ science and technology to local contexts, while others explain the development of local solutions to local problems, as well as the emergence of scientific communities in the southwest.<sup>163</sup> The research of Su-Jane Hunt and Geoffrey Bolton on water supplies in nineteenth century Perth has also been very useful for contextualising the movement towards a reticulated city and explaining how technical networks can deepen socio-economic inequities.<sup>164</sup> In contrast to other water engineering projects in the southwest, the Golden Pipeline to Kalgoorlie has attracted more attention from historians, who, over time, have become less enthralled with the heroic feat of engineering and more inquiring.<sup>165</sup>

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Melbourne, Hyland House, 1986; and A. Thomas, *Kalkarni: the Brookton story*, Brookton, Shire of Brookton, 1999.

<sup>163</sup> See, for instance, Q. Beresford, et al., *The Salinity Crisis: landscapes, communities and politics*, Crawley, UWA Press, 2001; G. H. Burvill, *Agriculture in Western Australia: 150 years of development and achievement, 1829-1979*, Nedlands, UWA Press, 1979; J. M. R. Cameron, *Ambition's Fire: the agricultural colonisation of pre-convict Western Australia*, Nedlands, UWA Press, 1981; P. Crawford, ‘Group settlers and land in the Northcliffe region, southwest Western Australia, 1924-1939’, in A. Gaynor, M. Trinca and A. Haebich (eds), *Country: visions of land and people in Western Australia*, Perth, WA Museum, 2002, pp. 125-46; A. Gaynor, ‘Looking forward, looking back: towards an environmental history of salinity and erosion in the eastern wheatbelt of Western Australia’, in Gaynor, Trinca and Haebich (eds), *Country*, pp. 105-124; S. Glynn, *Government Policy and Agricultural Development: a study of the role of government in the development of the Western Australian wheat belt, 1900-1930*, Nedlands, UWA Press, 1975; J. Johnston, ‘The history of the Tuart forest’, in de Garis (ed.), *Portraits of the Southwest*, pp. 136-53; B. Moore, ‘Tourists, scientists and wilderness enthusiasts: early conservationists of the southwest’, in de Garis (ed.), *Portraits of the Southwest*, pp. 110-135. For transnational and comparative histories, see for example, R. A. Buchanan, *The Engineers: a history of the engineering profession in Britain, 1750-1914*, London, J. Kingsley, 1989; D. Gilmartin, ‘Scientific Empire and imperial science: colonialism and irrigation technology in the Indus Basin’, *Journal of Asian Studies*, vol. 53, no. 4, 1994, pp. 1127-49; D. R. Headrick, *The Tentacles of Progress: technology transfer in the Age of Imperialism, 1850-1940*, New York, Oxford University Press, 1988; D. R. Headrick, *The Tools of Empire: technology and European imperialism in the nineteenth century*, New York, Oxford University Press, 1981; J. M. Powell, ‘Elwood Mead and California’s state colonies: an episode in Australasian-American contacts, 1915-31’, *Journal of the Royal Australian Historical Society*, vol. 67, no. 4, 1982, pp. 382-53; K. Proust, ‘Ignoring the signals: irrigation salinity in New South Wales’, *Irrigation and Drainage*, vol. 52, 2003, pp. 39-49; K. Proust, ‘Learning from the past for sustainability: towards an integrated approach’, PhD Thesis, The Australian National University, 2009; J. Rutherford, ‘Interplay of American and Australian ideas for development of water projects in northern Victoria’, in J. Powell (ed.), *The Making of Rural Australia: environment, society and economy*, Melbourne, Sorrett, 1974, pp. 116-34; R. d’Souza, ‘Water in British India: the making of a “colonial hydrology”’, *History Compass*, vol. 4, no. 4, 2006, pp. 621-28; J. B. Teisch, *Engineering Nature: water, development and the global spread of American engineering expertise*, Chapel Hill, University of North Carolina Press, 2011; Tyrrell, *True Gardens of the Gods*; J. L. Wescoat Jr, ‘Wittfogel east and west: changing perspectives on water development in South Asia and the United States, 1670-2000’, in A. Murphy and D. Johnson (eds), *Cultural Encounters with the Environment: enduring and evolving geographic themes*, Landham, Rowman and Littlefield, 2000, pp. 109-32.

<sup>164</sup> S-J. Hunt and G. Bolton, ‘Cleansing the dunghill: water supply and sanitation in Perth 1878-1912’, *Studies in Western Australian History*, vol. 2, 1978, pp. 1-17; and S-J. Hunt, *Water, the Abiding Challenge*, Perth, Metropolitan Water Board, 1980. See also, H. E. Hunt, *Perth’s Early Water Supplies*, Perth, Institution of Engineers Australia (WA), 1984.

<sup>165</sup> G. Blainey, *The Golden Mile*, St. Leonards, Allen and Unwin, 1993; A. Gaynor and J. Davis, ‘People, place and the pipeline: visions and impacts of the Goldfields Water Supply Scheme, 1896-1906’, in Leybourne and Gaynor (eds), *Water: histories, cultures, ecologies*, pp. 15-26.

In light of the ongoing concerns about anthropogenic climate change and drought in Australia, there has been a growing body of local research on climate history over the last decade – thirty years after Geoffrey Blainey lamented the lack of study in these areas by Australian historians.<sup>166</sup> Historians have long approached the writing of histories of climate and society with caution. Their circumspection is the legacy of the racial theories that geographers like Ellsworth Huntington promulgated in the early twentieth century.<sup>167</sup> Laced with Darwinist overtones, such determinist theories argued that a region's climate caused the particular development and character of its resident society. These ideas heavily influenced debates around the White Australia Policy and the white settlement of the tropical northern regions of Australia in the first half of the twentieth century.<sup>168</sup> But the influence of the *Annales* school, with its emphasis on the *longue durée*, has allowed the rehabilitation of climate as a topic of historical analysis. Coinciding with a renewed scientific interest in the possibility of a changing global climate, *Annales* student Emmanuel Le Roy Ladurie published his first study of climate in history in 1972, titled *Times of Feast, Times of Famine*.<sup>169</sup> With his eye firmly turned to change over centuries, Le Roy Ladurie concluded that, 'in the long term, the human consequences of climate seem to be slight, perhaps negligible, and certainly difficult to detect'.<sup>170</sup> The focus of his latest work on the short term, however, suggests the influence of some forty years of debate regarding the complex role of climate in human history.<sup>171</sup>

The southeast of Australia has provided the backdrop for many of these recent climate studies. This is Dorothea McKellar's land of 'drought and flooding rains' and makes an important contribution to the nation's food-bowl. Environmental historians

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See also, R. G. Hartley, *River of steel: a history of the Western Australian Goldfields and Agricultural Water Supply 1895-2003*, Bassendean, Access Press, 2007.

<sup>166</sup> T. Sherratt, 'Human elements', in Sherratt, Griffiths and Robin (eds), *A Change in the Weather*, p. 3; and G. Blainey, 'Climate and Australia's history', *Melbourne Historical Journal*, vol. 10, 1971, pp. 5-9.

<sup>167</sup> Griffiths, 'A humanist on thin ice', <<http://www.griffithreview.com/edition-29-prosper-or-perish/a-humanist-on-thin-ice>>.

<sup>168</sup> D. Walker, 'The curse of the tropics', in T. Sherratt, T. Griffiths and L. Robin (eds), *A Change in the Weather: climate and culture in Australia*, Canberra, NMA Press, 2005, pp. 92-101.

<sup>169</sup> E. Le Roy Ladurie, *Times of Feast, Times of Famine: a history of climate since the year 1000*, London, Allen and Unwin, 1972.

<sup>170</sup> E. Le Roy Ladurie, 1971, cited in C. Pfister, 'Climatic extremes, recurrent crises and witch hunts: strategies of European societies in coping with exogenous shocks in the late sixteenth and early seventeenth centuries', *Medieval History Journal*, vol. 10, no. 1-2, 2007, p. 38.

<sup>171</sup> E. Le Roy Ladurie, *Abrégé d'histoire du climat: du moyen âge à nos jours*, Paris, Fayard, 2007; Pfister, p. 39; and Griffiths, 'A humanist on thin ice', <<http://www.griffithreview.com/edition-29-prosper-or-perish/a-humanist-on-thin-ice>>. For an overview of the debates regarding the role of climate as a causative agent in human history, see N. Langston, 'Air', in D. C. Sackman (ed.), *A Companion to American Environmental History*, Malden, Wiley-Blackwell, 2010, p. 39

have focused largely on how settler Australians have tried to understand the climate and hydrology of the Murray-Darling Basin; the changes wrought upon the region; and how these changes have affected and continue to affect the Basin and its people.<sup>172</sup> Don Garden suggests that, ‘Climatic fluctuations may be even more important in colonial settler societies where learning about and adaptation to climate are critical to success’.<sup>173</sup> I concur with Garden’s position but consider that the period of learning should not be confined only to the colonial period, but extended into the twenty-first century, as anthropogenic climate change destabilises settler understandings of their ‘new’ land.<sup>174</sup>

### ***Charting troubled waters: a thesis overview***

*[I]t is both timely and sufficiently daunting to concentrate on the primal insecurities subsumed in the enduring question of supply.*<sup>175</sup>

- Joseph M. Powell, 2000

In this thesis, I examine the changing understandings of climate, climate variability and water resource management in the southwest region since European colonisation in 1826. I am especially concerned with how urban and rural Indigenous and non-Indigenous Western Australians in the region have responded and adapted to the persistent threat of running out of water, and how these responses have changed over time. I argue that the settler society in the southwest is inherently vulnerable to running out of water because its socioeconomic structures and traditions are modelled on Western European environmental conditions of regular and reliable seasons and water supplies, rather than the environmental characteristics of the region. As Western Australians have largely interpreted water scarcity as an aberration of the ‘normal’

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<sup>172</sup> In addition to the sources in note 148, see D. Garden, ‘The Federation Drought of 1895-1903: El Niño and society in Australia’, in G. Guilbaud and S. Mosley (eds), *Common Ground: integrating the social and environmental in history*, Newcastle upon Tyne, Cambridge Scholars Publishing, 2010, pp. 270-92; Gergis, Garden and Fenby, pp. 485-507; and E. O’Gorman, ‘Unnatural river, unnatural floods? Regulation and responsibility on the Murray River in the 1950s’, *Australian Humanities Review*, no. 48, 2010, <<http://www.australianhumanitiesreview.org/archive/Issue-May-2010/ogorman.html>>, (Accessed: 15 May 2011).

<sup>173</sup> D. Garden, ‘El Niño, irrigation dams and stopbanks: examining the repercussions of the 1876-78 El Niño in Australia and New Zealand’, *History of Meteorology*, vol. 4, 2008, p. 2.

<sup>174</sup> Griffiths, ‘A humanist on thin ice’, <<http://www.griffithreview.com/edition-29-prosper-or-perish/a-humanist-on-thin-ice>>.

<sup>175</sup> J. M. Powell, ‘Snakes and cannons: water management and the geographical imagination in Australia’, in S. Dovers (ed.) *Environmental History and Policy: still settling Australia*, Melbourne, Oxford University Press, 2000, p. 48.

climate, rather than as a consequence of their lack of adaptation, successive state governments and water managers (both professional and lay) have favoured scientific and technical approaches to the problem of running out of water. This preference for technocratic solutions, I argue, has not necessarily improved the resilience of Western Australians to water scarcity and has, in many cases, heightened their vulnerability to running out.

I also argue that the vulnerability and resilience of Western Australians to events of water scarcity is unevenly distributed across the southwest as a result of the region's political and socioeconomic histories. To chart these troubled waters, I have undertaken a chronological study of the period between colonisation and late 2006. This approach has allowed me to examine the interactions of the changing socioeconomic, cultural, political, and scientific understandings of the region's climate and water resources with the southwest's natural rhythms of boom and bust, of ebb and flow.

To understand climate variability and water scarcity in the southwest, I have supplemented meteorological statistics with sources that reveal perceptions of rainfall in their social and cultural contexts, including newspaper reports, Parliamentary proceedings, government publications, and written and oral histories.<sup>176</sup> These sources provide valuable insights into the political responses to issues of water scarcity, as well as personal and collective experiences and memories of running out and/or the fear of running out. These are highly subjective and steeped in their historical context, and must be interpreted accordingly.

In the first chapter, I examine the colonial experience at the Swan River between 1829 and Federation in 1901. Although a convict garrison was established on the south coast of Western Australia at King George Sound in 1826, I have focussed on the Swan River Colony as it provides the foundation for the development of the metropolitan area of Perth, which plays a central role in the story of water in the southwest. Over the course of the nineteenth century, King George Sound (later, Albany) became part of the rural hinterland of the southwest. I contend that the patterns of human settlement and economic structures that emerged during the colonial era laid the foundations for the settler society's ongoing vulnerability to running out of water. I highlight these foundations by contrasting the interactions between people and place of the European colonists with those of the local Nyoongar Aboriginal people, and how these

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<sup>176</sup> Garden, *Droughts, Floods and Cyclones*, p. 19. The difficulties posed by the size of the southwest region combined with time constraints precluded the undertaking of oral histories for my thesis. I have utilised instead the extensive oral history collections of the National Library of Australia and the J. S. Battye Library in Perth.

interactions changed as European settlement expanded over the course of the nineteenth century.

I further argue that the settlement patterns that developed in this colonial period also initiated the inequitable distribution of vulnerability to water scarcity across the region. As a consequence of socioeconomic, political and geographic factors, some people were more exposed to the risk of running out of water than others. During this period, colonists also established what they believed were the ‘normal’ parameters of the southwest’s climate by which they would assess later variations in rainfall and temperature.

Despite the isolation of the Colony and the limited colonial understandings of the southwest’s climate, settlements, developing transportation networks and livelihoods remained relatively insulated from instances of climate variability because the Colony’s small population was sparsely distributed among the more plentifully watered areas. As a result of these factors, I argue that the colonists were relatively complacent in their preparation for the possibility of running out of water. This complacency was exposed, I contend, when the Colony’s population exploded during the goldrush of the 1890s, which combined with unusually dry weather conditions to compromise the Colony’s rudimentary water supplies and sanitation networks. The application of Chadwickian solutions to water scarcity at the end of the nineteenth century, I argue, set in place a reliance on science and technology to prevent running out, and established patterns of unequal vulnerability and resilience to water scarcity in the southwest.

After gold-fever subsided in Western Australia, the Forrest government encouraged the closer settlement of the semi-arid lands between the Avon Valley and the eastern goldfields. The settlement of this wheatbelt region in the decades following Federation in 1901 to the end of the Second World War forms the basis for the second chapter. The livelihoods of some Western Australians were rendered more vulnerable to climate variability on the margins of the agricultural areas. Founded on a paucity of climate information, this agricultural expansion reinforced the vulnerability of the state’s economy to running out of water. The lack of resilience inherent in this enterprise was exposed, I argue, during a succession of droughts that descended upon the wheatbelt on the eve of World War One. These dry conditions raised anxieties about the suitability of the wheatbelt’s climate for agricultural settlement and the need to improve water supplies in these areas. During this time, the government also established the state’s dairy industry on the southwest coast, which was dependent on irrigated

water supplies. In Perth, meanwhile, many residents clamoured for the government to provide them with better quality and more reliable water supplies. These demands were eventually met by the construction of the Canning Dam and the extension of the reticulated network throughout the suburbs. But these developments, I argue, signalled a growing dependence on technocratic approaches to predict and prevent water scarcity, which would in time diminish the hydroresilience of Western Australians.

In Chapter Three, I turn to the post-war decades of the 1950s and 1960s, which were years of great optimism for Western Australians in the suburbs and in the country. Better climate conditions and higher commodity prices helped to encourage more people onto the land, including more marginal farming areas. Policies of rural development pushed settlement further eastward and onto climatically marginal lands, where some farmers would be vulnerable to running out of water in the dry 1970s. With assistance from the Commonwealth, the state government extended reticulated water supplies to parts of the wheatbelt to provide farming families with greater levels of comfort. In this chapter, I introduce the term Big Water to describe the development of large public water supply infrastructure and administration. The dependence of scheme water users on Big Water, I contend, rendered them vulnerable to running out because they became detached from the processes of water supply and enthralled with its illusion of endless water supplies. During this post-war era, I argue that the widespread faith in science and technology to deliver higher living standards and economic prosperity was at times misplaced, as it has contributed to undermining the resilience of many in the southwest to climate variability and water scarcity.

As I show in Chapter Four, the prosperity of the post-war era did not last. Dry conditions and poor commodity prices exposed the vulnerabilities of the Western Australian economy to water scarcity and produced additional hardships for those Western Australians on the land, which would persist into the medium and long-term. For the government and some of the farmers living on the margins of the wheatbelt, the weather was ‘abnormal’ and could therefore be treated with the technocratic solution of cloudseeding. The persistence of these ‘unusual’ dry conditions combined with the worsening problems of dryland salinity and emerging concerns about a changing global climate, to raise doubts about the wisdom of further land clearing in the agricultural areas of the southwest.

In the suburbs, meanwhile, the introduction of water restrictions and user pays combined to initiate a significant cultural change towards water in Perth households. The impact of dry conditions on the suburbs was softened, however, by the

development of other water sources in the region. In contrast, rural Western Australians were largely expected to improve their own hydroresilience. This contrast between urban and rural water development, I argue, fostered an inequitable pattern of vulnerability to running out of water in the southwest in the 1970s.

In Chapter Five, I examine how the rise of the principle of ecologically sustainable development during the 1980s and 1990s combined with economic rationalism to influence the management of water resources in the southwest and to affect the vulnerability of people in the region to water scarcity. The emerging recognition of a changing regional climate exposed the vulnerability of the region to lower rainfall and reduced water supplies. Continuing the historic reliance on technocratic approaches to ‘abnormal’ climate conditions, government water managers began to implement measures to increase the southwest’s scheme water supplies. These measures, I argue, served only to prolong patterns of water use that weakened, rather than improved, the hydroresilience of Western Australians.

The final chapter of this thesis examines the period between 2001 and 2006, when it seemed as though the entire country was in the grip of drought. Growing alarm about the possibility of anthropogenic climate change renewed concerns about water resources in Australia. The state government and its water managers declared the southwest faced a ‘water crisis’ and raised within the electorate concerns that the regional drying trend would lead to urban and rural water shortages in the future. Although there was a greater emphasis on cultural and behavioural changes to improve the hydroresilience of Western Australians, technocratic solutions continued to appeal to politicians and a large proportion of their constituents in the southwest. The completion of a controversial seawater desalination plant in late November 2006 was supposed to protect scheme water users in the region from water scarcity. I argue that its construction perpetuated patterns of water use that render scheme water users vulnerable to running out, and increased the inequitable distribution of hydroresilience between those who had access to scheme water and those who did not.

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In the proceedings of an international symposium held at The University of Western Australia in 2003 titled *Water: Histories, Cultures, Ecologies*, Joe Powell championed the study of Australia’s water histories. He argued, ‘Water management yields such a palpable history, such visible and durable evidence of our experience in and with this

astonishing country. We avoid it at some professional and civic cost.’<sup>177</sup> In this thesis, I situate the southwest’s water history in a much broader context. My thesis contributes to the field of Australian environmental history through its examination of people and place and the tangled climate and water histories of the southwest of Western Australia since European colonisation. The roots of the patterns of vulnerability and resilience that can be found in the southwest in the twenty-first century, and our ongoing reliance on technocratic approaches to problems of water scarcity, can be found in the region’s past. We must turn back to the early nineteenth century to understand how and why Western Australians have interpreted and experienced the climate and water resources of the southwest in particular ways; how and why these experiences changed over time; and the changing roles that science and technology have played in the relationships between Western Australians and the climate and water resources of the southwest.

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<sup>177</sup> Powell, ‘Australian watermarks’, p. 67.



## Settling the Seasons? Sowing the seeds of vulnerability (1829 to 1901)

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*...it is a fearfully dangerous experiment to come so far to a country wholly unknown and with habits formed in other modes of life as wide from this as Earth and Heaven.<sup>1</sup>*

- Captain Sir James Stirling, 1829

*Can you picture to yourself a new colony? You cannot. It is impossible for one, in the midst of the luxurious refinements of the old country, to conceive the actual state of the new one.<sup>2</sup>*

- George Fletcher Moore, 1830

The foundation of the Swan River Colony in the southwest of Australia on 1 June 1829 marked Britain's first attempt to establish an agricultural colony of private settlement since the late eighteenth century.<sup>3</sup> It did not take long, however, for the colony – officially renamed 'Western Australia' in 1831 – to earn a reputation as the Cinderella of the Antipodes, with its colonists struggling to establish themselves between the sea and the sand of the southwest region. For much of the nineteenth century, Western Australia's survival was in the balance and it relied heavily on the Colonial Office to stay afloat. The challenges the colonists faced were more a result of the difficulties of isolation, a small population and limited sources of capital, than the southwest's climate conditions or its availability of water supplies. Yet as the colonists haltingly expanded their colony they etched patterns of settlement, governance and resource use across the southwest and developed particular understandings of the southwest's environments that would render some groups within (and without) Western Australia particularly at risk of water scarcity. During the nineteenth century then, the colonists laid the foundations for the vulnerability of the region's human inhabitants to running out of water in the future.

Although the concept of vulnerability has been predominantly utilised in the contexts of disaster and development studies, I consider that it can also be productively

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<sup>1</sup> J. Stirling, 7 September 1829, cited in P. Statham-Drew, *James Stirling: admiral and founding governor of Western Australia*, Crawley, UWA Press, 2003, p. 145.

<sup>2</sup> G. F. Moore, 4 March 1831, cited in J. M. R. Cameron and E. K. G. Jaggard (eds), *Western Australian Readings*, Perth, Churchlands College, 1977, p. 84.

<sup>3</sup> J. M. R. Cameron, *Ambition's Fire: the agricultural colonisation of pre-convict Western Australia*, Nedlands, UWA Press, 1981, pp. 47, 52.

applied to the environmental histories of settler societies such as Western Australia.<sup>4</sup> In this context, ‘vulnerability’ complements the substantial literature that has examined the ways that colonists have tried to come to terms with colonised environments and both the immediate and long-term consequences of these efforts. In many instances, these repercussions have exacerbated the vulnerabilities of settler societies and lowered their resilience to natural hazards like water scarcity and climate variability. Furthermore, the social relations within these societies positioned some people to be more at risk from environmental change than others.

In some colonial contexts, such as Mauritius, scientific elites and bureaucrats have been alive to such changes and their potential consequences for the economic development of the colony as well as the health of both the colonists and colonised.<sup>5</sup> James Beattie regards these concerns as expressions of ‘environmental anxiety’, and echoes Richard Grove in arguing that these concerns prompted efforts to conserve and ‘improve’ colonial environments.<sup>6</sup> The blending of the ecological concepts of vulnerability and resilience with the complementary notion of environmental anxiety serves to question traditional narratives of imperial dominance over colonised environments and peoples, including the southwest of Australia. If such anxieties are expressions of colonists’ perceptions of their vulnerability in ‘new’ lands, then explorations of the discernable and underlying vulnerabilities of colonists and their settlements in the southwest will go some way to restore ‘anxiety’ into narratives of empire, in order to present a ‘far less confident picture of European expansion’ in the Antipodes.<sup>7</sup>

The struggles faced by the British colonists in southwest Western Australia have been well-documented and much has already been made of the ‘settlers’ initial weakness and suffering’.<sup>8</sup> In this chapter, therefore, I seek to examine the ways in which

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<sup>4</sup> U. Luebken and C. Mauch, ‘Uncertain environments, natural hazards, risk and insurance in historical perspective’, *Environment and History*, vol. 17, 2011, pp. 1-12.

<sup>5</sup> See for instance, R. H. Grove, *Green Imperialism: colonial expansion, tropical island Edens, and the origins of environmentalism*, Cambridge, Cambridge University Press, 1996.

<sup>6</sup> J. Beattie, *Empire and Environmental Anxiety: health, science, art and conservation in South Asia and Australasia*, Basingstoke, Palgrave Macmillan, 2011, p. 1; and Grove.

<sup>7</sup> R. Guha, ‘Not at home in Empire’, *Critical Inquiry*, vol. 23, no. 3, 1997, p. 483.

<sup>8</sup> A. Taylor, “Wasty ways”: stories of American settlement’, *Environmental History*, vol. 3, no. 3, 1998, p. 292. See also, J. M. R. Cameron, ‘The near collapse of Swan River Colony: review and reappraisal’, *Social Sciences Forum*, vol. 1, no. 1, 1973, pp. 7-31; J. M. R. Cameron, ‘Poison plants in Western Australia and coloniser problem solving’, *Journal of the Royal Society of Western Australia*, vol. 59, no. 3, 1977, pp. 71-77; J. M. R. Cameron, ‘Learning as a factor in land use: the inevitability of pastoralism in early Western Australia’, *Journal of Australian Studies*, no. 3, 1978, pp. 30-43; Cameron, *Ambition’s Fire*, pp. 86-135; and P. Statham, ‘Swan River Colony 1829-1850’, in C. T. Stannage (ed.), *A New History of Western Australia*, Nedlands, UWA Press, 1981, pp. 181-210.

particular vulnerabilities became entrenched in the social-ecological systems of the southwest. I examine the establishment of town sites and the development of European farming in the southwest, as well as the consequences of these processes for Aboriginal peoples. I then study the environmental anxieties about the health of colonists in the southwest and how these later translated into sanitary reforms that would help improve public health and transform the colonists' relationships with local water resources and climate conditions. Finally, I discuss the growth in scientific interest in the meteorology of the western third and its connections to agricultural development. Although these trends provided many benefits to the colonial enterprise, it is important to acknowledge that they came with costs, not only to the colonised peoples and landscapes, but also to the colonists themselves and to future generations of people in the southwest.

Three aspects of the colonisation of Western Australia are at the centre of my inquiry: the establishment of a geographically isolated permanent settlement; the absence of local knowledge; and the significance of water in both Indigenous and non-Indigenous cultures. I argue that, firstly, the colonial establishment of permanent settlements throughout the southwest required permanent access to (clean) water and precluded migration in response to variations in climate and water supplies. Second, the colonists' lack of environmental knowledge about the southwest threatened their efforts to establish sustainable farming practices in the region. Finally, their preference for settlement in well-watered areas brought them into competition with local Aborigines, with tragic consequences for the Indigenous peoples of the region. Together, I argue, these elements combined to increase the vulnerability of both the colonists and the colonised to climate variability and water scarcity, albeit in different ways and in different levels of magnitude, during the nineteenth century and beyond.

### ***Putting down roots: settling down in the southwest***

Just days after the landing of the first settlers on Garden Island in June 1829, Captain James Stirling elected to locate the administrative centre of the Swan River Colony, Perth, at the midpoint between the port of Fremantle at the river's mouth and the arable farming lands on the upper Swan, near Guildford (Fig. 1.1). Stirling had interpreted the tall jarrah stands and the alluvial soils near the river as a positive indication of soil fertility, and thus land suitable for farming and grazing.<sup>9</sup> Other towns soon followed as

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<sup>9</sup> P. Statham, 'Western Australia becomes British', and G. C. Bolton, 'Perth a founding city', in P. Statham (ed.), *The Origins of Australia's Capital Cities*, Oakleigh, Cambridge University

colonists established settlements along the Avon and Murray valleys and in the southwest corner of the continent.<sup>10</sup> From this dispersal of townships developed a particular hierarchy of settlement in the southwest in which Perth, the capital, was the locus of socioeconomic and political power but was also dependent upon its hinterland for wealth. This was an agrarian structure highly reliant on a predictable climate and reliable water supplies, with no place for the region's original human inhabitants.

In this section, I contend that the very nature of permanent settlement at the Swan River in 1829 rendered people in the southwest vulnerable to running out of water. This sedentism rooted the colonists to a particular place, which limited their ability to adapt to variations in climate conditions and the availability of water supplies. The region's Nyoongar people, by contrast, had long moved around country according to seasonal sequences, which ensured that their risk of thirst was minimised. The establishment of permanent settlements and infrastructure, founded upon the liberal doctrine of property rights, therefore not only affected the vulnerability of the colonists to water scarcity but also the resilience of the Nyoongar people to environmental variability. The rapid transformation of their lands and the competition with colonists for resources severely affected their ability to maintain the traditional strategies that they had developed over thousands of years to cope with the risk of running out.

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Press, 1989, pp. 126, 142. See also, A. Gaynor and I. McLean, 'Landscape histories: mapping environmental and ecological change through the landscape art of the Swan River region of Western Australia', *Environment and History*, vol. 14, 2008, pp. 187-204.

<sup>10</sup> C. Berry, 'The evolution of local planning in Western Australia', in D. Hedgcock and O. Yiftachel (eds), *Urban and Regional Planning in Western Australia: historical and critical perspectives*, Perth, Curtin University, 1992, p. 18.



will discuss later, this vulnerability became a source of considerable environmental anxiety in the southwest of Western Australia.

By contrast, the region's Nyoongar Aboriginal peoples were highly mobile, which had traditionally ensured their resilience to dry periods. Their peripatetic way of life was not one of Malthusian misery, but rather a product of their connection to country and its upkeep. Their mobility enabled them to fulfil their spiritual responsibilities as Nyoongar people, while allowing them to maximise their resources.<sup>13</sup> For the Nyoongar people, water was (and remains) spiritually significant: they believe their lands were created by the *Waakal* or Nyoongar Rainbow Serpent.<sup>14</sup> What the colonists named the Swan River, the Nyoongar knew as the *Derbal Yiragan*, the winding trail left by the 'huge *Waakal* twisting and turning as it made its way to the coast at *Walyalup* or Fremantle'.<sup>15</sup>

Such trails, at least on the Swan Coastal Plain, provided paths for Nyoongar movement around the region. The Pindjarup Nyoongar, for instance, followed an eighty kilometre 'seasonal run' from Pinjarra to Fremantle (*Walyalup*) by following the 'water chain' of lakes.<sup>16</sup> In addition to their spiritual significance, these water-based trails formed the basis for important 'seasonal food chain[s]'.<sup>17</sup> In the Swan River area, Nyoongar women (*yok*) could catch freshwater *yargan* or turtles in the dried up pools.<sup>18</sup> Explorer George Grey observed the success of *yok* searching for frogs and freshwater shellfish in the summer months, when:

[A] whole troop of native women may be seen paddling about in a swamp, slapping themselves to kill the mosquitoes and sandflies, and every now and then plunging their arms down into the mud and dragging forth their prey. I have often seen them with ten or twelve pound weight of frogs in their bags.<sup>19</sup>

The local Aboriginal people had developed a way of life that was resilient to running out but they could not be prepared for the changes that colonisation and the colonists wrought.

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<sup>13</sup> B. Gammage, "'...far more happier than we Europeans": Aborigines and farmers', *LPAS*, no. 12, 2005, p. 25.

<sup>14</sup> L. Collard, S. Harben and R. van den Berg, *Nidja Beeliar Boodjar Noonookurt Nyininy: A Nyungar interpretative history of the use of boodjar (country) in the vicinity of Murdoch University*, Perth, Murdoch University, 2004, p. 16.

<sup>15</sup> Collard, Harben and Van den Berg, p. 16.

<sup>16</sup> Collard, Harben and van den Berg, p. 52.

<sup>17</sup> Collard, Harben and van den Berg, p. 52.

<sup>18</sup> Collard, Harben and van den Berg, p. 55.

<sup>19</sup> G. Grey, 1841, cited in Collard, Harben and van den Berg, p. 55.

Although estimates vary, about six thousand Nyoongars are thought to have lived in the immediate vicinity of the Swan River at the time of British colonisation, with about four hundred near the site of Perth. For the Colony's first Governor James Stirling, however, the Aboriginal presence in the region was of little consequence and he did not attempt to negotiate a treaty with the Nyoongar to occupy their country.<sup>20</sup> After all, Western Australia was a settler colony, implicitly founded on the supplanting of indigenous peoples on the land and waterways.<sup>21</sup> For the British colonists, these would provide important sources of water supplies, as well as the means of transport and communication. Captain James Stirling, for instance, had assured prospective settlers that the 'freshwater lagoons' he had observed near the Swan River would provide ample water supplies to the Colony (Fig. 1.2).<sup>22</sup> But he had been ignorant of the effects of the Mediterranean rhythms of dry summers and wet winters on the shallow watertable along the coast. During the summer months, the lakes, streams, springs and swamps of the wetlands usually dried up and could not be depended upon for a constant water supply, although they provided valuable sources of food for the Nyoongar people at these times.<sup>23</sup> Colonists would have to cart water from the lakes, and supplement these supplies with brackish groundwater drawn from wells.<sup>24</sup> Natural springs close to Perth, such as at Spring Street, Mill Street and Kennedy Fountain, provided colonists with access to groundwater.<sup>25</sup> These public as well as household wells remained the major sources of water for Perth until at least the end of the nineteenth century, although water storage tanks later afforded the capital's wealthier residents some measure of comfort.<sup>26</sup>

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<sup>20</sup> Bolton, p. 145. John Batman later negotiated a treaty for land access with the Kulin Aboriginal people of Port Phillip in Victoria in 1835 but it was not recognised by the British Government. See, B. Attwood, *Possession: Batman's treaty and the matter of history*, Melbourne, Miegunyah Press, 2009.

<sup>21</sup> P. Wolfe, *Settler Colonialism and the transformation of anthropology: the politics and poetics of an ethnographic event*, London, Cassell, 1999, p. 1.

<sup>22</sup> J. M. Powell, *Watering the Western Third: water, land and community in Western Australia, 1826-1998*, Perth, Water and Rivers Commission, 1998, p. 14.

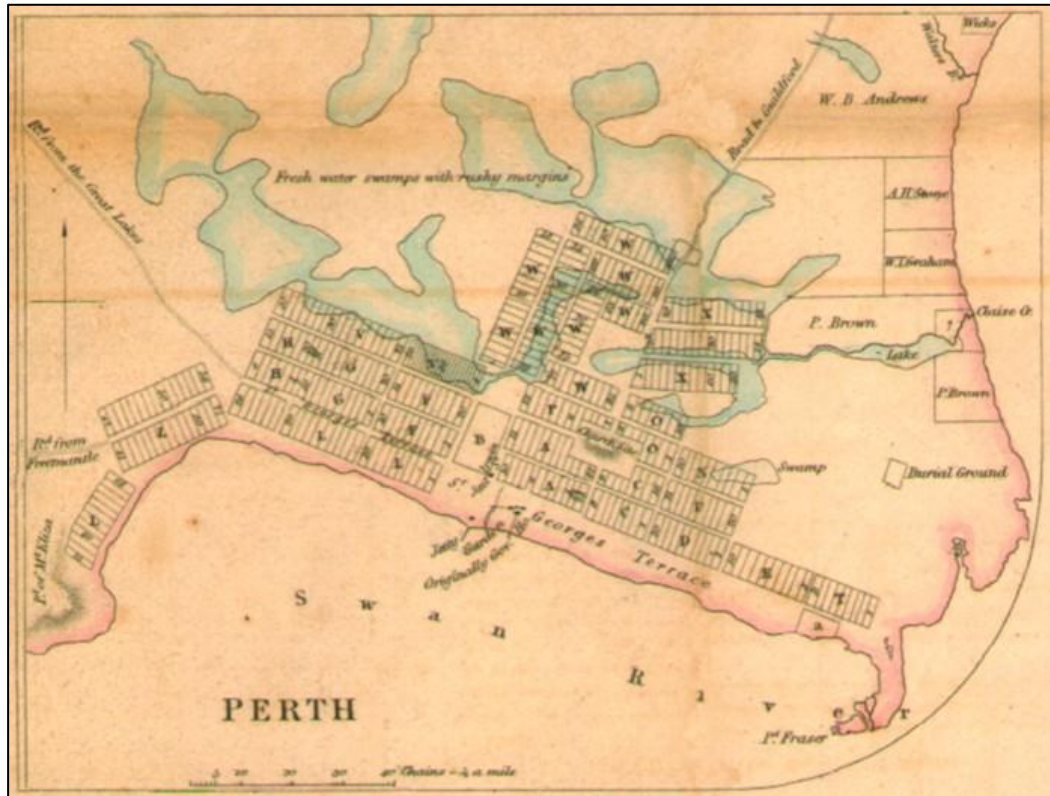
<sup>23</sup> Powell, p. 14.

<sup>24</sup> Powell, p. 13.

<sup>25</sup> W. A. Davidson, *Hydrogeology and Groundwater Resources of the Perth Region, Western Australia*, Perth, WA Geological Survey, 1995, p. 3.

<sup>26</sup> H. E. Hunt, *Perth's Early Water Supplies*, Perth, Institution of Engineers Australia (WA), 1984, pp. 20-21.

**Fig. 1.2: The freshwater swamps near Perth, 1833<sup>27</sup>**



As water was vital to the lives and livelihoods of both the colonisers and the colonised, it was a ‘common ground’.<sup>28</sup> But rather than presenting places for cooperation, waterways became sites of competition and conflict. Nyoongar relationships with their lands contrasted starkly with the colonists’ Lockean attachments to land and property. As Sylvia Hallam observes, ‘That close attachment to land (which Europeans call “property”, “ownership” or “tenure”), under Aboriginal lore and law involved knowledge, rights, and responsibilities’.<sup>29</sup> Theirs was a deeply spiritual connection to country, to the places that ‘had mapped out the pattern of their existence’.<sup>30</sup> The encroachment of colonial settlement across these tribal territories through property ownership and restrictions on Aboriginal movement across country disrupted the traditional practices of the Nyoongar.<sup>31</sup> The foundation of Perth on the banks of the Swan River, for instance, pushed some groups to Mongers Lake, three

<sup>27</sup> J. Arrowsmith, *Discoveries in Western Australia: from documents furnished by the Colonial Office by J. S. Roe, Esq. Surveyor General*, London, J. Arrowsmith, 1833.

<sup>28</sup> See, V. Strang, *The Meaning of Water*, New York, Berg, 2004, pp. 1-8.

<sup>29</sup> S. J. Hallam, ‘Peopled landscapes in southwestern Australia in the early 1800s: Aboriginal burning off in the light of Western Australian historical documents’, *Early Days*, vol. 12, no. 2, 2002, p. 184.

<sup>30</sup> S. Hallam, *Fire and Hearth: a study of Aboriginal usage and European usurpation in southwestern Australia*, Canberra, AIAS, 1975, p. 65.

<sup>31</sup> N. Green, *Broken Spears: Aborigines and Europeans in the southwest of Australia*, Perth, Focus Education Services, 1984, p. 183.



kilometres north of the town site.<sup>32</sup> On the Murray River, according to Lois Tilbrook, ‘soldiers broke down fish traps in the river and fired on the Aborigines who later approached the barracks’.<sup>33</sup> Elsewhere, the competition for resources led to violent clashes between the colonists and the local Nyoongar people, culminating in the bloody battle of Pinjarra in late 1834.<sup>34</sup>

Yet they could not leave their lands. As Captain Frederick Irwin observed in 1835,

Each tribe has its territory and landmarks. If but one is disturbed it experiences a difficulty in falling back, and retiring upon the tribes in its rear, who are similarly situated in their turn. They continue, therefore, to hover about their ancient grounds and depend for their subsistence upon them.<sup>35</sup>

The different approaches to land and property of Western Europeans and Nyoongar peoples were diametrically opposed and they would never be reconciled. Moreover, the imposition of Western European land ownership on Nyoongar lands rendered them both vulnerable, albeit in different ways, to environmental change in the southwest.

### ***Sowing the seeds of vulnerability: farming in the colonial southwest***

Owing to the Colony’s isolation from the other mainland colonies and the rest of the Empire, it was imperative that its colonists learnt to farm in order to feed themselves. But it took some time for the colonists to adapt their limited farming knowledge to the foreign conditions of the southwest.<sup>36</sup> After a difficult first year for the Colony, its hopes improved when Ensign Robert Dale crossed the Darling Ranges and found more fertile farming lands east of Guildford along the Avon River, the uppermost part of the Swan.<sup>37</sup> Yet farming in the southwest remained a challenging enterprise for colonists well into the twentieth century. In this section, I argue that the ways in which settlers

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<sup>32</sup> L. Tilbrook, ‘A chronology of the Swan River Colony 1829-1840’, in S. Hallam and L. Tilbrook (eds), *Aborigines of the Southwest Region 1829-1840*, Nedlands, UWA Press, 1990, p. xiv.

<sup>33</sup> Tilbrook, p. xiv.

<sup>34</sup> Tilbrook, p. xiv. See also, L. Collard and S. Harben, ‘Nartj katitj bidi ngulluckiny koorl? (Which knowledge path will we travel?)’, *Studies in Western Australian History*, vol. 26, 2010, pp. 87-90; and M. J. Bourke, *On the Swan: a history of Swan District, Western Australia*, Nedlands, UWA Press, 1987, pp. 66-85.

<sup>35</sup> F. C. Irwin, 1835, cited in Hallam, *Fire and Hearth*, p. 65.

<sup>36</sup> Cameron, *Ambition’s Fire*, p. 92.

<sup>37</sup> G. Bolton, *Land of Vision and Mirage: Western Australia since 1826*, Crawley, UWA Press, 2008, p. 11. The Swan and Avon Rivers are in fact the same river. The Avon River ‘becomes’ the Swan River where it meets Wooroloo Brook, about thirty kilometres north of Perth. See, Statham-Drew, *James Stirling*, p. 183.

adapted European farming practices to the environmental conditions of the southwest, at the expense of traditional Nyoongar land management, served to render both the colonist and the colonised vulnerable to variations in the climate and water supplies.

The colonists of the Swan River, as I have noted above, brought with them a Western European belief in the ‘centrality of property in land to the definition of civilisation’.<sup>38</sup> Land had long been the main source of wealth in Western Europe and its cultivation was a civilising act for both the land and the people.<sup>39</sup> Furthermore, it was cultivation that rendered the land valuable. Those societies that did not cultivate their lands in a similar fashion were therefore ‘uncivilised’.<sup>40</sup> These linkages between agriculture, civilisation and property provided the foundation for the colonisation of the western third of the continent and the dispossession of the Nyoongar people of the southwest.<sup>41</sup>

As James Belich has noted, an ‘emigrant joined someone else’s society, [whereas] a settler or colonist remade his own’.<sup>42</sup> In terms of the introduction of agricultural and pastoral practices to the southwest, this ‘remaking’ of British agriculture in Australian conditions contributed to the entrenching of vulnerability in the colonial enterprise. With their lack of local knowledge, the colonists’ efforts, as Joseph Powell has depicted in colonial Victoria and South Australia, were those of a ‘giant folk experiment’.<sup>43</sup> Many of the colonists were young workers from Britain’s industrial cities and lacked the necessary skills to establish successful farms.<sup>44</sup> More experienced colonists began to arrive in late 1830 but even they struggled to adapt their knowledge to the foreign conditions of the southwest.<sup>45</sup> Moreover, their British heritage shaped and informed the development of their knowledge of the southwest conditions, such that their interpretation of the Australian environment did little to improve their resilience to variations in climate and water supplies.

Cropping was an especially delicate business and sensitive to the coastal region’s distinctive soil and climate conditions.<sup>46</sup> By virtue of the comparatively long

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<sup>38</sup> Head, p. 63; and Statham, ‘Swan River Colony’, p. 184.

<sup>39</sup> Head, pp. 62-63.

<sup>40</sup> Head, p. 63. See also, R. Waterhouse, *The Vision Splendid: a social and cultural history of rural Australia*, Fremantle, Fremantle Arts Centre Press, 2005, p. 41.

<sup>41</sup> Head, p. 62.

<sup>42</sup> J. Belich, ‘The rise of the Angloworld: settlement in North America and Australasia, 1784-1918’, in P. A. Buckner and R. D. Francis (eds), *Rediscovering the British World*, Calgary, University of Calgary Press, 2005, p. 53.

<sup>43</sup> J. M. Powell, *An Historical Geography of Modern Australia: the restive fringe*, Cambridge, Cambridge University Press, 1988, p. 12.

<sup>44</sup> Cameron, *Ambition’s Fire*, p. 91. See also, Waterhouse, pp. 70-71.

<sup>45</sup> Cameron, *Ambition’s Fire*, p. 92.

<sup>46</sup> Cameron, ‘Learning as a factor in land use’, pp. 36-37.

period required for germination and the host of factors aside from the weather that might interfere with the quality and quantity of the harvest, it took the colonists some time to devise a suitable calendar for the planting cycle of a range of crops.<sup>47</sup> Their English preconceptions and the heavy investment in farming combined to inhibit change, argues James Cameron, such that ‘croplands, equipment and techniques were persisted with long after they were known to be inadequate’.<sup>48</sup> Colonists eventually realised that crops had to be planted early in the growing season to make the most of the winter rains.<sup>49</sup> As Lieut. Bunbury reported in 1836, ‘[T]he sooner the seed is in the ground the better’.<sup>50</sup> Yet the timing of these winter rains was highly variable, arriving any time from early April to the end of May.<sup>51</sup> Herein lay the root of the colonists’ farming problems: they were determined to impose the Western calendar on Australian seasons.<sup>52</sup> European agricultural traditions, and thus economic cycles, were founded on rhythms of regularity and reliability, and therefore predictability, rather than the Australian syncopations of irregularity and unreliability.<sup>53</sup>

As the seasons of the southwest did not conform to the colonists’ expectations, pastoralism offered an alternative, particularly after they had identified plants poisonous to their stock.<sup>54</sup> Prior to the introduction of fencing and heavy stocking, this form of land use was akin in some ways to the mobile Aboriginal hunting economies that colonisation had disrupted.<sup>55</sup> Cameron argues that pastoralism was ‘inevitable’ in the southwest as livestock could be moved to more hospitable areas if the environmental conditions were poor. During the dry seasons between 1834 and 1838, and 1844 to 1846, crops suffered because of the fixity of that farming system, while pastoralists managed to limit the effects of the climatic conditions on their stock because they could practice transhumance.<sup>56</sup> This flexibility provided them a ‘margin of error in the selection of land’ and the availability of land beyond the eastern boundary of the colony

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<sup>47</sup> Cameron, ‘Learning as a factor in land use’, pp. 35-37. See also, J. M. R. Cameron (ed.), *The Millendon Memoirs: George Fletcher Moore’s Western Australian diaries and letters, 1830-1841*, Carlisle, Hesperian Press, 2006, p. 3.

<sup>48</sup> Cameron, ‘Learning as a factor in land use’, p. 37.

<sup>49</sup> Cameron, ‘Learning as a factor in land use’, p. 41.

<sup>50</sup> W. St Pierre Bunbury and W. P. Morrell (eds), *Early days in Western Australia: being the letters and journal of Lieut. H. W. Bunbury*, London: Oxford University Press, 1930, p. 33.

<sup>51</sup> Cameron, ‘Learning as a factor in land use’, p. 41.

<sup>52</sup> See also, L. Robin, *How a Continent Created a Nation*, Sydney, UNSW Press, 2007, pp. 4-5.

<sup>53</sup> See L. Robin, ‘Migrants and nomads: seasoning zoological knowledge in Australia’, in T. Sherratt, T. Griffiths and L. Robin (eds), *A Change in the Weather: climate and culture in Australia*, Canberra, NMA Press, 2005, pp. 42-53.

<sup>54</sup> See, Cameron, ‘Poison plants in Western Australia’, pp. 71-77.

<sup>55</sup> T. Griffiths, ‘How many trees make a forest? Cultural debates about vegetation change in Australia’, *Australian Journal of Botany*, vol. 50, 2002, p. 381.

<sup>56</sup> Cameron, *Ambition’s Fire*, pp. 156-57.

soon beckoned.<sup>57</sup> Pastoralists also benefitted from the accumulation of knowledge in New South Wales and Van Diemen's Land, which reduced the uncertainties of animal husbandry in the west.<sup>58</sup> Following the pattern established in the eastern colonies, the pastoralists of the southwest would similarly 'give way' to the advance of higher-valued farming by the end of the nineteenth century.<sup>59</sup>

The incorporation of the settler society within the global market added yet another dimension of vulnerability to their livelihoods. As Libby Robin has observed, the global economy was (and remains) founded on the four seasons experienced in Europe and North America.<sup>60</sup> This rigid climatically-informed economic cycle lacked the flexibility to incorporate the more variable climate conditions of southern Australia, where nascent agricultural areas were forming. To participate in the market, (Western) Australian farmers had to conform their farming practices to this economic cycle of the northern hemisphere, while attempting to transplant European farming practices in Australian environmental conditions. Furthermore, the international demand for Western Australia's agricultural produce was strongly shaped by the climatic conditions across the world's 'commodity frontier', which in turn affected the prices for these commodities.<sup>61</sup> A surplus or deficit somewhere would have a ripple effect across other agricultural regions. The seasonal conditions and their effect on agricultural production in the southwest were subsumed by 'an expanding capitalist economy [which] devoured natural resources and transformed them into commodities'.<sup>62</sup>

The application of European farming practices to the southwest in the nineteenth century marked a departure from the style of land management that had shaped the region over thousands of years. Where the colonists delineated particular areas of land for the cultivation of introduced plant and animal species, the Nyoongar people had long pursued a hunter-gatherer lifestyle that enabled them to sustain themselves and country. Through European eyes, this way of life was an uncertain one, as evidenced in one of Stirling's reports to Governor Darling in 1827: 'Their numbers are considerable when it is remembered that the sources which supply food are so precarious'.<sup>63</sup>

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<sup>57</sup> Cameron, 'Learning as a factor in land use', p. 37; and Cameron, *Ambition's Fire*, p. 172.

<sup>58</sup> Cameron, 'Learning as a factor in land use', p. 36.

<sup>59</sup> Griffiths, p. 380.

<sup>60</sup> Robin, 'Migrants and nomads', pp. 42-53.

<sup>61</sup> W. Beinart and L. Hughes, *Environment and Empire*, Oxford, Oxford University Press, 2007, p. 2.

<sup>62</sup> Beinart and Hughes, p. 2.

<sup>63</sup> J. Stirling, 1827, cited in Hallam, *Fire and Hearth*, p. 23.

But the Nyoongar were not Malthusian ‘victims of nature’.<sup>64</sup> As Bill Gammage argues, ‘[W]hen Europeans arrived the Aborigines of Australia were deliberately organising plant and animal resources to make them abundant, convenient and predictable’.<sup>65</sup> This contrast is not to suggest that the Nyoongar people lived as ‘Ecological Aborigines’, in some kind of romantic symbiosis of people and nature.<sup>66</sup> Rather, I contend that their wide-ranging and long-term approach to managing the land, often with fire, provided them resilience against adverse seasons.<sup>67</sup> Conversely, European farming in Australian conditions was narrowly dependent on a particular parcel of land with a limited range of crops and stock, and subject to the vagaries of the weather. Although Nyoongar farming was also localised, their approach to crafting the land ensured a more ‘convenient and predictable’ abundance of plant and animal species than the colonists could achieve, at least during the nineteenth century.<sup>68</sup> As a result, ‘When Europeans came, Australia was a made landscape, a managed landscape, far more than it was natural’, and the southwest was no exception.<sup>69</sup>

In contrast to the colonists’ application of a northern hemisphere seasonal calendar to what they considered the corresponding months in the southwest, the Nyoongar followed a six-season ‘calendar’. According to Neville Green, the Nyoongar described the seasons at the Swan River as ‘*Birok*’, which ‘was approximate to December and January, *Burnoru* February and March, *Geran* April and May, *Maggoro* June and July, *Jilba* August and September, and *Kambarang* October and November’.<sup>70</sup> This cycle informed the nature and direction of their movements around country, as well as the size and purpose of their gatherings. During the winter months, the Nyoongar tended to fragment, while they tended to congregate in large groups during the drier warmer months.<sup>71</sup>

Although Aboriginal land management practices had been fashioned over thousands of years and proven resilient to environmental change, their ‘fire-stick farming’ was supplanted by the more aggressive but less resilient structure of European farming during the nineteenth century. By the late 1830s, Western Australia was self-

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<sup>64</sup> Gammage, p. 1.

<sup>65</sup> Gammage, p. 2.

<sup>66</sup> See, H. Goodall, ‘Renewing country: Aboriginal people and their lands in rangeland environments’, *Rangelands Journal*, vol. 23, no. 1, 2001, p. 101.

<sup>67</sup> Gammage, p. 2.

<sup>68</sup> Gammage, p. 6.

<sup>69</sup> Gammage, p. 5.

<sup>70</sup> Green, *Broken Spears*, p. 10. My emphasis. The Nyoongar of the Albany area had different names for these seasons: *Meerningal*, *Maungernan*, *Beruc*, *Meertilluc*, *Pourner*, and *Mokkar*.

<sup>71</sup> Hallam, *Fire and Hearth*, p. 42.

sufficient in basic foodstuffs and pastoralism had become a profitable export industry.<sup>72</sup> Many Nyoongars meanwhile, had been rendered dependent on colonial society such that, ‘the skilled developers of the land appeared as indolent ne’er-do-wells, who needed encouragement to acquire the means of [European] subsistence’.<sup>73</sup> The growing predominance of European farming in the southwest had immediately tragic consequences for the region’s Nyoongar people. Furthermore, the transplanting of this form of land use from the northern hemisphere with its reliance on regular and predictable seasons, rendered both the colonists and the colonised vulnerable to future climate variability.

### ***‘From sojourners to settlers’: British bodies and the climate of the Swan River***<sup>74</sup>

Much has been written about the ‘near collapse’ of the British colony at the Swan River during the 1830s and the reasons for its precarious early existence.<sup>75</sup> Historians have paid less attention, however, to the colonists’ anxieties about the implications of the southwest’s climate conditions for the progress of permanent white settlement. This is partly the result of, as Warwick Anderson notes, ‘the smaller scale of medical work’ in the colony, as well as ‘the lack of opportunity to publish, and the narrowly practical orientation of the local doctors’.<sup>76</sup> Another reason is that the effects of temperate climates on white bodies have often been overlooked in studies of colonial medicine and health.<sup>77</sup> In this section, I deploy Beattie’s concept of ‘environmental anxiety’ to explore colonists’ perceptions and understandings of the southwest’s climate and its possible effects on their health. I argue that their association of human physiology with the regional climate informed colonial studies of the local weather and climate conditions from colonisation to the late 1870s. Such studies, the colonial authorities

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<sup>72</sup> Statham, ‘Swan River Colony 1829-1850’, p. 189.

<sup>73</sup> Hallam, *Fire and Hearth*, p. 65.

<sup>74</sup> W. Anderson, *The Cultivation of Whiteness: science, health and racial destiny in Australia*, Carlton, Melbourne University Publishing, 2005, p. 13.

<sup>75</sup> See note 8. See also, J. S. Battye, *Western Australia: a history from its discovery to the inauguration of the Commonwealth*, Oxford, Oxford University Press, 1924, pp. 74-146; F. K. Crowley, *Australia’s Western Third*, Melbourne, Heinemann, 1960, pp. 11-31; S. Mossman, *Our Australian Colonies: their discovery, history and prospects*, London, Religious Tract Society, 1862, pp. 287-92; and A. Trollope, ‘Australia and New Zealand’, in P. D. Edwards and R. B. Joyce (eds), *Anthony Trollope: Australia*, Sydney, University of Queensland Press, 1967, pp. 557-75.

<sup>76</sup> Anderson, *The Cultivation of Whiteness*, p. 263.

<sup>77</sup> Beattie, p. 41. In addition to Anderson’s research, James Beattie’s recent work on climate and health is an exception, see for example, J. Beattie, ‘Imperial landscapes of health: place, plants and people between India and Australia, 1800s-1900s’, *Health and History*, vol. 14, no. 1, 2012, pp. 1-21.

hoped, would help to allay the anxieties of vulnerable white settlers over the unfamiliar climates of the southwest.

Accompanying Captain Stirling and botanist Charles Fraser on board the *HMS Success* in March 1827 was Royal Navy Surgeon Frederick R. Clause. In his report to the Admiralty, Clause reported, 'I am decided in my opinion that it is the most healthy part of the globe I have visited, having proof positive from the state of my sick list from our arrival off King George's Sound to our return, a lapse of a month, during which time I had only slight cases of colds etc'.<sup>78</sup> Assessments of the colony's 'salubrious' climate conditions for British colonisation rarely wavered from this position. That a surgeon accompanied Captain Stirling and Fraser on their voyage indicates the significance of medicine as a 'science of exploration' in the early nineteenth century. As Anderson explains, 'Medical science was a means of mobilising people across the globe, of bounding a territory, and of filling it in. How, and where, should valuable – and vulnerable – whites live in a new country? Ask the doctor. Ask the scientist'.<sup>79</sup> The prospect of permanent settlement, of transforming Britons 'from sojourners to settlers', required therefore medical insight into the prospects of white people in potential colonies.<sup>80</sup>

Race and environment were important themes of colonial discourse in the eighteenth and nineteenth centuries. Contemporary medical thought held that each race thrived only in its 'ancestral environment' such that emigration from these lands would lead to their degeneration.<sup>81</sup> In the nineteenth century, physicians considered that the human body was inseparable from its environment. They believed that the body 'functioned as an amazingly sensitive system of intake and excretion, of give and take with its changing environment. When that system was in balance, a state of health was achieved; but when the exchange went awry, disease was the result'.<sup>82</sup> Permanent settlement at the Swan River, with its alien environmental conditions, could therefore lead to the eventual demise of the resident white community. Consequently, emigration and colonisation were sources of substantial environmental anxiety for Britons throughout the Empire. Hippocratic assessments of the potential healthfulness of a region's climate, such as that proffered by Surgeon Clause, went some way to allay

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<sup>78</sup> F. R. Clause, 31 March 1827, cited in '6. Report to Darling (and the Colonial Office) on Swan River, 1827', in P. Statham-Drew (comp.), *The Stirling Reports and Other Key Documents*, 2003, MS0109B, Reid Library, The University of Western Australia.

<sup>79</sup> Anderson, p. 4.

<sup>80</sup> Anderson, p. 13.

<sup>81</sup> Anderson, p. 14.

<sup>82</sup> Anderson, p. 13.

these fears and to offer assurance that Britons could adapt and prosper in other parts of the Empire.<sup>83</sup>

Meteorological analyses of newly colonised places served then as a complement to the human body as a barometer of environmental change.<sup>84</sup> The collection of meteorological observations at the Swan River Colony commenced in May 1829. En route to the west coast of Australia, Captain Stirling instructed his Colonial Surgeon, Charles Simmons, to maintain a meteorological journal for the Colony, documenting barometer and thermometer readings, as well as the wind direction, and ‘every circumstance of the weather affecting health’.<sup>85</sup> These measurements were continued after the colony was established, with observations recorded at other loci of colonial science, the Botanic Gardens and the Colonial Hospital.<sup>86</sup>

For potential emigrants, such meteorological analyses provided unassailable evidence of the suitability of a place for permanent settlement. With its small population, the promoters or boosters of Western Australia were especially attuned to the role that its climate could play in attracting settlers. But it had to compete with other colonies in similarly temperate regions.<sup>87</sup> In his report to the Admiralty in 1827, Captain Stirling had recommended the Swan River region as an ideal place of respite for those suffering respiratory illnesses.<sup>88</sup> This approach reflected the prevailing belief that ‘[i]f a British body was already disordered and unwell in its natural climate, then a change might

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<sup>83</sup> Anderson, p. 14.

<sup>84</sup> Anderson, p. 33; J. Gentilli, ‘A history of meteorological and climatological studies in Australia’, *University Studies in History*, vol. 5, no. 1, 1967, p. 55; and G. Mitman, ‘In search of health: landscape and disease in American environmental history’, *Environmental History*, vol. 10, 2005, p. 207.

<sup>85</sup> Gentilli, p. 63.

<sup>86</sup> Meteorological Journal, Colonial Hospital, Perth, Cons 1270, 36, State Records Office of Western Australia (hereafter, SROWA); Meteorological Journal, Survey Office, Cons 1270, 37, SROWA; Meteorological Journal, Perth, Cons 1270, 1-11, SROWA, and M. Utting, *Windows to the Southern Skies*, Perth, Murdoch University, 1991, p. 14. Official and private meteorological measurements in the Swan River Colony, like in the other colonies, recorded air pressure, temperature and wind direction. Rainfall records, however, appear to have been taken only sporadically and were neither collated nor investigated for evidence of trends. This state of affairs mirrored the British situation, where the systematic collection, collation and study of rainfall data did not get underway until the 1860s. See, Gentilli, pp. 61-72; and D. E. Pedgley, *A Short History of the British Rainfall Organisation*, Reading, Royal Meteorological Society, 2002, pp. 2-3.

<sup>87</sup> The Swan River Colony’s rivals included the Cape Colony, Van Diemen’s Land (Tasmania), New Zealand, California and Canada. See, Beattie, p. 57; J. Beattie, ‘Colonial geographies of settlement: vegetation, towns, disease and well-being in Aotearoa/New Zealand, 1830s-1930s’, *Environment and History*, vol. 14, 2008, pp. 583-610; H. Deacon, ‘The politics of medical topography: seeking healthiness at the Cape during the nineteenth century’, in R. Wrigley and G. Revill (eds), *Pathologies of Travel*, Atlanta, Rodopi, 2000, pp. 279-97; L. Nash, *Inescapable Ecologies: a history of environment, disease and knowledge*, Berkeley, University of California Press, 2006, pp. 36-42; and N. Nicholls, ‘A healthy climate?’, in E. K. Webb (ed.), *Windows on Meteorology: Australian perspective*, Melbourne, CSIRO Publishing, 1997, pp. 105-106.

<sup>88</sup> Anderson, p. 40; and J. M. Powell, ‘Medical promotion and the consumptive immigrant to Australia’, *Geographical Review*, vol. 63, no. 4, 1973, p. 449-76.



help to restore order in [its] system'.<sup>89</sup> For instance, William H. Stone of the Brompton Hospital for Consumption observed in the *Lancet* in 1864 that, 'There are hundreds of Englishmen, many in fair circumstances, or practising useful and lucrative handicrafts, who but for our inclement sky would be healthy, useful members of society' if they emigrated to Western Australia.<sup>90</sup>

This colonial 'medicalisation of space' regularly compared and contrasted the suitability of different climates for European health.<sup>91</sup> As such, the dry and temperate climate of the southwest of Western Australia was contrasted with the tropical climes of India. The Western medical geography of the nineteenth century attributed high rates of disease and morbidity among Europeans in the tropics to the heat and humidity of these climes, 'especially when compounded by the usual intemperance, imprudence, diet and demeanour of the newly arrived'.<sup>92</sup> Stirling and other 'boosters' argued that the temperate Swan River outpost was well placed to serve as a convalescent station for British troops serving in tropical India.<sup>93</sup> The region's climate, Stirling argued in 1859, was far superior in its medicinal qualities to the Indian hill stations that the British favoured – after all, he explained, 'The climate of the Hills is only Preservative and not Curative in its effects on Indian maladies'.<sup>94</sup> In defence of the southwest's long, hot summers, Stirling argued that, "'[T]he extreme dryness of [Western Australia's] ... atmosphere prevents that heat from being injurious to health", and did not preclude Europeans from following "agricultural avocations".<sup>95</sup> During his term as Governor (1883-1889), Sir Frederick Napier Broome revived this agenda, revealing the persistence of physiological understandings of the climate in the western third, if only for their promotional value.<sup>96</sup> Although such assessments of Western Australia's healthy climate were inflated, they went some way to allay settler anxieties about the suitability of the western third for permanent settlement.

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<sup>89</sup> Anderson, p. 28.

<sup>90</sup> W. H. Stone, 'Change of climate as a remedial agent', *Lancet*, 6 August 1864, p. 167.

<sup>91</sup> See also, D. N. Livingstone, 'The moral discourse of climate: historical considerations on race, place and virtue', *Journal of Historical Geography*, vol. 17, no 4, 1991, pp. 413-34.

<sup>92</sup> See, G. Bankoff, 'Rendering the world unsafe: "vulnerability" as Western discourse', *Natural Disasters*, vol. 25, no. 1, pp. 20-22. Bankoff argues that such depictions of the tropics belong to a wider Western discourse of tropicality, development and vulnerability, which 'denigrates large regions of the world as disease-ridden, poverty-stricken and disaster-prone' (p. 20).

<sup>93</sup> Cameron, 'Western Australia: 1616-1829', p. 382; Anderson, pp. 264-65; J. P. Westrip and P. Holroyde, *Colonial Cousins: a surprising history of connections between India and Australia*, Kent Town, Wakefield Press, 2010, pp. 117-18, 252; and Beattie, *Empire and Environmental Anxiety*, p. 56.

<sup>94</sup> J. Stirling, 1859, cited in Beattie, *Empire and Environmental Anxiety*, p. 57. See also, A. Inglis, *Summer in the Hills – the nineteenth century mountain resort in Australia*, Melbourne, Australian Scholarly Publishing, 2007.

<sup>95</sup> Stirling 1859, cited in Beattie, *Empire and Environmental Anxiety*, p. 57.

<sup>96</sup> Beattie, *Empire and Environmental Anxiety*, p. 56.

## *Eastward bound*

White explorers had first ventured inland and along the south coast in the 1830s seeking better pastures beyond the Avon Valley. By the mid-1860s, the likes of Henry Maxwell Lefroy and the Forrest brothers had reached the ‘unknown and forbidding eastern districts’ of the Yilgarn region, just west of what would later become the eastern goldfields. As the settlers’ diaries and the exploration journals of these adventurers reveal, however, these were not ‘unknown’ lands at all.<sup>97</sup> Broadly, these sources offer two characterisations of the local Indigenous peoples, either ‘loyal and faithful servants’ and guides, or hostile savages trying to repel heroic pioneers and explorers.<sup>98</sup> As homesteads and sheep stations were established, these characterisations of the local Aborigines converged at the waterways of the pastoral regions.

The further east the explorers travelled, the fewer sources of permanent water they found amongst the york gums, jam wattles and native grasses.<sup>99</sup> During an expedition with Surveyor-General John Septimus Roe in 1836, George Fletcher Moore wryly observed, ‘I fear you will think I am only talking metaphorically when I say throughout the greater part of that vast space we did not see as much water at once as there is in your fishpond’.<sup>100</sup> The only sources of water there, these explorers learned, were to be found at the granite outcrops that dot the landscape.<sup>101</sup> Some of these outcrops stand at over thirty metres like tors, while others sprawl flat against the ground. These rocks had long provided water supplies for local Aboriginal peoples and served as important markers along trading routes.<sup>102</sup>

To maximise the amount of water they could harvest from these granite outcrops, Aboriginal water managers made the most of natural processes. Weathered sections of granite could be scraped away to form rock or ‘gnamma’ holes where water

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<sup>97</sup> N. Green, ‘Aborigines: the changing scene’, in L. Hunt (ed.), *Yilgarn: good country for hardy people – the landscape and people of the Yilgarn Shire, Western Australia*, Southern Cross, Shire of Yilgarn, 1988, pp. 129-32.

<sup>98</sup> H. Reynolds, ‘The land, the explorers and the Aborigines’, *Historical Studies*, vol. 19, no. 75, 1980, pp. 213-14.

<sup>99</sup> R. Underwood, ‘The jam post and plain wire fence: an insight into York’s agricultural, ecological and economic history’, *Barladong*, vol. 5, 2005, pp. 16-27.

<sup>100</sup> G. F. Moore, cited in E. Braid, ‘John Septimus Roe: first explorer of the wheatlands; the search for an inland sea’, *Early Days*, vol. 7, 1975, p. 92.

<sup>101</sup> F. Crowley, *Australia’s Western Third: a history of Western Australia from the first settlements to modern time*, Melbourne, Heinemann, 1970, p. 86.

<sup>102</sup> J. Stephens, ‘Karalee Rock: the formation of place and identity’, *Urban Policy and Research*, vol. 20, no. 1, 2002, p. 92; and Braid, p. 86.

could accumulate in ‘cup-sized depressions’.<sup>103</sup> Moore was the first European to record and publish his impression of the Aboriginal name for these holes. In his 1842 *Descriptive Vocabulary of the Language of the Aborigines*, he described them as ‘ngamar’ and gave the meaning as ‘a hole or pool of water in a rock’.<sup>104</sup> Another way that the Aborigines, and later colonists, formed holes or water channels was by lighting fires in cracks and using the heat to fracture the rock.<sup>105</sup> Rainwater would also stream down the granite rock face and accumulate at the base of the outcrops.<sup>106</sup> If a rock or clay basin lay beneath the surface, a soak would accumulate that would hold the water. In other dry areas, Aborigines reportedly scooped out holes in the clay to trap water.<sup>107</sup> To prevent evaporation and pollution by animals and birds, Aborigines covered the holes and soaks with branches and soil.<sup>108</sup> When water supplies were scarce, the local Aboriginal peoples were observed to ‘move back west’ to better-watered areas.<sup>109</sup>

The white explorers were heavily reliant on the knowledge of local Indigenous peoples to find these precious reserves of water ‘hidden’ in the landscape. The explorers’ dependence on Indigenous knowledge unsettles narratives of colonial domination of the environment and offers insights into the nature of the interactions between Indigenous and non-Indigenous peoples during the nineteenth century. Along the south coast, for instance, Aborigines had showed the Bussell family where to find water and assisted on a journey to the Swan River.<sup>110</sup> On an expedition to the Yilgarn, B. D. Clarkson, C. Harper and L. Lukin took their guide Gyngich, who had previously assisted other explorers in the area. Clarkson recorded his diary that he felt certain that ‘we shall not be able to get on well without (a guide), with the country in its present dry state’.<sup>111</sup>

On an expedition to map the watering holes of the pastoral country in the mid-1860s, explorer Charles Cooke Hunt took four Aboriginal guides – Mundal, Tommy

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<sup>103</sup> I. A. E. Bayly, ‘Review of how Indigenous people managed for water in desert regions of Australia’, *Journal of the Royal Society of Western Australia*, vol. 82, 1999, p. 18.

<sup>104</sup> G. F. Moore, cited in I. A. E. Bayly, *Rock of Ages: human use and natural history of Australian granites*, Nedlands, Tuart House, 1999, p. 29.

<sup>105</sup> Braid, pp. 85-86.

<sup>106</sup> Braid, p. 86.

<sup>107</sup> Braid, pp. 85-86.

<sup>108</sup> Braid, p. 86.

<sup>109</sup> Hunt, 1866, cited in L. Hunter, ‘Climate and landscape’, in Hunt (ed.), *Yilgarn*, p. 45.

<sup>110</sup> J. G. Bussell, ‘Account of the Country intervening between Augusta and Swan River’, and ‘Mr Bussell’s Journal of an Expedition to the River Vasse, from the Blackwood. 10-21 November 1831’, in J. Shoobert (ed.), *Western Australian Exploration, Vol. 1, December 1826 – December 1835*, Carlisle, Hesperian Press, 2005, pp. 227-28, 270.

<sup>111</sup> B. D. Clarkson, 1864, cited in, J. Maddock, *Westonia: the wheels of change*, Westonia, Shire of Westonia, 1998, p. 49.

Windich, Jimmy and Cowitch.<sup>112</sup> Hunt was amazed at the extent of their local knowledge: '[T]hey all seem to know the direction and names of these places'.<sup>113</sup> He attached Aboriginal names to many of the watering holes he recorded, such as 'Youndegin', 'Dodolokine' and 'Gnarlbine'.<sup>114</sup> Under Hunt's direction, convicts cleaned out some of these waterholes out and lined them with stones to make them more permanent and accessible to (white) people and stock.<sup>115</sup>

The establishment of watering points such as these throughout the inland areas was important for the development of the region's pastoral industry. Near these points, pastoralists set up their homesteads to ensure that there would be adequate supplies for their family and their stock.<sup>116</sup> During 'normal' seasons this pastoral utilisation of these sources was not necessarily problematic. When rains failed, however, these waterways became extremely valuable to both the pastoralists and the local Aborigines, particularly when less reliable sources had dried up. These water sources also provided important opportunities for Aborigines to access food because they attracted thirsty game that could be trapped. But these creatures also had to compete with the pastoralists' stock, which exacted a heavy toll on many species including the malleefowl, the chudditch and the bilby.<sup>117</sup> The expansion of pastoralism in the southwest disrupted traditional food and water sources, and therefore, diminished the resilience of local Aboriginal people to climate variability and water scarcity.

### ***Building the Sanitary City***

*Most people attribute all this [illness], as usual, to "the weather", and though the extraordinary climatic changes we have recently experienced may be a factor in the causation of these diseases it is as any rate only a secondary one, for we have it upon the best medical authority that the primary cause is the impurity of the water which the inhabitants of Perth are compelled to drink.*<sup>118</sup>

- *Inquirer*, May 1883

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<sup>112</sup> Maddock, p. 51.

<sup>113</sup> Hunt, 1866, cited in Hunter, p. 45.

<sup>114</sup> Water Authority of Western Australia, *The Wells of Explorer Charles Hunt: an assessment of their condition and historical significance as a groundwater resource*, 1991. See also Maddock, p. 35.

<sup>115</sup> Green, 'Aborigines: the changing scene', p. 130; Stephens, p. 93.

<sup>116</sup> E. Braid, 'Explorer surveyors classification work', *Journal of the Royal Historical Association of Western Australia*, vol. 8, no. 4, 1980, p. 25; and Maddock, p. 52.

<sup>117</sup> I. Abbott, 'Historical perspectives of the ecology of some conspicuous vertebrate species in south-west Western Australia', *Conservation Science Western Australia*, vol. 6, no. 3, 2008, pp. 1-214.

<sup>118</sup> 'Sanitary Matters', *Inquirer*, 2 May 1883, p. 3.

Although boosters boasted the ‘salubrity’ of the southwest region’s climate to potential emigrants, the colonial environment remained a source of significant anxiety for its residents. Diseases were not uncommon in the region and their incidence seemed at odds with the prevailing faith in the ‘restorative’ powers of its temperate climate. Anglican clergyman John Wollaston wondered in 1841, ‘I do not think this is so pleasant a climate as has been represented’.<sup>119</sup> But it was not until the 1870s that medical thinking began to move away from climate and related phenomena, such as miasma, to other causes of disease. In this section, I examine the changing medical understandings of the links between environment, health and settlement in Western Australia. Outbreaks of disease, I argue, exposed the unequal vulnerabilities inherent to permanent settlement and its reliance on clean and reliable water supplies. As Linda Nash has observed, ‘Settlers’ bodies were ... instruments of colonialism in a double sense – in that they both facilitated the colonial project and registered that project’s physical effects’.<sup>120</sup> Although the colony’s sanitary savants went some way to improving the health of many people, I contend that their deference to engineering solutions laid the foundations for the dependence of the southwest’s settlements on technical networks of water supplies and sanitation, which would serve to diminish their hydroresilience in the future.

Although the major settlements of the southwest remained relatively small compared to other cities and towns in Australasia (Figure 1.3), the colony was not immune to the social and physiological ills that physicians from the mid-nineteenth century were increasingly associating with urbanisation. In Europe and Great Britain, urban spaces had become sources of anxiety because they harboured bad smells (understood as ‘miasma’), and these concerns soon emerged in the growing metropolises of southern Australia. Although the southwest’s Aborigines had suffered from the introduction of new diseases such as influenza and measles, Western Australia’s isolation had served to protect its colonists from epidemics experienced elsewhere.<sup>121</sup> During the 1870s, however, the death rate among colonists from enteric diseases, such as diarrhoea and dysentery, soared.<sup>122</sup>

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<sup>119</sup> J. Wollaston, ‘An influenza epidemic (Dec, 1841)’, in M. Aveling (ed.), *Westralian Voices: documents in Western Australian social history*, Nedlands, UWA Press, 1979, p. 206.

<sup>120</sup> Nash, *Inescapable Ecologies*, p. 18.

<sup>121</sup> Green, *Broken Spears*, pp. 235-36.

<sup>122</sup> A. R. Waylen, ‘Report by the Colonial Surgeon on the Public Health of the Colony for the Year 1877’, in *Western Australian Votes and Proceedings of the Legislative Council (WALCV&P)*, Perth, Govt Printer, 1878, pp. 3-4.

**Fig. 1.3: Comparison of settler population of colonies**<sup>123</sup>

<i>Year</i>	<i>1829</i>	<i>1850</i>	<i>1860</i>	<i>1880</i>	<i>1901</i>
New South Wales ( <i>Est. 1788</i> )	31,034	154,976	197,851	404,952	720,840
Van Diemen's Land ( <i>Est. 1803; 'Tasmania' from 1856</i> )	15,143	44,229	49,653	60,568	90,945
<b>Western Australia</b> ( <i>Est. 1829</i> )	<b>769</b>	<b>3,576</b>	<b>9,597</b>	<b>16,985</b>	<b>117,885</b>
South Australia ( <i>Est. 1836</i> )		35,902	64,340	147,438	184,439
Victoria ( <i>Est. 1851</i> )			330,302	450,558	608,436
Queensland ( <i>Est. 1859</i> )			16,817	124,013	282,291

Coinciding with these outbreaks of disease in the 1870s was the appointment of the colony's first locally born medical practitioner to the post of Colonial Surgeon (1872-1895). Dr Arthur Waylen had undertaken his training in Britain during the 1840s and 1850s, where it is likely he became attuned to the Chadwickian movement for sanitary reform.<sup>124</sup> In his 1842 *Report on the Sanitary Conditions of the Labouring Population of Great Britain*, Edwin Chadwick had advocated the provision of pure, piped water supplies and a water-flushed sewerage network to remove disease-ridden filth and refuse.<sup>125</sup> In light of these recommendations, Waylen identified the colony's 'insufficient and contaminated' water supplies as the source of disease, particularly among the less affluent who could not afford to construct tanks for water storage.<sup>126</sup> Those reliant on wells were especially at risk of disease, as backyard cesspools were prone to leaking and polluting the water supplies.<sup>127</sup> Extensive programs to drain the lakes and swamps around the city in the 1860s and the early 1870s also contributed to the declining quality of the water drawn from these wells.<sup>128</sup>

<sup>123</sup> Australian Bureau of Statistics (ABS), *Australian Historical Population Statistics*, Canberra, ABS, 2008, <[http://www.abs.gov.au/AUSSTATS/subscriber.nsf/log?openagent&3105065001ds0001\\_2008.xls&3105.0.65.001&Data%20Cubes&ED3777A70ACA4E0DCA25749B00176970&0&2008&05.08.2008&Latest](http://www.abs.gov.au/AUSSTATS/subscriber.nsf/log?openagent&3105065001ds0001_2008.xls&3105.0.65.001&Data%20Cubes&ED3777A70ACA4E0DCA25749B00176970&0&2008&05.08.2008&Latest)>, (Accessed: 16 January 2012).

<sup>124</sup> S-J. Hunt and G. C. Bolton, 'Cleansing the dunghill: water supply and sanitation in Perth 1878-1912', *Studies in Western Australian History*, vol. 2, 1978, p. 2.

<sup>125</sup> T. Dingle, 'The life and times of the Chadwickian solution', in P. N. Troy (ed.), *Troubled Waters: confronting the water crisis in Australia's cities*, Canberra, ANU Epress, p. 7.

<sup>126</sup> Waylen, pp. 3-4.

<sup>127</sup> Hunt and Bolton, pp. 2-3.

<sup>128</sup> Hunt and Bolton, p. 2. For further detail regarding these drainage efforts, see F. Morel-EdnieBrown, 'Tethered Antipodes: imperial impress in central Perth, Western Australia', in P. Limb (ed.), *Orb and Sceptre: studies on British Imperialism and its legacies, in honour of Norman Etherington*, Clayton, Monash University Epress, 2008, pp. 4.1-4.43.

Although Perth had been likened to a dunghill at a public meeting of the colony's most prominent citizens in early 1878, progress towards improving sanitary conditions was slow.<sup>129</sup> A correspondent to the *Inquirer* mused in 1879 that, 'Perhaps if we lost a Governor or a Bishop, several members of Parliament, and all the City Council, something might be done for the preservation of public health'.<sup>130</sup> Yet Perth was not the only place where sanitation was inadequate: Waylen was also concerned about the state of the eastern districts, particularly York, Northam and Toodyay (then Newcastle).<sup>131</sup> In York, for instance, he reported that residents 'can hardly expect to escape sickness engendered by foul and insufficient water supply'.<sup>132</sup> He attributed the poor conditions to the complacency of the affluent and the Municipal Councils, whose legal responsibility it was to carry out sanitary duties. But Waylen's views fell largely on deaf ears, particularly as the drier conditions of the late 1870s had reduced the contamination of wells, which in turn, lowered the death rate.<sup>133</sup> It was not until the arrival of Governor Frederick Napier Broome in 1883 that the local champions of Chadwickian sanitary reform could prevail.<sup>134</sup>

Broome's first year of office had been marred by outbreaks of diseases such as measles, influenza, typhoid and diphtheria, which were especially felt by Aborigines and the less affluent within the southwest.<sup>135</sup> Waylen was quick to alert the Governor to the source of these diseases – the 'sewerage contamination of air and water' – and placed the blame for this state of affairs at the feet of the Municipal Councils.<sup>136</sup> Broome immediately took charge of the situation and appointed a royal commission under Waylen to inquire into the sanitary conditions of Perth and Fremantle. Also appointed to the commission were Waylen's younger colleague Dr Edward Scott, a fellow campaigner for sanitary reform, and zealous temperance advocate Reverend William Traylen. As Geoffrey Bolton has wryly noted, 'A man who urged others to drink water had a particular interest in the quality of public supply'.<sup>137</sup>

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<sup>129</sup> Hunt and Bolton, p. 3. The new director of public works J. H. Thomas joined with Waylen, Governor Ord and the Colonial Secretary to convene a meeting, which was attended by over sixty people. Among them were officials, medical practitioners and members of the Perth City Council.

<sup>130</sup> Diogenes, 'Wanted – "medica manus"', *Inquirer*, 22 January 1879, p. 3.

<sup>131</sup> 'Colonial Surgeon's Report', *Inquirer*, 20 December 1862, p. 4.

<sup>132</sup> A. R. Waylen, 'Report by the Colonial Surgeon on the Public Health of the Colony for the Year 1881', in *WALCV&P*, Perth, Govt Printer, 1882, p. 4.

<sup>133</sup> Hunt and Bolton, p. 3.

<sup>134</sup> Hunt, *Perth's Early Water Supplies*, p. 5.

<sup>135</sup> Hunt and Bolton, p. 4.

<sup>136</sup> A. R. Waylen, 1884, cited in Hunt and Bolton, p. 4.

<sup>137</sup> Hunt and Bolton, p. 4.

The evidence presented to the Commission revealed the extent of the inadequate sanitation in the major towns of the southwest, which had failed to keep pace with the growing population. In 1885, the Commission convinced the Legislative Council and municipal councils of the need to overhaul the storage and disposal of waste and sewage, and to replace the ‘antiquated and ... impossible wells and tanks as sources of [water] supply’ for Perth and Fremantle.<sup>138</sup> In the 1880s, corrugated iron had only been recently introduced to Western Australia so its use for rainwater tanks was still limited to more affluent households, while backyard wells could only provide limited supplies of uncertain quality.<sup>139</sup> Doubts were also cast on the amounts of water that could be abstracted from artesian bores around Perth, even though bores had been drilled previously in its vicinity. Lacking the resources to conduct a thorough exploration of this resource, the Government Geologist concluded that, ‘[T]here is no likelihood of obtaining a water supply on such principles here’.<sup>140</sup> Lake Monger could serve as an interim measure but eventually, the Commissioners believed, Perth’s water supplies would be piped from a dam across one of the rivers from the Darling Range.<sup>141</sup> Transporting water to the capital from thirty kilometres away was, however, beyond the finances and engineering expertise of the colonial government at this time.

The Commissioners paid little heed to the varied experiences of the eastern colonies.<sup>142</sup> They reported that they had instead, ‘relied on our own local and personal knowledge’.<sup>143</sup> The slow pace of government action on the Commissioners’ report led the Perth City Council to organise a supply of piped water to the capital. To date, engineering works in Western Australia had focussed predominantly on the construction of buildings, bridges, roads and most recently railways – vital projects for economic development in the western third. Roads and railways also required watering points to be constructed alongside to water drays and slake the thirst of the steam locomotives. Two engineers associated with these projects were Henry John Saunders, chief engineer of the Midland Railway Company, and his business partner, civil engineer James Barratt. Like many other colonial engineers across the continent, they had trained in

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<sup>138</sup> *West Australian*, 24 July 1885, p. 3.

<sup>139</sup> Hunt and Bolton, p. 5.

<sup>140</sup> Cited in Hunt, *Perth’s Early Water Supplies*, p. 9.

<sup>141</sup> Hunt and Bolton, p. 5.

<sup>142</sup> Hunt, *Perth’s Early Water Supplies*, p. 8.

<sup>143</sup> ‘Report of the Commission to inquire into and report upon the sanitary condition of the City of Perth and the Town of Fremantle especially with regard to the questions of water supply and the disposal of sewerage’, *WALCV&P*, Perth, Govt Printer, 1885, p. 5. See, Hunt and Bolton, p. 5.



Britain, and were public men, serving on the Perth City Council.<sup>144</sup> In 1887, their firm ‘Saunders and Barratt’ put to the Council a proposal to supply water to the capital and to Fremantle from a dam on Munday’s Brook, twenty-five kilometres southeast of Perth in the Darling Range.<sup>145</sup> This site, the *West Australian* later enthused, had been ‘apparently intended by Nature for some such purpose’.<sup>146</sup> The Fremantle Council rejected the scheme because it could cheaply source ample supplies from wells in the nearby Fremantle Prison.<sup>147</sup>

The proposal was redrafted and the Perth City Council eventually turned to a private Melbourne-based company to undertake the construction of a modified version of Saunders and Barratt’s plan. Construction of the Victoria reservoir on Munday’s Brook, a pipeline, and a storage reservoir on Mount Eliza commenced in February 1890, and the waterworks were opened in October the following year.<sup>148</sup> Meanwhile, concerns about the quality of Perth’s shallow groundwater supplies had led to the drilling for deeper artesian groundwater and water from bores drilled at the Perth railway yards in the early 1880s and late 1890s was used to supplement the city’s reticulation.<sup>149</sup> Contamination problems at Victoria Reservoir subsequently ensured that groundwater from bores at Guildford and closer to Perth remained the chief source of supply for the city until the construction of Canning Dam in 1940.<sup>150</sup>

The spread of this ‘Chadwickian solution’ to places like Perth, argues Tony Dingle, ‘constitutes an example of path dependence; that is, a situation where existing technologies shape and direct future developments’.<sup>151</sup> If necessity is the mother of invention, the success of this approach, as Dingle explains, precluded the need for the development of alternatives. ‘New usage habits grow up around new technologies’, as I will show in the next chapter, and this fostered a vulnerability among the people of Perth to running out of water at the turn of the twentieth century.<sup>152</sup>

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<sup>144</sup> R. MacLeod, ‘Colonial engineers and the cult of practicality: themes and dimensions in the history of Australian engineering’, *History and Technology*, vol. 12, no. 2, 1995, p. 148.

<sup>145</sup> Hunt, *Perth’s Early Water Supplies*, p. 11.

<sup>146</sup> ‘The Perth Water Works: visit of inspection’, *West Australian*, 3 December 1889, p. 3.

<sup>147</sup> Fremantle had been reticulated from the wells within Fremantle Gaol since at least 1874. This water was used for shipping, the railway station and other public establishments. It was later extended to the town’s private residents in the late 1880s. See, Hunt and Bolton, p. 6.

<sup>148</sup> Hunt and Bolton, p. 6.

<sup>149</sup> Davidson, p. 3.

<sup>150</sup> Davidson, p. 3.

<sup>151</sup> Dingle, p. 12.

<sup>152</sup> Dingle, p. 12.

*Becoming 'a little prophetically disposed'*<sup>153</sup>

Despite the discovery of lead and copper at Northampton in the 1850s, the Western Australian economy remained dependent on the fortunes of its farming industries.<sup>154</sup> Until the 1870s, the major loci of the settlement clung mostly to the coast where Europeans were more familiar with the climate conditions.<sup>155</sup> Some pastoralists also ventured into the lands east of the Avon Valley, which would later become the wheatbelt.<sup>156</sup> Small-scale grain farmers also established crops in the Avon Valley and the Irwin-Greenough district, four hundred kilometres north of Perth.<sup>157</sup> This northern district offered fertile tracts on the alluvial flats of the Irwin, Greenough and Champion Rivers around the Champion Bay area, and began to attract farmers from York and Toodyay after a particularly dry year in 1850.<sup>158</sup> The district benefitted from a mild winter climate and a period of unusually good rains, and quickly earned the title of the 'granary of the colony'.<sup>159</sup>

The scientific connections between climate and human health had waned by this time, and climate had since become increasingly associated with concerns about agricultural productivity. 'It is hoped', sighed a weary correspondent to the *Perth Gazette* in 1868, 'that something of practical use to the agriculturalist will come in time from the long tables of figures made up and added to day after day and hour after hour by the many attendants at observatories, but as yet these are little better than accumulations of barren facts'.<sup>160</sup> The development of Western Australia's meteorological services beyond this collection of 'barren facts' would provide, some farmers hoped, forecasts of the coming seasons, which would enable them to prepare accordingly.<sup>161</sup> In this section, I examine the development of official meteorological observations in Western Australia as a means to reduce the colony's vulnerability to climate variability. Two important developments were vital: the spread of telegraph communication in the southwest and its connection to the eastern colonies; and the appointment of a new Surveyor General to replace the retiring John Septimus Roe. But

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<sup>153</sup> 'Meteorology', *Perth Gazette*, 19 June 1868, p. 3.

<sup>154</sup> Bolton, *Land of Vision and Mirage*, p. 32.

<sup>155</sup> G. C. Bolton and D. E. Hutchison, 'The beginning', in B. J. O'Brien (ed.), *Environment and Science*, Nedlands, UWA Press, 1979, p. 7; and G. H. Burvill, *Agriculture in Western Australia: 150 years of development and achievement, 1879-1979*, Nedlands, UWA Press, 1979, p. 13.

<sup>156</sup> Bolton, *Land of Vision and Mirage*, p. 32.

<sup>157</sup> Bolton, *Land of Vision and Mirage*, p. 32.

<sup>158</sup> Burvill, p. 11.

<sup>159</sup> Burvill, p. 12; *Independent Journal*, 19 September 1851, p. 2; Powell, *Watering the Western Third*, p. 12.

<sup>160</sup> 'Meteorology', p. 3.

<sup>161</sup> 'Meteorology', p. 3.

the increasing centralisation of weather recordkeeping under the auspices of the colonial government, I argue, served to quarantine climate knowledge ‘within a discourse of expertise’.<sup>162</sup> In doing so, the measurement, monitoring and understanding of climate variability in the southwest was largely elevated above lay concerns, which would leave many people in the southwest unprepared and vulnerable to episodes of climate variability and water scarcity.<sup>163</sup>

Although the telegraph was relatively cheap and ideally suited to the long distances of the western third, Western Australians were slow to adopt the technology, waiting over a decade after Australia’s first electric telegraph was connected between Melbourne and Williamstown in 1854. Western Australia finally caught up in 1869 when Perth and Fremantle were connected. But the colony remained largely isolated until 1877, when Perth was connected by telegraph with Adelaide and the eastern colonies.<sup>164</sup> Meteorologists situated to the east of Western Australia, particularly Sir Charles Todd, South Australia’s Astronomical Observer and Superintendent of Telegraphs, had eagerly awaited this connection. Contrary to prevailing opinion, Sir Charles believed that Australia’s weather systems moved across the continent from the west coast to the east. His colleagues believed that if this was correct, the collection and transmission of meteorological observations from the western third might allow the derivation of weather forecasts for other parts of the continent, which would particularly benefit farmers and mariners.<sup>165</sup> Calls for better climate information and weather prediction had been far louder in the eastern colonies than the west, as droughts and floods in the 1870s had severely affected farmers, particularly those in the more recently settled marginal areas.<sup>166</sup> But Sir Charles could not confirm his hypothesis until the telegraph extended to the western third of the continent and more systematic meteorological observations were recorded there.<sup>167</sup>

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<sup>162</sup> G. Bankoff, *Cultures of Disaster: society and natural hazard in the Philippines*, London, Routledge, 2003, p. 11.

<sup>163</sup> G. Bankoff, *Cultures of Disaster: society and natural hazard in the Philippines*, London, Routledge, 2003, p. 11.

<sup>164</sup> R. Lee, ‘Linking a Nation: Australia’s transport and communications 1788 – 1970’, *Australia: Our National Stories*, Australian Heritage Commission, 2003, <<http://www.environment.gov.au/heritage/ahc/publications/commission/books/linking-a-nation/chapter-7.html>>, (Accessed: 4 April 2011).

<sup>165</sup> D. Day, *The Weather Watchers: 100 years of the Bureau of Meteorology*, Melbourne, Bureau of Meteorology, pp. 9-10.

<sup>166</sup> D. Garden, *Droughts, Floods and Cyclones: El Niños that shaped our colonial past*, North Melbourne, Australian Scholarly Publishing, 2009, pp. 147, 240. Folk meteorologists and weather prophets rose to the challenge, seeking evidence for their weather forecasts in the stars, planets and even animal behaviour.

<sup>167</sup> Day, p. 9.

This expansion of the telegraph network coincided with a changing of the guard in the Surveyor General's office. Western Australia's first Surveyor General, John Septimus Roe, had presided over its early development but a lack of funding and staff had limited his department's abilities to perform its duties. In 1870, Governor Weld appointed Western Australia's second Surveyor General, (Sir) Malcolm Fraser, who had worked as a surveyor in New Zealand. The newly appointed Surveyor-General reorganised his department and focussed its energies on improving the mapping of the western third.<sup>168</sup> Sir Malcolm also established a Meteorological Branch within his department to coordinate and collect meteorological observations from around the state. Although meteorological observations had been kept at Roe's office between 1830 and 1876, these had not documented that variable so crucial to Western Australia's agricultural progress – rainfall. The commencement of official rainfall records coincided with a series of particularly dry winters in the southwest.<sup>169</sup> The *Western Australian Times* hoped this project would help to 'remove the stigma cast upon [Western Australia] at a recent meeting of the Colonial Institute that "it had never spent a shilling upon investigations of its climate"'.<sup>170</sup> In Perth, the Meteorological Record Keeper, M. A. C. Fraser, took measurements twice daily within the grounds of his Department until the instruments were moved to the Botanical Gardens (now Government Gardens) in 1885.<sup>171</sup> But it took some time for the Department to recruit observers and to equip them with the appropriate meteorological instruments, which had to be supplied from Britain.

For the first two years of the service, Perth remained the sole station for observations as more instruments had not yet arrived. Meteorological Record Keeper Fraser was concerned about the limited extent of the colony's observations: he complained to Sir Malcolm that, '[N]othing is done to record even the bare outline of its meteorology and climatology, a science which at the present time is fast growing in public estimation and importance'.<sup>172</sup> Although Fraser's report was somewhat exaggerated, meteorological recordkeeping remained limited, and restricted to the coastal areas: of the seven stations reporting to his office in 1880, only York was

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<sup>168</sup> F. K. Crowley, 'Fraser, Sir Malcolm (1834-1900)', nd., *Australian Dictionary of Biography*, National Centre of Biography, Australian National University, <<http://adb.anu.edu.au/biography/fraser-sir-malcolm-3570>>, (Accessed: 20 January 2010).

<sup>169</sup> Waylen, 'Report by the Colonial Surgeon on the Public Health of the Colony for the year 1877', p. 3.

<sup>170</sup> 'When will it rain?', *Western Australian Times*, 22 March 1878, p. 2. See also, 'Rather Severe', *Western Australian Times*, 16 October 1877, p. 2.

<sup>171</sup> Gentilli, p. 71.

<sup>172</sup> M. Fraser, 1881, cited in Day, p. 10.

situated inland.<sup>173</sup> By contrast, New South Wales had ten times as many observers as Western Australia.<sup>174</sup> Attuned to the important role that meteorology could play in agricultural development, Fraser argued for the ‘adoption of the volunteer system of rain observations’ ‘to obtain a fuller knowledge of the amount of rain that falls annually, how far inland it reaches, and its effects on the yield of crops, etc’.<sup>175</sup> By 1890, the number of rainfall stations reporting to Perth had increased from two to eighty, thanks to the recruitment of volunteers.<sup>176</sup> Although the network of meteorological observers had expanded, conditions over the vast Indian and Southern Oceans remained unknown. Weather forecasts therefore remained out of reach.<sup>177</sup>

This increasingly technocratic approach to understanding the climate of the southwest affected the ways that some Western Australians prepared for, and responded to, dry spells. Until the 1880s, prayer for divine intervention in the weather was a common response among the drought-affected. During a dry period on the Victoria Plains in 1870, for instance, a correspondent to the *Perth Gazette* opined, ‘I think that in our present calamity and general necessity we ought to have recourse to Him who is the only one who can and will assist us – our common mediator Jesus Christ. ... “Ask and you shall receive”, says He, surely we have only to try’.<sup>178</sup> Similarly, a York writer argued in 1875, ‘[O]ught we to ask and to pray if we hope to receive [?]’<sup>179</sup> Such prayers had become common throughout the Australasian colonies as well as in England and Scotland since the early nineteenth century.<sup>180</sup> As the century wore on and understandings of the natural world grew, this practice came under criticism from ‘among the liberal Protestant elite and other social groups’ in England and Australia.<sup>181</sup> In its place, they advocated human ingenuity and preparedness.

By the 1880s, such sentiments had reached Western Australia, particularly after the Anglican Bishop of Melbourne, Dr Moorhouse, refused to support prayers for rain in 1882.<sup>182</sup> Moorhouse had thundered, ‘God indicated by His providential arrangements

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<sup>173</sup> M. A. C. Fraser, ‘Meteorological Report for the Year 1880’, in *WALCV&P*, Perth, Govt Printer, 1881, p. 4.

<sup>174</sup> ‘The weather’, *West Australian*, 1 February 1886, p. 3.

<sup>175</sup> M. A. C. Fraser, ‘Meteorological Report for the Year 1882’, in *WALCV&P*, Perth, Govt Printer, 1883, p. 4.

<sup>176</sup> Bureau of Meteorology, *Results of Rainfall Observations Made in Western Australia*, Melbourne, H. J. Green, 1929, p. 3.

<sup>177</sup> Utting, p. 25; and Day, p. 12.

<sup>178</sup> ‘Victoria Plains’, *Perth Gazette*, 25 May 1870, p. 3.

<sup>179</sup> ‘York’, *Inquirer*, 9 June 1875, p. 2.

<sup>180</sup> J. Beattie, ‘Rethinking science, religion and nature in environmental history: drought in early twentieth-century New Zealand’, *Historical Social Research*, vol. 29, 2004, pp. 95-96.

<sup>181</sup> Beattie, ‘Rethinking science, religion and nature in environmental history’, p. 96.

<sup>182</sup> Beattie, ‘Rethinking science, religion and nature in environmental history’, pp. 82-103.

that it was His will that we should conserve the water sent to us in winter'.<sup>183</sup> In light of Moorhouse's comments, 'HEV' advised that, '[A]lthough we cannot yet bring [rain] from the clouds at pleasure, nor command its distribution, provision might be made to secure it when it does come, and save all we possibly can, instead of letting it run to waste'.<sup>184</sup> Other local commentators suggested the adoption of practices underway in the eastern colonies and the United States, such as artesian boring and dam construction, while others pointed to the achievements of Indian and Egyptian irrigation.<sup>185</sup> Although calls for improved methods of water conservation and supply in the southwest's pastoral and agricultural areas continued until the end of the century, a lack of public and private funds hindered their widespread application in the region.<sup>186</sup> Besides, some farmers and graziers might not have considered such improvements necessary: as a contributor to London's *Daily Chronicle* observed, 'The rainfall is sufficient, even with the carelessness with regard to its conservation which now prevails'.<sup>187</sup>

With the achievement of responsible government came calls, particularly from the new Premier John Forrest (1890-1901), for the establishment of an astronomical and meteorological observatory in Perth. A surveyor by training, who had worked under Septimus Roe and later, Sir Malcolm, the Premier believed that scientific measurements and observations of Western Australia were necessary for its economic progress, and that it would go some way to overcoming the dearth of scientific inquiry in the state.<sup>188</sup>

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<sup>183</sup> J. Moorhouse, cited in Beattie, 'Rethinking science, religion and nature in environmental history', p. 96.

<sup>184</sup> H. E. V., 'Water famine and its prevention', *West Australian*, 17 March 1882, p. 4.

<sup>185</sup> 'The Inquirer', *Inquirer*, 26 February 1879, p. 2; 'The Inquirer', *Inquirer*, 31 May 1882, p. 2; 'The Inquirer', *Inquirer*, 7 March 1883, p. 2; 'The West Australian', *West Australian*, 9 March 1883, pp. 2-3; 'The Inquirer', *Inquirer*, 30 January 1884, p. 2; F. Napier Broome, cited in 'Western Australia', *West Australian*, 2 May 1885, pp. 6-7; 'Western Australia: its present and future', *West Australian*, 20 March 1889, p. 3; 'The West Australian', *West Australian*, 3 February 1890, pp. 2-3; 'The water question', *West Australian*, 30 May 1892, p. 6; 'A distinguished visitor to West Australia', *Western Mail*, 3 September 1892, p. 7.

<sup>186</sup> 'The Inquirer', *Inquirer*, 23 October 1878, p. 2; 'Weazel', *Western Australian Times*, 9 May 1879, p. 2; 'The West Australian', *West Australian*, 3 February 1890, pp. 2-3.

<sup>187</sup> P. Mendell, cited in 'The outlook in Australasia', *Daily News*, 2 November 1891, p. 3.

<sup>188</sup> F. K. Crowley, 'Forrest, Sir John [Baron Forrest] (1847-1918)', *Australian Dictionary of Biography*, vol. 8, 1981, <<http://adbonline.anu.edu.au/biogs/A080565b.htm>>, (Accessed: 4 April 2011); and Utting, p. 28. The comparatively small population and limited financial resources of the Swan River Colony hindered the development of a local scientific community to rival those in the other Australasian colonies. The Western Australian Natural History Society was not established until 1890, following the formation of the Australasian Association for the Advancement of Science (AAAS) two years earlier. The Society's president was the Premier, John Forrest, who had represented Western Australia at the first council meeting of the AAAS in 1888. Its secretary, Bernard Woodward, later became the director of the Western Australian Museum. After the Society went into abeyance in the mid-1890s because of the 'great difficulty in finding members willing to read papers', local scientists formed the Mueller Botanic Society in 1897 in memory of their late colleague Baron Ferdinand von Mueller. This Society commenced publication of its proceedings in 1899, and in 1903, broadened its interests to include natural history and changed its name to the West Australian Natural History Society in 1903. In 1909,

Science was valued as a means to more fully understand the Australian continent, many parts of which had ‘never yet been seen by the white man’.<sup>189</sup> It was the ‘sciences of exploration’, such as ‘the astronomy of the southern skies; geophysics, including mineral exploration and studies of the earth’s magnetism; and natural history, especially taxonomy and systematics’, that Forrest considered required the attention of colonial governments, particularly in Western Australia.<sup>190</sup>

Despite protests from some of his colleagues, Forrest prevailed and in 1896, Western Australia’s first observatory was established: a symbol of wealth, science and intercolonial cooperation overlooking the city from Mount Eliza. At its opening, the Premier proclaimed, ‘It would remain for all time an evidence of a liberal-minded and enlightened people, who, while doing all that was necessary to foster the material requirements of the colony, at the same time were anxious to promote and encourage intellectual pursuit’.<sup>191</sup> A new Government Astronomer, William Ernest Cooke, was appointed from the Adelaide Observatory, where he had worked under Sir Charles Todd. Now in charge of his own observatory, Cooke made every effort to improve the collection of meteorological records from around the state in order to create a ‘centralised receptacle of meteorological data’.<sup>192</sup> Based on these observations, Cooke

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the Society again changed its name to reflect its expanding scope, adopting the title, ‘The Natural History and Science Society of Western Australia’. Finally, in 1914, the Society received royal patronage and became the ‘The Royal Society of Western Australia’, some sixty years after the foundation of its counterparts in Victoria and New South Wales. Meanwhile, the Colony’s Geological Museum was opened to the public in 1891, a decade after its foundation under Reverend Charles Grenfell Nicolay. Its collections soon expanded to include historical, ethnographical and fine arts collections, and in 1897 it became the Western Australian Museum and Art Gallery, under the directorship of Bernard H. Woodward, the secretary of the first Western Australian Natural History Society. See, A. W. R. Bevan, ‘The Western Australian Museum meteorological collection’, in G. J. H. McCall, A. J. Bowden and R. J. Howarth (eds), *The History of Meteoritics and Key Meteorite Collections: fireballs, falls and finds*, London, Geological Society of London, 2006, p. 306; I. M. Crawford, ‘Woodward, Bernard Henry (1846-1916)’, *Australian Dictionary of Biography*, National Centre of Biography, ANU, <<http://adb.anu.edu.au/biography/woodward-bernard-henry-9182>>, (Accessed: 3 January 2012); P. Crawford and I. Crawford, *Contested Country: a history of the Northcliffe area, Western Australia*, Nedlands, UWA Press, 2003, p. 65; M. E. Hoare, ‘The intercolonial science movement in Australasia, 1870-1890’, *Records of the Australian Academy of Science*, vol. 3, no. 2, 1975, pp. 7-28; ‘The West Australian Natural History Society’, *West Australian*, 10 September 1890, p. 3; ‘WA Natural History Society’, *Western Mail*, 9 May 1903, p. 14; and B. Moore, ‘Tourists, scientists and wilderness enthusiasts: early conservationists of the south west’, in B. K. de Garis, *Portraits of the South West: Aborigines, women and the environment*, Nedlands, UWA Press, 1993, p. 120.

<sup>189</sup> J. Forrest, ‘President’s address, Section E (Geography)’, *Report of the First Meeting of the Australasian Association for the Advancement of Science*, Sydney, Australasian Association for the Advancement of Science, 1888, p. 354.

<sup>190</sup> L. Robin, ‘Ecology: a science of empire?’, in T. Griffiths and L. Robin (eds), *Ecology and Empire: environmental history of settler societies*, Edinburgh, Keele University Press, 1997, p. 64.

<sup>191</sup> J. Forrest, *West Australian*, 30 September 1896, p. 2.

<sup>192</sup> K. Douglas, *Under Such Sunny Skies: understanding weather in colonial Australia, 1860-1901*, Melbourne, Bureau of Meteorology, 2007, p. 15.

issued daily weather maps, rainfall reports and forecasts of the day's weather, which were displayed at prominent locations in Perth and Fremantle and in the local newspapers.<sup>193</sup> He also transmitted these observations interstate and internationally. Although the meteorological services in Western Australia had received greater attention at the end of the nineteenth century, there does not appear to have been a commensurate increase in the scientific understandings of local climates. Instead, the benefits of these improvements accrued, arguably, to meteorologists in the eastern colonies because Todd's hypothesis had been proven correct after the extension of the telegraph from Adelaide to Perth. The location of the new Commonwealth Bureau of Meteorology in Melbourne from 1908 only served to deepen Western Australia's peripheral position in the meteorological study of Australia.

By the 1880s, the purpose of meteorological inquiry had shifted away from environmental anxieties about health to anxieties about Western Australia's economic development. Western Australia had struggled to attract and retain both settlers and capital, and farmers and pastoralists had found it difficult to establish themselves in the alien environment of the southwest. The coincidence of agricultural growth and government interest in meteorology in Western Australia initiated, therefore, a highly utilitarian approach to the study of the climates of the western third. During the nineteenth century, however, meteorological observations in Western Australia were of greater benefit to the eastern colonies than to those in the west. The slow development of meteorological observations in Western Australia also meant that there was limited colonial knowledge about the climate conditions of large areas of the western third. As I will show in the next chapter, this lack of knowledge did little to check the expansion of agricultural cultivation into the drier lands beyond the Avon Valley after Federation.

### *Watering a Thirsty City*

As Perth's waterworks neared completion, the fortunes of the struggling colony turned with the discovery of gold, first in the Kimberleys in 1885 and more famously, in Coolgardie and Kalgoorlie in the early 1890s. These finds drew thousands of people seeking the latest El Dorado and precipitated an influx of wealth to the colony. Mirroring Victoria's mid-century gold fever, Western Australia's population trebled during the 1890s, drawing many emigrants from the depressed eastern colonies across

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<sup>193</sup> D. Hutchison, 'William Ernest Cooke, Astronomer 1863-1947', *Historical Records of Australian Science*, vol. 5, 1981, p. 62.



the Nullarbor. Once their luck had run out, a large proportion of them settled in Perth. All manner of ramshackle accommodation sprang up to house these hordes, including shanties and tent settlements on the city's outskirts. Stables and outbuildings were used for housing.<sup>194</sup> The local authorities had not expected this surge in numbers or the pressures that a larger population would impose upon the rudimentary water and sanitary services around Perth and the eastern goldfields. As a result, some people were left thirstier than others.

The situation came to a head in early 1897 when the onset of an especially dry summer overwhelmed Perth's basic water supplies, which were already struggling to meet demand. Although the construction of the Queen Victoria Reservoir allowed the reticulation of the city, this service was not uniform throughout Perth and the supply network could not keep up with the growth in demand that had resulted from the spike in population in 1896.<sup>195</sup> The limited availability of pipes had delayed the extension of water supplies to the newer, less affluent fringe of the city's north. Even after these suburbs were reticulated, there was not enough water to pump to meet demand during the summer months.<sup>196</sup> Although many residents could normally supplement reticulated supplies with water from tanks and wells, the seasonal conditions had left these sources dry. In the unreticulated areas of the city, where hordes of new arrivals had settled in camps in East Perth, Third Swamp (Hyde Park) and Subiaco, the drought put further pressure on the polluted wells and swamps upon which people relied for water.<sup>197</sup> Combined with the inadequate provisions for sewage and sanitation, typhoid inevitably struck.

Just months before the drought crept in, the Forrest Government had taken over responsibility for the water supply of Perth and its surrounding suburbs. Besieged by complaints from the city's irate residents, the government hastily made arrangements to take water to the people. In some parts of the city, reticulated supplies were restricted to a few hours at time and in other areas, the shortages were relieved by a water carting service and pumps, but these measures were not enough. Residents had to collect the carted water in buckets and return home with their burden through the city's 'heavy sand'. To make matters worse, in some parts of the city, the *West Australian* reported, the cart service was erratic, the carts leaked and could not access unsealed roads, and

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<sup>194</sup> C. T. Stannage, *The People of Perth: a social history of Western Australia's capital city*, Perth, Perth City Council, 1979, p. 274.

<sup>195</sup> V. Whittington, *Gold and Typhoid: two fevers – a social history of Western Australia, 1891-1900*, Nedlands, UWA Press, 1988, p. 4.

<sup>196</sup> Hunt and Bolton, p. 11.

<sup>197</sup> Hunt and Bolton, p. 11.

many carters failed to ring their bell to notify the residents that water was available.<sup>198</sup> So great was the desperation of some residents that a water carter was stoned in East Perth.<sup>199</sup>

But some residents fared better than others. As one disgruntled correspondent wrote to the *West Australian*, 'I am unfortunately a resident of Lamb-street, and for the last weeks have scarcely been able to get a drop of water from the service pipes on my premises, although I am told ... [that] the people in the Terrace are never without a strong supply'.<sup>200</sup> On one particular day, according to the Chairman of the Metropolitan Waterworks Board, about two hundred residents on Perth's affluent Adelaide Terrace used nearly thirty per cent of the city's scheme water because they could access it before it reached the Mount Eliza Reservoir.<sup>201</sup> Among these profligate users were the Premier, Sir John Forrest and his politician brother, Alexander, who would become the city's Mayor in 1898. A private supply for residents in the comfortable suburbs of Peppermint Grove and Claremont ensured they too were well-watered.<sup>202</sup> Perth's social elite were thus insulated from an unreliable water supply and the impact of drought, often at the expense of less affluent citizens. The uneven experience of the 'Great Water Famine', as the local press dubbed it, revealed the unequal exposure to risk that historical and socio-economic forces had produced among the residents of late nineteenth century Perth.<sup>203</sup> The Great Water Famine was not simply a consequence of drought, a natural aberration in the weather. Rather, it was a distinctly human event.

How had some Perth residents become more vulnerable to drought than others? The introduction of reticulated water supplies had greatly heightened the disparities between the city's most and least comfortable residents. A correspondent to the *West Australian* complained of this inequity in 1897, '[T]hose persons who lavish so much on their gardens should be stopped from using water while their fellow creatures are unable to get sufficient to quench their thirst'.<sup>204</sup> Certainly, differences in access to water had been an issue prior to reticulation. In some areas, people sourced water from shared wells, which were subject to over-extraction and pollution, while other residents relied upon private supplies. The introduction of reticulated water supplies, however, widened this gulf. As noted earlier, the Perth City Council had engaged the services of a

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<sup>198</sup> 'The water supply question', *West Australian*, 13 January 1897, p. 5.

<sup>199</sup> Hunt, *Perth's Early Water Supplies*, p. 21.

<sup>200</sup> Parched, 'To the Editor', *West Australian*, 17 November 1896, p. 10.

<sup>201</sup> Hunt and Bolton, pp. 12-13.

<sup>202</sup> Hunt and Bolton, p. 11.

<sup>203</sup> G. Bankoff, 'Constructing vulnerability: the historical, natural and social generation of flooding in metropolitan Manila', *Disasters*, vol. 27, no. 3, 2003, p. 225.

<sup>204</sup> South Australian, 'To the editor', *West Australian*, 13 January 1897, p. 5.

private company to construct the waterworks and provide water for the city. Naturally then, the company wanted to profit from its service and charged ratepayers accordingly. Residents in the reticulated areas of the city were charged for a piped water supply for 'one water closet and one bath'.<sup>205</sup> For additional water use, such as for the garden, residents paid for a metered service.<sup>206</sup>

In a society where wealth and privilege enabled better access to water, outward signs of this status, such as the cultivation of gardens and cleanliness, became highly significant. Perth's long dry summers made gardening during those months especially difficult without easy access to water. Only those with private supplies or with enough money to pay for reticulated water could cultivate summer gardens. Admiring Perth's 'only garden', the lush Government Gardens, the *West Australian* explained in 1887,

The drawbacks during summer and autumn are so great in this country that few people will undergo the trouble or expense of keeping a garden in anything like a presentable and flourishing [state]; besides, people here have little leisure, small means, and are all workers, trying to gain a competency or to make both ends meet.<sup>207</sup>

A year-round garden then was a sign of prosperity, for the 'garden, as much as the house, had become a defining space for middle-class status'.<sup>208</sup>

Cleanliness too was a symbol of affluence but without a reliable water supply, it was very burdensome to maintain. Once piped water became available in Perth in the 1890s, many affluent residents invested in bathrooms, which allowed them to bathe more frequently than they had previously.<sup>209</sup> Rising concerns in Britain and the United States about the civic importance of cleanliness had also become apparent in the colonies and by the late nineteenth century, its absence 'was regarded as tantamount to spiritual decay and social ruin'.<sup>210</sup> In addition to focussing citizens' attentions on their physical and moral hygiene, such anxieties shaped social expectations of what constituted the 'good woman'. In undertaking her primary duties of mothering and housework, she was expected to ensure the upkeep of those 'five manifestations of population ideology' at the end of the nineteenth century: 'public health, infant welfare,

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<sup>205</sup> 'The Perth Waterworks', *Western Mail*, 12 September 1891, p. 24.

<sup>206</sup> Hunt and Bolton, p. 7.

<sup>207</sup> 'Our only garden', *West Australian*, 22 December 1887, p. 3.

<sup>208</sup> K. Webber, 'Romancing the machine: the enchantment of domestic technology in the Australian home, 1850-1914', PhD Thesis, University of Sydney, 1997, p. 48.

<sup>209</sup> Stannage, *People of Perth*, p. 278.

<sup>210</sup> Webber, pp. 150-51.

social purity, education and child welfare'.<sup>211</sup> The water and sanitation infrastructure of Australian cities and rural towns were not yet adequate, however, for women to easily attain the standards of domestic cleanliness that these ideals demanded.<sup>212</sup>

During the Great Water Famine in Perth in the summer of 1896/97, a resident of Highgate Hill described her plight in the *West Australian* newspaper: 'No bath; barely any water with which to wash one; no laundry work at home – all put out (expensive and inconvenient); water for cooking, etc., economised to the last degree; scrubbing and cleaning quite impossible. This is a shameful and wicked state of affairs'.<sup>213</sup> Another correspondent reported trudging through Perth's sandy streets to obtain water in heavy tubs and buckets – sometimes late into the evening and often 'when the man of the house is away'.<sup>214</sup> These women would not have been alone in their despair. The difficulties of obtaining water in Perth were undermining their efforts to fulfil their duties and obligations as wives and mothers, as 'good women'. This episode of water scarcity, therefore, exposed the gulf between these women and those from more affluent households, who set the standard for 'what it was to be feminine, moral and domesticated' in Perth.<sup>215</sup>

Due to the unreliable and expensive scheme water, many people in Perth's suburbs returned to their dependence upon the well as an important source of supply. By 1911, the household corrugated iron water tank had also become an important supplementary supply system to the reticulated supply.<sup>216</sup> In light of the risks associated with contamination of backyard wells, the iron water tank also offered households a less polluted water supply.<sup>217</sup> Those with access to such private supplies were arguably more resilient to climate variability and water scarcity than those who relied on the rudimentary reticulated network. Meanwhile, unrestricted access to water and profligacy in its use would remain hallmarks of affluence in Perth well into the twentieth century.

### *Watering the 'last best west'*<sup>218</sup>

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<sup>211</sup> J. J. Matthews, *Good and Mad Women: the historical construction of femininity in twentieth-century Australia*, Sydney, George Allen & Unwin, 1984, pp. 86-87.

<sup>212</sup> E. Stratford, 'Gender and environment: some preliminary questions about women and water in the South Australian context', *Gender, Place and Culture*, vol. 2, no. 2, 1995, p. 214.

<sup>213</sup> Decent Cleanliness, 'To the editor', *West Australian*, 13 January 1897, p. 5.

<sup>214</sup> 'Highgate Hill', *West Australian*, 13 January 1897, p. 5.

<sup>215</sup> Stratford, p. 211.

<sup>216</sup> Stannage, p. 277.

<sup>217</sup> Hunt and Bolton, p. 15.

<sup>218</sup> J. Belich, *Replenishing the Earth: the settler revolution and the rise of the Anglo-world, 1783-1939*, Oxford, Oxford University Press, 2009, p. 394.

*It will be said of us as Isaiah said of old – “They made a way in the wilderness, and rivers in the desert”.*<sup>219</sup>  
- Sir John Forrest, 1896

As Perth’s demands for better water supplies grew, so too did those on the eastern goldfields. Although the goldfields lie beyond the boundaries of the southwest as defined in this thesis, the role of water supplies in its development is nonetheless relevant to my inquiry. Such was the perceived importance of the goldfields towns of Kalgoorlie and Coolgardie to Western Australia’s prosperity, the Forrest government invested in an extraordinary scheme to pipe water from the southwest to the desert’s edge. This pipeline would later help to establish the agricultural areas between the Darling Ranges and the goldfields after Federation. The pipeline, I contend, reflected an unwillingness of people on the goldfields to adapt to the semi-arid conditions of the goldfields region. Their reliance on the pipeline ensured that the state’s immediate future was bound to the export of water from the southwest.

As more gold discoveries were made, thousands of treasure seekers went to the ‘last best west’ and established settlements in the area around Kalgoorlie and Coolgardie. Situated on the fringe of the desert, water there was in especially short supply. Rainfall in the area is very variable, evaporation is high, and there are limited sources of potable surface and underground water. Like gold, then, water was precious on the eastern goldfields. Besides its importance to sanitation and health, it was vital for the mines where it was necessary for processing ore, and for the transportation of people, stock and goods to and from the fields, whether by foot, hoof or rail. But what the prospectors perceived as scarce, the Kalamaia Aboriginal people of the Yilgarn region had long found sufficient.<sup>220</sup> I argue that the requirement of abundant supplies of water for permanent settlement on the goldfields would serve to diminish their hydroresilience in the long-term.

After the discovery of gold on the eastern goldfields, demands for permanent water supplies in the area had waxed and waned with the seasons. Under these variable conditions, water was imported to the goldfields, first via camel trains and then, once the railway line had been extended to Coolgardie in 1896, via steam locomotives. Both modes of transportation required clean water supplies along their routes and the water

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<sup>219</sup> *Western Australian Parliamentary Debates*, 21 July 1896, p. 151.

<sup>220</sup> Green, ‘Aborigines: the changing scene’, p. 125. According to Green (p. 125), the Kalamaia people lived in an area that extended from, ‘Boorabin and Southern Cross; east to Bullabulling, north Touanmi, Lake Barlee and Pigeon Rocks; west to Burracoppin, Mukinbudin, Kalannie and Lake Moore; south to about Mt Holland in the Parker Range’. Their customs were distinct from those of other Aboriginal peoples that bordered their lands.

trains were especially thirsty: they consumed at least half their load in the round trip.<sup>221</sup> Another important source was the region's groundwater reserves but these were found to be extremely saline and were purified using condensers. These wood-fired condensing plants consumed vast quantities of timber from the surrounding woodlands, and in many cases exhausted local bore and mine water reserves.<sup>222</sup> Once the arid plains had been stripped bare to feed the condensers, dust choked the goldfields and even more water was required to keep it at bay.<sup>223</sup>

The government also constructed dams or 'tanks' on the goldfields to collect rainwater but the volatility of the seasons and high rates of evaporation diminished their effectiveness.<sup>224</sup> The rainfall record of the nearby town of Southern Cross demonstrates the extreme climate variability of the region in the early 1890s: both 1889 (258.5mm) and 1890 were wet years, which were followed by a near drought in 1891 (132.8mm). The years 1892 (383.5mm) and 1893 (356.7mm) were again wet but 1894 (130mm) and 1895 (137.7mm) returned the area to drought.<sup>225</sup> Miners and prospectors made do with constructing small dams and exploiting the region's gnamma holes, which had long sustained the local Aboriginal people.<sup>226</sup> As the European population grew and became permanent, and existing water supplies became more expensive and difficult to obtain, the case for seeking alternative sources of water supply strengthened. Without water for the goldfields, Premier Forrest believed, the mines would be abandoned and the flow of funds vital to the state's prosperity would dry up.

The Forrest government had worked especially hard to provide the eastern goldfields with services to overcome their isolation and to ensure their continued prosperity.<sup>227</sup> Investment in such public works, Forrest's government hoped, would ensure that the mining settlements became permanent and that the industry's wealth

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<sup>221</sup> Powell, *Watering the Western Third*, p. 20.

<sup>222</sup> Powell, *Watering the Western Third*, p. 20.

<sup>223</sup> A. Gaynor, "'Like a good deed in a naughty world': gardens on the eastern goldfields of Western Australia", *Australian Humanities Review*, no. 36, 2005, <<http://www.australianhumanitiesreview.org/archive/Issue-July-2005/11Gaynor.html>>, (Accessed: 10 December 2011).

<sup>224</sup> Heather Goodall has explored the Indian etymology of the term 'tank' and its use in southeastern Australia. See, H. Goodall, 'Digging deeper: ground tanks and the elusive Indian archipelago', in A. Mayne (ed.), *Beyond the Black Stump: Histories of Outback Australia*, Kent Town, Wakefield Press, 2008, pp. 129-60.

<sup>225</sup> Maddock, p. 35. Although Maddock asserts that 1890 was a 'wet year' in Southern Cross, rainfall data is unavailable from the Bureau of Meteorology for that year. See, Bureau of Meteorology, 'Monthly rainfall: Southern Cross (12074)', *Climate Data Online*, nd, <[http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p\\_nccObsCode=139&p\\_display\\_type=dataFile&p\\_startYear=&p\\_c=&p\\_stn\\_num=012074](http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=012074)>, (Accessed: 4 March 2012).

<sup>226</sup> A. Gaynor and J. Davis, 'People, place and the pipeline: visions and impacts of the Goldfields Water Supply Scheme', in M. Leybourne and A. Gaynor (eds), *Water: histories, cultures, ecologies*, Nedlands, UWA Press, 2006, p. 18

<sup>227</sup> Bolton, *Land of Vision and Mirage*, p. 65.

would continue to grow. By 1896, just a few years after the first finds in the area, railways and telegraph wires criss-crossed the state's inland to connect Perth to the goldfields.<sup>228</sup> This communication and transportation infrastructure had significant structural consequences for the Western Australian economy. They ensured the primacy of Perth and Fremantle as the Colony's centres of commerce and trade, at the expense of Albany and Esperance on the south coast.<sup>229</sup> These networks ensured that 'the goldfields' economy, which was politically and to a degree commercially alien, was firmly integrated with the established colonial structure'.<sup>230</sup> And this economy, in the 'waterless waste' of the eastern goldfields, became dependent on permanent and abundant water supplies.<sup>231</sup>

By early 1896, a plan to water the eastern goldfields was in place. Water would be transported uphill from a dam on the Helena River in the Darling Range near Perth via a pipeline to Coolgardie and Kalgoorlie, nearly six hundred kilometres away. The river was dammed at a narrow gorge with a thirty metre high wall of solid concrete, which created the world's highest overflow weir at the time.<sup>232</sup> The Mundaring Weir inundated nearly ten kilometres of the rugged and sparsely populated Helena valley.<sup>233</sup> The pipeline would follow the eastern Goldfields railway line and have eight steam-powered pumping stations. Even the engineering schemes of ancient Rome had not been so bold as to pump water such a distance, let alone uphill.<sup>234</sup> The state's chief engineer, Charles Yelverton O'Connor, who had designed this plan at the behest of the Premier, argued that it would supply water to the eastern goldfields quicker and more cheaply than the existing arrangements and other proposals.<sup>235</sup> The other schemes had included sinking deep artesian bores; condensing saline groundwater; and constructing large

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<sup>228</sup> The eastern Goldfields railway line extending between Northam and Southern Cross, which was opened in 1894, connected the Goldfields with Perth and Fremantle. By 1901, this track was the busiest in the state. See, S. Glynn, 'The transport factor in developmental policy: pioneer agricultural railways in the Western Australian wheat belt, 1900-1930', *Australian Journal of Politics and History*, vol. 15, no. 2, 1969, pp. 63-64.

<sup>229</sup> Glynn, p. 63.

<sup>230</sup> Glynn, p. 63.

<sup>231</sup> J. Forrest, 1896, cited in Stephens, p. 95.

<sup>232</sup> I. Elliot, *Mundaring: a history of the Shire*, Mundaring, Shire of Mundaring, 1983, p. 135.

<sup>233</sup> Elliot, p. 135.

<sup>234</sup> G. Blainey, *The Golden Mile*, St. Leonards, Allen & Unwin, 1993, p. 59.

<sup>235</sup> The authorship of the idea to construct a pipeline to the eastern goldfields has been claimed by mining entrepreneur Nathaniel Harper, while others suggest Lady Forrest was instrumental to the plan. See, Bolton, *Land of Vision and Mirage*, p. 66; and Blainey, p. 58. Premier Forrest had recruited O'Connor from New Zealand in early 1891 upon the recommendation of Sir Malcolm Fraser. Prior to his arrival in Western Australia in 1870 to take up the post of Surveyor-General, Sir Malcolm had been O'Connor's regional supervisor on the West Coast of New Zealand. See, A. G. Evans, *C. Y. O'Connor: his life and legacy*, Crawley, UWA Press, 2001, pp. 96-97.

reservoirs on the creeks running from the northwest.<sup>236</sup> On Thursday 22 January 1903, O'Connor's scheme was opened but he was not present at the ceremony. The project had been mired in controversy and O'Connor had taken his own life less than a year before his vision was realised.

Even when the scheme was completed, the larger mines continued to utilise the salty water pumped from the mines or water shafts, which was substantially cheaper than the water from the pipeline. Historian Geoffrey Blainey argues that this preference for local water sources over imported supplies shows that the pipeline was an unwanted and unnecessary enterprise.<sup>237</sup> Blainey disputes O'Connor's analyses of the rainfall statistics available for the goldfields and asserts that the area was not the 'desert' that the engineer purported it to be. As a result, O'Connor over-estimated the need for water supplies and over-capitalised on the project. Only the insatiable thirst of the growing Kalgoorlie mines, Blainey considers, 'saved the pipeline from becoming an economic failure'.<sup>238</sup> The extent to which the settlements of the eastern goldfields were vulnerable to water scarcity then was perhaps more fear than reality. At the very least, the decision to construct the pipeline reflected an unwillingness to change or a lack of support for adaptation to local conditions. More significantly, it reflected the economic and political importance that the Forrest government attached to the prosperity of the goldfields.<sup>239</sup>

Despite the lingering questions over the need for its construction, the Goldfields Water Supply Scheme is remembered as much for its audacity as for the demise of its protagonist, O'Connor. It remains one of the only schemes to pump water out of the southwest region and allowed, as the Forrest government hoped, the closer settlement of lands between the Avon Valley and the goldfields in the early twentieth century, which developed the state's wheatbelt. Yet the forging of this 'river in the desert' dramatically altered the ways that people related to water on the goldfields. This engineering feat mitigated the need for settler Australians to adapt to the environment such that extravagance rather than prudence became the natural approach to water use on the margins of the desert.

The availability of permanent fresh water supplies swiftly transformed the approach to water use around the homes of many goldfields residents. Such a shift was particularly evident in household gardens and municipal parks. Limited supplies of water on the goldfields had mostly prevented gardening along European lines, and as

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<sup>236</sup> Gaynor and Davis, p. 20.

<sup>237</sup> Blainey, pp. 74-76.

<sup>238</sup> Blainey, p. 75.

<sup>239</sup> R. T. Appleyard, 'Economic and demographic growth', in Stannage (ed.), *A New History of Western Australia*, p. 236.



Andrea Gaynor has found, many ‘learned to do without’, making do with different plants and other pleasures.<sup>240</sup> Once the ‘golden pipeline’ was opened, garden tastes changed dramatically in the direction of a ‘more conventional form, with neat lawns and leafy shrubs’.<sup>241</sup> This change in the types of gardens cultivated on the goldfields supports the contention that the availability of water supply mediates patterns of water use in modern homes. From this perspective, the connection of goldfields homes to reticulated supplies served to ‘domesticate’ water, whereby it became readily available inside the home at the easy turn of the tap. Consequently, many residents became ‘enthralled by the fantasy of endless supply embodied in the water faucet’.<sup>242</sup> Facilitated by the pipeline, more water begat demand for more water on the goldfields. Reliant then on water piped over a vast distance, from a dam far away, the people of the goldfields arguably became more vulnerable to water scarcity than ever before.<sup>243</sup> But they were not alone: water now underwrote, and could therefore undermine, the entire colonial economy.

### *Watering a State*

In this chapter, I have examined how the colonial establishment of permanent settlements; the introduction of European farming; and a lack of local knowledge rendered the colonists vulnerable to running out of water during the nineteenth century and beyond. The contrast of these characteristics to those of the Nyoongar way of life led to a dramatic weakening of their hydroresilience, just one of the many disastrous consequences of colonisation for the southwest’s Indigenous peoples.

Despite the bloody encounters between colonists and the colonised, the development and the expansion of the Swan River Colony was largely dependent on the local knowledge of Aboriginal guides and the broader patterns of resource use that had been forged in the southwest over thousands of years. Meanwhile, the colonists’ efforts to develop local knowledges were hampered by the combination of a Western

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<sup>240</sup> Gaynor, <<http://www.australianhumanitiesreview.org/archive/Issue-July-2005/11Gaynor.html>>.

<sup>241</sup> Gaynor, <<http://www.australianhumanitiesreview.org/archive/Issue-July-2005/11Gaynor.html>>.

<sup>242</sup> Z. Sofoulis, ‘Big water, everyday water: a sociotechnical perspective’, *Continuum*, vol. 19, no. 4, 2005, p. 456; and M. Kaïka, ‘Interrogating the geographies of the familiar: domesticating nature and constructing the autonomy of the modern home’, *International Journal of Urban and Regional Research*, vol. 28, no. 2, 2004, pp. 265-86.

<sup>243</sup> Another legacy of the golden pipeline was the transformation of the lands and lives of the local Aboriginal people such that they became increasingly dependent on the settler economy ‘for the basic resources for survival’. This history deserves further research. See, Green, ‘Aborigines: the changing scene’, p. 126.

worldview and the suite of technologies that they deployed in the establishment of the Colony. Both had originated in the northern hemisphere and were best-suited to the environmental conditions of the metropole, not the antipodean periphery of the southwest.

Studies of the climate and weather were initially undertaken to overcome anxieties about the implications of the colonial environs for white settler bodies. Changing understandings of the transmission of disease, however, encouraged more systematic meteorological efforts to meet the eastern colonies' demands for improved meteorological data and to assist the agricultural development of Western Australia. Owing to the limited finances of the government and the nascent scientific community in the southwest, these meteorological efforts were hindered for some time. Nevertheless, the slow accumulation of climate observations across the western third served to concentrate knowledge about local conditions in the hands of a scientific elite. Later, the influence of new ideas about sanitation slowly led to the reticulation of the suburbs and an improvement in public health. The greater availability of water for some residents began to alter their relationships with water supplies, while highlighting the socio-economic and gendered nature of water use in Perth.

The discovery of gold on the desert's fringe finally allayed colonial anxieties about Western Australia's economic development. The significance of these discoveries was reflected in the Forrest government's decision to export water from the southwest to the eastern goldfields to ensure their ongoing production would not be threatened by the risk of running out. Limiting the development of adaptive measures, the 'golden pipeline' facilitated the transformation of the gardens and homes of the residents of the eastern goldfields and diminished their hydroresilience in the process.

Despite the precarious state of Western Australia for most of the nineteenth century, the demands of small population with sparsely settled farm and pastoral lands and relatively kind seasons had combined to mostly shield colonists from the elements. Emboldened by their progress after the discovery of gold, Western Australians would march confidently into the new century, where climate variability and water scarcity waited to expose the extent of their vulnerability to running out.

## **Thirst in the Golden West: Suburban and agricultural expansion (1901 to 1945)**

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Western Australians ushered in the new century with unprecedented confidence. ‘With their colony stronger, sturdier, and more vigorous in its septuagenary than ever it was’, trumpeted the *Western Mail* in 1900, ‘the colonists can well look forward to the close of the century exhibiting indications of local development and progress that will place Western Australia in even a more important position than she now holds in the Australasian group’.<sup>1</sup> On the eve of Federation, the eastern goldfields continued to provide wealth for the western third, and its farmers were spared the Federation Drought that afflicted their cousins in the eastern states. During the first half of the new century, the western third underwent a transformation involving massive suburban and agricultural expansion that was sustained by political vision but was founded on the provision of water supplies. The Western Australian population more than doubled, Perth swelled, and the number of rural holdings increased more than three-fold.<sup>2</sup> But this expansion was not without its costs, as the southwest’s vulnerability to climate variability and water scarcity was further entrenched.

In the expanding agricultural areas of the southwest, droughts on the eves of the First and Second World Wars exposed the extent of these vulnerabilities, while a growing suburban dependence on reticulated water supplies was revealed by water shortages in the interwar years (Appendix I). The vulnerabilities arising from permanent settlement, a lack of local knowledge and an economic reliance on water were exacerbated by an unprecedented passion for development. Writing in the early 1980s, historian Lenore Layman observed, ‘From the earliest days of colonial self-government to the present decade, from Sir John Forrest to Sir Charles Court, an ideology of development has been a major characteristic of Western Australia’s political culture’.<sup>3</sup> The enduring features of Western Australian developmentalism have included state intervention to initiate, promote and implement development; an ‘anti-eastern states,

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<sup>1</sup> ‘The closing year of the century’, *Western Mail*, 6 January 1900, p. 43.

<sup>2</sup> Australian Bureau of Statistics, ‘A century of population change in Western Australia’, *Western Australian Statistical Indicators*, Canberra, Australian Bureau of Statistics, 2001, <[http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/BAD8CD1156A5EB5DCA256AE20002C95C/\\$File/13675\\_sep2001.pdf](http://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/BAD8CD1156A5EB5DCA256AE20002C95C/$File/13675_sep2001.pdf)>, (Accessed: 4 May 2011), p. 24; and J. M. Powell, *Watering the Western Third: water, land and community in Western Australia, 1826-1998*, Perth, Water and Rivers Commission, 1998, p. 33.

<sup>3</sup> L. Layman, ‘Development ideology in Western Australia, 1933-1965’, *Historical Studies*, vol. 20, no. 79, 1982, p. 234.

anti-federal (often populist) polemic'; and an 'inflated rhetoric which has claimed for Western Australia a 'greatness' to match its geographical area'.<sup>4</sup>

The government focus on development was by no means unique: the state has played a particularly central role in economic development in Australian history, as it has in other settler capitalist societies.<sup>5</sup> Moreover, the very notion that 'development' required instigation, as opposed to something that occurs spontaneously, was first advocated in economic tracts from the Australian colonial context in the 1830s and 1840s.<sup>6</sup> Imperial occupation and exploitation provided the ideal environment for scientific experts to flourish. Their role in development had emerged in the context of social unrest in Victorian Britain where liberal thinkers both possessed the means to portray progress as a rational and desirable goal to the populace, and believed they could direct and manage the path to its achievement.<sup>7</sup> Despite the incipience of Western Australia's scientific bureaucracy until after the First World War, successive state governments relied upon an emerging faith and credibility invested in science and technology.<sup>8</sup> These governments nonetheless shared an almost reckless optimism about the prospects for managing and achieving economic development.<sup>9</sup> These elements of Western Australian developmentalism and their deployment to engineer the state's wheatbelt, to irrigate the southwest, and to 'beautify' Perth's suburbs in the early twentieth century served, I contend, to render people in the southwest particularly vulnerable to variations in climate and water supplies – to running out.

### ***Making the 'last great wheatbelt'***

The development of the agricultural areas of Western Australia in the first half of the twentieth century created the 'last of the world's great wheatbelts'.<sup>10</sup> From the late

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<sup>4</sup> Layman, p. 234.

<sup>5</sup> A. Kellow and S. Niemeyer, 'The development of environmental administration in Queensland and Western Australia: why are they different?', *Australian Journal of Political Science*, vol. 34, no. 2, 1999, pp. 205-206.

<sup>6</sup> J. M. Hodge, *Triumph of the Expert: agrarian doctrines of development and the legacies of British colonialism*, Athens, Ohio University Press, 2007, pp. 28-29. For further information, see H. W. Arndt, 'Economic development: a semantic history', *Economic Development and Cultural Change*, vol. 29, no. 3, 1981, pp. 457-66; and H. W. Arndt, *Economic Development: the history of an idea*, Chicago, University of Chicago Press, 1987.

<sup>7</sup> Hodge, pp. 28-29.

<sup>8</sup> James C. Scott, *Seeing like a State: how certain schemes to improve the human condition have failed*, New Haven, Yale University Press, 1998, p. 4.

<sup>9</sup> Scott, pp. 4-5.

<sup>10</sup> D. Murray, 'Land settlement and farming systems', in L. Hunt (ed.), *Yilgarn: good country for hardy people – the landscape and people of the Yilgarn Shire, Western Australia*, Southern Cross, Shire of Yilgarn, 1988, p. 267.

nineteenth century, successive state governments encouraged the closer settlement of the woodland beyond the Avon Valley in order to establish a wheat-growing industry to sustain the economic development of Western Australia. In this chapter, I frame the creation of the Western Australian wheatbelt as a social engineering scheme forged by a technocratic state. I argue that the wheatlands created by the modernist governments of Western Australia prior to, and following the Federation of the Commonwealth in 1901, were vulnerable to variations in climate and water supplies. This vulnerability arose from a combination of geography, a paucity of local knowledge, and banking policies, which left many in the agricultural areas exposed to the droughts of 1914 and 1940.

Following Western Australia's achievement of self-government in 1890, the state's first Premier, Sir John Forrest, had endeavoured to realise his vision of agricultural expansion throughout the southwest region. The recommendations of the 1887 Venn Commission, appointed to inquire into the stagnant state of colonial agriculture, saw the Forrest government legislate to provide assistance to farmers. This included making more land available to settlers, bank loans to facilitate 'improvements' to their lands, and agricultural advice on farming methods.<sup>11</sup> Forrest envisaged agriculture as the stable foundation for economic development and self-sufficiency that the volatile mining industry could not provide. The focus of this rural expansion would be the development of a wheat industry between the Darling Ranges and the semi-arid interior of Western Australia.<sup>12</sup> Although this region would be later described as 'hydraulically difficult country', its relatively flat landscape made it ideal for cropping.<sup>13</sup>

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<sup>11</sup> G. C. Bolton, *Land of Vision and Mirage: Western Australia since 1826*, Crawley, UWA Press, 2008, p. 60; F. K. Crowley, *Australia's Western Third: a history of Western Australia from the first settlements to modern times*, Melbourne, Heinemann, p. 104; Colonial, 'Correspondence', *West Australian*, 24 August 1887, p. 3. This legislation included the Homestead Act 1893, the Agricultural Bank Act 1894 and the Land Act 1898. See, Powell, *Watering the Western Third*, p. 26.

<sup>12</sup> R. T. Appleyard, 'Economic and demographic growth 1850-1914', in C. T. Stannage (ed.), *A New History of Western Australia*, Nedlands, UWA Press, 1981, p. 229. According to Sean Glynn, Forrest's interest in the agricultural sector was politically and economically motivated. Firstly, it was a consequence of the tensions between his conservative government and the more radical mining community. To counter the emerging Labor political movement in the goldfields, Forrest sought to foster support from the farming community. In addition, unlike many other important primary industries, such as gold, timber and private railways, the wheat industry remained in Western Australian hands. See, S. Glynn, *Government policy and agricultural development: a study of the role of government in the development of the Western Australian wheat belt, 1900-1930*, Nedlands, UWA Press, 1975, p. 23.

<sup>13</sup> Dept of Public Works and Water Supply, *Comprehensive Agricultural Areas and Goldfields Water Supply Scheme: a comprehensive scheme for reticulating water for towns, stock and domestic purposes to certain areas of the mixed farming (cereals and sheep) districts of Western Australia; a request for aid from the Commonwealth government*, Perth, Govt Printer, 1946, p. 6; and Q. Beresford et al., *The Salinity Crisis: landscapes, communities and politics*, 2<sup>nd</sup> ed., Crawley, UWA Press, 2004, p. 16.

Although the colonial government had attempted to promote the expansion of farming into new areas through a land grant system, the scale of the endeavour and the difficulties of attracting overseas investment to Western Australia led the government to assume a central role in the development of the wheatbelt region.<sup>14</sup> Its role was not confined only to financing farmers, but extended to establishing vital infrastructure in the region. The vast distances of the state's nascent agricultural areas from the capital, Perth, and the port, Fremantle, demanded an efficient means to transport goods and people throughout the southwest. Private efforts to establish land grant railways in the 1880s and 1890s had been beset with problems, which had delayed the completion of the arteries vital to 'opening' up new lands and slowed the progress of closer settlement.<sup>15</sup> To spur land settlement after 1901, the government undertook to ensure that all agricultural lands and townships had access to rail services within a radius of fifteen miles (24km).<sup>16</sup> The emerging pattern of agricultural settlement then aligned closely with the networks of timber and steel snaking through the region (Figure 2.1).<sup>17</sup> Between Federation and the outbreak of the First World War, over four thousand kilometres of rail were laid in the wheatbelt, which helped to treble the amount of alienated land from nearly three million hectares to nearly nine million hectares.<sup>18</sup> In the age of the steam locomotive, both farmers and their main mode of transport depended on permanent, reliable supplies of fresh water, and were therefore vulnerable to water scarcity in the dry lands of the emerging Western Australian wheatbelt.

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<sup>14</sup> According to Glynn, the low rates associated with freighting wheat and superphosphate; the seasonal nature of their transportation; and the dispersed nature of agricultural settlement made Western Australian agriculture unattractive to private investors. See, S. Glynn, 'The transport factor in developmental policy: pioneer agricultural railways in the Western Australian wheat belt, 1900-1930', *Australian Journal of Politics and History*, vol. 15, no. 2, 1969, p. 61; and M. Tonts, 'State policy and the yeoman ideal: agricultural development in Western Australia, 1890-1914', *Landscape Research*, vol. 27, no. 1, 2002, pp. 105-106.

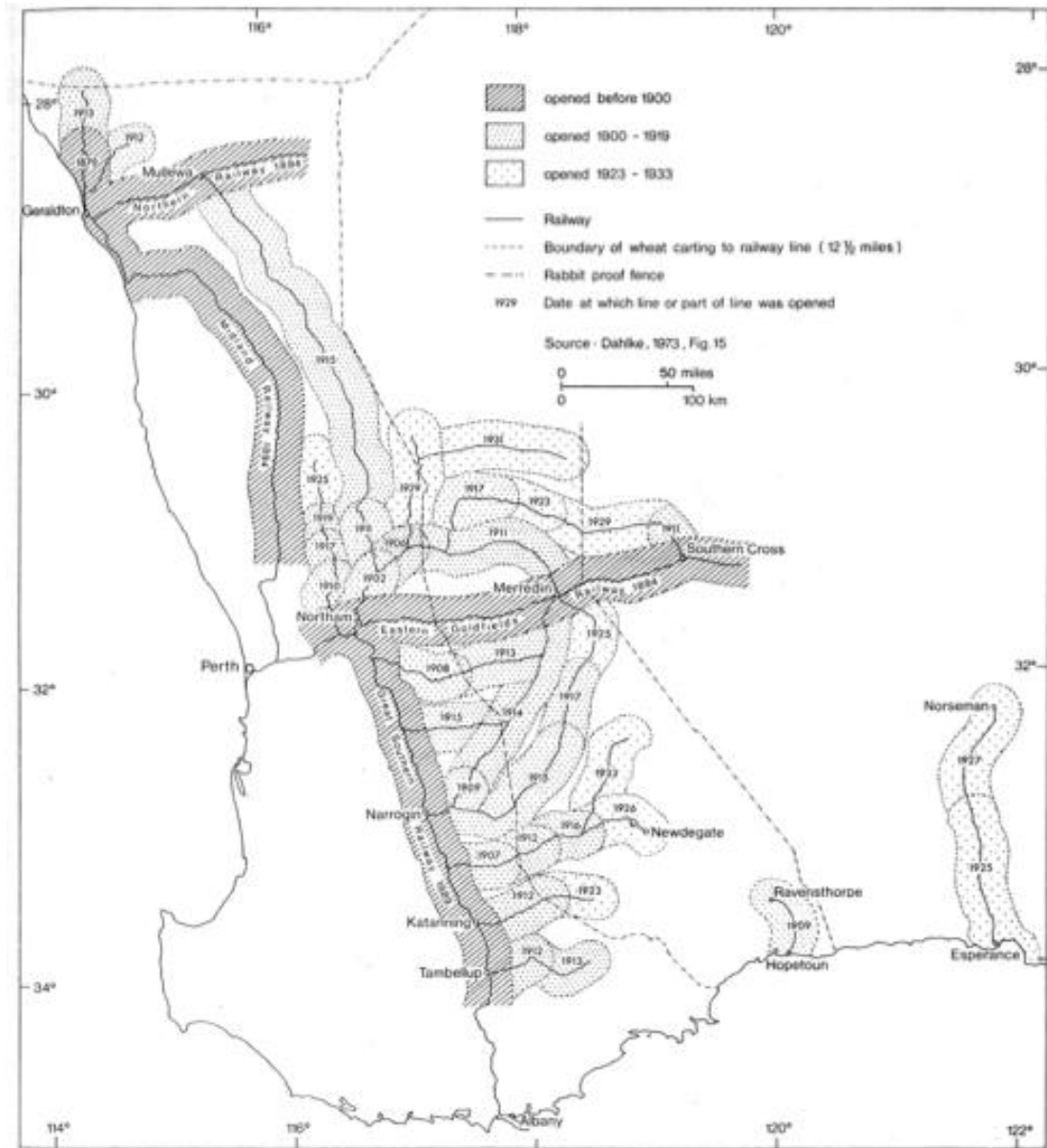
<sup>15</sup> For instance, the Great Southern Railway was completed in 1889, five years after the government awarded the contract to the Western Australian Land Company in 1884. Likewise, the York to Geraldton railway took eight years to build and opened in 1894. See, Tonts, pp. 105-106.

<sup>16</sup> WA Royal Commission on Immigration, *Report of the Royal Commission on Immigration together with appendices and minutes of evidence*, Perth, Govt Printer, 1905, p. 22.

<sup>17</sup> Glynn, p. 65.

<sup>18</sup> Tonts, p. 112.

**Fig. 2.1: Expansion of the railways and opening of agricultural areas<sup>19</sup>**



Some farming areas and railways benefitted from their proximity to the Mundaring to Kalgoorlie Pipeline, which had been constructed to supply water from the Darling Ranges to the arid eastern goldfields at the turn of the century. As Premier Sir John Forrest had long envisioned the agricultural development of the state's inland, he and his Chief Engineer, O'Connor, also saw a role for the Golden Pipeline in supplying water to the southwest's drier eastern districts.<sup>20</sup> Indeed, Forrest alluded to such intentions in his speech at the official opening of the Eastern Goldfields Water Scheme at Kalgoorlie on 25 January 1903: 'The completion of this beneficent work must have

<sup>19</sup> J. Dahlke, 'Evolution of the wheat belt in Western Australia: thoughts on the nature of pioneering along the dry margin', *Australian Geographer*, vol. 13, 1975, p. 5.

<sup>20</sup> R. G. Hartley, *River of Steel: a history of the Western Australian Goldfields and Agricultural Water Supply 1895-2003*, Bassendean, Access Press, 2007, p. 176.

an immense influence in promoting the advancement of these goldfields and *in assisting the settlement of the country through which the pipeline passes*'.<sup>21</sup> The Goldfields Water Supply Scheme would become an important source of water for many parts of the wheatbelt in its early development, not least because this expansion of services could help to offset the maintenance costs of the pipeline.<sup>22</sup>

With most wheatbelt farmers undertaking both wheat cropping and sheep rearing, those without access to reticulated water supplies had to find alternative sources to meet their domestic needs and to water their livestock. The government's rail engineers had already encountered the difficulties of sourcing reliable water supplies in the streamless areas of the wheatbelt.<sup>23</sup> They had overcome the lack of surface water by exploiting and excavating the gnammas holes and soaks that had long sustained the Nyoongar and Kalamaia Aboriginal peoples of the region. Many farmers developed their own supplies, such as natural reservoirs, wells, and 'earth tanks' or dams, as well as collecting water from 'every roof they possessed'.<sup>24</sup> Albert Facey for instance, recounts digging a soak near Narrogin and later, sinking a dam on a property in Jitarning.<sup>25</sup> Others carted water from government dams that were excavated at eight-mile (13km) intervals to encourage settlement in new areas of the wheatbelt.<sup>26</sup> The effects of this landscape authorship, explains Joe Powell, were unmistakable: 'The face of the land became scarred and pitted with all these water lines and water points – deftly incorporating, here and there, a less geometric physiognomy which had been sculpted by Aboriginal water managers'.<sup>27</sup>

Although these supplies were sufficient when the seasons were favourable, the slim margin for error in the wheatbelt was exposed when rains fell short of expectation. The winter of 1911, for example, put these supplies to the test, when the wheat-growing districts registered an average of 12.54 inches (318.5mm) of rain, at least four inches fewer than the preceding four years.<sup>28</sup> These dry conditions resulted in a significant reduction of the average yield of wheat per acre and many farmers in the central and

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<sup>21</sup> J. Forrest cited in 'The celebrations at Kalgoorlie', *West Australian*, 26 January 1903, p. 5. My emphasis.

<sup>22</sup> Hartley, p. 220.

<sup>23</sup> See for instance, W. H. Shields, 'Water-supply on the Yilgarn railway, Western Australia', *Minutes of the Proceedings of the Institution of Civil Engineers*, vol. 146, 1901, pp. 242-57.

<sup>24</sup> Powell, p. 27.

<sup>25</sup> A. B. Facey, *A Fortunate Life*, Ringwood, Penguin, 1985, pp. 69, 193-94. A 'soak' is a hole that is dug to exploit a natural seepage of water up to the surface of the soil. This hole then fills with fresh water.

<sup>26</sup> 'Water and Sewerage Works Department's Annual Report', *West Australian*, 29 December 1913, p. 3.

<sup>27</sup> Powell, p. 27.

<sup>28</sup> Bureau of Meteorology, *Results of Rainfall Observations in Western Australia*, Melbourne, H. J. Green, 1929, p. 53.



eastern agricultural areas had to cart water over significant distances for their stock.<sup>29</sup> Dependent on run-off from rainfall, dams had proven ineffectual when they were most needed.

The Scaddan government's (1911-1916) response to the drought conditions, I contend, displayed the hallmarks of a technocratic approach to the management of climate variability and water scarcity. Rather than question the historical and social dimensions of natural hazards such as climate variability, a technocratic approach advocates the application of scientific prediction and centralised management of hazards to mitigate disasters.<sup>30</sup> Joseph Powell suggests that 'the most visible official response' to the 1911 drought was a shift away from the reliance on earth tanks to well-boring.<sup>31</sup> The newly established state-wide Water Supply, Sewerage and Drainage Department despatched 'boring teams' to drill for water in the dry districts.<sup>32</sup> In 1911 and 1912, according to Powell, eighty teams were employed on a shift-work basis to produce about twenty wells each month. Their success was largely dependent on the accessibility and quality of the groundwater.<sup>33</sup> In his memoir, Albert Facey describes blasting granite out of a deep well near Corrigin to force water up to the surface. A windmill then pumped water from the well into a thousand gallon tank, from where the water was piped into a trough.<sup>34</sup> These wells were located near roads at regular intervals for watering travelling stock. The Department also improved soaks and rock holes; cleared dam catchments to improve run-off; erected corrugated iron tanks at railway sidings; and ensured these supplies were more accessible to farmers.<sup>35</sup> These were technocratic solutions designed to stave off the abandonment of the agricultural areas and to insure the wheatbelt against future shortages. Although many desperate farmers no doubt welcomed these measures, this hasty provision of water supplies arguably gave farmers and the government the confidence to go on, and to ultimately extend into areas of the southwest where farmers would be too vulnerable to climate variability and water scarcity.

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<sup>29</sup> Bureau of Meteorology, p. 87.

<sup>30</sup> G. Bankoff, 'Rendering the world unsafe: "vulnerability" as Western discourse' *Disasters*, vol. 25, no. 1, 2001, p. 24.

<sup>31</sup> Powell, pp. 27-29.

<sup>32</sup> Powell, p. 27. In 1912, the monolithic Water Supply, Sewerage and Drainage Department subsumed the Metropolitan Water Supply, Sewerage and Drainage Department; the Goldfields Water Supply and Agricultural Water Supplies; Artesian Boring; Country Towns Water Supplies, Irrigation and Land Drainage; and the provision of water supplies in mining districts.

<sup>33</sup> Powell, pp. 27-29.

<sup>34</sup> Facey, p. 206.

<sup>35</sup> Powell, pp. 27-29.

These solutions also had ramifications for the resilience of the local Aboriginal people to dry seasons. In early September 1913, the Commissioner of the Wheatbelt, George L. Sutton presented a lecture to an audience at the Western Australian Museum. Using lantern slides he showed his audience the state's agricultural progress and explained, 'Yesterday our wheat lands were a blacks' camp. To-day they are being broken up with the most suitable implements modern engineering can devise'.<sup>36</sup> Sutton's speech deployed the rhetoric of white development: that agricultural cultivation was a moral act of civilisation, which rendered white (Western) Australians superior to Aboriginal peoples, who seemed to lack the ability to till the soil.<sup>37</sup> Yet many Aboriginal people remained in the emerging agricultural areas: Anna Haebich estimates that about three-quarters of the southwest's Aboriginal population (possibly 1,500 people) lived in the wheatbelt region at the turn of the twentieth century.<sup>38</sup> The development of Western Australia's wheat industry dramatically transformed Nyoongar and Kalamaia lands and limited the ability of many Aborigines to access country, which constrained their adaptive capacities to cope during periods of water scarcity. Consequently, I contend, many Aboriginal people were compelled into dependence on white settlements from which they were comprehensively marginalised, and therefore, rendered especially vulnerable to climate variability.

Prior to agricultural development, much of the land that would become the wheatbelt had been held under pastoral lease. The pastoralists had utilised the region's waterholes and moved their stock according to the seasons. Many of the region's Aboriginal people had been able to gain employment from the pastoral stations, and the station owners permitted them to hunt and camp on the land. Although the Aborigines had been paid a pittance, this employment had at least allowed them to continue to live on country, to maintain some elements of traditional life, and to access important soaks and water holes, although many of these had been damaged by stock.<sup>39</sup>

As the wheatbelt slowly began to take shape, however, these opportunities for the region's Aborigines to remain on country were greatly diminished. As the large pastoral properties were broken up, fenced and cultivated, many farmers prohibited Aboriginal access to their properties.<sup>40</sup> Furthermore, their employment opportunities

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<sup>36</sup> G. L. Sutton, cited in, 'Wheatgrowing: the state's resources', *West Australian*, 8 September 1913, pp. 7-8.

<sup>37</sup> See also R. Broome, 'Changing Aboriginal landscapes of pastoral Victoria, 1830-1850', *Studies in the History of Gardens and Designed Landscapes*, vol. 31, no. 2, 2011, pp. 88-96.

<sup>38</sup> A. Haebich, 'European farmers and Aboriginal farmers in south Western Australia', *Studies in Western Australian History*, vol. 8, 1984, p. 61.

<sup>39</sup> Haebich, p. 61.

<sup>40</sup> Haebich, *For Their Own Good*, p. 14.

were reduced as their labour was only required for clearing bush and seasonal labour.<sup>41</sup> The extensive land clearing required for agricultural development also affected the water quality of the region's few streams, which became brackish and unsuitable for drinking.<sup>42</sup> Although Aboriginal farmers were denied the land titles for their farms, the Lands Department expected them to carry out a host of 'improvements' to their blocks, such as building a farm house and fences, as well as clearing and cultivating portions of the land.<sup>43</sup> If these requirements were not met, the Department could reduce the size of their land or resume their properties. But many of these farmers lacked the capital to make these improvements and could not use their properties as security for bank loans.<sup>44</sup> The few Aborigines who had been granted farms found their efforts subject to such constraints that it was nearly impossible for them to survive.<sup>45</sup>

The onset of dry conditions in 1911 combined with these factors to force many Aborigines to move into camps on the outskirts of wheatbelt towns.<sup>46</sup> In one town, the Aboriginal population increased fivefold in three years, from forty to over two hundred.<sup>47</sup> Accompanying this shift was a threefold increase in the reliance of Aborigines on government rations, from about 1,000 in 1907 to over 3,000 by the outbreak of the First World War.<sup>48</sup> As historian Anna Haebich explains, the state of the camps quickly degenerated: 'There were no proper shelters, no sanitary or rubbish services, no fresh water, no work and only meagre rations of flour, tea and sugar for the elderly and dependent mothers, issued by the police on behalf of the Aborigines Department'.<sup>49</sup> Many perished as a result of these conditions.<sup>50</sup> The development of the wheatbelt, therefore, forced many Aborigines into a condition of dependency on the state and onto the fringes of the white settlements in the southwest, where their hydroresilience continued to be eroded.

Cultivating the 'last of the world's great wheatbelts' not only meant clearing the land of native vegetation but also forcing many Nyoongar Aboriginal people off country. Their replacement by mixed farming transformed these lands with dramatic

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<sup>41</sup> A. Haebich, *For Their Own Good: Aborigines and government in the southwest of Western Australia, 1900-1940*, Nedlands, UWA Press, 1992, p. 14.

<sup>42</sup> Haebich, *For Their Own Good*, p. 131.

<sup>43</sup> Haebich, 'European farmers and Aboriginal farmers', p. 63.

<sup>44</sup> Haebich, 'European farmers and Aboriginal farmers', p. 63.

<sup>45</sup> A. Haebich, "'Clearing the wheat belt': erasing the Indigenous presence in the southwest of Western Australia", in A. Dirk Moses (ed.), *Genocide and Settler Society*, New York, Berghahn Books, 2004, p. 271.

<sup>46</sup> Haebich, *For Their Own Good*, pp. 131-32.

<sup>47</sup> Haebich, "'Clearing the wheat belt'", pp. 272-74.

<sup>48</sup> Haebich, *For Their Own Good*, p. 46.

<sup>49</sup> Haebich, "'Clearing the wheat belt'", pp. 272-74.

<sup>50</sup> Haebich, "'Clearing the wheat belt'", pp. 272-74.

consequences for the soils and waterways of the area. The confidence and enthusiasm of farmers and their government towards the opening up of the state's wheatlands would serve to encourage the eastward expansion of the wheatbelt onto environmentally and economically marginal lands where settlers would be at risk of running out of water. This vulnerable position would be exposed by the onset of drought conditions on the eve of World War One.

### *Irrigating the Southwest*

Other calls to the government to provide additional water supplies came from an unlikely source: the farmers in the coastal districts of the southwest. In the late 1890s, the *Western Mail* had observed, 'Surely it is one of the satires loved of nature, that, while an elaborate scheme is necessary to supply the goldfields with water, a whole district in the South-West is piteously demanding help to get rid of a superabundance of it'.<sup>51</sup> Farmers in the Harvey area had found that they could withstand the dry summer months by irrigating from the drains that had been excavated in the district to alleviate frequent flooding. This water was mostly used for the irrigation of pastures to ensure that cows were in milk throughout the year.<sup>52</sup> In addition to dairy pastures, farmers irrigated orchards, vines, vegetables and lucerne on the productive alluvial soils of the Pinjarra Plain.

Optimistic about replicating the perceived successes of the Mildura and Renmark irrigation settlements in Victoria and South Australia, many farmers in the Harvey area were demanding in 1911 that the government provide irrigated water supplies.<sup>53</sup> A government irrigation scheme, these farmers hoped, would provide a more efficient and equitable system than the utilisation of the drains.<sup>54</sup> After government engineer Hugh Oldham surveyed the rivers from the Serpentine to the Collie to gauge their suitability for impounding water, Harvey Dam was constructed on the Harvey River in 1916 and its waters distributed through open, unlined channels. Time would tell whether it would be the panacea that irrigators had hoped for.

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<sup>51</sup> 'Drainage in the south-west', *Western Mail*, 13 August 1897, p. 41.

<sup>52</sup> W. S. Cooper, 'Drainage and irrigation', in J. Gentilli (ed.), *Western Landscapes*, Nedlands, UWA Press, 1979, pp. 244-45.

<sup>53</sup> A. C. Staples, *They Made Their Destiny: a history of settlement of the Shire of Harvey, 1829-1929*, Harvey, Shire of Harvey, pp. 427-28.

<sup>54</sup> Cooper, p. 248.

### *Battling on the home front*

‘[G]rim drought stalks almost the length and breadth of the land’, reported the *West Australian* on New Year’s Day, 1915.<sup>55</sup> Many farmers had had little opportunity to recover from the dry conditions of 1911 and now, the entire agricultural area was affected, with some areas receiving less than half their ‘average’ rainfall.<sup>56</sup> These conditions caused the state’s wheat yield to plummet by eighty per cent in a single year.<sup>57</sup> For many older farmers, it was the worst season they had ever known.<sup>58</sup> John Payne of Perenjori remembered the emotional toll of this drought on his father, who ‘[p]ut his head in his hands and he cried there for a long time’.<sup>59</sup> The region’s Aboriginal farmers were especially affected as they generally lacked the financial resources to persevere and many were forced to leave their properties.<sup>60</sup> The coincidence of the drought with the commencement of World War One saw many young rural men enter the armed services in order to escape economic hardship.<sup>61</sup> Once again, the Scaddan government employed a technocratic approach to the management of the drought. The government advocated the application of scientific research, the adoption of risk management practices, and the hard work of farmers as vital to the state’s agricultural development. I argue that this response, however, served only to boost the confidence of many wheatbelt farmers and encourage them to expand the limits of settlement into the climatically marginal areas of the southwest.

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<sup>55</sup> ‘1914: the State’, *West Australian*, 1 January 1915, p. 4.

<sup>56</sup> Glynn, *Government Policy and Agricultural Development*, p. 111. By this time, the wheatbelt stretched ‘from Murchison River in the North to Ravensthorpe in the South, may be taken to be the settled farming areas north and east of Northampton, and from thence embracing the wheat-growing land east of a line drawn from Nabawah (Chapman) through Nangetty, Marchagee, Wongan, Cunderdin, Quairading, Dumblebung and Gnowangerup’. See, Royal Commission on the Agricultural Industries of Western Australia, *Progress Report of the Royal Commission on the Agricultural Industries of Western Australia on the Wheat Growing Portion of the Southwest Division of the State*, Perth, Govt. Printers Office, 1917, p. i.

<sup>57</sup> Powell, p. 9.

<sup>58</sup> Bureau of Meteorology, p. 88.

<sup>59</sup> J. M. Payne, interviewed by G. O’Hanlon, 1996, Battye Library, OH2738, p. 13.

<sup>60</sup> P. Biskup, *Not Slaves, Not Citizens: the Aboriginal problem in Western Australia 1898-1954*, St Lucia, University of QLD Press, 1973, p. 147.

<sup>61</sup> Bolton, p. 102; and R. Waterhouse, *The Vision Splendid: a social and cultural history of rural Australia*, Fremantle, Fremantle Arts Centre Press, 2005, p. 197. Deb Anderson has observed the application of militarist discourses to Australian histories of drought-affected landscapes. She also points to the work of Michael McKernan, a former senior Australian War Memorial historian and author of *Drought: the red marauder*. The accounts of a Victorian Mallee soldier settler’s experiences of drought during the Depression alerted McKernan (and Anderson) to the relationships between war, drought and white male identities in twentieth-century Australia. See, D. Anderson, ‘Drought, endurance and climate change “pioneers”’: lived experience in the production of rural environmental knowledges’, *Cultural Studies Review*, vol. 16, no. 1, 2010, p. 90; and M. McKernan, *Drought: the red marauder*, Crows Nest, Allen & Unwin, 2005.

The overwhelming effects of drought and World War One on Western Australian farmers led to 'grave doubts' about the southwest's suitability for agricultural development, particularly regarding wheat farming in the eastern wheatbelt.<sup>62</sup> These were environmental anxieties that questioned the state's economic future. As most of the wheatlands had only been settled after 1908, many farmers had struggled to establish themselves under difficult climatic and financial conditions.<sup>63</sup> Compared to the longer established farmers, the more recently established farmers lacked the capital and experience to cope with the dry conditions. In 1916, the state government established a Royal Commission to inquire into the state's agricultural industries; its findings for the wheatbelt and the southwest coastal areas were published the following year. Echoing colonial assessments of the Swan River Colony in the nineteenth century, the Commissioners concluded that, 'The settlers, in brief, have up to the present, conducted a vast experimental farm for the benefit of the State and posterity'.<sup>64</sup>

Evidence to the Royal Commission revealed just how vulnerable some wheatbelt farmers were to climate variability and water scarcity. Witnesses reported that farmers were 'inclined to lose heart' as their debts mounted.<sup>65</sup> In the Victoria district, noted a witness, 'Half of them do not get a decent feed a week'. He wondered, 'It puzzles me to know where the records of rainfalls come from and how it is that people were rushed out into these dry areas'.<sup>66</sup> Of great concern to the Commissioners was the amount of rain that the wheatbelt farmers could expect to receive. Frank Heywood of Shackleton, for instance, had no previous experience of farming but reported, 'I do not believe the government had sufficient data when they printed (the average rainfall) on the lithos'.<sup>67</sup> Farmers at Ajana and Carnamah considered the government had deliberately misled them with promises of 14 and 16 inches of average annual rainfall respectively. The government, argued these farmers, had not only overlooked the drought of 1911 but also assured them that it would be 'absolutely droughtless'.<sup>68</sup> The government had estimated that 12 inches of winter rainfall was sufficient for cropping and rainfall data suggests that, on average, most of the agricultural areas received this

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<sup>62</sup> Glynn, *Government policy and agricultural development*, p. 113. Similar uncertainty about the land and climate was evident in southeastern Australia, see Waterhouse, p. 73.

<sup>63</sup> Royal Commission on the Agricultural Industries of WA, p. i.

<sup>64</sup> Royal Commission on the Agricultural Industries of WA, p. vii.

<sup>65</sup> Royal Commission on the Agricultural Industries of WA, pp. 109, 167.

<sup>66</sup> Royal Commission on the Agricultural Industries of WA, p. 68.

<sup>67</sup> Royal Commission on the Agricultural Industries of WA, p. 433.

<sup>68</sup> Royal Commission on the Agricultural Industries of WA, pp. 369, 395.

amount.<sup>69</sup> But averages can be misleading. Until the end of the First World War, geographer Jürgen Dahlke has argued, this wheatbelt area was ‘critically marginal’ because of the rudimentary nature of the farming techniques employed at that time.<sup>70</sup>

For the government and the farmers on the wheatbelt’s eastern fringe, the drought of 1914 had exposed a mismatch between their ambitions and their knowledge. The testimonies above suggest that at least some farmers blamed the government for the consequences of the drought. This position reflects the prevalence of a technocratic approach to disaster prevention at this time. As this approach fosters the concentration of scientific expertise in government bureaucracy, concern about the preparedness, prediction and control of natural hazards is abrogated to specialists. This process, according to Kenneth Hewitt, ‘quarantines disaster in thought as well as in practice’, which in turn, places the responsibility to ameliorate disaster squarely on the government.<sup>71</sup> After all, the Western Australian government had promoted farming in the areas that were affected by drought and the state’s farmers were vital to its plans for agricultural development. As the Commissioners argued,

These men and women pioneers are doing a great national work, often at considerable cost to themselves and their families, and it is the State’s duty, and in its own best interests to do everything possible to assist these people in overcoming the natural disadvantages which hamper them and prevent them becoming successful mixed farmers, and as such an asset to the State, instead of cereal growers doomed to a life of hard continuous labour for an inadequate reward.<sup>72</sup>

If farming on the margins was to continue, the government would have to do more to reduce the vulnerability of its farmers to climate variability and water scarcity.

Although the Commissioners were alive to the limited climatic knowledge of the outer limits of the wheatbelt, they attempted to impose a ‘safe’ limit for cultivation. Upon the request of the Commissioners, Surveyor-General Frederick Slade Brockman charted a line of ‘reliable rainfall’ across the western third, recalling Goyder’s Line in

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<sup>69</sup> Bureau of Meteorology, ‘Shackleton Post Office (10283): Monthly rainfall’, *Climate Data Online*, nd,

<[http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p\\_nccObsCode=139&p\\_display\\_type=dataFile&p\\_startYear=&p\\_c=&p\\_stn\\_num=010283](http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=010283)>, (Accessed: 5 March 2012).

<sup>70</sup> Dahlke, p. 4.

<sup>71</sup> K. Hewitt, ‘The idea of calamity in a technocratic age’, in K. Hewitt (ed.), *Interpretations of Calamity: from the viewpoint of human ecology*, Boston, Allen & Unwin, 1983, pp. 9-12.

<sup>72</sup> Royal Commission on the Agricultural Industries of WA, p. xviii.

South Australia.<sup>73</sup> In creating this lesser-known Brockman Line, the Surveyor-General constructed a region in which farmers could safely expect climatic conditions that were suitable for wheat-growing.<sup>74</sup> But it would do little to help farmers avoid or ameliorate droughts in the future; instead, the rainfall limit had ‘merely reinforced the prevailing definition of wheat-growing areas’.<sup>75</sup> It served then to support the continued development of these districts that were vulnerable to running out.

After all, drought in the southwest was believed to be an abnormal phenomenon.<sup>76</sup> As the Commissioners reported, ‘Our rainfall ... is more regular than in any of the other States, and we should be able to look forward to regular yields as our methods of cultivation improve’.<sup>77</sup> Failure on the land, therefore, was not seen to be due so much to the land or climate but to the lack of effort and determination of the farmer.<sup>78</sup> The ‘land is usually good to those who use it well’, observed the Commissioners, ‘While it rejects infallibly the unfit and the ineffective’.<sup>79</sup> ‘Good’ farmers were those who applied the latest innovations in wheatgrowing, such as the new wheat varieties and superphosphate that were helping to support the agricultural expansion into the drier wheatbelt region.

To assist farmers in their endeavours, the Commission demanded better services from the state’s Department of Agriculture. To foster the productivity of the inland areas, the Forrest government had established a Bureau of Agriculture in 1894, which later became the Department of Agriculture. The purpose of the Bureau was to regulate the farming industries and their produce, and to communicate scientific developments that could help farmers.<sup>80</sup> Its establishment of experimental farms in the inland areas

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<sup>73</sup> ‘Agricultural industry: the Royal Commission – use of fertilisers’, *Western Mail*, 18 May 1917, p. 49; and ‘News and notes’, *West Australian*, 25 December 1917, p. 4.

<sup>74</sup> The Brockman Line extended from the coast at Bluff Point past Ajuna, Yuna and Mullewa, along the No. 2 Rabbit Proof Fence to a point east of Kondut. Then east, 8 kilometres north of Mt Marshall and Welbungin, south-east to Burracoppin, then south near Mt Cramphorne and Karlgarin to a point about 30 kilometres north-east of Lake Grace, then south-east to Mt Madden and the No. 1 Rabbit Proof Fence. See, G. H. Burvill, *Agriculture in Western Australia: 150 years of development and achievement, 1829-1979*, Nedlands, UWA Press, 1979, p. 25.

<sup>75</sup> A. Gaynor, ‘Looking forward, looking back: towards an environmental history of salinity and erosion in the eastern wheatbelt of Western Australia’, in A. Gaynor, M. Trinca and A. Haebich (eds), *Country: visions of land and people in Western Australia*, Perth, WA Museum, 2002, p. 108.

<sup>76</sup> R. L. Heathcote, ‘The JP Thomson Oration- Braving the Bull of Heaven: drought management strategies, past, present and future, 2 May 2000’, Royal Geographical Society of Queensland, nd, <<http://www.rgsq.org.au/node/270>>, (Accessed: 11 May 2011).

<sup>77</sup> Royal Commission on the Agricultural Industries of WA, p. xi.

<sup>78</sup> J. M. Powell, *An Historical Geography of Modern Australia: the restive fringe*, Cambridge, Cambridge University Press, 1988, p. 117.

<sup>79</sup> Royal Commission on the Agricultural Industries of WA, p. xi.

<sup>80</sup> Burvill, *Agriculture in Western Australia*, p. 23.



reflected the pattern of agricultural expansion at this time, with the intention of demonstrating that farming could be successful in these areas.<sup>81</sup>

One of the methods that the Department advocated to wheatbelt farmers was dry farming. These techniques had first emerged in the 1870s and 1880s on the Great Plains of the United States.<sup>82</sup> The dry farming concept was based on the idea that cultivating bare fallow left behind a layer of fine dust, which would prevent evaporation and conserve soil moisture. The concept was enthusiastically adopted in eastern Australia at the turn of the century, and later brought to Western Australia by George L. Sutton, the first Commissioner for the Wheatbelt.<sup>83</sup> The fervour for fallow captured the imagination of the agricultural technocracy throughout the nation's cereal regions because it was supposed to make the most of the limited rainfall in these districts.<sup>84</sup> Through technical advice, competitions and Agricultural Bank lending policies, technocrats urged farmers to frequently cultivate bare fallow to increase their yields and improve their ability to withstand dry conditions.<sup>85</sup>

Although the Commissioners had found fault with some of the government's more reckless policies, the vital importance of agricultural development remained unquestioned. The definition of a 'safe' rainfall limit counted for little when overseas markets beckoned and allowed farmers to roll the dice when it came to the seasons after the war.<sup>86</sup> Sooner or later, their luck would run out.

The orchardists in the Harvey district, meanwhile, faced the problem of simply too much water. The predictions of large water losses; the uneven distribution of water through ungraded, established citrus groves; and waterlogging problems were all borne out.<sup>87</sup> Despite their much shorter examination of the challenges facing the Harvey district compared to their study of the wheatbelt, the Commissioners were scathing of the state's first large-scale irrigation scheme. 'The application of water to land', they

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<sup>81</sup> Burvill, *Agriculture in Western Australia*, p. 23.

<sup>82</sup> W. F. McClure, 'Dry farming', *Journal of the Department of Agriculture of Western Australia*, vol. 18, 1909, pp. 134-35.

<sup>83</sup> Gaynor, p. 110. This attention to American practice reflected a broader trend across agriculture, mining and education, whereby the scientific gaze was looking beyond the British example. See, R. MacLeod, 'Science, progressivism and "practical idealism": reflections on efficient imperialism and federal science in Australia, 1895-1915', *Scientia Canadensis*, vol. 17 1993, pp. 7-25.

<sup>84</sup> N. Barr and J. Cary, *Greening a Brown Land: the Australian search for sustainable land use*, South Melbourne, Macmillan, 1992, pp. 131-32.

<sup>85</sup> But the superfine topsoil that this method created, agricultural scientists later realised in the 1920s and 1930s, only exacerbated soil erosion. See, Gaynor, pp. 110-11; and Barr and Cary, 132-34.

<sup>86</sup> F. K. Crowley, *Australia's Western Third: a history of Western Australia from the first settlements to modern time*, Melbourne, Heinemann, 1970, p. 172.

<sup>87</sup> Cooper, p. 245.

surmised, 'is not an open sesame to profitable production'.<sup>88</sup> The main grievance for the Commissioners was the scientific and technical advice, or lack thereof, that had guided the scheme's development: '[T]here is perhaps no more regrettable feature of the Harvey question that the fact that there no attempt was made to show the settlers how to use the water'.<sup>89</sup> The WSSD had deployed inexperienced engineers on the project and failed to address the significant drainage issues affecting the region.<sup>90</sup> Likewise, Oldham's decision to use unlined channels, rather than the piped network that the farmers had wanted, proved a failure. Water could easily escape the channels, causing 'considerable damage' to the poorly drained orchards.<sup>91</sup> Irrigators and their governments would continue to face the problems of 'too much' and 'too little' in their ongoing efforts to overcome the summer 'drought' in these districts.

### ***Watering the suburbs***

After Federation, Australians across the new nation continued to gravitate toward cities along the coastline, and Perth was no exception.<sup>92</sup> The capital and its expanding suburbs grew nearly threefold between 1911 and 1941, from 87,000 to 229,700.<sup>93</sup> By the end of the Second World War, more Western Australians lived in Perth than in the state's agricultural areas, eclipsing the metropolitan dominance of the other states.<sup>94</sup> The expansion of the suburbs transformed the environment of the Swan Coastal Plain as land was cleared to make way for new homes.<sup>95</sup> The water use of suburban householders also underwent a dramatic change, with each Perth resident in 1941 consuming daily nearly twice as much water as they had in 1911. Whereas before the First World War Perth residents on average consumed nearly 164L each per day, by the beginning of the Second World War, they were consuming nearly 306L.<sup>96</sup> In this section I examine this increase in per capita water use, and argue that this unquenchable

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<sup>88</sup> Royal Commission on the Agricultural Industries of Western Australia, *Second Progress Report of the Royal Commission on the Agricultural Industries of Western Australia on the Selected Portions of the South-West Coastal Districts*, Perth, Govt. Printers Office, 1918, p. xiii.

<sup>89</sup> Royal Commission on the Agricultural Industries of Western Australia, *Second Progress Report*, p. xiv.

<sup>90</sup> Powell, *Watering the Western Third*, p. 29.

<sup>91</sup> Royal Commission on the Agricultural Industries of Western Australia, *Second Progress Report*, p. xiv.

<sup>92</sup> G. D. Snooks, 'Development in adversity 1913-1946', in Stannage (ed.), *A New History of Western Australia*, p. 257.

<sup>93</sup> H. E. Hunt, 'Address', in *Seminar H<sub>2</sub>O: domestic extravagance*, Nedlands, UWA, 1975, p. 2.

<sup>94</sup> Snooks, p. 257.

<sup>95</sup> I. Abbott, 'Aborigines, settlers and native animals: a zoological history of the south-west', *Early Days*, vol. 12, no. 3, 2003, p. 237.

<sup>96</sup> Hunt, p. 2.

thirst was a result of a growing suburban dependence on abundant water supplies. This dependence, in turn, would render the people of Perth vulnerable to running out of water in the future.

Some of this increase in water use can be attributed to the increased domestic availability and accessibility of water, which resulted from the growing reticulation of the suburbs. The opening of the Kalgoorlie Pipeline in 1903 had created a disparity in comfort between those on the eastern goldfields and those in the suburbs of Perth, who remained largely reliant on artesian bores.<sup>97</sup> Even in the early 1920s, the *Daily News* would opine, ‘There is no sound reason why the people of the metropolitan area should be treated differently from the rest of the population’.<sup>98</sup> This would later become a complaint from regional residents about the special treatment given to the people of Perth. Reticulation was frequently used as an enticement to prospective residents of the new suburbs and the Metropolitan Water Supply, Sewerage and Drainage Board (MWSSDB) increased its water storages to ensure these supplies would be available.<sup>99</sup> By 1913, ‘all areas serviceable by gravity’ had been reticulated.<sup>100</sup> Yet nearly a quarter of Perth’s homes remained without piped water and they depended on ‘wells and neighbours’ taps’ for their supplies.<sup>101</sup> Many more continued to rely on galvanised iron tanks to supplement the expensive and unreliable reticulated supplies.<sup>102</sup>

In the summer of 1919/20, the State government introduced water restrictions on suburban water use. These restrictions forbade the use of mechanical sprinklers as the tendency of Perth residents to consume more water during the hot summer months threatened to exhaust the city’s water supplies. This move was met with a backlash, evident in the local press. The *Daily News* raged:

The Water Supply Department’s order issued to-day is a humiliating confession of incapacity and short-sightedness, and the citizens whose gardens are doomed, and whose pride will very soon be humbled in the hot sand, will be altogether justified if they demand either that the Government, which has allowed such a state of affairs to come to pass, shall either straightway take steps to ensure that no future summer will find us in such evil straits, or will get out of office and give the reins to

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<sup>97</sup> Hartley, p. 170.

<sup>98</sup> ‘Water for the metropolitan area’, *Daily News*, 17 May 1923, p. 8.

<sup>99</sup> S-J Hunt, *Water, the Abiding Challenge*, Perth, Metropolitan Water Board, 1980, p. 66. These included a dam at Bickley Brook (1911) and a reservoir at Mt Hawthorn (1914).

<sup>100</sup> Hartley, p. 171.

<sup>101</sup> C. T. Stannage, *The People of Perth: a social history of Western Australia’s capital city*, Perth, Perth City Council, 1979, p. 277.

<sup>102</sup> Stannage, *The People of Perth*, p. 277.

another set of Ministers who will be less wedded to finicky trifles, and more given to exercise of initiative in big things and capable of administration in the departments which count so largely in our everyday life.<sup>103</sup>

The editor of the *Sunday Times* argued that the government had failed to keep pace with the growing metropolitan population.<sup>104</sup> Although per capita consumption had remained steady, total consumption had doubled since 1911, from about 5,000ML to over 10,000ML in 1921.<sup>105</sup>

The press argued that as the ‘people [paid] for water, and [paid] dearly’, they should be able to use their scheme water when, where, and how they wished.<sup>106</sup> Such an argument suggested a growing consumer activism among Perth water users. In their study of water shortages in London in the 1890s, Vanessa Taylor and Frank Trentmann consider that such activism represented a ‘politics of entitlement and provision in times of scarcity’, which arose from the growing connections between the private and public spheres that reticulated water supplies had forged.<sup>107</sup> In both London and Perth, these connections were technical as well as political. The linkage of households to pumping stations and dams, which allowed changes in private routines, became the basis for political mobilisation regarding water services. In Perth, such protests not only reflected public dissatisfaction with the state of the city’s water supplies, but also the sense of vulnerability among householders to running out of water. This vulnerability, I contend, arose from anxieties about the nature of Perth’s urban and domestic spaces.

Anxieties about the health and progress of white Western Australians were important influences on the relationships that people in the growing suburbs of Perth had developed with water supplies and their (natural) surrounds by the first half of the twentieth century. Their anxieties, I contend, led them to develop dependencies on abundant water supplies to overcome their fears, which weakened their hydroresilience. The application of the concept of ‘environmental anxiety’ to the households and suburbs of Perth in the early twentieth century challenges the traditional historical narrative of imperial domination of colonised environments. Extending the concept of environmental anxiety to the suburban context also questions the supposed

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<sup>103</sup> ‘The city beautiful’, *Daily News*, 3 December 1919, p. 4.

<sup>104</sup> ‘Water restriction’, *Sunday Times*, 24 December 1933, p. 11.

<sup>105</sup> Hunt, ‘Address’, p. 2.

<sup>106</sup> ‘The city beautiful’, *Daily News*, 3 December 1919, p. 4; and ‘A waterless city: gross negligence somewhere’, *Daily News*, 14 March 1920, p. 8.

<sup>107</sup> V. Taylor and F. Trentmann, ‘Liquid politics: water and the politics of everyday life in the modern city’, *Past and Present*, no. 211, 2011, pp. 203-14.

environmental (and economic) security that Australians have long associated with suburban spaces.

After the First World War, concerns were reignited among the British and Australian middle classes about racial degeneration and the decline of the Empire.<sup>108</sup> Roused by these concerns, reformers from an emergent class of technocrats sought to overcome social ills through the application of principles of science and reason to domestic life.<sup>109</sup> Stimulating this movement were widely held anxieties about the influence of the environmental conditions inside and outside the (middle class) home on mental and physical health of Western Australians. Meanwhile, the body and its health had come to be seen as a closed system, distinct and separate from its environment.<sup>110</sup> White Western Australians, for instance, no longer perceived the climate characteristics of the temperate southwest as a threat to their health. Likewise, belief in the miasmatic theory of disease transmission had been replaced with germ theory.<sup>111</sup>

These ideas point to the paradox that Linda Nash has observed in modern public health: 'it insisted on the need for certain environmental changes while denying that the environment played an active role in the production of disease'.<sup>112</sup> In line with the modernist state, advocates of these environmental reforms were mostly male members of an emerging professional middle class seeking to reshape (Western) Australian suburbs, homes and families according to their vision of a modern society.<sup>113</sup> Advocates such as William Saw, Billie Bold, Harold Boas and also Bessie Rischbeith called for the improvement of parks and playgrounds to better the lives of Western Australians, particularly children. Water was an important, yet often overlooked, tool to achieve such reform.<sup>114</sup> By the end of the nineteenth century, a constant water supply had come to symbolise modern civilisation and these supplies provided the means to cultivate attractive open spaces.<sup>115</sup> The environmental anxieties held in the suburbs, therefore,

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<sup>108</sup> K. Reiger, 'All but the kitchen sink: on the significance of domestic science and the silence of social theory', *Theory and Society*, vol. 16, no. 4, 1987, p. 503; and J. A. Gregory, 'Protecting middle-class suburbia: an ideal space for the citizens of interwar Perth', *Studies in Western Australian History*, vol. 17, 1997, p. 77.

<sup>109</sup> K. Reiger, *The Disenchantment of the Home: Modernising the Australian Family 1880-1940*, Melbourne, Oxford University Press, 1985, pp. 2-3.

<sup>110</sup> L. Nash, *Inescapable Ecologies: a history of environment, disease and knowledge*, Berkeley, University of California Press, 2003, pp. 88-91.

<sup>111</sup> P. Troy, 'Conclusion', in P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australian cities*, Canberra, ANU Epress, 2008, p. 196.

<sup>112</sup> Nash, p. 113.

<sup>113</sup> Reiger, 'All but the kitchen sink', p. 497.

<sup>114</sup> J. A. Gregory, "'Let our watchword be 'order' and our beacon 'beauty'": achieving town planning legislation in Western Australia', in R. Freestone (ed.), *Cities, Citizens and Environmental Reform: histories of Australian Town Planning Associations*, Sydney, Sydney University Press, 2009, pp. 173-99.

<sup>115</sup> Taylor and Trentmann, pp. 204-205.

kindled an ever-growing thirst in many Perth householders and rendered them vulnerable to water scarcity.

The state government had blamed Perth's avid gardening enthusiasts for the need to implement water restrictions. The Minister for Water Supply, William George, likened their water consumption to 'criminal practice', and considered their behaviour mindless because 'in the sandy soils of Perth this flooding of water simply leached out the plant food'.<sup>116</sup> But without liberal amounts of water, cried one newspaper correspondent, 'the City Beautiful ... must quickly become little better than an arid desert'.<sup>117</sup> This condemnation was an affront to the city's gardeners who had invested heavily in improving the appearance of their properties. Yet it revealed the cultural significance that suburban gardens had attained in Perth by the early decades of the twentieth century.

The expansion of Perth's reticulated water supplies had coincided with changing expectations about the appearance of the city and its suburbs. During the First World War, Perth's town planning movement emerged and its influence on suburban development in Western Australia was almost immediate.<sup>118</sup> The leaders of the local movement widely advocated the importance of orderly planning, open spaces and aesthetic appeal in town planning.<sup>119</sup> In an address to the Royal Society of Western Australia in 1918, William Saw, the President of the Town Planning Association of Western Australia, argued,

We must do better than we have done in conserving our baby life by taking greater care of the mothers of the nation ... by getting [them] ... out ... to zones ... where the children, in their garden villages, will grow up taller, stronger, deeper in the chest, freer from physical defects, happier, more likely to be stalwart effectives in the wealth-creating forces of the State, and less likely to be a burden on the community.<sup>120</sup>

Attention to these details not only reflected the ideals of the international town planning

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<sup>116</sup> 'Shortage of water: the Minister for Water Supply', *West Australian*, 27 November 1920, p. 8. Frank Trentmann and Vanessa Taylor explore the development of the 'apathetic consumer', the 'wasteful consumer' in, 'From users to consumers: water politics in nineteenth century London', in F. Trentmann (ed.), *The Making of the Consumer: knowledge, power and identity in the modern world*, Oxford, Berg, 2005, pp. 70-71.

<sup>117</sup> 'The city beautiful', *Daily News*, 3 January 1919, p. 4.

<sup>118</sup> Gregory, "'Let our watchword be 'order' and our beacon 'beauty'", pp. 173-99.

<sup>119</sup> Gregory, "'Let our watchword be 'order' and our beacon 'beauty'", pp. 181-82.

<sup>120</sup> W. A. Saw, 'Some aspects of town planning', *Journal and Proceedings of the Royal Society of Western Australia*, vol. 5, 1918-19, p. 41, cited in Gregory, 'Protecting middle-class suburbia', p. 77.

movement, but was also evidence of the prevailing anxieties about the influence of the environment on the mental and physical health of suburban Western Australians.

Creating the ideal environment for the 'healthy moral and physical development' of Western Australian children was the duty of the state's 'good' citizens. Citizenship, therefore, was closely related to the upkeep of the home's outward appearance. The maintenance of the front garden in particular was, according to Robert Freestone, 'vital in order to attain the coherence of the garden suburb street picture, which secured a demonstrable sense of community'.<sup>121</sup> Garden fashions called for a large expanse of lawn, with flowering shrubs and annuals.<sup>122</sup> The backyard, in contrast, was a utilitarian space for household tasks.<sup>123</sup> To allow the front garden to deteriorate would undermine the bonds of the community, reflecting imperial anxieties of racial and imperial decline during the interwar period.<sup>124</sup> These middle class concerns about the appearance of the front garden led to the heavy use of water outside Perth homes, particularly during the long summer months.<sup>125</sup> During the period of water restrictions, some local businesses appealed to these anxieties and encouraged gardeners to invest in windmills and engine pumps to 'be independent' and to ensure 'a free water supply, when you want it, and where you want it'.<sup>126</sup> It was only after this period of water restrictions that locally produced gardening publications for local conditions, such as the *Western Australian Gardening Guide*, advocated methods of water conservation.<sup>127</sup>

Although Perth's gardening enthusiasts were especially outraged at the restrictions on their water use, many householders found their reticulated water supplies had literally dried up. In March 1920, the *Daily News* cried, 'Last night practically the whole city was without water, and the sorry spectacle was witnessed, even in Hay-street West, of mothers taking their pitchers to those who possessed wells, to obtain water with which to wash their children before putting them to bed'.<sup>128</sup> Reminiscent of the

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<sup>121</sup> R. Freestone, 'Planning, housing, gardening: home as a garden suburb', in P. Troy (ed.), *A history of European housing in Australia*, Oakleigh, Cambridge University Press, 2000, p. 133.

<sup>122</sup> J. Viska, *A Guide to Conserving and Interpreting Gardens in Western Australia*, Perth, Australian Garden History Society (WA Branch), 2007, pp. 26-27.

<sup>123</sup> G. Seddon, *Landprints: reflections on place and landscape*, Melbourne, Cambridge University Press, 1997, p. 153.

<sup>124</sup> Gregory, 'Protecting middle-class suburbia', p. 77.

<sup>125</sup> D. R. Williamson, 'Statistics of water use', in *Seminar H<sub>2</sub>O*, pp. 6-7.

<sup>126</sup> Bros, 'Advertisement', *West Australian*, 23 October 1920, p. 2; Malloch Bros, 'Advertisement', *West Australian*, 4 December 1920, p. 2; Malloch Bros, 'Advertisement', *West Australian*, 24 December 1921, p. 5; State Implement and Engineering Works, 'Advertisement', *Daily News*, 6 December 1920, p. 3; and Malloch Bros, 'Advertisement', *West Australian*, 22 January 1921, p. 9.

<sup>127</sup> Wilson and Johns, *Western Australian Gardening Guide*, Perth, Beer's Union Print, 1924; and Gaynor, *Harvest of the Suburbs*, p. 22.

<sup>128</sup> 'A waterless city', *Daily News*, 14 March 1920, p. 8.

Great Water Famine of the late 1890s, this account highlights the domestic relationship between women and water, and the ways in which gender relations shaped water use in suburban Perth in the early twentieth century.<sup>129</sup> At the time of these shortages, nearly half the average household's water consumption took place inside the home.<sup>130</sup> These shortages exposed the dependence of many suburban households on relatively reliable scheme water supplies to maintain the fragile veneer of civility, and in doing so, revealed the vulnerability of the middle class home to running out.

As the account above suggests, such episodes of water scarcity interrupted the domestic routines of Perth's housewives and the declining number of domestic servants, adding to their heavy burden.<sup>131</sup> After all, argued the local magazine *Western Homes*, they were responsible for making the ideal home: 'The parents of the West must strive to make a home of their house, and create that "Home Influence" which does not distort but beautifies; which makes *good citizens*, and not bad parasites or dangerous criminals'.<sup>132</sup> Despite the improvements in household plumbing and the availability of piped scheme water, the domestic duties of most housewives remained arduous. Even homes that were connected to scheme water supplies did not necessarily have a kitchen sink and its associated drainage system. For instance, on the eve of World War One, a visitor to a comfortable home in suburban Claremont would have found that 'the kitchen tap was near the floor, dishes were done in a bowl, and the dirty water was tipped into a kerosene tin which father emptied daily'.<sup>133</sup> Although indoor plumbing had become commonplace around the First World War, some homes still remained without these conveniences in the 1940s.<sup>134</sup> Nevertheless, these rudimentary technologies helped Perth housewives to conform to middle class expectations of the domestic sphere. Their chores had become 'redefined as scientific work of national importance' – of creating good citizens.<sup>135</sup> Water scarcity, however, rendered these technologies impotent and exacerbated suburban anxieties of running out.

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<sup>129</sup> C. Nash, 'Environmental history, philosophy and difference', *Journal of Historical Geography*, vol. 26, no. 1, 2000, p. 25; and D. Spain, *Gendered Spaces*, Chapel Hill, University of North Carolina Press, 1992, p. 7.

<sup>130</sup> Williamson, pp. 6-7.

<sup>131</sup> R. Evans and K. Saunders, 'No place like home: the evolution of the Australian housewife', in K. Saunders and R. Evans (eds), *Gender Relations in Australia: domination and negotiation*, Sydney, Harcourt Brace Jovanovich, 1992, pp. 176-90.

<sup>132</sup> *Western Homes*, Nov. 1929, p. 7, cited in Gregory, 'Protecting middle-class suburbia', p. 88. Emphasis in text.

<sup>133</sup> R. Barton, 'Household technology in Western Australia, 1900-1950', *Oral History Association of Australia Journal*, vol. 7, 1985, p. 109.

<sup>134</sup> Barton, p. 109.

<sup>135</sup> Reiger, p. 507.



When restrictions were re-imposed in the following years, newspapers called for ‘lunch hour demonstrations’, warning the government that ‘the people [would] not tolerate further fooling. Water must come, or, on the first opportunity, the Government must go’.<sup>136</sup> In 1923, over two thousand Perth residents attended a meeting at the Rosemount Theatre in North Perth chaired by Premier Mitchell – a sizable crowd for a city of just under 155,000 people. Their concerns were with both the quality and the quantity of the reticulated water supplies. The disgruntled assembly brought with them specimens of the unpalatable water supply, which they said resembled ‘liquid sausage meat’ and ‘tomato sauce’.<sup>137</sup> Premier Mitchell told the audience, ‘[I]t is not the desire of the Government in any way to hamper the laudable desire of the people to beautify their surroundings’.<sup>138</sup> He then announced his Government’s plan to extend the reticulation system to meet the needs of the city, which would include new service reservoirs on Mt Eliza, Mt Hawthorn and Melville Park in the late 1920s; new catchment dams at Wungong and Churchman’s Brooks in 1925 and 1929, respectively; and lastly the Canning River Scheme, which was finally completed in 1940.<sup>139</sup> Until the completion of Canning Dam, however, restrictions were intermittently imposed on garden water use to reduce the draw on the city’s limited supplies.

By the end of the Second World War, nearly all the houses in Perth had running water.<sup>140</sup> This expansion of the city’s supply, I contend, would facilitate increased water use by many Perth residents, particularly outside their homes. Indeed, by the end of the war, per capita water consumption had more than doubled since the turn of the twentieth century.<sup>141</sup> In the southwest’s agricultural areas, however, fewer than half of the homes had a coldwater tap inside the house.<sup>142</sup> Raising the living standards of the state’s farming families would become an important project after the war. This post-war project, I contend, reflected the enduring strength of the environmental reform

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<sup>136</sup> Editorial, ‘Give us water’, *Daily News*, 14 March 1920, p. 4; ‘Topics of the day: water for the metropolitan area’, *Daily News*, 17 March 1923, p. 8.

<sup>137</sup> A. E. Mason, ‘Letter to the Editor’, *West Australian*, 21 January 1922, p. 8; ‘Perth water: Minister’s assurance’, *West Australian*, 21 January 1922, p. 8; ‘Perth water service’, *West Australian*, 23 March 1923, p. 7; Tired of Waiting, ‘Letter’, *Daily News*, 16 March 1923, p. 7; and A. Victim, ‘Letter to the Editor’, *West Australian*, 21 January 1922, p. 8.

<sup>138</sup> J. Mitchell, cited in ‘Water supply’, *West Australian*, 14 March 1923, p. 7.

<sup>139</sup> ‘Perth water service’, *West Australian*, 23 March 1923, p. 7; and Hunt, *Water, the Abiding Challenge*, pp. 68-69. See also J. A. Gregory, ‘Opening of the Canning Dam’, *Studies in Western Australian History*, vol. 10, 1989, pp. 67-74. This announcement did not go without complaint – over six hundred Gosnells residents petitioned against the scheme because of their concerns about the “drastic regulations governing catchment areas” would be “the ruin of the district”. See, ‘Public opinion’, *Daily News*, 20 March 1923, p. 5.

<sup>140</sup> Barton, p. 109.

<sup>141</sup> Hunt, ‘Address’, p. 2.

<sup>142</sup> Barton, p. 109.

movement that had shaped the development of Perth's suburbs and homes in the first half of the twentieth century. The movement's emphasis on the role of the suburban and domestic environment in improving the moral and physical health of (white) Western Australians played a significant part in entrenching the thirsty lifestyle that would characterise Perth after the war. It was a lifestyle that would leave the suburbs vulnerable to running out.

### *Development and depression between the wars*

Following the Armistice, James Mitchell's National Party government (1919-1924; 1930-1933) renewed its support for expanding agricultural settlement throughout the heavily timbered southwest and into the increasingly marginal lands to the east. The policies of Group, Soldier and unemployed workers' settlement schemes in Western Australia reflected efforts throughout the British Empire to colonise the dominions with British emigrants; aid economic recovery; and to reward soldiers for performing their wartime duties.<sup>143</sup> In Western Australia, it was anticipated that the agricultural production of these settlers would offset the decline of the gold industry and overcome the shortage of dairy supplies and associated products in the state. Furthermore, the schemes would relieve post-war unemployment and the influx of migrants would boost Western Australia's prospects for economic development.<sup>144</sup> But the difficulties that the group settlers faced as they attempted to establish a dairy industry in the coastal southwest made success in the wheatbelt vital, for both the State's economy and the government's reputation.<sup>145</sup>

There were doubts within the scientific community regarding the wisdom of Western Australia's agricultural expansion into the eastern districts. Among them was the outspoken physiographer Griffith Taylor, who had worked for the Bureau of

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<sup>143</sup> M. Brayshay and J. Selwood, 'Dreams, propaganda and harsh realities: landscapes of group settlement in the forest districts of Western Australia in the 1920s', *Landscape Research*, vol. 27, no. 1, 2002, p. 82; Powell, *An Historical Geography of Modern Australia*, p. 93; and Waterhouse, pp. 198-201.

<sup>144</sup> Glynn, *Government Policy and Agricultural Development*, pp. 120-30.

<sup>145</sup> Glynn, *Government Policy and Agricultural Development*, p. 119. The southwest Group Settlement Scheme commenced in 1921 with groups in the Manjimup district, followed by others between Busselton and Augusta, at Denmark and Northcliffe and on the Peel Estate south of Perth. Potential British migrants were lured with promises of the 'richly fertile and well-watered south-west of the state, where soil and climate are of the best ... capable of growing anything'. The settlers struggled to establish themselves and dairy pastures in the region and by the time Mitchell left office in 1924, nearly half the British settlers had already abandoned the settlements. Soon after, a Royal Commission was established to investigate the Scheme's failings. See, Burvill, p. 36; *Newcastle Chronicle*, 15 July 1922, cited in Brayshay and Selwood, p. 86; and Bolton, *Land of Vision and Mirage*, p. 111.

Meteorology and participated in Scott's *Terra Nova* expedition to Antarctica prior to his appointment as foundation head of the geography department at the University of Sydney in 1920, the first of its kind in Australia.<sup>146</sup> In contrast to the resounding call for 'Australia Unlimited' after the war, Taylor counselled caution. He considered that large areas of Australia remained uninhabited by Europeans because these lands were suitable for neither agriculture nor pastoralism.<sup>147</sup> In his 1911 book *Australia* (and its subsequent editions), Taylor had denoted a large portion of inland Western Australia as 'useless'. This description was clearly at odds with the expansionist agenda of the Mitchell government. Perceived then as 'insidious and disloyal', Taylor's textbook was banned from the state's school and University curriculums in 1921.<sup>148</sup> The rejection of Taylor's cautionary message was symptomatic of the revival of long-held anxieties regarding the progress of a White Australia. Moreover, it was representative of the widespread disregard for scientific advice when it conflicted with a political agenda of development and land settlement – a trend that only deepened the vulnerabilities of the social-ecological system to variations in climate and water supplies.<sup>149</sup>

Taylor's former employer, the Bureau of Meteorology, was far more supportive of the Western Australian government's development agenda. In 1929, for instance, the Bureau published the *Results of Rainfall Observations in Western Australia*, the fifth volume in a six-volume series in which the rainfall statistics of each state were compiled.<sup>150</sup> The Bureau's representation of Western Australian climates complemented the expansionist agenda of the recently elected Collier government, which pursued policies similar to its predecessor. In the preface to report, the Commonwealth Meteorologist, Henry A. Hunt, explained:

The records of past seasons ... are ... indispensable to the success of most of the young inexperienced men on the land. By a study of his districts' (sic) seasons in the past, a young settler is able to avoid under or over expenditure in increasing his stock or in improvements. The records will show him how many good, bad, or indifferent years he is

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<sup>146</sup> J. M. Powell, 'Taylor, Thomas Griffith (1880-1963)', *Australian Dictionary of Biography*, National Centre of Biography, ANU, <<http://adb.anu.edu.au/biography/taylor-thomas-griffith-8765>>, (Accessed: 11 May 2010).

<sup>147</sup> C. Strange and A. Bashford, *Griffith Taylor: visionary environmentalist explorer*, Canberra, NLA, 2008, p. 103.

<sup>148</sup> This episode is discussed in depth in Carolyn Strange and Alison Bashford's biography of Taylor, *Griffith Taylor*, p. 124; and Joseph Powell's *An Historical Geography of Modern Australia*, pp. 121-49.

<sup>149</sup> See, G. C. Bolton, *Spoils and Spoilers: a history of Australians shaping their environment*, North Sydney, Allen & Unwin, 1992, pp. 138.

<sup>150</sup> Victoria (1910), Queensland and South Pacific (1913), New South Wales (1914), South and North Australia (1917), Western Australia (1929) and Tasmania (1936).

entitled to expect; and he will not be over optimistic after a good season nor over pessimistic after a bad one. The records, too, are made available for the guidance of the majority of established farmers and graziers, for memory of past seasons can rarely be relied upon.<sup>151</sup>

This passage suggests that the Bureau's system of data collection and recording was closely aligned to agricultural interests. Furthermore, this system could provide more accurate knowledge of the local weather than experience on the land itself, and in time, offer the Bureau the means to 'tame chance' in the state's agricultural areas.

Reflecting its alliance with the development project of the state government, the Bureau of Meteorology directed its advice towards the Western Australian 'Primary Producer'. One of the volume's articles extensively detailed the relationship between rainfall, wheat yield and geographic location. The authors argued that dry fallow practices had the 'virtual effect of increasing total available rainfall for each harvest season'.<sup>152</sup> The eastern limits of the wheat belt, therefore, could be expanded beyond the existing 10-inch wheat-growing line to the 7.5-inch line. This would embrace towns such as Norseman and Southern Cross.<sup>153</sup> The authors cautioned against wheat-growing in certain areas, such as Mulline and Davyhurst, as they did not receive sufficiently reliable rainfall.<sup>154</sup> They also assured readers that improvements in agricultural science would provide the means for settlers to develop the eastern margins of the wheat belt. Indeed, in 1929 after a year of light rainfall, the state's Department of Agriculture had boasted, 'Not many years ago a season such as the last one would have meant disaster to the majority of wheat growers'.<sup>155</sup> This shared belief in the possibilities for settling and indeed cultivating Western Australia's semi-arid inland saw the Bureau of Meteorology and the Department of Agriculture portray the climate of the region's marginal lands as safe and secure for European agriculture, bolstering the government's development aspirations.

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<sup>151</sup> Bureau of Meteorology, p. iii.

<sup>152</sup> E. B. Curlewis and M. E. W. O'Dowd, 'Wheat-growing in Western Australia: a review and a forecast', in Bureau of Meteorology, p. 65. In the same year, the WA Department of Agriculture opened files on soil erosion, to which dry farming was found to be a significant contributing factor. See, Gaynor, 'Looking forward, looking back', p. 111.

<sup>153</sup> Curlewis and O'Dowd, pp. 64-67. This '7.5" wheat period isohyet' appears to generally coincide with what is now the 300mm line of average annual rainfall, the eastern frontier of the WA wheat belt. See, M. G. Keen, 'Average annual rainfall', *WA Department of Agriculture*, 2000, <<http://www.agric.wa.gov.au/ikmp/images/rainmapwa.jpg>>, (Accessed: 21 December 2009).

<sup>154</sup> Curlewis and O'Dowd, p. 65.

<sup>155</sup> Department of Agriculture, *Annual Report*, 1929 cited in Glynn, *Government Policy and Agricultural Development*, p. 131.

Whatever reservations farmers might have had about these districts were easily overcome with the favourable market and climate conditions of the decade following the end of the Great War.<sup>156</sup> With generous government subsidies and scientific advice, wheat farming edged eastwards beyond Brockman's line of reliable rainfall.<sup>157</sup> The government was deaf to the possibility of insufficient rainfall in these increasingly marginal eastern lands, and fortunately for them, the seasons were wet.<sup>158</sup> Bolton has suggested that Mitchell's farming successes in the long-established and better-watered Avon Valley during the 1890s when markets had been more favourable, 'had led him habitually to underestimate the hazards of pioneer farming, and confirmed his enthusiasm for agricultural expansion'.<sup>159</sup> Indeed, the wheat acreage trebled during the 1920s, as farmers were spared dry conditions like those experienced in 1911 and 1914.<sup>160</sup> The total area under crop grew from nearly 650,000 to nearly 2 million hectares between 1920 and 1930, and wheat production reached a record of 53.5 million bushels in 1931.<sup>161</sup> By the 1930s, Bolton explains, the region had become 'the heartland of Western Australia; their creation, from a dry and uncultivated wilderness, was the State's proudest and most recent achievement'.<sup>162</sup>

### ***Building a 'discriminatory sanitary order'***<sup>163</sup>

Bringing this 'dry and uncultivated wilderness' into cultivation, however, came at great cost to the region's Aboriginal population. With few employment opportunities on the land after the war and fewer places to camp, more Aborigines had drifted into the outskirts of wheatbelt towns, particularly in the Midlands, Avon and Great Southern districts.<sup>164</sup> But these towns were unprepared for this growth in the Aboriginal population and few white residents were willing to accommodate their presence. Forced off country, many of the region's Aborigines were now forced out of the towns and onto local reserves or into native settlements like Carrolup (est. 1915) and Moore River (est.

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<sup>156</sup> Glynn, *Government Policy and Agricultural Development*, 119.

<sup>157</sup> Gaynor, 'Looking forward and looking back', p. 109.

<sup>158</sup> G. C. Bolton, *A Fine Country to Starve In*, Nedlands, UWA Press, 1994, p. 24.

<sup>159</sup> G. C. Bolton, 'Mitchell, Sir James (1866-1951)', *Australian Dictionary of Biography*, National Centre of Biography, ANU, <<http://adb.anu.edu.au/biography/mitchell-sir-james-733>>, (Accessed: 5 May 2011).

<sup>160</sup> Bolton, *A Fine Country to Starve In*, p. 24.

<sup>161</sup> Haebich, *For Their Own Good*, p. 223.

<sup>162</sup> Bolton, *A Fine Country to Starve In*, p. 2.

<sup>163</sup> G. Prakash, *Another Reason: science and the imagination of modern India*, 1999, cited in Nash, *Inescapable Ecologies*, p. 100.

<sup>164</sup> Haebich, *For Their Own Good*, pp. 225-27, 229. Such trends had been observed in southeastern Australia in the late nineteenth century, see Waterhouse, pp. 59-60.

1918). According to Anna Haebich, the number of gazetted town reserves in the area increased from six in 1920, to thirteen by 1925.<sup>165</sup> Among the reasons for their expulsion was the view that Aborigines were ‘carriers of disease’, and needed to be kept separate from the otherwise healthy (white) population.<sup>166</sup> As Alison Bashford has observed, ‘The discourse of public health was always an effective mode for the expression and practice of racism, since health, hygiene and cleanliness were one significant way in which the “whiteness” of white Australia was conceptualised’.<sup>167</sup>

Already considered filthy, Aborigines were forced onto small reserves that were often situated near town rubbish dumps and sanitary depots, where there were inadequate water supplies and sanitation facilities.<sup>168</sup> Robert Bropho recalls that in the early 1940s at the Eden Hill camp on the eastern outskirts of Perth, the ‘only water supply was from the local tip on the hill near the swamp’ or from shallow wells they dug in the ground.<sup>169</sup> In their tin billies they collected water with ‘tadpoles and the slime on the top’, ‘with a bit of flavour in it from human piss and human shit’.<sup>170</sup> In the wheatbelt, Paul Hasluck observed:

Clothing is seldom washed – how can it be when there are no facilities for doing so or even vessels in which to carry sufficient water into the dwelling? The human body goes unwashed because there are no baths and often little water, though a swim now and again, in some not too distant waterhole helps a little.<sup>171</sup>

Although Hasluck was sympathetic to their plight, more often than not, white Western Australians blamed the Aborigines themselves for their state of health and living conditions. As Linda Nash argues in the Californian context, ‘The *habits* rather than the biology of non-white groups would be ... frequently cited to explain higher rates of

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<sup>165</sup> Haebich, *For Their Own Good*, pp. 233-34.

<sup>166</sup> Haebich, *For Their Own Good*, p. 185.

<sup>167</sup> A. Bashford, “‘Is White Australia possible?’ Race, colonialism and tropical medicine’, *Ethnic and Racial Studies*, vol. 23, no. 2, 2000, p. 149.

<sup>168</sup> Haebich, *For Their Own Good*, p. 234. For further insights into the conditions on the Aboriginal reserves in the southwest, see the life histories of Leonard (Jack) Williams, Stella Penny, Gwen Eades, Eric Krakouer, and Mervyn Winmar in T. Mia (ed.), *Ngulak Ngarnk Nidja Boorda: Our Mother, This Land*, Perth, Centre for Indigenous History and the Arts, 2000, pp. 25, 28; 38-39; 47; 49-52; 67.

<sup>169</sup> R. Bropho, *Fringedweller*, Chippendale, Alternative Publishing Co-operative, 1980, p. 27.

<sup>170</sup> Bropho, p. 30. In light of Heather Goodall’s observations that gender relations structured the collection of water in Aboriginal communities in northwestern New South Wales in the 1930s and 1940s, it is possible that Aboriginal women on the southwest reserves were similarly tasked with the strenuous role of carting water from nearby rivers and wells. See, H. Goodall, ‘Gender, race and rivers: women and water in northwestern New South Wales’, in K. Lahiri-Dutt (ed.), *Fluid Bonds: views on gender and water*, Kolkata, Stree Books, 2006, pp. 300-301.

<sup>171</sup> P. Hasluck, *Our Southern Half-caste Natives and Their Conditions*, 1936, cited in Biskup, p. 163.

sickness and death'.<sup>172</sup> Confined to the margins of white settlements on reserves, camps and in settlements, the southwest's Aborigines could be better regulated and controlled under what Gyan Prakash has described in nineteenth century India as 'a discriminatory sanitary order'.<sup>173</sup> Protecting the health of white Western Australians, as in colonial India, required the containment of the putative source of disease – the bodies, habits and homes of Aborigines.<sup>174</sup>

The apparent disregard among Aborigines for hygiene and cleanliness were grounds for their exclusion from the very institutions that could have helped to improve their living standards and employment prospects. After all, according to prevailing middle class ideas about citizenship and environment, unclean people were 'bad citizens'.<sup>175</sup> Across the southwest in towns like Quairading, Katanning and Koogan, parents of white school children demanded the expulsion of Aboriginal children on the grounds that they were an unhealthy physical and moral influence on their own children.<sup>176</sup> These demands were finally answered on the eve of the hotly contested state elections of November 1914, when the 'offending' Aboriginal children were 'expelled from the schools under a provision in the *Education Act 1893* authorising the exclusion of children deemed to be "injurious" to the health, welfare and morality of other people'.<sup>177</sup> As Haebich observes, the persistence of this practice into the late 1940s denied 'generations of Aboriginal children the right to a state education'.<sup>178</sup>

Likewise, Aborigines were denied proper hospital care on the grounds that their lack of hygiene posed a danger to white patients.<sup>179</sup> Finally in 1915, the government agreed to the demands of the wheatbelt towns to 'clear Aborigines from the town camps and to intern them in segregated settlements'.<sup>180</sup> This discriminatory system trapped the Aborigines of the southwest as surely in a prison, where their abilities to uphold their traditional sources of resilience to climate variability and water scarcity were systematically eroded. Their lack of access to clean water would not only exclude the southwest's Aborigines from education and health care, but also initiate a cascade of discriminatory effects that would continue to be realised long after the First World War.

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<sup>172</sup> Nash, *Inescapable Ecologies*, p. 102. Emphasis in text.

<sup>173</sup> Prakash, cited in L. Nash, *Inescapable Ecologies*, p. 100.

<sup>174</sup> Prakash, *Another Reason*, pp. 132-33.

<sup>175</sup> Gregory, 'Protecting middle-class suburbia', p. 78.

<sup>176</sup> Haebich, *For Their Own Good*, pp. 140-42, 237.

<sup>177</sup> Haebich, "Clearing the wheatbelt", pp. 272-74.

<sup>178</sup> Haebich, "Clearing the wheatbelt", p. 274.

<sup>179</sup> Haebich, *For Their Own Good*, pp. 144, 236.

<sup>180</sup> Haebich, "Clearing the wheatbelt", pp. 272-74.

## *High and dry*

Despite the heady days of the 1920s, the prosperity of many Western Australian farmers would not continue. During this decade, wheat farmers in other parts of the world had begun to reduce their wheat acreages in response to an uncertain economic outlook.<sup>181</sup> But in Western Australia, wheat remained king. The state's economy had become heavily reliant on the buoyant overseas wheat market and the state government was convinced that Western Australian wheat could continue to compete against exports from Canada and the United States on British and European markets.<sup>182</sup> Seduced by the prosperity of the 1920s, many farmers took on debts to expand their farms.<sup>183</sup> On the eve of the new decade, however, commodity prices collapsed with disastrous consequences for the state's wheat farmers.

The severity of these economic conditions had left many farmers financially exposed to the onset of dry conditions in the mid-1930s, which lasted until the end of the decade. Aside from 1939, rains across the agricultural areas were below average and the drought of 1940 rivalled that of 1914 in its severity. Invasions of ravenous grasshoppers, rabbits and emus decimated the surviving crops, exacerbating the farmers' plight.<sup>184</sup> For the eastern wheatbelt, circumstances were especially dire – farmers there were over-laden with debt and faced with poor seasons, poor soils and poor prices. Nearly three thousand would abandon their properties.<sup>185</sup> As Premier Wilcock observed, 'All their labour has gone for nothing, all their hopes have been dashed, and the only result has been disaster'.<sup>186</sup>

In contrast to the Scaddan government's response to the dry conditions during World War One, the Wilcock government (1936-1945) decided that it was no longer tenable to encourage wheat farming in the more marginal eastern districts. The human toll had become too great, and the state government lacked the funds to continue to subsidise their agrarian endeavours.<sup>187</sup> In 1940, the Commonwealth joined with the Wilcock government to initiate a 'reconstruction' program to support a shift from wheat to sheep in these 'marginal' areas. The main criteria for 'marginality' were the rainfall and cropping statistics of these areas: about 250 mm (10-11 inches) of annual rainfall

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<sup>181</sup> Bolton, *A Fine Country to Starve In*, pp. 25-26.

<sup>182</sup> Bolton, *A Fine Country to Starve In*, pp. 25-26.

<sup>183</sup> Glynn, *Government Policy and Agricultural Development*, pp. 126-28, 134-38.

<sup>184</sup> Burvill, p. 48.

<sup>185</sup> J. Maddock, 'Marginal areas', in J. Gregory and J. Gothard (eds), *Historical Encyclopedia of Western Australia*, Crawley, UWA Press, 2009, pp. 552-53; and Dahlke, p. 9.

<sup>186</sup> *Western Australian Parliamentary Debates*, vol. 2, 27 October 1938, p. 1670.

<sup>187</sup> Bolton, *A Fine Country to Starve In*, pp. 263-64.



was classified 'marginal'.<sup>188</sup> Five of these marginal areas were targeted for reconstruction: 'Ajana to Kalannie; Kalannie to Southern Cross; Dulyalbin; the Lakes/Ravensthorpe District; and Esperance/Salmon Gums' (Figure 2.2).<sup>189</sup> Over a period of four years, about two thousand farms were reduced to just under eight hundred farms, which would now rely on sheep as their main source of income. The Commonwealth assisted with purchasing stock as well as fencing material and water supplies, while the state government helped by 'reducing land prices, reclassifying soils, increasing acreages by linking abandoned properties, and writing off debts'. The intention of these reconstruction efforts had been to reduce the vulnerability of farmers in these marginal areas to variations in climate and the market. Yet when better seasons and prices returned after the Second World War, along with improvements in soil science, wheat growing resumed in these marginal areas (see Chapter 3).

Meanwhile, the dire economic circumstances of the 1930s proved to be a windfall for the irrigators of the southwest. After the First World War, soldier settlers had struggled to establish themselves in the poorly drained areas around Harvey and Waroona. The Public Works Department had to pump additional irrigation water from the Brunswick and Serpentine Rivers, while irrigators in the Waroona district found that their reliance on drains was 'inequitable, uneconomic and inefficient'.<sup>190</sup> With Commonwealth assistance, the Mitchell government embarked on a scheme to put over six thousand unemployed men to work on public works around the state.<sup>191</sup> The irrigation and drainage works at Harvey would be one of those projects. At last there was the cheap labour and political will to build the water supply and drainage infrastructure for which irrigators had pressed for a decade.<sup>192</sup>

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<sup>188</sup> Maddock, pp. 552-53.

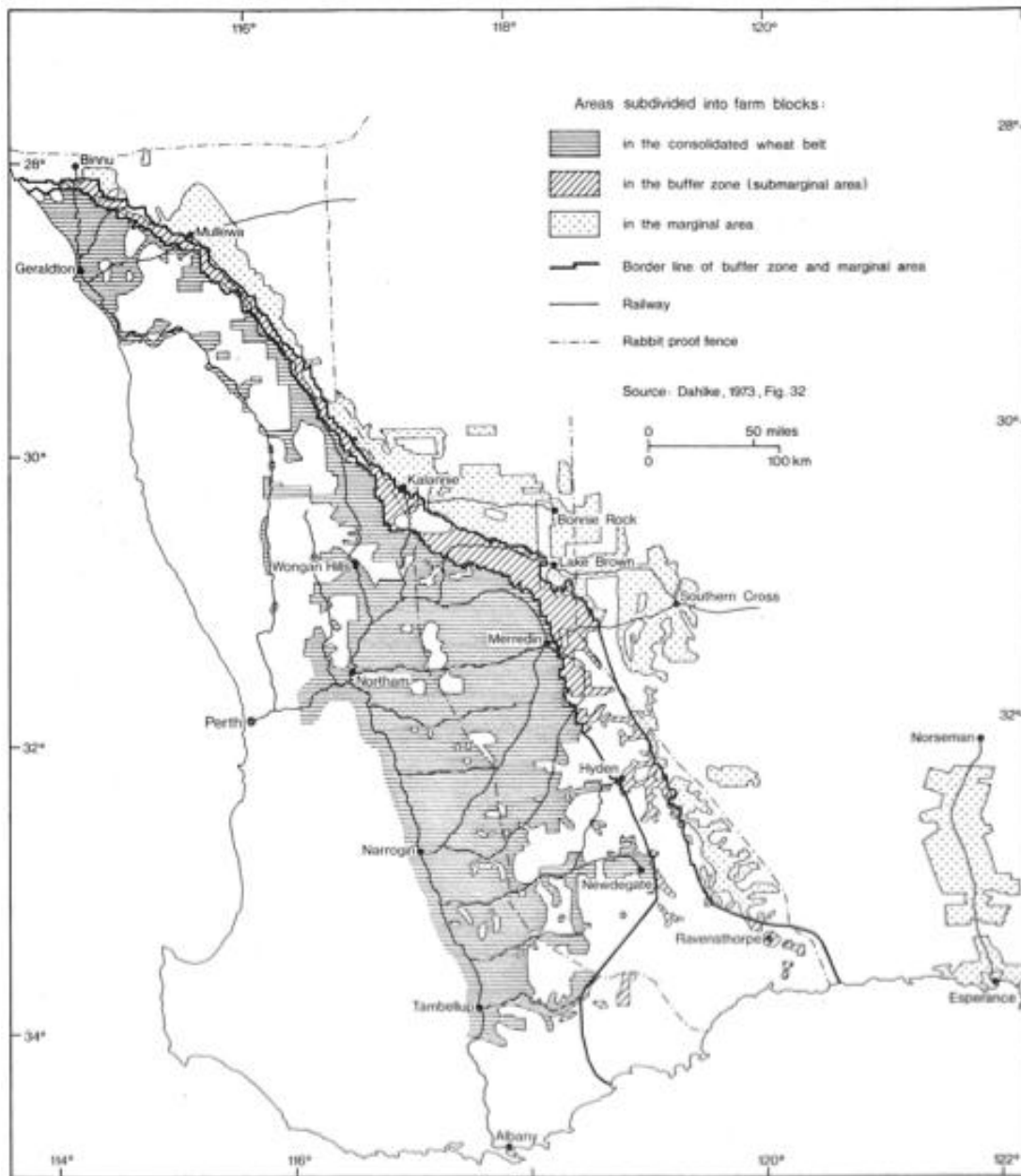
<sup>189</sup> Maddock, pp. 552-53.

<sup>190</sup> Cooper, p. 248.

<sup>191</sup> Bolton, *A Fine Country to Starve In*, p. 182. These men also constructed Canning Reservoir and the Wicherina Dam near Geraldton.

<sup>192</sup> Cooper, p. 249.

**Fig. 2.2: Marginal areas of the Western Australian wheatbelt<sup>193</sup>**



Construction began on raising the height of the Harvey Dam in late 1930, and the work was completed in 1932, which included expanding the size of the Harvey irrigation district and excavating additional channels. Drakesbrook Dam at Waroona was commenced in 1930 and finished in 1931. That year, despite protestations from many farmers in the Collie district who were unconvinced of the benefits of irrigation, work began on the Wellington Dam, which was completed in 1933.<sup>194</sup> Finally, the construction of a drain to divert the Harvey River ensured that by 1934, water from the

<sup>193</sup> Dahlke, p. 10.

<sup>194</sup> Cooper, p. 249.

river no longer spread across the plain but ran straight into the Indian Ocean.<sup>195</sup> In the meantime, the irrigation channels were lined with concrete to reduce the losses of water from seepage, and the paddocks underwent grading, to ensure the more even and efficient distribution of water.<sup>196</sup> So successful was irrigated dairy farming during this period that construction began on the damming of Samson Brook in 1939, and surveys commenced for the Stirling Dam on the Harvey River, which was completed after the Second World War.<sup>197</sup>

### ***Conclusion***

During the first half of the twentieth century, most people in the southwest had been enthralled by the promise of agricultural development. The subsequent creation of the wheatbelt between the Darling Ranges and the eastern goldfields allowed closer settlement in the agricultural areas, while a small dairy industry grew along the coast. Their faith in the reliable climate of the southwest was dashed by the onset of dry conditions on the eve of the First World War, which raised questions about the viability of the wheatbelt and the irrigation schemes along the coast. The Jeremiahs were dismissed, and before long, governments and farmers were gambling on the return of better seasons and favourable markets between the wars. Their confidence in the land and the weather would push the limits of settlement further east, leaving many farmers vulnerable to running out in the post-war decades.

Meanwhile, residents in the growing suburbs demanded reticulation and more reliable water supplies to allay their anxieties about the moral and physical hygiene of white Western Australian families. The enduring emphasis on the role of domestic environment in making good citizens played a significant part in entrenching the thirsty lifestyle that would flourish in the post-war era. Their demands for continuous and abundant water supplies would not be met until the large-scale water resource developments of the 1950s and 1960s, which would foster and facilitate the emergence of a profligate water culture in the southwest.

The expansion of the wheatbelt and the suburbs had devastating consequences of the Aboriginal peoples of the region. Forced off country and rejected from white settlements on the racialised grounds of ‘public health’, many Aborigines found

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<sup>195</sup> A. Brearley, *Ernest Hodgkin's Swanland: estuaries and coastal lagoons of southwestern Australia*, Crawley, UWA Press, 2005, p. 166.

<sup>196</sup> Cooper, p. 251.

<sup>197</sup> Cooper, p. 249.

themselves subjected to a discriminatory sanitary order in the southwest, which would persist long after the Second World War.

The end of the war signalled to many people in the southwest that the hardships of drought and depression were over and that an exciting new chapter for the state was about to unfold. Although many Western Australians would be swept up in the developmentalist zeal of the post-war years, their prosperity would lay the foundations for running out in the future.

### **A Million Acres a Year: Engineering Post-War Prosperity (1945 to 1969)**

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*[T]he development imperative had appeared in so many guises: it was an effective transmitter of sonorous claims of national security; it barracked for the can-do of gung-ho modern engineering; and it buzzed with all the whisperings of a collective conscience which was sincerely confused about 'wasted' opportunities – and especially about 'empty' or even emptyish space. And certainly, the development imperative resonated with unusual effect in Western Australia.<sup>1</sup>*

- J. M. Powell, 1998

During the 1960s, the Liberal Brand government proudly declared that a million acres of land was being released to agriculture each year. This pronouncement reflected the spirit of progress and development that had defined post-war Western Australia, particularly in the 1950s and 1960s, and the state government's ongoing role as the shrewd architect of this growth. After the Second World War, waves of European migrants boosted the state's population and stimulated the construction industry, which was building the new suburbs extending along the Swan Coastal Plain.<sup>2</sup> The state's industrial development was unfolding south of Perth, the Ord River Scheme in the far north was advancing, and lucrative mining projects were underway.<sup>3</sup> For the agricultural areas, the Korean War had also ushered in a boom and the southwest's farmers benefitted from the mostly wet seasons that followed the Second World War (Appendix II). These were heady days indeed for many people in the southwest.

The Western Australian brand of developmentalism that had emerged in the 1890s and blossomed in the interwar years continued to hold sway after the Second World War. In the 1950s, however, the characteristics of this brand underwent subtle

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<sup>1</sup> J. M. Powell, *Watering the Western Third: water, land and community in Western Australia, 1826-1998*, Perth, Water and Rivers Commission, 1998, p. 48.

<sup>2</sup> F. K. Crowley, *Australia's Western Third: a history of Western Australia from the first settlements to modern time*, Melbourne, Heinemann, 1970, pp. 336-37. For a brief overview of the sense of prosperity in rural Australia after the war, see R. Waterhouse, *The Vision Splendid: a social and cultural history of rural Australia*, Fremantle, Fremantle Arts Centre Press, 2005, pp. 208-211.

<sup>3</sup> During the Second World War, the Western Australian government (with assistance from the Commonwealth) began scientific investigations into the prospects for irrigated agriculture in the Kimberley in the state's northwest. Despite widespread criticism about the cost and feasibility of the project, the Scheme went ahead and the main dam on the Ord River was finally completed in 1972, which created Lake Argyle. High costs, poor cotton yields, unfavourable markets and insect problems blighted the Scheme and by 1978, only six farmers remained. It would remain widely regarded as a 'white elephant' until the end of the twentieth century. See Powell, pp. 40-46; and B. R. Davidson and S. Graham-Taylor, *Lessons From the Ord*, St. Leonards, Centre for Independent Studies, 1982.

changes, while retaining the core elements of the interventionist state; the focus on agricultural, pastoral and mining development; and a populist rhetoric based on parochial anti-eastern states and anti-federal sentiments, as outlined in the previous chapter. In addition to the earlier approach, the conservative state government was now increasingly receptive to large-scale foreign investment in resource development and was willing to relinquish its ownership and control of these ventures.<sup>4</sup> Furthermore, the government offered lucrative incentives to attract this capital, such as generous provision of infrastructure. The allure of development often meant, however, that the benefits of such projects were not adequately evaluated. Guiding all of these elements, argues Lenore Layman, was a rhetoric ‘centred on the concept of “bigness”’, whereby the scale of the state’s industrial development in the 1950s and 1960s might at last match Western Australia’s geographical area.<sup>5</sup>

Local and national scientific research was also infused with this ethos of development, which shaped both the nature and application of science and technology in the post-war era. Despite the social and economic implications of droughts in Australia, it was not until well after the Second World War that scientific attention was turned to their study. In 1955, the Chief Scientific Officer of the Bureau of Meteorology, James C. Foley, undertook a continent-wide study of droughts. He concluded that no corner of the continent was safe from drought and warned, ‘The rapid expansion of primary industries in Australia in the last fifty years has greatly increased the vulnerability of the economic position of the country to drought’.<sup>6</sup> The historic commitment to European agriculture and pastoralism in the antipodes was continuing to render Australians vulnerable to running out and the nation turned to science to allay their anxieties.

This direction of scientific and technological research was especially evident in the development of the southwest’s water resources and the study of local climates where it was deployed in response to environmental anxieties over aridity and fertility. The state and Commonwealth governments cooperated to extend reticulated water supplies to the southwest’s agricultural areas; advances in engineering improved the effectiveness of farm dams; and the growing suburbs of Perth were connected to the city’s expanding network of pipes and reservoirs. Meanwhile, local climate studies seemed to confirm the suitability of the southwest for extensive land settlement and

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<sup>4</sup> L. Layman, ‘Development ideology in Western Australia 1933-1965’, *Historical Studies*, vol. 20, no. 79, 1982, p. 235.

<sup>5</sup> Layman, p. 235.

<sup>6</sup> J. C. Foley, *Droughts in Australia: review of records from the earliest years of settlement to 1955*, Melbourne, Commonwealth Bureau of Meteorology, 1957, pp. 1, 223.

agricultural development. There seemed to be no bounds to the southwest's post-war progress.

In the words of local poet Dorothy Hewett, however, 'The seeds of our destruction have always been imbedded in our brutal innocence'.<sup>7</sup> In this chapter I argue that this post-war pursuit of technocratic solutions to providing water to suburban and rural Western Australians in the southwest encouraged their dependence on plentiful water supplies, which rendered them vulnerable to the shortcomings of a large and inflexible system. Combined with the wet seasons of the 1950s and 1960s, the reticulation of the suburbs and rural areas allowed them to become complacent about the possibilities of climate variability and water scarcity. This postwar faith in the unfettered progress of the state produced a widespread lack of caution – an approach that diminished the hydroresilience of many Western Australians to running out. But none so much as a large proportion of the southwest's Aboriginal population, who were mostly excluded from the government's vision of a prosperous post-war Western Australia.

### ***Big Water in the West***

With a renewed emphasis on the ethos of national development in the post-war period, the fruits of the enduring partnership of government and science were particularly evident in the field of water management. Australian governments understood the command of the nation's water resources as vital to the recovery and economic development of the nation. Critics of this landscape authorship would later note the great environmental and economic costs that the grand water projects of the post-war era entailed. George Seddon, for instance, quipped that this was a period of turning 'gold into water', a reference to Ernestine Hill's 1937 history of the Murray irrigation area, *Water into Gold*.<sup>8</sup> After the Second World War, state and national governments invested heavily in supplying both rural and urban Australians with a seemingly infinite supply of water, creating a system which Fiona Allon and Zoë Sofoulis have termed 'Big Water'.<sup>9</sup> They argue that '[W]ater authorities (shorthand for a mix of government,

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<sup>7</sup> D. Hewett, 'Preface', in D. Hewett (ed.), *Sandgroppers: a Western Australian anthology*, Nedlands, UWA Press, 1973, p. x.

<sup>8</sup> G. Seddon, *Searching for the Snowy: an environmental history*, St. Leonards, Allen & Unwin, 1994, p. 37; D. I. Smith, *Water in Australia: resources and management*, Melbourne, Oxford University Press, 1998, p. 167; and E. Hill, *Water into Gold*, Melbourne, Robertson & Mullens, 1937.

<sup>9</sup> F. Allon and Z. Sofoulis, 'Everyday water: cultures in transition', *Australian Geographer*, vol. 37, no. 1, 2006, p. 48.

corporate and statutory bodies) have evolved to deliver residents a counter-rational (but nation-building) fantasy of an unending, seasonally invariant flow of water'.<sup>10</sup> In the southwest of Western Australia, Big Water comprised the Metropolitan Water Supply, Sewerage and Drainage Department (MWSSDD, later the Metropolitan Water Supply, Sewerage and Drainage Board) in Perth and the Public Works Department (PWD) in rural areas. Big Water, I contend, entrenched particular behaviours and attitudes towards water consumption that have rendered many Western Australians vulnerable to running out.

The rise of Big Water in the post-war era was a product of the partnership between government and science that had become an important characteristic of the modern Australian technocratic state. The principal architects of Big Water in post-war Western Australia were the engineers of the state's PWD, with the financial and political backing of the state and Commonwealth governments. In the early 1950s, two key players in this nexus of government and science were the engineering head of the PWD, Russell Dumas and the Minister for Works, David Brand, who would later become the state's longest serving Premier (1959-1971). They shared a zeal for the state's economic development and focussed their efforts on stimulating both industry and agriculture.<sup>11</sup> For Dumas, as he declared to a meeting of the Institute of Engineers of Western Australia in 1939, '[E]ngineering is the basis of civilisation'.<sup>12</sup> During the 1930s, he had designed and overseen the construction of Wellington Dam and the Collie irrigation area, as well as the raising of Harvey Weir and the extension of Harvey's irrigation area.<sup>13</sup> He had also played an important role in the development of the controversial Ord River Scheme in the state's far north in the 1940s, which would become a monument to the Big Water era, a symbol of how '[t]he pursuit of the gigantic was an integral part of modern nation-building in Australia'.<sup>14</sup> Together Dumas and Brand negotiated for the establishment of the Anglo-Iranian Oil Company's (later, British Petroleum, and now BP) refinery at Kwinana, south of Perth, and for the expansion of reticulated water supplies throughout the state's agricultural areas. Big Water was vital to their endeavours to develop Western Australia to its fullest potential.

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<sup>10</sup> Allon and Sofoulis, p. 48.

<sup>11</sup> Layman, p. 244.

<sup>12</sup> 'Work of engineer: influence in world's development', *West Australian*, 17 February 1939, p. 11.

<sup>13</sup> Layman, p. 237.

<sup>14</sup> Allon and Sofoulis, p. 48.



As Sir David would later recall, his colleague ‘had undoubted faith in what could be done in Western Australia through water supply’.<sup>15</sup>

Although Big Water was intended to overcome inadequate water supplies in particular locales, it would have unforeseen consequences for the vulnerability and resilience of those living in both the reticulated and unreticulated areas. In Western Australia, the post-war development and expansion of suburban and rural water supply schemes enabled the enjoyment of higher living standards and greater amenities. However, these local testaments to Big Water also led many consumers and industries into a dependency upon continuous and copious water supplies, which had hitherto been interrupted by water restrictions. This dependency would, in turn, leave many Western Australians exposed and vulnerable to later episodes of climate variability and water scarcity. Those outside the scope of Big Water relied upon their own private supplies. This independence, I suggest, may have fostered a greater degree of hydroresilience to running out than those who drank from the cup of Big Water. But few took the opportunity to prepare themselves for drier times.

### *Watering the Wheatbelt*

Of the potential constraints to Australia’s post-war progress, the Commonwealth Rural Reconstruction Commission was especially concerned about the paucity of water in the continent’s farming regions. Its *First Report* (1944) warned, ‘[I]n the long run water supply will be the limiting factor in Australian expansion. Australian agriculture will in time need all the water which it is possible to conserve’.<sup>16</sup> This environmental anxiety about a natural constraint on the nation’s agricultural development recalled earlier concerns about aridity and the future of white settlement (see Chapter 2). The revival of the southwest’s flagging agricultural industries and the visions of post-war land settlement would require the investment of engineering expertise to provide water to the wheatbelt.

The challenge to the nation was not simply one of collecting every falling droplet but of engaging in the enormous task of directing water to thirsty rural regions. This was especially pressing in the wheatbelt region of Western Australia, the home state of the Rural Reconstruction Commission’s Chairman, deputy Premier Frank Wise. His state’s PWD engineers had already identified water as a potential limitation on

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<sup>15</sup> David Brand interviewed by Jean Teasdale, 1976, Battye Library, OH 150, p. 45.

<sup>16</sup> Cited in Powell, p. 35.

agricultural development in the wheatbelt.<sup>17</sup> In the early 1930s, PWD engineer B. S. Crimp had reported, ‘I am confident ... it will be essential to have fresh water from the Darling Ranges to cope with the demands in the Wheat Belt’.<sup>18</sup> His colleague, Edward Tindale, later invoked the state’s grandest engineering scheme in support of reticulating the wheatbelt. He argued in 1936 that, ‘The proposal may not [seem] economically sound for a start, but I am convinced that it will be ultimately consummated. The Coolgardie Scheme (the Golden Pipeline) did not look too convincing when it was undertaken’.<sup>19</sup> The post-war agenda of national development would help to breathe life into this nascent vision of Big Water.

Although some wheatbelt towns had been connected to the Golden Pipeline before the war, the state government considered these supplies insufficient for its post-war vision of land settlement and agricultural development. In terms of the conditions ideal for European agriculture, the state government considered that the lands east of the Darling Ranges presented ‘hydraulically difficult country’.<sup>20</sup> There are no extensive river systems and the streams there are mostly intermittent and brackish, due to the low relief and accumulation of salt over millions of years.<sup>21</sup> In addition, the wheatbelt climate is characterised by wet winters and dry summers, with less rain in the inland areas. Dry seasons during and after the war had renewed environmental anxieties about the likelihood of running out and the consequences of such an event for agricultural production and farming families. Fears of Japanese invasion following the fall of Singapore in early 1942 and the possibility of evacuating coastal populations inland had also highlighted the paucity of potable water supplies in the agricultural areas.<sup>22</sup>

These anxieties could be overcome through the reticulation of the wheatbelt – the inland consolidation of Big Water in Western Australia. In 1946 the state Labor government, now led by Frank Wise (1945-1947), announced its intention to bring ‘stability to an important area (the wheatbelt), increas[e] production, and most importantly, to bring an essential social amenity to the people’ through the

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<sup>17</sup> Crimp, cited in J. S. H. Le Page, *Building a State: the story of the Public Works Department of Western Australia 1829-1985*, Leederville, Water Authority of WA, 1986, p. 474.

<sup>18</sup> B. S. Crimp, 1934, cited in Le Page, p. 474.

<sup>19</sup> E. Tindale, 1936, cited in Le Page, p. 474.

<sup>20</sup> Dept of Public Works and Water Supply, *Comprehensive Agricultural Areas and Goldfields Water Supply Scheme: a comprehensive scheme for reticulating water for towns, stock and domestic purposes to certain areas of the mixed farming (cereals and sheep) districts of Western Australia; a request for aid from the Commonwealth government*, Perth, Govt Printer, 1946, p. 6.

<sup>21</sup> A. Brearley, *Ernest Hodgkin’s Swanland: estuaries and coastal lagoons of southwestern Australia*, Crawley, UWA Press, 2005, p. 24.

<sup>22</sup> Reports on Water Supply Schemes, pp. 6-7, c. 1939, Russell Dumas Papers, MN 156, 1295A/O, Batty Library (hereafter, BL); and Dept of Public Works and Water Supply, p. 6.

Comprehensive Water Supply Scheme (CWSS), which I will explain shortly.<sup>23</sup> Such a technocratic response was necessary to enable increased stocking of sheep in the wheatbelt after the war. Sheep had come to play an increasingly important role in Western Australia's agricultural enterprises and the booming wool prices after the war bolstered this position.<sup>24</sup> These sheep required water supplies during the long summer months, which could not be guaranteed in the dry agricultural areas. A Commonwealth study concluded that, '[T]here is no prospect of increasing materially the stock-crop ratio for these parts until further supplies can be obtained'.<sup>25</sup>

In addition to its utilitarian purpose, the government also intended the CWSS to improve the standard of living of farming families in the agricultural areas. Many farmers and their families had long been 'making do' with meagre supplies, 'suffering all the discomforts and social disabilities which a shortage of water entails'.<sup>26</sup> The Commission had undertaken a survey of the agricultural areas that had found only about half of the homes surveyed considered they had adequate water for house and garden purposes.<sup>27</sup> Living standards were least adequate in the northeastern districts. The state government and the Rural Reconstruction Commission were primarily concerned with raising the living standards of farming families to those enjoyed by their suburban cousins. These aspirations to replicate the lifestyle of those living in the cooler and wetter coastal suburbs of Perth in the drier agricultural areas contributed to environmental anxieties about water resources and land settlement in the wheatbelt. Without reliable water supplies, the state government correctly argued, it would be difficult to attract and retain a rural population, which would stymie post-war projects of land settlement and population growth.<sup>28</sup>

These concerns reflected a broader theme in post-war political thought of the unique economic, political and cultural value of rural Australia to the nation. This national preoccupation with the livelihoods and lifestyles of those engaged in the agricultural and pastoral industries was the manifestation of what Don Aitkin has

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<sup>23</sup> K. J. Kelsall, 'The Comprehensive Water Supply Scheme', *Journal of Agriculture (Western Australia)*, vol. 18, no. 3, 1977, p. 69. As Joseph Powell explains, the concept of a 'comprehensive' water supply had its origins in the mining districts of mid-nineteenth century Victoria. The term 'comprehensive' implies inclusiveness, of providing water for a variety of purposes to encourage settlement and economic development in remote areas. See, Powell, p. 27.

<sup>24</sup> L. Robin, *How a Continent Created a Nation*, Sydney, UNSW Press, 2007, pp. 58-62.

<sup>25</sup> T. Langford-Smith, 'Water supply in the agricultural areas of Western Australia', *Australian Geographer*, vol. 5, no. 6, 1947, p. 121.

<sup>26</sup> Dept of Public Works and Water Supply, p. 6.

<sup>27</sup> Langford-Smith, p. 155.

<sup>28</sup> Dept of Public Works and Water Supply, p. 18.

described as ‘countrymindedness’.<sup>29</sup> Western Australia was no exception. Although the drift to the city was already underway, the persuasiveness of this idea of countrymindedness was bolstered by the fact that nearly half the state’s population resided in the rural districts in the mid-1950s.<sup>30</sup> The administrator of the Perth Royal Show, Sir John Dwyer, emphasised this vital role of primary production to all Australians in 1951: ‘The wellbeing of all of us depends on the efforts of the man on the land, for the land is the basis of a country’s prosperity, and on its wise usage depends the future comfort, wealth and happiness of the nation’.<sup>31</sup> The ideology of countrymindedness not only informed protectionist agricultural policies but also combined with anxieties of a vast and empty land vulnerable to invasion to encourage large-scale migration and land settlement schemes.<sup>32</sup> In many cases these schemes, laced with agrarian mythology, lured inexperienced farmers to marginal lands, and left them vulnerable to running out.

After several rounds of deliberations between the state government and the Commonwealth regarding the extent of federal financial assistance, a slightly smaller, ‘Modified’ version of the CWSS proceeded in 1946. Under the modified scheme, the reticulated area was reduced by two thirds, from 12 million to 4 million acres, with the number of towns served shrinking from 35 to 23, and the population falling from 56,000 to 32,700.<sup>33</sup> To serve the great distances of the southwest’s agricultural areas, the Scheme operated in two sections (Figure 3.1). The first section supplemented the Golden Pipeline to create the Goldfields and Agricultural Water Supply, which serviced 1.6 million hectares of the central and north-eastern wheatbelt from Mundaring Weir. Meanwhile, the Great Southern Towns Water Supply Scheme would pump water from the Wellington Dam on the Collie River to the southern wheatbelt.<sup>34</sup> The CWSS would provide a metered water supply service to the boundary of every farm holding in the reticulated area.<sup>35</sup> Shortly before the first stage of the Scheme was completed in 1962, the State government decided to extend the scheme to the towns of Corrigin,

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<sup>29</sup> D. Aitkin, ‘“Countrymindedness”: the spread of an idea’, *Australian Cultural History*, vol. 4, 1985, pp. 34-41.

<sup>30</sup> J. A. Gregory, *City of Light: a history of Perth since the 1950s*, Perth, City of Perth, 2003, p. 40.

<sup>31</sup> Cited in J. Phillips, ‘The Rocky Gully exodus’, in G. Davison and M. Brodie (eds), *Struggle Country: the rural ideal in twentieth century Australia*, Melbourne, Monash University ePress, 2008, p. 8.1.

<sup>32</sup> D. Walker, *Anxious Nation: Australia and the rise of Asia, 1850-1939*, St Lucia, University of Queensland Press, 1999; and D. Walker, ‘Survivalist anxieties: Australian responses to Asia, 1890s to the present’, *Australian Historical Studies*, vol. 33, no. 120, 2002, pp. 319-30.

<sup>33</sup> Le Page, p. 478.

<sup>34</sup> Dept of Public Works and Water Supply, p. 23.

<sup>35</sup> ‘Comprehensive water scheme’, *West Australian*, 3 December 1947, p. 8. Each property was rated on an acreage basis and services in town were rated on a rental valuation basis.

Dalwallinu, Pithara, Ballidu and Kojonup, and soon after with Commonwealth assistance, Gnowangerup, Broomehill, Kalannie, North Koorda, North Bencubbin and Wilgoyne. The existing walls of both the Mundaring and Wellington reservoirs were raised to increase their storage capacities to supply the reticulated wheatlands.<sup>36</sup> By the time of its completion in 1960, Wellington Dam was the largest dam in the southwest region.<sup>37</sup> For the towns that were connected to the CWSS, their reticulation marked momentous occasions in their local histories.<sup>38</sup> Big Water would underpin their post-war growth but, as the next chapter will show, it could also undermine their independence and resilience to running out in the future.

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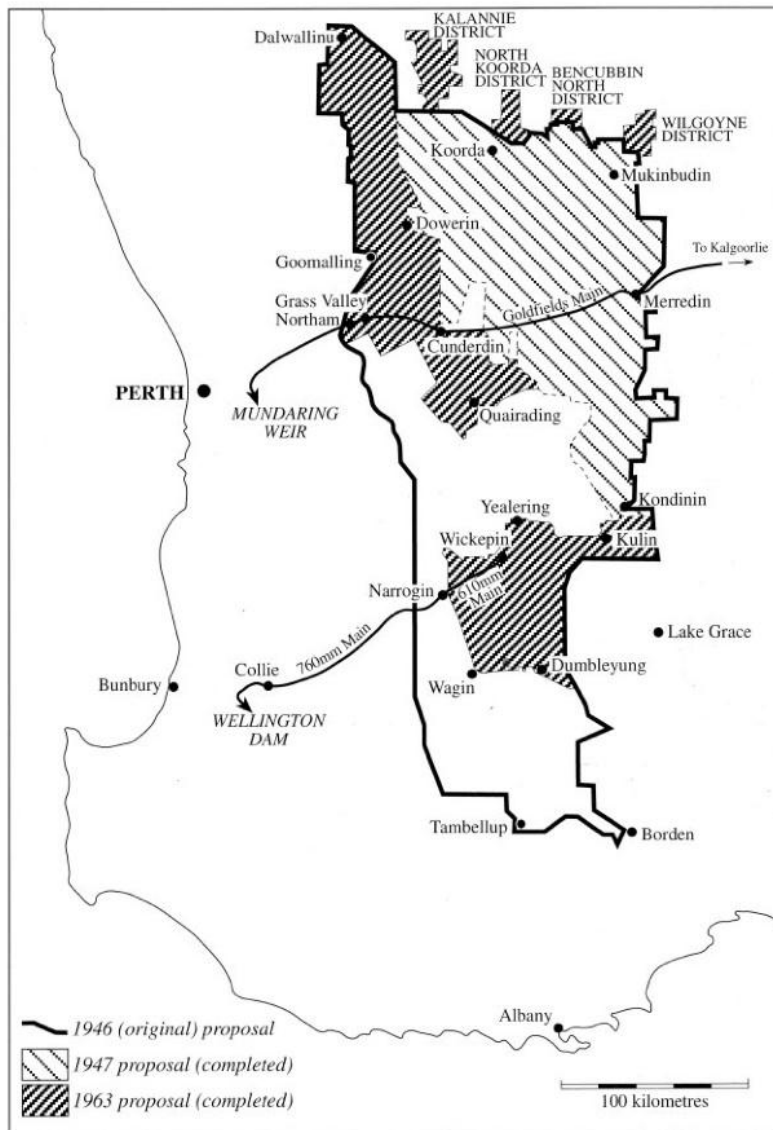
<sup>36</sup> Mundaring Weir was raised by 9.8 metres and Wellington Dam by 15.2 metres. Kelsall, p. 69.

<sup>37</sup> Water Corporation, *Great Southern Towns Water Supply Scheme*, 2011, <[http://www.watercorporation.com.au/Education/education\\_greatsouthern\\_supply.cfm?uid=2731-1029-8081-1998](http://www.watercorporation.com.au/Education/education_greatsouthern_supply.cfm?uid=2731-1029-8081-1998)>, (Accessed: 10 September 2011).

In addition to raising the dam wall, the PWD constructed a 2MW hydroelectric station to provide electricity for the nearby Collie Mines. Built at the behest of the State Electricity Commission, it was the first publicly built power facility of its kind in Western Australia. It ceased operation in the late 1990s. See, Heritage Council of Western Australia, 'Wellington Dam Precinct', *Register of Heritage Places*, 2008, <[http://register.heritage.wa.gov.au/PDF\\_Files/U-Z%20-%20A-D/Wellington%20Dam%20Precinct%20\(1%20-AD\).PDF](http://register.heritage.wa.gov.au/PDF_Files/U-Z%20-%20A-D/Wellington%20Dam%20Precinct%20(1%20-AD).PDF)>, (Accessed: 15 January 2012).

<sup>38</sup> L. Anderson, *Windows on the Wheatbelt*, Bassendean, Access Press, 1999, p. 20; A. Thomas, *Kalkarni: the Brookton story*, Brookton, Shire of Brookton, pp. 228-29; and W. E. Greble, *A Bold Yeomanry: social change in a wheat belt district, Kulin, 1848-1970*, Perth, Creative Research, 1979, p. 184.

**Fig. 3.1: The Comprehensive Water Supply Scheme**<sup>39</sup>



### *An Achilles Heel*

The promise of Big Water was that of continuous, reliable and copious water supplies. Payment for this scheme water then was not just for its supply but also for its ongoing supply and quality – for the guarantee of permanency. To deliver this promise, water reserves had to be stored and their quality protected. Those who used Big Water were therefore vulnerable to fluctuations in the quality and quantity of supplies through their reliance on a distant source over which they had little personal control. Although Big Water reflected the interests of powerful players in the state government and PWD, it would come under threat from another consequence of developmentalism: secondary salinity. The same developmentalist ethos that had given birth to Big Water had also fostered a lack of caution, particularly with regard to agricultural land settlement. As

<sup>39</sup> Powell, *Watering the Western Third*, p. 49.

Geoffrey Bolton has noted, ‘Agricultural scientists tended to be damned when they brought bad news and praised only when they brought good’.<sup>40</sup> This was especially evident in the persistence of land clearing in the Wellington Dam catchment.

By the early 1950s, the PWD had become concerned about the growing levels of salinity in the Wellington Dam as a result of land clearing in its catchment.<sup>41</sup> But such warnings fell on deaf ears amid the din of developmentalism.<sup>42</sup> In 1951, the President of the state’s Land Settlement Board, George K. Baron Hay declared, ‘Land settlement in WA must proceed ... we dare not stop ... I suggest that this is the most auspicious time to push ahead with the development of our country to the maximum we can achieve’.<sup>43</sup> In 1961, the PWD wrote to the Department of Agriculture requesting that ‘no further land be alienated’ and suggested that ‘clearing control of land already alienated will assuredly be necessary’.<sup>44</sup> Although the relationship between land clearing and salinity had been recognised at the turn of the century, the Department of Agriculture dismissed the notion of restricting land release ‘because of the large areas that would have to be left uncleared’.<sup>45</sup>

The PWD’s warnings were voiced at the height of the Brand government’s program to clear ‘a million acres a year’ and went, therefore, unheeded.<sup>46</sup> By the end of the 1960s, the area of land under cultivation in Western Australia had nearly doubled from 14 million to 25 million acres, which was unprecedented in national history.<sup>47</sup> This disregard for salinity was even more disturbing, given that the paucity of potable water supplies in the agricultural areas had been a significant factor in the post-war development of the CWSS. As I will later explain, by the 1980s, the deterioration of the catchment had become so severe that Wellington Dam ceased to supply water to the Great Southern Towns Scheme and was replaced by the Harris Dam on the Harris River, north of Collie, in 1990. This disregard for scientific advice when it conflicted with the ideology of developmentalism threatened to undermine Big Water and render those who relied upon its function vulnerable to running out.

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<sup>40</sup> G. C. Bolton, *Spoils and Spoilers: Australians make their environment, 1788-1980*, Sydney, George Allen & Unwin, 1981, p. 138.

<sup>41</sup> Q. Beresford et al., *The Salinity Crisis: Landscapes, Communities and Politics*, 2<sup>nd</sup> ed., Crawley, UWA Press, 2004, p. 77.

<sup>42</sup> Cited in Beresford et al., pp. 70, 78.

<sup>43</sup> Cited in Phillips, p. 8.3.

<sup>44</sup> Cited in Beresford et al., p. 78.

<sup>45</sup> Cited in Beresford et al., p. 78; and A. Gaynor, ‘Looking forward, looking back: towards an environmental history of salinity and erosion in the eastern wheatbelt’, in A. Gaynor, M. Trinca and A. Haebich, *Country: visions of land and people in Western Australia*, Perth, WA Museum, 2002, p. 114.

<sup>46</sup> Beresford et al, p. 73.

<sup>47</sup> Beresford et al., pp. 61-63.

At the 35<sup>th</sup> State Conference of the Country Women's Association in 1959, State President Lilian Higgins declared, 'If I was asked to assess the value of any Government to this country I would do so according to the number of miles of water pipe lines that were laid during their term of government'.<sup>48</sup> The extension of Big Water across the southwest's agricultural areas was indeed a feat to be celebrated, representing a testament to Australian engineering expertise and a commitment to the future of rural Western Australia.<sup>49</sup> When the Minister for Works and Water Supplies John Tonkin officially opened Brookton's connection to the CWSS in December 1958, the district's schoolchildren were given a 'half-holiday' to mark the occasion.<sup>50</sup> Likewise, in Kulin, the connection to the eastern Goldfields line in 1966 'underpinned subsequent growth in the town' and allowed for the building of a town swimming pool.<sup>51</sup> The secretary of the Dowerin museum, Gwen Friend, would later remember that the 'connection to the comprehensive water scheme' was the 'most important event in the history of the town'.<sup>52</sup> The arrival of piped water to these towns brought an end to pan toilets and allowed many households to nurture more sophisticated gardens.<sup>53</sup> Yet it would also render them vulnerable to running out because they were now dependent on a distant source of water supplies.

### ***Drowning the Southwest***

With the growing post-war demand for dairy products in Perth, the southwest's irrigators joined the wheatbelt farmers' clamour for 'water, water everywhere!'<sup>54</sup> They needed more water for their irrigated summer pastures of paspalum, rye grass and cocksfoot.<sup>55</sup> Amid prevailing anxieties that Western Australia was 'every year menaced by the fear of drought' because 'she cannot, at present, store enough from one year's

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<sup>48</sup> L. Higgins, 'State President's Address: 35<sup>th</sup> State Conference', *Countrywoman of Western Australia*, August, 1959, p. 4.

<sup>49</sup> Heather Goodall has observed similar transformative effects of reticulated water supplies on country towns in post-war northwestern New South Wales. It is possible that women in the agricultural areas of the southwest similarly enjoyed the opportunity to bathe in clean swimming pools and the new forms of socialisation that such facilities enabled. See, H. Goodall, 'Gender, race and rivers: northwestern NSW', in K. Lahiri-Dutt (ed.), *Fluid Bonds: views on gender and water*, Kolkata, Stree Books, 2006, pp. 293-94.

<sup>50</sup> Thomas, pp. 228-29.

<sup>51</sup> Greble, p. 184.

<sup>52</sup> Anderson, p. 20.

<sup>53</sup> Anderson, p. 20.

<sup>54</sup> 'Problem of milk supply in summer months', *West Australian*, 6 May 1950, p. 3; 'The aim is water, water everywhere!', *Sunday Times*, 4 October 1953, p. 34; and 'The Wellington Dam', *West Australian*, 29 April 1954, p. 2.

<sup>55</sup> Le Page, p. 568.



end to another to afford water security', the engineers of Big Water complied with the irrigators' demands.<sup>56</sup> There were several choices available for increasing the water supplies available to the Harvey District: the Harvey Dam could be raised; a new dam could be built on the Harvey River downstream of the existing dam; or a new dam could be built on Logue Brook. This latter option was favoured because of its close proximity to irrigable lands between Yarloop and Wagerup, which would reduce the costs of distribution, and it was the cheapest scheme.<sup>57</sup> Construction of the dam on Logue Brook was commenced in 1960 and completed in 1963, bringing an end to a four-year period during which the rationing of irrigation water had been necessary. Three years later, Big Water completed the construction of Waroona Dam, which would provide water for the Waroona Irrigation District.<sup>58</sup> Finally, in 1969, work finished on the small Glen Mervyn Dam on a tributary of the Preston River, which stored water for controlled release down the river during summer.<sup>59</sup>

Interestingly, the large gains in terms of water storage since the 1930s were not accompanied by a corresponding increase in the area covered by the irrigation districts. Irrigators had instead shifted to a more intensive system of watering their pastures.<sup>60</sup> Such a method of cultivation not only required large water storages, but also resulted in the application of large quantities of water to swampy lands. As Joseph Powell has noted in his study of the region, '[E]ach intervention in the natural system led inexorably to others'.<sup>61</sup> Big Water was required then to ensure both abundant water supplies and sophisticated drainage systems to remove it. In the Collie District at least, dependent as it was on water supplied from the Wellington Dam, this intensive watering added vast quantities of increasingly saline water to the soil and the watertable, contributing to secondary salinity in the district. These large soakings would also combine with phosphatic fertilisers to be the source of algal blooms and nutrient pollution in the Peel-Harvey estuary, which were already emerging as problems in the late 1940s and early 1950s.<sup>62</sup> Big Water, therefore, helped facilitate the development of water-intensive methods of cultivation, which would have significant implications for

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<sup>56</sup> 'W.A. is short of water', *Western Mail*, 14 July 1949, p. 40.

<sup>57</sup> Le Page, 567.

<sup>58</sup> Le Page, p. 568.

<sup>59</sup> Le Page, p. 570

<sup>60</sup> W. S. Cooper, 'Drainage and irrigation', in J. Gentilli (ed.), *Western Landscapes*, Nedlands, UWA Press, 1979, p. 250.

<sup>61</sup> Powell, *Watering the Western Third*, pp. 49-50.

<sup>62</sup> A. Brearley, *Ernest Hodgkin's Swanland: estuaries and coastal lagoons of south-western Australia*, Crawley, UWA Press, 2005, pp. 166-67.

the land and water resources, as well as the natural ecosystems, of the southwest irrigation districts.

### *Slaking the Suburbs*

In addition to the rural expressions of Big Water in the post-war era, its snaking networks of water supply were also facilitating Australia's evolution into a suburban nation, and Western Australia was no exception. Although Perth was the smallest of the mainland capital cities, it was the fastest growing metropolitan area in the nation, swelling by 22 per cent from 1947 to 1954.<sup>63</sup> By 1959, over sixty per cent of the state's population was living in the suburbs along the Swan Coastal Plain.<sup>64</sup>

This suburban growth was not without its costs. For instance, Aboriginal camps were forced, sometimes violently, to make way for housing estates lest they become 'too close to the eyes and ears of suburban ratepayers'.<sup>65</sup> The steady march of the suburbs also took its toll on nearby bushland. As Frank Crowley lamented in his 1962 history of South Perth,

Almost everywhere the bulldozer, the builder, and the bitumen have obliterated the last signs of the state of nature. Gone forever are the banksia, the sheoaks, the blackboys, and the Christmas trees. And in their place stand the neatly built, wholesome-looking homes of brick, fibro or asbestos.<sup>66</sup>

Less visible was the growing impact of the suburbs on the southwest's water resources. By the mid-1970s, water consumption in Perth had almost tripled since the end of the war – increasing from about 60 to nearly 170ML per day.<sup>67</sup> In this section, I examine the post-war development of Big Water in the growing suburbs of Perth and how the expansion of reticulated water supplies shaped and influenced suburban attitudes and behaviours regarding water consumption. I argue that the post-war affluence of suburban Western Australians combined with political rhetoric to 'conceal' Big Water, encouraging Perth households to indulge in the fantasy of endless water supplies. The

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<sup>63</sup> Gregory, p. 38.

<sup>64</sup> Crowley, p. 361.

<sup>65</sup> In Nedlands, for instance, the Council ordered a bulldozer to clear away the Aboriginal camp at Butler's Swamp. See, G. C. Bolton and J. A. Gregory, *Claremont: a history*, Nedlands, UWA Press, 1999, p. 198; and G. C. Bolton, 'Black and white after 1897', in C. T. Stannage (ed.), *A New History of Western Australia*, Nedlands, UWA Press, 1981, p. 155.

<sup>66</sup> F. K. Crowley, *Westralian suburb: the history of South Perth, Western Australia*, Perth, Rigby, 1962, p. 111.

<sup>67</sup> D. R. Williamson, 'Statistics of water use', in *Seminar H<sub>2</sub>O: domestic extravagance*, Perth, University of Western Australia, 1975, np.

sole dependence on these water supplies that suburban Western Australians were able to develop would leave many of them unprepared and vulnerable to running out.

Post-war political aspirations for the economic growth of Western Australia shaped the development of Big Water along the Swan Coastal Plain. Dry seasons after the war had highlighted the limits of the region's existing sources of water supply and the expected post-war growth of the metropolitan population would only stretch these supplies further.<sup>68</sup> Furthermore, ambitions for the state's industrial development around Kwinana also demanded the provision of ample water supplies to attract investment.<sup>69</sup> In early 1951, the Minister for Water Supplies, David Brand, announced the government's program to increase the scheme water available to the people of Perth. These public works, which provided employment to many returning soldiers and New Australians, included further storage reservoirs, the sinking of an additional bore in the southern suburbs, and the damming of the Serpentine River near Jarrahdale.<sup>70</sup> After all, a Big City had a thirst that needed to be slaked, and Perth's Big Water was born.

In July 1953 the *West Australian* declared, 'High water consumption creates storage problem'.<sup>71</sup> The journalist assured readers, however, that, '[A]t the rate of progress the department has made so far in the supplying of water, it seems unlikely that any day we turn on the tap in our bathroom or kitchen, no water will appear'.<sup>72</sup> The 'high water consumption' of the article's headline was a simply natural consequence of efforts to maintain the appearance of traditional lawns and gardens in Perth's long dry summers and sandy soils. Although this custom had made Perth's water consumption per head the highest among the capital cities (except Canberra), it went largely unquestioned. According to the journalist, suburban supplies were adequate to meet the growing demands of Perth households, so long as there were sufficient rains to fill the dams. Less than a decade after the war, a situation of 'path dependency' had emerged in the suburbs of Perth, whereby the existing infrastructure shaped and directed future water resource development.<sup>73</sup> As a result, anxieties about running out combined with the supply of more water to beget demands for more water and so on, which would diminish their resilience to fluctuating water supplies.

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<sup>68</sup> S-J. Hunt, *Water, the Abiding Challenge*, Perth, Metropolitan Water Board, 1980, pp. 83-84. See also, 'Water supply for 1,000,000 people', *West Australian*, 23 October 1951, p. 2, and 'Providing water for 1,000,000', *West Australian*, 20 June 1952, p. 9.

<sup>69</sup> Layman, p. 247.

<sup>70</sup> Hunt, pp. 83-84.

<sup>71</sup> 'High water consumption creates storage problem', *West Australian*, 23 July 1953, p. 2.

<sup>72</sup> 'High water consumption creates storage problem', p. 2.

<sup>73</sup> T. Dingle, 'The life and times of the Chadwickian solution', in P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australia's cities*, Canberra, ANU Epress, 2008, p. 12.

Improving technology was not the sole cause of the post-war profligacy of the people of Perth. I contend that the development of the domestic sphere as an important political space after the war played a significant role in shaping suburban attitudes and behaviours regarding water use around the home. The detached, single-storey homes of the Australian suburbs had long been ‘project[s] for privacy’, sanctuaries from the outside world.<sup>74</sup> Under Prime Minister Robert Menzies, this vision of the home was developed further, as the home became shaped as a site of ‘independent individualism’ in contrast to the mass organisation, impersonal rationality and bureaucracy that Menzies associated with the Labor Party.<sup>75</sup> This political emphasis on individualism came at the expense of qualities such as ‘compassion, sympathy, generosity, trust, gratitude’, which are necessary for ‘the acknowledgment and appreciation of human interdependence’.<sup>76</sup>

As Andrea Gaynor has suggested, the diminishing social value of these communal qualities not only affected relationships between Australians but also fostered a widespread sense of an independence from natural processes in the suburbs.<sup>77</sup> The vagaries of a wilful nature, with its own cycles and constraints on the household’s ambitions, were relegated beyond the boundary line of the suburban property (or perhaps even further), which reinforced the ideological construction of the domestic space as an impenetrable, clean and private sanctuary for its residents.<sup>78</sup> In the post-war era, the increasing availability of consumer products and a culture of suburban consumerism fostered the impression that the necessities of nature could be circumvented. Advertisements in gardening magazines and newspapers offered readers tempting solutions to the problems that nature’s hand had seemingly dealt them.<sup>79</sup> Poor soils? Add an artificial fertiliser. Unwanted insects? Spray one of the new organochlorine or organophosphate insecticides. Too dry? Just turn on the sprinklers. This sense of independence from nature, at the expense of interdependence, I argue,

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<sup>74</sup> G. Davison, ‘Australia – the first suburban nation?’, *Journal of Urban History*, vol. 22, no. 1, 1995, pp. 40-74; and M. Peel, ‘Between the houses: neighbouring and privacy’, in P. Troy (ed.), *A History of European Housing in Australia*, Melbourne, Cambridge University, 2000, p. 277.

<sup>75</sup> J. Murphy, ‘Social policy and the family’, in S. Prasser, J. R. Nethercote and J. Warhurst (eds), *The Menzies Era: a reappraisal of government, politics and policy*, Sydney, Hale & Iremonger, 1995, p. 228.

<sup>76</sup> A. Gaynor, *Harvest of the Suburbs: an environmental history of growing food in Australian cities*, Crawley, UWA Press, 2006 p. 118. See also, J. Brett, *Robert Menzies’ Forgotten People*, Carlton, Melbourne University Press, 2007, p. 72.

<sup>77</sup> Gaynor, p. 118.

<sup>78</sup> M. Kaïka, ‘Interrogating the geographies of the familiar: domesticating nature and constructing the autonomy of the modern home’, *International Journal of Urban and Regional Research*, vol. 28, no. 2, 2004, p. 270.

<sup>79</sup> See for example, E. R. Power, ‘Pests and home-making: depictions of pests in homemaker magazines’, *Home Cultures*, vol. 4, no. 3, 2007, pp. 213-36.

combined with expansion of Big Water to shape household water consumption in post-war Perth.<sup>80</sup>

Inside the home, the post-war boom and introduction of new household appliances had revolutionised the lifestyles of suburban Australians.<sup>81</sup> Hot water could now be obtained by the turn of a tap, which allowed the introduction of appliances like washing machines and dishwashers, as well as more luxurious bathrooms for more frequent bathing.<sup>82</sup> Many of these household appliances were marketed to Australian wives, who had become the ‘purchasing managers’ for the household.<sup>83</sup> In the more affluent 1950s and 1960s, as Jill Julius Matthews argues, more money was now available for family consumption, not least because more Australian women were part of the paid workforce.<sup>84</sup> The utilisation of these technologies could help Australian housewives more easily overcome their anxieties about cleanliness and hygiene of both their homes and families. As Fiona Allon notes, “‘Clean’ was perhaps *the* key term of the Atomic Age (the post-war era)”.<sup>85</sup> By maintaining a pristine and sterile domestic space, the Australian housewife was ‘doing her bit’ for the moral defence of the nation. She was, after all, a domestic scientist moulding modern Australian citizens.<sup>86</sup> These changes helped to triple water consumption in Perth after the war and entrenched a suburban reliance on Big Water to maintain a high standard of living.<sup>87</sup>

Although other mainland capital cities exhibited this trend towards higher water use, the rate of consumption of water in Perth domestic gardens was unusual.<sup>88</sup> Only residents in Perth and Adelaide had increased the use of water per capita in their gardens since the end of the war.<sup>89</sup> In the post-war era, over half of Perth’s water consumption took place in suburban gardens and in the dry summer months, this

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<sup>80</sup> G. Davison, ‘Down the gurgler: historical influences on Australian domestic water consumption’, in P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australia’s cities*, Canberra, ANU Epress, 2008, p. 58.

<sup>81</sup> A. McLeod, ‘Quality control: the origins of the Australian Consumers’ Association’, *Business History*, vol. 50, no. 1, 2008, p. 80.

<sup>82</sup> Davison, pp. 49-50; and A. McLeod, “‘The lady means business’”: marketing to the electrical appliance consumer in the 1950s and 60s’, *Melbourne Historical Journal*, vol. 31, 2003, pp. 54-69.

<sup>83</sup> J. J. Mathews, *Good and Mad Women: the historical construction of femininity in twentieth-century Australia*, Sydney, George Allen & Unwin, 1984, p. 90.

<sup>84</sup> Mathews, p. 90.

<sup>85</sup> F. Allon, ‘The nuclear dream: everyday life in the atomic age’, in S. Ferber, C. Healey and C. McAuliffe (eds), *Beasts of Suburbia: reinterpreting cultures in Australian suburbs*, Melbourne, Melbourne University Press, 2004, p. 50.

<sup>86</sup> Allon, p. 50.

<sup>87</sup> Davison, pp. 49-50.

<sup>88</sup> Williamson, pp. 11, 16.

<sup>89</sup> Williamson, pp. 11, 16.

proportion rose to about seventy per cent of water use.<sup>90</sup> This increase had occurred in spite of some households' access to private water supplies through backyard bores.<sup>91</sup> Perth gardeners had long appreciated the benefits of applying copious quantities of water on their gardens to defy the natural constraints of dry summers and sandy soils. The Nylex plastic garden hose and improved sprinklers were a panacea to Perth's keen gardeners, who could now soak their couch or buffalo lawns and flower beds more easily.<sup>92</sup> After all, watering Perth's gardens was widely considered to be 'as necessary a daily routine as regular breathing is to the survival of man'.<sup>93</sup> Maintaining the appearance of the front garden had always been important to Perth gardeners but the increasingly aesthetic and recreational roles of the back garden also required additional watering for its upkeep.<sup>94</sup> This profligate water use in Perth's suburbs led George Seddon to warn Western Australians in 1970 to 'fear the hose', as 'once you start using the hose, your garden becomes dependent on it, and you are hooked forever'.<sup>95</sup>

In his 1969 poem, 'The way we live now', local poet William Grono observed a complacent air in the suburbs of Perth. He penned, 'Yes, we like it here. Sometimes the shrewdest of us find the time, after the gardening, before television, sipping beer on enclosed verandahs, to speculate on the future'.<sup>96</sup> But only the 'shrewdest' of Western Australians – those who could perhaps see that these halcyon days could not last. Big Water had combined with post-war affluence and home ownership to foster a sense of independence from the constraints of natural processes and a seemingly unshakeable thirst in the suburbs of Perth. The dry seasons of the 1970s would serve to remind Western Australians in the southwest that they were not separate from nature after all – they were vulnerable to running out.

### ***Beyond Big Water***

Big Water was not extended to all Western Australians in the southwest. Despite the state government's aim to reticulate the wheatbelt, the geographical span of the agricultural areas had prevented the expansion of the CWSS to all farming families. For

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<sup>90</sup> Williamson, np.

<sup>91</sup> Williamson, p. 6.

<sup>92</sup> Davison, p. 56.

<sup>93</sup> P. Ritter with E. Pagram, *Faces of Perth*, Kelmscott, Ritter Press, 1967, p. 13.

<sup>94</sup> Davison, p. 55.

<sup>95</sup> G. Seddon, *Swan River Landscapes*, 1970, cited in G. Seddon, *Swan Song: reflections on Perth and Western Australia 1956-1995*, Nedlands, UWA, 1995, p. 30.

<sup>96</sup> W. Grono, 'The way we live now', in W. Grono and N. Hasluck (eds), *On the Edge*, Claremont, Freshwater Bay Press, 1980, pp. 7-8.

those who were connected, the cost of consuming scheme water was often prohibitive, which encouraged some families to develop their own supplies. But even this option was beyond the reach of many of the region's Aboriginal families. In this section, I explore the different experiences of those who were beyond the reach of Big Water in the post-war era. First I examine the development of private water supplies in the agricultural areas. Although there were many opportunities for farmers to improve their own supplies and improve their resilience to climate variability and water scarcity, the rural boom of the post-war era lulled the southwest's farmers into a false sense of security and left them unprepared for running out. I then consider the post-war persistence of the region's discriminatory sanitary order and its consequences for Aboriginal families in the southwest.

### *Farm Water*

Those who could not access the CWSS remained wholly reliant on their own supplies and on carting water from government dams. In subsequent years, some districts would push for extensions to the CWSS to protect them from running out.<sup>97</sup> However, even in the reticulated areas, farmers did not necessarily depend entirely on these supplies. As farmers were responsible for connecting to the service and paid for the amount of water their farms consumed, it remained cheaper for many farmers to continue to rely on their own supplies, such as farm dams and bores. For many, the Scheme served then as a supplement to existing measures, as a 'safeguard from dry season traumas' in the wheatbelt.<sup>98</sup>

As a consequence of dry conditions and engineering advances, the excavation of earth tanks or dams in the agricultural areas had undergone significant changes in the post-war years. Some of these measures would serve to reduce the vulnerability of wheatbelt farmers to running out as they could better prepare themselves for dry conditions. For instance, the drought conditions of 1944 and 1945 had prompted the PWD to 'rehabilitate' older excavated dams as well as to construct new ones, particularly in areas outside the boundaries of the Comprehensive Water Supply Scheme.<sup>99</sup> The larger and more effective earth moving equipment that became available

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<sup>97</sup> K. J. Kelsall, 'The Comprehensive Water Supply Scheme', in *Wheatbelt Water Supply Seminar, Muresk Agricultural College, 14<sup>th</sup> April, 1977*, Perth, Water Research Foundation of Australia, WA State Committee, 1977, pp. 4-7.

<sup>98</sup> Powell, p. 49.

<sup>99</sup> J. E. Davis, 'Supplementary public water supply schemes constructed by the Public Works Department', in *Wheatbelt Water Supply Seminar*, p. 3.

after the Second World War enabled the construction of much bigger and deeper dams both for town supplies and on farms.<sup>100</sup> Although these measures may have contributed to improving the resilience of some farmers to running out, more reliable water supplies could also reduce the drought relief burden on the government during periods of water scarcity. Like the CWSS, the government's investment in improved farm water supplies, therefore, might be understood as a means to sustain permanent settlement in climatically marginal areas in the post-war era.

These new approaches to water conservation also extended to farmers' private supplies. After the Second World War, the scourge of soil erosion was a matter of great national public and political concern. One of the causes of soil erosion was water, which swept away precious topsoil as it flowed into farm dams. A Department of Agriculture survey undertaken during the war had found that this form of soil erosion affected nearly two thirds of wheatbelt farmers and that the extent of this erosion on their properties was increasing.<sup>101</sup> To overcome this problem, the engineers of the PWD devised the 'greatest single advance in water conservation that has been made in this state': the roaded catchment for farm dams.<sup>102</sup> To create a roaded catchment, engineers used heavy rolling machinery to compact a series of parallel 'roads', which were designed to direct water run-off into troughs or channels that would drain water into a nearby dam. Compacting the soil in this manner ensured it would be impervious, thus preventing soil erosion and maximising the collection of rain.<sup>103</sup> Some farmers complained that this method consumed too much land that could be put to better use under crop or pasture.<sup>104</sup> By the 1970s, however, farmers had constructed roaded catchments for over forty per cent of the farm dams in the southern agricultural areas.<sup>105</sup>

To encourage farmers to adopt these measures, government established the Farm Water Supply Loans Scheme in 1965 to provide finance for bores and dams in the southern, northern and north-eastern areas of the wheatbelt, including non-reticulated

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<sup>100</sup> Davis, p. 3.

<sup>101</sup> S. L. Kessell, 1940, cited in Gaynor, 'Looking forward, looking back', p. 111.

<sup>102</sup> V. C. Munt, cited in Public Works Department, 'Roaded catchments for farm water supplies', *Journal of the Department of Agriculture of Western Australia*, vol. 5, no. 6, 1956, p. 667. Roaded catchment structures are also called 'contour banks'. See, G. Boylen, 'Contour banks save water and prevent soil erosion', *Countryman*, 23 August 1962, pp. 4-5.

<sup>103</sup> Public Works Department, 'Roaded catchments for farm water supplies', p. 667.

<sup>104</sup> J. Lawson, 'Roaded catchments end water shortages – government offers service to farmers', *Countryman*, 25 May 1961, p. 7.

<sup>105</sup> I. A. F. Laing, 'Farm dams in the wheatbelt', in *Wheatbelt Water Supply Seminar*, p. 5. This also included 'flat-batter dams', which 'combine a circular, artificial, water harvesting catchment with a central [excavated] storage tank'. See, J. S. Whitmore, *Drought Management on Farmland*, Dordrecht, Kluwer Academic Publishers, 2000, p. 172.



properties within the area of the CWSS.<sup>106</sup> But the Advisory Committee for the Loans Scheme was ‘disappointed’ and ‘disturbed’ to find that many eligible farmers were not interested in applying for these loans. They concluded that ‘[g]enerally farmers are not sufficiently water conservation conscious’.<sup>107</sup> The Committee attributed this lack of interest to the ‘excellent winters’ of recent years; a false sense of security provided by generally low stocking rates; to the reluctance to invest in infrastructure for which there was no immediate return; a lack of understanding about the Loans Scheme; and the false hope that the CWSS would eventually extend to provide for their future needs.<sup>108</sup> Similar reasons were also likely to have discouraged farmers to store fodder for the dry summer period. As one Meckering farmer earlier observed in 1957, ‘This State enjoys such a consistent rainfall that the fodder conservation side of our farming operations has been sadly neglected’.<sup>109</sup> The widespread faith in the persistence of the prevailing conditions allayed any environmental anxieties about the ‘hydraulically difficult country’ of the wheatbelt, leaving many unprepared for the dry seasons of the 1970s.<sup>110</sup>

#### *White Water, Black Water*

Although Big Water did not extend reticulated water supplies to all of Western Australia’s farming families, there was extensive technical and financial support available to improve their resilience to climate variability and water scarcity in the post-war era. After all, the ethos of development and ideology of countrymindedness had shaped the expansion of Big Water and their influence ensured that the government would provide assistance to those outside its scope. But not to everyone, for Big Water was also White Water.

In 1948, the McLarty Liberal government (1947-1953) introduced the policy of assimilation for the state’s Aboriginal population, seventeen per cent of whom resided

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<sup>106</sup> B. G. Jennings, ‘Farm water supply loans scheme’, in *Wheatbelt Water Supply Seminar*, p. 2. The districts surveyed were North Kalannie – Goodlands, Mollerin, Cleary, Beacon, Moondon, Wialki and Bonnie Rock, East Narembeen, Muntadgin, Mt Walker, Holt Rock and Lake Varley, and Pingaring.

<sup>107</sup> Farm Water Supply Advisory Committee, *First Annual Report, 30<sup>th</sup> May 1966*, Perth, Govt Printer, 1966, pp. 2-3.

<sup>108</sup> Farm Water Supply Advisory Committee, pp. 2-3.

<sup>109</sup> J. P. Reynolds, letter to the Commissioners of the Rural & Industries Bank, 4 June 1957, Fodder Conservation Competition, Cons 7204, 1958/017v1, State Records Office of Western Australia (hereafter SROWA).

<sup>110</sup> Farm Water Supply Advisory Committee, *Supplementary Report, 2<sup>nd</sup> March 1967*, Perth, Govt Printer, 1967, p. 1.

in the southwest.<sup>111</sup> The intention of this policy, led by the newly-appointed Commissioner for Native Affairs Stanley G. Middleton, was to enhance the political rights of Aboriginal people; to improve their living standards; and to effectively break down the political, cultural and socioeconomic barriers that prevented their advancement in white society.<sup>112</sup> A significant component of this policy was to alleviate Aboriginal poverty through the provision of better housing and sanitation facilities, and through the education of Aboriginal children.<sup>113</sup> But these keys to white society, including access to Big Water, were not freely given – they had to be earned. As Anna Haebich observes, ‘The step of seeking acceptance as an assimilated individual demanded the greatest price: to abandon the old, accept the superiority of the new, and remain permanently on trial in a world where the goalposts for acceptance were continually being shifted’.<sup>114</sup> Despite Middleton’s best intentions, the assimilation policies of his Department served only to perpetuate the discriminatory sanitary order that had prevailed in the southwest since the turn of the twentieth century. Here I utilise Haebich’s extensive research to examine how the interplay of Big Water and government policies of assimilation shaped the lives of the southwest’s Aboriginal peoples during the post-war era.<sup>115</sup> I argue that the exclusion of Aboriginal people from Big Water undermined the policy of assimilation, contributed to the fragmentation of Aboriginal families, and ultimately helped to perpetuate the dependence of many Aboriginal people on the state into the late twentieth century.

Under the policy of assimilation, it had become compulsory for Aboriginal children to attend state schools or other education facilities.<sup>116</sup> To facilitate the acceptance of Aboriginal children in the classroom, the government made half-hearted attempts to improve the domestic environments of Aboriginal families. Encouraging these families into ‘conventional’ homes would, in theory, not only raise their living standards but also serve to fragment extended families into the more ‘conventional’ (or white) living arrangements of the nuclear family, and provide an important political sign of the progress of the assimilation policy.<sup>117</sup> Not surprisingly, this housing policy was met with both white and black resistance. Some white Western Australians protested the

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<sup>111</sup> A. Haebich, *Spinning the Dream: assimilation in Australia, 1950-1970*, North Fremantle, Fremantle Press, 2008, p. 224.

<sup>112</sup> A. Haebich, ‘Nuclear, suburban and black’, in T. Rowse, *Contesting Assimilation*, Perth, API Network, 2005, p. 202.

<sup>113</sup> Haebich, ‘Nuclear, suburban and black’, p. 202.

<sup>114</sup> Haebich, *Spinning the Dream*, p. 227.

<sup>115</sup> Haebich, ‘Nuclear, suburban and black’, pp. 201-36.

<sup>116</sup> Haebich, ‘Nuclear, suburban and black’, pp. 211-14.

<sup>117</sup> Haebich, ‘Nuclear, suburban and black’, p. 215.

accommodation of Aboriginal families in their towns, while many Aborigines resented the greater surveillance of their daily lives that this policy seemed to entail.<sup>118</sup> There was also an official reluctance to significantly invest in the improvement of the living standards of Aboriginal families. For instance, in contrast to its assistance to New Australians and other families, the Commonwealth government provided no funding to the state for the provision of better housing for Aborigines.<sup>119</sup> It was clear that 'Aboriginal families were not included in the national imaginary of a nation of homeowners'.<sup>120</sup>

With the State Housing Commission, the Department of Native Affairs resorted to a program of transitional housing, which would allow Aboriginal people to advance through three stages of housing and prepare them for life in 'conventional' homes. The first stage comprised 'huts in camps on gazetted reserves with communal sanitation, ablution and laundry facilities'; the second, 'self-contained houses of up to five rooms on reserves or town blocks'; and the final stage, 'conventional houses in State housing estates in town'.<sup>121</sup> A lack of funding, however, hampered this progression. In the Great Southern district, for instance, only five of the twenty-two reserves had full access to water, laundry, shower and toilet facilities. At least ten had no facilities at all.<sup>122</sup> According to an officer of the Department, these services 'were a fair approximation of similar necessities provided at, for example, caravan parks'.<sup>123</sup> By the end of the 1960s, nearly two thirds of the houses built were equivalent to just the first stage, and fewer than five per cent were of the standard of 'conventional' housing.<sup>124</sup> Such conditions were not conducive to the assimilated lifestyles to which Aboriginal families were supposed to aspire.

Departmental officials conducted regular inspections of these facilities and their residents to monitor the progress of Aboriginal families towards the official goal of assimilation. Families were expected to demonstrate signs of their assimilation by

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<sup>118</sup> Haebich, 'Nuclear, suburban and black', p. 215. See also, P. Biskup, *Not Slaves, Not Citizens: the aboriginal problem in Western Australia, 1898-1954*, St Lucia, University of QLD Press, 1973, pp. 244-46.

<sup>119</sup> Haebich, 'Nuclear, suburban and black', p. 215. Australian Minister for Immigration Arthur Calwell in the Chifley government (1945-1949) coined the term 'New Australians' to describe post-war migrants from Europe, which differentiated them from British-born migrants to Australia.

<sup>120</sup> Haebich, *Spinning the Dream*, p. 243.

<sup>121</sup> Haebich, 'Nuclear, suburban and black', p. 215.

<sup>122</sup> Haebich, *Spinning the Dream*, p. 255.

<sup>123</sup> B. A. McLarty, 'Department of Native Welfare Lectures, Perth Technical College', 1966, Lecture 3, cited in, B. T. Haynes et al., *W. A. Aborigines 1622-1972*, Fremantle, History Association of Western Australia, 1972, p. 69.

<sup>124</sup> S. Toussaint, 'Nyungars in the city: a study of policy, power and identity', MA Thesis, University of Western Australia, 1987, p. 117.

displaying clean and tidy homes with the mother and father playing their designated parental roles and without the presence of the extended family.<sup>125</sup> Department officials also provided extensive training – what Haebich calls ‘assimilation’s “Trojan horse”’ – to guide Aboriginal people, especially women, in the management of the home, including cleaning, child care, health, budgeting and liaison with local authorities.<sup>126</sup> But as nearly 85 per cent of the southwest’s Aborigines still lived on reserves for most of the year, where infrastructure was poorly maintained, it was extremely difficult for Aborigines to maintain these standards.<sup>127</sup> In many cases, a failure to meet the Department’s standards was grounds for the removal of Aboriginal children from their families. As one Department officer noted in 1968, ‘A thorough examination was not made as the father was not present. From what I saw however, I am satisfied that the children are “neglected”, if for no other reason than the shack they live in’.<sup>128</sup> Deprived of access to the standard of living that Big Water could provide, Aboriginal people were ill-equipped to advance towards the ‘conventional’ Australian way of life.

The standard of living that reticulated supplies provided white Western Australians was the measure against which Aboriginal people were compared. But the limited availability of water supplies and sanitary services to Aboriginal settlements and the poor standard of Aboriginal housing severely constrained the ability of many Aborigines to meet these expectations. More often than not, white Western Australians held Aborigines responsible for their predicament, instead of the bureaucracy that had failed to provide adequate support for the assimilation of Aboriginal people. Despite citizenship and greater freedoms in the post-war era, many Aborigines in the state’s southwest remained governed by a discriminatory sanitary order and these conditions persisted into the 1970s. As Robert Bropho rued, ‘We have given up hope of being accepted for what we are, and my children are scarred for life. ... Their home now, as fringedwellers, is living under canvas’.<sup>129</sup>

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<sup>125</sup> Haebich, ‘Nuclear, suburban and black’, p. 215.

<sup>126</sup> Haebich, ‘Nuclear, suburban and black’, p. 259; and Haebich, *Spinning the Dream*, p. 215.

<sup>127</sup> Haebich, *Spinning the Dream*, p. 255.

<sup>128</sup> Cited in Aboriginal Legal Service of Western Australia, *Telling Our Story: a report by the Aboriginal Legal Service of WA (Inc) on the removal of Aboriginal children from their families in Western Australia*, Perth, ALSWA, 1995, p. 76.

<sup>129</sup> R. Bropho, *Fringedweller*, Chippendale, Alternative Publishing Co-operative, 1980, p. 57.

## *A climate for growth*

Mirroring the post-war expansion of Big Water in the southwest was the burgeoning scientific bureaucracy focussed on the nation's economic development. The contributions of meteorologists to Australia's war effort had served to reinforce their close relationship with the nation's governments.<sup>130</sup> This relationship continued after the war and significantly influenced the nature and direction of climate research during peacetime. The nation's meteorologists would serve among the 'officer corps' of government scientists deployed for 'the new battle with the land'.<sup>131</sup> In this section, I explore the application of climate science to the post-war development of (Western) Australian agriculture. I contend that this practice perpetuated the national tradition of applying scientific practices 'borrowed from elsewhere' to unique (Western) Australian environments for the purposes of economic development.<sup>132</sup>

Upon the recommendation of the Rural Reconstruction Commission, the Commonwealth Bureau of Meteorology established climatological sections in each state after the war. Their role was to provide climate information on the suitability of particular regions for the economic development of agricultural and pastoral industries.<sup>133</sup> This decentralisation of data collection was a significant change in the Bureau's operations, which had previously taken place in Melbourne (see Chapter 1).<sup>134</sup> David Day observes that this devolution was particularly celebrated in Western Australia, where the Perth observatory's isolation from Melbourne had hampered efforts to provide meteorological records when required.<sup>135</sup> The developmentalist focus of the state government and the applied nature of post-war meteorology ensured that scientific studies of the unique climates of the southwest remained inherently focused on the region's agricultural areas.

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<sup>130</sup> See D. Day, *Weather Watchers: 100 years of the Bureau of Meteorology*, Carlton, Melbourne University Publishing, 2007, pp. 250-65; and B. Collis, *Fields of Discovery: Australia's CSIRO*, Crows Nest, Allen & Unwin, 2002, p. 358.

<sup>131</sup> L. Robin, 'Home and away: Australian sense of place', *Australian Humanities Review – Eco-humanities Corner*, no. 41, 2007, <<http://www.australianhumanitiesreview.org/archive/Issue-February-2007/EcoRobin.html>>, (Accessed: 5 August 2010); and L. Robin, 'Battling the land and global anxiety: science, environment and identity in settler Australia', *Philosophy, Activism, Nature*, vol. 7, 2010, p. 8.

<sup>132</sup> Robin, *How a Continent Created a Nation*, p. 215.

<sup>133</sup> Day, p. 264.

<sup>134</sup> Day, p. 264.

<sup>135</sup> Day, p. 265. Colin E. Hounam was appointed to oversee climatological research at the Perth office. See also, C. E. Hounam, *Climate of the West Australian Wheat Belt with Special Reference to Rainfall over Marginal Areas*, Melbourne, Commonwealth Meteorological Bureau, 1947.

In addition to this Commonwealth scientific expertise, the study of (Western) Australian climates was also a subject of local interest. At the forefront of local research was an Italian geographer at the state's University, who had fled Europe on the eve of the Second World War. Soon after his arrival in Fremantle in September 1939, Joseph Gentilli was appointed to a lectureship in economics and just two years later, established a new course in economic geography. From the outset, Gentilli's project was to 'transform bare statistics (of which there were many) into maps (of which there were none)' to improve scientific understandings of Australian environmental conditions, particularly its climates.<sup>136</sup> These studies provided the framework for Gentilli to compare Australia's regions to others around the world using the Köppen system of climate classification, which is based on the notion that native vegetation is the best expression of climate type.<sup>137</sup> The global, rather than the local, was key to these studies, which reflect Robin's observation that, 'In a nation built by emigrants from elsewhere, Australia's characteristics rests on comparisons with unlike places'.<sup>138</sup>

The purpose of such comparisons was to provide insights into the possibilities of economic development in the seemingly under-developed regions of Australia. And Gentilli embraced this developmentalist ethos in his work. In 1941 he declared, 'Western Australia's key problem is how to increase her population; nearly all other problems are mere corollaries of this one great question'.<sup>139</sup> Determining the climate suitability of different areas for closer settlement in Western Australia would be regarded as a key to the state's post-war progress and prosperity. According to Gentilli's calculations, most of the wheatbelt was only expected to experience fewer than thirty drought years in a century and was therefore well-suited for closer settlement (Figure 3.2).<sup>140</sup> This estimate was not based on 'natural' conditions, but instead on the agrarian use of the region. For his focus on agricultural development, Gentilli was roundly applauded, including a commendation from the state's former Premier and then Governor Sir James Mitchell.<sup>141</sup> Gentilli also conveyed his findings about the local environment to the state's secondary school students in textbooks, which ensured that

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<sup>136</sup> P. Armstrong, 'Obituary: Joseph Gentilli (1912-2000)', *Australian Geographical Studies*, vol. 39, no. 2, 2001, p. 250. See also, L. Robin and L. Joseph, 'The boom and bust desert world: a bird's eye view', in L. Robin, R. Heinsohn and L. Joseph (eds), *Boom and Bust: bird stories for a dry country*, Collingwood, CSIRO, 2009, pp. 17-18.

<sup>137</sup> J. Gentilli, *Geography of Climate: the synoptic world pattern*, Nedlands, UWA, 1958, p. 131; and H. Stern, G. de Hoot and J. Ernst, 'Objective classification of Australian climates', *Australian Meteorological Magazine*, vol. 49, 2000, pp. 87-96.

<sup>138</sup> Robin, *How a Continent Created a Nation*, p. 6.

<sup>139</sup> J. Gentilli, *Atlas of Western Australian Agriculture*, Crawley, UWA Text Books Board, 1941, p. 49.

<sup>140</sup> J. Gentilli, *Australian Climates and Resources*, Perth, Whitcombe & Tombs, 1946, p. 124.

<sup>141</sup> J. Mitchell, 'Preface', in Gentilli, *Atlas of Western Australian Agriculture*, np.

future generations of Western Australians would continue to understand their state through the lens of developmentalist sciences.<sup>142</sup> Such an approach was vital to the state's development, as the state's Director of Education noted in 1941, '[W]ith increased knowledge and the application of Science, progress towards the full and wise utilisation of the natural resources of such a young country can be effected'.<sup>143</sup>

In the early 1950s, scientists reported that temperatures in the northern hemisphere had risen since the nineteenth century. These findings prompted lay anxieties, both in the United States and Australia, about a changing climate and the extent to which the use of nuclear weapons had contributed to these changes.<sup>144</sup> Already the residents in Perth had begun to wonder whether seasonal conditions differed from those they had experienced in the past.<sup>145</sup> These concerns led Gentilli to study whether any such changes in climate could be observed in the southwest region. He and his ornithologist colleague Dominic Serventy had already noticed that, despite extensive efforts to drain swamps around Perth, the watertable in these areas had risen since the end of the First World War, much to the benefit of many aquatic bird species.<sup>146</sup>

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<sup>142</sup> Libby Robin notes that science education was a 'prestigious' component of Australian school curricula from the 1930s and 1940s, with a particular focus on utilising the nation's natural resources. See, Robin, *How a Continent Created a Nation*, p. 155.

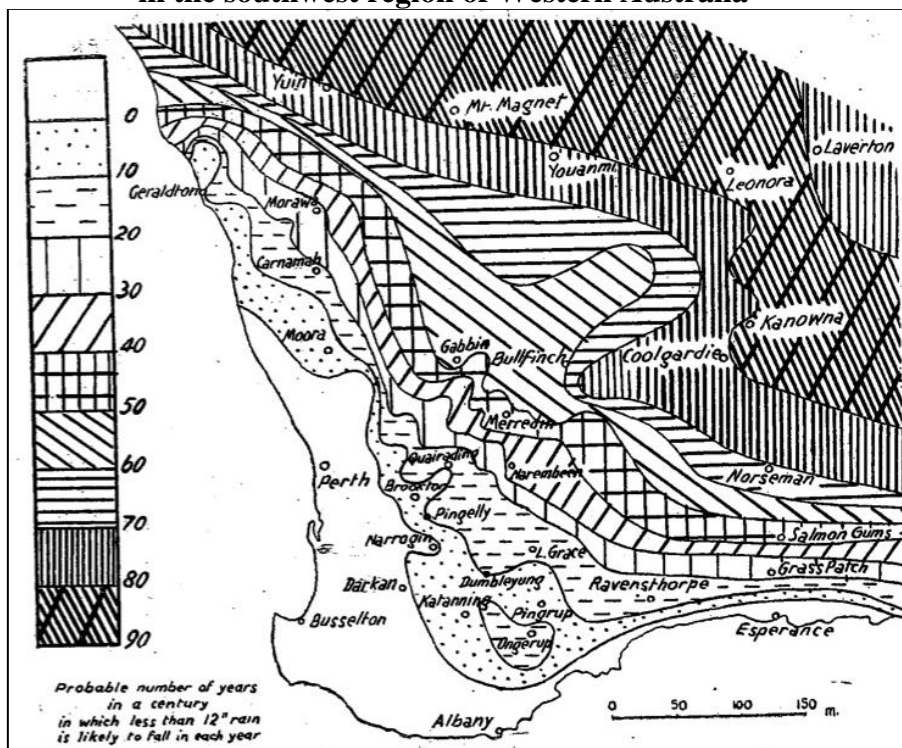
<sup>143</sup> M. G. Little, 'Foreword', in Gentilli, *Atlas of Western Australian Agriculture*, np.

<sup>144</sup> J. R. Fleming, *Historical Perspectives on Climate Change*, New York, Oxford University Press, 1998, pp. 118-19.

<sup>145</sup> For instance, J. Gentilli, 'Is Christmas what it used to be?', *West Australian*, 20 December 1947, p. 5; 'Is Perth's weather changing?', *Western Mail*, 18 March 1948, p. 4; A. G. Akeroyd, 'No evidence of it', *Western Mail*, 18 March 1948, p. 4; J. Gentilli, 'Perth's climate', *Western Mail*, 8 April 1948, p. 13; G. Souter, 'Glaciers, icebergs melt as world gets warmer', *Sunday Times*, 7 October 1951, p. 4; 'Science answers the poser: are our seasons changing?', *West Australian*, 18 August 1953, p. 2; and P. Trundle, 'Has the atom bomb affected our weather?', *Courier-Mail*, 23 November 1954, p. 2.

<sup>146</sup> D. Serventy, 'The birds of the Swan River District, Western Australia', *Emu*, vol. 47, 1948, p. 254; Jeranger, 'Changing climate and bird distribution', *West Australian*, 16 June 1951, p. 10; and J. Gentilli, 'Present climatic fluctuations in Western Australia', *West Australian Naturalist*, vol. 3, 1952, p. 155.

**Fig. 3.2: Gentili's calculation of the probability of drought in the southwest region of Western Australia**<sup>147</sup>



A study of the rainfall records revealed to Gentili that between 1877 and 1945 winter rainfall in Perth had increased.<sup>148</sup> This confirmed the explanations that Water Supply Department engineers had offered for the sodden conditions in the early 1930s.<sup>149</sup> Gentili was uncertain, however, as to the cause of these changes and whether they would continue.<sup>150</sup> Despite this uncertainty, Gentili, like many of other climate scientists, was quite unconcerned about this trend, as neither its direction nor its magnitude appeared to pose a serious threat to livelihoods. Wetter conditions would reduce the likelihood of drought and potentially benefit the wheatbelt's farmers. Had the meteorological record revealed a drying trend, however, Gentili might have been more alarmed, as he had recently concluded that, 'The Western Australian environment is ... much more deeply affected by movements of the arid margin and by a decrease than by an increase in the rainfall'.<sup>151</sup> The drier climate conditions that would develop later in the twentieth century would confirm his fears.

Despite the scientific interest in the climates of Western Australia after the war, this research had not progressed sufficiently to convince the state government to

<sup>147</sup> Gentili, *Australian Climates and Resources*, p. 124.

<sup>148</sup> Gentili, 'Present climatic fluctuations in Western Australia', pp. 157-58. CSIRO physicist E. L. Deacon undertook a similar study for south-eastern Australia, see 'Climatic change in Australia since 1880', *Australian Journal of Physics*, vol. 6, 1953, pp. 209-18.

<sup>149</sup> Serventy, 'The birds of the Swan River District', p. 254.

<sup>150</sup> Gentili, 'Present climatic fluctuations in Western Australia', p. 163.

<sup>151</sup> J. Gentili, 'Bioclimatic changes in Western Australia', *West Australian Naturalist*, vol. 2, no. 8, 1951, p. 184.



experiment with the emerging technology of cloud seeding. Western Australian governments had followed the growing profile of cloud seeding with close interest from the late 1940s. The technology of cloud seeding was developed in the United States in 1946 and soon became part of a broader military effort to control the weather.<sup>152</sup> In Australia and overseas, scientists saw great possibilities in these findings. CSIRO developed its own version of this technology with the intention of using it to overcome dry periods in the nation's agricultural regions. After the first Australian trials of cloud seeding were conducted near Sydney in 1947, it did not take long for the idea to travel across the Nullabor to Western Australia.<sup>153</sup>

The Brand government was reluctant, however, to commit its resources to a science untested in Western Australia's unique climate conditions. It remained unmoved by the enthusiastic attempts of E. G. 'Taffy' Bowen, head of CSIRO's Radiophysics Laboratory, to persuade the engineers of the state's PWD to undertake tests. Likewise, proposals from wealthy pastoral station owners and mining companies to commence cloud seeding in the northwest were considered but ultimately rejected. The exact reasons for the Brand government's unwillingness to trial cloud seeding are not explicitly stated in the documentary record. It is likely, however, that the government considered the prevailing climatic conditions adequate for agricultural growth. Premier Brand relented only in 1966, after receiving a letter from the Acting Prime Minister Jack McEwen that impressed upon him the importance of cloud seeding for overcoming climatic limits to agricultural production.<sup>154</sup> From the mid-1960s, therefore, Western Australia joined New South Wales, Victoria, Queensland and South Australia in undertaking local cloud seeding operations under the advice of CSIRO.<sup>155</sup>

In the eastern states, these cloud seeding operations had been triggered by widespread drought conditions. These severe droughts, particularly in New South Wales and Queensland, prompted the Bureau of Meteorology to increase its research into the

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<sup>152</sup> J. Fleming, 'The pathological history of weather and climate modification: three cycles of promise and hype', *Historical Studies in the Physical and Biological Sciences*, vol. 37, no. 1, 2006, pp. 9-10.

<sup>153</sup> B. F. Ryan and W. D. King, 'A critical review of the Australian experience in cloud seeding', *Bulletin of the American Meteorological Society*, vol. 78, no. 2, 1997, p. 241.

<sup>154</sup> J. McEwen, Letter to D. Brand, 11 July 1966, Public Works Department, Cons 1109, 1955/0019, SROWA. McEwen wrote similar letters to the other State premiers, in which he offered them CSIRO advice and urged them to initiate cloud seeding operations. See, G. R. McBoyle, *Weather modification: Australia's role in the world scene*, St Lucia, University of Queensland, 1980, p. 70.

<sup>155</sup> R. W. Home, 'Rainmaking in CSIRO: the science and politics of climate modification', in T. Sherratt, T. Griffiths and L. Robin (eds), *A change in the weather: climate and culture in Australia*, Canberra, NMA Press, 2005, p. 77; and Ryan and King, p. 243.

causes and patterns of these conditions.<sup>156</sup> It was only in the wake of the droughts of the mid-1960s that the Bureau's director Bill Gibbs ventured a definition for drought in Australia: a 'severe water shortage'.<sup>157</sup> But what 'shortage' meant for the farmer, might be different to the market gardener, the pastoralist, and the gardening enthusiast.<sup>158</sup> Although CSIRO considered it had the technology to beat droughts, the Bureau's meteorologists were struggling to define and measure them, let alone predict their onset.<sup>159</sup>

Meanwhile, the Western Australian government's engineers remained sceptical about the cloud seeding experiments. Some considered too little was known about the atmospheric (and oceanic) systems shaping the state's climate. They were also concerned about public opposition to the trials, particularly the fear that rain making in one area might deprive another area of its rain.<sup>160</sup> In other words, they did not want to disrupt the climate status quo. As CSIRO was willing to shoulder half of the financial burden, the Brand government decided to give the technology the benefit of the doubt. The Chief of the Department of Agriculture's Plant Research Division pondered, 'As there are few areas in WA in the southwestern part where water for irrigation can be found it may be useful if rain making by the practice of cloud seeding can be brought into use'.<sup>161</sup> In May and June 1967, the PWD conducted a cloud seeding experiment in the southwest, aiming to stimulate rainfall in the Avon River region. But with only seven hours of seeding, the researchers were left unconvinced that the experiments had increased rainfall in the area. One wrote, '[I]t is more probable that it was just very wet months in the target area and the downwind area'.<sup>162</sup> It would not be until the dry spells of the early 1970s that Western Australian scientists returned to rainmaking as a possible means to change the weather.

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<sup>156</sup> South-eastern Australia was drought-affected between 1964 and 1968. Foley's successor, Bill Gibbs, considered this drought to be 'as severe as any previously recorded in 170 years of [E]uropean settlement in Australia' (p. iii). See, W. J. Gibbs and J. V. Maher, *Rainfall Deciles as Drought Indicators*, Melbourne, Bureau of Meteorology, 1967, pp. iii.

<sup>157</sup> Gibbs and Maher, p. 2.

<sup>158</sup> R. L. Heathcote, 'Drought in Australia: a problem of perception', *Geographical Review*, vol. 59, no. 2, 1969, pp. 176-77.

<sup>159</sup> The research of Gibbs and Maher went some way towards measuring Australian droughts. They ranked rainfall data between the years 1885 and 1965 from highest to lowest amounts and grouped them in deciles. The rainfall in the lowest, or first, decile was equivalent to drought conditions, which they compared to records of drought. See also, Heathcote, pp. 178-79.

<sup>160</sup> D. B. Collett, Letter to K. O'Hara, 6 April 1967, Public Works Department, Cons 1109, 1955/0019, SROWA.

<sup>161</sup> G. H. Burvill, Draft article for *Country* magazine, 14 September 1967, Public Works Department, Cons 1109, 1955/0019, SROWA.

<sup>162</sup> R. McCullough, 'WA Cloud seeding experiment: statistics report, May and June, 1967', 25 July 1967, Public Works Department, Cons 1561, 1967/0158, SROWA.

The state's engineers may have lacked confidence in the depth of scientific knowledge about Western Australian climates, but successive state governments were sufficiently convinced of the suitability and reliability of the southwest climate conditions to continue to promote extensive land settlement programs across the region. Although the Rural Reconstruction Commission had advocated a cautious approach to post-war land settlement, the state's Land Settlement Board declared in 1951 that,

It may be sound policy under normal conditions to examine every new project most critically and ascertain – if necessary – by experiment the answer to every question of management or soil use, as a pre-requisite to settlement. Such information, however, may take years to obtain, during which the vital factor of 'timing' may be lost.<sup>163</sup>

The Board members were confident that land settlement would be a great success and considered it reasonable to take a 'calculated risk'.<sup>164</sup>

Such was the enthusiasm for agricultural development in Western Australia that sixty per cent of qualified applicants were allotted farms, compared to just ten per cent in other states.<sup>165</sup> By the mid-1960s, thanks to a host of technological advances in the agricultural sciences, wheat growing had resumed in areas that had been deemed 'marginal' prior to the war.<sup>166</sup> The combination of the sanguine seasons of the post-war decades with a faith in the ability of science and technology to overcome natural limits had assuaged most environmental anxieties about the reliability of Western Australia's agricultural areas by the late 1960s. The dry seasons of the 1970s would expose the vulnerabilities that this post-war confidence had created.

### ***The Luckiest State?***

In this chapter, I have examined how many rural and suburban Western Australians became complacent about the possibilities of climate variability and water scarcity in the post-war era. This complacency, I contend, would render them vulnerable to running out in the climatically and economically volatile 1970s. The sanguine climate

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<sup>163</sup> Cited in Q. Beresford, 'Developmentalism and its environmental legacy: the Western Australian wheatbelt, 1900-1990s', *Australian Journal of Politics and History*, vol. 47, no. 3, 2001, pp. 406-407.

<sup>164</sup> Cited in Beresford, pp. 406-407.

<sup>165</sup> Beresford et al., *The Salinity Crisis*, p. 62.

<sup>166</sup> J. Dahlke, 'Evolution of the wheat belt in Western Australia: thoughts on the nature of pioneering along the dry margin', *Australian Geographer*, vol. 13, 1975, p. 14; and Powell, p. 48. According to Joseph Powell, these technological advances included improved varieties of crops, strains of livestock and fertilisers; better rotations; more efficient and effective clearing, cultivation and harvesting equipment and practices; increased use of pesticides and herbicides; more efficient handling and transport facilities; and the identification and remedy of trace element deficiencies, particularly in light lands.

conditions of the post-war decades, particularly from the late 1950s, assuaged environmental anxieties about aridity, white settlement and climate variability in the southwest. The prevailing conditions seemed to confirm confident scientific assessments of the climate, combining to bolster efforts to settle and expand the state's agricultural areas. But the favourable seasons fostered complacency among many of the southwest's farmers, who saw little need to invest in better water and fodder supplies. Moreover, lands were settled with few concerns regarding their suitability for European agriculture or for the settlers who would farm them. This confidence and inexperience would combine to leave many southwest farmers vulnerable to running out.

Developmentalism, which has enthralled Western Australian governments and much of their citizenry since Federation, was not restricted to clearing 'a million acres a year'. This intoxicating idea also swept through the suburbs of Perth, as more and more people – both Australians and New Australians – flocked to the city in the post-war decades. There they established their personal 'projects for privacy', replete with the latest consumer appliances. Many householders would find themselves increasingly distanced not only from each other, but also from nature, at least illusorily. This perceived alienation from nature was arguably fostered by the birth of Big Water in the suburbs of Perth. At the turn of a tap, Perth residents had unprecedented accessibility to seemingly unlimited quantities of potable water. Big Water therefore helped to transform the use of water inside and outside Perth homes as many householders became dependent on its availability to allay their anxieties about the appearance of their gardens and cleanliness of their homes and bodies. And in this dependency lay their vulnerability – they had become beholden to Big Water.

Big Water was also an important tool in the post-war project of land settlement and economic development. The reticulation of the southwest's agricultural areas through the CWSS provided the serviced farmlands with insurance against running out in 'hydraulically difficult country'. Works were also undertaken to increase the supplies available to the southwest's irrigation districts. In the process of improving the availability of water supplies in rural areas, those who utilised these reticulated networks became dependent on a source over which they had no personal control. They were reliant on Big Water to ensure that the quality and quantity of water supplies were maintained – both now and in the future. But the thirst of Big Water had to compete with the voracious hunger of agricultural development, and this duel would soon take its toll on the southwest's water supplies, in the form of increasing salinity.

Although the farmers outside the scope of Big Water were offered technical assistance to reduce their vulnerability to running out, many others were less fortunate. Aboriginal families in the southwest were largely excluded from the benefits of the post-war expansion of reticulated water supplies. Despite political emphasis on improving the living standards and political rights of Indigenous people, the failure of Australian governments to provide better housing and sanitation facilities left many Aboriginal families caught in the assimilation trap. The inadequacy of public housing for the southwest's Aboriginal people contributed to the fragmentation of Indigenous families and their marginalisation from post-war Western Australian society.

In his 1987 book *From the Ground Up*, historian Bryce Moore scathingly observed that 'the contented and prosperous citizens of mineral-rich Western Australia during the 1960s really believed that theirs was the Lucky Country, and that Western Australia was its luckiest state'.<sup>167</sup> The post-war era had been particularly kind to the residents of the western third – farmers had enjoyed a run of reasonable seasons, the suburbs had swelled, industrialisation was underway, and mineral exports were fuelling a boom. Giddy with this prosperity, as Moore suggests, they were not prepared for the time when their luck would run out. The following decade would put them to the test.

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<sup>167</sup> B. Moore, *From the Ground Up: Bristle, Whittackers and Metro Brick in Western Australian history*, Nedlands, UWA Press, 1987, p. 198.

## The 'Age of Anxiety': Reaching the limits of settlement (1969 to 1983)

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*Our experience of a high-technology city in such a fragile environment is brief, and there are so many things that could go wrong in Western Australia that a high degree of vigilance is called for. ... It may therefore be prudent to insist on more than usually generous safety-margins in planning for Perth and Western Australia.*<sup>1</sup>

- George Seddon, 1977

On the eve of a new decade, Western Australians in 1969 farewelled the prosperity of the post-war years, the 'Age of Innocence' that George Seddon described, and entered with trepidation a new era.<sup>2</sup> The onset of drought conditions in 1969, which severely affected farmers across the southwest (Appendix III), foreshadowed the dry seasons that would characterise the decade and shape the ways that suburban and rural Western Australians related to water in the southwest. Accompanying this climatic volatility was economic instability overseas and at home, which added to the difficulties facing many local farmers. Across the nation, agriculture was undergoing a decline in importance, and Western Australia was no exception, particularly with the burgeoning resource development in the state's northwest.<sup>3</sup> Meanwhile, as environmental problems like salinity took an increasing toll on the southwest's land and water resources, the promise of unfettered development lost some of its shine.

The poor seasons of the late 1960s and their persistence during the 1970s combined with erratic markets to usher in an 'Age of Anxiety' in the southwest, which would expose the vulnerability of many suburban and rural Western Australians to running out of water.<sup>4</sup> Naturally, some fared better than others in these circumstances, owing largely to their geographical position, their affluence, and their preparedness for periods of climate variability and water scarcity. In this chapter, I study the affects of the 1969 drought on southwest farmers and how it stimulated research interest in climate variability in the region. I then examine the ways that new economic and social constraints affected technocratic responses to the expansion of Big Water during the 1970s. Although these technocratic approaches to running out of water remained the

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<sup>1</sup> G. Seddon, *Swan Song: reflections on Perth and Western Australia, 1956-1995*, Nedlands, University of Western Australia, 1995, p. 55.

<sup>2</sup> Seddon, pp. 76, 78.

<sup>3</sup> B. Head, 'From the deserts the profits come: state and capital in Western Australia', *Australian Quarterly*, vol. 57, no. 4, 1985, p. 375.

<sup>4</sup> Seddon, pp. 76, 78.

dominant means by which Western Australians and the government sought a return to 'normal', the onus was now on consumers, rather than the government, to improve their hydroresilience. In the suburbs, however, the continued expansion of Big Water would arguably serve to offset some consumers' anxieties about water scarcity, while heightening the vulnerability of others to running out. I then study the persistence of a discriminatory sanitary order for Aboriginal people in the southwest. Finally, I examine how the run of dry years combined with growing concerns about global climate change to raise doubts about further land release in the southwest.

### *A Change in the Weather*

'I heard twice on the radio news that the warm, fine weather should continue for the present but that it should deteriorate soon', wrote a Kojonup farmer to the *West Australian* in April 1969, 'I don't know who thought of the word "deteriorate" in this instance, but I do know that all farmers hope the weather deteriorates very soon'.<sup>5</sup> The situation in the southwest's agricultural areas did deteriorate as the months passed by, but not in the way that this correspondent had hoped. By the end of the year, a large proportion of the southwest's agricultural areas had been declared 'drought affected'.<sup>6</sup> The extent and severity of the conditions were comparable to the disastrous seasons of 1914 and 1940, which had called into question the wisdom of prevailing land settlement and agricultural policies (see Chapter 2). In this section, I examine how the southwest's farmers fared in the dry conditions as well as the technocratic responses that the state and Commonwealth governments employed to remedy their plight. I contend that the severity of the drought for many farmers was a result of a long-standing belief in the 'reliability' of the rains of the southwest, which had fostered a sense of complacency towards running out. The dry conditions of 1969 dashed these illusions and contributed to both lay and scientific reinterpretations of the seasons of the southwest region.

The long run of moist seasons after the Second World War had reinforced official and lay belief in the reliability of the rains of the agricultural areas. As the Chairman of the Farm Water Supply Committee Jack Gabbedy conceded, '[F]armers generally had become quite complacent as to the need for guarding against drought years and this complacency probably resulted from the series of very wet years in the decade preceding 1969'.<sup>7</sup> Their faith that these conditions would continue had been

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<sup>5</sup> R. D. Rock, 'Rain wanted', *West Australian*, 25 April 1969, p. 6.

<sup>6</sup> See, 'Copy of notice appearing in Commonwealth Gazette 6/11/1969', Declared Drought Areas 1969, Cons 2780, 1969/1281 v5, SROWA.

<sup>7</sup> J. P. Gabbedy, 'Drought water exercise 1969-1971', 2 August 1971, Farm Water Supply

bolstered by scientific research, such as that undertaken by local geographer Joseph Gentilli. Furthermore, most farmers would not have experienced the extent of variability in the region because they had only settled there recently. Others had not experienced such dry conditions since the devastating drought of 1914.<sup>8</sup> Across the southwest, farmers generally believed that ‘things like that (the 1969 drought) *should not* happen here’.<sup>9</sup> These ideas had led many farmers to inadequately bolster their fodder and water supplies for the increased stock levels they were carrying in the late 1960s.<sup>10</sup> Farmers’ expectations of the region’s climate and their sense of ‘normal’ or ‘abnormal’ weather conditions reflected, therefore, the strong influence of individual and collective experiences and memories.<sup>11</sup> Relatively confident that drought would spare the southwest, few farmers had taken advantage of PWD and Department of Agriculture initiatives to improve their resilience to variations in climate and water supplies.

As the dry conditions continued, the Brand government was also accused of ‘tak[ing] the punt’ that drought would not afflict the state’s agricultural and pastoral areas.<sup>12</sup> The Labor Opposition and rural press criticised the government for failing to respond more quickly.<sup>13</sup> But the government’s response was hampered by the reluctance of farming shires to proclaim their area drought-stricken. As Minister for Agriculture Crawford Nalder reported to Parliament in early August 1969, ‘Not one local authority will admit that drought conditions exist’.<sup>14</sup> Although such a proclamation entitled farmers to drought assistance from both the Commonwealth and state governments, these shires were concerned that the stigma associated with the label of ‘drought-affected’ might damage their shire’s reputation as a profitable farming area and cause land prices to plummet.<sup>15</sup> The reality of drought clearly conflicted with long-held official and lay ideas about the nature of the southwest’s climate.

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Committee, Cons 7203, V097V2, SROWA.

<sup>8</sup> D. Altheer, ‘Pastoralists seek drought committee’, *Countryman*, 31 July 1969, p. 14.

<sup>9</sup> G. Gare, ‘Have we under-estimated drought in WA?’, *Countryman*, 2 April 1970, p. 5. My emphasis.

<sup>10</sup> See, B. E. Rosenthal, *Wheat quotas in Australia*, Brisbane, Dept of Primary Industries (QLD), 1975, p. 10; D. Black, ‘Liberals triumphant: the politics of development 1947-1980’, in C. T. Stannage (ed.), *A New History of Western Australia*, Nedlands, UWA Press, 1981, p. 463; ‘Playing it down’, *Countryman*, 14 August 1969, p. 3; C. W. Quin, ‘Wheat losses will not be as severe as feared’, *West Australian*, 14 October 1969, p. 2; and Meeting Minutes, ‘Advisory Committee on adverse seasonal conditions’, 12 August 1969, Drought Advisory Committee, Cons 1609, 1969/0801, SROWA.

<sup>11</sup> M. Hulme, S. Dessai et al., ‘Unstable climates: exploring the statistical and social constructions of “normal” climate’, *Geoforum*, vol. 40, 2009, p. 198.

<sup>12</sup> D. Altheer, ‘Pastoralists seek drought committee’, *Countryman*, 31 July 1969, p. 14.

<sup>13</sup> Altheer, p. 14; ‘Playing it down’, *Countryman*, 14 August 1969, p. 3.

<sup>14</sup> *Western Australian Parliamentary Debates (WAPD)*, vol. 183, 6 August 1969, p. 88.

<sup>15</sup> P. Mullally, ‘Farmers declare drought areas’, *Countryman*, 14 August 1969, p. 3; and E. C. House cited in, ‘False pride prevents drought declarations’, *Countryman*, 21 August 1969, p. 9.



Once a local council conceded the extent of their shire's dire situation, the Brand government implemented emergency efforts to relieve the affected areas.<sup>16</sup> These measures included financial assistance, water carting, searching for alternative water sources, and drilling for underground water to boost supplies.<sup>17</sup> The future expansion of Big Water, the State government, farmers and rural press believed, would 'drought proof' the agricultural areas and ensure their return to prosperity. Just a year earlier, the State government had presented a proposal to the Commonwealth for funds to expand the scope of the Comprehensive Water Supply Scheme (CWSS) to include the York-Greenhills and Corrigin-Bullaring areas.<sup>18</sup> As the *West Australian* declared in October 1969, 'Australia reaps big national dividends, even in times of wheat surplus and falling wool prices from the areas the CWS[S] serves. Those dividends would be bigger in these adverse times if there were more water to sustain the sheep'.<sup>19</sup> Nevertheless, in 1972, the Commonwealth rejected Western Australia's proposals. Another request for assistance to reticulate districts with severe water problems, including the West Midlands, Eradu and the areas east of Merredin, was also turned down in 1975 (Figure 4.1).<sup>20</sup> These decisions would contribute to a reorientation in the State government's approach to watering the wheatbelt and to the study of its climate.

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<sup>16</sup> WAPD, vol. 183, 21 August 1969, p. 482.

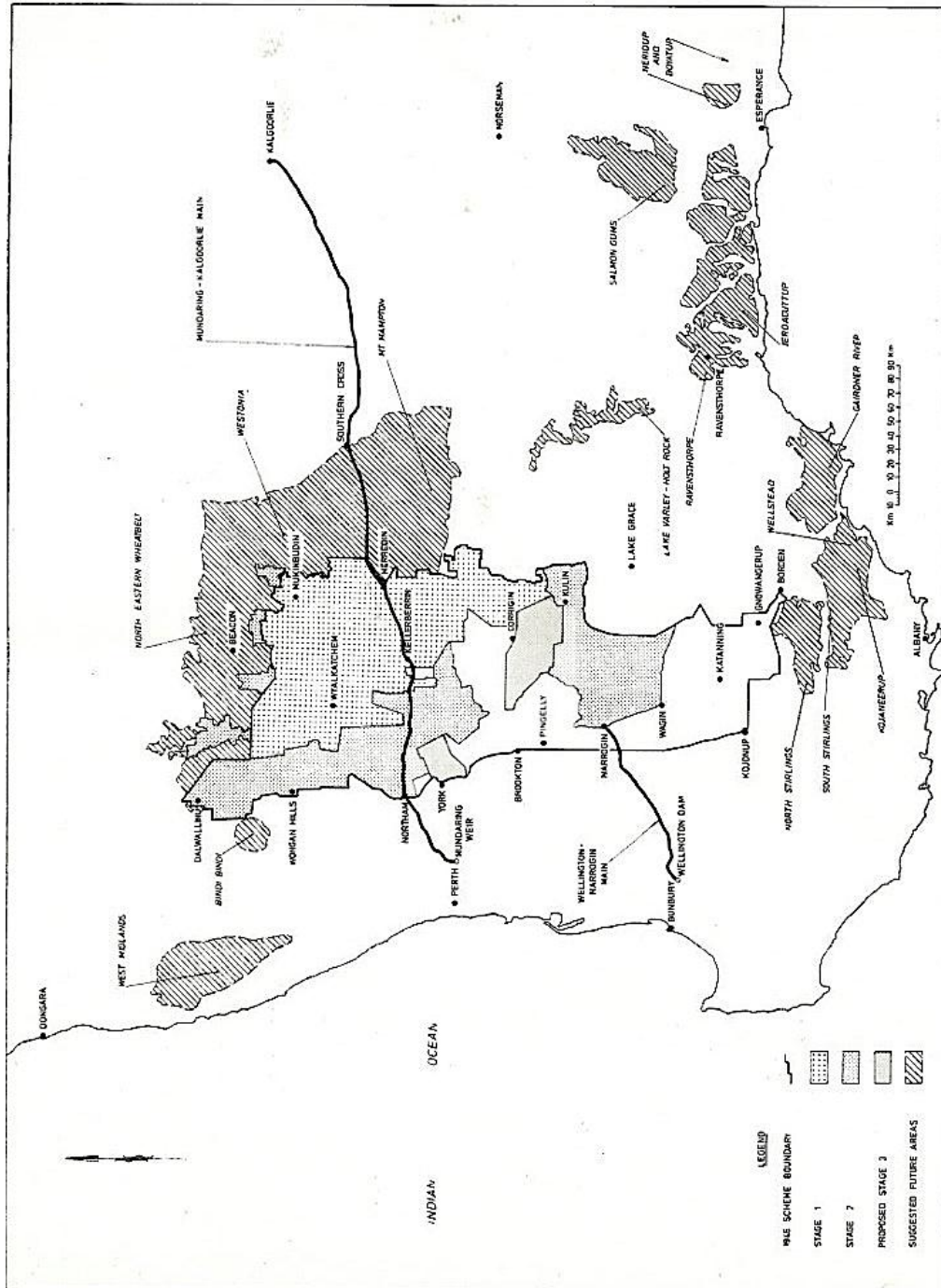
<sup>17</sup> J. P. Gabbedy, 'Drought water exercise 1969-1971', 2 August 1971, Farm Water Supply Committee, Cons 7203, V097V2, SROWA.

<sup>18</sup> K. J. Kelsall, 'The Comprehensive Water Supply Scheme', in *Wheatbelt Water Supply Seminar, Muresk Agricultural College, Northam*, Perth, Water Research Foundation of Australia, WA State Committee, 1977, p. 5.

<sup>19</sup> 'Water schemes', *West Australian*, 8 October 1969, p. 6.

<sup>20</sup> Kelsall, p. 7.

**Fig. 4.1: State Government proposals for expanding the Comprehensive Water Supply Scheme (1967 and 1973)<sup>21</sup>**



Although meteorological interest in drought had grown in eastern Australia after the war, far less attention had been paid to such conditions in Western Australia. Forecasters there faced the difficulty of calculating their predictions with little weather information from the Indian Ocean.<sup>22</sup> Even in the late 1970s, the Indian Ocean remained ‘very much a “no-man’s land” in global meteorology’ and forecasters relied upon

<sup>21</sup> K. J. Kelsall, ‘The Comprehensive Water Supply Scheme’, *Journal of Agriculture*, vol. 18, no. 3, 1977, p. 71.

<sup>22</sup> D. Day, *Weather Watchers: 100 years of the Bureau of Meteorology*, Melbourne, Bureau of Meteorology, 2007, p. 345.

observations from ships and Amsterdam Island in the central Indian Ocean.<sup>23</sup> The development of mineral and oil resources in the state's northwest during the 1960s had led the local office of the Bureau of Meteorology to focus its attentions on the study of weather phenomena that might disrupt northern development, such as tropical cyclones.<sup>24</sup> In contrast, few efforts seemed to have been devoted to developing a method of long-range forecasting for the southwest. This was likely a result of the widely held idea of the reliability of the southwest climate, the relatively wet conditions of the post-war decades, and the seemingly accurate forecasting by local Bureau of Meteorology forecasters.<sup>25</sup> Besides, as it was rare for both sides of the continent to be drought-affected at the same time, agricultural production in unaffected areas could compensate for the losses in affected regions.<sup>26</sup> It was left then to the University of Western Australia's Institute of Agriculture and the state's Department of Agriculture to examine the southwest's climates more closely.

The drought of 1969 had coincided with recent personnel changes at the Institute of Agriculture and a subsequent new focus on climate variability in the southwest region. The Institute had enjoyed an especially close relationship with the cereal industry since the late 1950s, and continued to yoke its progress to the development and needs of the expanding wheat industry throughout the 1960s.<sup>27</sup> After working with the CSIRO Division of Land Research at the Kimberley Research Station, Walter Stern was appointed Foundation Professor of Agronomy at the Institute of Agriculture in 1967.<sup>28</sup> According to Stern, State government plans in the late 1960s to push land settlement further east of Lake King into marginal lands prompted him to engage with

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<sup>23</sup> R. L. Southern, 'The Atmosphere', in B. J. O'Brien (ed.), *Environment and Science*, Crawley, UWA Press, 1979, p. 224; and G. W. Cook, Bureau of Meteorology, pers. comm., 22 November 2011.

<sup>24</sup> 'The Perth RO since 1929', *Federation and Meteorology*, Australian Science and Technology Heritage Centre, 2001, <<http://www.austehc.unimelb.edu.au/fam/1305.html>>, (Accessed: 5 December 2011).

<sup>25</sup> For instance, upon the death of local forecaster A. G. Akeroyd in 1948, the *West Australian* paid tribute to the 'remarkable degree of accuracy' of his weather forecasts. *West Australian*, 1948, cited in R. Southern, 'Akeroyd the Great', *Weather News*, no. 237, 1976, Available: <<http://www.austehc.unimelb.edu.au/fam/1310.html>>, (Accessed: 10 June 2010).

<sup>26</sup> R. L. Heathcote, 'Managing the droughts? Perception of resource management in the face of the drought hazard in Australia', *Vegetatio*, vol. 91, 1991, pp. 220-21.

<sup>27</sup> F. Alexander, *Campus at Crawley: a narrative and critical appreciation of the first fifty years of the University of Western Australia*, Melbourne, F. W. Cheshire, 1963, pp. 445-46. Alexander suggests this close relationship between the Institute and the rural industries was unique in Australia, even 'where a university's economic environment was largely agricultural or pastoral'.

<sup>28</sup> The University's Institute of Agriculture had had a strong relationship with CSIR (later, CSIRO) since the 1930s. CSIR occupied a portion of the Institute's buildings and provided significant funding for the Institute's research. According to University historian Fred Alexander, the CSIR presence helped to maintain the Institute's independence from the State Department of Agriculture. See, Alexander, pp. 423-29.

climatologists.<sup>29</sup> Acutely aware of the isolation of Western Australia and the University, he recruited the sole climatologist from the CSIRO Division, American Eugene A. Fitzpatrick, and Peter B. Wright from the British Meteorological Office. Their research was influenced by the recent encouragement of the Director of the Bureau of Meteorology, Bill Gibbs, at an ANZAAS meeting on drought to ‘ascertain the frequency with which droughts may be expected’.<sup>30</sup> Consecutive years of poor rainfall would have a more devastating impact on farmers than a single bad year as they would not be in a position to either recover financially from the previous season or to ensure adequate supplies of water and fodder for the coming year. Knowledge of how often droughts might occur would direct farmers to plan their agricultural and pastoral practices accordingly. Their research found that the likelihood of drought in the southwest had been underestimated – there was a one in seven chance of a serious drought developing between the break of the season and at the end of July.<sup>31</sup> Since these findings were concerned with the timing of rains, rather than total rainfall, they were more precise and applicable to wheatgrowing than Gentili’s earlier estimation of drought probability in the southwest.

Meanwhile, similar research was being undertaken at the state’s Department of Agriculture. At the height of the 1969 drought, the Assistant Director of the Department, George H. Burvill, had observed, ‘A few years ago it was forecast that the cleared area could rise to fifty million acres. But the drought has shown us that we should perhaps look more closely at whether we have been expanding too far into the low rainfall areas’.<sup>32</sup> This statement was particularly striking in light of the fact that just two years earlier, the government was still releasing a million acres of Crown land a year, particularly along the south coast.<sup>33</sup> For Burvill at least, it suggests an

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<sup>29</sup> W. R. Stern, pers. comm., October 2009. In 1947, Colin E. Hounam of the Perth office of the Bureau of Meteorology had argued that this area near the No. 1 Rabbit Proof Fence was climatically suitable for wheat production. See, C. E. Hounam, *Climate of the West Australian Wheat Belt with Special Reference to Rainfall Over Marginal Areas*, Melbourne, Commonwealth Meteorological Bureau, 1947, p. 17. Although Joseph Gentili was still at the University, he was no longer closely engaged on the relationship between climate and agricultural production. Although his research interests continued to expand in the 1970s, he continued to work on the climate classification of Australia. See for example, J. Gentili, *Climates of Australia and New Zealand*, New York, Elsevier, 1971; and *Australian Climate Patterns*, Melbourne, Thomas Nelson, 1972.

<sup>30</sup> W. J. Gibbs, ‘Drought amelioration’, in *Report of the ANZAAS Symposium on Drought*, Melbourne, Bureau of Meteorology, 1967 cited in Day, p. 338. ‘ANZAAS’ is the Australian and New Zealand Association for the Advancement of Science.

<sup>31</sup> See, Southern, p. 210. The break in the season varies from early March along the south coast to the end of May in the northern inland areas.

<sup>32</sup> ‘Farm costs rise, says professor’, *West Australian*, 22 September 1969, p. 9.

<sup>33</sup> W. R. Stern, ‘Trends and prospects’ in G. H. Burvill (ed.), *Agriculture in Western Australia: 150 years of development and achievement, 1829-1979*, Nedlands, UWA Press, 1979, p. 385.

acknowledgement that certain land policies supported by his Department had rendered some farmers vulnerable to running out. At a meeting on water supplies in Mukinbudin in early 1970, Burvill revealed his Department's estimates for the upcoming seasons in the eastern and north-eastern areas of the wheatbelt based on long-term rainfall averages. In contrast to earlier glowing assessments of the southwest's climates, Burvill concluded that in these areas at least, there had been 'more dry years than wet years'.<sup>34</sup> The drought of 1969, he warned, was the beginning of a 'period of five to eight years of below-average rainfall'.<sup>35</sup> As that drought had 'revealed some chinks in our armour', farmers in these areas, with government assistance, needed to undertake measures to improve their hydroresilience.<sup>36</sup>

These revisions of official ideas about the climate variability of the agricultural areas and the diminishing likelihood of further Commonwealth funding for extending the CWSS combined to prompt government efforts to help farmers protect themselves from dry conditions. Although the Farm Water Supplies Committee had been in operation since the mid-1960s, relatively few farmers had taken advantage of its assistance, as the 1969 drought had revealed. In the central and north-eastern wheatbelt – those areas the Department of Agriculture expected to be worst affected by poor seasons over the next decade – just fifteen per cent of farm dams were regarded as 'drought proof'.<sup>37</sup> Meanwhile, farm dams were the only source of stock water on most farms in the southern and southeastern wheatbelt, as well as in the Mallee and Esperance areas.<sup>38</sup> Although the PWD had hailed its development of the roaded catchment after the war, by 1969 very few farmers in the agricultural areas had adopted this technique to improve the runoff into their dams. Plentiful rains in the 1950s and 1960s had made such investments in infrastructure seem wasteful so they had relied instead on natural catchments of sloping pastures.<sup>39</sup> The need to cart water during the 1969 drought exposed their misplaced faith in the weather.<sup>40</sup> The Committee considered that over half of the wheatbelt's dams could benefit from the addition of roaded catchments, which was a more sustainable alternative than digging bigger and deeper dams.<sup>41</sup> The return of dry conditions in the late 1970s would reveal just how many

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<sup>34</sup> G. H. Burvill cited in 'Wheatgrowers may have to change farming pattern', *Countryman*, 22 January 1970, p. 6.

<sup>35</sup> 'Wheatgrowers may have to change farming pattern', p. 6.

<sup>36</sup> 'Wheatgrowers may have to change farming pattern', p. 6.

<sup>37</sup> I. A. F. Laing, 'Farm dams in the wheatbelt', in *Wheatbelt Water Supply Seminar*, p. 6.

<sup>38</sup> Laing, p. 2.

<sup>39</sup> Laing, p. 4.

<sup>40</sup> Laing, p. 3.

<sup>41</sup> Laing, p. 6.

farmers had learned from 1969 and undertaken measures to reduce their vulnerability to running out.

Unfortunately for many southwest farmers, the estimations of the Department of Agriculture were borne out by the dry conditions of the 1970s. Although cyclones *Glynis* and *Ingrid* in January and February of 1970 brought with them heavy rains and strong winds, the dry summer conditions prevented the replenishment of water storages across the areas afflicted by the 1969 drought and in some southern districts, the dry conditions persisted well into the following year.<sup>42</sup> The drought had exposed the vulnerability of many farmers to climate variability and water scarcity, prompting government efforts to apply technocratic solutions to ameliorate their circumstances. The poor season also prompted Western Australians to review their preconceptions of the southwest's climate as a place of reliable rainfall. For many farmers, the impact of the drought was deepened by the changing fortunes of agriculture in the Australian economy. Fewer farmers could look forward with 'unbridled optimism' to 'unlimited opportunities', and many more saw 'uncertainty and scepticism' on the horizon.<sup>43</sup> In Western Australia at least, government advisors considered, 'This change in outlook has occurred rapidly and, if any specific time is to be identified as the turning point, it might be from the beginning of 1969'.<sup>44</sup>

### ***Fear the hose***

On the eve of the drought of 1969, *Choice* magazine had observed, 'The amount of garden hose in Australia could, like Puck, put a girdle around the earth with very little difficulty'.<sup>45</sup> Wielding their new Nylex plastic garden hoses and with their supplies assured by the post-war growth of Big Water, the people of Perth embraced the suburban ritual of watering their gardens with gusto. After the war, Perth householders had become prodigious users of water, outstripping the residents of the other capitals.<sup>46</sup>

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<sup>42</sup> Southern, p. 197; and G. H. Burvill, Letter to C. Nalder, 18 March 1970, Drought Advisory Committee, Cons 1609, 1969/0801, SROWA. Cyclone *Ingrid* caused 'spectacular losses' in recently shorn sheep, resulting in the deaths of about 140,000 head from the stress of the conditions. See, Department of Agriculture (WA), *Annual Report 1969/70*, Perth, Dept of Agriculture (WA), 1970, p. 7.

<sup>43</sup> Advisory Committee on Agricultural Education, *Agricultural Education in Western Australia: Report of the Advisory Committee on Agricultural Education appointed by the Minister for Education in Western Australia under the chairmanship of Professor W. R. Stern*, Perth, WA Education Dept, 1971, p. 30.

<sup>44</sup> Advisory Committee on Agricultural Education, p. 30.

<sup>45</sup> 'Garden hoses', *Choice*, vol. 5, 1964, p. 140.

<sup>46</sup> The Nylex brand of moulded plastic hose was made commercially available in 1945. G. Davison, 'Down the gurgler: historical influences on Australian domestic water consumption', in P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australian cities*, Canberra, ANU Epress, 2008, p. 56.

Total water consumption in Perth had been doubling almost every fifteen years since 1920.<sup>47</sup> With the economic development of the 1950s and 1960s, the state's population had soared and was increasingly concentrated in the suburbs of Perth. The city had swelled from 62 per cent of the state's population in 1954, to 68 per cent in 1971.<sup>48</sup> At the dawn of the 'Age of Anxiety', the Metropolitan Water Board (MWB) was struggling to keep pace with the growth in demand, which fuelled engineers' concerns about running out by the end of the century. How would Big Water continue to slake the thirst of the suburbs? From where would it drink next? In this section, I examine the development of additional surface and groundwater water supplies for the suburbs of Perth in the early 1970s and the influence of new social and economic constraints on this expansion of Big Water. I contend that the efforts of Big Water to ensure the 'efficiency, constancy and predictability' of groundwater supplies in particular – those central tenets of engineered resilience – would diminish the ecological resilience of this resource to running out.<sup>49</sup>

In late 1969, construction began on the Dandalup River scheme near Pinjarra to provide water to the suburbs of Perth. Under this scheme, a pipehead dam would be built across the North Dandalup River and a major dam constructed at Lake Banksiadale on the South Dandalup River.<sup>50</sup> The damming of the North Dandalup River had been earmarked during the war as a possible supplement to the Mundaring Weir in the plan to reticulate the agricultural areas.<sup>51</sup> The rapid post-war growth of Perth and its thirst for water soon led to the consideration of the site as a water source for the city. The prospect of piping water away from a district that supported dairying, orcharding, livestock and timber milling raised the ire of rural shires.<sup>52</sup> At the 1960 South West Conference of the Country Party in Bunbury, the delegates resolved "that no further catchments should be provided to create new supplies for the metropolitan area", especially in that area south of Pinjarra'.<sup>53</sup> Local politicians outside Perth argued that damming the Dandalup Rivers was at odds with political rhetoric of decentralisation and regional development.<sup>54</sup> And where would it stop, they wondered – which river

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<sup>47</sup> S-J. Hunt, *Water, the Abiding Challenge*, Perth, Metropolitan Water Board, 1981, p. 96.

<sup>48</sup> Head, p. 376.

<sup>49</sup> C. Muir, D. Rose and P. Sullivan, 'From the other side of the knowledge frontier: Indigenous knowledge, social-ecological relationships and new perspectives', *Rangeland Journal*, vol. 32, 2010, p. 262.

<sup>50</sup> Hunt, p. 94.

<sup>51</sup> R. G. Hartley, 'A century of water supply to the Western Australian goldfields and wheat-belt from Mundaring Weir and the Kalgoorlie pipeline', *Early Days*, vol. 11, 2000, p. 738.

<sup>52</sup> 'North Dandalup', *Western Mail*, 20 October 1949, p. 26.

<sup>53</sup> Cited in Hunt, p. 91.

<sup>54</sup> 'S. W. warning over water', *West Australian*, 23 March 1972, p. 22.

would be next? But the thirst of the suburbs had to be quenched – as engineer Ian O’Hara noted in 1967, ‘It seems to be quite well-established that the garden suburb is part of the accepted way of life’.<sup>55</sup>

By 1971, water from the North Dandalup pipehead dam was supplying water to Perth. The South Dandalup Dam was completed in 1974 and became the largest of the reservoirs supplying Perth (Figure 4.2).<sup>56</sup> But the fears of running out remained. Even in the late 1960s, Big Water’s engineers considered that Perth’s dams would only be able to supply two thirds of the water necessary to slake suburban thirsts by the end of the century.<sup>57</sup> Further calculations in the early 1970s only confirmed these anxieties: demand for water would exceed the available supplies by the mid-1980s.<sup>58</sup> Although suburban householders had responded well to campaigns to voluntarily conserve water in the summer of 1972/73, Big Water’s engineers were convinced that more water was needed.<sup>59</sup> In 1973, PWD engineers calculated the long-range demand for water and their findings gave colleagues further cause for concern.

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<sup>55</sup> I. J. O’Hara, ‘Utilization of water resources with particular reference to lawn and garden watering’, Metropolitan Water Supply, Sewerage and Drainage Board, Cons 6733, 1967/880672, SROWA.

<sup>56</sup> Hunt, p. 94.

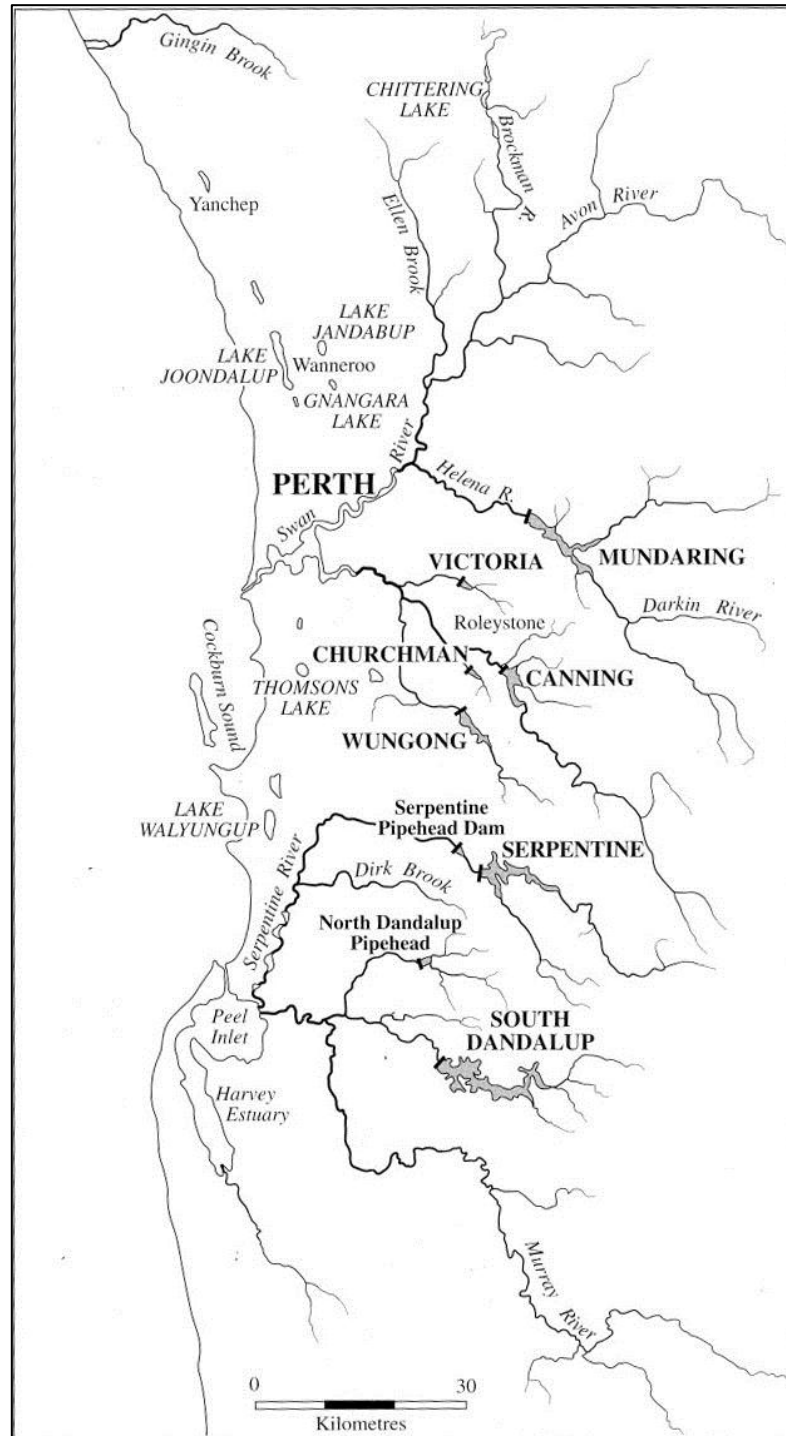
<sup>57</sup> I. J. O’Hara, ‘Utilization of water resources with particular reference to lawn and garden watering’, Metropolitan Water Supply, Sewerage and Drainage Board, Cons 6733, 1967/880672, SROWA.

<sup>58</sup> See, B. S. Sadler and C. A. R. Field, *South West Regional Water Planning Study: working report*, Perth, PWD, 1973.

<sup>59</sup> See R. Morgan, ‘A thirsty city: an environmental history of water supply and demand in 1970s Perth’, *Studies in Western Australian History*, vol. 27, 2011, pp. 83-84.



**Fig. 4.2: The dams of Big Water in the 1970s<sup>60</sup>**



Compared to Canada and the United States, water planning in Australia was very rudimentary at this time.<sup>61</sup> Estimations of future demand tended to assume that population and per-capita consumption would continue to increase at existing rates, and

<sup>60</sup> J. M. Powell, *Watering the Western Third: water, land and community in Western Australia*, Leederville, Water and Rivers Commission, 1998, p. 56.

<sup>61</sup> D. I. Smith, *Water in Australia: resources and management*, Melbourne, Oxford University Press, 1998, pp. 191-92.

water would have to be supplied accordingly.<sup>62</sup> This approach reflected the relatively high level of available water resources per head in Australia's cities.<sup>63</sup> In Perth, however, this abundance was now in doubt – the most accessible and cheapest sources had already been developed and some of these were now being threatened by salinity.<sup>64</sup> Big Water's 'inventory of potable water resources' was slowly being strangled. This would not be addressed until the late 1970s.

It was in this context of looming scarcity for Perth that Big Water and the state government addressed growing demands from irrigators in the Harvey district for more water (see Figure 4.3). Irrigators argued that the Harvey Dam was no longer adequate for their needs and that a new dam was necessary to support their farm planning and to ensure the reliable supply of dairy products to Perth.<sup>65</sup> Reflecting the Whitlam government's recent withdrawal of the dairy industry subsidy, economists, including the author of *Australia: wet or dry*, Bruce R. Davidson, argued that it was not in the state government's interest to continue providing cheap water to irrigators.<sup>66</sup> Instead, they recommended that irrigators compete with other consumers (particularly those in Perth) under free market conditions for water supplies, or shift to dryland milk production, which did not require as much water.<sup>67</sup> But support for this radical change was not unanimous. As one commentator asked, 'Is the human suffering, ghost towns and farms created by following such a policy warranted for a saving of this [small] magnitude?'<sup>68</sup>

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<sup>62</sup> Smith, pp. 191-92.

<sup>63</sup> Smith, pp. 191-92.

<sup>64</sup> B. A. Carbon, 'Introduction', in B. A. Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*, Perth, CSIRO, 1975, pp. 4-5.

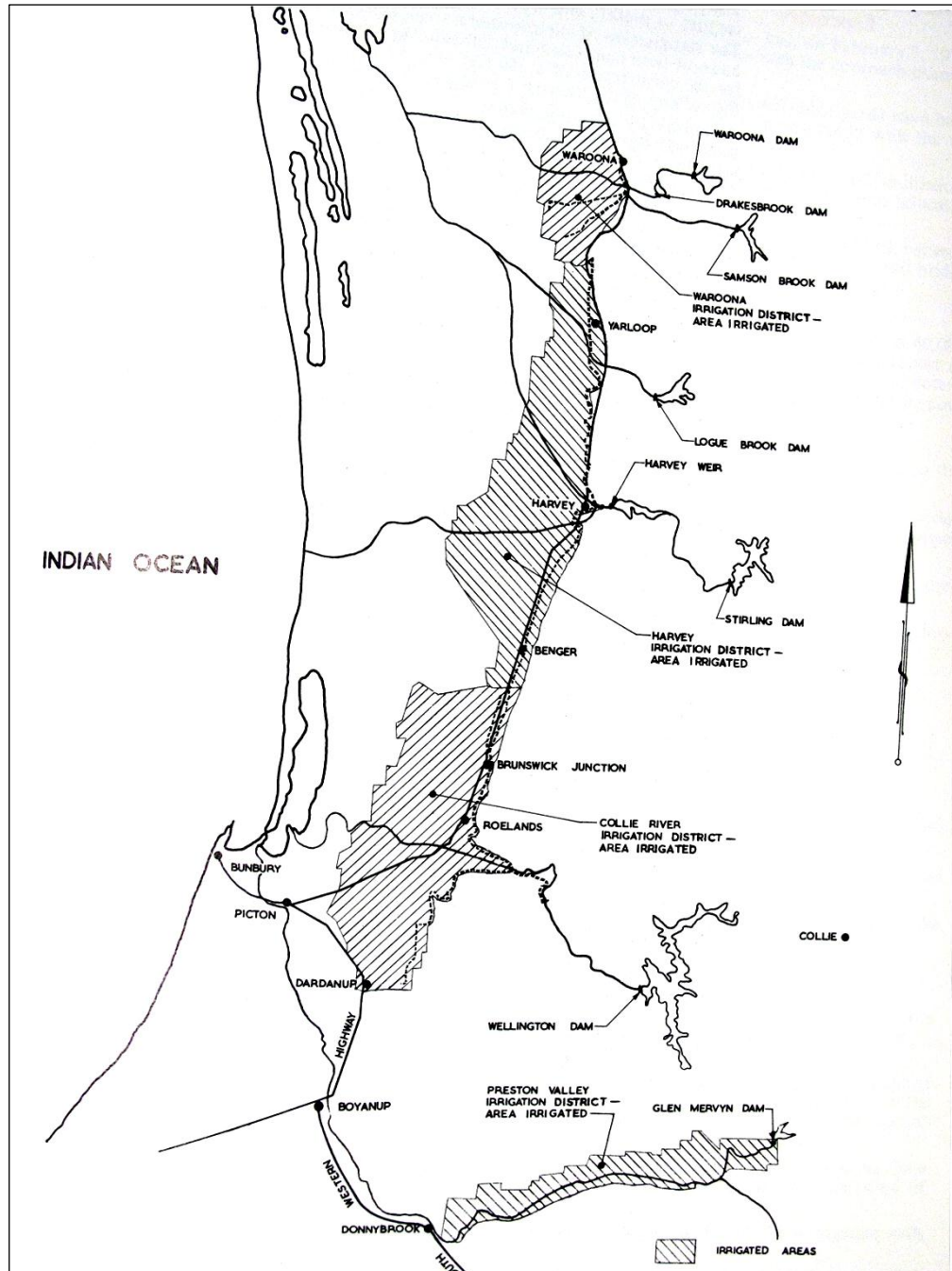
<sup>65</sup> J. W. Offer, 'Viewpoint of an irrigation farmer', in *A Seminar on Irrigated Agriculture on the Coastal Plain: future water requirements and alternatives*, Crawley, UWA Extension Service, 1977, pp. 83-84.

<sup>66</sup> J. Warhurst, 'The Industries Assistance Commission and the making of primary industry policy', *Australian Journal of Public Administration*, vol. 41, no. 1, 1982, pp. 15-32; and G. D. Oliver, 'Policy and local food sources'; G. M. Cann, 'Agricultural water use: the dairy industry economic aspects'; and B. R. Davidson, 'Economic aspects of Perth's water supply', in *Water Requirements for Agriculture, Industry and Urban Supply for a Metropolis of Two Million in the Southwest of Western Australia*, Perth, AIAS, 1975, pp. 11-12, 13-22; 44-51.

<sup>67</sup> Oliver, pp. 11-12; Cann, pp. 13-22; and Davidson, pp. 44-51.

<sup>68</sup> J. S. Abbott, 'Water requirements for agriculture, industry and urban supply in the southwest of Western Australia', in *Water Requirements for Agriculture, Industry and Urban Supply*, p. 56.

Fig. 4.3: The Southwest Irrigation Districts in 1970<sup>69</sup>



A compromise presented itself: the piping of the Harvey irrigation district. Some fifty kilometres of dilapidated open channels continued to supply water to irrigators, a system that allowed up to a quarter of the water released from dam storages to be lost in the process of delivery.<sup>70</sup> This deficit, engineers calculated, was equivalent to the amount released from Logue Brook Dam and Harvey Dam combined.<sup>71</sup> The savings achieved through piping the district would conserve enough water to meet some of the

<sup>69</sup> Public Works Department, *Annual Report 1970/71*, Perth, PWD, 1971, p. 25.

<sup>70</sup> Le Page, p. 618.

<sup>71</sup> Le Page, p. 617.

irrigators' demands. The construction of the piped scheme commenced in 1977 and was finally completed in the late 1980s. Nearly seventy years after government engineer Hugh Oldham had dismissed the idea, the irrigators of Harvey finally had their vision realised. But water for Perth would have to be found elsewhere. Two other options appeared – one a pipedream, the other a panacea.

In the search to secure water for the southwest, some members of the community looked to sources outside the region. The Western Mining Corporation (WMC) was especially concerned that limited water supplies would restrict industrial development and mining activities in the Eastern Goldfields.<sup>72</sup> Following a 1970 PWD report on the state's exploitable surface water resources, the WMC undertook a feasibility study of the possibility of establishing a dam site on the Fitzroy River in the state's northwest and pumping the water to Perth and Kalgoorlie.<sup>73</sup> Although the WMC envisioned the Fitzroy pipeline proposal as a descendant of 'O'Connor's [Kalgoorlie] pipedream', Premier Sir Charles Court was less enthusiastic about the prospect of importing water to the southwest.<sup>74</sup> Seeing a conflict with his visions for northern development, he argued in 1975, '[W]e cannot expect to reach too far with our pipelines to bring to Perth water that might be needed elsewhere'.<sup>75</sup> Besides, the MWB's engineers calculated that it would cost the government at least \$5.50 a litre to supply water from the northwest – nearly sixty times more than some of the other available options.<sup>76</sup> Although the return of dry conditions in the late 1970s renewed this pipedream, Sir Charles remained unmoved.<sup>77</sup> The rivers were simply too far and expensive to tap, and these plans to pipe water from the state's northwest were shelved, at least temporarily.

Far closer and far cheaper were the groundwater resources of the Swan Coastal Plain. International efforts to further global hydrological studies in the early 1960s had encouraged Australian endeavours to undertake the long-awaited measurement of the

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<sup>72</sup> G. M. Ralph, *Pipe dreams and realities: a review of various schemes to provide water to the southern parts of WA*, Perth, Western Mining Corporation, 1974, p. 16. Emphasis in original.

<sup>73</sup> D. B. Collett, *The usable surface water resources of Western Australia*, Perth, PWD, 1970; and Ralph, p. 8.

<sup>74</sup> Ralph, p. 17.

<sup>75</sup> C. Court, 'Official opening of the EPA and CSIRO Symposium on groundwater resources of the Swan Coastal Plain', in Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. 1. See also, B. S. Sadler and C. A. R. Field, 'Water supply resources and demands in the southwest region', in *Water requirements for agriculture, industry and urban supply for a metropolis of two million in the south west of Western Australia*, Perth, AIAS (WA) and IEA (WA), 1974, p. 6.

<sup>76</sup> B. Sadler, 'Water supply and alternate sources', in Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. 56.

<sup>77</sup> 'No plans yet for dam on Fitzroy', *Western Farmer*, 31 March 1977, p. 2; and 'The Ord under scrutiny', *Western Farmer*, 1 September 1977, p. 14.

continent's water resources.<sup>78</sup> As part of its assessments of the underground water resources of Western Australia, the PWD undertook exploration of the groundwater reserves between Gingin in the north and Mandurah in the south. These studies revealed extensive stocks within two superficial formations about seventy metres below the ground that the MWB considered could be cheaply utilised for scheme water supplies.<sup>79</sup> These shallow formations are the Gnangara Mound, located between Gingin Brook and the Swan River, and the Jandakot Mound, located between the Swan River and the Serpentine River flats (Figure 4.4).<sup>80</sup> These superficial formations are composed of late Tertiary to Quaternary age sediments, such as sand, silt, clay and limestone and are recharged by rains percolating through the water table.<sup>81</sup>

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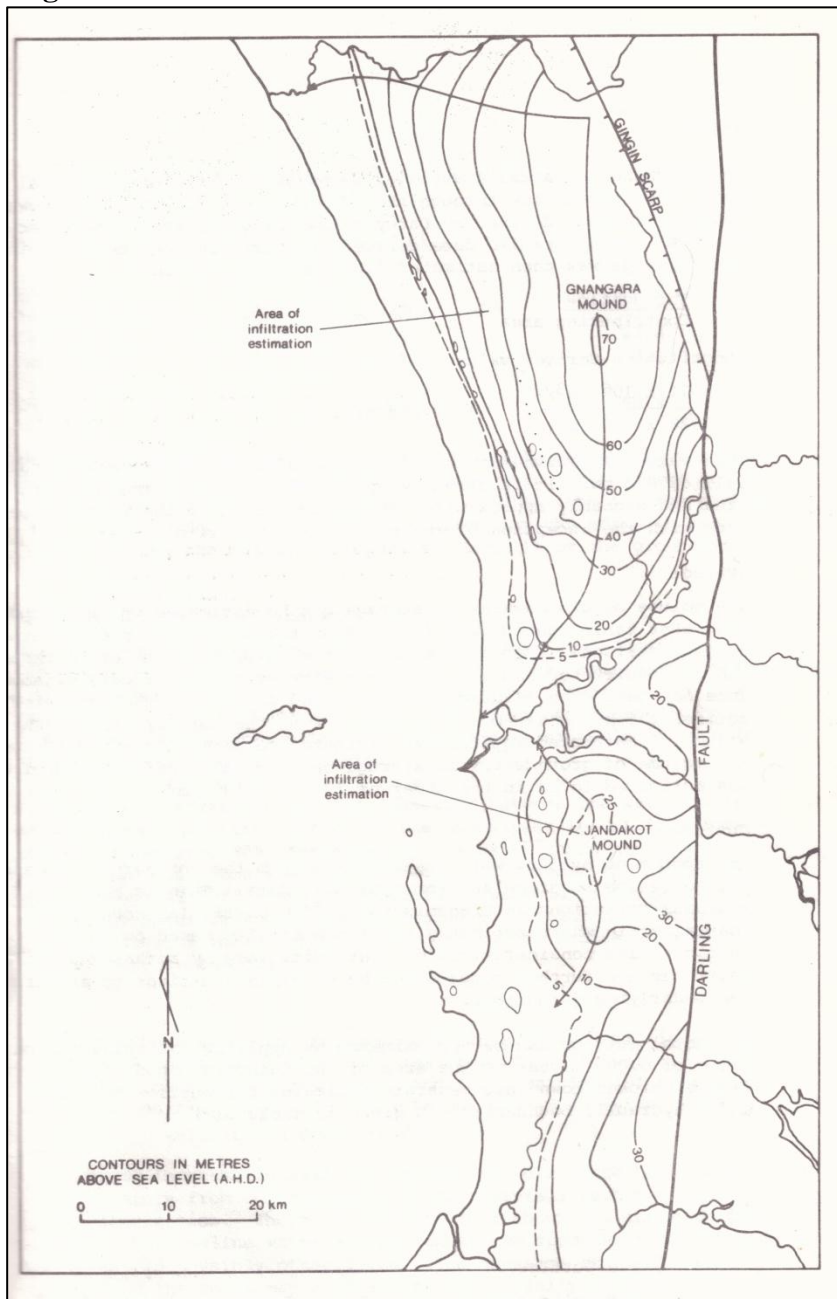
<sup>78</sup> According to Walter Boughton, the 1963 figures for 'some sixty per cent of the total average annual runoff [in Australia] were based on estimates rather than measurements'. See, W. Boughton, 'Hydrology and water resources in Australia – the past', in *Proceedings of the 30<sup>th</sup> Hydrology and Water Resources Symposium, 4-7 December 2006, Launceston, Tasmania*, Sandy Bay, Tas., Conference Design, 2006, np. See also, R. L. Nace, 'Hydrology comes of age: impact of the International Hydrological Decade', *Eos*, vol. 61, no. 53, 1980, p. 1241-44; and E. S. Hills (ed.), *Water resources: use and management, proceedings of a symposium held at Canberra by the AAS, 9-13 September 1963*, Melbourne, Melbourne University Press, 1964.

<sup>79</sup> G. C. Cargeeg et al., *Perth Urban Water Balance Study*, vol. 1, Leederville, WAWA, 1987, p. 38.

<sup>80</sup> MWSSD Board, *Annual Report for the Year Ended 30<sup>th</sup> June, 1975*, Perth, Govt Printer, 1975, pp. 16-18.

<sup>81</sup> W. A. Davidson, *Hydrogeology and Groundwater Resources of the Perth Region, Western Australia*, Perth, WA Geological Survey, 1995, p. 54.

**Fig. 4.4: Groundwater resources of the Swan Coastal Plain<sup>82</sup>**



Conveniently, this subterranean treasure trove was almost exactly aligned with the coastal ribbon of Perth's post-war suburban development. This proximity to the suburbs of Perth, however, meant that Big Water was not the only party interested in their utilisation. Since European colonisation, many of the wetlands, lakes and swamps of the Swan Coastal Plain – the portals to these groundwater reserves – had been largely perceived as sources of disease, which prompted widespread drainage programs. By the late 1960s however, more Western Australians were beginning to appreciate these areas, not only in terms of their value as water supplies for local market gardens and pine

<sup>82</sup> J. M. Arnold and C. S. Sanders, 'Wetlands of the Swan Coastal Plain', in B. R. Whelan (ed.), *Groundwater resources of the Swan Coastal Plain*, Perth, CSIRO, 1981, p. 84.

plantations but as places for recreation and as habitats for local flora and fauna. These changing perceptions of Perth's wetlands were characteristic of the growing environmental awareness and concerns among suburban Western Australians. In the early 1970s, for instance, many residents of the suburb of North Beach campaigned to prevent the clearing of the wetlands and bushland of Star Swamp for housing development.<sup>83</sup>

These lay concerns combined with scientific interest in the complex ecologies of these areas to prompt public scrutiny of Big Water's subterranean expansion. Local ecologists were especially concerned about the combination of dry years and the extraction of groundwater on the ecological health of the wetlands.<sup>84</sup> Already some fifty per cent of the Swan Coastal Plain's wetlands had been destroyed, reported ecologists, and further deterioration could affect migratory birds and cause the loss of swamp and lake vegetation.<sup>85</sup> The recently created Environmental Protection Authority had the task of overseeing the monitoring of groundwater levels and ensuring that this vital source was not contaminated. These community concerns added an ecological aspect to the developmentalist approach to the management of Perth's water supplies.<sup>86</sup> As one local engineer described it, '[E]verything affects everything else' and 'decisions should take into account wider implications likely to affect the long-term interests of the community'.<sup>87</sup> Perth's groundwater reserves could be utilised to slake the suburbs' thirst, but not to the significant detriment of the scientific, social and economic values of the wetlands.

The focus on monitoring and measurement by local scientists and engineers as a means to limit the effects of groundwater abstraction on the ecologies of the Swan Coastal Plain conform to the notion of engineered resilience. This form of resilience suggests a meeting of 'ecological science informed by the biological sciences, and environmental science informed by the physical sciences and engineering'.<sup>88</sup> The aims

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<sup>83</sup> After nearly a decade of campaigning, the Star Swamp Bushland was gazetted as an A-Class Reserve in 1985. See, *Friends of Star Swamp Bushland*, 2010, <<http://www.friendsofstarswamp.org/>>, (Accessed: 6 May 2011).

<sup>84</sup> J. J. Havel, 'The effects of water supply for the city Perth, Western Australia, on other forms of land use', *Landscape Planning*, vol. 2, 1975, pp. 75-132; T. L. Riggert, 'Consequences of variations of the water table level: wildlife', and T. E. H. Aplin, 'Consequences of variations of the water table level: vegetation and flora', in Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*, pp. 122-25, 126-39.

<sup>85</sup> Riggert, pp. 122-25; and Aplin, pp. 126-39.

<sup>86</sup> K. J. Frawley, *Exploring Some Australian Images of Environment*, Canberra, UNSW & ADFA, 1987, p. 27.

<sup>87</sup> B. S. Sadler, 'State water planning in Western Australia: trends and future directions', in W. D. Sewell, J. W. Handmer and D. I. Smith (eds), *Water Planning in Australia: from myths to reality*, Canberra, ANU, 1985, p. 163.

<sup>88</sup> Muir, Rose and Sullivan, p. 262.

of engineered resilience reflect its engineering origins: ‘efficiency, constancy and predictability’. The application of these principles to the abstraction of groundwater was all-important to preventing Big Water from running out and to protecting the wetlands.<sup>89</sup> Yet such a focus on the constant production of water over other elements of the groundwater ecologies could come at a cost. As ecologist Buzz Holling explains, ‘Productivity or yield is often increased over short time periods due to management efficiency and optimisation but suffers in the long run as ecological surprises exceed the diminished resilience of the system’.<sup>90</sup> By concentrating on ensuring the stability of water levels, scientific measurement and monitoring could affect the intricate processes and functions of ecologies, and therefore affect its resilience to periods of climate variability and water scarcity.<sup>91</sup> Furthermore, local critics were concerned that Big Water had not adequately defined the consequences of groundwater abstraction and whether it was ‘undesirable’ for wetland environments.<sup>92</sup> In the absence of clear definitions, these critics argued, it would be difficult for Big Water to make decisive and transparent choices about the management of the groundwater resources of the Swan Coastal Plain. Only time would tell just how much Big Water would be allowed to transform these areas.

Concerns about the effects of groundwater abstraction on Perth’s wetlands did not extend, however, to considerations of the possible consequences that this might have for Nyoongar country. This was in spite of the recent introduction of the *Aboriginal Heritage Act 1972*, which was designed to protect places and objects of significance to Aboriginal people.<sup>93</sup> In the same year as the first symposium convened on the ‘Groundwater Resources of the Swan Coastal Plain’ in late 1975, local archaeologist Sylvia Hallam documented many colonial accounts of Aboriginal use of Perth’s wetlands in her important book, *Fire and Hearth*.<sup>94</sup> Each of these accounts attest

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<sup>89</sup> Muir, Rose and Sullivan, p. 262.

<sup>90</sup> C. R. Allen, L. H. Gunderson and C. S. Holling, ‘Commentary of Part One articles’, in L. H. Gunderson, C. R. Allen and C. S. Holling, (eds), *Foundations of Ecological Resilience*, Washington, Island Press, 2010, pp. 6-7.

<sup>91</sup> Allen, Gunderson and Holling, pp. 6-7.

<sup>92</sup> D. Bennett and D. K. Macpherson, ‘Groundwater management – must there be a conflict?’, in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, pp. 440-43.

<sup>93</sup> See, D. Ritter, ‘Trashing heritage: dilemmas of rights and power in the operation of Western Australia’s Aboriginal heritage legislation’, *Studies in WA History*, vol. 23, 2003, pp. 195-208.

<sup>94</sup> S. Hallam, *Fire and Hearth: a study of Aboriginal usage and European usurpation in south-western Australia*, Canberra, Australian Institute of Aboriginal Studies, 1975. See also, B. J. Wright, ‘Aboriginal sites and their protection’, in R. M. Berndt and C. H. Berndt (eds), *Aborigines of the West: their past and present*, Nedlands, UWA Press, 1979, pp. 367-83. The first symposium on the *Groundwater Resources of the Swan Coastal Plain* was jointly organised by the Environmental Protection Authority and the CSIRO Division of Land Resources Management at Murdoch University, which had been opened the previous year. There is no evidence of consultation with Aboriginal people about their views on the utilisation of these



to the ‘significance’ of these sites to Nyoongar people, particularly owing to the spiritual importance of freshwater. Freshwater holds vital meaning to many Aboriginal peoples across Australia and the Nyoongar are no exception.<sup>95</sup> For Nyoongar people, freshwater sources are the creation of the *Waakal*, the Nyoongar Rainbow serpent, the ‘giver of life’ – the ‘Creator, the keeper of freshwater sources’.<sup>96</sup>

The enduring significance of Perth’s wetlands to local Aboriginal people may have been overlooked because of a lack of appreciation for the ongoing connections of Nyoongar people to country. Even Hallam noted, ‘[O]ne might not expect much evidence of [the *Waakal*’s] importance or his association with water ... to survive in the South-west’.<sup>97</sup> This position reflects contemporary misconceptions about the identities of Australian Aborigines living in urban settings. As Sandy Toussaint explains, ‘It was generally believed that by their very presence in an urban context, Aboriginal people

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groundwater resources in the conference proceedings, even though the wetlands near the university’s campus remained significant to local Aboriginal people. For instance, oral historian Fred Collard recalled Nyoongar camping in the surrounding swamps and bush in the 1960s. He explained, ‘Nyoongars camped from Fremantle through the bush down through the Murdoch Swamp, down to the Riverton Hotel. That was all bush and Nyoongar camps were scattered all through there ... near the swamps like Bibra Lake, Mandogalup Lake and Booragoon Lake’. See, Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*; and L. Collard, S. Harben and R. van den Berg, *Nidja Beeljar Boodjar Noonookurt Nyininy: A Nyungar interpretative history of the use of boodjar (country) in the vicinity of Murdoch University*, Perth, Murdoch University, 2004, p. 44.

<sup>95</sup> See for instance, M. Barber and S. Jackson, ‘Aboriginal water values and resource development pressures in the Pilbara region of north-west Australia’, *Australian Aboriginal Studies*, no. 2, 2011, pp. 32-49; L. Collard, ‘The Cosmology: the Creator of the Trilogy Waakal or Nyungar Rainbow Serpent’, in M. Leybourne and A. Gaynor, *Water: histories, cultures, ecologies*, Crawley, UWA Press, 2006, pp. 121-30; H. Goodall, ‘The river runs backwards: the language of order and disorder on the Darling’s northern flood plain’, in T. Bonyhady and T. Griffiths (eds), *Words for Country landscape and language in Australia*, Sydney, NSW Press, 2001, pp. 30-51; H. Goodall, ‘Main streets and riverbanks: the politics of place in an Australian river town’, in S. Hood-Washington, P. Rosier and H. Goodall (eds), *Echoes from the Poisoned Well*, Lanham, Lexington, 2006, pp. 255-70; H. Goodall, ‘Riding the tide: Indigenous knowledge, history and water in a changing Australia’, *Environment and History*, vol. 14, 2008, pp. 355-84; S. Jackson and J. Morrison, ‘Indigenous perspectives in water management, reforms and implementation’, in K. Hussey and S. Dovers (eds), *Managing Water for Australia: the social and institutional challenges*, Collingwood, CSIRO, 2007, pp. 24-41; E. McDonald, B. Coldrick and W. Christensen, ‘The green frog and desalination: a Nyungar metaphor for the (mis)management of water resources, Swan Coastal Plain, Western Australia’, *Oceania*, vol. 78, no. 1, 2008, pp. 62-75; D. Rose, *Dingo Makes Us Human: life and land in an Aboriginal Australian culture*, Melbourne, Cambridge University Press, 1992; D. Rose, ‘Indigenous water philosophy in an uncertain land’, in L. C. Botterill and D. A. Wilhite (eds), *From Disaster Response to Risk Management*, Dordrecht, Springer, 2005, pp. 37-50; S. Toussaint, ‘For whom the Fitzroy River flows: a fluctuating analysis of social and environmental sustainability and incremental sovereignty’, in D. Ghosh, H. Goodall and S. H. Donald (eds), *Water, Sovereignty and Borders in Asia*, Hoboken, Routledge, 2007, pp. 174-87; S. Toussaint, P. Sullivan and S. Yu, ‘Water ways in Aboriginal Australia: an interconnected analysis’, *Anthropological Forum*, vol. 15, no. 1, 2005, pp. 61-74; J. Weir, *Murray River Country: an ecological dialogue with traditional owners*, Canberra, Aboriginal Studies Press, 2009; and S. Yu, ‘Ngapa Kunangkul (Living Water): An indigenous view of groundwater’, in A. Gaynor, M. Trinca, and A. Haebich, (eds), *Country, visions of land and people*, Perth, WA Museum, 2002, pp. 33-55.

<sup>96</sup> Collard, p. 129.

<sup>97</sup> Hallam, p. 82.

would ultimately come to deny, or shed, their Aboriginal heritage', that they were 'without culture'.<sup>98</sup> Worse, they were not regarded as "real" Aborigines'.<sup>99</sup>

If only non-urban Aboriginal people had connections to country, only non-urban places and objects of significance required protection. In light of the mineral resources boom of the 1960s, it follows that the *Aboriginal Heritage Act* was intended for objects and sites in the state's northwest, not in the more densely populated and developed southwest.<sup>100</sup> It was not until the mid-1980s that the Western Australian Museum commissioned a site survey of metropolitan Perth.<sup>101</sup> Nyoongars in the suburbs of Perth, however, had retained many practices and beliefs from the past: many Nyoongars living in Perth in the 1970s did know about the *Waakal*, even if they were unsure of the exact path of its Dreamtime journey.<sup>102</sup> As one elder would later recall, 'We used to travel all through there [the Gnangara Pine Plantation] and we could get water from the swamps'.<sup>103</sup> The ongoing connections of many Nyoongar people to the wetland areas of the Swan Coastal Plain were just one of the many ways that they continued their spiritual associations with country in the late twentieth-century.<sup>104</sup> The state government's apparent disregard for the significance of the wetlands to Nyoongar people, therefore, served to undermine their ecologies and connections to country. Despite these sacrifices for the development of water supplies in the southwest, Nyoongars continued to benefit the least from the expansion of Big Water.

The MWB's development of underground resources commenced with the commissioning of groundwater schemes on the Gnangara Mound with Mirrabooka in December 1970, followed by Gwelup (1974), Wanneroo (1976) and East Mirrabooka

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<sup>98</sup> S. Toussaint, 'Aboriginal resistance and the maintenance of identity: Nyungars and the state', *Social Analysis*, no. 32, 1992, p. 16.

<sup>99</sup> M. Langton, 'Urbanising Aborigines: the social scientists' great deception', *Social Alternatives*, vol. 2, no. 2, 1981, p. 16.

<sup>100</sup> R. M. Berndt (ed.), *Aboriginal Sites, Rights and Resource Development*, Nedlands, UWA Press, 1982. This position persisted into the early 1980s. For instance, an edited collection titled *Aboriginal Sites, Rights and Resource Development* focused largely on Aboriginal rights to land in the resource-rich regions of northern Australia. Only one contributor, the Chairman of the Australian Institute of Aboriginal Studies, Les Hiatt, acknowledged the 'the sea and waterways' as 'vitaly important component[s] in the subsistence economy of coastal and riverine Aborigines around the continent' (p. 13). Most of his chapter, however, focussed on northern Australia.

<sup>101</sup> J. Host with C. Owen, *'It's Still in My Heart': the Single Noongar Claim History*, Crawley, UWA Publishing, 2009, p. 117.

<sup>102</sup> S. Toussaint, 'Nyungars in the city: a study of policy, power and identity', Masters Thesis, UWA, p. 104.

<sup>103</sup> E. McDonald, B. Coldrick and L. Villiers, *Study of Groundwater-Related Aboriginal Cultural Values on the Gnangara Mound, Western Australia*, 2005, <<http://www.water.wa.gov.au/PublicationStore/first/82492.pdf>>, (Accessed: 20 June 2010), p. 74.

<sup>104</sup> Toussaint, 'Aboriginal resistance and the maintenance of identity', p. 20.

(1980), and on the Jandakot Mound in 1979 (see Appendix IV).<sup>105</sup> Although Big Water continued to take into account the possible environmental effects of this development, the potential effects on Nyoongar heritage went largely unnoticed. By the mid-1970s, the aquifers provided about ten per cent of Perth's water supply and the city's reliance on this source was expected to grow.<sup>106</sup> Along with greater surface water supplies, these groundwater sources helped to cushion the effects of dry seasons on the suburbs later in the decade. The utilisation of these reserves helped to perpetuate the belief of consumers in the endless supplies of plentiful, cheap water that sustained their profligate water culture. The implementation of harsh water restrictions and user pays later in the decade would burst their bubble.

### *A discriminatory sanitary order*

The post-war Age of Innocence may have looked 'a little like Eden' to many Western Australians but for the Aboriginal people living outside Big Water, it had been anything but paradisiacal.<sup>107</sup> Despite some improvements to their political status in the late 1960s, Aborigines in the southwest remained largely on the fringes of white society. Many continued to live in squalid camps both in the suburbs and in country towns such as Moora, Kellerberrin and Narrogin.<sup>108</sup> In this section, I examine the persistence of a discriminatory sanitary order for Aboriginal people during the 1970s and early 1980s in the suburbs and rural areas of the southwest region. I argue that decades of neglect and inequitable housing policies combined with enduring environmental anxieties about cleanliness and hygiene to perpetuate the marginalisation of Aboriginal people in the southwest.

The legacy of discriminatory housing and welfare policies took on a new guise in the 1970s. New federal policies of self-determination and Aboriginal housing emphasised raising living standards of Australian Aborigines to those enjoyed by non-Indigenous Australians. In 1975, for instance, the House of Representatives Standing Committee on Aboriginal Housing declared, 'All Aborigines should be housed in

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<sup>105</sup> MWSSD Board, *Annual Report for the Year Ended 30<sup>th</sup> June, 1975*, Perth, Govt Printer, 1975, pp. 16-18; and C. G. Pollett, 'Public water supply schemes and groundwater response', in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. 201, 226.

<sup>106</sup> A. D. Allen, 'The Swan Coastal Plain: hydrogeology of superficial formation', in Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. 14.

<sup>107</sup> D. Hewett, *Sandgropers*, 1973, cited in B. Bennett (ed.), *The Literature of Western Australia*, Nedlands, UWA Press, 1979, p. 145.

<sup>108</sup> Toussaint, 'Nyungars in the city', p. 113.

conventional houses to the standards as those of the European community'.<sup>109</sup> But this rhetoric was not reflecting reality. In 1971, the Department of Native Welfare was abolished and its housing responsibilities transferred to the State Housing Commission, which established an Aboriginal Housing Board (AHB) under its auspices in 1978. As Sandy Toussaint observes, the ability of the AHB to influence Commission planning appears to have been slight. For instance, the Commission allocated three quarters of Commonwealth housing assistance to village programs in the state's northwest in the early 1980s against the recommendations of the AHB.<sup>110</sup> Consequently, few homes could be built around Perth, where over three quarters of the state's Aboriginal population lived below the poverty line and were among the lowest income earners in the country.<sup>111</sup> The failure of the Commission to heed the advice of the AHB, therefore, exacerbated the severe housing problems facing many Aboriginal people.

Despite these administrative changes and the rhetoric of self-determination, assimilationist ideas persisted in the management of Aboriginal housing.<sup>112</sup> I contend that the longevity of these ideas was a result of concerns among the non-Indigenous community about sharing suburban spaces with Aborigines; concerns that echoed earlier environmental anxieties surrounding race and health in the southwest. For instance, the Commission implemented a 'salt and pepper' approach to the distribution of Aboriginal families in the suburbs. This was designed to assist their assimilation, to prevent 'ghettoisation' and to assuage widespread (white) concerns about the accommodation of Aboriginal people in the suburbs of Perth.<sup>113</sup> Similarly, the Commission initiated a 'saturation point' policy in the mid-1970s to limit the number of families of Aboriginal descent who could be accommodated in an area. If the 'saturation point' had been reached, no additional Aboriginal families could be housed in that area – even if there were vacant lodgings available. Moreover, the Commission's policy was to accommodate Aboriginal families in detached dwellings only, where they could be kept at arm's length from their neighbours.<sup>114</sup> With nearly three quarters of Aboriginal families in Western Australia dependent on public housing, these assimilationist policies served to hinder the government's provision of accommodation for Aboriginal people. Although decades of marginalisation and paternalism had fostered Aboriginal

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<sup>109</sup> L. C. Furnell, *Report of the Royal Commission Upon All Matters Affecting the Wellbeing of Persons of Aboriginal Descent in Western Australia*, Perth, Govt Printer, 1974, p. 221.

<sup>110</sup> M. Gevers, 'Aboriginal housing – some facts', *Shelter Newsletter*, vol. 2, no. 2, 1983, pp. 6-7.

<sup>111</sup> P. Hollingworth, *Australians in Poverty*, West Melbourne, Nelson, 1979, p. 112.

<sup>112</sup> Toussaint, 'Nyungars in the city', p. 118.

<sup>113</sup> Furnell, pp. 223-24; and M. Heppell, *A Black Reality: Aboriginal camps and housing in remote Australia*, Canberra, AIAS, 1979, pp. 17-19.

<sup>114</sup> Toussaint, 'Nyungars in the city', pp. 118-120.

dependency on the state, these public housing policies reflected an unwillingness or unpreparedness of the state to improve the circumstances of Aboriginal people.

With limited public housing available to the southwest's Aboriginal people, many had to seek alternative accommodation. But where? The private rental market was hardly accessible and in the early 1980s, fewer than a quarter of Aboriginal people living in Perth were tenants in 'conventional' housing, while the rest lived in circumstances ranging from 'semi-conventional housing' to 'improvised dwellings'.<sup>115</sup> Others found shelter in even less conventional surrounds, such as refuges, relatives' homes, and parks as well as camps such as the 'bull paddock' in East Perth.<sup>116</sup> But even those who resided in 'conventional' housing had a tenuous hold on this accommodation. Aboriginal families living in public housing were often subject to inspections without prior notice to ensure they were meeting the Commission's standards of housekeeping. These standards, of course, were based on suburban expectations of cleanliness, neatness and order to overcome anxieties about citizens' moral and physical health in domestic spaces. More often than not, Aboriginal tenants were found wanting. Many were simply unprepared for 'conventional' living arrangements. As Aboriginal activist Ken Colbung argued in 1974, 'Sure you say "we put them into good houses and they don't even know how to look after them". If you had been living for years on the rubbish tips nothing else you wouldn't know how to look after a house either'.<sup>117</sup> These tenants were again branded with the stigma of 'bad standards', which justified eviction and even the removal of their children.<sup>118</sup> Furthermore, this stigma made it unlikely that they would be reconsidered for public housing. Rather than helping to improve the lives of Aboriginal families, the state's housing policies tended to perpetuate the discriminatory sanitary order and to deny many families access to the very means – scheme water – to raise their standard of living and social position. The exclusion of many Aborigines from access to the benefits of Big Water, therefore, continued to shape their lives in the southwest and served to continue their marginalisation from 'conventional' white society into the 1980s.

### *A vulnerable city*

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<sup>115</sup> M. V. Robinson et al., *An Accommodation Service for Aboriginal Families in Perth*, Perth, Dept for Community Welfare, 1978, p. 17.

<sup>116</sup> Toussaint, 'Nyungars in the city', p. 127.

<sup>117</sup> K. Colbung, in C. Tatz (ed.), *Black Viewpoints: the Aboriginal Experience*, Sydney, Australia and New Zealand Book Co., 1974, p. 29.

<sup>118</sup> Toussaint, 'Nyungars in the city', pp. 22, 151.

In a 1977 issue of the Australian Conservation Foundation's journal *Habitat*, George Seddon described Perth as an 'exceptionally vulnerable city' owing to 'its almost total dependence on stored water'.<sup>119</sup> Even Big Water's subterranean expansion could not forestall the introduction of water restrictions in mid-1977 to cope with dry conditions. The restrictions lasted from July 1977 to October 1978, and were then eased to partial restrictions to May 1979.<sup>120</sup> Meanwhile, the MWB also embarked on a publicity campaign to reinforce the importance of water conservation and to make the 'public aware of the seriousness of the water shortage'.<sup>121</sup> But water restrictions could not continue indefinitely, as they were proving both financially and politically costly to the Court government.<sup>122</sup> The emerging influence of market principles in water resource management overseas led the state government to implement a 'pay for use' or 'user pays' water rating system in July 1978, which would reward consumers who used less water. In this section, I explore the changing focus of water managers, away from the traditional engineering approaches and towards strategies of demand management. I then examine how the people of Perth responded to the introduction of water restrictions and a user pays rating structure during the dry seasons of the late 1970s.<sup>123</sup>

Although Perth's water use had been restricted in the past, the government's policies to curb suburban water consumption during the 1970s reflected new approaches to managing water resources. After nearly a decade without water restrictions, the particularly hot summer of 1971/72 led the Water Board to experiment with a voluntary conservation campaign. This was an attempt to promote more water-efficient behaviour in the home and garden and so relieve pressures on the limited supplies of Big Water. The program lasted from December 1972 to March 1973 with the Board publishing details of domestic water consumption in a daily 'Water Gauge' in the *West Australian* newspaper.<sup>124</sup> Yet the pattern of water consumption for this period suggests that

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<sup>119</sup> Seddon, *Swan Song*, p. 54.

<sup>120</sup> During the total restrictions, householders were only allowed to hand-water their gardens at specific times. Under partial restrictions, residents could use garden sprinklers on alternate days for four hours per day, between 6am and 7am, and between 6pm and 9pm.

<sup>121</sup> 'Final water gauge', *West Australian*, 4 April 1977, p. 4.

<sup>122</sup> 'Rain down 36pc', *West Australian*, 1 October 1979, p. 1.

<sup>123</sup> I have explored this episode of water management in greater depth in R. Morgan, "Fear the hose": an historical exploration of sustainable water use in Perth gardens, 1970s', *Transforming Cultures eJournal*, vol. 5, no. 1, 2010,

<<http://epress.lib.uts.edu.au/ojs/index.php/TfC/issue/view/87/showToc>>; and Morgan, 'A thirsty city', pp. 81-97; and Morgan, 'A thirsty city', pp. 81-97.

<sup>124</sup> 'Waste will mean water cuts', *West Australian*, 18 February 1972, p. 3; 'Water gauge', *West Australian*, 1 December 1972, p. 5; and 'Water saving starts today', *West Australian*, 1 December 1972, p. 3. A similar concept was employed in Melbourne in early 1973 with little success, see J. Keating, *The Drought Walked Through: a history of water shortage in Victoria*, Melbourne, Dept of Water Resources, 1992, p. 211.

householders were more responsive to temperature than the Board's campaign.<sup>125</sup> The voluntary conservation campaign of 1972/73 may therefore have improved community awareness of domestic scheme consumption, with few alterations to household behaviour.

Just a year later, however, the Water Board implemented restrictions in January 1974.<sup>126</sup> During heatwave conditions, the Board complained that householders were not co-operating with their calls to reduce consumption.<sup>127</sup> The responses from Perth householders published in the local newspapers apportioned most of the blame for the January restrictions to those who watered their gardens excessively. These correspondents urged the Water Board to carry out 'spot checks' on the suburbs to catch such householders, who were said to be watering 'roofs, paths, roads and people next door'.<sup>128</sup> Indeed, the Water Board received a record 350 complaints from residents concerned about their neighbours' water use.<sup>129</sup> This response represents a marked departure from the Australian stereotype of collective defiance in the face of authority and state interference.<sup>130</sup> Perhaps these complaints represented a sign of a growing public awareness of the problems associated with excess water consumption. Alternatively, householders might have resented neighbours flouting the restrictions to maintain a handsome garden or to avoid the inconveniences of handwatering. A more likely explanation is that complainants believed in sharing the burden of government intrusions fairly and equally.

Although the Water Board implemented another voluntary water conservation campaign in late 1976, ongoing dry conditions necessitated the introduction of water

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<sup>125</sup> Morgan, 'A thirsty city', p. 36. The pattern of water consumption correlates closely to the relatively mild temperatures during the period of the Water Budget campaign. Temperature has remained an enduring influence on household water use, particularly in the garden, into the twenty-first century. See, Environmental Protection Authority (EPA), *State of the Environment Report*, EPA, 2007, <<http://www.epa.wa.gov.au/AbouttheEPA/SOE/2007/Pages/default.aspx>>, (Accessed: 10 May 2012), p. 207.

<sup>126</sup> Metropolitan Water Board, 1967/880672, *Water – Overall – Utilisation of Water Resources with Particular Reference to Lawn and Garden Watering*, note, O'Hara, 12 June 1972, SROWA, Cons 6733. There were two periods of restrictions. The first period was from the voluntary restrictions of 9 January 1974, to the compulsory restrictions of 12 January 1974, which ended on 16 January 1974. This period of restrictions was due to the limited ability of the water supply system to bring water from the dams to the city reservoirs in the Hills each day. These restrictions prevented the use of sprinklers, and the filling of swimming pools and storage tanks between 7am and 8pm. Only hand watering was permitted. The second period of restrictions commenced on 24 January 1974 and ended on 28 January 1974 due to high water consumption in a spell of hot weather. For press coverage, see, 'Perth gets warning on water use', *West Australian*, 9 January 1974, p. 3.

<sup>127</sup> 'All curbs on water use lifted', *West Australian*, 16 January 1974, p. 1; and 'Water cuts may return', *West Australian*, 19 January 1974, p. 3.

<sup>128</sup> L. Clausen, 'Sprinkler use', *West Australian*, 24 January 1974, p. 6.

<sup>129</sup> 'Decision on water cuts today', *West Australian*, 15 January 1974, p. 1; and 'Hot spell may break today', *West Australian*, 26 January 1974, p. 1.

<sup>130</sup> R. Ward, *The Australian Legend*, 2<sup>nd</sup> ed., Melbourne, Oxford University Press, 1965, p. 157.

restrictions in mid-1977. The Water Board also embarked on a publicity campaign to reinforce the importance of water conservation. The publicity to encourage the reduction of household water consumption generally focused residents' attention on their gardens, where prying neighbours and Water Board inspectors could most easily observe their abstinence or extravagance with scheme water.<sup>131</sup> The campaign thus publicised the work of the Board's inspectors, as well as publishing images of reservoirs at low levels. This emphasised the importance of conserving water in each home and garden in the metropolitan area, and encouraged householders to monitor their own consumption and that of others. Through this publicity campaign, then, the Water Board aimed to make the 'public aware of the seriousness of the water shortage'.<sup>132</sup>

Over the course of the decade, meanwhile, a transformation had occurred in the ways that overseas and Australian governments perceived the provision of water supplies. In the United Kingdom and United States, water managers had become increasingly aware that water consumption was not merely for the purposes of public health – the 'sanitary revolution [was] over'.<sup>133</sup> A gulf had emerged between 'essential needs' and 'various less essential demands'.<sup>134</sup> Meanwhile, the cost of Big Water, of sustaining the illusion of endless supplies, had grown exponentially since the war and other public works were competing for these funds.<sup>135</sup> Those 'less essential demands' would have to be curtailed. The Western Australian government recognised that it too faced these challenges regarding water supply and demand and invited overseas experts to help it reduce the pressures on Perth's limited water supplies.

These experts advocated the shift away from traditional, development-oriented engineering approaches to the management of water supplies. Managing water resources required the creation of 'conditions which will bring about optimum use of water resources' through the 'adoption of measures to modify water needs and to maximise efficiency in water use'.<sup>136</sup> The primary tool to achieve this efficiency, argued the experts, was the price mechanism, that is, user pays. This was perhaps unsurprising,

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<sup>131</sup> For instance, the campaign published images of reservoirs at low levels and publicised the work of the Board's inspectors. This emphasised the importance of conserving water in each home and garden in the metropolitan area, and encouraged householders to monitor their own consumption and that of others.

<sup>132</sup> 'Final water gauge', *West Australian*, 4 April 1977, p. 4.

<sup>133</sup> S. H. Hancke and R. K. Davis, 'Demand management through responsive pricing', *Journal of the American Water Works Association*, 1971, pp. 555, 559. See also, S. H. Hancke and D. B. Preston, 'Face to face', *Journal of the American Water Works Association*, vol. 75, no. 5, 1983, pp. 20-30.

<sup>134</sup> K. Smith, 'Trends in water resource management', *Progress in Physical Geography*, vol. 3, 1979, p. 243.

<sup>135</sup> J. J. Pigram, *Issues in the management of Australia's water resources*, Melbourne, Longman Cheshire, 1986, pp. 300-301.

<sup>136</sup> Pigram, pp. 300-301.



given that the government's experts included a Director of the Board of the Western Mining Corporation and former state Under-Treasurer; the Financial Director of the Thames Water Authority; and an American economist who would later serve on President Reagan's Council of Economic Advisors.<sup>137</sup> These suggested changes also generally reflected the growing influence of neo-liberal *laissez faire* thinking in Australian politics, which advocated the market over state intervention.<sup>138</sup> In the wake of the political instability of the Whitlam government, the emergence of stagflation, and the well-publicised visit of Milton Friedman, conservative Australian politicians in the mid-1970s saw in these principles a viable alternative to what they perceived to be the failed Keynesian policies of the post-war era.<sup>139</sup>

In Perth, Big Water sought to implement a shift to user pays, under which household water rates would now reflect more closely the costs of providing this service. As for the people of Perth, the new pricing policy recast their identities as consumers. Before, they had been citizens with a right to water and the government determined their ability to pay for this water through the valuation of their property, which provided a proxy measure of the wealth and income of the consumer and their 'capacity to pay'. Now, under user pays, they were customers, who could 'buy different quantities of the commodity, water, according to their willingness to pay'.<sup>140</sup> This changing consumer identity resembled the process underway in England and Wales following the nationalisation of the water industry in 1974. There, pricing policies had developed to ensure the recovery of the cost of supplies, whilst in Perth, it was a means to manage demand by linking price to consumption.<sup>141</sup> Although the introduction of

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<sup>137</sup> Binnie International (Australia), *Development Study*, Perth, MWSSD Board, 1977. The Court government commissioned engineering firm Binnie International (Australia) in 1977 to review the management of metropolitan water supply and demand. In addition to advice from consulting engineers, Maunsell and Partners, the report incorporated the views of Sir Kenneth J. Townsing, a Director of the Board of Western Mining Corporation and former state Under-Treasurer (1959 to 1975); Eric J. Gilliland, the Financial Director of the Thames Water Authority in the United Kingdom, where water and sewerage utilities had recently undergone significant restructuring; and Steve Hancke, an American economist at The Johns Hopkins University, who later served as a Senior Economist on President Reagan's Council of Economic Advisors. The 1977 *Development Study* advocated the adoption of corporate objectives by water managers, and the promotion of economic efficiency and the efficient use of resources. For a critique of these recommendations, see M. J. Hollick, *The Management of Water Supplies in Western Australia*, Nedlands, UWA, 1983, pp. 14-16.

<sup>138</sup> T. Moore, 'Life is not meant to be easy', in J. Walter and T. Moore (eds), *What were they thinking? The politics of ideas in Australia*, Sydney, UNSW Press, 2010, p. 250.

<sup>139</sup> Moore, p. 255.

<sup>140</sup> L. Sharp, 'Water demand management in England and Wales: constructions of the domestic water user', *Journal of Environmental Planning and Management*, vol. 49, no. 6, 2006, p. 872.

<sup>141</sup> K. Bakker, 'Paying for water: water pricing and equity in England and Wales', *Transactions of the Institute of British Geographers*, vol. 26, no. 2, 2001, p. 2.

user pays in Perth would help to reduce water consumption in the late 1970s, some households would bear the brunt of this reduction more heavily than others.

The Metropolitan Water Board implemented a system of user pays water rating for the domestic sector on 1 July 1978.<sup>142</sup> The new system stipulated a fixed charge for households (\$36), an allowance of 150kL per annum, and a further charge for each kilolitre used in excess of the 150kL allowance (at 17c per kL).<sup>143</sup> The most significant difference between the new and old systems was the introduction of a water allowance for each household. In the past, property values had determined the household's water rates, which were independent of the quantity of water consumed. Under the new system, all households had the same allowance (150kL), regardless of house value, family size, or block size. Although there appeared to be general support for the philosophy behind the new scheme, four aspects of the system particularly raised the ire of householders.<sup>144</sup>

The most controversial element of this new scheme was the retrospective application of 'pay for use' rating. The new rates took effect from the date of the last meter reading, not from July 1<sup>st</sup>, which was the date of the scheme's implementation.<sup>145</sup> For many households, the 'consumption year' had commenced in February and March, months before the new system was even conceived.<sup>146</sup> Some residents were therefore penalised for using their 150kL allowance prior to its introduction.<sup>147</sup> They complained to the press that they had expected the Water Board to inform them of the effect of the retrospective application of the scheme. Taking up the cause of those worst affected, the editor of the *West Australian* noted in August 1978,

The Government needs to remember that the responsible way in which Perth people responded to their water crisis created the climate for the introduction and acceptance of a 'pay for use' system. Depleted water storages are now not the Government's only worry. An enormous reservoir of public goodwill is drying up rapidly. It will

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<sup>142</sup> G. J. Syme, S. J. Kantola and J. F. Thomas, 'Water resources and the quarter-acre block', in R. Thorne and S. J. Arden (eds), *People and the Man Made Environment*, Sydney, University of Sydney, 1980, p. 183; and Binnie International, pp. 46-55.

<sup>143</sup> Metropolitan Water Authority, *Domestic Water Use in Perth, Western Australia*, Perth, Metropolitan Water Centre, 1985, p. 52

<sup>144</sup> D. Crogan, 'Paying for water', *West Australian*, 3 June 1978, p. 6; R. Ellett, 'Benefits seen in water pricing', *West Australian*, 26 May 1978, p. 6; P. J. Gregson, 'Charge for water', *West Australian*, 11 May 1978, p. 6; S. E. I. Johnson, 'Water payments', *West Australian*, 8 May 1978, p. 6; and M. Piesse, 'Paying for water', *West Australian*, 2 September 1978, p. 6.

<sup>145</sup> 'New water plan under Lab. fire', *West Australian*, 2 June 1978, p. 11.

<sup>146</sup> Editorial, 'Think again', *West Australian*, 30 August 1978, p. 6.

<sup>147</sup> C. Crook, 'Water scheme under attack', *West Australian*, 27 March 1979, p. 6; and M. E. and S. Hutchinson, 'Altered charges for water users', *West Australian*, 7 September 1978, p. 6.

continue to dry up unless some corrective action about retrospectivity is taken.<sup>148</sup>

To appease its irate customers, the Water Board increased the 1978 allowance to 210kL, which saved households \$10.20 on the water bill. For those customers whose meters had been read prior to July 1<sup>st</sup>, the Board also granted a *pro rata* additional allowance of 12.5kL for each month between the meter reading and the July implementation of the new scheme.<sup>149</sup>

The Opposition viewed 'pay for use' as an opportunity for the Water Board to increase rates.<sup>150</sup> Some residents estimated that this new flat rate was nearly double the cost of 150kL under the previous system (in cents per kL), and decried its impact on poor families.<sup>151</sup> Newspaper correspondents also complained of large increases in their total water bill.<sup>152</sup> Others, meanwhile, found the new system had a negligible impact on their bills, probably because the new allowance was not significantly different from their usage under the previous system.<sup>153</sup>

The local press deemed the new system particularly problematic for larger families.<sup>154</sup> The *West Australian* claimed that the Water Board had based the 150kL allowance on the 'efficient domestic use of a family of 3.5 people',<sup>155</sup> but according to the Australian Bureau of Statistics, the average Australian family was larger than this estimate, comprising 2 adults and 2.4 children. Pursuing a populist argument, the newspaper argued that even the average family of 4.4 would use significantly more water than 3.5 people, and so would be likely to face excess water charges.<sup>156</sup> This, of course, overlooked the likelihood that the size of the average household might be smaller than the average family.

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<sup>148</sup> Editorial, 'Think again', p. 6.

<sup>149</sup> E. A. Baker, 'Government may lift water allowance', *West Australian*, 4 October 1978, pp. 1, 8; and E. A. Baker, 'Government to ease impact of water costs', *West Australian*, 11 October 1978, p. 1.

<sup>150</sup> This issue was frequently raised in Parliament by the State Opposition. For instance, 'ALP Attacks Increase in Water Charges', *Daily News*, 1 June 1978, p. 4; 'Call to revise water charges', *West Australian*, 2 October 1978, p. 12; and 'Water to cost less in Labor scheme', *West Australian*, 3 October 1978, p. 5.

<sup>151</sup> J. F. Hansen, 'Protest at water allowance', *West Australian: Fremantle Suburban News*, 28 September 1978, p. 19; V. L. McAulley, 'Charges on water', *West Australian*, 13 September 1978, p. 6; and A. N. Mather, 'Charges on water', *West Australian*, 30 May 1978, p. 6.

<sup>152</sup> Correspondents complained of increases of 37, 55.4, and 60 per cent on the previous year's water rates. G. W. Dymond, 'Cost of water comparisons', *West Australian*, 15 August 1978, p. 6; G. M. Easton, 'Rises in price for water', *West Australian*, 26 August 1978, p. 6; and R. Matthews, 'Call for a review', *West Australian*, 25 August 1978, p. 6.

<sup>153</sup> D. Phillips, 'Water charges', *West Australian*, 25 August 1978, p. 6.

<sup>154</sup> F. Hrubos, 'Charges on water', *West Australian*, 2 June 1978, p. 6; and 'Some householders now on excess water', *West Australian*, 1 September 1978, p. 17.

<sup>155</sup> 'Water forecast: a costly summer', *West Australian*, 9 August 1978, p. 3.

<sup>156</sup> 'Water forecast: a costly summer', p. 3.

The loudest opposition came from Perth's keen gardeners, who considered that the new rating system discriminated especially against them. They believed the Court government had 'unmercifully slug[ged] thousands of people' who did 'an environmental job in keeping Perth pleasant and presentable'.<sup>157</sup> One asked, 'Is our choice only to be brown lawns, wood chips or paving bricks?'.<sup>158</sup> Others accused the Water Board of turning Western Australia from the 'State of Excitement' and the 'Wildflower State' into the 'Dead State', the 'State of Dehydration' and the 'State of the Desert'.<sup>159</sup> Not all householders were sympathetic, however, to the plight of Perth's gardeners. As one correspondent joked, 'Those who insist on 2 hours of hand-watering their gardens every day for 6 months must expect to pay for the luxury'.<sup>160</sup>

Despite this initial controversy, the new system combined with the cultural effects of the water restrictions and publicity campaigns to bring about a reduction in the consumption of scheme water by the end of the 1970s.<sup>161</sup> When restrictions were lifted in 1979, a major rise in scheme water use did not occur. Total and average water use in 1981/82 remained well below 1975/76 levels, even though the number of properties serviced by the Water Board had increased by over twenty per cent during this period (Figure 4.5).<sup>162</sup> The Board's 1985 Domestic Water Use Study of consumer attitudes and behaviours regarding scheme water – itself a reflection of growing interest in demand management – observed that the economic pressures of 'pay for use' rating were most accountable for this change in behaviour, particularly among non-bore users. Furthermore, the Study found that this reduction in scheme water use had most likely occurred outside the home, as indoor water use was very insensitive to price changes.<sup>163</sup> Indeed, the Study established that in contrast to the mid-1970s, over half of the average household's scheme water consumption occurred inside the home in the mid-1980s.<sup>164</sup> The introduction of 'pay for use' rating, as well as enforced restrictions and water conservation campaigns, therefore combined to reduce domestic scheme water use in Perth, particularly in the garden.

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<sup>157</sup> B. Reid, 'The water charges called a "slug"', *West Australian*, 10 May 1978, p. 6.

<sup>158</sup> B. McCartney, 'Quota of water', *West Australian*, 29 August 1978, p. 6.

<sup>159</sup> B. J. Alford, 'Query on water', *West Australian*, 31 August 1978, p. 6; R. L. Down, 'Rights on water', *West Australian*, 22 August 1978, p. 6; and G. O'Brien, 'Base water allowance', *West Australian*, 12 May 1978, p. 6.

<sup>160</sup> D. Phillips, 'Water charges', *West Australian*, 25 August 1978, p. 6.

<sup>161</sup> See, Morgan, "Fear the hose",

<<http://epress.lib.uts.edu.au/ojs/index.php/TfC/issue/view/87/showToc>>; and Morgan, 'A thirsty city', pp. 81-97.

<sup>162</sup> Metropolitan Water Authority, pp. 2, 66.

<sup>163</sup> Metropolitan Water Authority, p. 59.

<sup>164</sup> Metropolitan Water Authority, p. 13.

**Fig. 4.5: Average annual household scheme water use 1976 to 1982<sup>165</sup>**

Year	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82
Use (kL)	508	450	288	270	306	307	311

The persistence of lower levels of household water consumption into the 1980s suggests that these elements helped to shape a broader cultural change towards water use in Perth's suburbs. The dry 1970s had exposed the cultural dependence of Perth residents on the illusion of endless water supplies that had developed with the ascendance of Big Water after the Second World War. The voracious growth of Big Water had both fostered and facilitated their escalating demands for water in the post-war era. With this façade stripped away by the introduction of water restrictions and conservation campaigns, many households became cognisant that they could maintain their lifestyles with less (scheme) water. The implementation of user pays at last provided these consumers with the financial incentive to lower their scheme water use and to shape a less thirsty water culture in the suburbs of Perth.

This cultural change manifested itself differently throughout the suburbs. Households responded in varying ways to the Board's call for conservation according to the householders' gender, socio-economic standing, landscaping preferences, and level of environmental awareness. Guided by Caroline Nash's recommendation that the 'politics of social difference' should be used to 'disaggregate the notion of the "human"' in environmental histories, and using data gathered from surveys during the late 1970s, I now turn to an analysis of the effects of, and community responses to, water scarcity in late 1970s Perth.<sup>166</sup>

Some of the Board's water conservation publicity was specifically aimed at women, linking the image of the enthusiastic and competent housewife to a range of conservation messages regarding water use inside the home. These included turning off taps in the kitchen and bathroom to reduce household expenditure and waste. One 1977 advertisement offered guidance on reducing household water wastage through a series of images of a young woman undertaking her daily domestic routine, using a basin of water to wash her hair and pouring dishwashing water onto the garden.<sup>167</sup> At a time when an increasing proportion of women were engaging in paid work outside the home, the Board's publicity linked femininity with domesticity and consumption, assuming

<sup>165</sup> Metropolitan Water Authority, p. 60.

<sup>166</sup> C. Nash, 'Environmental history, philosophy and difference', *Journal of Historical Geography*, vol. 26, 2000, p. 23.

<sup>167</sup> 'The great drought', *Sunday Times*, 31 January 1977, p. 9.

that women could and should take primary responsibility for water conservation inside the home.<sup>168</sup>

During this period, water conservation publicity also reinforced the different roles of men and women outside their homes. Although images of men and women in their homes and gardens were prevalent in local gardening literature, there is very little evidence of conservation campaigns involving characters and photographs prior to the 1970s. The Water Board's 1977 'Save Water' campaign, however, portrayed the garden as a distinctly masculine sphere, where men were responsible for watering, maintenance, and lawn upkeep. Women were depicted as beautiful accessories to the perceived male gardening experience, confined to the lesser role of tending the garden's flowerbeds.<sup>169</sup> As many suburban gardens transformed into domestic spaces of leisure and recreation during the 1950s and 1960s, the domestic role of women inside the home had now extended beyond the sliding doors and into the back garden. As Katie Holmes argues, '[S]he remained the housewife in the garden, while the man became the gardener'.<sup>170</sup>

Although men and women were depicted as enjoying different relationships to their gardens, many of them shared a desire to preserve their traditional English-style gardens, even at great financial cost. Indeed, the financial relationship of householders to their homes tended to guide their approach to domestic water conservation. The Domestic Water Use Study found that owner-occupied homes consumed twice as much as rental properties, probably because tenants were less likely to invest in 'someone else's' garden. Likewise, wealthier householders tended to consume more water and would have been able to afford the higher charges associated with excess water use under the user pays system.<sup>171</sup> Alternatively, these consumers could have shifted their reliance onto groundwater sources, which I discuss further below.

Those householders who did not want, or could not afford, to install private bores could opt to make landscaping changes to their gardens. The early 1970s saw many urban Australians take an interest in native plants for their appearance and

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<sup>168</sup> J. Duruz, 'Suburban gardens', in S. Ferber, C. Healy and C. McAuliffe (eds), *Beasts of Suburbia: reinterpreting cultures in Australian suburbs*, Melbourne, Melbourne University Press, 1994, p. 204.

<sup>169</sup> According to the *Sunday Times*, 'The double cover (of the water conservation brochure) shows Test bowler Dennis Lillee in bathers and barefooted, guiding a lawnmower over a suburban lawn as green and as flat as a billiard table. With him is model Elizabeth Fisher raking a flower-bed'. See, 'Move to avert water crisis', *Sunday Times*, 24 October 1976, p. 14. Furthermore, the central character in this particular campaign was 'Dudley Drip', a stereotypical 'Aussie bloke' dressed in shorts and thongs. See, *West Australian*, 2 October 1976, p. 3.

<sup>170</sup> K. Holmes, 'In her master's house and garden', in P. Troy (ed.), *A History of European Housing in Australia*, Oakleigh, Cambridge University Press, 2000, p. 175.

<sup>171</sup> Metropolitan Water Authority, p. 34.

practicality. After the war, Australian garden writers and designers had encouraged gardeners to use native flora as a means to protect vulnerable species from suburban and agricultural expansion.<sup>172</sup> Writers like Betty Maloney and Jean Walker urged their readers to embrace, rather than fear, the bush and its flora.<sup>173</sup> Trevor Hogan considers this trend represented a preference for the informal over the formal; the revaluing of local over exotic species; a sense of natural landscape; and an ‘attempt to make the suburban garden an expression of the owner’s own good taste and ecological awareness’.<sup>174</sup> The increased enthusiasm for native plants may also be seen as a sign of Australia’s burgeoning national confidence in the 1970s and the emergence of a broader environmentalism, perhaps even a sign of respect for the *genius loci* (or the spirit of the place).<sup>175</sup> By the 1970s, in Perth at least, gardening with native plants was becoming a more mainstream activity, particularly after the long-awaited opening of Western Australia’s botanic gardens at Kings Park in 1965.<sup>176</sup>

In Perth, the State government and gardening experts urged residents to replace their exotic plants and lawns with more hardy, drought-resistant Australian natives to cope with the below average rainfall of the late 1970s. Since the 1950s, proponents of gardening with native flora had assured gardeners that these plants were ‘maintenance-free’ and more Western Australian species became commercially available from the late 1960s.<sup>177</sup> Local nursery-owner George Lullfitz described the benefits of planting native flora in 1978:

Probably the most important advantage is that the native plants require very little watering and maintenance. With a developing city like Perth the demand for water is heavy, and increasing, and the need to restrict water use in recent low-rainfall years has brought it sharply to our attention that we do not have enough water to support

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<sup>172</sup> K. Holmes, ‘Growing Australian landscapes: the use and meanings of native plants in gardens in twentieth-century Australia’, *Studies in the History of Gardens and Designed Landscapes*, vol. 31, no. 2, 2011, p. 126.

<sup>173</sup> Holmes, ‘Growing Australian landscapes’, p. 127.

<sup>174</sup> T. Hogan, “‘Nature strip’: Australian suburbia and the enculturation of nature’, *Thesis Eleven*, vol. 74, 2003, p. 56.

<sup>175</sup> G. Seddon, *Landprints: reflections on place and landscape*, Melbourne, Cambridge University Press, 1998, pp. 113-18; and Holmes, ‘Growing Australian landscapes’, pp. 127-28. In his book *Tough Times*, Frank Crowley suggests that in the 1970s, ‘what was happening in Australia under the name of “nationalism” was a mixture of a desire to catch up with the rest of the world, and a desire on the part of Australians to run things for themselves, with new confidence and new standards’. See, F. K. Crowley, *Tough Times: Australia in the seventies*, Melbourne, Heinemann, 1986, pp. 265-7.

<sup>176</sup> See, D. Erickson, *A Joy Forever: the story of Kings Park and Botanic Garden*, West Perth, Botanic Gardens & Parks Authority, 2009.

<sup>177</sup> Holmes, ‘Growing Australian landscapes’, p. 127.

exotic plants introduced from regions of higher rainfall and maintain luxurious lawns that consume huge quantities of water. The obvious solution is to plant trees, shrubs and ground covers that will survive without continual watering.<sup>178</sup>

Official campaigns echoed earlier calls from newspaper correspondents who had advised householders to adapt their gardens to local conditions.<sup>179</sup>

Local businesses encouraged this apparent shift in favour of less thirsty plants and landscaping designs. Advertisements and gardening columns featured references to Perth's water restrictions and 'pay for use', emphasising the availability of alternative, native garden designs and landscaping features, such as brick paving and wooden railway sleepers.<sup>180</sup> Nurseries advertised a wide range of native plants, including *Callistemon*, *Grevillea*, *Banksia*, and *Boronia*, reminding shoppers to 'Go Native, Save Water'.<sup>181</sup> To appeal to those gardeners who were reluctant to forgo their English-style traditional garden, native plants were marketed as able to 'enhance the appearance of their homes' and 'provide a splash of colour with minimum maintenance'.<sup>182</sup>

The 1985 Domestic Water Use Study found that many Perth gardens had undergone marked landscaping changes in the late 1970s. A significant proportion of householders reduced their lawn area, and increased their use of native plants, woodchips, and brick paving. Affluent households, which invested heavily in their gardens, were more likely to make such changes than less affluent ones.<sup>183</sup> It is worth noting that affluent households could have afforded excess water and bores, but many

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<sup>178</sup> G. Lullfitz, *Grow the West's Best Native Plants*, Perth, West Australian Newspapers, 1978, p. 8.

<sup>179</sup> N. Barron, 'Call for ban on pools', *West Australian*, 7 November 1972, p. 6; M. Cromack, 'A compelling bid to save water', *West Australian*, 21 November 1972, p. 6; F. E. Lefroy, 'Water problems faced by Perth', *West Australian*, 30 January 1974, p. 6; L. McKenna, 'Letter', *Daily News*, 5 February 1971, p. 8; P. H. Samuell, 'Regulating water needs in Perth', *West Australian*, 26 January 1974, p. 6; D. I. Sutherland, 'Letter', *West Australian*, 30 November 1972, p. 6; and A. Torrent, 'Water: Law needs to be changed', *West Australian*, 14 November 1972, p. 6.

<sup>180</sup> Instant Gardens, 'Advertisement', *West Australian*, 16 September 1978, p. 13; Great Western and Grove Garden Centres, 'Advertisement', *West Australian*, 28 October 1978, p. 20; G. Lullfitz, 'Native is the answer', *West Australian: Classified Liftout*, 12 August 1978, p. 23; Midland Brick, 'Advertisement', *West Australian*, 28 October 1978, p. 3; 'Nature's way to save water', *West Australian*, 30 October 1978, p. 23; Rockwood Landscape Supplies, 'Advertisement', *West Australian*, 20 October 1979, p. 9; Waldeck Nurseries, 'Advertisement', *West Australian*, 20 October 1979, p. 12; and Westate Pumps, 'Advertisement', *West Australian*, 21 October 1978, p. 6. Bush or native gardens in Perth were composed of Australian and Western Australian plant species, extensive use of ground covers, local rock and stone, and railway sleepers. In contrast to the symmetry and order of the English garden, native gardens were 'free form' in style, a representation of the bush in the suburbs.

<sup>181</sup> Great Western Garden Centre, 'Advertisement', *West Australian*, 30 October 1976, p. 11; Wildflower Nursery, 'Advertisement', *West Australian*, 13 August 1977, p. 6; and Wildflower Nursery, 'Advertisement', *West Australian*, 22 October 1977, p. 6.

<sup>182</sup> Lullfitz, p. 8.

<sup>183</sup> Metropolitan Water Authority, p. 66.



chose to make significant landscaping changes to their gardens. These garden alterations, however, did not necessarily lead to a reduction in water use.<sup>184</sup> A lack of knowledge of the water needs of native plants might have limited the impact of native gardens on householders' water use.<sup>185</sup> A more likely explanation, however, is that landscaping choices were influenced more by garden fashions and the desire to reduce the expenditure of time, labour and money on the garden, than the push to reduce domestic water consumption.<sup>186</sup> It therefore appears that the shift towards native plants in some Perth gardens was partly a result of pressures regarding water use, but other social and cultural factors also played a very significant role.

Of course some households rejected the trend towards native plants in Perth gardens: Australian plants were widely perceived as dry, brown and ugly.<sup>187</sup> Some households resisted any change at all. As noted above, many newspaper correspondents deplored the brutality of reducing their garden watering, believing that their personal hard work and the beauty of their gardens would be sacrificed in the name of water conservation. Arthur Tonkin, MLA for Mirrabooka, even called for the state government to 'reduce population growth rather than restrict water' because 'dead lawns are worse than a small city'.<sup>188</sup>

This resistance to reducing water use in Perth gardens in order to preserve the traditional English-style garden was more than merely an aesthetic preference. Western Australia has historically attracted a high number of British migrants compared to the other states and their presence has strongly influenced the taste and character of Perth's suburbs.<sup>189</sup> Perth households were therefore especially inclined towards the traditional English-style garden. In all Australian capital cities, however, traditional gardens were important cultural sites, invested with suburban meanings of civility and social status.

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<sup>184</sup> Metropolitan Water Authority, pp. 49, 66.

<sup>185</sup> G. J. Syme and S. J. Kantola, 'Investment in Private Bores: Underground Water Usage from a Household Perspective', in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. 454; and D. P. Heeps, 'Summary of the regulations, restriction and design mechanisms', in *Proceedings of the National Workshop on Urban Water Demand Management*, Perth, Western Australian Water Resources Council, 1986, p. 141.

<sup>186</sup> Metropolitan Water Authority, pp. 49, 51. Elizabeth Caldicott describes similar circumstances in Adelaide at this time. See E. Caldicott, 'Gardening Australian style- the Adelaide example', *South Australian Geographical Journal*, vol. 96, 1997, p. 50.

<sup>187</sup> G. Bolton, *Spoils and Spoilers: Australians make their environment 1788-1980*, Sydney, George Allen and Unwin, 1988, p. 130; J. Fiske, B. Hodge and G. Turner, *Myths of Oz: reading Australian popular culture*, Sydney, Allen and Unwin, 1987, pp. 26-46; and I. Hoskins, 'Constructing time and space in the garden suburb', in Ferber, Healy and McAuliffe (eds), *Beasts of Suburbia*, pp. 1-18.

<sup>188</sup> A. Tonkin, 'Preserving Perth and its beauty with controls', *West Australian*, 2 January 1978, p. 6.

<sup>189</sup> J. Jupp, 'Post-war English settlers in Adelaide and Perth', in J. Jupp (ed.), *The Australian People: an encyclopedia of the nation, its people and their origins*, 2<sup>nd</sup> ed., Oakleigh, Cambridge University Press, 2001, p. 316.

This consensus on the significance of the traditional garden could only have emerged after decades of reliable water supplies across the nation's urban centres.<sup>190</sup> Many Australians believed the garden communicated the social standing of their home and family in terms of suburban standards of social duty and conformity. These standards were most prominently displayed in the front garden where their maintenance was, as Robert Freestone argues, 'vital in order to attain the coherence of the garden suburb street picture, which secured a demonstrable sense of community'.<sup>191</sup> The large amounts of water required to maintain this traditional image of suburban respectability may have hindered the practical success of the Water Board's efforts to promote water conservation. Furthermore, landscaping changes that would significantly alter the traditional garden were not an option for those householders who placed a high value on the aesthetic and social values of such gardens. The historic commitment to the traditional garden in suburban Perth, which was symptomatic of the enduring profligate water culture, prevented many gardeners from improving their hydroresilience.

For households that valued their traditional gardens and were fortunate enough to be financially and geographically well-situated, private bores and wells could be installed, giving access to virtually unlimited water for garden use.<sup>192</sup> Although private bores have a long history in Perth's suburbs, bore ownership trebled between 1976 and 1982.<sup>193</sup> This access came at a price: the average cost of bores installed during this period was about \$1600 (at 1982 prices), excluding the cost of reticulation.<sup>194</sup> The most important factors relating to bore ownership were the price of scheme water and the scheme water use restrictions. Over a third of all bores in place by 1982 were installed from 1977 to 1979 – the period of restrictions and the introduction of user pays.<sup>195</sup> Although bore users were found to consume significantly less scheme water than non-bore users at the end of the period, the Domestic Water Use Study estimated that the volume of groundwater extracted from the shallow aquifer by domestic bores was over

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<sup>190</sup> Holmes, 'In her master's house and garden', p. 164; and K. Holmes, "'In spite of it all, the garden still stands": gardens, landscape and cultural history', in H-M. Teo and R. White (eds), *Cultural History in Australia*, Sydney, University of New South Wales Press, 2003, p. 184.

<sup>191</sup> R. Freestone, 'Planning, housing, gardening: home as a garden suburb', in Troy (ed.), *A History of European Housing in Australia*, p. 133.

<sup>192</sup> Syme and Kantola, 'Investment in private bores', p. 461.

<sup>193</sup> Metropolitan Water Authority, p. 63

<sup>194</sup> Metropolitan Water Authority, p. 43. At a conference in 1981, Sir Charles Court estimated that over 55,000 residents had invested some \$110 million in their gardens by installing bores. See, C. Court, 'Address', in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. II.

<sup>195</sup> Metropolitan Water Authority, pp. 41, 43. Approximately 55 per cent were installed by 'do-it-yourself' methods.

seven times the average household scheme water irrigation of non-bore-users.<sup>196</sup> Private bores were clearly installed so that householders could continue (or even extend) their existing consumption behaviour while reducing their scheme water use. This trend persisted into the 1980s, when the Water Board estimated that up to 45 per cent of total water used for domestic consumption in Perth came from private bores.<sup>197</sup> Many consumers therefore interpreted the Water Board's efforts to encourage water conservation as relating only to *scheme* water use, rather than water in general.<sup>198</sup>

The increased household tapping of groundwater sources suggests that there was a dearth of information and knowledge in the community regarding the environmental impact of groundwater use. Prior to the mid-1970s there was very little public comment from the government or householders regarding the effects of groundwater use and during earlier periods of restriction, the Water Board had recommended residents install private bores to reduce public demand for scheme water.<sup>199</sup> As these backyard bores tapped the same source of groundwater as Big Water, some residents expressed concerns about the ecological consequences of this supplementary supply.<sup>200</sup> Big Water's engineers believed, however, that private abstraction would have little effect on groundwater levels because it would generally involve small abstractions from a large number of widely distributed wells. Furthermore, the engineers reasoned, more water permeated to the shallow aquifers beneath the residential block, compared to the undeveloped Gnangara Mound so the water table would hardly decline.<sup>201</sup>

Consequently, although the Water Board made information regarding groundwater use available, there was not the same level of urgency to conserve this water resource that had accompanied voluntary and enforced restrictions on scheme

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<sup>196</sup> Metropolitan Water Authority, p. 40. By using the flow rates of the low-lift, high-volume centrifugal pump at depths of less than and more than 8m, the Domestic Water Use Study estimated that overall groundwater use was 1000kL per annum for each house with a bore. The scheme water irrigation component for bore users (34 kL per annum) is insignificant compared to the estimated groundwater irrigation use of 1000kL per annum.

<sup>197</sup> P. Armanasco, 'State position paper: Western Australia', in *Proceedings of the National Workshop on Urban Water Demand Management*, p. 78.

<sup>198</sup> G. J. Syme, 'Summary of the education/persuasion mechanism', in *Proceedings of the National Workshop on Urban Water Demand Management*, p. 160.

<sup>199</sup> 'Water restrictions start on Thursday', *West Australian*, 29 September 1959, p. 1; 'Underground information', *West Australian*, 30 September 1959, p. 11; and 'Water flows before cuts', *West Australian*, 30 September 1959, p. 11.

<sup>200</sup> A. J. Peck, 'Water-bore levels', *West Australian*, 25 October 1977, p. 6.

<sup>201</sup> C. Burton, 'Water balance of the coastal plain: future', and D. R. Williamson and K. Cole, 'Management aspects in relation to groundwater supplies: urban, garden and sewerage needs', in Carbon (ed.), *Groundwater Resources of the Swan Coastal Plain*, pp. 100, 211.

water.<sup>202</sup> Furthermore, attempts to licence and meter private bores in the early 1970s had been met with staunch opposition from the community. Bore owners believed they were reducing pressure on scheme water supplies and thus helping the Water Board conserve water.<sup>203</sup> In spite of public education campaigns encouraging the reduction of scheme water, the widespread acceptance of groundwater as an alternative or supplement to scheme water suggests that both Big Water and its customers were reluctant to significantly reduce the *total* demand for water or to question Perth's profligate water culture. Although bore-owners could reduce their dependence on Big Water to slake their thirst, access to unfettered water supplies would do little to improve their long-term hydroresilience.

The responses to the water demand management policies of the late 1970s may also be examined in the context of the rising profile of local and overseas environmental issues as part of a broader trend of increasing international ecological awareness and the emergence of the new environment movement.<sup>204</sup> Maria Kaïka argues that in western societies, the home operates as a means of separating 'the inside from the outside, nature from human beings, [and] the public from the private sphere'.<sup>205</sup> Although Kaïka refers chiefly to Western European trends, her ideas fit a long-held Australian notion of the domestic space, house and garden, as a private sphere, impenetrable, a sanctuary for its residents.<sup>206</sup>

In the 1970s, when public awareness of environmental problems was concerned largely with 'green' issues, such as conserving bushland, the issue of water scarcity did not appear to be woven into the emerging environmental consciousness.<sup>207</sup> Furthermore,

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<sup>202</sup> I. J. O'Hara, 'The role of the Metropolitan Water Board in the management of the groundwater resource', in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, p. 396.

<sup>203</sup> Bennett, Letter to General Manager, Metropolitan Water Supply Department, 18 July 1972, Bores – Other – Private Bores, Cons 6756, 1972/375533 pt 3, SROWA; H. P. Cahill, Letter to H. D. Evans, 7 July 1972, Bores – Other – Private Bores, Cons 6756, 1972/375533 pt 2, SROWA; B. Paterson, 'Bores save water draw', *West Australian*, 27 October 1977, p. 6; and J. H. Winter, 'Bore-water savings', *West Australian*, 26 October 1977, p. 6. In the late 1980s, demand for scheme water remained 31 per cent lower than the 1976 peak, due mostly to the community's increased use of groundwater. See, K. Webster, 'Profile of Australian water use with reference to domestic water use in Perth', in *Proceedings of the National Workshop on Urban Water Demand Management*, p. 85.

<sup>204</sup> See, M. L. Crawford, 'The introduction of environmental protection legislation in the State of Western Australia, 1970: conservation pressure group activity and the Brand government', Honours Dissertation, University of Western Australia, 1976, np; and R. Dempsey (ed.), *The Politics of Finding Out: environmental problems in Australia*, Melbourne, Cheshire, 1974.

<sup>205</sup> M. Kaïka, 'Interrogating the geographies of the familiar: domesticating nature and constructing the autonomy of the modern home', *International Journal of Urban and Regional Research*, vol. 28, 2004, p. 265.

<sup>206</sup> Kaïka, p. 270; and Hogan, 'Nature Strip', p. 66.

<sup>207</sup> There had already been a significant public response to the Environmental Protection Authority's call for submissions to the System 6 Study in 1976/77, and there was particularly

Perth residents often understood the broader environment as somehow independent of or ‘distanced’ from the household, geographically and politically. This ‘exclusivity’ of the domestic space reflected a cultural attachment of many householders to their homes as places to retreat from the outside world.<sup>208</sup> As private gardens were usually not seen in this sense as part of nature but part of the home, water use in the garden was not widely considered to have environmental implications.<sup>209</sup>

Enforced restrictions and user pays posed a threat to this socio-cultural isolation of the home, rendering visible those social processes that had scripted nature as ‘the other’.<sup>210</sup> More precisely, as access to water was restricted Perth residents started to experience some of the consequences of their thirsty lifestyles; they were increasingly subject to the vagaries of ‘nature’. The intermittent periods of enforced and voluntary restrictions from the early 1920s to the late 1970s, combined with the additional measure of user pays, thus exposed the fragility of suburban standards of civility and ‘domestic bliss’.<sup>211</sup> Although suburban anxieties about running out would persist into the 1980s, the demand management strategies deployed in the late 1970s helped to temper the profligate (scheme) water culture of the people of Perth.

### ***Protecting Big Water***

Despite the curtailment of water consumption through restrictions and user pays, the government’s anxieties about running out persisted. Although Perth’s population growth and water demand were beginning to slow by the mid-1970s, water managers

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strong concern regarding the pollution of Cockburn Sound. A. Harris, ‘System 6 could fix your future’, *West Australian*, 20 December 1976, p. 7; ‘Many reply in Cockburn survey’, *West Australian*, 17 January 1977, p. 12; and ‘Reserves to be chosen’, *West Australian*, 22 December 1976, p. 30. Also, in March 1977, the television station Channel 9 screened a locally produced documentary, ‘The Land We Love’, narrated by local actress Judy Nunn and directed by John Izzard. As part of the System 6 Study, the film depicted ‘a sense of loss already’, showing scenes of environmental degradation at Cockburn Sound, Jackadder Lake, Robb Jetty, and Wellington Dam. See, Monitor, ‘Switch to ecology’, *Sunday Times*, 22 March 1977, p. 28.

<sup>208</sup> M. Peel, ‘Between the houses: neighbouring and privacy’, in Troy (ed.), *A History of European Housing in Australia*, p. 277.

<sup>209</sup> It took some time for the problems associated with the use of toxic chemicals, particularly in suburban gardens, to gain widespread awareness in Australian households, where most residents considered themselves independent from nature until at least the 1970s. While residents may have been increasingly careful with their use of pesticides and fertilisers around their homes, they were arguably more concerned with their health than any environmental impact. See, S. Boyden, ‘Australia and the environmental crisis’, in Dempsey (ed.), *The Politics of Finding Out*, pp. 3-4; and A. Gaynor, *Harvest of the Suburbs: An Environmental History of Growing Food in Australian Cities*, University of Western Australia Press, 2006, p. 130.

<sup>210</sup> Kaïka, p. 266.

<sup>211</sup> Kaïka, p. 280.

still feared that the growth of water demand might outstrip supplies.<sup>212</sup> Technological solutions offered them tantalising ways of increasing suburban water supplies but at considerable expense.<sup>213</sup> It would be far cheaper for water managers to protect the existing sources of water supply than develop new sources. In this section, I examine the measures that Perth's water managers undertook in the late 1970s to reduce the vulnerability of Big Water to running out. These measures inflamed tensions between urban and rural Western Australians about the most responsible use of the southwest's limited water resources. Preventing the suburbs from running out, feared many farmers, might increase the likelihood of running out themselves.

Although the state government had already dismissed plans to pipe water from the northwest, another grand project presented itself as the means to attain endless water supplies for Perth. This was a vision that was far grander in scale: Antarctic icebergs. International scientific and political interest in the possibility of utilising Antarctic icebergs to alleviate water scarcity was first sparked at a conference of the International Glaciological Society in Cambridge, England in 1969.<sup>214</sup> Research continued into the early 1970s, primarily under the auspices of the RAND Corporation and also at the behest of Prince Mohamed Al Faisal Al Saud of Saudi Arabia.<sup>215</sup> In 1974, the Australian Academy of Science (AAS) established a special committee to consider the possibilities of using this technology in southern Australia. The *Financial Review* reported that 'with two thirds of the world's fresh water bailed up on the continent it is inevitable that technological improvements will eventually allow this immense reservoir to be harvested on a large scale'.<sup>216</sup> No one seemed to note the irony inherent in taking water from one desert to another.

In 1978, Foundation Professor of Meteorology at Flinders University, Peter Schwerdtfeger, approached the Western Australian State Committee of CSIRO with regard to employing iceberg technology in Western Australia. Schwerdtfeger had been closely involved in the AAS study and had recently become the Australian coordinator for Iceberg Transport International, an international consortium sponsored largely by Saudi Arabia that was considering Western Australia for its iceberg experiments.<sup>217</sup>

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<sup>212</sup> Hollick, pp. 149-50.

<sup>213</sup> Smith, 'Trends in water resource management', pp. 241-42.

<sup>214</sup> P. Schwerdtfeger, 'The development of iceberg research and potential applications', *Polar Geography and Geology*, vol. 9, no. 3, 1985, p. 203.

<sup>215</sup> Schwerdtfeger, p. 203.

<sup>216</sup> 'Towing icebergs to South Australia', *Financial Review*, 3 October 1979, pp. 13-14.

<sup>217</sup> L. Brophy, 'Iceberg for WA could cost \$100m.', *Daily News*, 28 March 1978, p. 19. See also, G. Mouglin, Letter to P. Schwerdtfeger, 20 February 1978, Iceberg Utilization, CSIRO WA State Committee, K637, 40, National Archives of Australia (WA) (hereafter NAA(WA)).

According to these plans, an iceberg would be towed from Antarctica and moored off the Western Australian coast near Fremantle. A pipeline would be constructed to transport the iceberg water to land. Despite enthusiastic negotiations between Schwerdtfeger and the State Committee, especially its secretary John Brophy, local scientists and engineers dismissed the idea. The PWD Director of Engineering, Bob Hillman, and the MWB Chief Engineer, Harold Hunt, declared that the financial cost of the plan made the proposal unfeasible.<sup>218</sup> It was just another pipedream.

Meanwhile, Big Water had become increasingly reliant on the groundwater resources of the Swan Coastal Plain. In the late 1970s, for instance, up to fifty per cent of Big Water's supplies were drawn from its groundwater schemes on the Gnangara Mound.<sup>219</sup> Although groundwater reserves had softened the severity of water restrictions in the late 1970s, their utilisation was not without cost. Ecologists, for instance, noted the stress that the tapping of these reserves had put on nearby native vegetation, which were already under strain in the dry conditions of the late 1970s.<sup>220</sup> Both the quality and quantity of Perth's groundwater resources needed protection to ensure that this valuable stopgap for Big Water would not run out.<sup>221</sup> Already the EPA had recommended against the proposed Pacminex Alumina refinery in Upper Swan because of the risk it posed to groundwater supplies.<sup>222</sup> Mining was not the only threat, however, to the groundwater reserves of the Swan Coastal Plain. The region's market gardeners also competed with Big Water's claim to these supplies.

The MWB had introduced restrictions on water and land use near its groundwater schemes since the early 1970s.<sup>223</sup> But as these applied to the Gnangara Mound, where the landscape was relatively undeveloped, there had been few, if any,

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<sup>218</sup> Report of a Meeting, 1 May 1978, Iceberg Utilization, CSIRO WA State Committee, K637, 40, NAA(WA).

<sup>219</sup> Caldwell, p. 10.

<sup>220</sup> E. Heddle, 'Native vegetation on the northern Swan Coastal Plain, Western Australia', in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, pp. 189, 195.

<sup>221</sup> Hollick, p. 37; and M. J. Caldwell, 'Perth water supply – the role of groundwater resources', in Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, pp. 11-12.

<sup>222</sup> One of the first tasks of the recently established Environmental Protection Authority was to report to the Tonkin Labor government about the proposed location of the Pacminex Alumina Refinery in the Upper Swan in 1971. One of the reasons for the Authority's rejection of this location was the possibility that liquid effluent from the refinery would contaminate groundwater reserves in the area. See, B. J. O'Brien, 'Land use: competitive and compatible', in B. J. O'Brien, *Environment and Science*, Nedlands, UWA Press, 1979, p. 264; and A. Kellow and S. Niemeyer, 'The development of environmental administration in Queensland and Western Australia: why are they different', *Australian Journal of Political Science*, vol. 32, no. 2, 1999, p. 212.

<sup>223</sup> Hollick, p. 40

complaints from the public.<sup>224</sup> This was not the case in 1977 when the MWB revealed its intention to control and tap the groundwater reserves of the Jandakot Mound south of Perth. At that time, market gardeners were using this area for the cultivation of fruit and vegetables, and animal husbandry. Under the new regulations, farmers faced restrictions on the use of insecticides and animal manure on market gardens and cattle farms, as well as licensing on their private bores.<sup>225</sup> Not only were they concerned that their farming methods would be curtailed without compensation but they also feared a drop in the water table level. This would reduce the availability of water close to the surface, which these farmers relied upon to water their pastures and crops during the summer without irrigation.<sup>226</sup> If the water table fell, farmers would have to invest in drilling and irrigation equipment to supply their properties with water during the annual dry season.<sup>227</sup>

Outraged that they were not offered compensation, some Jandakot farmers joined forces with the Cockburn Town Council to take legal action against the MWB, and a bloodthirsty rural press closely followed their case.<sup>228</sup> The farmers unsuccessfully alleged that the Board had failed to comply with a section of the Metropolitan Water Supply Sewerage and Drainage Act that required the Board 'to make certain details of its plans public for objections before obtaining the approval of the Governor' to develop the water resources.<sup>229</sup> The rural newspaper *Western Farmer* seized upon the story and presented the Jandakot situation as a conflict between both rural and urban interests, and productive and unproductive uses of water, as well as an issue of ecological destruction.

According to the *Western Farmer*, the MWB's treatment of the Jandakot farmers represented yet another example of the state government favouring its suburban constituents over rural areas. Although the Jandakot area was ostensibly suburban by this time, the landholders subscribed to a rural identity, which stemmed from its

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<sup>224</sup> Of the schemes situated on the Gnangara Mound, Gwelup was the only one that was in an urbanised area and had experienced some pollution. The Mirrabooka scheme was in a rural area that was partly used for agriculture and partly for recreational open space. The Wanneroo scheme was located within the State Forest, which made control relatively easy but increasing urbanisation around Wanneroo presented the water authorities with management challenges. The abstraction of groundwater from the Gnangara Mound also posed problems for timber production, as the Forestry Department's pine plantations were located in the area. See, Hollick, pp. 40-44.

<sup>225</sup> 'Uproar on bid to drain farm water', *Western Farmer*, 14 April 1977, pp. 1, 7.

<sup>226</sup> Hollick, p. 40.

<sup>227</sup> B. Collis, 'Jandakot water row', *Western Farmer*, 5 May 1977, p. 25.

<sup>228</sup> 'Cockburn Shire enters water war', *Western Farmer*, 21 April 1977, p. 2.

<sup>229</sup> Hollick, p. 41. The case finally concluded in mid-1978, with the courts ruling in favour of the Metropolitan Water Board.



development as an Agricultural Area at the turn of the century.<sup>230</sup> The *Western Farmer* asked, '[I]s it right to threaten a region's agricultural future for the comfort of city and town dwellers?'<sup>231</sup> This perspective argued that because the water use of Jandakot farmers was intended for horticulture and animal husbandry, it was justifiable and 'right'. The diversion of the groundwater resources for suburban use was inherently (morally) flawed. For instance, the newspaper reported, 'Landholders question why their water supplies to grow food should be restricted for the benefit of urban lawns and gardens'.<sup>232</sup>

In its support of the Jandakot farmers, the *Western Farmer* also argued that the MWB development of the area's groundwater reserves would be detrimental to the local wetland areas. The toll of the successive dry years of the late 1970s on the shallow lakes and native vegetation had not gone unnoticed.<sup>233</sup> According to the newspaper, increasing the draw on the groundwater resources would only deplete them further.<sup>234</sup> The utilisation of this water by farmers, the newspaper suggested, was not contributing to lowering the water table. As one farmer argued, '[T]he water we use goes back into the ground. When it's pumped to the city it will be gone forever'.<sup>235</sup> For the market gardeners on the outskirts of Perth, these restrictions raised anxieties about their livelihoods – the vulnerability of the suburbs, they considered, would be reduced at their expense.

Although groundwater had become an important supplement to the hills sources, these surface water storages remained vital components of both the urban and rural water supply networks. It was therefore necessary to protect the quality and quantity of the water supplied from the dams in the Darling Ranges. Although there had been PWD concerns about the rising salt levels in Perth's water supplies since at least the 1950s, the issue did not come to the attention of the suburban public until the mid-1970s.<sup>236</sup> The local media and the Campaign to Save Native Forests conservation group stirred up community concern about the quality of the urban water supply, citing the links between saline water and health problems.<sup>237</sup> Keen to downplay these anxieties, the government attributed the salt levels to the prevailing drought conditions and assured

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<sup>230</sup> W. S. Cooper, 'Drainage and irrigation', in J. Gentilli (ed.), *Western Landscapes*, Nedlands, UWA Press, p. 239.

<sup>231</sup> 'We're living on watered down time', *Western Farmer*, 20 April 1978, p. 4.

<sup>232</sup> B. Collis, 'Jandakot chokes on its troubled waters', *Western Farmer*, 15 June 1978, p. 47.

<sup>233</sup> 'Dry gives insight on tapping', *Western Farmer*, 19 May 1977, p. 20.

<sup>234</sup> B. Collis, 'Jandakot scheme "to fill off coast"', *Western Farmer*, 13 October 1977, pp. 1-2.

<sup>235</sup> B. Collis, 'Jandakot chokes on its troubled waters', *Western Farmer*, 15 June 1978, p. 47.

<sup>236</sup> Beresford et al., 2004, pp. 77-78, 91.

<sup>237</sup> Beresford et al., p. 92.

the public that the water quality had improved following winter rains.<sup>238</sup> But the weight of research conducted by government scientists suggested otherwise: the clearing of native vegetation was the real cause of the rising salinity.<sup>239</sup> And it was endangering potable water supplies.

Nearly seventy years after government scientists first identified a relationship between the clearing of native vegetation and salinity, the state government undertook measures to limit the spread of salt. In January 1979, the government introduced ‘lightning legislation’ to ban land clearing in the Mundaring Weir and Denmark River catchment areas and the Warren and Kent River Water Reserves.<sup>240</sup> This legislation was enacted without consultation with the affected farmers to avoid a rush of clearing before ban commenced, which resulted in protests from farmers and their representatives that they had been unfairly treated. Again, the rural press seized upon the issue as yet another example of the suburbs profiting from the expense of rural communities. *Western Farmer* journalist Brad Collis reported:

The knowledge that Australia is an unenvironmentally (sic) dry continent is nothing new, but few urban dwellers among WA’s coastal plain knew just how much until the latest string of dry winters. At first, country people, who have suffered water shortages all their lives, were amused at the city’s awakening to the problem. But the smiles have died as the roots of a thirsty metropolis now threaten to strangle the life from farming closest to water catchment areas.<sup>241</sup>

Despite the backlash from affected farmers, the government maintained its position on the clearing bans to ensure that the region’s water supplies would be protected.

Successive dry seasons in the late 1970s had exposed the vulnerability of Perth’s Big Water to running out. Water managers could not afford to experiment with the visions of water dreamers – they had to protect the city’s existing and future groundwater and surface water supplies. But ensuring water for the suburbs meant encroaching on rural uses of land and water. The stage was set for a clash between the city and its hinterland, between misuse and use, frivolity and utility. The subsequent curtailment of farming practices reflected a change in the weather for the southwest’s agricultural areas.

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<sup>238</sup> Beresford et al., p. 92.

<sup>239</sup> Beresford et al., p. 93.

<sup>240</sup> Clearing control legislation was introduced under the *Country Areas Water Supply Act 1947*.

<sup>241</sup> B. Collis, ‘Urban thirsts pour salt in the wounds’, *Western Farmer*, 25 October 1979, pp. 49-50.

## *Paying the piper*

Although many southwest farmers had found the seasonal conditions of the early 1970s difficult, the series of dry years later in the decade were unprecedented in their severity and impact. Unusually low winter rains in 1976 brought drought conditions to many areas of the southwest region, which lasted into the early 1980s for many farmers, particularly in the north-eastern wheatbelt.<sup>242</sup> The severity of the drought shocked farmers across the region, with old-timers like Dalwallinu farmer Ted Black noting that he had ‘never seen it as dry’.<sup>243</sup> As these conditions lingered, farmers in the north-eastern wheatbelt suffered four consecutive years of drought. Even areas like Kondinin and Katanning, where rainfall had been considered safe and reliable, were affected.<sup>244</sup> As Perenjori farmer Bill Bestry recalled, ‘They were our hardest years ... They set us back a lot, set us back a long way, those years’.<sup>245</sup> By the end of the decade, the drought-affected area extended from the north-eastern wheatbelt and upper central region down into the southern wheatbelt.<sup>246</sup> In this section I examine the technical responses of farmers and the government to drought years, and explore the economic and technological constraints that shaped them. The same economic turn that had transformed Big Water in the suburbs was affecting the ways that both farmers and the government prepared for, and responded to, climate variability and water scarcity. I contend that the government’s shift towards user pays in its agricultural policies, from state paternalism to neoliberalism, combined with the dry conditions and unfavourable markets to increase the vulnerability of many southwest farmers to running out.

By the late 1970s, it had become increasingly likely that the farmers in unreticulated parts of the wheatbelt would remain outside the scope of Big Water. In 1978, the state government proposed the development of reticulated water supplies to farmlands north of the boundary of the area served by the CWSS, where it had been difficult to establish farm supplies. This scheme involved the development of groundwater resources at Agaton, which would also supplement the CWSS to alleviate the burden on the Mundaring source. But the financial cost of the project was its

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<sup>242</sup> Department of Agriculture (WA), *Annual Report of the Department of Agriculture for the Year Ended 30<sup>th</sup> June 1983*, Perth, The Dept, 1983, p. 6.

<sup>243</sup> N. Higgs, ‘Rain in a week – that’s the limit’, *Western Farmer*, 15 July 1976, p. 1.

<sup>244</sup> B. Collis, ‘State’s “safest” area seeks drought relief’, *Western Farmer*, 18 May 1978, pp. 1, 6; and ‘Unimaginable’, *Western Farmer*, 2 October 1980, p. 6.

<sup>245</sup> William Peter Bestry, interviewed by John Bannister, 30 March 1998, Battye Library, OH2885.

<sup>246</sup> ‘Drought in WA 1980/81’, 14 May 1981, Drought Consultative Committee, Cons 7203, V126, SROWA.

downfall. The Commonwealth government refused to support the program in 1981 and the state government was unable to fund the scheme alone. The state government's failure to attain Commonwealth funding for the expansion of the CWSS revealed the growing fiscal constraints on the provision of public water supplies in the 1970s and 1980s.

The earlier rejection of plans to extend the CWSS and the failure of Agaton demonstrated to the government, at least, that Big Water in its rural form was unlikely to undergo further expansion. As the Department of Agriculture reported in 1981, 'Economic forces have moved against projects involving water transfer over great distances, and in favour of maximum local development of supplies'.<sup>247</sup> Big Water had always run at a loss in the agricultural areas, because the government subsidised the supply of scheme water to farms.<sup>248</sup> Besides, improvements in technology had reduced the cost and difficulty of constructing dams and sinking bores.<sup>249</sup> Greater development of local supplies, whether in towns or on farms, would not only protect agricultural production from drought, but would also reduce the financial burden of government subsidies for the CWSS and alleviate the mounting public debts of drought assistance.<sup>250</sup> It seems that whatever enhancements farmers had made to their water supplies since 1969 had not been sufficient to reduce their risk of running out. Further efforts were required to prepare themselves for future periods of water scarcity and the government provided assistance to these ends through low-cost loans as well as fodder and agistment subsidies. More than ever before, the onus was on farmers to protect themselves from running out.

Yet in the areas of the wheatbelt most affected by drought, the government's campaigns to improve water conservation on farms must have seemed frustrating. The Department of Agriculture had urged farmers to access underground water if possible; enlarge dam catchments and use contour drains to capture water; prevent dam leakages; and excavate 'flat batter' dams, which combine a circular, artificial catchment with a central storage dam.<sup>251</sup> Although these were sensible strategies for the future, if

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<sup>247</sup> Department of Agriculture (WA), *Annual Report of the Department of Agriculture for the Year Ended 30<sup>th</sup> June 1977*, Perth, The Dept, 1977, p. 5; and Department of Agriculture (WA), *Annual Report of the Department of Agriculture for the Year Ended 30<sup>th</sup> June 1981*, Perth, The Dept, 1981, p. 29.

<sup>248</sup> Farmers in Southern Cross, for instance, paid less than eighty per cent of the costs to deliver water to their properties. See Hollick, p. 67.

<sup>249</sup> Hollick, p. 67.

<sup>250</sup> 'Dry dilemma', *Western Farmer*, 2 October 1980, p. 4.

<sup>251</sup> B. Collis, 'Underground is the best prospect', *Western Farmer*, 21 April 1977, np; 'Majority of dams are ineffective', *Western Farmer*, 1 September 1977, p. 6; V. Carter, 'New dam sparks

underground water was not available, they provided no remedy for the immediate problem at hand: a severe shortfall of rain. As the drought wore on, the prospect of making the heavens open appeared very attractive. In July 1977 nearly two hundred farmers from Morawa and Perenjori formed the Northern Rainmakers Committee and were prepared to finance a cloudseeding operation if CSIRO could provide the equipment.<sup>252</sup> Reports of successful experimentation elsewhere in Australia and overseas gave these desperate farmers hope that their situations could improve. As CSIRO and the Federal and state governments were responsible for funding and conducting the cloudseeding missions in other states, the affected farmers naturally turned to the Court government for assistance in establishing their own program.

The unconvincing results of previous attempts to modify the region's weather made the state government and CSIRO particularly reluctant to support the farmers' efforts. Although the state government sympathised with their position, the idea of investing in an unproven technique for uncertain results was at odds with the growing influence of *laissez faire* principles among decision-makers. As a result, the Agriculture Minister Dick Old stressed the need for further research on local weather conditions before any action could be undertaken.<sup>253</sup> Neither CSIRO nor the Bureau of Meteorology wanted to be involved 'in a trial that was doomed from the start'.<sup>254</sup>

But as the dry wore on, the farmers of the northeastern wheatbelt persevered with their cause. In 1979, the Northern Rainmakers (now with over five hundred members) joined with Northampton's Elsewhere Rain Inducement Committee and other groups in nearby Dalwallinu and Mount Marshall to form the Western Australian Weather Research Association (WRA).<sup>255</sup> The Association managed to convince the government of the need for funding and with this assistance, it could afford to sponsor a cloud study of the northern wheatbelt by physicists at the Western Australian Institute of Technology.<sup>256</sup> The purpose of the three-year study (1980 to 1982) was to determine the nature of the local atmospheric conditions and to commence a cloudseeding program based on this information.<sup>257</sup> But the tests were inconclusive: the study found that although the northern wheatbelt region was probably suitable for cloudseeding, it

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interest', *Western Farmer*, 27 July 1978, p. 49; 'Another dam field day', *Western Farmer*, 17 August 1978, p. 23; and 'Boost for farm water', *Western Farmer*, 3 May 1979, p. 15.

<sup>252</sup> 'Morawa farmers chase the rain', *Western Farmer*, 14 July 1977, p. 1.

<sup>253</sup> Collis, 'It's rain...or bust', p. 6.

<sup>254</sup> Day, p. 383.

<sup>255</sup> Collis, 'It's rain ... or bust', p. 6.

<sup>256</sup> 'Rainmaking study to begin in WA', *Western Farmer*, 14 February 1980, p. 5.

<sup>257</sup> B. F. Ryan and W. D. King, 'A critical review of the Australian experience of cloud seeding', *Bulletin of the American Meteorological Society*, vol. 78, no. 2, 1997, pp. 245-46.

would be difficult to identify a noticeable increase in rainfall in the short term. As a result, a long-term commitment of funding would be necessary.<sup>258</sup> Yet this commitment would not eventuate. In late 1981, CSIRO announced the end of its cloudseeding program because it was no longer economically feasible.<sup>259</sup>

The inability of the Bureau of Meteorology to provide long-term or seasonal forecasts to southwest farmers was also a source of discontent. In July 1976, the *Western Farmer* began to publish the predictions of private weather forecaster, Lennox Walker – the successor to the controversial weather prophet, Inigo Jones.<sup>260</sup> The Bureau of Meteorology declined to comment on the accuracy and effectiveness of his forecasts, which he based on an analysis of sunspot activity and official meteorological data. Walker's forecasts appeared regularly in the rural press until the early 1980s but it is not clear whether farmers in the southwest paid heed to Walker's predictions. If they sought further information from Walker at his Crohamhurst Observatory in Queensland, they could subscribe to his service – at a price, of course. It is likely, however, that many farmers in southwest Western Australia considered Walker as reliable a guide to local conditions as the Bureau's forecasters in Melbourne – just another 'wise man' from the east.<sup>261</sup> Most farmers would remain dependent on their own local knowledge and the Bureau's short-term forecasts to help them avoid running out.

Many farmers in the southwest's agricultural areas at the end of the decade, therefore, found themselves having to take matters into their own hands. Economic constraints on the expansion of Big Water forced farmers to undertake the measures necessary to improve water and fodder conservation on their farms. Although the government provided some assistance for these projects, the onus was increasingly on farmers to reduce their vulnerability to running out. They could no longer rely on the

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<sup>258</sup> Ryan and King, p. 249. In a last ditch attempt to ameliorate the drought conditions, some farmers in Southern Cross invited a Tasmanian rainmaker to conduct an experiment in their area in mid-1983. Rains fell before the experiment could be undertaken and the plans were 'shelved'. See, John and Betty Williamson, interviewed by Bill Bunbury, 8 March 2008, National Library of Australia (hereafter NLA), TRC 5945/6.

<sup>259</sup> 'Cloud seeding seems feasible', *Western Farmer*, 7 January 1982, p. 8.

<sup>260</sup> Inigo Jones was a long-range weather forecaster in Queensland, who had been issuing forecasts independent of the Bureau of Meteorology since 1923. Although the Bureau dismissed his predictions, he attracted a devoted following, particularly among the farmers and graziers of New South Wales and Queensland. See, T. Sherratt, *Inigo Jones: the weather prophet*, Melbourne, Bureau of Meteorology, 2007; T. Sherratt, 'Recording the weather', in *Archives: discovery and exploration, Perth, Western Australia, 6-9 August 2008*, Australian Society of Archivists, <[http://www.naa.gov.au/Images/tim-sherratt\\_tcm16-35730.pdf](http://www.naa.gov.au/Images/tim-sherratt_tcm16-35730.pdf)>, (Accessed: 6 December 2011); and C. Strange, 'The personality of environmental prediction: Griffith Taylor as 'latter-day prophet'', *Historical Records of Australian Science*, vol. 21, 2010, p. 136.

<sup>261</sup> D. Anderson, 'Drought, endurance and "the way things were": the lived experience of climate and climate change in the Mallee', *Australian Humanities Review*, no. 45, 2005, pp. 77-78.

favour of paternalist governments. But self-reliance came at a cost: technical solutions to water shortage and climate variability, such as cloudseeding, required deep pockets at a time when many farmers were being crushed by the cost-price squeeze.<sup>262</sup> After decades of policies promoting the merits of closer settlement, Australian governments were recommending to farmers that they ‘get big or get out’.<sup>263</sup> Unless farmers could afford to improve their water supplies, they would remain vulnerable to running out.

### *Another Gigantic Folk Experiment*

Despite the economic difficulties facing the state’s agricultural industries and the dry seasons of the late 1970s, the state government announced in 1980 that it would release three million hectares of land in the Ravensthorpe area.<sup>264</sup> Laced with the rhetoric of country-mindedness, this new era of land release echoed the land settlement programs of earlier governments, especially under Premiers Sir John Forrest, Sir James Mitchell and Sir David Brand. Still in the 1980s the government believed that, ‘[Y]oung aspiring farmers [wanted] a chance to get into primary production without the need for big capital sums to buy an established property’.<sup>265</sup> Moreover, more country shires stood to benefit from a new era of land release.<sup>266</sup> Land releases would increase the local population and rating revenues; boost local industries and businesses; provide better fire and vermin control for neighbouring properties; and enable young farmers to acquire farms near their parents’ properties.

But the expansion of European settlement across the southwest region into areas with little or no meteorological information had been a bitter experience for many farmers, especially during the droughts of 1914 and 1940. Their livelihoods had been ‘gigantic folk experiments’, characterised by uncertainty, as they struggled to interpret the unfamiliar climatic patterns, soils, flora and fauna of the ‘new’ lands.<sup>267</sup> By the 1970s, however, some things were certain: soil erosion, salinity, poor seasons and the

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<sup>262</sup> M. Tonts, ‘Some recent trends in Australian regional economic development policy’, *Regional Studies*, vol. 33, 1999, p. 581.

<sup>263</sup> L. Arnold and B. Chatterton, ‘Future rural policies for Australia’, *Politics*, vol. 12, no. 1, 1977, p. 127.

<sup>264</sup> Beresford et al., p. 97; and K. Newbey, *Land use planning of the North Fitzgerald Area: initial ecological survey, interim report*, Perth, Author, 1982, p. 3.

<sup>265</sup> Cited in Beresford et al., p. 95.

<sup>266</sup> Beresford et al., pp. 94-95. According to Beresford et al., there had been a lull in land release during the 1970s due to the combination of low wool prices and the impact of wheat quotas, which had encouraged a policy of consolidation rather than expansion. See for instance, Shire of Dandaragan, *Submission to the Minister for Lands, re: release of vacant crown land for Agriculture*, Dandaragan, The Shire, 1981, p. 11.

<sup>267</sup> J. M. Powell, *An Historical Geography of Modern Australia: the restive fringe*, Cambridge, Cambridge University Press, 1988, p. 12.

cost-price squeeze had combined to make life difficult for those on the land. In addition, there were growing environmental anxieties that the earth's climate was changing, which could affect the viability of farming in the southwest. Nevertheless, the government forged ahead and opened the marginal lands in the south-eastern wheatbelt for settlement, thrusting another generation of farmers into yet another folk experiment, rendering them vulnerable to running out.

A series of severe climate events in the early 1970s had raised international scientific and political concerns that the earth's climate was changing. During 1972, for instance, drought afflicted the Sahel and the Ukraine, and the Indian Monsoon failed, which resulted in crop losses and world shortages of grain.<sup>268</sup> The publication of the Club of Rome's *Limits to Growth* that year had piqued Western anxieties about whether the earth could sustain the burgeoning global population. The international scientific response to these anxieties about the Earth's carrying capacity and the added pressures of a changing climate were naturally technocratic, focussing on predicting and monitoring climate variability. And Australia was no exception. In early 1975, the Whitlam Government commissioned the Australian Academy of Science to investigate whether the continent's climate was changing and whether such change could be predicted.<sup>269</sup> The Academy organised a group of Australian scientists representing a wide range of disciplines to collaborate on this investigation as a Committee on Climatic Change.<sup>270</sup>

The terms of reference for the Committee were to report on overseas research about changes in global climate and the extent to which these changes were human-caused; whether the climate of Australia was undergoing change; whether future change could be predicted; and to identify the consequences of these changes for agricultural production in Australia.<sup>271</sup> In its report, the Committee highlighted the relationship between human settlement patterns, agricultural production and climate variability. The greater use of lands of marginal rainfall would render these populations and their activities increasingly vulnerable to climate variability, regardless of long-term climate change.<sup>272</sup> For Australian conditions at least, the Committee noted, 'visions of vastly

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<sup>268</sup> W. O. Roberts, 'Climate change and the quality of life for the Earth's new millions', *Proceedings of the American Philosophical Society*, vol. 120, no. 3, 1976, pp. 230-32; and R. A. Morgan, 'Diagnosing the dry: historical case notes from southwest Western Australia, 1945-2007', *Osiris*, vol. 26, 2011, p. 96.

<sup>269</sup> Day, pp. 383-84.

<sup>270</sup> Australian Academy of Science Committee on Climatic Change, *Report of a Committee on Climatic Change*, Canberra, Australian Academy of Science, 1976 p. 76.

<sup>271</sup> Australian Academy of Science Committee on Climatic Change, p. 78.

<sup>272</sup> Australian Academy of Science Committee on Climatic Change, p. 10.



increased agricultural production are unrealistic'.<sup>273</sup> Regardless of climatic change, if this pattern was to continue, warned the Committee, 'the effects of climatic variability are likely to become progressively more serious, frequent and damaging'.<sup>274</sup>

Meanwhile, the Australian Branch of the Royal Meteorological Society had convened a conference titled 'Climatic Change and Variability: a southern perspective' at Monash University in Victoria. Many of the members of the Climatic Change Committee participated in this conference. One of the presentations assessed the possible implications of climatic change on Mediterranean agriculture in Western Australia.<sup>275</sup> In the paper, Bureau of Meteorology researcher Michael Coughlan speculated on the implications of a regional drying trend in the southwest, which he estimated had commenced prior to the First World War.<sup>276</sup> In the higher rainfall areas of the agricultural region, Coughlan expected that less winter rain could benefit farming as waterlogged soils restricted plant growth.<sup>277</sup> In the drier areas, however, lower rainfall would severely affect farming activities. He estimated that most of the area that was currently receiving less than 300mm rainfall 'would go out of agricultural production'.<sup>278</sup> Towns that stood to be affected included Southern Cross, Merredin, Salmon Gums, Kellerberrin, Hyden, Morawa and Mullewa. Over a thousand farms operated in this area, producing over twenty per cent of the state's wheat crop.<sup>279</sup> If Coughlan's observations were correct and the drying trend persisted, farmers on the eastern fringes of the agricultural areas were at risk of running out of water for cropping.

Geographer Joseph Gentilli, who had been consulted by the Committee on Climatic Change, was also concerned about the consequences of a changing climate for

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<sup>273</sup> Australian Academy of Science Committee on Climatic Change, p. 10.

<sup>274</sup> Australian Academy of Science Committee on Climatic Change, p. 23.

<sup>275</sup> M. J. Coughlan, 'Changes in Australian rainfall and temperatures', in A. B. Pittock et al. (eds), *Climatic change and variability: a southern perspective*, Melbourne, Cambridge University Press, 1978, p. 195. Coughlan notes that in Western Australia, there was insufficient data to identify a clear pattern for either rainfall or temperature. At the time of this conference, Coughlan was the only researcher at the Bureau of Meteorology working on the subject of climate change. The prevailing view of the Bureau was that there was insufficient climatic data from both Australia and the Southern Hemisphere to conclude that the Australian climate was changing. See, M. Coughlan, Letter to Perth Regional Office, Bureau of Meteorology, 30 May 1975, Climatic Change, PP956/1, 30/69, NAA(WA).

<sup>276</sup> According to local ornithologist, Dominic Serventy, his friend and colleague Joe Gentilli had observed a similar drying trend in the semi-arid fringe of the southwest. See, D. L. Serventy, 'The use of data on the distribution of birds to monitor climatic changes', *Emu*, vol. 77, 1977, pp. 163-64.

<sup>277</sup> G. W. Arnold and K. A. Galbraith, 'Case study one: climatic change and agriculture in Western Australia', in Pittock et al. (eds), *Climatic change and variability: a southern perspective*, pp. 297-98.

<sup>278</sup> Arnold and Galbraith, p. 298.

<sup>279</sup> Arnold and Galbraith, p. 298.

the agricultural production in the southwest.<sup>280</sup> In his 1972 book, *Australian Climate Patterns*, Gentilli had stressed the importance of analysing climates not only spatially, but also temporally in order to assess their variability over time. In light of this attention to climate change, Gentilli also qualified his earlier support for agricultural development in the southwest. He criticised the release of a ‘million acres a year’ on the margins of the wheatbelt on climatic grounds. He explained:

[T]hese were millions of acres of land with climates precariously balanced between aridity and semi-aridity, released for settlement after a period of increasing rainfall which had just brought their climate into the semi-arid category. Without any great climatic change, a simple return to the conditions of a few decades earlier may now have returned these lands to the margins of the arid region, where land utilisation in any form is more precarious, less effective and more expensive.<sup>281</sup>

This damning assessment of the state’s post-war agricultural policies, which Gentilli had once vigorously supported, suggests that he now considered many wheatbelt farmers had been betrayed and rendered vulnerable to running out.

The combination of these findings deeply concerned both the Department of Agriculture and the Metropolitan Water Board in Western Australia.<sup>282</sup> In fact, Coughlan noted, Western Australia was ‘the first region that’s shown sufficient interest’ in the issue of climatic change.<sup>283</sup> Despite Coughlan’s findings, however, the Bureau of Meteorology was reluctant to confirm any such change was underway. Their official position was that the ‘case is “not proven”’.<sup>284</sup> As Bob Southern, the Regional Director of the Bureau in Western Australia, explained to Noel Fitzpatrick, the Director of the Department of Agriculture in 1976, ‘My point is simply that the possible effects of long term climatic change are swamped by the realities of normal seasonal expectancy based on current data’.<sup>285</sup>

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<sup>280</sup> Australian Academy of Science Committee on Climatic Change, p. 80; and C. H. B. Priestley, Letter to J. Gentilli, Invitation to participate, Committee on Climatic Change, 5 June 1975, SI4G-960, Basser Library, Australian Academy of Science,

<sup>281</sup> Gentilli, *Australian Climate Patterns*, pp. 264-65.

<sup>282</sup> E. N. Fitzpatrick, Letter to Regional Director, Bureau of Meteorology (WA), 3 February 1976, Climatic Change, PP956/1, 30/69, NAA(WA). In the 1976/77 Annual Report of the Metropolitan Water Board, it notes that Meteorological Officers had assured the Board that the dry conditions of the 1970s ‘should not be interpreted as an indication of a change in climate’. See, MWSSD Board, *Annual Report for the Year Ended 30<sup>th</sup> June 1977*, Perth, MWSSD Board, 1977, p. 4.

<sup>283</sup> M. Coughlan, Letter to Perth Regional Office, Bureau of Meteorology, 30 May 1975, Climatic Change, PP956/1, 30/69, NAA(WA).

<sup>284</sup> Minutes, Climatic change discussion meeting, 13 February 1975, Climatic Change, SI4G-960, vol. 1, Basser Library, Australian Academy of Science.

<sup>285</sup> R. Southern, Letter to E. N. Fitzpatrick, 17 February 1976, Climatic Change, PP956/1, 30/69, NAA(WA).

Dry conditions alone, however, were not the sole cause of the Department of Agriculture's concerns; there were also growing anxieties about the financial viability of farms in marginal areas of the wheatbelt. Even before scientific and economic concerns over the viability of farming in marginal lands had been voiced, the Director of Agriculture Noel Fitzpatrick had conceded in 1973 that, more generally,

Recommendations have frequently been made against release of certain areas on grounds of infertility, erosion risk, salinity hazard, economic unviability and flood and waterlogging hazard. Unfortunately it is true that pressure for the release of land for agriculture has in the past resulted in the development of some areas which should have been kept virgin for one or more of the above reasons.<sup>286</sup>

A Commonwealth Inquiry into the 'New Land Farms' scheme had recently concluded that the release of land to farmers in the southeastern wheatbelt in the 1950s and 1960s had been 'poorly conceived and managed'.<sup>287</sup> For instance, the land was marginal in terms of both soil and climate; there had been little experience of farming in the area; and most applicants were inadequately prepared for farming under these circumstances.<sup>288</sup> The worsening economic pressures and poor seasonal conditions of the late 1970s only exacerbated their vulnerable position.

Yet it was lands nearby these struggling farms around Ravensthorpe that the state government planned to release for agricultural development. Despite the financial benefits that might accrue to local shires from such expansion, there was not unanimous support for the government's agenda. In addition to concerns about salinity, wind erosion and local flora and fauna, local and official anxieties about developing these areas centred on the lack of information about the region's climate and the prevailing drought conditions that were affecting farmers in the Esperance, Ravensthorpe and Jerramungup areas.<sup>289</sup> For instance, the Officer in Charge of the Jerramungup

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<sup>286</sup> E. N. Fitzpatrick, 1973, cited in Q. Beresford, 'Developmentalism and its environmental legacy: the Western Australia wheatbelt, 1900-1990s', *Australian Journal of Politics and History*, vol. 47, no. 3, 2001, pp. 413-14.

<sup>287</sup> Beresford, p. 407.

<sup>288</sup> Beresford, p. 407.

<sup>289</sup> K. Newbey, 'Land release errors', *Western Farmer*, 12 February 1981, p. 4; K. Newbey, 'Land release survey needed', *Western Farmer*, 7 April 1982, p. 4; 'Land release: do we really know enough?', *Western Farmer*, 15 April 1982, p. 44; M. Piggott, 'Land release: will we learn from past errors?', *Western Farmer*, 20 May 1982, p. 32; C. Bolt, 'Land releases condemned', *Western Farmer*, 22 July 1982, p. 8; C. Bolt, 'Salt, erosion claims over land releases', *Western Farmer*, 3 February 1983, p. 2; 'Wind storms lash south', *Western Farmer*, 10 February 1983, p. 1; 'Land release', *Western Farmer*, 30 March 1983, p. 4; 'Land release concern rises', *Western*

Agricultural District Office was reportedly ‘worried by the lack of real climatic data for his region’.<sup>290</sup>

So too were members of the Land Release Study Group. A handful of concerned individuals from the Esperance area had come together to put a stop to the government’s plans of agricultural expansion. Although there was a diversity of opinions within the group, the members together argued ‘for a fair and equitable appraisal of the land’.<sup>291</sup> Among them was Mount Barker farmer Ron Richards, who argued, ‘No adequate analysis of effective rainfall has been carried out. Sufficient records do not exist’.<sup>292</sup> Another member, Ongerup botanist Ken Newbey, agreed. He had conducted his own study of the area designated for land release using the daily records of a neighbouring farmer.<sup>293</sup> He also noted the scant nature of the meteorological record as well as the highly variable weather of the region, where Ongerup had recently recorded both its driest (1969) and wettest (1971) years.<sup>294</sup>

In late 1980, Newbey raised his concerns about the release of lands near Ravensthorpe with his local MLA, the Liberal Party’s Geoff Grewar. He reassured Newbey that, ‘A government which releases land for settlement in an area that would be extremely marginal would be irresponsible and I do not believe this Government, with all the advices available to it, would release land of doubtful viability’.<sup>295</sup> But Grewar had underestimated the sway that developmentalism continued to hold over the state Liberal government: the land release went ahead.<sup>296</sup> The subsequent Burke Labor government followed suit and provided the infrastructure around Ravensthorpe for settlement to get underway.<sup>297</sup> The expression of environmental anxieties from local farmers and government scientists about climate variability, salinity and the effects of land development on local ecologies, as well as the economic constraints on

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*Farmer*, 30 March 1983, p. 7; and ‘Land release plan criticised’, *Western Farmer*, 16 June 1983, p. 7. See also, Beresford et al, p. 101.

<sup>290</sup> M. Piggott, ‘Wind erosion widespread on sandplain’, *Western Farmer*, 1 October 1981, p. 45.

<sup>291</sup> K. Bradby, ‘Diversity or dust’, in P. Newman, S. Neville and L. Duxbury (eds), *Case Studies in Environmental Hope*, Perth, EPA, 1988, p. 101.

<sup>292</sup> C. Bolt, ‘Land release policy “dangerous”’, *Western Farmer*, 21 May 1981, p. 12.

<sup>293</sup> Newbey, *Land Use Planning*, p. 16. Newbey had familiarised himself with some climatological principles from the United States, where at least forty years of recording was ‘estimated to be necessary to obtain stable frequency distributions of rainfall on continents. See Newbey, pp. 6-7; and H. E. Landsberg and W. C. Jacobs, ‘Applied climatology’, in T. F. Malone (ed.), *Compendium of Meteorology*, Boston, American Meteorological Society, 1951, pp. 976-92.

<sup>294</sup> Newbey, *Land use planning*, pp. 6-7.

<sup>295</sup> G. Grewar, Letter to K. Newbey, 29 December 1980, Ken Newbey Collection, Correspondence, MN 2253, Acc. 6062A/15, Battye Library.

<sup>296</sup> Beresford et al., p. 118.

<sup>297</sup> Beresford et al., p. 118.

government expenditure, suggest that the development of the lands near Ravensthorpe put southwest farmers at risk of running out.

### *Conclusion*

For the suburbs, this Age of Anxiety had been an age of water restrictions – an age of inconvenience. The growing influence of economic rationalism on water management in Western Australia led to the introduction of user pays as a means to curtail water consumption and delay the development of expensive water supplies. In comparison to the challenges faced by rural people, however, these were mere interruptions to daily life for the expansion of Big Water had insulated the people of Perth from the severity of dry conditions.

The droughts of the 1970s spared few of the wheatbelt's farmers. The poor seasons prompted a reconsideration of the southwest's reputation as a region of reliable rainfall. Furthermore, it was no longer economically viable to further expand Big Water in the agricultural areas. Farmers would have to fend for themselves to a much greater extent than before. With government assistance, farmers were expected to undertake measures to improve their private water and fodder conservation in order to reduce their vulnerability to climate variability and water scarcity. For many farmers, these additional responsibilities came at a time when they faced growing economic pressures in the 1970s. Still the lure of country-mindedness remained strong in Western Australia: despite environmental anxieties about climate variability and ecological degradation, the state government persevered with its plans to release lands near Ravensthorpe. As George Seddon has suggested, '[A] tempting response to a decline in prosperity is to squeeze the environment harder'.<sup>298</sup> But it could only be squeezed so much.

The expansion of Big Water in the suburbs was not without cost. Preventing Perth from running out put strain on the Swan Coastal Plain's wetlands and diminished their resilience to climate variability and water scarcity. The significance of these areas to the region's Aboriginal people had also gone unnoticed by ecologists and water managers. Moreover, the Aboriginal people of the southwest remained marginalised from 'conventional' Western Australian society as a consequence of a discriminatory sanitary order reinforced by assimilationist housing policies.

Much to their chagrin, farmers also had to make way for the expansion of Big Water for the suburbs as the government imposed policies to protect the quality of water

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<sup>298</sup> Seddon, p. 55.

catchments and groundwater sources. Although groundwater had saved Perth's gardens, in doing so it supported their profligate water culture. Nevertheless, when restrictions were lifted in 1979, Perth households maintained a significantly reduced level of scheme water consumption into the 1980s. But the ongoing reliance of many suburban gardens on unfettered bore use suggests that the people of Perth were still wedded to a vision of endless water supplies and had not improved their hydroresilience.

**Precaution and Prediction:  
Economic rationalism, ecologically sustainable development and  
environmental change in the risk society (1983 to 2001)**

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*Expansion and development is a powerful hegemonic ethos in Australia generally, and in WA in particular. This should not mean, however, that development is allowed to proceed regardless of its impact on the physical and social environment. This would endanger the very lifestyle the state's development has facilitated.<sup>1</sup>*

- Ian Alexander, 1988

In the final decades of the twentieth century, there was growing concern in Western nations that humankind, through its commitment to industrial development, had fostered the conditions for its own downfall. The corollary of progress was that the world was being rendered vulnerable to natural hazards and environmental problems that threatened to undermine the human race. Urgent action would be required to prevent this decline from spiralling out of control. During the 1980s and 1990s, suburban and rural Western Australians would become increasingly aware of the toll that unchecked development had taken on their state's natural environment, particularly the 'inseparable trinity' of the forest, soil and water resources of the southwest.<sup>2</sup> Logging, land clearing and soil degradation, while significant problems in and of themselves, were also affecting the quality of the region's water supplies, which the dry 1970s had already been shown to be limited. Scientists identified a drying trend in the region (Appendix V), which some attributed to the atmospheric effects of global greenhouse gas emissions. As the state's population ticked over the one million mark, this growth and the sprawling suburbs of Perth placed additional pressures on the southwest's water supplies. These threats to the quality and quantity of the southwest's water resources posed both environmental and economic challenges to the region, and helped to feed Western Australians' environmental anxieties about their future.

Many of the environmental problems facing Western Australians in the 1980s and 1990s spanned space and time; defied 'established rules of causality, blame and

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<sup>1</sup> I. Alexander, 'Western Australia: the resource state', *Australian Geographer*, vol. 19, no. 1, 1988, p. 128.

<sup>2</sup> L. Robin, *Building a Forest Conscience: an historical portrait of the Natural Resources Conservation League of Victoria*, Springvale South, Natural Resources Conservation League of Victoria, 1991, p. 23.

liability'; and '[could not] be compensated or insured against'.<sup>3</sup> These were what Anthony Giddens terms 'manufactured risks' – risks produced by the 'very progression of human development, especially by the progression of science and technology'.<sup>4</sup> The scale and complexity of such environmental problems, Giddens has argued, fed a growing disenchantment with modernisation, which posed unprecedented challenges to traditional technocratic decision-making institutions.<sup>5</sup> Such critique or 'reflexive modernisation', argued sociologists like Ulrich Beck and Giddens in the 1990s, was characteristic of a transition from an industrial society to the local and global 'risk society', whereby the global ecological crisis was perceived as 'a profound institutional crisis of industrial society itself'.<sup>6</sup> These elements of the risk society had already begun to emerge in the southwest, as evidenced in the formation of the Land Release Study Group in the late 1970s to campaign against further agricultural development in the Esperance area. Questioning the established order was, therefore, a result of reaping what previous generations had sown; a product of being rendered vulnerable to disaster.

This reflexivity creates a difficult situation for the technocratic state, not least for its scientific role in disaster prevention. On the one hand, applications of science and technology for economic development are blamed for manufacturing risks; while on the other, scientific research is deemed necessary to identify and address these risks.<sup>7</sup> These tensions strain the relationship between scientific experts and a lay public. Furthermore, these tensions can diminish trust in the very institutions on which societies depend for their protection against harm.<sup>8</sup> This undermining of scientific authority is detrimental to a society increasingly preoccupied with the future and reliant on science and its institutions for information and guidance.<sup>9</sup> Dependent on technocratic solutions but untrusting of experts, citizens are left vulnerable to manufactured risks. The ecological

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<sup>3</sup> U. Beck, 'Risk society and the provident state', in S. Lash, B. Szeryzniski and B. Wynne (eds), *Risk, Environment and Modernity: towards a new ecology*, London, Sage Publications, 1996, p. 31.

<sup>4</sup> A. Giddens and C. Pierson, *Conversations with Anthony Giddens: making sense of modernity*, Palo Alto, Stanford University Press, 1998, p. 210. In the Western Australian case, however, this assessment should be qualified as science and technology has played a somewhat ambivalent role in the state's progress: sometimes facilitating development and sometimes cautioning (though perhaps ineffectively) against it.

<sup>5</sup> U. Beck, *Risk Society: towards a new modernity*, London, Sage, 1992, p. 20.

<sup>6</sup> Beck, 'Risk society and the provident state', p. 32; U. Beck, 'Preface', in U. Beck, A. Giddens and S. Lash (eds), *Reflexive Modernisation: politics, tradition and aesthetics in the modern social order*, Cambridge, Polity Press, 1994, p. 8; and Giddens and Pierson, p. 214.

<sup>7</sup> F. Fisher, *Citizens, Experts and the Environment: the politics of local knowledge*, Durham, Duke University Press, 2000, p. 53.

<sup>8</sup> Fisher, pp. 4, 63; and B. Wynne, 'May the sheep safely graze?', in Lash, Szeryzniski and Wynne (eds), *Risk, Environment and Modernity*, pp. 47-55.

<sup>9</sup> Giddens and Pierson, p. 209; and Fisher, p. 53.



problems facing Western Australians in the southwest in the 1980s and 1990s were no exception.

In this chapter, I explore how Western Australians understood and responded to the immediate and prospective threats to the quality and quantity of the water resources of the southwest region, in the context of the emerging conditions of the risk society, as well as growing ecological awareness and the influence of economic rationalism on public policy. Technocratic measures remained the primary means to diagnose, predict and prevent these threats, with an unprecedented emphasis on forward planning as a means by which to forestall the development and impact of environmental problems.<sup>10</sup> Nevertheless, some Western Australians had become sceptical of the capacity of government institutions to adequately undertake these duties.

The development of additional supplies went some way to alleviate anxieties about water scarcity, but in contrast to earlier periods, Big Water's suburban and rural consumers were being conditioned to accept significant responsibility for the strain on water supplies and to change their behaviours, if not their lifestyles, to require less water. Despite the apparent gains in social and political justice for the Aboriginal people of the southwest, many remained on the fringes of society. Finally, I examine how debates about global climate change affected technocratic responses to the prospect of a drying climate in the southwest.

### *Salt water*

By the early 1980s, Western Australian land and water managers in the southwest realised that water scarcity was not only a question of quantity, but also one of quality. The run of dry years in the late 1970s (Appendix V) had exposed the vulnerability of the region's water resources as the lack of rain had increased the salinity of rivers and dams.<sup>11</sup> Bans on the further clearing of native vegetation in the catchment areas of the Mundaring Weir, Warren River, Kent River and Denmark Rivers at this time had been the first official acknowledgement of the relationship between land degradation and water quality. But it was too little, too late. By the mid-1980s, national hydrological studies revealed that Western Australia bore the undesirable distinction of having the largest proportion of surface water classified as marginal, brackish and saline in the

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<sup>10</sup> J. M. Powell, *Watering the Western Third: water, land and community in Western Australia, 1826-1998*, Perth, Water and Rivers Commission, 1998, p. 64.

<sup>11</sup> Select Committee on Salinity, *Report on Salinity in Western Australia: discussion paper*, Perth, The Committee, 1988, pp. 20.

country.<sup>12</sup> By reducing the availability of the region's potable water supplies, nearly a century of land clearing had diminished the resilience of the southwest's water resources to running out.

The problems of dryland and stream salinity presented quite different challenges to the southwest's water resources than the more familiar nemesis of drought. Environmental degradation hazards like salinity are, as hazards scholar Douglas Paton argues, 'insidious, incremental, possibly irreversible, have a diffusion pattern across the landscape, and possess a long life expectancy'.<sup>13</sup> As such, salinity represents the kind of 'manufactured risk' that sociologists associated with the risk society in the 1990s. Although primary salinity is a natural feature of the southwest environment, where salt has accumulated over thousands of years, secondary salinity is a product of the region's agricultural development during the twentieth century. The large-scale clearing of native vegetation across the southwest and its replacement with shallow-rooted crops and pasture dramatically transformed the hydrology of the region.<sup>14</sup> The crops and pasture did not use as much water as the deep-rooted vegetation it had replaced, which allowed water to pool as groundwater across the relatively flat lands of the wheatbelt. As the watertable rose, it brought to the surface the tons of salt that had amassed underground, which was detrimental for many native plants and other salt-intolerant species, including most crops and pastures. In addition to these effects on vegetation, evaporation of the saline groundwater at the surface damaged the soil and, as it drained away over time, degraded the quality of the region's waterways as well as farm water supplies.<sup>15</sup>

Although the State government had taken action to prevent further deterioration of the region's water supplies in the late 1970s, there had been an awareness of the relationship between landclearing and salinity some fifty years earlier.<sup>16</sup> In a paper read before the Royal Society of Western Australia in 1924, W. E. Wood of the Railway Department had argued that, '[I]t is generally recognised that our streams increase in salinity after the native vegetation is destroyed', which he attributed to a rising

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<sup>12</sup> K. Webster, 'Water resources', in R. T. Appleyard (ed.), *Western Australia into the twenty first century: economic perspectives*, Perth, St George Books, 1991, pp. 330-31.

<sup>13</sup> D. Paton, G. Kelly and M. Doherty, 'Exploring the complexity of social and ecological resilience to hazards', in D. Paton and D. Johnston (eds), *Disaster Resilience: an integrated approach*, Springfield, Charles C Thomas, 2006, pp. 196-97.

<sup>14</sup> State Salinity Council, *The Salinity Strategy: Natural Resource Management in Australia*, Perth, Government of Western Australia, 2000, pp. 14-15, cited in Q. Beresford et al., *The Salinity Crisis: landscapes, communities and politics*, 2<sup>nd</sup> ed., Nedlands, UWA Press, 2004, pp. 6-7.

<sup>15</sup> State Salinity Council, *The Salinity Strategy*, cited in Beresford et al., pp. 6-7.

<sup>16</sup> Beresford et al., pp. 45-50.

watertable.<sup>17</sup> But the allure of agricultural development had muted the repeated calls of government scientists to limit landclearing in the southwest, and thus deepened the vulnerability of Western Australians to climate variability and water scarcity.<sup>18</sup> The ongoing denial of the theory linking land clearing to salinity was later reinforced by poor equipment, which failed to detect rising salinity in the Wellington catchment in the 1960s.<sup>19</sup> Hydrologist Keith Bartlett recalled that, '[T]he quality of the gauging stations back then was so poor' that the deterioration of the water quality had gone undetected.<sup>20</sup> The degradation of the Wellington catchment exposed the brittle state of the dam's engineered resilience. Furthermore, its deterioration revealed the vulnerability of Big Water to running out.

One of the remedies that the nation's land and water managers prescribed for restoring salt-affected soils and waterways was extensive tree-planting or reforestation.<sup>21</sup> Trees and salt-tolerant shrubs, they hoped, would utilise some of the excess water and help to lower the watertable. Such programs, however, were beyond the means of many farmers in the salt-affected areas of the southwest. An increasing emphasis on 'efficient' agriculture since the 1970s, declining terms of trade and high input costs had locked Australian farmers in a cost-price squeeze. Consequently, many were not financially able to implement changes to their farming methods that might reduce land degradation on their properties. Instead they had to continue 'mining' the land to avoid further financial difficulties.<sup>22</sup> As Perenjori farmer Bernie Kuhne rued in the early 1980s, 'I've still got a plough and I can't afford to work my land any other way. I know I'm putting my soil at risk by beating the hell out of it but I wouldn't do it if I didn't have to'.<sup>23</sup>

The process of reforestation also proved challenging for Big Water. In the late 1970s, the Public Works Department had commenced extensive tree-planting in the

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<sup>17</sup> W. E. Wood, 'Increase of salt in soil and streams following the destruction of the native vegetation', *Journal of the Royal Society of Western Australia*, vol. 10, no. 7, 1924, pp. 39, 41.

<sup>18</sup> G. Bolton, *Spoils and Spoilers: a history of Australians shaping their environment*, 2<sup>nd</sup> ed., Sydney, Allen and Unwin, 1992, p. 138; and A. Gaynor 'Looking forward, looking back: toward an environmental history of salinity and erosion in the eastern wheatbelt of Western Australia', in A. Gaynor, M. Trinca and A. Haebich (eds), *Country: visions of land and people in Western Australia*, Perth, Western Australia Museum, 2002, p. 106.

<sup>19</sup> B. Sadler and W. Cox, *Water Resources Management: the socio-political context*, Paris, UNESCO, 1986, p. 18.

<sup>20</sup> K. Bartlett, cited in B. Bunbury, *Till the Stream Runs Dry: a history of hydrography in Western Australia*, Perth, Dept of Water, p. 71.

<sup>21</sup> N. Barr and J. Cary, *Greening a Brown Land: the Australian search for sustainable land use*, South Melbourne, Macmillan, 1992, pp. 65-73.

<sup>22</sup> Gaynor, p. 119.

<sup>23</sup> B. Kuhne, cited in 'Drought means more than just water losses', *Western Farmer*, 23 February 1984, p. 47.

catchment of Wellington Dam to arrest the deterioration of its water supplies and to rehabilitate the area.<sup>24</sup> Such catchment management strategies were unusual in Australia at this time, where engineers still tended to oversee the management and delivery of water supplies.<sup>25</sup> But it was taking too long for results to materialise and some engineers feared that the water quality might never sufficiently improve to supply potable water to the Great Southern Towns Water Supply Scheme.<sup>26</sup> A new dam, they argued, would produce much quicker results. This aspect of the engineering solution was especially appealing to the new Water Authority of Western Australia, which was more commercially-oriented than its predecessor, the Public Works Department (PWD), and placed greater emphasis on processes of cost-benefit analysis.<sup>27</sup> The merger of the rural water supply branch of the PWD and the Metropolitan Water Board in 1985 formed the Water Authority, which took control of the public water supplies across the state. In contrast to the PWD, the Water Authority was responsible for setting the charges for water to the consumer as well as the management and protection of the state's water resources.<sup>28</sup> After several years of political wrangling over the cost and location of the new dam, the Burke government announced it would construct the Harris Dam north of Collie in June 1987.<sup>29</sup> The new dam would reticulate the Great Southern Towns, while irrigators in the Collie catchment would continue to draw water from the Wellington Dam as scientists considered the saline supplies would not affect the fertility of their

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<sup>24</sup> Reforestation had been undertaken at Mundaring Weir in the early twentieth century to curb the salinisation of the catchment. See, R. George, D. McFarlane and R. Nulsen, 'Salinity threatens the viability of agriculture and ecosystems in Western Australia', *Hydrogeology Journal*, vol. 5, no. 1, 1997, p. 7.

<sup>25</sup> I. C. Loh, 'Appendix 1: the History of Catchment and Reservoir Management on Wellington Reservoir Catchment W.A.', in P. Laut and B. J. Taplin (eds), *Catchment Management in Australia in the 1980s*, Canberra, CSIRO Division of Water Resources, 1989, p. 219.

<sup>26</sup> Specifically, the reforestation scheme was faced with the difficulties of land acquisition, subdivision and the practical forestry issues of tree establishment and management. Engineers did not expect the salinity of the catchment to reduce significantly until the mid to late 1990s. See, Loh, pp. 218-19.

<sup>27</sup> Loh, p. 219.

<sup>28</sup> G. J. Syme and B. E. Nancarrow, 'Overcoming water scarcity in Perth, Western Australia', in R. Q. Grafton and K. Hussey (eds), *Water Resources, Planning and Management*, Melbourne, Cambridge University Press, 2011, p. 358; and A. T. Laws, 'Restructuring the water industry in Western Australia to better manage the state's resources', in *Hydrogeology and Land Use Management: Proceedings of the 29<sup>th</sup> Congress of the International Association of Hydrogeologists*, Bratislava, International Association of Hydrogeologists, 1999, p. 18.

<sup>29</sup> Water Authority of Western Australia (WAWA), *Annual Report For the Year Ended June 30 1987*, Perth, WAWA, 1987, p. 29. The idea to build a dam on the Harris River had been flagged since at least the 1960s. See, Young and Young, Letter to Ernie Bridge, 17 June 1986, Wellington Dam Catchment Area, Cons 7303, 10A15003/O, State Records Office of Western Australia (hereafter, SROWA).

pastures. The ongoing use of water from Wellington Dam would do little, however, to ameliorate the salinity of their lands, of which over thirty per cent was salt-affected.<sup>30</sup>

The problem of salinity would continue to plague land and water managers in the southwest into the 1990s. The deterioration of the quality of water supplies from Wellington Dam had been a wake-up call to the government and water managers that salinity was an urgent problem in the southwest but the construction of the Harris Dam ensured that consumers dependent on these reticulated supplies would not go without. Meanwhile, many farmers facing salinity problems on their properties lacked the means to remedy the situation, leaving themselves even more vulnerable to the scarcity of useful water in the future.

### *Different strokes*

The dry winters of the mid-1980s brought to the southeastern agricultural areas their lowest rains since the drought of 1969 and reduced Perth's dams to their lowest levels since the parched late 1970s.<sup>31</sup> Winds completely bared some districts as soil erosion took its toll across the wheatbelt, and local water supplies reached critically low levels.<sup>32</sup> Meanwhile, residents of the western suburb of Floreat watched in alarm as the 'centrepiece of their green and pleasant suburb, Perry Lakes, dr[ie]d to a couple of puddles'.<sup>33</sup> Across the southwest, Big Water urged its consumers to reduce their water use. Consumption was restricted in some country towns, while irrigators experimented with new methods to cope with the dry conditions.<sup>34</sup> Farmers in areas that had been declared 'drought affected' and 'water deficient' were provided with financial assistance, transport subsidies and access to emergency water supplies.

In this section I examine the contrasting rural and suburban responses to the episodes of climate variability and water scarcity in the mid to late 1980s. As the state government's program of drought relief was proving increasingly costly to maintain, the

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<sup>30</sup> R. George, 'Environmental effects of past and possible future public irrigated agriculture in the region', in G. J. Luke et al. (eds), *Background Papers to Water Authority of Western Australia's South-West Irrigation District Strategy Study*, South Perth, Dept of Agriculture, 1991, p. 41.

<sup>31</sup> 'Nine shires declared in drought', *Western Farmer*, 2 February 1984, p. 6; 'Perenjori farmers seek aid on loans', *Western Farmer*, 9 February 1984, p. 3; WAWA, *Annual Report for the Year Ended 30<sup>th</sup> June 1986*, Perth, WAWA, 1986, np; and WAWA *Annual Report for the Year Ended 30<sup>th</sup> June 1988*, Perth, WAWA, 1988, np.

<sup>32</sup> J. Kronborg, 'Dustbowl danger in south', *Western Farmer*, 18 February 1988, p. 3; L. Schofield, '\$20m blown away as drought intensifies', *Western Farmer*, 17 March 1988; and J. Kronborg, 'Dry slashes crops in Great Southern', *Western Farmer*, 9 July 1988, p. 5.

<sup>33</sup> D. Britton, 'Wetlands under threat', *West Australian*, 14 February 1987, p. 31.

<sup>34</sup> WAWA, *Annual Report*, 1986, np; WAWA, *Annual Report for the Year Ended 30<sup>th</sup> June 1987*, Perth, WAWA, 1987, np; and WAWA, *Annual Report*, 1988, p. 29.

government continued to encourage farmers to improve their own water supplies. Yet many farmers lacked the resources to undertake such improvements, leaving them vulnerable to the inevitable recurrence of dry conditions. Meanwhile, the efforts of Big Water to maintain the illusion of endless water supplies increased the dependency of the suburbs on the groundwater reserves of the Swan Coastal Plain and undermined the long-term resilience of these sources to climate variability and contamination.

Dry seasons affected many farmers during the 1980s, particularly in the north-eastern wheatbelt and the Great Southern, and the state government undertook relief measures to assist them during these difficult times of drought and rural downturn.<sup>35</sup> But the state government could not sustain this expenditure.<sup>36</sup> A large proportion of state government expenditure was on line-haulage – the transport of water to a central place for farmers to access.<sup>37</sup> Already the federal government had begun to flag to the states that it would reduce its contributions to assistance and that it expected state authorities to foot a larger percentage of the bill.<sup>38</sup> In response, the Western Australian government embarked on a study of farm water supplies in the agricultural areas of the southwest to determine the extent to which farmers were prepared for the effects of dry spells.<sup>39</sup> This study found that across the wheatbelt, ‘Farms generally appear to have insufficient capital invested in water supply’.<sup>40</sup> Some of the least adequate water supplies were found in the southern and south-eastern wheatbelt – those areas that had only been recently settled in the last phase of land release in the late 1970s. Salinity had also rendered many otherwise satisfactory sites for farm dams unusable.<sup>41</sup>

The state government embarked on a program to remedy these problems of farm water supplies. In the north-eastern wheatbelt, where it was difficult to establish supplies due to low rainfall, high evaporation, saline groundwater, and prevailing soil

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<sup>35</sup> J. Grill, *Western Australia: drought and water supply relief in the agricultural districts – 1987/88*, Perth, Dept of Agriculture, 1987; and R. Mills, ‘Rural communities fighting for survival’, *Western Farmer*, 8 June 1989, p. 7.

<sup>36</sup> D. A. Wilhite, ‘Drought policy in the US and Australia: a comparative analysis’, *Water Resources Bulletin: American Water Resources Association*, vol. 22, no. 3, 1986, p. 432.

<sup>37</sup> Farm Water Strategy Group, *Western Australian Farm Water Plan Interim Report, March 1994*, Perth, Group, 1994, p. 12.

<sup>38</sup> ‘Big drought aid bill’, *Western Farmer*, 23 January 1986, p. 3; and ‘States to pay more for future droughts’, *Western Farmer*, 11 July 1985, p. 3. In 1989, the Commonwealth government removed drought relief from the National Disaster Relief Arrangements, forcing the state government to devise alternative arrangements. See, N. Coles et al., ‘Farm water planning strategies for dryland agricultural areas: local and regional perspectives’, in *10th World Water Congress: Water – the World’s Most Important Resource*, Melbourne, International Water Resources Association, 2000, p. 390.

<sup>39</sup> I. A. F. Laing, R. G. Pepper and A. F. McCrea, *Problem districts for On-Farm Water Supply in South Western Australia*, Perth, Dept of Agriculture, 1988.

<sup>40</sup> Laing, Pepper and McCrea, p. 20.

<sup>41</sup> Laing, Pepper and McCrea, p. 3.

conditions, the government connected towns to the existing Goldfields and Agricultural Water Supply Scheme (Figure 5.1).<sup>42</sup> This region was an exception to the government's increasingly 'economically rational' outlook because there were no other alternatives to reticulated water.<sup>43</sup> In other areas like the southern districts, the government provided cash incentives to farmers to undertake improvements to their own supplies through the installation of more farm dams and roaded catchments.<sup>44</sup> In line with its emerging neoliberal perspective, the government provided a relatively low level of assistance for farmers to undertake these changes.<sup>45</sup> Many simply could not afford the investment in the difficult economic times of the late 1980s.

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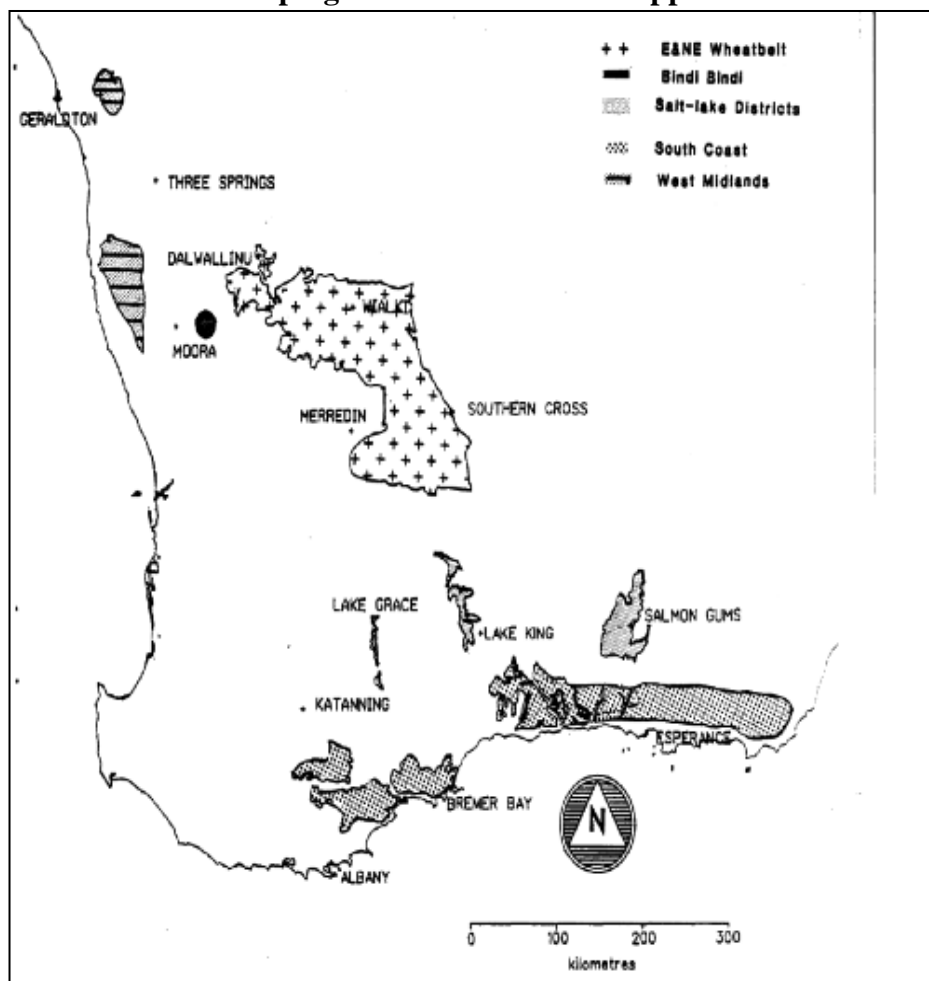
<sup>42</sup> 'Goldfields water scheme extended', *Western Farmer*, 22 September 1988, p. 19. Some examples from the late 1980s included Koonkoobing to Arnolds Extension and Beacon Rock to North Clearly in Mt Marshall; Mount Walker in the Yilgarn; and Warralakin in Koorda. See, S. Murphy-White, *Farm Water for the North-Eastern and Eastern Wheatbelt of Western Australia*, Merredin, Dept of Agriculture, 2007, p. 38.

<sup>43</sup> S. T. Smith, 'A logical approach to water resource utilisation in the wheatbelt', in *Wheatbelt Water Supply Seminar, Muresk Agricultural College, Northam, Perth*, Water Research Foundation of Australia (WA), 1977, p. 2.

<sup>44</sup> 'Cash incentives to boost farm water', *Western Farmer*, 17 November 1988, p. 2.

<sup>45</sup> Farm Water Strategy Group, p. 45.

**Fig 5.1: Areas the Department of Agriculture identified (according to soil type) as facing the greatest difficulty in developing reliable farm water supplies<sup>46</sup>**



The lack of winter rain in the late 1980s was also taking its toll on the dams in the Darling Ranges, which were providing about seventy per cent of the southwest's scheme water supplies.<sup>47</sup> To supplement the dams, Big Water had become increasingly reliant upon the groundwater reserves beneath the Swan Coastal Plain, particularly in the northern suburbs (Appendix IV).<sup>48</sup> But if the drying wetlands around Wanneroo were any indication of the health of these sources, their engineered resilience was already under strain (Figure 5.2).<sup>49</sup> As the population of Perth passed one million, the prevailing dry conditions exposed the vulnerability of the growing metropolis to water scarcity. The heightened significance of groundwater to Big Water in the late 1980s

<sup>46</sup> Laing, Pepper and McCrea, p. 13.

<sup>47</sup> G. Mauger, *Planning Future Sources for Perth's Water Supply, 1989 Revision*, Perth, Water Authority of WA, 1989, p. 16.

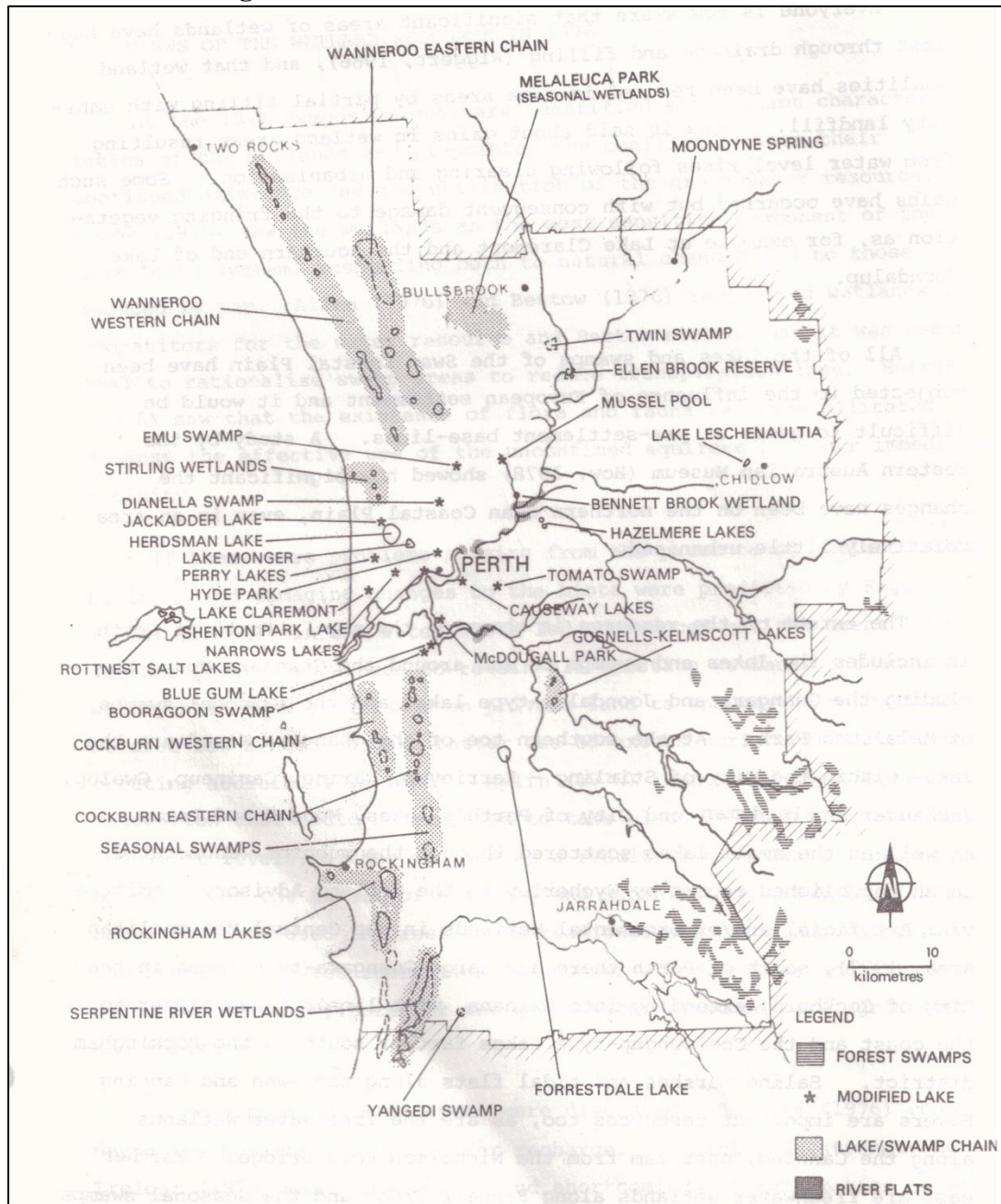
<sup>48</sup> B. J. Fleay, 'Land planning: the water utility viewpoint', in G. Lowe (ed.), *Swan Coastal Plain Groundwater Management Conference Proceedings*, Leederville, WA Water Resources Council, 1989, p. 69.

<sup>49</sup> B. Marwick, 'Lakes dry up as you draw water', *Wanneroo Times*, 20 May 1986, p. 11; B. Marwick, 'Where have all the lakes gone?', *Wanneroo Times*, 20 May 1986, p. 9.



combined with the growing ecological awareness among many Western Australians to spark public debates about the sustainable management of the Swan Coastal Plain's land and water resources.

**Fig. 5.2: Wetlands of the Swan Coastal Plain<sup>50</sup>**



By the late 1980s, ecologists estimated that up to eighty per cent of the original wetlands of the Swan Coastal Plain had been drained or filled.<sup>51</sup> The remaining wetlands were not only at risk of drying out but also of contamination and pollution,

<sup>50</sup> J. M. Arnold and C. S. Sanders, 'Wetlands of the Swan Coastal Plain', in B. R. Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, Perth, Water Research Foundation of Australia (WA), 1981, p. 84.

<sup>51</sup> Government of Western Australia, *State of the Environment Report*, Perth, Government of WA, 1992, p. 107.

which would have severe consequences for local ecosystems. For instance, in 1984, a large toxic algal bloom in Thomsons and Forrestdale Lakes near Jandakot (Fig. 5.2) had poisoned many migratory birds.<sup>52</sup> Led by physicist Phil Jennings, the Wetlands Conservation Society formed in early 1985. Many of its sixty foundation members were ‘veterans’ of the Farrington Road dispute the previous year, during which they had tried to protect North Lake from development. Their sense of purpose was bolstered by the visit of biologist Paul Ehrlich to Perth in late 1985, when he lectured at Murdoch University on the subject of ‘Extinction: the implications of the loss of our biological heritage’.<sup>53</sup> The Society aimed to monitor development activities in wetland areas, particularly in the southern suburbs; register wetlands as regional parks; rehabilitate damaged wetlands; and develop recreational and educational facilities.<sup>54</sup> To carry out these aims, the Society developed strong links with the Conservation Council of Western Australia (est. 1967) as well as the Royal Australasian Ornithologists Union (est. 1901).<sup>55</sup>

In response to such public concerns about the effects of private and public groundwater abstraction on the watertable the state government initiated several studies to devise strategies to manage these underground reserves.<sup>56</sup> These studies highlighted the need to ensure water supplies for a growing population, and the protection of all water resources, while noting the high and increasing per capita water consumption of the people of Perth. These studies also revealed that bores in some suburbs were producing increasingly saline water and that environmental constraints on the use of shallow groundwater were necessary.<sup>57</sup> Using the greater powers of the recently proclaimed *Environmental Protection Act* 1986, the Environmental Protection

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<sup>52</sup> P. Jennings, ‘A decade of wetland conservation in Western Australia’, in R. Giblett and H. Webb (eds), *Western Australian Wetlands*, Perth, Black Swan Press, 1996, p. 154.

<sup>53</sup> *Wetlands Conservation Society Newsletter*, October, 1985, np; and P. R. Ehrlich, *Third Keith Roby Memorial Lecture in Community Science*, Perth, Murdoch University, 2 October 1985.

<sup>54</sup> *Wetlands Conservation Society Newsletter*, February, 1986, np.

<sup>55</sup> *Wetlands Conservation Society Newsletter*, March, 1985, np.

<sup>56</sup> In 1985 the state’s Water Resources Council commissioned the Research Group for Groundwater Management under Malcolm Hollick to undertake a study of the social, environmental, legal and economic aspects of groundwater management on the Swan Coastal Plain, with a particular focus on the Jandakot area. This study was followed by a review of Perth’s major planning strategy, the *Corridor Plan*, which had been adopted in 1970. Finally, the state government initiated the Perth Urban Water Balance Study. See, J. Singleton, ‘The Metropolitan Region Planning Review and groundwater resource considerations’, in Lowe (ed.), *Swan Coastal Plain Groundwater Management Conference Proceedings*, p. 41; and K. C. Webster, ‘Groundwater management on the Swan Coastal Plain: an overview’, in Lowe (ed.), *Swan Coastal Plain Groundwater Management Conference Proceedings*, p. 26.

<sup>57</sup> S. J. Appleyard, W. A. Davidson and D. P. Commander, ‘The effects of urban development on the utilisation of groundwater resources in Perth, Western Australia’, in J. Chilton (ed.), *Groundwater in the Urban Environment: selected city profiles*, Rotterdam, A. A. Balkema, 1999, p. 100; and P. Raftos, ‘Study shows problems’, *Weekly Advertiser*, 28 September 1987, p. 6

Authority set limits on Big Water's groundwater abstraction to protect significant groundwater-dependent ecosystems, such as wetlands and caves.<sup>58</sup> Furthermore, the government recognised the potential for conflict between land use and groundwater protection, which required greater coordination of catchment planning.<sup>59</sup>

This consideration of water resources in urban planning and of the need for the protection of wetlands and waterways reflected the growing influence of Integrated Catchment Management (ICM) in the southwest. Although ICM was not formally adopted by the state government until 1988, its emphases on the resolution of land and water degradation problems through the coordination of different agencies and greater public involvement were already evident in nascent efforts to address secondary salinity and groundwater protection in the region.<sup>60</sup> The development of ICM in Western Australia reflected international trends towards an 'ecosystem approach' or 'integrated water management' in the 1980s and 1990s.<sup>61</sup> These approaches were later endorsed at the International Conference on Water and Environment in early 1992, which led into the Earth Summit in Rio de Janeiro later that year.

Such strategies relied heavily then on the rise of the 'sustainability sciences', which serviced the notion of 'sustainable development'.<sup>62</sup> The 1987 report of the World Commission on Environment and Development had redefined the very concept of development. Economic development was to be 'sustainable' so as to limit environmental damage, while ensuring environmental and intergenerational justice.<sup>63</sup> The report, argues Libby Robin, explicitly linked science to facilitating 'practical outcomes for development'.<sup>64</sup> Among the sciences marshalled for sustainable development would be the 'crisis disciplines', such as conservation biology, addressing issues where scientists and decisionmakers must 'act before knowing all the facts'.<sup>65</sup> In this way, crisis disciplines share characteristics of 'post-normal' science. In contrast to other strains of scientific inquiry such as applied or pure research, post-normal science 'encompasses the management of irreducible uncertainties in knowledge and its ethics,

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<sup>58</sup> Appleyard, Davidson and Commander, 1997, p. 100.

<sup>59</sup> Webster, p. 26.

<sup>60</sup> B. Mitchell and M. Hollick, 'Integrated Catchment Management in Western Australia: transition from concept to implementation', *Environmental Management*, vol. 17, no. 6, 1993, p. 735.

<sup>61</sup> Mitchell and Hollick, p. 742.

<sup>62</sup> L. Robin, *How a Continent Created a Nation*, Sydney, UNSW Press, 2007, p. 152.

<sup>63</sup> Robin, *How a Continent Created a Nation*, p. 152.

<sup>64</sup> L. Robin, 'New science for sustainability in an ancient land', in S. Soerlin and P. Warde (eds), *Nature's End: history and the environment*, New York, Palgrave Macmillan, 2009, p. 192.

<sup>65</sup> M. Soulé, 1985, cited in Robin, *How a Continent Created a Nation*, p. 152.

and the recognition of different legitimate perspectives and ways of knowing'.<sup>66</sup> Scientific inquiry in these disciplines required constant adaptation to adapt to changing circumstances – an experience that local zoologist Bert Main likened to his training as an aircraft navigator in the 1940s: 'The potential for the worst case scenario to eventuate was always present and was only avoided by a continuous series of decisions ... [to ensure] arrival at the designated time'.<sup>67</sup>

Meanwhile, local environmentalists were not convinced that Big Water or the state's Environmental Protection Authority would adequately protect the groundwater reserves and wetlands of the Swan Coastal Plain. The Conservation Council of Western Australia, for instance, roundly criticised the Hollick Report for its 'narrow perspective dominated by economic rationalism' and failure to guide the management of the 'whole ecosystem on a sustainable basis'.<sup>68</sup> Likewise, the Wetlands Conservation Society argued that the report 'flies in the face of the overwhelming public support for the maintenance of healthy wetlands ... and is contrary to the State Conservation Strategy (especially to the principle of sustainable development)'.<sup>69</sup> Furthermore, argued members of the Society, such 'risk analysis is fraught with imperfections as evidenced by the Alaskan oil spill and the Chernobyl disaster'.<sup>70</sup> Such scepticism of scientific authority and expertise reflected the extent to which the characteristics of a 'risk society' were evident in Perth by this time.<sup>71</sup> Critics did not trust the local authorities to protect the wetlands or to manage the city's groundwater reserves sustainably. They feared that the thirst for groundwater would leave the wetlands vulnerable to running out.

Their scepticism proved to be well-founded. In 1989 the State Planning Commission announced its plans to build some 4,000 homes on the Jandakot Mound as part of the East Thomsons Lake development. According to the Banjup Action Group, which formed in response to the announcement, the massive drainage required for the urban development would drain large amounts of water from the Mound, pollute

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<sup>66</sup> S. O. Funtowicz and J. R. Ravetz, 'Science for the post-normal age', *Futures*, vol. 25, no. 7, 1993, p. 754.

<sup>67</sup> A. R. Main, 'How much biodiversity is enough?', *Agroforestry Systems*, vol. 45, 1999, p. 23.

<sup>68</sup> R. Siewert, Letter to G. Lowe, WAWRC Water Management and Use Committee, 22 June 1989, WA Water Resources Council, Cons 6197, 1986/048 v3, SROWA.

<sup>69</sup> N. Godfrey, Letter to G. Lowe, WAWRC Water Management and Use Committee, 25 July 1989, WA Water Resources Council, Cons 6197, 1986/048 v3, SROWA.

<sup>70</sup> Wetlands Preservation Society, Report, 'Hollick Report Proposes Wholesale Destruction of Wetlands', 1989, WAWRC Water Management and Use Committee, Cons 6197, 1986/048 v3, SROWA.

<sup>71</sup> A. Giddens, 'Living in a post-traditional society', in Beck, Giddens and Lash (eds), *Reflexive Modernisation: politics, tradition and aesthetics in the modern social order*, pp. 87-88.

groundwater reserves, and affect local flora and fauna.<sup>72</sup> Amid claims that the government pressured the Environmental Protection Authority to approve the housing development, the Conservation Council took legal action to force the Minister for the Environment to release the Authority's report on the project.<sup>73</sup> It then mounted a strong campaign for statutory protection of the Jandakot Mound. Reflecting on the episode in 1991, environmentalist Barbara Churchward mused, 'With the state government trying to recoup millions lost by WA Inc., it is hardly surprising that the prospect of fast-tracking development of non-renewable resources is appealing'.<sup>74</sup> It was not until 1998 that the Court Liberal government (1993-2001) took steps to protect the area from further development.<sup>75</sup>

By the end of the 1980s, concerns about the 'environment' had grown from a special interest of the urban, educated, middle class to the general public.<sup>76</sup> Australian environmentalism, which had crystallised over wilderness issues such as saving the Little Desert and Lake Pedder from developers, now appealed to a wider audience, who were concerned about 'ecological risks' to their lifestyles.<sup>77</sup> The *West Australian*, for instance, observed in 1987 that, '[J]udging by recent public protests at intrusions into the wetlands, WA's lakes and swamps mean a lot to people – both as sanctuaries for wildlife and as pleasant places for leisure activities. No one wants to have a picnic beside a dried-up mudhole'.<sup>78</sup> This shift in mainstream attitudes, argue sociologists Jan Pakulski and Steve Crook, was consolidated by the end of the decade, in the midst of growing media coverage of pollution and ecological 'disasters', such as the *Exxon Valdez* oil spill.<sup>79</sup> But sustainable development was a complex process. As the *West*

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<sup>72</sup> 'The fight is on to save rural retreat', *Canning/Melville Times*, 11 April 1989, p. 7; M. Godby, 'Jandakot Water Mound', 6WN, 10 April 1989, 7pm (Transcript); D. Warnock, 'Banjup Action Group', 6WF, 10 April 1989, 8.30am (Transcript); J. Newman and N. Poh, 'Proposed Jandakot housing development', TVW7, 9 April 1989, 6pm (Transcript); and C. Manly, 'Experts warn on Jandakot', *Sunday Times*, 9 April 1989, p. 23.

<sup>73</sup> *Wetlands Conservation Society Newsletter*, June, 1989, np.

<sup>74</sup> B. Churchward, 'A conservationist's view', in R. Hughes (ed.), *Reflections on 20 Years*, Perth, EPA, 1991, p. 41. The term 'WA Inc.' refers to a series of scandals that dominated Western Australian politics in the early 1990s, which related to the conduct of the Labor government and its relations with business interests. See, B. Stone, 'Accountability reform in Australia: the WA Inc Royal Commission in context', *Australian Quarterly*, vol. 65, no. 2, 1993, pp. 17-30.

<sup>75</sup> *Wetlands Conservation Society Newsletter*, June, 1994, np; and P. Jennings, 'Good news from Jandakot', *Greener Times*, July, 1998, p. 9.

<sup>76</sup> D. Hutton and L. Connors, *A History of the Australian Environment Movement*, Melbourne, Cambridge University Press, 1999, pp. 165-240; and J. Pakulski and B. Tranter, 'Environmentalism and social differentiation: a paper in memory of Steve Crook', *Journal of Sociology*, vol. 40, no. 2, 2004, pp. 225-26.

<sup>77</sup> Pakulski and Tranter, p. 225.

<sup>78</sup> D. Britton, 'Wetlands under threat', *West Australian*, 14 February 1987, p. 31.

<sup>79</sup> J. Pakulski and S. Crook, 'Introduction: the end of the green cultural revolution?' in J. Pakulski and S. Crook (eds), *Ebbing of the Green Tide? Environmentalism, public opinion and the media in Australia*, Hobart, University of Tasmania, 1998, p. 9; and Pakulski and Tranter, p. 225.

*Australian* continued, ‘The trouble is that people want lakes, they want an abundant and cheap public water supply, and a significant number also want green, well-watered gardens fed by private bores. It may, in the end, become a question of the community deciding on its priorities’.<sup>80</sup> The continued support of backyard bores by the state government would sustain the disconnect between domestic water consumption and outside ‘nature’, serving to perpetuate the profligate water culture that the people of Perth enjoyed.

Although the significance of these wetlands sites to local Aboriginal people did not appear to feature in these discussions, greater efforts were being made to undertake heritage studies of these areas. Studies examined the significance of such sites as Lake Claremont or ‘Butler’s Swamp’, Perry Lakes in Floreat, Jolimont Swamp, Lake Monger, Hyde Park, Dogswamp, and Lake Gnangara (Figure 5.2).<sup>81</sup> Many local Aboriginal people lamented that there would have been a far greater amount of information available had the surveys been conducted earlier.<sup>82</sup> This research suggested a belated realisation that the *Aboriginal Heritage Act* was relevant to the protection of areas in the southwest, not just the more ‘traditionally oriented regions’ of the state.<sup>83</sup> These studies also reflected the growing movement towards improving social and political justice for Aboriginal people in the 1980s and early 1990s, as demonstrated by such processes as the Seaman Inquiry, the Swan River Brewery dispute, and the recognition of native title. Despite these advances, however, the absence of Aboriginal concerns in debates about wetlands and groundwater during this period reflects the prevailing lack of awareness of Aboriginal heritage issues in the wider community at this time.<sup>84</sup>

### ***Dry horizons***

These dry years of the mid to late 1980s coincided with the emergence of the enhanced greenhouse effect on the Australian political agenda. Local water managers feared these conditions were indicative of a changing climate, which would have severe consequences for Big Water if they were to continue. The well-publicised Villach

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<sup>80</sup> D. Britton, ‘Wetlands under threat’, *West Australian*, 14 February 1987, p. 31.

<sup>81</sup> R. O’Connor, C. Bodney and L. Little, *Preliminary Report on the Survey of Aboriginal Areas of Significance in the Perth Metropolitan and Murray River Regions*, East Perth, Heritage Council of WA, 1985, pp. 13-20, 25-35, 38-39.

<sup>82</sup> O’Connor, Bodney and Little, p. 3.

<sup>83</sup> O’Connor, Bodney and Little, p. 3.

<sup>84</sup> D. Ritter, ‘Trashing heritage: dilemmas of rights and power in the operation of Western Australia’s Aboriginal heritage legislation’, *Studies in WA History*, vol. 23, 2003, p. 208.

meetings of the mid-1980s had alerted them to the possibility that decision-makers could no longer rely on ‘the assumption that past climatic data without modification are a reliable guide to the future’.<sup>85</sup> These findings prompted local water managers to wonder how long the dry years might continue. When would they abate? Would rainfall return to ‘normal’? In this section, I compare the responses of Western Australian water managers and lay people to the prospect of drier conditions in the southwest in the late 1980s. I argue that these responses conformed to a technocratic approach, whereby the responsibility for predicting and preparing for climate change was abrogated to government scientists, which would do little to improve the hydroresilience of Western Australians.

The developing climate change agenda of the mid-1980s prompted the CSIRO and the federal Labor government to convene the Greenhouse87 conference at Monash University in late 1987. By this time, the increasing scientific and political concern about anthropogenic climate change and its likely impacts had begun to seriously challenge conventional approaches to environmental and resource management. Greenhouse87 was the first national meeting of scientists and resource managers to discuss the potential socioeconomic and environmental effects of anthropogenic climate change for Australia. The basis of these discussions was a CSIRO climate scenario for the year 2030 ‘based on information from general circulation models, studies of past climatic records, palaeoclimatic data and arguments concerning the nature of the general circulation (of the atmosphere)’.<sup>86</sup> The concentration of carbon dioxide in the atmosphere was expected to have doubled by 2030. The resulting changes in the atmospheric circulations would, according to the model, cause a decline in the rainfall of the southwest.<sup>87</sup>

With less frequent rainfall and higher temperatures, this scenario depicted a significantly drier and warmer future for the southwest in the twenty-first century.<sup>88</sup> What made this prospect particularly alarming was that the southwest region had a

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<sup>85</sup> In 1985, a joint United Nations Environment Program, World Meteorological Organisation and International Council of Scientific Unions meeting was held in the Austrian town of Villach to discuss the relationship between greenhouse gases and global temperatures. See, World Meteorological Organization *Report of the International Conference on the Assessment of the Role of Carbon Dioxide and of Other Greenhouse Gases in Climate Variations and Associated Impacts*, Villach, Austria, 9–15 October 1985, <<http://www.icsu-scope.org/downloadpubs/scope29/statement.html>>, (Accessed: 13 May 2011).

<sup>86</sup> G. Pearman, ‘Preface’, in G. Pearman (ed.), *Greenhouse, Planning for Climate Change*, Collingwood, CSIRO Publications, 1988, p. x.

<sup>87</sup> A. B. Pittock, ‘Actual and anticipated changes in Australia’s climate’, in Pearman (ed.), *Greenhouse*, p. 42.

<sup>88</sup> Pittock, p. 43.

reputation for having the most ‘consistent and reliable’ rainfall in Australia.<sup>89</sup> According to the CSIRO’s scenario, the southwest’s future climate might be less suitable for the region’s prevailing land practices and water management. Although this was not the first time that the declining rainfall of the southwest had been linked to the enhanced greenhouse effect, Greenhouse87 marked a turning point in the way that Big Water’s engineers planned for the future.<sup>90</sup>

The Water Authority suspected that the expected drop in rainfall might have already commenced in about 1970 and that it would continue into the middle of the twenty-first century.<sup>91</sup> Such a climate change would lead to a twenty per cent reduction in rainfall and an even greater decline (over forty per cent) in the average streamflow of the region’s rivers, due to the relationship between the soils, climate and vegetation in catchment areas.<sup>92</sup> With lower rainfall and streamflow, demand for scheme water would exceed supplies more quickly than anticipated.<sup>93</sup> This new line of thinking suggested that water supplies could be insufficient by as early as 2020, rather than lasting until nearly 2040. Other sources for Big Water would have to be found and demand for water would have to be curtailed as soon as possible.<sup>94</sup>

Although Western Australian water managers were not the first to consider the challenges that climate change posed to existing water supply networks, they faced a unique situation where the predictions were remarkably similar to the climatic conditions the southwest had actually experienced since the 1970s.<sup>95</sup> In these circumstances, the urgency of preparing a strategy to protect the southwest’s water supplies in the face of anthropogenic climate change was far greater than in other regions at the time. Thus the Water Authority was among the first in the world to respond to climate change on the basis of an observable decline in rainfall. Nevertheless, it was not an easy or straightforward decision for Big Water to adjust to

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<sup>89</sup> B. C. Bates and G. Hughes, ‘Adaptation measures for metropolitan water supply for Perth, WA’, in F. Ludwig et al. (eds), *Climate Change Adaptation in the Water Sector*, London, Earthscan, 2009, p. 197.

<sup>90</sup> For example, Australian Academy of Science *Report of a Committee on Climatic Change*, Canberra, Australian Academy of Science, 1976; A. B. Pittock, ‘Recent climatic change in Australia, implications for a CO<sub>2</sub>-warmed Earth’, *Climatic Change*, vol. 5, 1983, pp. 321–340; and R. G. Chittleborough, *Planning to Meet Climatic Change*, Perth, Department of Conservation and Environment, 1986.

<sup>91</sup> B. Sadler, R. Stokes and G. Mauger, ‘The water resource implications of a drying climate in southwest Western Australia’, in Pearman (ed.), *Greenhouse*, p. 299.

<sup>92</sup> Sadler, Stokes and Mauger, pp. 299–300.

<sup>93</sup> Sadler, Stokes and Mauger, p. 305.

<sup>94</sup> Sadler, Stokes and Mauger, p. 305.

<sup>95</sup> I have explored these ideas at length in R. A. Morgan, ‘Dry horizons: the responses of Western Australian water managers to the enhanced greenhouse effect in the late 1980s’, *History Australia*, vol. 8, no. 3, 2011, pp. 158-76.



this greenhouse scenario. Engineers faced the challenge of recommending significant planning decisions to Government ministers under conditions of scientific uncertainty and political scepticism, a state of affairs redolent of Giddens' observation of the risk society, where 'the future becomes ever more absorbing, but at the same time opaque'.<sup>96</sup>

As scientific and political interest in the enhanced greenhouse effect grew in the latter half of the 1980s, so too did doubts over the veracity of global warming claims, particularly in the United States. Some Western Australians shared similar concerns. For the state's resource-based economy, the problem of anthropogenic climate change was (and remains) a double-edged sword. The state Labor government's progressive approaches to tackling the issue, such as committing to a reduction of greenhouse gas emissions by twenty per cent by the year 2000 (based on 1988 figures) and undertaking the first comprehensive greenhouse gas audit in Australia, potentially threatened the fortunes of the mining industry – the foundation of the state's economic prosperity.<sup>97</sup> Furthermore, some sections of the state government were sceptical of CSIRO research on the relationship between the enhanced greenhouse effect and climatic change.<sup>98</sup> Big Water's engineers were faced, therefore, with uncertainty not only in terms of the implications of climate change for the water resources of the southwest, but also in terms of political opinion regarding the state's role in mitigating global warming.

In addition, scientists were themselves uncertain about the accuracy of the predictions of climate models, an uncertainty that remains an issue for climate modellers today. At the Greenhouse87 Conference, for instance, convenor Graeme Pearman, the Chief of the CSIRO's Division of Atmospheric Science, was reluctant for resource managers to base their planning decisions on the very tentative Greenhouse87 scenario.<sup>99</sup> The process of climate change prediction gave rise to a 'cascade of uncertainty', whereby 'the uncertainty contained in projections of global change combines with uncertainties in projections of regional change, with both propagating through to impact assessments'.<sup>100</sup> Climate models also lacked the detail to reveal likely

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<sup>96</sup> Giddens and Pierson, p. 211.

<sup>97</sup> For instance, in the early 1990s, minerals and petroleum accounted for over 60 per cent of the state's exports and about 90 per cent of the state's electricity was generated from coal. See N. Blake and L. Stocker, 'Greenhouse gas audit for Western Australia', *Sustainable Development*, vol. 2, no. 2, 1994, pp. 21, 23.

<sup>98</sup> Office of Minister for Resources, Note to W. Carr, Department of Industrial Development, 12 December 1989, Cons 6639, 1989/153 v01, SROWA.

<sup>99</sup> Pearman, p. x.

<sup>100</sup> R. Jones, 'Managing uncertainty in climate change projections: issues for impact assessment', *Climatic Change*, vol. 45, 2000, pp. 404–406.

changes at the regional scale or to simulate the hydrological cycle.<sup>101</sup> As a result, scientists were unable to definitively assess the impact of the enhanced greenhouse effect on regional rainfall patterns and streamflows.<sup>102</sup> These uncertainties were the basis for criticism within the Western Australian policymaking community about the use of general circulation models for the state's water planning.<sup>103</sup> For many critics, the field of climate modelling was simply not at the stage where models could responsibly guide resource managers.

In spite of this scepticism, the lower rainfall levels since the 1970s suggested to water managers that the Greenhouse87 scenario was not far from the realms of fantasy. Its coincidence with two winters of below average rainfall in the southwest fed their anxieties that dry conditions could continue.<sup>104</sup> Furthermore, a failure to act on the prediction of a drier future would have severe consequences if these conditions materialised. If the Water Authority invested in infrastructure for lower winter rainfall but the predictions were not fulfilled, the consequences would be less disastrous than if they had invested for higher winter rainfall or 'business as usual' but received less. Regardless of the scepticism among policymakers, Big Water would have to expand to avoid running out.

The greenhouse effect undermined one of the very basic assumptions of water management, that of stationarity.<sup>105</sup> The principle of stationarity provides the foundation for planning, designing and operating water infrastructure such as dams and irrigation systems.<sup>106</sup> It assumes that neither the prevailing extent of climatic variability nor the relationships between the major climatic variables, such as rainfall and temperature, will

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<sup>101</sup> P. H. Gleick, 'Methods for evaluating the regional hydrologic impacts of global climatic changes', *Journal of Hydrology*, vol. 88, no. 1-2, 1986, pp. 97–116; and A. B. Pittock, 'The greenhouse effect, regional climate change and Australian agriculture', in *Agronomy in a Mediterranean Environment: Proceedings of the 5<sup>th</sup> Agronomy Conference*, 24 to 29 September, 1989, Perth, Western Australia, Australian Institute of Agricultural Science, <<http://www.regional.org.au/au/asa/1989/plenary/greenhouse-effect/p-01.htm#TopOfPage>>, (Accessed: 13 May 2011).

<sup>102</sup> N. Matalas, 'Stochastic hydrology in the context of climate change', *Climatic Change*, vol. 37, 1997, p. 98.

<sup>103</sup> B. J. O'Brien, *The Greenhouse Effect and the Death of Mark Twain*, Perth, Eco Ethics, 1994, p. 9.

<sup>104</sup> WAWA, *Annual Report*, 1987, p. 27.

<sup>105</sup> Although anthropogenic climate change has challenged this assumption for some time, it was only in 2008 that researchers at the US Geological Survey announced 'stationarity is dead'. See C. Milly, et al., 'Stationarity is dead: whither water management', *Science*, vol. 319, 2008, pp. 573–574. Bates and Hughes suggest that water scarcity in other Australian regions has also cast doubt over the idea of stationarity. These include: the driest decade on record for the city of Melbourne; a long period of low flows in the River Murray; and ongoing water restrictions in urban and rural areas across the country. See Bates and Hughes, 'Adaptation measures for metropolitan water supply for Perth', p. 194.

<sup>106</sup> R. Jones and C. Brooke, *Adapting Australia's Water Resources to a Changing Climate*, Melbourne, CSIRO, 2005, p. 3.

change.<sup>107</sup> Implicit in this assumption is a prediction for the future: that the prevailing climatic conditions will continue indefinitely.<sup>108</sup> This was a comforting prospect for water managers who had to contend with a host of other variables, such as demand and water quality, which *could* change. Yet neither the drying trend since the 1970s nor the Greenhouse87 scenario reflected a stable, static, predictable climate. Instead, the water managers saw that the southwest's climate could be vary in novel ways, with no guarantee that future climatic conditions would reflect those of the past. They could no longer rely on the historical record alone to inform their planning for the future.

The Greenhouse87 prediction of a drier future thus led local water managers, led by WAWA hydrologist Brian Sadler, to reconsider the trends and fluctuations of rainfall and streamflow within the data set.<sup>109</sup> Until the late 1980s, their planning had considered the entire meteorological record in the southwest region. But wetter conditions in the earlier half of the twentieth century had obscured the below average rainfall that had prevailed since the drought of 1969. Restricting the historical record to the more recent past gave Sadler and his colleagues what they believed to be a more realistic view of the future, given their new expectation of drier greenhouse conditions. Excluding the statistics from the wet 1930s and 1940s reduced the amount of water expected to flow into Big Water's dams by about 13 per cent. This calculation therefore produced a vision of the past that was more congruent with the possibility of a drier southwest.<sup>110</sup> No longer were the run of dry years from the 1970s only temporary. Instead water managers believed that these parched conditions were permanent and worsening as part of a broader trend of a changing global climate.

The Greenhouse87 scenario encouraged Big Water to accelerate the development of other water supplies, as reductions to demand alone would not suffice if the dry run of years continued into the 1990s. After much deliberation, the Water Authority chose a dam site south of Perth on the North Dandalup river in preference to sites situated further north.<sup>111</sup> This decision took into account the prediction that rain-

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<sup>107</sup> Milly et al., p. 573.

<sup>108</sup> Commonwealth Dept of the Arts, Sport and the Environment *Impact of Climate Change: Hydrology and Water Resources, Australia*, Canberra, AGPS, 1992, p. vi.

<sup>109</sup> F. Ludwig, 'Using seasonal climate forecasts for water management', in Ludwig et al. (eds), *Climate Change Adaptation in the Water Sector*, p. 80.

<sup>110</sup> The system yield is the maximum demand that the water supply system can sustain under specific expectation of restrictions. See Mauger, *Planning Future Sources for Perth's Water Supply*, p. 30.

<sup>111</sup> G. Hughes, 'Meeting the challenge of climate variability in a major water supply system', *Water Science and Technology: Water Supply*, vol. 3, no. 3, 2003, p. 202.

bearing systems would shift further south under enhanced global warming conditions.<sup>112</sup> In addition, the river had already been ‘developed’ for Big Water with the construction of a pipehead dam in the 1970s.<sup>113</sup>

Western Australians were invited to learn more about the future of their state at ‘the biggest conference on the Greenhouse Effect ever held in the world’, the national Greenhouse88 conference at the Perth Superdrome in November 1988.<sup>114</sup> Several hundred people attended Greenhouse88 in Perth and there was extensive coverage of the meeting in the local press. In addition to the growing ecological awareness among Australians during the 1980s, the close association (in the public eye) of the enhanced greenhouse effect with the problem of ozone depletion might have accounted for this public interest.<sup>115</sup> Earlier that year, the Canadian government had hosted a conference on ‘The Changing Atmosphere’ in Toronto.<sup>116</sup> Although there had been no official government representation, the conference delegates had declared a ‘Call to Action’ for developed countries to reduce their emissions of carbon dioxide to 1988 levels by the year 2000.<sup>117</sup> This conference, as well as the discovery of the stratospheric ‘ozone hole’ and the publication of the Brundtland Report stirred public concern for the global environment.<sup>118</sup> Soon after, the World Meteorological Organisation and the United Nations Environment Program joined forces to establish the Intergovernmental Panel on Climatic Change.

Local media coverage on the predicted consequences of the greenhouse effect focused particularly on the prospect of rising sea levels and the repercussions for coastal and riverside properties.<sup>119</sup> The local press reported that the greenhouse effect could cause flooding along the rivers and estuaries of the state, and could inundate riverside

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<sup>112</sup> Hughes, ‘Meeting the challenge of climate variability’, p. 202. The WAWA also commenced studies exploring the use of silviculture for water production, that is, the thinning of forests in catchment areas to increase streamflow. As the results of these experiments were not yet certain, forest thinning was not yet included in the long-term planning for future sources. See Mauger, *Planning Future Sources for Perth’s Water Supply*, p. 32.

<sup>113</sup> L. Schofield, ‘North Dandalup’s river runs dry’, *Western Farmer*, 10 March 1988, p. 26.

<sup>114</sup> ‘WA part of atmosphere seminar’, *South Western Times*, 20 October 1988, p. 37.

<sup>115</sup> A. Henderson-Sellers, ‘Australian public perception of the greenhouse issue’, *Climatic Change*, vol. 17, no. 1, 1990, pp. 78, 91. Sheldon Ungar reports similar findings in the United States, see S. Ungar, ‘Bringing the issue back in: comparing the marketability of the ozone hole and global warming’, *Social Problems*, vol. 45, no. 4, 1998, p. 515.

<sup>116</sup> H. Bulkeley, ‘The formation of Australian climate change policy: 1985-1995’, in A. Gillespie and W. C. G. Burns (eds), *Climate Change in the South Pacific: impacts and responses in Australia, New Zealand and small island states*, Boston, Kluwer, 2000, p. 37.

<sup>117</sup> Bulkeley, p. 37.

<sup>118</sup> D. Bodansky, ‘The history of the global climate change regime’, in U. Luterbacher and F. Sprinz (eds), *International Relations and Global Climate Change*, Boston, MIT Press, 2001, p. 23.

<sup>119</sup> ‘A change in our weather’, *Western Farmer*, 27 October 1988, p. 6.

developments.<sup>120</sup> These predictions coincided with growing public debates about coastal planning and development issues in Perth. These debates had focused on the environmental impact of development projects on the fragile coastline and whether plans for a marina and beachside high-rise accommodation should proceed.<sup>121</sup> Meanwhile, as drought conditions persisted in the rural areas of the southwest, opinion in the region's farming community was divided over the greenhouse effect. Some believed it was already underway, citing the poor rains over the last decade as evidence, while others disagreed, attributing the run of bad seasons to a natural climate cycle.<sup>122</sup>

Local and national conservation groups seized the opportunity to call on the state and federal governments to reduce fossil fuels and improve energy efficiency to limit climate change.<sup>123</sup> Like its counterparts in New South Wales and Victoria, the Western Australian government publicly adopted the Toronto target for 'planning purposes'.<sup>124</sup> The Commonwealth government followed soon afterwards and established a national climate change program to coordinate research.<sup>125</sup> Despite this early enthusiasm, the Commonwealth signaled its pragmatic approach to the international climate change policy process and warned that attempts to meet such targets would not come at a cost to the national economy.<sup>126</sup>

Amidst political and scientific debate about the greenhouse effect, another vision of the future emerged. In the late 1980s, Labor politician Ernie Bridge – the first Aboriginal to become a cabinet minister in Western Australia – began to champion his idea to pipe water from the Fitzroy River in the state's northwest to Perth.<sup>127</sup> The catchment of the Fitzroy River extends from Halls Creek in the East Kimberley to Derby in the West Kimberley, covering some 85,000 square kilometres of ecologically

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<sup>120</sup> K. Majer, 'Greenhouse effect', *Chronicle*, 13 June 1989, p. 4; W. Evans, 'Greenhouse threat to foreshore', *Southern Gazette*, 20 June 1989, p. 1; 'Watery worry for flood fringe', *Times*, 20 June 1989, p. 7; 'Will you be flooded?', *Midland Reporter*, 27 June 1989, p. 1; and 'Greenhouse may benefit the Swan', *Fremantle Gazette*, 11 July 1989, np.

<sup>121</sup> D. M. Fenton and G. J. Syme, 'Perception and evaluation of the coastal zone: implications for coastal zone planning', *Coastal Management*, vol. 17, 1989, pp. 295-308.

<sup>122</sup> 'Farmers keep watch', *Western Farmer*, 5 November 1987, p. 14.

<sup>123</sup> A. Harris, 'Greenies unite on climate threat', *West Australian*, 3 November 1988, p. 32; and K. Acott, 'Groups join on greenhouse effect', *West Australian*, 7 November 1988, p. 12. These groups included the Australian Conservation Foundation, the Conservation Council of Western Australia, The People for Nuclear Disarmament, Community Aid Abroad, and the Australian Federation of Consumer Organisations.

<sup>124</sup> C. Hamilton, *Running from the Storm: the development of climate change policy in Australia*, Sydney, UNSW Press, 2001, pp. 31-32.

<sup>125</sup> Bulkeley, p. 38.

<sup>126</sup> Bulkeley, p. 38.

<sup>127</sup> 'Two options for water next century', *Great Southern Herald*, 11 January 1989, p. 6; and 'Pipeline a realistic option: Bridge', *Geraldton Guardian*, 5 January 1989, p. 3.

diverse country – the same country in which Bridge had been born.<sup>128</sup> Echoing earlier schemes to water the inland and to make the deserts bloom, Bridge argued that the pipeline would encourage closer settlement and irrigable agriculture north of Geraldton, and that it would drought-proof the southwest well into the twenty-first century.<sup>129</sup> The pipeline could also help to lower greenhouse gas emissions because it would allow trees to grow in the arid inland of Western Australia.<sup>130</sup>

In contrast to a similar proposal that Western Mining Corporation had made to the Court government over a decade earlier, Bridge's idea captured the hearts and minds of many Western Australians and even some Federal Labor politicians.<sup>131</sup> Although critics pilloried the plan, the Premier, Dr Carmen Lawrence, invested in several studies to determine its technical and financial feasibility.<sup>132</sup> These studies concluded that while technically possible, the pipeline was simply too costly. Nevertheless, Bridge continued to campaign for his pipeline into the twenty-first century.

Part of the appeal of Bridge's ambitious project was that it allayed long-held anxieties about the 'empty' or 'under-utilised' regions north of the Tropic of Capricorn. According to economist Bruce Davidson, who first critiqued these ideas in his 1965 book *The Northern Myth*, the political appeal of developing Australia's north was manifold: it would deter invasion from Asia; it would utilise the region's 'valuable resources' to provide food for Australians and the world's starving masses; and it would

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<sup>128</sup> S. Toussaint, 'For whom the Fitzroy River flows: a fluctuating analysis of social and environmental sustainability and incremental sovereignty', in D. Ghosh, H. Goodall and S. H. Donald (eds), *Water, Sovereignty and Borders in Asia*, Hoboken, Routledge, 2008, p. 176.

<sup>129</sup> Schemes such as those advocated by J. J. C. Bradfield and Ion Idriess in 1930s and 1940s, sought to increase rainfall in the inland areas of eastern Australia by establishing large inland lakes. See, T. Griffiths and T. Sherratt, 'What if the northern rivers had been turned inland?', in S. Macintyre and S. Scalmer (eds), *What If? Australian history as it might have been*, Carlton, Vic., Melbourne University Press, 2006, pp. 234-54; P. K. Hope, N. Nicholls and J. L. McGregor, 'The rainfall response to permanent inland water in Australia', *Australian Meteorological Magazine*, vol. 53, 2004, pp. 251-62; N. Nicholls, 'Climate and culture connections in Australia', *Australian Meteorological Magazine*, vol. 54, no. 4, 2005, pp. 313-14; and R. Wooding, 'Populate, parch and panic: two centuries of dreaming about nation-building in inland Australia', in J. Butcher (ed.), *Australia under construction: nation-building – past, present and future*, Canberra, ANU EPress, 2008, pp. 57-70.

<sup>130</sup> E. Bridge, 'Bridge pipeline for people of 2088', *West Australian*, 7 November 1988, p. 28; P. Walsh, 'A theory that just doesn't hold water', *Australian Financial Review*, 28 January 1992, p. 11; and P. Walsh, 'Pouring cold water on a pipedream', *Australian Financial Review*, 17 April 1992, p. 13.

<sup>131</sup> N. Way, 'In the pipeline', *Business Review Weekly*, 29 November 1991, p. 14.

<sup>132</sup> See for example, 'Water scheme a joke – Beahan', *Albany Advertiser*, 29 August 1989, p. 7; and G. B. Davis, 'Kimberley water pipe plan a folly', *West Australian*, 26 March 1992, p. 10. The studies included, Kimberley Regional Development Advisory Committee, *Water from the Kimberleys: water for the southwest in the twenty-first century*, Perth, Binnie & Partners, 1988; Infrastructure Development Corporation, *Development of a Water Pipeline, Kimberleys to Perth*, Sydney, The Corporation, 1990; Chase Manhattan Bank, *Kimberleys to Perth Water Pipeline*, Perth, The Bank, 1991; and Kimberley Water Resources Development Advisory Board, *Report of the Kimberley Water Resources Development Advisory Board*, Perth, Kimberley Water Resources Development Office, 1993.

improve the standard of living of the region's Aboriginal people.<sup>133</sup> These northern regions encompass nearly forty per cent of the Australian continent's area but a mere one per cent of its population reside there.<sup>134</sup> The arrow pointing to the continent's north in Bridge's publicity material suggests he was attuned not only to (Western) Australian anxieties about drought but also to the enduring fear of the 'yellow peril' (Figure 5.3).<sup>135</sup> Alternatively, he was perhaps alluding to the enormous untapped Asian markets to the nation's north. Although Bridge's idea was not acted upon, the scheme would continue to inspire many Western Australians in the twenty-first century. Its endurance is testament to the appeal of the grand engineering schemes of Big Water with their promises of nation-building, national security and drought-proofing Australia.

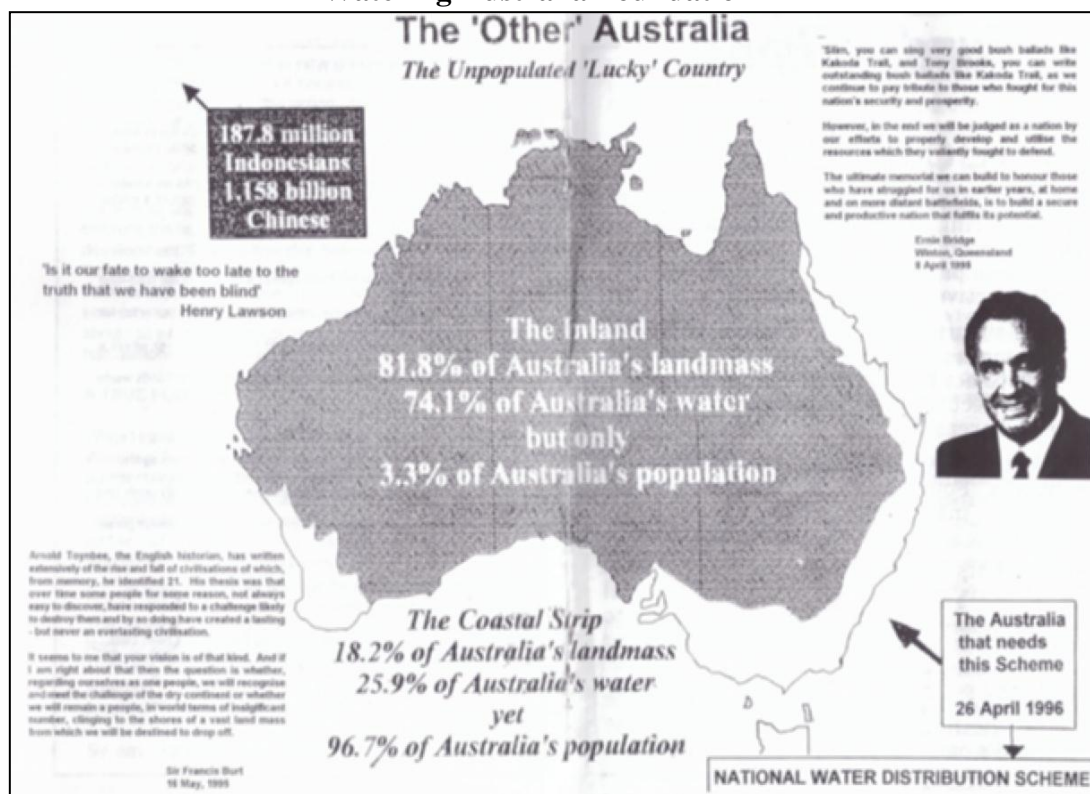
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<sup>133</sup> B. R. Davidson, *The Northern Myth: a study of the physical and economic limits to agricultural and pastoral development in tropical Australia*, Melbourne, Melbourne University Press, 1972, p. 2.

<sup>134</sup> L. Robin, *How a Continent Created a Nation*, p. 124. These ideas of the northwest have persisted in Western Australia since Alexander Forrest's exploratory expeditions of the Ord and Fitzroy Valleys in the Kimberley district in the late 1870s, and peaked with the Ord River Scheme in the 1960s and 1970s.

<sup>135</sup> The announcement of Bridge's ambitions to pipe water from the northwest came in the wake of heated national debate regarding Asian immigration in the 1980s and a series of bombings of Chinese restaurants in the suburbs of Perth by the right-wing Australian Nationalists' Movement at the end of that decade. With regard to Australian anxieties regarding Asian immigration, see for instance, D. Walker, *Anxious Nation: Australia and the rise of Asia, 1850-1839*, St. Lucia, University of Queensland Press, 1999, and D. Walker, 'Survivalist anxieties: Australian responses to Asia, 1890s to the present', *Australian Historical Studies*, vol. 33, no. 120, 2002, pp. 319-30. For further information on the emerging economic relationship between Australia and Asia, see A. Capling, 'Twenty years of Australia's engagement with Asia', *Pacific Review*, vol. 21, no. 5, 2008, pp. 601-22.

**Fig. 5.3: An excerpt from a promotional pamphlet issued by Bridge's Watering Australia Foundation<sup>136</sup>**



Despite the political significance of Aboriginal land rights in the late 1980s and Bridge's own Aboriginal heritage, in the public discussion of the proposal, there appears to have been little consideration of the significance of the Fitzroy River to the Indigenous peoples of the Kimberley. One feasibility study conceded that it was unlikely that the pipeline would improve water supplies to remote communities and warned that it might even create health problems due to 'cultural conflict'.<sup>137</sup> Another reported only the economic implications of the pipeline's construction.<sup>138</sup> These reports consistently overlooked Aboriginal relationships to the Fitzroy River and how taking water from this source might affect those connections. The Fitzroy is vital to those Aboriginal peoples who identify and are recognised as 'the river people' – members of the Ngarinyin, the Gooniyandi and the Bunuba groups.<sup>139</sup> The river not only provides food and water resources, but also provides a spiritual and cultural link between the past, present and future.<sup>140</sup> As Margaret Kunjuka said in 2001, 'The river, that's our life. That's the main one for everyone. It's there for our young people. They got to take

<sup>136</sup> E. Bridge, *The Priority – Australia: its people, its future*, Perth, Watering Australia Foundation, 1996, np.

<sup>137</sup> Kimberley Regional Development Advisory Committee, p. 90.

<sup>138</sup> Chase Manhattan Bank.

<sup>139</sup> S. Toussaint, P. Sullivan and S. Yu, 'Water ways in Aboriginal Australia: an interconnected analysis', *Anthropological Forum*, vol. 15, no. 1, 2006, p. 62.

<sup>140</sup> Toussaint, Sullivan and Yu, pp. 65-66.



over'.<sup>141</sup> Taking their water to benefit the southwest would have unimaginable effects on the cultural and socioeconomic resilience of these Aboriginal people. That these possible effects were barely considered demonstrates the political significance of slaking the thirst of Big Water and its customers, as well as the status of Aboriginal interests in Western Australian society.

These technocratic responses, whether to a greenhouse future or to long-held environmental anxieties about drought, both proposed the same solution: more water supplies for the southwest. The prospect of a drier future at least prompted among ecologically concerned Western Australians reflections on the crisis of modernity and the role of science in creating the enhanced greenhouse effect. Yet such reflexivity, as sociologists Beck and Giddens have observed, also fostered doubts over the veracity of anthropogenic climate change and whether action needed to be taken at all – a position that would only perpetuate the processes responsible for the greenhouse gas emissions that were potentially changing the southwest's climate. By contrast, the pipeline proposal inherently accepted the trajectory of Australian economic and population development, which had rendered the nation vulnerable to climate variability and water scarcity.

### *The (economic) dries*

Whether they were serviced by Big Water or lived outside its reach, the responses of Western Australians to the dry seasonal conditions of the early 1990s bore the imprint of the growing influence of economic rationalism in Australian policy circles. Although those outside Big Water were worst affected, most Western Australians in the southwest found that they themselves had to assume an unprecedented level of financial responsibility for overcoming the difficulties posed by climate variability and water scarcity. This shift in responsibility from the state to the individual further diminished the hydroresilience of less affluent sections of the community.

Although the construction of Harris Dam had assured the continuity of reliable water supplies for the towns and properties already connected to the Great Southern Towns Water Supply Scheme, many areas in the southwest remained self-reliant for their water supplies. This independence, however, did not necessarily mean that these farmers were undertaking measures to ensure their resilience to climate variability. Many had continued to neglect their water supplies because of a false sense of security,

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<sup>141</sup> M. Kunjuka cited in Toussaint, Sullivan and Yu, p. 65.

a dependence on emergency government supplies, and/or because they could not afford the investment.<sup>142</sup> Some of the worst affected were the recently settled farmers on the south coast in the areas around Esperance, Jerramungup and Ravensthorpe, which had been released for development in the early 1980s. Dry conditions would continue to persist in this region into the late 1990s.<sup>143</sup>

By the end of the 1980s, as noted earlier, Australian governments were reconsidering the ways that they responded to drought. It had become too expensive to continue to frame droughts as ‘natural disasters’ or ‘Acts of God’ in a continent where climate variability was increasingly recognised as the norm. In response, State and Commonwealth governments cooperated to develop a national drought policy (finalised in 1992) that rewarded self-reliance, risk management, and the long-term maintenance of environmental resources such as soil and water.<sup>144</sup> An act of collective amnesia allowed these governments to forget the efforts of their predecessors to encourage agricultural settlement in climatically marginal areas where they would be vulnerable to water scarcity. Under this new regime, as Judith Brett observed, ‘Drought-stricken farmers were no longer heroic victims of fickle nature, but merely bad risk managers’.<sup>145</sup>

In the southwest in the early 1990s, this new approach to climate variability was translated into the encouragement of local initiatives to identify and resolve problems in water supplies in order to improve the hydroresilience of farmers.<sup>146</sup> The Department of Agriculture, for instance, developed a suite of computer models that could help farmers to better plan their farm management for the year, including the prediction of crop yields and the design of farm water supplies.<sup>147</sup> Although the design of such models was well-intentioned, many farmers considered them to be too complex and not developed to address the most risky of their management decisions, such as acquiring

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<sup>142</sup> Farm Water Strategy Group, pp. 72, 89.

<sup>143</sup> Coles et al., p. 392.

<sup>144</sup> L. C. Botterill, ‘Uncertain climate: the recent history of drought policy in Australia’, *Australian Journal of Politics and History*, vol. 49, no. 1, 2003, p. 72; and D. H. White and L. Karsseis, ‘Australia’s National Drought Policy: aims, analyses and implementation’, *Water International*, vol. 24, no. 1, 1999, p. 3.

<sup>145</sup> J. Brett, ‘Fair share: country and city in Australia’, *Quarterly Essay*, no. 42, 2011, p. 49.

<sup>146</sup> Dept of Agriculture, *Annual Report for the Year Ended 30<sup>th</sup> June 1995*, Perth, Dept of Agriculture, 1995, p. 51.

<sup>147</sup> These models included the Model of an Integrated Dryland Agricultural System (MIDAS), MUDAS and TACT, as well as DAMCAT and RAIN TANK. See, R. S. Kingwell, D. J. Pannell and S. D. Robinson, ‘Tactical responses to seasonal conditions in whole-farm planning in Western Australia’, *Agricultural Economics*, vol. 8, 1993, pp. 214-215; and M. H. M. Casey and I. A. F. Laing, *A review of four on-farm water supply demonstration farms*, South Perth, Dept of Agriculture, 1993, pp. 5, 14, 52.

neighbouring properties.<sup>148</sup> Furthermore, as with responses to salinity, it was the farmers themselves who would be expected to fund most of this investment.<sup>149</sup>

This shift to greater self-reliance coincided with great challenges facing the nation's rural sector in the 1980s and 1990s. These challenges were not only economic, but also cultural and political, as Australians collectively lost their sense of 'countrymindedness'. The forces of globalisation were taking their toll on farming communities as pressures mounted for farm amalgamation, greater efficiency and productivity gains, and increased involvement with agribusiness.<sup>150</sup> These changes compounded the persistent problems of technological change, environmental degradation and rising debt, accelerating a drift to the cities, economic hardship and a decline in morale.<sup>151</sup> Historian Graeme Davison has observed that while none of these challenges were unique, 'What was new was the strength of the combined force with which they now acted, and the changed framework of expectations in which their impact was now interpreted'.<sup>152</sup> In the late 1980s, for instance, the *Western Farmer* regularly juxtaposed headlines such as, 'Future rests on efficiency', 'Aim first for conservation' and 'Innovation the key to future development', with the sombre observations of 'Rural communities fighting for survival', 'Fighting to save the future', and 'Farm debt swells'.<sup>153</sup> Under these unprecedented conditions, many farmers across the nation would struggle to improve not only their hydroresilience, but also the

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<sup>148</sup> P. Hayman, 'Decision support systems in Australian dryland farming: a promising past, a disappointing present and uncertain future', in R. A. Fischer et al. (eds), *New directions for a diverse planet: proceedings for the 4<sup>th</sup> International Crop Science Congress, Brisbane, Australia, 26 September – 1 October 2004*, Regional Institute, 2004, <[http://regional.org.au/au/asa/2004/symposia/4/1/1778\\_haymanp.htm#TopOfPage](http://regional.org.au/au/asa/2004/symposia/4/1/1778_haymanp.htm#TopOfPage)>, (Accessed: 31 October 2010).

<sup>149</sup> Farm Water Strategy Group, p. 66; and Coles et al., p. 392. Under the terms of the Farm Water Grant Scheme, farmers would contribute two thirds of the funds for farm water supplies.

<sup>150</sup> G. Lawrence, 'Globalisation, agricultural production systems and rural restructuring', in C. Cocklin and J. Dibden (eds), *Sustainability and Change in Rural Australia*, Sydney, UNSW Press, 2005, p. 119.

<sup>151</sup> G. Davison, 'Rural sustainability in historical perspective', in Cocklin and Dibden (eds), *Sustainability and Change in Rural Australia*, p. 53. See also, G. Davison, 'Introduction', in G. Davison and M. Brodie (eds), *Struggle Country: the rural ideal in twentieth century Australia*, Melbourne, Monash University EPress, 2005, pp. ix-xvi.

<sup>152</sup> Davison, 'Rural sustainability in historical perspective', p. 53.

<sup>153</sup> See, for example, F. Nuttall, 'Economics hit soil fertility', *Western Farmer*, 16 January 1986, p. 7; P. Bunny, 'Aim first for conservation', *Western Farmer*, 17 April 1986, pp. 9, 11; P. Williams, 'Fighting to save the future', *Western Farmer*, 31 July 1986, p. 17; S. Oxley, 'Farm debt swells', *Western Farmer*, 26 March 1987, p. 9; 'Future rests on efficiency', *Western Farmer*, 26 March 1987, p. 40; 'Soil loss costing farms billions', *Western Farmer*, 12 May 1988, p. 10; 'Farmers in front line', *Western Farmer*, 26 May 1988, p. 16; 'Innovation the key to future development', *Western Farmer*, 20 October 1988, p. 2; B. Morton, 'A species that must be saved', *Western Farmer*, 12 January 1989, p. 6; 'No special treatment for farmers', *Western Farmer*, 19 January 1989, p. 5; 'Wheatbelt crisis', *Western Farmer*, 19 January 1989, p. 6; and R. Mills, 'Rural communities fighting for survival', *Western Farmer*, 8 June 1989, p. 7.

economic, social and environmental sustainability of their communities.<sup>154</sup>

In the suburbs, meanwhile, low metropolitan dam storages after the dry winter of 1994 had led the Liberal government to impose the first water restrictions on Perth householders since the late 1970s.<sup>155</sup> The relatively moderate restrictions commenced on November 1 and prohibited the use of garden sprinklers between 8am and 8pm (later, 9am to 6pm) in the areas serviced by Big Water's Integrated Water Supply Scheme – Perth, Mandurah and the eastern Goldfields.<sup>156</sup> Surprisingly, the policy was met with little resistance from the community, particularly when compared to earlier periods. This lack of public dissent, I suggest, indicates that the restrictions did not affect householders to the same extent as they had in the past. The relatively muted response to restrictions reflected a shift in the public perception of responsibility for the restrictions from Big Water to householders themselves. In this section, I argue that Big Water's greater emphasis on water demand management during the 1980s and early 1990s, particularly through user pays and conservation education, conditioned consumers to bear the burden for alleviating pressures on water supplies. A concurrent growth in ecological awareness further encouraged this sense of consumer or individual responsibility for the relative scarcity of water in the southwest, which helped to increase the hydroresilience of some households in the southwest.

In addition to the introduction of user pays in the late 1970s, the Water Authority had increasingly encouraged their customers to reduce their scheme water consumption.<sup>157</sup> Mirroring campaigns underway elsewhere around Australia, the objective of reducing scheme water demand reflected the economic and environmental position faced by many water utilities, namely that the cheapest water supplies had been exhausted such that further water source development would be expensive and potentially, environmentally harmful. The success of these campaigns in limiting the growth in per capita demand was influential in the planning of the future sources of the

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<sup>154</sup> J. Dibden and L. Cheshire, 'Community development', in Cocklin and Dibden (eds), *Sustainability and Change in Rural Australia*, p. 212.

<sup>155</sup> The North Dandalup Dam had only been completed in October 1994.

<sup>156</sup> G. Meertens, 'Water cheats to face crackdown', *West Australian*, 24 October 1994, p. 1. These restrictions were designed to reduce domestic water consumption by ten per cent by the end of May 1995, at which stage they would be lifted. Although householders achieved this reduction in their usage, the restrictions remained in place to moderate metropolitan demand for scheme water.

<sup>157</sup> In 1986, Western Australia hosted the first national workshop on water demand management and later, the Water Authority produced a water conservation plan to guide its efforts to lower water consumption. See, WA Water Resources Council, *Proceedings of the National Workshop on Urban Water Demand Management, Alexander Library, Perth Cultural Centre, April 29 – May 1, 1986*, Canberra, WA Water Resources Council, 1986; and WAWA, *Water Conservation Plan 1987/89*, Leederville, WAWA Water Resources Directorate, 1987.

southwest's scheme water supplies in the late 1980s.<sup>158</sup> These efforts to curb scheme water demand reflected the changing identity of Big Water in Australia at the end of the twentieth century. Big Water had once promised Australians endless water supplies and thirsty households had happily watered and flushed away. Now that Big Water was under economic and environmental pressures, it called for its customers to exercise restraint. Blaming water users alone for their unsustainable levels of consumption, argues Zoë Sofoulis, ignores the central role that Big Water has played in delivering the 'sublime illusion' of unlimited water supplies.<sup>159</sup> Big Water, therefore, does not engage in a process of reflection on its role in facilitating unsustainable water use nor is it held accountable for perpetuating consumers' delusions of infinite supplies. As a result, the technologies and infrastructure that have facilitated the supply of seemingly limitless quantities of water go unchallenged and unchanged.

Customers would not have accepted the blame for their high water use had they not been primed to consider themselves at fault and in need of curbing their consumption. Despite the political prominence of economic issues during the 'recession we had to have' in the early 1990s, Australian political scientists Stephen Crook and Jan Pakulski observed in 1994 that 'environmental concerns have entered the public consciousness and are likely to stay there'.<sup>160</sup> Among the myriad environmental problems that were threatening the world at the end of the twentieth century was the growing sense of an impending water crisis, for which humankind was at least partly responsible.<sup>161</sup> The El Niño drought of 1994, which ravaged farmers and pastoralists in New South Wales and Queensland, provided Australians with what some perceived as grim evidence to substantiate these claims. Excessive consumption of limited resources, like water, was no longer (morally) acceptable and needed to be curbed.<sup>162</sup> Strategies of demand management, such as user pays and water restrictions, therefore, were widely and equally regarded as reasonable methods to relieve the pressure on scarce water resources.

The price mechanism had become an especially useful tool for Big Water to influence demand for its product. In the southwest, the experience of user pays since the

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<sup>158</sup> WAWA, *Sources Development Plan 1988 Review*, Leederville, WAWA, 1988, np.

<sup>159</sup> Z. Sofoulis, 'Big Water, Everyday Water: a sociotechnical perspective', *Continuum*, vol. 19, no. 4, p. 460; and F. Allon and Z. Sofoulis, 'Everyday Water: cultures in transition', *Australian Geographer*, vol. 37, no. 1, 2006, pp. 46-47.

<sup>160</sup> S. Crook and J. Pakulski, 'Shades of green: public opinion on environmental issues in Australia', *Australian Journal of Political Science*, vol. 30, 1995, p. 45. This paper had been submitted in January 1994 and finally accepted for publication in October that year.

<sup>161</sup> J. Linton, *What is Water? The history of a modern abstraction*, Toronto, UBC Press, 2010, pp. 191-211.

<sup>162</sup> Allon and Sofoulis, pp. 46-47.

1970s had helped condition Big Water's customers to accept water as an 'economic resource', and therefore, a 'precious commodity'. By the early 1990s, the unprecedented national focus on economic efficiency and competitiveness had become 'the most pervasive policy shift of recent decades'.<sup>163</sup> Led by the Council of Australian Governments (comprising the heads of Australian state, territory and Commonwealth governments), the National Competition Policy, which was based on these ideas, was rolled out across the country.<sup>164</sup> In the area of water reform, Big Water's attentions were focussed on 'productivity, reduction of state subsidies, user-pays, separation of policy and provision, privatisation and corporatisation of functions, break-up to allow competition, use of market and property rights mechanisms and importantly, provisions of flows to the environment'.<sup>165</sup>

The introduction of these reforms in Western Australia led to the split of the Water Authority into three agencies in 1996: the Office of Water Regulation, the Water and Rivers Commission, and the Water Corporation, all of which answered to the Minister for Water Resources and therefore, were subject to political influence.<sup>166</sup> The Office of Water Regulation was responsible for the regulation of the state's water industry through a system of licences that apply to all providers of water supply, sewerage, drainage and irrigation services. The Office also provided advice to the Minister on a wide range of policy matters affecting the industry and monitored the performance of the industry.<sup>167</sup> The Water and Rivers Commission was accountable for the sustainable development of the Western Australia's water resources and the conservation of the environment, and allocated water resources between competing interests to achieve these ends. The Commission was also responsible for the investigation, measurement and assessment of the state's surface and subterranean water

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<sup>163</sup> K. Hussey and S. Dovers, 'Trajectories in Australian water policy', *Journal of Contemporary Water Research and Education*, no. 135, 2006, p. 39.

<sup>164</sup> Following the recommendations of the National Competition Policy Review Committee (chaired by Fred Hilmer), the Council of Australian Governments established and implemented the National Competition Policy, which formed the centrepiece of the Federal Labor government's microeconomic reforms of the early 1990s. According to the National Competition Council, 'A key principle of the program was that competitive markets will generally best serve the interests of consumers and the wider community'. See, National Competition Council, *National Competition Policy*, 2007, <<http://ncp.ncc.gov.au/>>, (Accessed: 3 January 2012).

<sup>165</sup> Hussey and Dovers, p. 39.

<sup>166</sup> Water Corporation, *Annual Report for the Year Ended 30<sup>th</sup> June 1996*, Leederville, Water Corporation, 1996, p. 4.

<sup>167</sup> Laws, p. 18. The responsibilities of the Office of Water Regulation were subsumed by the creation of the Economic Regulation Authority in 2004, which also regulates the gas, electricity and rail industries in Western Australia.

resources.<sup>168</sup> The Water Corporation supplied water and wastewater services across the state, including water supplies to irrigation schemes in the southwest.<sup>169</sup>

This restructuring of the state's water sector was met with scepticism from local environmentalists. For the Conservation Council, the changes reflected the insidious influence of 'economic fundamentalism', a 'virus' that was spreading across all levels of Australian government in the 1990s.<sup>170</sup> Although the 'catchcry was more efficiency and competitiveness', a member of the Council wryly observed that 'nobody dared to ask with whom they were to compete'.<sup>171</sup> The Conservation Council would later blame the attendant processes of restructuring and downsizing for the loss of the water sector's 'most experienced staff', which they considered had left Big Water unprepared for dry spells in the late 1990s.<sup>172</sup>

The function of the Water Corporation was to supply water and wastewater services to its customers 'in accordance with prudent commercial principles and endeavour to make a profit, consistent with maximising its long-term value'.<sup>173</sup> This charter explicitly commodified Western Australia's water resources and framed the consumers of these supplies in market terms. This would suggest that the price mechanism would become an increasingly important to the management of demand for water in the late 1990s. But such a move would have been politically imprudent.

Despite the emphasis of the National Competition Policy on the ethos of user pays, the state governments felt politically compelled to hold the hand of the market. The Western Australian government was no exception and sought to cushion the effects of user pays on consumers. By this time, water bills were composed of a fixed charge and a usage charge.<sup>174</sup> Since 1993, this usage charge was determined by a system of five inclining block tariffs, whereby water became increasingly expensive as more was consumed.<sup>175</sup> But the structure of the water bill meant that this usage charge composed less than half of the total cost. As a result, this usage charge could not send a strong price signal or provide a significant incentive to reduce water use.<sup>176</sup> The only incentive

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<sup>168</sup> Laws, p. 19.

<sup>169</sup> Laws, p. 19.

<sup>170</sup> J. Payne, 'Streamlining the Water Authority', *Greener Times*, September, 1995, p. 4.

<sup>171</sup> Conservation Council of WA, *Annual Report 1995/96*, Perth, Conservation Council of WA, 1996, np.

<sup>172</sup> R. Siewert, 'Perth's water crisis', *Greener Times*, September 1998, p. 2.

<sup>173</sup> Water Corporation, *Annual Report for the Year Ended 30<sup>th</sup> June 1997*, Leederville, Water Corporation, 1997, p. 1.

<sup>174</sup> Economic Regulation Authority (ERA), *Inquiry on Urban Water and Wastewater Pricing: Issues Paper*, Perth, ERA, 2004, pp. 5, 50.

<sup>175</sup> This system replaced the 'free allowance' of 150kL that had been introduced in the late 1970s.

<sup>176</sup> ERA, p. 49.

it provided was to thirsty households who possessed the financial means to invest in water-saving technology in order to pay lower water rates. Besides, the state government already subsidised lower water prices such that consumers did not foot the bill for source development or the cost of water itself.<sup>177</sup> The short-term electoral goals of the state government served to undermine a community shift towards greater hydroresilience in the 1990s.

Meanwhile, the broader policy shifts towards corporatisation and privatisation across the public sector was taking its toll on the most vulnerable members of the Western Australian community. During the 1990s, the state's provider of public housing, Homeswest, was increasingly emphasising 'cost efficiency' in its rental operations, which contributed to the growing privatisation of its services.<sup>178</sup> Indigenous families, who were particularly dependent on public housing, faced longer waiting times and overcrowding as a result of the limited availability of accommodation.<sup>179</sup> With limited financial resources and cultural obligations to house kin, Indigenous tenants also faced a greater likelihood of eviction.<sup>180</sup> In the late 1990s, the rate of eviction on a per capita basis for Aboriginal families in Homeswest housing was three times higher than for non-Aboriginal tenants.<sup>181</sup> Reporting an episode in Karrinyup, journalist Carmelo Amalfi observed, 'The eviction of the Martin family from Paris Way has solved a problem for Homeswest and some residents. But it has exacerbated the problems of the Martin family, with children condemned to the insecurity of homelessness'.<sup>182</sup>

Such problems were compounded by the redevelopment of low-income suburbs like East Perth, where there had been a high level of public housing, emergency accommodation and social services, and the lack of public assistance to improve the rudimentary housing and sanitation conditions at the Swan Valley Nyoongar Community in Lockridge.<sup>183</sup> Beyond the city, these neoliberal reforms also exacerbated spatial differences in economic development, service provision and social wellbeing,

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<sup>177</sup> ERA, *Inquiry on Urban Water and Wastewater Pricing: Final Report*, Perth, ERA, 2005, pp. 23, 97.

<sup>178</sup> Equal Opportunity Commission, *Finding a Place: an inquiry into the existence of discriminatory practices in relation to the provision of public housing and related services to Aboriginal people in Western Australia*, Perth, Equal Opportunity Commission, 2004, pp. 67-68.

<sup>179</sup> Equal Opportunity Commission, pp. 159-77.

<sup>180</sup> Equal Opportunity Commission, p. 199.

<sup>181</sup> Equal Opportunity Commission, p. 199.

<sup>182</sup> C. Amalfi, 'Privation behind anger in suburb', *West Australian*, 18 June 1997, p. 12.

<sup>183</sup> E. Crawford, 'Equity and the city: the case of the East Perth redevelopment', *Urban Policy and Research*, vol. 21, no. 1, 2003, pp. 81-92; and S. Delmege, 'The fringedweller's struggle: cultural politics and the force of history', PhD Thesis, Murdoch University, 2000, pp. 251-68.



which served to aggravate the spiral of rural decline in parts of the southwest.<sup>184</sup> The changing face of the provision of public services in the 1990s, was producing a cascade of challenges for the least fortunate, particularly Aboriginal people, which would leave many beyond the reach of the benefits of Big Water at the end of the twentieth century.

By the end of the 1990s, Western Australians both inside and outside Big Water had become accustomed to the influence of economic rationalism on water resource management. Whether they were farmers investing in their own water supplies, or suburban householders checking their water bills, they had become conditioned to accept that the user pays, not according to their ability but their willingness to pay or their ability to curb consumption. In the rural areas of the southwest, government drought policy was forcing farmers to review their perceptions of drought as a normal characteristic of the region's climate and to plan ahead accordingly. Those dependent on Big Water were also increasingly viewing water as a relatively scarce resource. But the state government and the Water Corporation had vested interests in maintaining a profligate water culture in the suburbs and its attendant anxieties, which would manifest themselves in the 'water crisis' of the early twenty-first century.

### *Dry Horizons II*

With the overhaul of the management of the state's water resources in the mid-1990s came closer scrutiny of the lower levels of rainfall that had prevailed since the 1970s. Less rainfall and less streamflow would have significant consequences for the operation of the new Water Corporation. Drier conditions would necessitate the development of other sources and curbs on water consumption to meet its mandate to provide water services to its customers across the state.<sup>185</sup> For a profit-driven business, these were both costly options and, for the Liberal Government, it would be politically unpopular to either enforce tighter water restrictions or to raise water rates to cover expensive infrastructure investments.<sup>186</sup> Furthermore, a less reliable water supply network would increase the risk exposure of the Water Corporation's Board of Management.<sup>187</sup> It was both politically and financially imperative, therefore, to determine the extent of the

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<sup>184</sup> M. Tonts, 'Spatially uneven development: government policy and rural reform in the wheatbelt of Western Australia', *Anthropological Forum*, vol. 14, no. 3, 2004, pp. 237-40.

<sup>185</sup> Water Corporation, *Annual Report*, 1997, p. 1.

<sup>186</sup> See, Stokes et al., p. v; and J. K. Ruprecht, B. C. Bates and R. A. Stokes (eds), *Climate Variability and Water Resources Workshop*, East Perth, Water and Rivers Commission, 1996. p. 10.

<sup>187</sup> Hughes, 'Meeting the challenge of climate variability', p. 203.

drying trend and whether it would continue indefinitely. Faced then with the possibility of a drying climate, Big Water implemented the technocratic responses of climate monitoring and prediction in order to help it maintain the illusion that it could indefinitely provide 'endless supplies' to its thirsty customers.

In early 1996 the newly established Water and Rivers Commission convened a seminar and workshop in Perth to address the recent low levels of rainfall; its effects on the hydrology of the southwest region; and the extent to which seasonal climate variability could be predicted.<sup>188</sup> Climate scientists and water managers reviewed the existing state of knowledge of regional climate variability and the impacts of rainfall decline on water supply. According to one of the participants, Brian Sadler, the workshop represented a turning point for scientists and decisionmakers as the rainfall conditions were no longer viewed as a prolonged drought.<sup>189</sup> They now identified a 'non-linear jump' to a new regional climate equilibrium: a state of lower winter rainfall.

This new perspective on the region's climate saw the state's water managers further reduce the estimated long-term annual inflow to the southwest water supply system. As Jim Gill, former head of the Water Corporation later reflected, '[I]n '96, we decided we were kidding ourselves with the amount of water we expected from the dams, and we de-rated the system ... so it came from ... 280GL down to about 230GL'.<sup>190</sup> By this stage, the region's supply capacity was considerably exceeded by expected demand. In order to meet this demand and to avoid imposing tighter water restrictions on its consumers, the Water Corporation brought forward its plans to expand and develop the region's water supplies.<sup>191</sup> The strategy to provide its customers with additional supplies by 2021 was now fast-tracked by a decade to ensure that sufficient supplies would be available by 2010.

The Court government translated this plan to increase water supplies into a political spectacle of 'drought-proofing' Perth, which was reminiscent of the Big Water of the 1950s and 1960s. Although the prospect of completely drought-proofing an area was no longer a credible option for water managers, it remained a potent ideal for

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<sup>188</sup> Ruprecht, Bates and Stokes (eds), 1996.

<sup>189</sup> B. Sadler, 'Informed adaptation to a changed climate state, is southwestern Australia a national canary?', *Indian Ocean Climate Initiative*, 2001, <[http://www.ioci.org.au/pdf/IOCI\\_PaperJan6.pdf](http://www.ioci.org.au/pdf/IOCI_PaperJan6.pdf)>, (Accessed: 20 November 2010), p. 3.

<sup>190</sup> J. Gill, 'Perth's water future: security through diversity', in *2004 Australian National Plumbing Forum*, Institute of Plumbing, September 2004, <<http://www.plumbing.org.au/2004%20Forum%20Reports/2004%20Forum%20Report%205%20-%20Perth's%20Water%20Future.pdf>>, (Accessed: 27 January, 2009), p. 3.

<sup>191</sup> Bates and Hughes, p. 198.

politicians seeking to demonstrate their great vision to the electorate.<sup>192</sup> In 2000, Minister for Water Resources Kim Hames announced, ‘We’re trying to get as close as possible to drought-proofing Perth without the enormous expense of pipelining from the Kimberley’.<sup>193</sup> This position was supported by the Water Corporation, which argued that ‘plentiful water sources should be developed, essentially without limit, and provided for those who are prepared to pay for them’.<sup>194</sup> Although these views appeared at odds with the more restrained approach of consumers regarding scheme water use, their persistence attested to the enduring political capital of Big Water, of the vision of endless water supplies.

The government’s perception of a thirsty electorate undoubtedly informed its continued promotion of backyard bores to alleviate the pressures on scheme water supplies. In 1997, the government argued that sinking bores would not only reduce demand on scheme water but would also help the environment. Drawing on bores that tapped into shallow groundwater reserves could go some way to lower the watertable, which had risen in some areas due to urban development.<sup>195</sup> The government also published the *Perth Groundwater Atlas* so that householders could determine whether their property was well-situated for accessing groundwater supplies.<sup>196</sup> As backyard bores remained unlicensed, unmetered and therefore unmonitored, such a strategy, argued environmentalists, contradicted measures to protect the groundwater reserves of the Swan Coastal Plain. As the Conservation Council wondered, ‘How will sustainable groundwater yields be ensured when the drawdown from the thousands of domestic bores in Perth cannot be measured and yet they are depleting the same groundwater sources as those used for water supply (sic)’.<sup>197</sup> In some coastal areas, the use of household bores had already led to saltwater intrusion and rendered these backyard investments useless.<sup>198</sup> By supporting the unfettered persistence of a profligate water culture, the government was putting groundwater supplies at risk – the same reserves that would be necessary for Big Water in the future.

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<sup>192</sup> See also, J. Veraart and M. Bakker, ‘Climate proofing’, in Ludwig et al. (eds), *Climate Change Adaptation in the Water Sector*, pp. 109.

<sup>193</sup> S. Butler, ‘\$52m dam will quench Perth’s raging thirst’, *West Australian*, 11 October 2000, p. 34.

<sup>194</sup> Water Corporation, *Annual Report*, pp. 3-5.

<sup>195</sup> K. Hames, ‘Preface’, in Water and Rivers Commission, *Perth Groundwater Atlas*, East Perth, Water and Rivers Commission, 1997, np.

<sup>196</sup> Water and Rivers Commission, *Perth Groundwater Atlas*.

<sup>197</sup> S. Robinson, ‘Accountability problems in the water industry restructure’, *Greener Times*, February, 1996, p. 10.

<sup>198</sup> R. Siewert, ‘Perth’s water crisis’, *Greener Times*, September, 1998, p. 2.

In addition to encouraging residents to invest in private water supplies, the government declared its intentions to build additional dams and draw more water from already strained groundwater sources.<sup>199</sup> Its major project in the late 1990s was the Stirling-Harvey Redevelopment Scheme, which involved replacing the existing Harvey Dam with a larger reservoir to meet irrigators' needs. Water from the Stirling Dam, which would no longer provide water to irrigators, would be piped to Big Water in Perth, Mandurah and the Goldfields. The government reassured the electorate that the expansion of Harvey Dam did not represent a new source as such because the river had already been dammed.<sup>200</sup> The Conservation Council of Western Australia continued to advocate policies of demand management to relieve pressure on the waterways and groundwater reserves of the southwest. Furthermore, some critics questioned the wisdom of investing in dams in the context of a drying climate. Both the Greens and the Labor Opposition observed, 'If it doesn't rain, Harvey won't fill'.<sup>201</sup>

The plans to rebuild Harvey Dam and pipe water to the city also raised concerns among farmers in the Harvey catchment that their water needs were perceived to be of less importance than those of the city.<sup>202</sup> These tensions revived anxieties that had simmered since at least the 1970s, that water would be transferred away from productive uses in rural areas to meet the needs of 'wasteful' suburban households. For the government and Water Corporation, the Stirling-Harvey Redevelopment Scheme was ideal because it would 'balance' the extraction of groundwater north of Perth; it was enlarging an existing scheme; it was a source of good quality water; and was located in an area of relatively high and reliable rainfall.<sup>203</sup> Local politicians framed the plan as a blow to country livelihoods, tapping into rural anxieties about the pending deregulation of the local dairy industry and the growing marginalisation of rural

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<sup>199</sup> G. Capp, 'Dams may not be worth the trouble', *West Australian*, 1 November 1997, p. 14.

<sup>200</sup> G. Capp, 'Hames pushes dam for Harvey', *West Australian*, 13 November 1998, p. 10; R. A. Stokes et al., *Perth's Water Future: a vision for the water supply of Perth and Mandurah to 2050*, Leederville, Water Authority of WA, 1995, p. 3-11.

<sup>201</sup> C. Amalfi, 'Summer threat to water ebbs', *West Australian*, 12 August 2000, p. 13; and C. Amalfi, 'Dry city turns to bores', *West Australian*, 20 August 1998, p. 9.

<sup>202</sup> S. Butler, '\$52m dam will quench Perth's raging thirst', *West Australian*, 11 October 2000, p. 34. See, Welker Environmental Consultancy, *Stirling-Harvey Redevelopment Scheme: public environmental Review*, Perth, EPA, 1999, p. 1. The Redevelopment Scheme was as follows: construction of a new dam on the Harvey River, near the existing weir; diversion of water from the Stirling Reservoir to Perth; diversion of water from the Harris Dam to the Stirling Reservoir; upgrade Stirling Dam; and replace areas of Harvey-Quindanning road that will be inundated by the dam construction. See, Environmental Protection Authority, *Stirling-Harvey Redevelopment Scheme Including Changes to the Harris Dam Project: Water Corporation*, Perth, EPA, 1999, pp. 2-5.

<sup>203</sup> Welker Environmental Consultancy, p. i.

(Western) Australians more generally.<sup>204</sup> For instance, the president of the National Party's Collie branch claimed, 'We know the votes are in Perth and ... once the pipeline is in place, there will be an irresistible appeal in catering to the masses in Perth to the detriment of rural people'.<sup>205</sup> Such populist rhetoric aside, the wider Harvey community considered that the Water Corporation needed to guarantee water for local irrigators before water was transferred to Perth.<sup>206</sup> In their view, Big Water would divert 'local' water for the benefit of the people of Perth, which would leave Harvey residents and irrigators more vulnerable to climate variability and water scarcity.

Although some of the additional water supplies would come from enlarging the Harvey Dam, most of the extra water would be drawn from the Gngangara Mound. In terms of the amount of water available, the costs of abstracting and piping the water, and the environmental impact of using this source, the Water Corporation considered that groundwater was the best option for increasing water supplies. Furthermore, the prevailing scientific view was that the drying regional climate would have less of an impact on groundwater than on dams.<sup>207</sup> Like its proposal to enlarge the Harvey Dam, the Water Corporation argued that its increased reliance on the Gngangara Mound would be cheaper and have fewer ecological consequences than alternative sources because it was merely extending an 'existing scheme'.<sup>208</sup>

But again this reasoning did not convince local environmentalists. They cited recent episodes during which wetlands and trees were suffering as a result of the exploitation of this shallow groundwater source.<sup>209</sup> The Conservation Council argued that the Water Corporation was prioritising cheap water supplies over environmental protection. A Council spokeswoman noted, 'We could double Perth's total consumption tomorrow using [the deeper] Yaragadee (sic). But the Corporation, which is committed to delivering water at the lowest price, will tell you it is too expensive'.<sup>210</sup> Most

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<sup>204</sup> A. Hamilton, 'Farmers quiz House on government help', *Countryman*, 10 February 2000, p. 5; and D. Aitkin, 'Afterword: return to "countrymindedness"', in G. Davison and M. Brodie (eds), *Struggle Country: the rural ideal in twentieth century Australia*, Melbourne, Monash University Epress, 2005, p. 11.5. In June 2000, the Western Australian Parliament passed legislation to repeal the regulation of the dairy industry.

<sup>205</sup> V. Rechichi, 'Fears new Harris link to city will drain supplies', *West Australian*, 25 August 1999, p. 39.

<sup>206</sup> Beckwith & Associates Environmental Planning, *Harvey-Stirling Dam options: social impact analysis. Report for the proposed Harvey Basin Surface Water Allocation Plan*, South Perth, Beckwith & Associates, 1998, p. 64.

<sup>207</sup> Stokes et al., p. 4-13.

<sup>208</sup> Stokes et al., p. 6-3.

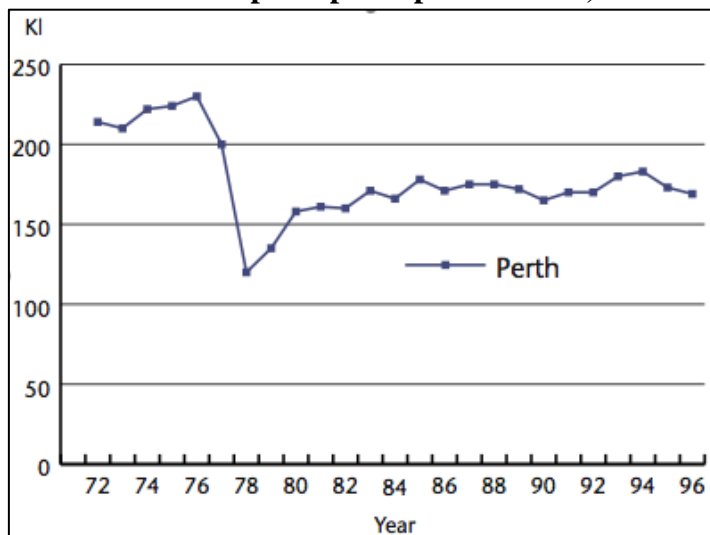
<sup>209</sup> See for instance, T. Mendez, 'Perth faces water curbs next year', *West Australian*, 9 March 1998, p. 5; G. Capp, 'EPA nod for "damaging" water plan', *West Australian*, 10 October 1998, p. 5; J. Pratley, 'Bore water to cut lake acid', *West Australian*, 7 September 1999, p. 7; and M. Quekkett, 'Water crisis menaces WA', *West Australian*, 29 November 1999, p. 7.

<sup>210</sup> C. Amalfi, 'Reservoir of hope lies under Perth', *West Australian*, 31 August 1998, p. 10.

importantly, conservationists argued, the government should explore other sources of water, such as recycling wastewater, and curtail the water consumption of Perth households.<sup>211</sup>

Although demand management strategies and the 1994 restrictions had kept per capita demand at bay since the late 1970s (Figure 5.4), total scheme water consumption in Perth had increased by at least twenty-five per cent since 1990.<sup>212</sup> Undoubtedly water consumption was far greater in households that had access to unmonitored bore water. Rather than further restrict water use, the state government and the Water Corporation preferred to encourage householders to supplement their supplies through backyard bores. This policy protected the government from voter backlash and the Water Corporation from loss of revenue, whilst maintaining the profligate water culture of the suburbs. Could this approach continue in a drying climate?

**Fig 5.4: Scheme water consumption per capita in Perth, 1972/73 to 1996/97<sup>213</sup>**



### *Looking to the Indian Ocean*

The Water and Rivers Commission workshop in 1996 at which scientists and engineers had reviewed the planning for the southwest's water resources, had taken place just a year before the Kyoto Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). Despite the Hawke government's initial

<sup>211</sup> See for example, 'Taylor opposes water conservation', *Greener Times*, April, 1994, p. 4; 'Water restrictions supported', *Greener Times*, October, 1994, p. 4; 'Let's stop wasting water', *Greener Times*, January, 1995, p. 8; 'Perth's water future', *Greener Times*, September, 1995, pp. 3-4; and R. Siewert, 'Perth's water crisis', *Greener Times*, September, 1998, p. 2.

<sup>212</sup> Water Corporation, *Annual Report for the Year Ended 30<sup>th</sup> June 2000*, Leederville, Water Corporation, 2000, p. 27.

<sup>213</sup> J. F. Thomas, *Water in the Australian Economy: a joint study project of the Australian Academy of Technological Sciences and Engineering and the Institution of Engineers Australia*, Parkville, Australian Academy of Technological Sciences and Engineering, 1999, p. 28.

enthusiasm for the international climate change policy process at the Earth Summit in 1992, both Labor and Coalition governments had since been reluctant to accept legally binding targets and had advocated the merits of a ‘differentiated’ approach in the pursuit of greenhouse gas emission reduction goals.<sup>214</sup> Meanwhile, in Western Australia, the conservative Court government had not agreed to the terms of the UNFCCC and was proceeding to build a coal-fired power station in Collie. Furthermore, there had been no inventory of greenhouse gas emissions in Western Australia since the 1990 audit and the state’s Greenhouse Coordination Council had been in indefinite recess for over two years.<sup>215</sup> In this section I examine how these political and economic positions on the issue of anthropogenic climate change influenced the state government’s responses to the recommendations of the Water and Rivers Commission workshop.

Not long after the workshop had been convened, the Second Assessment Report of the Intergovernmental Panel on Climate Change (1996) concluded that ‘the balance of evidence suggests a discernible human influence on global climate’.<sup>216</sup> The workshop participants had found that a decade later, the questions that had been raised in the response of Western Australian engineers to the Greenhouse87 scenario remained unanswered. These were questions seeking to determine the nature of the regional climate change, and its timing, rate and magnitude. The workshop concluded that the answers to those questions remained ‘beyond the current limits of science’. Further study of the region’s climate was necessary, with an additional question regarding the ‘fundamental nature of climate variability in the South West’.<sup>217</sup> Although this new question was valid, its addition to the prospective research agenda indicated another perspective on the region’s climate conditions. This perspective, I contend, sought to exploit the scientific uncertainties surrounding the cause of the climate trends in the southwest in order to advance the interests of the Western Australia’s important minerals and energy industries.

The chief proponent of this alternative perspective was the foundation chair of the Environmental Protection Authority (1971 to 1977), physicist Brian J. O’Brien.<sup>218</sup>

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<sup>214</sup> Bulkeley, pp. 33, 39. In December 1992, Australia was the eighth nation to ratify the UNFCCC.

<sup>215</sup> E. Horne, ‘Views on the Greenhouse Coordination Council’, *Greener Times*, September, 1995 p. 18; ‘State of the Environment Report 1996’, *Greener Times*, November/December, 1996, p. 10; and ‘WA fails to address greenhouse issues’, *Greener Times*, April, 1997, p. 5.

<sup>216</sup> IPCC, *IPCC Second Assessment: Climate Change 1995*, Geneva, World Meteorological Organisation, 1996, p. 5.

<sup>217</sup> Ruprecht, Bates and Stokes, p. 11.

<sup>218</sup> O’Brien’s activities mirror those of some former physicists in the US, who Naomi Oreskes and Erik M. Conway document in their 2010 book *Merchants of Doubt*. Like O’Brien, former physicists such as Fred Singer and Fred Seitz have been associated with neoliberal think-tanks

Since his retirement from the EPA, O'Brien had worked as an environmental consultant. In a 1991 article for the *Mining Review*, in which he argued that CSIRO predictions in the 1980s had been overly alarmist, he described himself as a campaigner for 'more rigorous science and rational debate' in discussions of the greenhouse effect.<sup>219</sup> In light of his comments the following year that 'the coal preference contributes relatively minor amounts of carbon dioxide to global greenhouse', his call for the redirection of scientific research towards the El Niño-Southern Oscillation (ENSO) can not be interpreted as benign.<sup>220</sup> Instead, O'Brien's comments indicate a concerted and ongoing effort to cloud 'rational debate' on the issues of climate change and energy policy in Western Australia.

O'Brien played an important 'behind the scenes' role in the Court government's establishment of the Indian Ocean Climate Initiative (IOCI) in 1998. Correspondence from IOCI Chair, Brian Sadler, and the Deputy Premier, Hedy Cowan, indicates that O'Brien had made repeated 'representations' to Cowan where he advocated the need for improved seasonal forecasting for the southwest region.<sup>221</sup> Although the content of O'Brien's representations are not known, it is safe to assume that his views on the greenhouse effect were consistent with those he expressed in public. For instance, in a 1994 speech to the state's Pastoralists and Graziers Association, O'Brien had argued, 'If the history and reality of such natural changes of climate had been as well known to urban dwellers as they are to the rural community, then perhaps the fears of greenhouse or man-made climate change would not have become so exaggerated and alarmist'.<sup>222</sup> That O'Brien's suggestions for improving seasonal forecasting resonated with Cowan should come as no surprise: Cowan was the leader of the Western Australian National Party, which represented the state's agricultural and pastoral industries. His earlier efforts to establish a government-funded dryland salinity program to remedy the

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that have actively sought to undermine greenhouse debate. Like his US counterparts, O'Brien used his authority and influence as a government scientist to defend coal-powered energy in Western Australia. See, N. Oreskes and E. Conway, *Merchants of Doubt: how a handful of scientists obscured the truth on issues from tobacco smoke to global warming*, New York, Bloomsbury Press, 2010.

<sup>219</sup> B. J. O'Brien, 'Greenhouse impacts on the southwest of Western Australia', *Mining Review* vol. 17, no. 1, 1991, p. 20.

<sup>220</sup> B. J. O'Brien, 1992, cited in *Fifty Years of Powering Western Australia: from Western Collieries to Wesfarmers Coal*, Collie, Wesfarmers Coal, 2003, pp. 110-11.

<sup>221</sup> B. Sadler, Letter to B. J. O'Brien, 21 November 1996, Indian Ocean Climate Initiative, 65/0008-pt 1, Bureau of Meteorology, WA Regional Office; and Ministerial Media Statement, Hedy Cowan, Deputy Premier, Government of Western Australia, 12 November 1997, Indian Ocean Climate Initiative, 65/0008-pt 1, Bureau of Meteorology, WA Regional Office.

<sup>222</sup> B. J. O'Brien, *Dreams of rain-forecasting: the missing tool in agriculture*, Floreat Park, EcoEthics, 1994, p. 5. Emphasis in original.



degraded landscape of the wheatbelt had been thwarted because of its rural focus.<sup>223</sup> Research into climate variability in the southwest, however, could benefit both urban and rural Western Australians. Hence, it had been Cowan who in 1997 presented the proposal to the Coalition cabinet to establish IOCI.<sup>224</sup>

By the early 1990s, Australian climate scientists had become increasingly aware of the relationship between the sea surface temperatures of the Indian Ocean and winter rainfall in Australia. A better understanding of this relationship, they believed, could hold the key to improved seasonal forecasting across the country. The recent development of forecasting methods derived from the Southern Oscillation Index, which could indicate the development of El Niño and La Niña events based on temperatures in the Pacific Ocean, had proven especially valuable for the eastern states.<sup>225</sup> With the existing scientific understanding of this relationship between rainfall and ENSO, forecasters struggled to calculate forecasts for the late summer and autumn periods of eastern Australia, and for the western third over most of the year.<sup>226</sup> A closer examination of the Indian Ocean, scientists hoped, would reveal its interactions with the Pacific Ocean and the effects of these on Australian climate conditions.

Scientific interest in the Indian Ocean had increased significantly during the 1950s and 1960s, particularly in the wake of the International Geophysical Year (1957-58) and the creation of the Scientific Committee on Oceanic Research in 1957.<sup>227</sup> Compared to the Atlantic and Pacific Regions, the Indian Ocean was underrepresented in the scientific literature and its exploration, oceanographers believed, would be valuable to marine science and build up scientific communities in the region.<sup>228</sup> The resultant network of observations on the Indian Ocean provided data for local geographer Joseph Gentilli to further develop his comparative studies of climate

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<sup>223</sup> Beresford et al., p. 142.

<sup>224</sup> IOCI Panel, *Report on Second Year—the Indian Ocean Climate Research Initiative—for Western and Southern Australia*, East Perth, IOCI, 2000, p. 2.

<sup>225</sup> N. Nicholls, 'Climatic outlooks: from revolutionary science to orthodoxy', in T. Sherratt, T. Griffiths and L. Robin (eds), *A Change in the Weather: climate and culture in Australia*, Canberra, NMA, 2005, pp. 18-29.

<sup>226</sup> W. Drosowsky, 'Potential predictability of winter rainfall over southern and eastern Australia using Indian Ocean sea-surface temperature anomalies', *Australian Meteorological Magazine*, vol. 42, 1993, p. 1.

<sup>227</sup> For further information on the establishment of the Scientific Committee on Oceanic Research and its interest in the Indian Ocean, see J. D. Hamblin, *Oceanographers and the Cold War: disciples of marine science*, Seattle, University of Washington Press, 2005, pp. 59-139. For information on the development of CSIRO's network of observations of the Indian Ocean, see G. Meyers, 'Predictability and the role of the oceans in the climate system', in *'Of Droughts and Flooding Rains': Managing with climate variability conference*, Canberra, Land and Water Resources Research and Development Corporation, 1996, pp. 10-15.

<sup>228</sup> Hamblin, p. 121.

regions.<sup>229</sup> It was the southwest region that particularly interested him, because it differed from the west coast climates of Africa and South America.<sup>230</sup> In the mid-latitudes of those regions, rainfall was relatively low, whereas the southwest of Australia received comparatively high rainfall. Gentili's analysis of the Indian Ocean data revealed the presence of 'rafts' of warm water that spread along the southwest coast and fostered the conditions for coastal showers.<sup>231</sup> The availability of more sophisticated technology in the late 1970s led oceanographer George Cresswell to characterise these poleward flowing rafts of warm water, which he named the 'Leeuwin Current' in 1980.<sup>232</sup>

Later in the 1980s, Australian climate scientists from CSIRO and the Bureau of Meteorology looked further north, towards the Equator, to examine the interactions of the Indian and Pacific Oceans in the Indonesian region.<sup>233</sup> Meteorologist Neville Nicholls hoped that such studies 'might add to the skill obtainable in seasonal rainfall prediction' for Australia.<sup>234</sup> These inquiries led to two findings that would guide the research of IOCI in the late 1990s. Firstly, marine and climate scientists found that the complex interactions of currents in the Indian and Pacific Oceans (a system called the Indonesian Throughflow) caused El Niño events to affect both eastern Australia and the western third, albeit in different ways.<sup>235</sup> Although these events caused drought in the east, similar conditions would not necessarily develop in the west. Complicating the effects of the El Niño in Western Australia was another phenomena, the Indian Ocean Dipole, or the Nicholls Dipole. The Dipole, when it is present, causes westerly winds to direct rains over the continent.<sup>236</sup> More research on the Indian Ocean, climate and marine scientists concluded, would prove valuable for improving the national

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<sup>229</sup> J. Gentili, 'Thermal anomalies in the Indian Ocean', *Nature*, vol. 238, 1972, p. 93.

<sup>230</sup> J. Gentili, 'Homologous peri-oceanic west coast climates in the southern hemisphere', in A. F. Pearce and D. I. Walker (eds), *The Leeuwin Current: an influence on the coastal climate and marine life of Western Australia*, Perth, Royal Society of Western Australia, 1991, pp. 15-33.

<sup>231</sup> J. Gentili, 'Differentiating the rainfall pattern of rain-bearing systems in Western Australia', *Western Geographer*, vol. 7, 1983, pp. 31-34. The term 'rafts' was coined by Gentili's colleague Dominic Serventy in the 1950s during discussions he had with fishermen about the warm waters and the tropical species of fish that they associated with it. See, G. R. Cresswell, 'The Leeuwin Current – observations and recent models', in Pearce and Walker (eds), *The Leeuwin Current*, p. 1.

<sup>232</sup> G. R. Cresswell and T. J. Golding, 'Observations of a south-flowing current in the southeastern Indian Ocean', *Deep-Sea Research*, vol. 27A, 1980, pp. 449-66.

<sup>233</sup> B. Collis, *Fields of Discovery: Australia's CSIRO*, Crows Nest, Allen & Unwin, 2002, pp. 332-34.

<sup>234</sup> N. Nicholls, 'Sea surface temperatures and Australian winter rainfall', *Journal of Climate*, vol. 2, 1989, p. 973.

<sup>235</sup> G. Meyers, 'Variation of Indonesian throughflow and the El Niño-Southern Oscillation', *Journal of Geophysical Research*, vol. 101, no. c5, 1996, pp. 12255-63.

<sup>236</sup> Nicholls, 'Sea surface temperatures and Australian winter rainfall', pp. 965-73.

meteorological community's ability to predict the weather – both in eastern and Western Australia.

It was this promise of better forecasting, rather than the declining rainfall trend *per se*, that was instrumental in the establishment of IOCI. As earlier chapters attest, the ability to predict the nature of the coming season had long proven elusive in Western Australia. Forecasting the weather conditions of the year ahead, or even several years ahead, would be an incredibly valuable service for the rural community and water managers alike. Forecasting seasonal conditions could help Big Water avoid 'financial losses of tens of millions annually and socio-political "fallout"' of introducing harsh water restrictions.<sup>237</sup> If the Water Corporation had sufficient warning of dry conditions, it could implement 'milder forms of water restrictions', accelerate its development of other water sources, and seek approval from the Water and Rivers Commission to draw additional supplies from groundwater reserves.<sup>238</sup> For the agriculture and water sectors alike, there were direct economic benefits to be derived from unraveling the secrets of the southwest's climate.

The state government hoped that IOCI would consolidate the research conducted by the Bureau of Meteorology and CSIRO on the climate processes of the southwest and provide state agencies with much-needed information on the climate variability affecting the region.<sup>239</sup> Its principal purpose was to analyse the possible relationships between sea temperatures in the Indian Ocean; the declining rainfall pattern of the southwest; and the El Niño-Southern Oscillation phenomenon, with the aim of improving the accuracy of weather forecasting and the prediction of climate change. Despite the focus of IOCI's research on the complexities of the Indian Ocean and its implications for climate variability and change in the southwest, its establishment coincided with the closure of CSIRO's Marine Branch laboratories in Perth. Members of its staff were either made redundant or transferred to Hobart, which 'virtually eliminated CSIRO's marine presence in Western Australia'.<sup>240</sup> Marine research for the west coast, therefore, would be chiefly conducted in Brisbane or Hobart, ensuring that

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<sup>237</sup> R. Stokes, 'Water Corporation interest in climate variability and seasonal forecasting', 21 February 1997, Indian Ocean Climate Initiative, 65/0008, Bureau of Meteorology, WA Regional Office.

<sup>238</sup> R. Stokes, 'Water Corporation interest in climate variability and seasonal forecasting', 21 February 1997, Indian Ocean Climate Initiative, 65/0008, Bureau of Meteorology, WA Regional Office.

<sup>239</sup> S. Power, B. Sadler and N. Nicholls, 'The influence of climate science on water management in Western Australia: lessons for climate scientists', *Bulletin of the American Meteorological Society*, vol. 86, 2005, pp. 839-44.

<sup>240</sup> E. Davies Ward, 'WA loses CSIRO Marine Branch', *Greener Times*, June, 1998, p. 4.

scientific understandings of southwest conditions would be developed far from the affected region.

By the end of the 1990s, the issue of the region's drying trend had been absorbed into competing but not exclusive scientific and policymaking positions on climate change, drought, and climatic variability, which I explore further in the next chapter. The water managers of the southwest did not have the luxury of waiting for more definite conclusions on the possible impacts of climate change. In their view, the climate in the southwest had changed, and it was adversely affecting the region's water supplies. Although the collaborative research effort embodied by IOCI reflected a range of concerns for the region, these concerns were all directed at understanding the climate processes that affected the southwest. As a response to agricultural and environmental concerns about the causes and implications of the ongoing dry conditions in the southwest, IOCI represented the latest chapter in the checkered history of state-sponsored scientific investigation into the region's climate for the purposes of economic development and reducing the effects of water scarcity.

### *Conclusion*

At the end of the twentieth century, Western Australians in the southwest faced unprecedented challenges to their hydroresilience. The degradation of land and water resources across the agricultural areas could no longer be ignored, coastal wetlands were under strain, and the region's climate appeared to be changing. Yet the blind faith in science and technology that had once characterised the state's development had begun to recede as the characteristics of the 'risk society' became evident in some sections of the community. Environmentalists were especially sceptical of the traditional technocratic approaches to climate variability and water scarcity. In their demands for alternative strategies to improve the hydroresilience of the southwest's social-ecological systems, they found unlikely allies in those who doubted the veracity of anthropogenic climate change.

In light of the uncertainty surrounding the impact of the greenhouse effect on the regional climate, water managers attempted to reduce the vulnerability of Big Water to water scarcity. In addition to re-evaluating their expectations of future rainfall, water managers endeavoured to shore up supplies for Big Water by protecting groundwater from contamination and exploitation. Their efforts were hampered, however, by the unwillingness of state governments to curb consumption. The inaction of the

government was both populist and indicative of the ethos of user pays – if customers were willing to pay for water, they could use as much as they wanted. In the area of water resources, at least, the influences of economic rationalism and corporatisation were hindering the environmental and social objectives of ecologically sustainable development in the suburbs of Perth. Many households remained entrenched in their thirsty lifestyles, which would leave them vulnerable to running out in the future.

The withdrawal of government protection and financial support for the nation's agricultural industries extended to an emphasis on self-reliance and risk management in the area of climate variability. Already faced with declining terms of trade, unserviceable debts, slumping morale and land degradation, many farmers lacked the financial reserves to overcome the environmental problems facing their farms and to improve their resilience to water scarcity. They would be particularly vulnerable to the onset of dry conditions at the turn of the twentieth century.

Despite repeated lip-service to the international climate change policy process, state and federal governments had achieved little in reducing greenhouse gas emissions during the 1990s. As the greenhouse effect was contributing to the drying climate in the southwest, this short-sighted policy was serving only to diminish the region's hydroresilience. It was not until the end of the century that funding was provided for scientific research into the causes and magnitude of the climate changes affecting the southwest. This occurred just in time for the 'water crisis' of the new millennium.

**Watershed:  
Climate and water in the early twenty-first century (2001 to 2006)**

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*Perth today survives on fossil water, pumping water out of the ground. No-one knows how much is there or how long that fossil water will last. But given the dire situation of agriculture in Western Australia, the increasing salinisation, the destruction of the western wheat belt, you have got to think that Perth might be the first metropolitan ghost town, if you want, of the twenty-first century. It is the most isolated city on the planet and is exquisitely vulnerable to the sorts of changes that global warming is bringing and amplifying every decade.<sup>1</sup>*

- Tim Flannery, 2004

On the eve of a new century, Western Australians were poised for another mining boom in the state's northwest. But this renewed prosperity would not be without its difficulties. With the flow of good fortune to Perth came more people to the suburbs, placing further demands on the strained environment of the Swan Coastal Plain, particularly its groundwater reserves. The onset of dry conditions from 2001 (Appendix VI) would add to the pressure on Big Water to maintain its illusion of endless supplies for its customers. These lean years further burdened the southwest's farmers, who were already beset with environmental and financial challenges. The southwest was not alone, however, in confronting the challenges of drought and water scarcity, as large parts of Queensland, New South Wales, Victoria and South Australia were also running dry. Growing lay and scientific anxieties about the role of anthropogenic climate change in the regional drying trend focussed political attentions on the future of the southwest's water resources in a drier climate.

Despite a lingering mistrust of science and technology, most Western Australians continued to rely on technocratic means to understand and respond to the risk of running out. In this chapter, I examine how the association of drought with anthropogenic climate change raised anxieties about the vulnerability of Big Water to climate variability and water scarcity. Although the government's tightening of water restrictions and development of additional sources of supply averted shortages, I contend that this approach left Big Water and its customers vulnerable to dry conditions in the future. These technocratic solutions would perpetuate consumers' dependency on reticulation and diminish the resilience of the region's groundwater reserves to

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<sup>1</sup> T. Flannery, *Sydney Futures Forum*, Sydney, NSW Dept of Infrastructure, Planning and Natural Resources, 18 May 2004.

ecological change. For those beyond Big Water, drought and the prospect of a drying climate added to the swathe of financial and environmental challenges they faced, which shaped the ways in which farmers in particular responded to climate variability and water scarcity in the early twenty-first century.

### *On the ropes*

On the eve of the new millennium, drought crept across the wheatbelt's paddocks once again. As the dry conditions wore on, government officials declared that the agricultural areas faced the region's worst drought on record.<sup>2</sup> The onset of the drought hit some farmers especially hard. Many were still recovering from devastating episodes of frost and locust plagues in the late 1990s. The De Landgrafft family at Lake King, who had acquired their property in the dying days of land release, were up against their fourth 'lean harvest' in a row, as were the Wyatts in Pingaring.<sup>3</sup> Meanwhile, the Browning family at Kondinin were 'trying to be positive' as they adopted 'survival tactics'.<sup>4</sup> Even areas that farmers had long regarded as 'safe' from drought were hit as the affected area extended from Mullewa in the northeast to Esperance on the south coast.<sup>5</sup> The persistence of dry conditions in 2002 and early 2003 had many farmers against the ropes with crashing waves of dust and emu invasions offering few opportunities to shield themselves from the blows.<sup>6</sup> The dry conditions combined with earlier misfortunes to grind down the resilience of many farmers in the southwest to climate variability and water scarcity. In this section, I examine how the drought affected those farmers beyond the reach of Big Water and further eroded their resilience to poor seasons, land degradation and unfavourable markets.

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<sup>2</sup> L. Tickner, 'Stricken farmers call for more aid', *West Australian*, 18 July 2001, p. 7.

<sup>3</sup> J. Pratley, 'A grim harvest for family', *West Australian*, 2 December 2000, p. 4; and N. Lee, 'Desperate wait for rain and feed', *Countryman*, 7 June 2001, p. 3.

<sup>4</sup> N. Lee, 'Family in survival mode', *Countryman*, 28 June 2001, p. 3.

<sup>5</sup> L. Tickner, 'Time to act on drought crisis: MP', *West Australian*, 29 June 2001, p. 12; L. Tickner, 'Drought cost put at \$2.5b', *West Australian*, 3 July 2001, p. 5; and L. Tickner, 'Farmers suicide in drought', *West Australian*, 7 July 2001, p. 8.

<sup>6</sup> See for instance, P. Trott, 'Wheatbelt drought threat', *West Australian*, 24 June 2002, np; N. Lee, 'Sheep feed and soil blowing away', *West Australian*, 4 July 2002, np; A. Hayward, 'Drought hotspots', *Countryman*, 11 July 2002, p. 5; P. Trott, 'Wheatbelt farmers in for lean year – forecast', *West Australian*, 22 July 2002, np; N. Taylor, 'Dams and dollars dry up on farms', *Sunday Times*, 28 July 2002, p. 9; P. Trott, 'State's farmers seek drought aid', *West Australian*, 30 July 2002, np; P. Trott, 'Dry winter spells cut in crop yield', *West Australian*, 24 August 2002, np; P. Trott, 'Drought may force farmers to quit', *West Australian*, 14 September 2002, np; N. Taylor, 'Drought farms call for help', *Sunday Times*, 15 September 2002, p. 13; N. Taylor, 'A town dying of thirst', *Sunday Times*, 29 September 2002, p. 3; F. Adolph, 'Disaster in wheatbelt', *Sunday Times*, 29 September 2002, p. 3; N. Taylor, 'Hungry emus eye crops', *Sunday Times*, 13 October 2002, p. 5; N. Taylor, 'Dust blight for farmers', *Sunday Times*, 3 November 2002, p. 18; and N. Butterly, 'Wheat farmers' fingers crossed for rain', *Sunday Times*, 15 June 2003, p. 61.

Although the state's Department of Agriculture had warned farmers in early 2002 that the development of a moderate El Niño would lead to below average rainfall in the Western Australian wheatbelt, farmers did not necessarily act on this information.<sup>7</sup> Some felt the risk of dry conditions was not significant enough to warrant changing their plans, while others had little confidence in the Department's forecasts, particularly as they differed from those issued by other agencies, such as the Melbourne-based Bureau of Meteorology.<sup>8</sup> Farmers in the central and eastern areas of the wheatbelt who had heeded these forecasts reduced the size of their cropping programs and the amount of fertiliser they applied to their crops, which prevented them suffering financial losses.<sup>9</sup>

Most drought-affected farmers had very few financial resources to shield themselves from the consequences of the climate conditions and prepare themselves for the future. The average farm debt in the dry Lake Grace district had more than doubled since the late 1990s and parts of the eastern wheatbelt, which had been hit hard by the drought, were among the state's lowest earning areas.<sup>10</sup> For many farmers, the regime of self-reliance and efficiency had exacerbated their troubled financial circumstances. The risk averse farm planning and management that these policies encouraged left lean margins with which to operate and few financial reserves with which to gamble. In some cases, the implementation of strategies that were less risky in terms of production,

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<sup>7</sup> D. Stephens et al., 'Experiences in the use of climate information, and its communication in 2002/03, from the perspective of the Department of Agriculture, WA', in N. Plummer et al. (eds), *DroughtCom Workshop: improving the communication of climate information*, Vol. 2, 2003, Melbourne, Bureau of Meteorology, p. 42. In 1984, meteorologist Mal Lamond established the private consulting firm, Austweather (later, Lamond Weather Services), and commenced issuing seasonal forecasts to subscribers in southeast Asia and Australia, including those in the Western Australian wheatbelt. These forecasts are largely based on the Southern Oscillation Index and in 1994, a CSIRO study of rainfall predictions in Australia found the Austweather forecasts exhibited 'significant overall skill', far greater than those issued by the National Climate Centre of the Bureau of Meteorology. In the late 1980s, Lamond began working with student David Stephens, who later joined the state's Department of Agriculture as a climatologist, to improve the accuracy of this forecasting technique. See, I. Smith, 'Assessments of categorical rainfall predictions', *Australian Meteorological Magazine*, vol. 43, 1994, pp. 143-51; D. J. Stephens, T. J. Lyons and M. H. Lamond, 'A simple model to forecast wheat yield in Western Australia', *Journal of the Royal Society of Western Australia*, vol. 71, nos 2-3, 1989, pp. 77-81; D. J. Stephens and M. L. Lamond, 'Midlatitudes role in ENSO', *Bulletin of the American Meteorology Society*, vol. 84, no. 5, 2003, pp. 568-69; and D. Stephens, pers. comm., 11 January 2012.

<sup>8</sup> Stephens et al., pp. 42-44.

<sup>9</sup> Stephens et al., p. 42; and D. Stephens, pers. comm., 20 March 2012.

<sup>10</sup> B. Ruse, 'Country-city gap widens', *West Australian*, 18 January 2003, np. These areas were Pingelly, Trayning and Wickelup.



that is to cope with seasonal variability, could make the farming enterprise ‘much more prone to financial risk’.<sup>11</sup> For instance,

[L]ow stocking rates may not allow enough income to be generated in the good seasons to allow a farmer to survive the poor seasons. Stocking according to season may result in stock being purchased at high prices and sold at low prices. Dates of lambing or calving that favour production may not favour marketing. Fodder may be conserved on the farm to support higher stocking rates, but with the extra stock numbers, less surplus is available to be conserved.<sup>12</sup>

In a market economic context, the political emphasis on drought risk management, therefore, had heightened the financial vulnerability of many southwest farmers to climate variability at the turn of the twenty-first century.

Although the severity of the drought qualified many farmers in affected areas for relief under the provisions for ‘exceptional circumstances’ in the national drought policy, their financial difficulties flowed through to the wider rural community.<sup>13</sup> The farmer’s lighter pocket meant she or he had less to spend on machinery; slashed property values meant lower council rates and dwindling shire coffers; and a lack of hope was devastating for family wellbeing and mental health.<sup>14</sup> Less spare change also meant there was less room in farmers’ budgets to undertake land and water conservation

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<sup>11</sup> D. White, D. Collins and M. Howden, ‘Drought in Australia: prediction, monitoring, management and policy’, in D. A. Wilhite (ed.), *Drought Assessment, Management, and Planning: Theory and Case Studies*, New York, Kluwer, 1993, p. 227.

<sup>12</sup> White, Collins and Howden, p. 227.

<sup>13</sup> K. Gauntlett, ‘Impact hits communities’, *West Australian*, 29 June 2001, p. 12; N. Lee, ‘Business feels pinch of the dry’, *Countryman*, 12 July 2001, p. 4; ‘WAFF man concerned over small business being forgotten in dry’, *Kalgoorlie Miner*, 13 July 2001; A. Malan, ‘Farmers deserve Federal help’, *West Australian*, 19 July 2001, p. 16; L. Ladyman, ‘Rates fear for councils’, *Countryman*, 26 July 2001, p. 5; P. Trott and S. Peacock, ‘Rain or bust in regions’, *West Australian*, 28 July 2001, p. 61; L. Ladyman, ‘Country shires united in battle against drought’, *Countryman*, 9 August 2001, p. 5; N. Lee, ‘Common issues aired on drought’, *Countryman*, 1 August 2002, p. 6; N. Taylor, ‘A town dying of thirst’, *Sunday Times*, 29 September 2002, p. 3; and P. Trott, ‘Drought dollars feed bush town’, *West Australian*, 12 November 2002, np.

<sup>14</sup> Sociologist Margaret Alston has undertaken extensive research into the diverse social impacts of drought on men, women and families in rural New South Wales. She argues that the dominant discourses and imagery of drought have marginalised the experiences of Australian rural women and families during periods of climate variability and water scarcity. See for instance, M. Alston, ‘“I’d like to just walk out of here”: Australian women’s experience of drought’, *Sociologia Ruralis*, vol. 46, no. 2, 2006, pp. 154-70; M. Alston, ‘The gendered impact of drought’, in B. B. Bock and S. Shortall (eds), *Rural Gender Relations: issues and case studies*, Cambridge, CABI Publishing, 2006, pp. 165-80; M. Alston, ‘Gender implications of water management in Australian agriculture’, in K. Lahiri-Dutt (ed.), *Fluid Bonds: views on gender and water*, Kolkata, Stree Books, 2006, pp. 246-57; M. Alston, ‘Gender and climate change: variable adaptations of women and men’, *Just Policy*, no. 46, 2007, pp. 29-35; and M. Alston, ‘Drought policy in Australia: gender mainstreaming or gender blindness?’, *Gender, Place and Culture*, vol. 16, no. 2, 2009, pp. 139-54.

projects that might reduce their vulnerability to further degradation of their properties. Already more than a third of the region's dams were brackish or saline and even more were of marginal quality.<sup>15</sup> One drought-affected Narembeen farmer, for instance, reported that he could no longer afford to construct additional drains on his property to drain away saline water, which he considered would lead to the loss of even more of his land to salt.<sup>16</sup> The more precarious financial situations of many farmers also affected their access to government assistance for water supplies. Most government grants to improve dams and construct pipelines, for instance, required farmers to contribute at least half of the cost of this infrastructure, reflecting the prevailing influence of user pays on agricultural policy.<sup>17</sup>

The dry conditions also prompted calls from farming organisations for access to 'multi peril crop insurance', which would provide farmers another tool of risk management through financial protection against crop failures.<sup>18</sup> But a government appointed taskforce found the scheme would have 'no future ... in the absence of significant government subsidisation of premiums of underwriting of risk'.<sup>19</sup> Even though analysts considered that the relatively reliable climate of the southwest made the region ideal for crop insurance, the concept was out of step with the neoliberal direction of Australian agricultural policy.<sup>20</sup>

Although the government had worked hard to shore up supplies for Big Water, those beyond the reticulated network had to bear the brunt of the return of dry conditions in 2005 and 2006. Farmers on the south coast and the northeastern wheatbelt were hit particularly hard once again, with many recording their worst harvests.<sup>21</sup> Meanwhile, in the northern wheatbelt over seventy per cent of farmers had changed

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<sup>15</sup> Environmental Protection Authority (EPA), *State of the Environment Report*, EPA, 2007, <<http://www.epa.wa.gov.au/AbouttheEPA/SOE/2007/Pages/default.aspx>>, (Accessed: 10 May 2012), p. 85.

<sup>16</sup> M. Zekulich, 'Farmers going down the drain', *West Australian*, 28 December 2000, p. 13.

<sup>17</sup> Department of Water, *Rural Water Plan Implementation 1995-2010*, Perth, Dept of Water, 2011, pp. 10, 16.

<sup>18</sup> G. Hertzler, 'Prospects for insuring against drought in Australia', in L. C. Botterill and D. A. Wilhite (eds), *From Disaster Response to Risk Management*, Dordrecht, Springer, 2005, p. 133.

<sup>19</sup> Cited in Hertzler, p. 127. Such insurance was made available to WA wheat and barley growers in early 2011. See, 'Growers get multi-peril crop insurance', *ABC News*, 5 April 2011, <<http://www.abc.net.au/news/2011-04-05/growers-get-multi-peril-crop-insurance/2629706>>, (Accessed: 10 October 2011).

<sup>20</sup> Hertzler, p. 127.

<sup>21</sup> S. Jerrard, 'Many WA towns run out of water', *West Australian*, 31 January 2005, p. 1; S. Jerrard, 'Rural areas hit with tougher water bans', *West Australian*, 9 February 2005, p. 11; A. Probyn, 'WA farmers miss out on drought aid', *West Australian*, 17 October 2006, p. 1; A. Probyn, 'Most WA farmers to get no drought relief', *West Australian*, 25 October 2006, p. 4; and N. Taylor, 'Farm yields dry up', *Sunday Times*, 29 October 2006, p. 2.

their management practices ‘in response to perceived changes in climate’.<sup>22</sup> The growing trend towards reduced tillage and early sowing since the 1980s as well as the introduction of new crop varieties had led to higher yields, despite the run of dry seasons.<sup>23</sup> Whether southwest farmers considered the ‘changes in climate’ were natural or human-induced, many were certain that ‘humans would adapt naturally as the climate changed’.<sup>24</sup>

### **Big Water**

The dry winter of 2001 delivered the lowest streamflows to Perth’s dams since the drought of 1914. Although the Court government had promised to ‘drought proof’ Perth the previous year, Big Water now had to increase its draw on groundwater reserves and

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<sup>22</sup> Australian Bureau of Statistics (ABS), *Farm management and climate, 2006-2007*, no. 4625.0, Canberra, ABS, 12 September 2008, <[http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/CA7A10D4D9A868E7CA2574C10015B61D/\\$File/46250\\_2006-07.pdf](http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/CA7A10D4D9A868E7CA2574C10015B61D/$File/46250_2006-07.pdf)>, (Accessed: 12 January 2012), p. 11. These changing practices reflected the findings of L. Head et al., ‘A fine-grained study of the experience of drought, risk and climate change among Australian wheat farming households’, *Annals of the Association of American Geographers*, vol. 101, no. 5, 2011, pp. 1089-1108.

<sup>23</sup> L. Morgan et al., *Climate Change, Vulnerability and Adaptation for South West Western Australia, 1970 to 2006*, South Perth, Dept of Agriculture and Food, 2008, p. 55; and W. K. Anderson et al., ‘The role of management in yield improvement of wheat crop – with special emphasis on Western Australia’, *Australian Journal of Agricultural Research*, vol. 56, 2005, pp. 1137-49. During the 1970s, economic and environmental pressures had combined to encourage southwest farmers to explore minimum tillage. Traditional techniques of weed control disturbed the soil through repeated ploughing, raking, ripping, and scarifying, which made soils vulnerable to problems such as erosion. In contrast, minimum tillage cropping systems utilised herbicides to kill weeds, which reduced the need for ploughing and retained the soil structure. Less ploughing meant that farmers could lower their fuel costs, which was especially attractive in light of the 1970s oil crises. Minimum tillage therefore offered farmers the opportunity to significantly reduce the costs of grain production, particularly in terms of fuel, labour and time. As minimum tillage cultivation required less work before sowing, the method also offered farmers greater flexibility than conventional tillage to respond to market and climate variability. Although many farmers had experimented with minimum tillage practices during the 1980s, it was not until the 1990s that the system became widespread. Between 1993 and 1995, the percentage of grain growers using these techniques in WA increased five-fold, from just two per cent to ten per cent. Adoption of the technique then soared in the mid to late 1990s, a trend that the Department of Agriculture considers responsible for a sharp rise in annual yield growth over the same period. The average rate of increase of yield grew from about 12kg per hectare per year from 1950 to 1990, to about 55kg per hectare per year in the 1990s. See for example, ‘Future lies in high yields: Department’, *Western Farmer*, 19 December 1985, p. 5; Department of Agriculture (WA), *Annual Report for the Year Ended 30<sup>th</sup> June 1985*, South Perth, Dept of Agriculture, 1985, p. 5; W. L. Crabtree, *Toward Better Minimum Tillage for South-Coastal Sandplain Soils*, South Perth, Dept of Agriculture (WA), 1990; R. Chan, ‘Tillage reduced at Goomalling’, *Western Farmer*, 23 August 1990, p. 23; K. Bligh, *No Till Farming Systems in North America with relevance to Western Australia*, Dept of Agriculture, 1995, <[http://www.agric.wa.gov.au/objtwr/imported\\_assets/content/\\_archive/tr158.pdf](http://www.agric.wa.gov.au/objtwr/imported_assets/content/_archive/tr158.pdf)>, (Accessed: 29 October 2010), p. 1; Anderson et al., pp. 1108-1139; and W. Crabtree, *Search for Sustainability with No-Till Bill in Dryland Agriculture*, Beckenham, Crabtree Agricultural Consulting, 2010.

<sup>24</sup> C. Evans, C. Storer and A. Wardell-Johnson, ‘Rural farming community climate change acceptance’, *International Journal of the Society of Agriculture and Food*, vol. 18, no. 3, 2011, p. 228.

tighten water restrictions on its customers to ensure sufficient supplies. In addition to the prohibition of sprinklers during the day, customers were now forbidden from using their sprinklers more than twice a week.<sup>25</sup> Bore owners were also expected to tighten their belts and had their water use restricted to night-time.<sup>26</sup> The government also targeted Perth's thirstiest residents with a price hike for those households who used more than 550kL of scheme water a year.<sup>27</sup> Although these restrictions and price rises failed to address the inherent vulnerability of Big Water arising from its large and complex technical networks, they achieved a reduction in scheme water use and helped to force a small degree of cultural change surrounding water consumption in the suburbs.

The tightening of water restrictions and higher prices focussed household conservation efforts on their gardens and helped to reduce water consumption in Perth from over 180kL per head per year in 2000/2001 to about 150kL the following year.<sup>28</sup> In many households, bore water most likely made up the difference. Although the use of bores was restricted, the government again encouraged residents to invest in these independent supplies to relieve the pressures on Big Water, despite the potential ecological effects of this unmonitored private abstraction on shallow groundwater reserves.<sup>29</sup> The government also relaxed regulations on the use of grey water in suburban gardens and later offered small rebates on less thirsty showerheads, washing machines and toilet cisterns, as well as rainwater tanks.<sup>30</sup> Although fewer than ten per cent of households invested in a rainwater tank, more than a quarter had a bore to ensure their gardens would not suffer.<sup>31</sup> The obvious benefit of the bore was that it could run all year, while the rainwater tank relied on rains, which was not necessarily helpful during Perth's dry summer months.

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<sup>25</sup> C. Amalfi, 'Water restrictions to hit bore owners', *West Australian*, 4 September 2001, np.

<sup>26</sup> Amalfi, np.

<sup>27</sup> S. Pennells, 'Charges aim at top water guzzlers', *West Australian*, 11 February 2003, np.

<sup>28</sup> Australian Academy of Technological Sciences and Engineering (ATSE), *Perth's Water Balance: the way forward*, Melbourne, ATSE, 2002, p. II.

<sup>29</sup> P. Trott, 'Summer water bans loom', *West Australian*, 3 September 2001, np; and C. Amalfi, 'Total sprinkler ban looms', *West Australian*, 3 November 2001, np.

<sup>30</sup> N. Taylor, 'Half of water put on lawns', *Sunday Times*, 18 November 2001, p. 2; C. Amalfi, 'Bucket limit on waste water', *West Australian*, 2 February 2002, np; and Pennells, 'Charges aim at top water guzzlers', np.

<sup>31</sup> See, ABS, 'Water choices of Perth households', *Western Australian Statistical Indicators*, 2010, no. 1367.5, Canberra, ABS, 12 February 2010, <<http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/1367.5Feature%20Article82010?opendocument&tabname=Summary&prodno=1367.5&issue=2010&num=&view=>>, (Accessed: 5 February 2011). See also, Marsden Jacob Associates, *The Cost Effectiveness of Residential Rainwater Tanks in Perth*, Perth, Marsden Jacob Associates, April, 2009, <<http://www.water.wa.gov.au/PublicationStore/first/85820.pdf>>, (Accessed: 3 March 2012).

As the reduction in consumption suggests, most of Big Water's customers were receptive to the need to conserve scheme water. Many remained concerned, however, about the consequences of such measures for the appearance of their gardens. The people of Perth were just as anxious about maintaining their lawns and gardens as they had been in the late 1970s. After a hiatus during the 1980s and early 1990s, customers had begun to use as much water outside the home as they had before the introduction of user pays in the late 1970s. During this time, observed George Seddon, Perth had 'gone palm', favouring lush and thirsty greenery over more hardy species that could withstand dry spells.<sup>32</sup> Although homes were occupying a larger proportion of the residential block, leaving less space for outdoor areas, these spaces had become sites of entertainment, recreation and conspicuous consumption.<sup>33</sup> From elites through to the aspirational working class, front gardens especially were places of spectacle, which required large amounts of water to maintain their verdant appearance to residents and visitors.<sup>34</sup> As a resident from the leafy, riverside suburb of Applecross explained, '[I]f you drive down the street and everybody has got reasonable lawns and one's got a dead patch, it's like pointing the finger of scorn isn't it'.<sup>35</sup>

The association of a dry garden with an uncivilised household remained powerful in the suburbs. Faced with the daunting prospect of maintaining the appearance of a large verge area under water restrictions, one resident complained, 'If I left it looking like nature it would look like an Aboriginals' camp wouldn't it. You know I am nearly forced to put a lawn in aren't I'.<sup>36</sup> This racist turn of phrase underlines the potent legacy of the discriminatory sanitary order that had been forged in the southwest at the turn of the twentieth century and continued to play a part in the marginalisation of the region's Aboriginal people. Despite the greater availability of welfare services for disadvantaged Western Australians, Indigenous people remained overrepresented among the state's homeless population, and many therefore, lacked regular access to the benefits of Big Water.<sup>37</sup>

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<sup>32</sup> G. Seddon, *Landprints: reflections on place and landscape*, Oakleigh, Cambridge University Press, 1997, p. 105.

<sup>33</sup> T. Hall, *The Life and Death of the Australian Backyard*, Collingwood, CSIRO, 2010, pp. 41-72.

<sup>34</sup> Hall, pp. 88, 116-19.

<sup>35</sup> Cited in T. Kurz et al., 'The ways that people talk about natural resources: discursive strategies as barriers to environmentally sustainable practices', *British Journal of Social Psychology*, vol. 44, 2005, p. 609.

<sup>36</sup> Cited in Kurz et al., p. 609. Please note that verge areas in Perth are the property of local governments, although they do not pay for their maintenance. In addition, many local governments prevent residents from planting the verge with anything other than lawn.

<sup>37</sup> C. Chamberlain and D. MacKenzie, *Counting the Homeless*, Canberra, ABS, 4 September 2006,

<<http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/57393A13387C425DCA2574B90016>

Although Big Water's demand management policies achieved the desired reduction in water consumption, these approaches were not unproblematic. The combination of water restrictions and rebates again pointed the finger solely at consumers for the southwest's water worries, rather than the infrastructure of Big Water itself, which continued to detach water users from the processes of water supply and allowed the persistence of a profligate water culture. The strategy of water restrictions is cheap, quick and effective, but it is an especially blunt instrument because it does not differentiate between users and uses of household water.<sup>38</sup> Moreover, it does not challenge the path dependencies of the technologies and institutional cultures of Big Water.<sup>39</sup> As Stephen Dovers has observed, this 'blame-shifting onto the individual ... eases need for effective reform of patterns of production and consumption, settlement and governance'.<sup>40</sup> In other words, these strategies did little to question the status quo of Big Water in the suburbs.

Nor did the popularity of automatic reticulation systems in Perth's suburbs. About a quarter of Perth households owned such systems, which reduced the inconvenience of water restrictions for those who could afford them.<sup>41</sup> By 2008, over two thirds of Perth properties had invested in this technology.<sup>42</sup> Although such reticulation systems made it much easier for households to comply with water restrictions, the lack of interruption to their daily routines allowed many to remain divorced from the processes of water supply as they did not have to alter their personal routines to accommodate the restrictions. Culturally and physically remote from the source of their water supplies, the people of Perth remained, vulnerable to climate variability and water scarcity in the future.

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2DF0/\$File/20500-2008Reissue.pdf>, (Accessed: 6 November 2010), pp. 45-46. See also, S. Gordon, K. Hallahan and D. Henry, *Putting the Picture Together: Inquiry into response by government agencies to complaints of family violence and child abuse in Aboriginal communities*, Perth, Dept of Premier and Cabinet, 2002.

<sup>38</sup> Z. Sofoulis, 'Big Water, Everyday Water: a sociotechnical perspective', *Continuum*, vol. 19, no. 4, p. 456-57.

<sup>39</sup> P. Troy, 'Conclusion', in P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australian cities*, Canberra, ANU Epress, 2008, p. 196.

<sup>40</sup> S. Dovers, 'Urban water: policy, institutions and government', in P. Troy (ed.), *Troubled Waters: confronting water crisis in Australia's cities*, Canberra, ANU Epress, 2008, p. 83.

<sup>41</sup> M. Loh and P. Coghlan, *Domestic Water Use Study in Perth, Western Australia 1998-2001*, Leederville, Water Corporation, 2003, p. 6.

<sup>42</sup> Water Corporation, *Perth Residential Water Use Study 2008/2009*, Perth, Water Corporation, 2010, p. 17.

## *A Water Crisis?*

Although restrictions had managed to reduce the residential demands on Big Water, the government's anxieties about the persistence of dry conditions in the southwest remained. The idea of a 'water crisis' facing the southwest, particularly Perth, took hold early in the first term of the Gallop Labor government. The state Environment Minister uttered the phrase in Parliament in late August 2001 and the press followed, as the prospect of tighter water restrictions loomed after a dry winter.<sup>43</sup> The state of crisis was seemingly confirmed in October when the Water Corporation declared that the inflows into the dams of Big Water were the worst since 1914.<sup>44</sup> Government-funded scientific research suggested that the declining rainfall trend would continue and that it was more than likely a consequence of anthropogenic climate change. Despite these findings, the head of IOCI, Brian Sadler, confided to colleagues at the Bureau of Meteorology in August 2002 that 'the water situation is actually being managed pretty well and falls short of being the crisis that it is often labelled to be'.<sup>45</sup> In this section, I examine how and why the state government depicted the dry conditions affecting the water supplies of Perth as a 'water crisis'. Although there was a trend of declining rainfall, I contend that the prevailing climate conditions and water storages did not constitute a crisis. Rather, the state government played on the electorate's anxieties about running out to justify developing additional water supplies for the southwest in the early twenty-first century. This strategy, I argue, required the government to construct a situation of scarcity in order to provoke the electorate's anxieties. The government could then act to allay these concerns by increasing supplies, which would enhance its political standing to voters.

The onset of these dry conditions in the southwest coincided with the publication of the first stage of IOCI research in 2002, which appeared to substantiate the government's declaration of a 'water crisis'. IOCI scientists reported that the region had experienced a rainfall decline since the mid-1970s, which they attributed to a

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<sup>43</sup> *Western Australian Parliamentary Debates*, vol. 369, 22 August 2001, p. 2748; M. Stevens, 'Summer sprinkler ban looms', *West Australian*, 23 August 2001, np; and B. McCarthy, 'Bridge's plan would solve water crisis', *Sunday Times*, 9 September 2001, p. 14.

<sup>44</sup> M. Stevens, 'Summer sprinkler ban looms', *West Australian*, 23 August 2001, np; C. Amalfi, 'Water restrictions to hit bore owners', *West Australian*, 4 September 2001, np; C. Amalfi, 'Water crisis deepens', *West Australian*, 19 October 2001, np; C. Amalfi, 'Waste water rescue plan', *West Australian*, 3 November 2001, np; C. Amalfi, 'Blunt warning to save water', *West Australian*, 15 November 2001, np; and N. Taylor, 'Half of water put on lawns', *Sunday Times*, 18 November 2001, p. 2.

<sup>45</sup> B. Sadler, Email to William Wright and John Cramb, 'Re: brief question or two', 20 August 2002, Bureau of Meteorology, Indian Ocean Climate Initiative, 65/0008-09, Bureau of Meteorology, WA Regional Office.

combination of natural climate variability and the enhanced greenhouse effect.<sup>46</sup> For several decades then, the southwest had been experiencing those drier conditions that many scientists predicted would afflict the southern region of Australia as carbon dioxide levels increased into the middle of the twenty-first century. The dry conditions that were affecting the southwest in 2002, therefore, were not merely a passing episode, but were instead evidence of an ongoing drying trend. Scientists identified fewer days where rain fell, and less rain when it did fall.<sup>47</sup> With less rainfall, there was even less runoff or streamflow into the region's dams because dry soils take longer to saturate, which delays the process of water seeping into waterways and aquifers.<sup>48</sup> These forecasts of even drier conditions in the future captured the headlines and conjured a vision of the metropolis deserted for want of water: simply, 'Perth water options dry up'.<sup>49</sup>

The recently elected Labor state government utilised IOCI's findings to underpin some of its policies, particularly in the areas of the environment, transport, and water resource development. This approach contrasted strikingly with that of the conservative Federal government, which, since its election in 1996, had worked tirelessly to suppress and undermine greenhouse debate within Australia and to stymie attempts to negotiate an international climate change regime. The Federal government argued that any global agreement on reducing greenhouse emissions would be detrimental to the resource-dependent Australian economy. This position reflected the coalition's traditional support base, the business, mining, and agriculture sectors. As a result, Commonwealth-funded scientists were pressured to avoid engaging in the public debate on anthropogenic climate change.<sup>50</sup> For the Coalition, the nation's economic development took precedence over the long-term future of the environment.

The state government was arguably more receptive to the research of climate scientists because their findings aligned with both the Labor Party's focus on sustainable economic development and the environmental concerns of its predominantly

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<sup>46</sup> IOCI, *Climate Variability and Change in South West Western Australia*, Perth, IOCI, 2002, np.

<sup>47</sup> B. C. Bates et al., 'Key findings from the Indian Ocean Climate Initiative and their impact on policy development in Australia', *Climatic Change*, vol. 89, nos 3-4, 2008, p. 342.

<sup>48</sup> Å. Wahlquist, *Thirsty Country: options for Australia*, Crows Nest, Allen & Unwin, 2008, p. 2.

<sup>49</sup> D. Day, *The Weather Watchers: 100 years of the Bureau of Meteorology*, Carlton, Melbourne University Publishing, 2007, p. 465; and P. Trott, 'Perth water options dry up', *West Australian*, 7 March 2002, np.

<sup>50</sup> N. Khadem, 'Scientists free to talk, says CSIRO', *Age*, 14 February 2006, <<http://www.theage.com.au/news/national/scientists-free-to-talk-says-csiro/2006/02/13/1139679536438.html>>, (Accessed: 4 March 2011).



urban support.<sup>51</sup> The 2001 state election had been largely fought over environmental issues, particularly the logging of old-growth forests in the southwest region. Promising to protect the remaining old-growth forests, Labor had achieved a landslide victory against the conservative Coalition and initiated the process to cease logging in the southwest forests. Labor's election had also coincided with the release of findings from the Intergovernmental Panel on Climate Change that, 'There is new and stronger evidence that most of the [global] warming observed over the last 50 years is attributable to human activities'.<sup>52</sup> A year later, the eastern states experienced a dry spell that the Bureau of Meteorology reportedly described as the nation's 'first climate change drought'.<sup>53</sup>

In late 2002, IOCI published an image of this water situation that would become synonymous with the southwest's 'water crisis' and the campaign to invest in another source of water supplies. The image was a graphical representation of the amount of water flowing into Big Water's dams and the steady reduction of these amounts since the 1970s (Figure 6.1). Although dams were no longer the only major source of water supplies for Perth, Mandurah and the Goldfields, the vivid depiction of the ebbing flows into the region's dams portrayed the water situation as critical.<sup>54</sup> This position would only worsen with a growing population and IOCI's prediction of an ongoing drying trend.

The image was first presented to the public in the state government's *State Water Strategy*, which emphasised the urgency of addressing the future of water supplies in the southwest. In the document, Premier Geoff Gallop warned, 'Western Australia has reached a critical point in the way we use and reuse our precious water resources'.<sup>55</sup> This message of urgency, of a critical state of affairs in the state's water management, prevailed under the Gallop government. And this message was underscored by the graph of the diminishing amount of water entering Perth's dams. This graph depicting Perth's water situation was (and continues to be) used regularly in

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<sup>51</sup> J. Pakulski and B. Tranter, 'Environmentalism and social differentiation: a paper in memory of Steve Crock', *Journal of Sociology*, vol. 40, no. 3, 2004, p. 227.

<sup>52</sup> Houghton et al., 2001, cited in IOCI, p. 18.

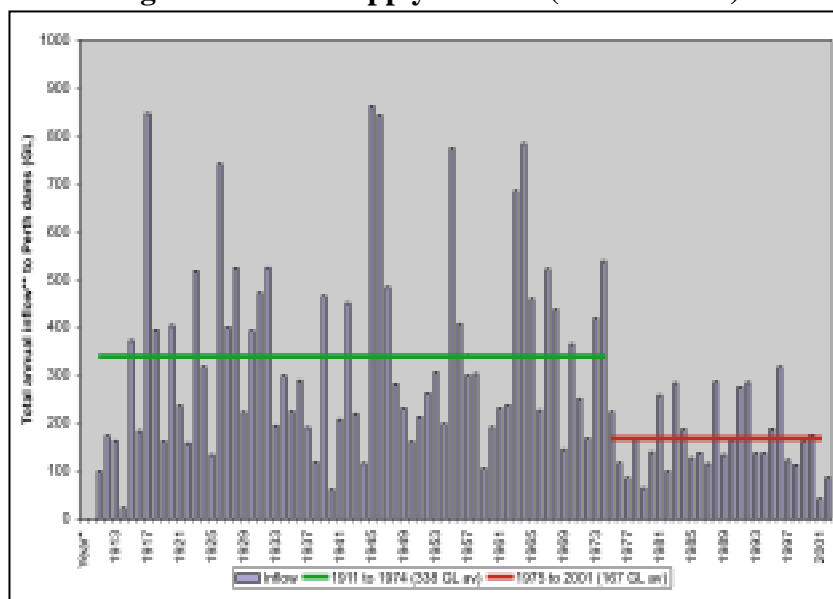
<sup>53</sup> M. Coughlan, cited in Wahlquist, p. 41.

<sup>54</sup> In 2006, Perth was drawing around sixty per cent of its water supply from groundwater sources. See, J. Marsden and P. Pickering, *Securing Australia's Urban Water Supplies: opportunities and impediments*, Camberwell, Marsden Jacob Associates, November, 2006, <<http://www.environment.gov.au/water/publications/urban/pubs/urban-water-report.pdf>>, (Accessed: 3 March 2011), p. 14.

<sup>55</sup> G. Gallop, 'Premier's statement', in Government of Western Australia, *Securing our water future: a state water strategy for Western Australia*, Perth, Government of Western Australia, 2003, p. 1.

government reports and scientific papers regarding the southwest's water resources.<sup>56</sup> The nature of the graph, with its bars of water quantities and lines of average inflows, provides its reader with a clear and simple representation of declining water supplies. This interpretation is enhanced by the additional 'step declines' of average inflow that scientists consider to have occurred since 2001 (Figure 6.2). This 'staircase' image leads even the most unimaginative reader to expect further 'step declines' to occur until there is zero inflow.

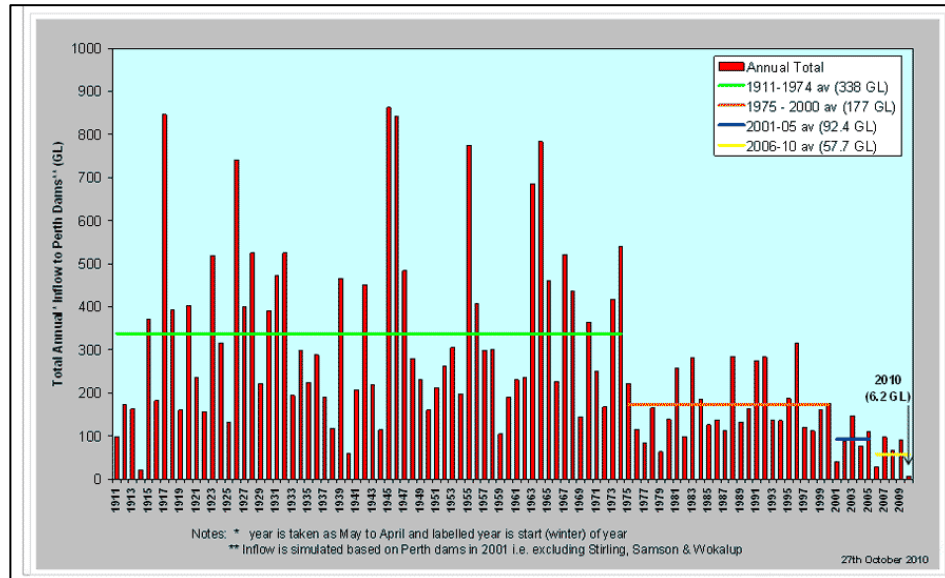
**Figure 6.1: Inflow into dams providing water to the Integrated Water Supply Scheme (1911 to 2001)<sup>57</sup>**



<sup>56</sup> See for instance, D. McFarlane, *Context Report on South West Water Resources for: expert panel examining Kimberley water supply options*, Canberra, CSIRO, 2005, p. 21; Water Corporation, *Source Development Plan 2005-2050: an overview*, Leederville, Water Corporation, 2005, p. 1; Wentworth Group of Concerned Scientists, *Australia's climate is changing Australia*, 2006, <[http://www.wentworthgroup.org/uploads/3.%20Aust.Climate\\_is\\_Changing\\_Australia.pdf](http://www.wentworthgroup.org/uploads/3.%20Aust.Climate_is_Changing_Australia.pdf)>, (Accessed: 4 March 2011), p. 3; Government of Western Australia, *State Water Plan*, Perth, Dept of Premier and Cabinet, 2007, p. 19.

<sup>57</sup> Government of Western Australia, p. 3.

**Figure 6.2: Inflow into dams providing water to the Integrated Water Supply Scheme (1911 to 2010)<sup>58</sup>**



This graphical representation of the region’s water position warrants further examination. As Richard Hamblyn notes, such graphs ‘are often accorded the status of found (rather than made) objects, particularly by non-scientists, who rarely treat them as though they were carefully constructed visual statements’.<sup>59</sup> As these graphs (Figures 6.1 and 6.2) do not indicate the state of the other sources of water for supplying the region (groundwater), laypeople in the government and wider community could (and did) interpret them as depicting a water supply system perilously close to running out of water. Likewise, the graphs generally accompany discussions of the region’s ‘drying climate’, which reinforces the inevitability of the looming water crisis. To the layperson, the graphs therefore depict the declining rainfall trend, rather than the state of the dams. It follows then, that other sources of water must be developed to avert the crisis. The creation and circulation of these graphs, therefore, supported the shared agenda of the state government and Water Corporation to expand Big Water, and earn votes and revenue in the process.

The simplicity of the graphs also presents the situation as detached from its geographical context. Although they infer the diminishing storages of Big Water’s dams, they do not show the spatial change of rainfall patterns as rains move southwards towards the Southern Ocean. Nor do they show the toll of Big Water and private bores on the groundwater reserves of the Swan Coastal Plain. Finally, these graphs of the

<sup>58</sup> Water Corporation, *Impact on Water Availability – WA reduced inflows to dams*, 2010, <[http://www.watercorporation.com.au/D/dams\\_streamflow\\_large.cfm](http://www.watercorporation.com.au/D/dams_streamflow_large.cfm)>, (Accessed: 4 March 2011).

<sup>59</sup> R. Hamblyn, ‘The whistleblower and the canary: rhetorical constructions of climate change’, *Journal of Historical Geography*, vol. 35, 2009, p. 232.

region's water resources suggests a dialogue with more well-known visual representations of anthropogenic climate change, such as the Keeling Curve of atmospheric concentrations of carbon dioxide recorded at Mauna Loa Observatory in Hawai'i and Michael Mann's 'hockey stick' curve of temperature changes in the northern hemisphere over the past one thousand years.<sup>60</sup> Read together, these graphs arguably helped to present the water supply situation of southwest Western Australia as a product of global climate change, requiring urgent and far-reaching local responses. Accurate as this association with anthropogenic climate change was, it also lent scientific and political legitimacy to the state government's program to develop additional water supplies in the southwest.

### *Filling the gap*

The unusually dry conditions since 2001 had already exposed the vulnerability of the groundwater reserves of the Gngangara and Jandakot Mounds to the effects of drought and Big Water's thirst. With less rain in the future, water managers expected that Big Water's dams would struggle to fill and it would have to draw more heavily on its groundwater reserves. Meanwhile, less rain would also slow the replenishment of these aquifers. The overall effect on these sources would accelerate the depletion of the subterranean reserves with severe repercussions for both horticulture and wetlands.<sup>61</sup> By 2004, the Environmental Protection Authority had observed that water levels in the caves in Yanchep National Park had declined to such an extent that 'some loss of species is likely to have occurred'.<sup>62</sup> Some wetlands had experienced fires and greater acidity due to drying out and vegetation had 'collapsed' at Lake Nowergup and declined at Lake Wilgarup.<sup>63</sup> These problems prompted the government to accelerate the thinning of pine plantations on the Gngangara Mound in order to alleviate the pressures on these ecosystems.

Even before the drought of 2001, Big Water had come under fire for its voracious appetite and the toll this had exacted upon the groundwater reserves of the Swan Coastal Plain. And in response to the series of dry years at the turn of the twenty-

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<sup>60</sup> Hamblyn, pp. 232-33.

<sup>61</sup> S. Hewitt, 'Fears for water levels at mound', *West Australian*, 25 May 2004, p. 12; and P. Trott, 'Perth facing water crisis', *West Australian*, 9 June 2004, p. 1.

<sup>62</sup> Water and Rivers Commission, *Environmental Management of Groundwater Abstraction from the Gngangara Mound 2000-2003: triennial report to the Environmental Protection Authority*, East Perth, Water and Rivers Commission, 2004, p. 6.

<sup>63</sup> Water and Rivers Commission, p. 6.

first century, Big Water had drawn even more heavily on these reserves to meet the demands of its consumers. The dry conditions exposed the inadequacy of the monitoring procedures, which had failed to ensure the protection of these reserves. The ecological consequences of this failure underlined the inherent fragility of the engineered resilience of these groundwater systems.

The plundering of these reserves reinforced community scepticism about the government's ability to protect the environment from overexploitation by Big Water in the future. The limited scientific understanding of the complex workings of these groundwater systems only heightened this lack of trust in the government, Big Water and its scientists. As a CSIRO scientist explained to reporter Åsa Wahlquist in 2008,

There are still major questions about the recharge under different climate and land-use regimes, what the sustainable yield is, what the relationship between the fluctuations of those water levels and the environmental health is. So even a system like that on the doorstep of Perth, and half of the water supply of Perth, is not as well understood as we would wish it to be.<sup>64</sup>

This uncertainty only served to deepen anxieties about the security of Big Water in a drier future.

The erosion of the ecological resilience of Perth's groundwater reserves and wetlands had cultural implications for many local Aboriginal people. It was now dry where they had once been able to rely on soaks at swamps and other sources for fresh water.<sup>65</sup> Aborigines told anthropologists that the declining water table was affecting the growth of medicinal plants and that 'the waterfowl have gone, as have the turtles, the marsupials and much else of the local fauna'.<sup>66</sup> The ailing health of these wetlands had serious consequences for Aborigines, as 'without water there wouldn't be any Aboriginal spiritual life'.<sup>67</sup> The careful monitoring of groundwater levels, therefore, was necessary not simply to protect these reserves for ecosystems and for the use of Big Water, but also to ensure they would continue to meet the spiritual and cultural needs of the region's Aboriginal people.

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<sup>64</sup> T. Hatton, cited in Wahlquist, pp. 101-102.

<sup>65</sup> E. McDonald, B. Coldrick and W. Christensen, 'The green frog and desalination: a Nyungar metaphor for the (mis-)management of water resources, Swan Coastal Plain, Western Australia', *Oceania*, vol. 78, 2008, p. 69.

<sup>66</sup> McDonald, Coldrick and Christensen, pp. 68, 70.

<sup>67</sup> Cited in McDonald, Coldrick and Christensen, p. 66.

## *Securing Big Water's Future?*

Amid the ongoing 'water crisis', the state government investigated a host of technocratic solutions to guard against the threat of water scarcity.<sup>68</sup> It also implemented demand management strategies in an effort to permanently reduce per capita annual water consumption. Debate raged over the next source of supply throughout the first term of the Gallop Labor government and dominated the 2005 state election. In this section, I examine the options for the next source of supply for Big Water and contend that the familiar turn to technocratic solutions again largely served to perpetuate the vulnerability of Big Water and its customers to climate variability and water scarcity.

Following the dry conditions of 2001 and 2002, the state government announced in early 2002 its intentions to utilise seawater desalination technology to supply water for Perth. Under this plan, a reverse osmosis desalination plant would be constructed in the vicinity of the southern suburbs of Kwinana or East Rockingham, which would provide scheme water during periods of 'drought emergency', that is, to avert total sprinkler bans.<sup>69</sup> It is important to note that in the suburbs of Perth, such periods of 'drought emergency' were far removed from the nature of drought in rural Western Australia, and still more remote from the devastating conditions in less developed regions, such as the Sahel and East Africa. Nevertheless, total sprinkler bans were anathema to the state government. The harsh restrictions of 1978 would not be repeated as Western Australian politicians considered they would be akin to electoral suicide. The people of Perth, they believed, could not be deprived of water for their gardens.

Reverse osmosis desalination of seawater had been on Big Water's long-term agenda since the 1980s, when the then Water Authority had concluded that it would 'be preferred to any proposal to obtain water from farther afield, such as the Pilbara, the Ord, or icebergs from Antarctica'.<sup>70</sup> But it had remained too expensive to warrant investment. Seawater desalination had re-emerged under the Court government, when the Water Resources Minister Kim Hames asked the Water Corporation to conduct a study into the state of the technology, its use in Western Australia, and the possibilities of its use in the future. The study focussed mainly on the use of desalination plants to

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<sup>68</sup> Government of Western Australia, p. 15.

<sup>69</sup> Environmental Protection Authority, *Perth Metropolitan Desalination Proposal: Water Corporation of Australia – report and recommendations of the Environmental Protection Authority*, 2002, <[http://www.watercorporation.com.au/\\_files/Desalination\\_Bulletin\\_1070.pdf](http://www.watercorporation.com.au/_files/Desalination_Bulletin_1070.pdf)>, (Accessed: 1 February 2012).

<sup>70</sup> G. Mauer, *Planning Future Sources for Perth's Water Supply*, Leederville, Water Authority of WA, 1987, p. 14.

supply water for industrial and agricultural purposes.<sup>71</sup> But Hames was unconvinced of the need to invest in the technology. In 2000 he declared: ‘The prospect of desalination on a large scale in Perth is still a long way off’, because his government had invested in projects that would ‘deliver a supply security last enjoyed more than thirty years ago’.<sup>72</sup> During the particularly wet winter that year, Hames and his colleagues had not imagined the onset of the dry conditions in 2001. Nor had they appreciated the effects of the region’s drying trend on Big Water and the declining condition of the Gnangara mound, Big Water’s main source of supplies.

Despite these problems affecting the Gnangara Mound and evidence of declining rainfall, the plan to utilise desalination technology was met with staunch opposition from environmentalists, rural politicians, and the press. According to these critics, the desalination plant would be too expensive, and these costs would be passed on to consumers through higher water rates. Another problem was the plant’s environmental impact, not only on the marine environment but also on the atmosphere, due to the emission of greenhouse gases. After all, if the drying trend was the result of climate change, which is due to increased greenhouse gas emissions, it would be unwise to resort to solutions that would only increase those emissions.<sup>73</sup> Besides, Western Australian greenhouse gas emissions per capita were already the highest in Australia and among the highest in the developed world.<sup>74</sup> Finally, rural politicians argued that the plan was too focussed on Perth and that it did not provide sufficient benefits for regional Western Australians.<sup>75</sup> In light of these issues, in February 2003 the Government turned its attention to tapping the South West Yarragadee aquifer in the southwest Capes region.<sup>76</sup>

The appeal of the South West Yarragadee aquifer was that it could provide the necessary amount of water quickly and cheaply. The borefield’s proximity to the Donnelly River was also attractive to the Big Water, which had its sights set on

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<sup>71</sup> Water Corporation, *Desalination – creating new water sources: a strategic review of desalination possibilities for Western Australia*, Leederville, Water Corporation, 2000.

<sup>72</sup> K. Hames, ‘Foreword’, in Water Corporation, *Desalination*, p. 1.

<sup>73</sup> Wahlquist, p. 4.

<sup>74</sup> EPA, *State of the Environment Report*, p. 29.

<sup>75</sup> W. Pryer, ‘Desalination plant closer’, *West Australian*, 1 February 2002, np; W. Pryer, ‘High price to convert sea water’, *West Australian*, 15 March 2002, np; C. Amalfi, ‘Bridge revisits a pipe dream’, *West Australian*, 16 February 2002, np; G. Armstrong, ‘Taps shut on saltwater bid’, *Sunday Times*, 29 December 2002, np; and G. Armstrong, ‘Water still runs deep’, *Sunday Times*, 5 January 2003, np.

<sup>76</sup> S. Pennells, ‘Charges aim at top water guzzlers’, *West Australian*, 11 February 2003; and G. Armstrong, ‘Facing a sprinkler ban’, *Sunday Times*, 29 June 2003, p. 3.

damming this river or its tributaries in the future.<sup>77</sup> The South West Yarragadee describes the section of the Yarragadee Formation near the Blackwood River in the southwest corner of the state.<sup>78</sup> The Yarragadee aquifer is a large and complex groundwater system that lies beneath the superficial and Leederville aquifers, and extends roughly from Geraldton to the south coast. According to the Water Corporation's plan, the underground water would be extracted from bores in an area between Margaret River and Nannup, and piped north to the Harvey Dam, from where it would supply Big Water.<sup>79</sup> Conveniently, the Water Corporation had recently negotiated with Harvey irrigators to fund the piping of their irrigation channels in return for the water savings, which would go towards Big Water. Although the irrigators had initially rejected this deal on the grounds that it would affect their businesses, they eventually came to a satisfactory arrangement.<sup>80</sup>

During 2003 and early 2004, the environmental and economic impact of this plan to utilise the water resources of the South West Yarragadee became the subject of intense public debate. The advocates of tapping this groundwater reserve maintained that it would provide Perth, Mandurah and the Goldfields with a cheaper water supply than other options over a long period of time. As such, it would alleviate the need to make further investments in water supplies in the near future.<sup>81</sup> But this economic argument left many unconvinced, particularly those with concerns about its impacts on the environment and the economy of the Capes region. The transfer of water from a

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<sup>77</sup> McFarlane, pp. 25, 63, 102-103. The possibility of damming the Donnelly River for public water supplies emerged in the mid-1970s and by the turn of the twenty-first century, it was the 'largest undeveloped fresh surface water resource in the south of the State' (p. 102). In 2004, the Gallop Government created the Greater Beedelup National Park, which included the preferred reservoir site on the river, as part of its Old Growth Forests Policy.

<sup>78</sup> From the mid-1960s to the mid-1990s, hydrologists undertook investigative drilling of the groundwater resources of the southern Perth Basin between Bunbury and Augusta. The first groundwater management area was proclaimed at Bunbury in 1975, followed by Busselton-Capel in 1984 and the remainder of the region in the Blackwood Groundwater Area in 1989. A Groundwater Management Area is a region where groundwater is or might be intensively developed for water supplies. See, P. Whincup (Chair), *South-West Yarragadee Aquifer: peer review panel report on South-West Aquifer Modelling System (SWAMS v1.2.1)*, Dept of Environment (WA), 2004, <<http://www.water.wa.gov.au/PublicationStore/first/56259.pdf>>, (Accessed: 1 March 2011), p. 1.

<sup>79</sup> Water Corporation, *Water Forever: options for our water future*, 2008, <[http://www.watercorporation.com.au/\\_files/PublicationsRegister/22/Water\\_Forever\\_Options\\_Report.pdf](http://www.watercorporation.com.au/_files/PublicationsRegister/22/Water_Forever_Options_Report.pdf)>, (Accessed: 1 February 2012), p. 58.

<sup>80</sup> P. Trott, 'Water sale rejected by farmers', *West Australian*, 25 April 2002, np; P. Jarvis, 'Harvey irrigators reject diversion', *Countryman*, 2 May 2002, p. 4; P. Jarvis, 'Water supply our future, say farmers', *Countryman*, 2 May 2002, p. 4; P. Trott, 'Gallop backs plan to divert SW water', *West Australian*, 25 June 2004, p. 4; and McFarlane, p. 59.

<sup>81</sup> See for instance, E. Dortch, 'Desalination hopes rise on lower costs', *West Australian*, 10 September 2003, np; P. Trott and W. Pryer, 'Business to escape water wastage fines', *West Australian*, 13 November 2003, np; and P. Trott and E. Dortch, 'Bores to solve water problem', *West Australian*, 10 December 2003, np.



rural area to the suburbs came under fierce criticism from local shires, which argued that the plan threatened the region's 'pristine environment and agricultural potential'.<sup>82</sup> Rural politicians deployed agrarian rhetoric in the media, arguing that the groundwater had productive uses in the Capes region.<sup>83</sup> Many Perth residents were also unconvinced about the plan, sharing the concerns of those beyond the suburbs.<sup>84</sup>

Underlying these concerns about the abstraction of water from the South West Yarragadee was the scientific uncertainty surrounding the size of the aquifer and the amount of water that could be sustainably withdrawn. Although government hydrologists had realised the enormity of the aquifer in the late 1980s, there had been limited exploration of its size and features since.<sup>85</sup> A major reason for this lapse was the reorganisation of the state's water sector in the mid-1990s and a subsequent decline in funding for hydrological research.<sup>86</sup> Despite this, government scientists were generally satisfied that the aquifer could sustain further abstraction of groundwater.<sup>87</sup> But their research indicated that the salinity levels and flows of the Blackwood River stood to be affected. Furthermore, the deterioration of the wetlands of the Gngangara Mound had diminished the community's faith in the monitoring of the ecological effects of Big Water's groundwater abstraction activities. Critics argued that similar damage could be caused to the South West Yarragadee if Big Water was permitted to access this source.<sup>88</sup>

In 2004, the mounting criticism of Big Water's plan to tap the South West Yarragadee led the government to reassess the construction of a seawater desalination plant in Kwinana. Although the desalination plant was by no means uncontroversial, the South West Yarragadee proposal was simply proving too contentious in the lead up to the 2005 state election.<sup>89</sup> With electoral redistribution looming, the government sought

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<sup>82</sup> P. Trott, 'Big water project on way', *West Australian*, 12 December, 2002, np.

<sup>83</sup> Trott, 'Big water project on way', np.

<sup>84</sup> E. Dortch, 'City against SW aquifer grab', *West Australian*, 4 July 2003, np.

<sup>85</sup> L. Baddock, pers. comm., March 2011.

<sup>86</sup> D. D. R. Pearson, *Second Public Sector Performance Report*, Auditor General of Western Australia, 2003, <[http://www.audit.wa.gov.au/reports/pdfreports/report2003\\_07.pdf](http://www.audit.wa.gov.au/reports/pdfreports/report2003_07.pdf)>, (Accessed: 4 March 2011), pp. 4-5.

<sup>87</sup> P. Trott and E. Dortch, 'Bores to solve water problem', *West Australian*, 10 December 2003; Strategen, *South West Yarragadee: Blackwood Groundwater Area*, Water and Rivers Commission, 2004, <<http://www.water.wa.gov.au/PublicationStore/first/50920.pdf>>, (Accessed: 1 February 2012); and E. Dortch and S. Jerrard, 'SW aquifer store raised 50pc', *West Australian*, 20 September 2005, p. 12.

<sup>88</sup> M. Videnieks, 'Sea one solution to water worries', *West Australian*, 12 March 2004; C. Amalfi and M. Videnieks, 'Aquifer option remains: Gill', *West Australian*, 2 August 2004, p. 25; and C. Madden, 'Delay on aquifer decision', *Sunday Times*, 14 November 2004, p. 26.

<sup>89</sup> M. Videnieks, 'Green light for \$346m water scheme', *West Australian*, 29 July 2004, p. 1; 'People slugged for belated water decision', *West Australian*, 30 July 2004, p. 14; J. Poprzeczny, '2005 State election', *WA Business News*, 17 February 2005; E. Dortch and W. Pryer, 'Now the truth emerges', *West Australian*, 10 March 2005, p. 1; E. Dortch, 'Water Corp leak backs Yarragadee over desal', *West Australian*, 6 August 2005, p. 1; S. Jerrard,

to protect its hold on the marginal seats in the vicinity of the aquifer.<sup>90</sup> In spite of the myriad political challenges that desalination posed to the government seeking re-election, such as energy use, expense and environmental concerns, the plan had a trump card: seawater desalination offered Perth a 'climate-independent' water supply.<sup>91</sup>

By the 2005 election, the prospect of a 'water crisis' in the southwest had been revived. For instance, in June 2004, the *West Australian* had shrilled, 'Perth will die, says top scientist', referring to Australian mammologist Tim Flannery's predictions for the future of the southwest region.<sup>92</sup> According to Flannery, 'Perth will become a ghost metropolis over the next few decades unless governments acknowledge that global warming is a reality'.<sup>93</sup> The prevailing dry conditions and water restrictions provided the physical 'evidence' for this prediction, which fed anxieties about the prospect of very scarce water resources in the future. Seawater desalination, however, offered a solution to protect Big Water from the vagaries of the weather. It was simple, as the director of the state water strategy proclaimed: 'We need a water supply which is independent of climate'.<sup>94</sup> To 'green' the proposal, which had come under fire for its potential energy consumption, the government assured voters that renewable energy would power the plant, thus reducing its greenhouse gas emissions and impact on the global climate.<sup>95</sup>

These ongoing political anxieties about the southwest's water future in the lead up to the 2005 state election revived the prospect of using water from the Kimberley

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'Yarragadee water plan ready to go before EPA', *West Australian*, 7 September 2005, p. 4; and E. Dortch and S. Jerrard, 'SW aquifer store raised 50pc', *West Australian*, 20 September 2005, p. 12.

<sup>90</sup> E. Dortch and W. Pryor, 'Now the truth emerges', *West Australian*, 10 March 2005, p. 1.

<sup>91</sup> 'People slugged for belated water decision', *West Australian*, 30 July 2004, p. 14; W. Pryer, 'Power crisis would shut down production', *West Australian*, 30 July 2004, p. 6; W. Pryer, 'Garrett lends hand as Gallop changes tack on greenhouse', *West Australian*, 15 September 2004, p. 19; C. Amalfi, 'New \$50 tax for water plant', *West Australian*, 30 July 2004, p. 6; C. Amalfi, 'The water solution that was ignored', *West Australian*, 11 August 2004, p. 1; C. Amalfi, 'Salt lake warning over water plant', *West Australian*, 5 August 2004, p. 35; and G. Armstrong, 'Marine life "safe" from salt waste', *Sunday Times*, 8 August 2004, p. 17.

<sup>92</sup> C. Amalfi, 'Perth will die, says top scientist', *West Australian*, 25/6/2004, p. np; A. Davies, 'Sydney's future eaten: the Flannery prophecy', *Sydney Morning Herald*, <<http://www.smh.com.au/articles/2004/05/18/1084783517732.html>>, (Accessed: 2 March 2011).

<sup>93</sup> Cited in Amalfi, 'Perth will die', np.

<sup>94</sup> C. Amalfi, 'Desalination plant involves private sector', *West Australian*, 28 April 2004, p. 14. See also, G. Armstrong, 'Desalination plant closer', *Sunday Times*, 29 February 2004, p. 11; and C. Amalfi, 'New \$50 tax for water plant', *West Australian*, 30 July 2004, p. 6. See also, Water Corporation, *Desalination in Western Australia*, Water Corporation, nd, <<http://www.watercorporation.com.au/D/desalination.cfm>>, (Accessed: 5 March 2012).

<sup>95</sup> M. Videnieks, 'Turning wind into water', *West Australian*, 10 February 2005, p. 8; C. Madden, 'Wind farm to power water plan', *Sunday Times*, 17 April 2005, p. 29; and E. Dortch, 'Gallop's wind farm energy claims fire up Greens', *West Australian*, 13 August 2005, p. 8. The desalination plant is supplied with electricity from the Emu Downs wind farm near Cervantes, some two hundred kilometres north of Perth.

region to slake the southwest's thirst, just months after the government withdrew its support for the development of a genetically-modified cotton industry near Broome, which would have doubled the state's annual water consumption.<sup>96</sup> The idea to bring water from the north had been raised at a community forum on water resources in 2002 but once again, the government and economists deemed the infrastructure too expensive. Undeterred, Ernie Bridge announced the launch of the Watering Australia Foundation's 'National Distribution Program', which involved harnessing the water resources of the rivers of northern Australia, such as the Fitzroy, Daly and Burdekin, for the benefit of the drought-stricken southern states.<sup>97</sup> Meanwhile, a Sydney-based defence and technology firm had made separate approaches to the state government and the Coalition Opposition regarding its own proposal to deliver water from the Fitzroy River to the southwest.<sup>98</sup> Although the government had committed to the seawater desalination plant in late 2004, the popular support for the idea of the Kimberley pipeline forced the government to undertake a more detailed study of the plan. Before this study was completed, however, the Opposition announced on the eve of the 2005 election that a Coalition government would build a canal to utilise the vast water resources of the Kimberley for the southwest.<sup>99</sup>

For economists and environmentalists, the costs involved in the 3700-kilometre Kimberley canal were simply too great to entertain. Several studies had been undertaken into the feasibility of the plan to utilise water from the Kimberley since Ernie Bridge had proposed it in the late 1980s.<sup>100</sup> These reports shared the same conclusion: bringing

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<sup>96</sup> Australian Conservation Foundation, 'Green and Indigenous groups say no to GM cotton in the West Kimberley', 28 June 2004, <<http://www.acfonline.org.au/news-media/releases/green-indigenous-groups-say-no-gm-cotton-west-kimberley>>, (Accessed: 5 January 2012).

<sup>97</sup> P. McGeough, 'One man's audacious plan to slake the thirst of a parched continent', *Sydney Morning Herald*, 7 June 1995, p. 7; E. Bridge, *Making It Happen*, Perth, Watering Australia Foundation, 1996, np; and P. Sweeney, 'Desalination rejected', *Sunday Times*, 3 October 2004, p. 20. Bridge had established the Watering Australia Foundation in 1995 to promote his vision.

<sup>98</sup> G. Armstrong, 'Water from our North', *Sunday Times*, 14 November 2004, p. 1; R. Williams, 'Water plan just a poll stunt: Barnett', *West Australian*, 15 November 2004, p. 1; 'Water policy development hasty, but necessary', *West Australian*, 16 November 2004, p. 14; S. Hewitt, 'Water chief kept in dark over \$2b Kimberley plan', *West Australian*, 16/11/2004, p. 8; M. Videnieks, 'Tenix cheers Gallop change of heart on water channel', *West Australian*, 16 November, 2004, p. 8; and J. Strutt, 'Kimberley canal plan unveiled', *Sunday Times*, 21 November 2004, p. 31.

<sup>99</sup> P. van Onselen, 'The Western Australian election of 26 February 2005: a canal too far for the Coalition', *Australian Journal of Political Science*, vol. 40, no. 3, 2005, p. 454; M. Videnieks and P. Rule, 'Barnett promises \$2b water canal', *West Australian*, 3 February 2005, p. 1; and 'Barnett's canal a grand vision or uneconomic political mirage', *West Australian*, 4 February 2005, p. 16.

<sup>100</sup> Kimberley Regional Development Advisory Committee, *Water from the Kimberleys: water for the southwest in the twenty-first century*, Perth, Binnie & Partners, 1988; Infrastructure Development Corporation, *Development of a Water Pipeline, Kimberleys to Perth*, Sydney, The Corporation, 1990; Chase Manhattan Bank, *Kimberleys to Perth Water Pipeline*, Perth, The Bank, 1991; and Kimberley Water Resources Development Advisory Board, *Report of the*

water south would require an astronomical investment. When the feasibility study commissioned by the government was eventually completed in April 2006, it restated these earlier findings.<sup>101</sup> The energy required to pump water from the north was much higher than the energy required for desalination – after all, the water ‘doesn’t run by gravity’.<sup>102</sup> If water was brought from the Kimberley, the average household water bill would increase by 100 to 400 per cent.<sup>103</sup> These critics had the support of former Premier Sir Charles Court, who maintained his view that the plan would compromise the economic development of the state’s northwest.<sup>104</sup> There were also concerns from the Kimberley that transferring water south would affect the local ecology, the cultural practices of the traditional owners, and the viability of pastoral and horticultural lands.<sup>105</sup> Yet again, as anthropologist Sandy Toussaint observed, ‘Kimberley indigenous groups were hardly visible throughout the campaign’ and ‘largely absent from public debate’.<sup>106</sup>

Nevertheless, many Western Australians in the southwest shared Bridge’s vision.<sup>107</sup> It offered the opportunity of water supplies for the northern pastoral and agricultural lands near the canal, areas that would otherwise be unconnected to scheme water and some of which had been recently drought-affected. The construction of the project, advocates argued, would also provide jobs to local workers and stimulate the economy of regional Western Australia. Underpinning the project’s appeal, the Water Corporation suggested, was that it was a familiar idea for the lay public to grasp. Unlike the other water supply options that had been tabled, water from the Kimberley was perhaps ‘popular because it ma[de] people feel comfortable because it’s not a new technology, it’s just a big dam some place with a pipeline’ or canal.<sup>108</sup> But the enduring

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*Kimberley Water Resources Development Advisory Board*, Perth, Kimberley Water Resources Development Office, 1993.

<sup>101</sup> R. T. Appleyard (chair), *Options for Bringing Water to Perth from the Kimberley: an independent review*, Perth, Dept of Premier and Cabinet, 2006. This study also considered the options of supplying water via canal and tanker.

<sup>102</sup> Wahlquist, p. 78.

<sup>103</sup> Wahlquist, p. 77.

<sup>104</sup> G. Parker, ‘The challenge of a generation’, *West Australian*, 13 January 2007, p. 1.

<sup>105</sup> K. MacDonald, ‘Water pipe from north “too costly”’, *West Australian*, 11 November 2004, p. 48; W. Pryer, R. Taylor and K. Gauntlett, ‘Barnett rejected pipe plan’, *West Australian*, 4 February 2005, p. 7; and E. Dortch, ‘Kimberley ripples over Perth water’, *West Australian*, 5 April 2005, p. 33; and S. Toussaint, ‘For whom the Fitzroy River flows: a fluctuating analysis of social and environmental sustainability and incremental sovereignty’, in D. Ghosh, H. Goodall, and S. H. Donald (eds), *Water, Sovereignty and Borders in Asia*, Hoboken, Routledge, 2008, pp. 174-88.

<sup>106</sup> Toussaint, p. 181.

<sup>107</sup> ‘Water pipeline backed’, *Sunday Times*, 22 August 2004, p. 11; and K. MacDonald, ‘Water pipe from north “too costly”’, *West Australian*, 11 November 2004, p. 48.

<sup>108</sup> K. MacDonald, ‘Water pipe from north “too costly”’, *West Australian*, 11 November 2004, p. 48.

appeal of these large water projects, which persists in Western Australia and other states, warrants further exploration.

As it had in the 1980s and 1990s, the Kimberley canal project resonated with long-held Australian ideas about the 'empty' North. Underlying political desires to develop and populate the north has been an enduring (non-Indigenous) sense of the region's emptiness and wasted potential, which I examined in the previous chapter. The 2005 plan to divert water from the Fitzroy River to the southwest of the state was one such plan to utilise the Kimberley region's underused resources. Tapping the vast resources of the Fitzroy, the project's proponents argued, made good sense – the river has, on average, the greatest volume of annual flow and floods in the state.<sup>109</sup> Furthermore, the region stood to become wetter under the greenhouse effect, in contrast to the drying southwest, so even more water would be going to 'waste' if it were not utilised.<sup>110</sup> The rhetoric in support of the Kimberley project employed phrases such as, 'boost (northern) development', 'water resources lying idle in the north', 'untapped and underutilised', and 'unused water'.<sup>111</sup> As one journalist noted, 'No matter if you are a drought-ravaged Wheatbelt farmer or trying to maintain a green suburban lawn on watering restrictions, the numbers are awesome'.<sup>112</sup>

An examination of the debates over the canal also reveals a recurring allusion to the past, the persuasiveness of which cannot be underestimated. References to historical figures and their legacies proved to be politically potent, resurrecting the hope and vision especially associated with Western Australia's gold rush era. Supporters of the plan to transport water from the Kimberley revived the ghosts of Engineer-in-Chief C. Y. O'Connor and Premier Sir John Forrest, associating the new idea with Western

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<sup>109</sup> Toussaint, pp. 175-76.

<sup>110</sup> J. Strutt, 'Kimberley canal plan unveiled', *Sunday Times*, 21 November 2004, p. 31; P. Law, 'Water torture', *Sunday Times*, 13 February 2005, p. 45. Radio broadcaster Alan Jones employed similar rhetoric in his promotion of drought-proofing initiatives in the Murray-Darling Basin in 2002. See, S. Bell, 'Concerned scientists, pragmatic politics and Australia's green drought', *Science and Public Policy*, vol. 33, no. 8, 2006, p. 562.

<sup>111</sup> B. Ruse, 'Northern pipe dream revived', *West Australian*, 30 November 2001; P. Sweeney, 'Desalination rejected', *Sunday Times*, 3 October 2004, p. 20; 'Water pipeline backed', *Sunday Times*, 22 August 2004, p. 11; and H. Fitzsimmons, 'Canal from Kimberley to solve Perth water crisis', *AM*, ABC Online, 15 November 2004, <<http://www.abc.net.au/am/content/2004/s1243586.htm>>, (Accessed: 5 December 2011).

Jay Arthur documents similar rhetoric in her analysis of media coverage, political speeches and tourist material relating to the Ord River Project between 1965 and 1997. See, 'An unobtrusive goanna', in D. Rose and A. Clarke (eds), *Tracking Knowledge in North Australian Landscapes*, Darwin, North Australia Research Unit, ANU, 1997, pp. 37-49.

<sup>112</sup> G. Parker, 'Water from the north – the challenge facing a generation', *West Australian*, 13 January 2007, p. 1.

Australia's golden age of pioneering development and engineering ascendancy.<sup>113</sup> Like O'Connor's 'golden pipeline', the Kimberley canal would make the desert bloom. Incidentally, the invocation of O'Connor's name in connection with the new project arose shortly after the centenary of his death (2002).<sup>114</sup> The power of this gold rush past not only recalled an earlier phase of 'water dreaming', but also tapped into a seam of disenchantment in the electorate, of discontent with the state of Australian political leadership and society at large at the turn of the twenty-first century.

The rhetorical connection between the Kimberley project and visionary leadership in media and political circles suggests that journalists and politicians perceived a lack of voter confidence in their elected leaders. The Opposition manipulated this sentiment through its evocation of an enduring mythology in Western Australian history, what Geoffrey Bolton has described as the 'myth of dynamic entrepreneurship'. 'Bold entrepreneurs', Bolton explains, 'have pushed projects for investment and development ... with limitless faith in the West's resources and too little appreciation for the need for assessment and conservation of those resources'.<sup>115</sup> Where, asked the government's critics, was this strong, visionary leadership in Western Australia now?

By this time, there had developed a widespread public disaffection, or at least anxiety, regarding the prevailing ethos of economic rationalism.<sup>116</sup> It was this populism that the leader of the conservative Opposition, Colin Barnett (who was, ironically, a former university lecturer of economics in the 1970s and the executive director of the state's Chamber of Industry and Commerce in the 1980s), invoked in a reflection on the Kimberley project after the 2005 election. Barnett wondered,

If you go back in history and do mind-numbing cost-benefit, internal rates of return, all those sorts of analyses, which great projects in Australia would have been built? Would we have had a trans-Australian railway? I

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<sup>113</sup> G. Armstrong, 'Water still runs deep', *Sunday Times*, 5 January 2003; L. Bartlett, 'Rubbery figures in the pipeline', *Sunday Times*, 25 January 2004, p. 61; O. Rutley, 'C. Y. O'Connor would have done it', *Sunday Times*, 3 October 2004, p. 63; D. V. Glewis, 'Water pipe along gas route best option', *Sunday Times*, 30 January 2005, p. 53; and P. Rule, 'Water plan upsets C. Y. O'Connor descendant', *West Australian*, 7 February 2005, p. 6.

<sup>114</sup> C. Ayris, *C. Y. O'Connor: a brief biography*, West Perth, Cyril Ayris Freelance, 2004; A. G. Evans, *C. Y. O'Connor: his life and legacy*, Crawley, UWA Press, 2001; A. G. Evans, *The Trial of C. Y. O'Connor: a play in two acts*, Subiaco, Irish Heritage, 2003; J. Lefroy, *The Pipeline C. Y. O'Connor Built*, Fremantle, Fremantle Arts Centre Press, 2003; and National Trust, *The Golden Pipeline: a time capsule of water, gold and Western Australia*, West Perth, National Trust (WA), 2002.

<sup>115</sup> G. Bolton, *Land of Vision and Mirage: Western Australia since 1826*, Crawley, UWA Publishing 2008, pp. 1-2.

<sup>116</sup> See for example, J. Walter, *What Were They Thinking? The politics of ideas in Australia*, Sydney, UNSW Press, 2010.

doubt it. We probably wouldn't have had the overland telegraph, we wouldn't have had the Snowy Mountains scheme. We certainly wouldn't have had the railway up (from Adelaide) to Darwin. ... In this booming State with its powerful tradition of can-do enterprise, surely the ingenuity, drive and resolve can be found to use Kimberley water to secure future prosperity.<sup>117</sup>

This reference to Australia's grand nation-building engineering projects appealed to a nostalgia for a golden age of the country's economic history. The pace of microeconomic reform since the Hawke and Keating governments of the 1980s had arguably strengthened the economy but for many Australians, this had come at a personal cost. As journalist Michael Gordon reported in 2004, Australia was 'a country with an economic surplus but a confidence deficit'.<sup>118</sup> Projects like the Kimberley canal, so awe-inspiring in their scale and vision, might just have restored the electorate's faith in their leaders and their nation.

The emergence and surprising success of Pauline Hanson and her right-wing One Nation Party in the late 1990s had revealed to the mainstream media and political parties that outside the capital cities, there was considerable concern about the social and economic changes that neoliberal policies had brought about.<sup>119</sup> The appeal of the Kimberley canal arguably lay both in its visionary scale and its potential to provide tangible benefits for regional Western Australians, such as employment in the construction phase and irrigation for their properties. Indeed, surveys conducted by the *West Australian* newspaper revealed that the project appealed more to country voters than to those in the suburbs.<sup>120</sup> Another aspect of the project's rural appeal lay with its chief exponent: Ernie Bridge. Although Bridge might not have possessed the statesman qualities of figures like Sir John Forrest or Sir David Brand or Sir Charles Court, his enduring passion for the project evidently endeared him to many Western Australian voters. He was an 'everyman', a 'good bloke', a 'battler', especially against the 'pointy heads' who were stifling his vision, and holding back the state's long-awaited northern

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<sup>117</sup> G. Parker, 'Keep an eye on water in north: Appleyard', *West Australian*, 13 January 2007, p. 9.

<sup>118</sup> M. Gordon, 'Howard's Australias', *Age*, 7 August 2004, <<http://www.theage.com.au/articles/2004/08/06/1091732092416.html>>, (Accessed: 1 March 2011).

<sup>119</sup> P. McManus and B. Pritchard, 'Introduction', in B. Pritchard and P. McManus (eds), *Land of Discontent: the dynamics of rural and regional Australia*, Sydney, UNSW Press, 2000, p. 1; and M. Leach, 'Hansonism, political discourse and Australian identity', in M. Leach, G. Stokes and I. Ward (eds), *The Rise and Fall of One Nation*, St. Lucia, University of Queensland Press, 2000, p. 46.

<sup>120</sup> R. Taylor, 'Poll gives new desal plan a big tick', *West Australian*, 22 May 2007, p. 10.

development. Bridge and his Kimberley project contrasted with the elitist, intellectual, urban focus of the Labor government.<sup>121</sup>

In spite of the popular appeal of the Kimberley canal, the project proved to be the undoing of the Coalition during the 2005 electoral campaign. As a political commentator noted, the ‘canal dominated the election campaign’.<sup>122</sup> A series of bungled budgets for the project, however, portrayed a poorly prepared Opposition. These errors played a significant role in the Coalition’s failure to win the confidence of the electorate at the polls and ushered in the Labor government for a second term. Nevertheless, water from the Kimberley remains a tantalising prospect in the southwest, while the tapping of the South West Yarragadee continues to divide Western Australians.<sup>123</sup>

In November 2006, Big Water’s customers in the southwest became the first in Australia to sip desalinated seawater.<sup>124</sup> Other state governments took note and before long, desalination plants were on the drawing board in similarly drought-affected areas, including the Gold Coast, Sydney, Melbourne and Adelaide.<sup>125</sup> Desalination no longer represented ‘bottled electricity’, as former New South Wales Premier Bob Carr had once quipped; rather, it represented to governments seemingly limitless water and perhaps most importantly, electoral security.<sup>126</sup> The allure of ‘climate independent’ water supplies was difficult to resist, especially as severe water restrictions bit hard in the eastern states. But desalination in Perth at least was no silver bullet. Although it relieved some of the pressure on groundwater sources, the desalination plant only provided a fraction (17 per cent) of Big Water’s supplies.<sup>127</sup> This amount hardly matched the rhetoric of climate independence that deluded politicians and Big Water’s customers, and lulled them into a false sense of security about the reliability of the

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<sup>121</sup> C. Loveland, ‘Letter: water before rail line’, *West Australian*, 27 August 2002, np; D. V. Glewis, ‘Letter: water pipe along gas route best option’, *Sunday Times*, 30 January 2005, p. 53; M. Pownall, ‘Canal call poses quite a conundrum’, *WA Business News*, 10 February 2005, np; and ‘Rubbery figures in the pipeline’, *Sunday Times*, 25 January 2004, p. 61.

<sup>122</sup> Van Onselen, p. 454.

<sup>123</sup> B. Spencer, ‘Liberals revive pipeline’, *West Australian*, 26 April 2007, p. 1; and W. Hatley, ‘“Hands off” Yarragadee’, *Augusta-Margaret River Times*, 29 October 2010, <<http://au.news.yahoo.com/thewest/regional/southwest/a/-/community/8225220/hands-off-yarragadee/>>, (Accessed: 23 January 2012).

<sup>124</sup> A. Banks, ‘Tap turned on at Perth’s \$387 million desalination plant’, *West Australian*, 20 November 2006, p. 1.

<sup>125</sup> P. Spearritt, ‘The water crisis in Southeast Queensland: how desalination turned the region into carbon emission heaven’, in Troy (ed.), *Troubled Waters*, p. 30; and N. Onishi, ‘Arid Australia sips seawater, but at a cost’, *New York Times*, 10 July 2010, <<http://www.nytimes.com/2010/07/11/world/asia/11water.html?pagewanted=all>>, (Accessed: 23 January 2012).

<sup>126</sup> J. Harley, ‘Carr makes surprise desalination announcement’, *7.30 Report*, ABC, 12 July 2005, <<http://www.abc.net.au/7.30/content/2005/s1412876.htm>>, (Accessed: 4 March 2011).

<sup>127</sup> A. Banks, ‘Tap turned on at Perth’s \$387 million desalination plant’, *West Australian*, 20 November 2006, p. 1.



southwest's water supplies.

### *Hosing down climate change*

'Give the people water and their votes will follow', wrote Clive Hamilton of the approach of the Howard government to the politics of climate change in Australia in its final year in office.<sup>128</sup> According to Hamilton, the conservative Prime Minister had sought to change the tenor of the climate change debate by turning 'the climate problem into a water problem'.<sup>129</sup> John Howard had pursued this strategy, argued Hamilton, because he was aware that:

[F]or most Australians the most worrying manifestation of climate change was the drought. The two had become joined in the popular understanding, both in the bush where the paddocks were parched and in the cities where water restrictions had turned lawns brown.<sup>130</sup>

Despite their ideological differences, similar observations might be made of the manoeuvrings of the Gallop Labor government in Western Australia during Perth's 'water crisis'. The state government tapped into the enduring anxieties of Western Australians in the southwest that their verdant city was a fleeting mirage; that due to their isolation and their position between the desert and the sea, they would inevitably run out of water. Addressing water issues in the southwest, therefore, would have a broad appeal in the electorate.<sup>131</sup> With the promise of a climate-independent water supply and a limited program of water restrictions, the state government was able to manage the crisis without causing severe hardship for voters. The water crisis also served to mask the government's lack of action on the much more difficult long-term issue of reducing the state's greenhouse gas emissions.

The state government's anxieties about the ongoing drying trend in the southwest and its association with anthropogenic climate change prompted its implementation of technocratic responses to guard against worsening water scarcity for Big Water and its customers. From the outset, the government proclaimed its intent to 'secure' Perth's water future through a program of water restrictions and additional

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<sup>128</sup> C. Hamilton, *Scorcher: the dirty politics of climate change*, Collingwood, Black Inc., 2007, p. 219.

<sup>129</sup> Hamilton, p. 219.

<sup>130</sup> Hamilton, p. 219.

<sup>131</sup> L. van Schoubroeck, *The Lure of Politics: Geoff Gallop's Government 2001-2006*, Crawley, UWA Publishing, 2010, pp. 232, 235.

water supplies.<sup>132</sup> Between the drought of 2001 and 2006, the government had invested twice as much in the development of supplies for Big Water as its counterparts in Sydney, Melbourne, Brisbane and Adelaide.<sup>133</sup> The implication of such promises of water security was that without government investment in additional infrastructure, Big Water and its customers would be *insecure* and at dire risk of water scarcity, which would be detrimental to the economy and consumers' lifestyles. Although such investment has allowed the government to avoid harsh restrictions, these measures have served largely to perpetuate the expectation of relatively unfettered water supplies, thereby weakening the hydroresilience of scheme water users in the southwest to climate variability in the future. Rather than a solution to the southwest's water worries, therefore, Big Water's growing infrastructure is symptomatic of the inherent vulnerability of the southwest's economy and settlement patterns to water scarcity.<sup>134</sup>

The promise of additional supplies served to undermine the government's promotion of residential water conservation because the prospect of water scarcity appeared more remote.<sup>135</sup> A comparison of household water use across Australian cities in 2005 revealed that Perth was third behind Canberra and Adelaide, despite the city's heavy reliance on backyard bores.<sup>136</sup> Even allowing for the year-round rainfall of the other capitals, this statistic is intriguing given the policy of water restrictions and the spectre of a drying climate in the southwest. This relatively high water consumption of Perth households can be partly attributed to the lack of financial incentive to curtail scheme water use. Although a market mechanism had been introduced in order to manage water scarcity in the late 1970s, the price of water did not adequately reflect the increasing cost of supplies for Big Water. Despite the 'water crisis', successive governments had not allowed the price of water to increase in real terms since 1998. The political sensitivity of price rises, therefore, hampered the function of the price signal to encourage consumers to reduce their demand for water.<sup>137</sup> Already cognitively distanced from the source of scheme water supplies, this lenient pricing of water served to further insulate households from the effects of the southwest's drying climate and the growing difficulty of supplying Big Water.

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<sup>132</sup> W. A. Water Symposium, *Our Water Future*, Perth, W. A. Water Symposium, 2002; and Government of Western Australia, *Securing Our Water Future*.

<sup>133</sup> Marsden and Pickering, p. ES.ii.

<sup>134</sup> McDonald, Coldrick and Christensen, 2008, p. 71.

<sup>135</sup> M. Edwards, 'Transcript: WA's solutions to the water crisis – desalination versus Yarragadee aquifer', *Stateline: Western Australia*, ABC, 18/3/2005, <<http://www.abc.net.au/stateline/wa/content/2005/s1329088.htm>>, (Accessed: 14 March 2011).

<sup>136</sup> McFarlane, p. 69.

<sup>137</sup> McFarlane, p. 69; and Economic Regulation Authority (ERA), *Inquiry on Urban Water and Wastewater Pricing: final report*, Perth, ERA, 2005, pp. 23, 25-30, 30-38.

By 2005, the state government considered that the electorate would not tolerate tighter limits on water consumption and pledged that they would reduce the likelihood of a total ban on water sprinklers from one year in thirty, to just one year in two hundred, which was an extremely conservative approach to water planning.<sup>138</sup> Australians in other capital cities, meanwhile, were likely to face sprinkler bans once every twenty-five years. In parts of New South Wales, Victoria, Queensland and South Australia, residents would later be prevented from washing their cars and using scheme water on their gardens – a far cry from the twice a week watering regime in Perth. The financial losses for Big Water that restrictions had already produced in the southwest were also likely to have influenced this decision to limit restrictions. The possible effects on the plant nursery, turf growing, lawn mowing, and swimming pool industries also played a role.<sup>139</sup> Such a populist policy, however, demanded the development of further supplies for Big Water. As the South West Yarragadee continued to divide the electorate after the state election, the government committed to the construction of a second desalination plant in 2007 at Binningup, which was completed in 2011.<sup>140</sup>

Premier Gallop and his government had earned praise from around the nation for the way that they had managed the city's 'water crisis' and averted total sprinkler bans. That they had achieved this success as the 'national canary in the climate change coal mine' had made the feat all the more remarkable.<sup>141</sup> But was it? For the most part, the government's strategy appeared to be 'business as usual' – expanding water supplies to meet the demands of consumers. A more remarkable approach for the Gallop government would have been to make more concerted efforts to encourage the development of a water-conserving culture to improve the hydroresilience of Western Australians in the southwest. In light of IOCI findings that the regional drying trend was associated with anthropogenic climate change, the government might also have implemented strategies to reduce the state's greenhouse gas emissions.

The Labor government had teased environmentalists with the announcement in 2005 that IOCI would be a cornerstone of its new state greenhouse strategy. Although this strategy might have 'raised the priority of greenhouse issues and committed

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<sup>138</sup> Marsden and Pickering, p. 16; and Water Corporation, *Source Development Plan 2005-2050: an overview*, p. 3.

<sup>139</sup> McFarlane, 2005, p. 68.

<sup>140</sup> S. Jerrard, 'Water Corp dream comes to costly halt', *West Australian*, 16 May 2007, p. 6; and A. Hobbs, 'It's hard to talk with a dry throat', *WA Business News*, 18 May 2007, np.

<sup>141</sup> M. Turnbull, 'Malcolm Turnbull speaks to National Press Club in Adelaide', Parliament of Australia, 22 November 2006, <[http://parlinfo.aph.gov.au/parlInfo/download/media/pressrel/4VLL6/upload\\_binary/4vll63.pdf;fileType=application/pdf](http://parlinfo.aph.gov.au/parlInfo/download/media/pressrel/4VLL6/upload_binary/4vll63.pdf;fileType=application/pdf)>, (Accessed: 1 February 2012).

departments ... to a range of actions aimed at reducing emissions and adapting to climate change', it was more a symbolic gesture than a roadmap for action.<sup>142</sup> Not long after his election in 2001, Premier Gallop had expressed his opposition to Australia's ratification of the Kyoto Protocol because of it would constrain Western Australia's resource-based economy. This position put his government at odds not only with local environmentalists, but also with the Labor governments of New South Wales, Victoria and South Australia.<sup>143</sup> Furthermore, his government commissioned another coal-fired power plant in the southwest and promoted greenhouse intensive industries in Kwinana and the state's northwest.<sup>144</sup> Environmentalists criticised the Gallop government for its contradictory approach. As a campaigner for the Australian Conservation Foundation argued in 2005,

Western Australia is in the grip of a water crisis, which is consistent with climate change predictions. The Gallop government is on the one hand searching for ways to combat the crisis, and on the other, knowingly contributing to it by allowing inefficient coal-fired power stations to be built.<sup>145</sup>

The government's lip service to climate change mitigation would do little to improve the southwest's hydroresilience, leaving Western Australians vulnerable to running out in a drier future.

## ***Conclusion***

Since the late 1990s, dry conditions and the issue of regional climate change have dominated Western Australian perceptions and understandings of the southwest's environment and water resources. Growing scientific support for the role of anthropogenic climate change in the regional drying trend deepened political anxieties about the vulnerability of Big Water and its customers to water shortages, particularly in light of the deteriorating condition of the Gngangara Mound. Heated political debates

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<sup>142</sup> Morgan et al., p. 56; and Bates et al., p. 351.

<sup>143</sup> 'Greens blast Gallop for Kyoto stance', *ABC Online*, 18 September 2002, <[http://www.abc.net.au/cgi-](http://www.abc.net.au/cgi-bin/common/printfriendly.pl?news/politics/2002/09/item20020918082658_1.htm)

[bin/common/printfriendly.pl?news/politics/2002/09/item20020918082658\\_1.htm](http://www.abc.net.au/cgi-bin/common/printfriendly.pl?news/politics/2002/09/item20020918082658_1.htm)>, (Accessed: 1 February 2012); and 'States employ former political figureheads in Kyoto push', *ABC Online*, 19 November 2002, <[http://www.abc.net.au/cgi-](http://www.abc.net.au/cgi-bin/common/printfriendly.pl?news/politics/2002/11/item20021118080328_1.htm)

[bin/common/printfriendly.pl?news/politics/2002/11/item20021118080328\\_1.htm](http://www.abc.net.au/cgi-bin/common/printfriendly.pl?news/politics/2002/11/item20021118080328_1.htm)>, (Accessed: 1 February 2012).

<sup>144</sup> Editorial, 'Greenhouse irresponsibility', *Greener Times*, June, 2002, p. 2.

<sup>145</sup> T. Fairfield, cited in 'WA government ignores global warming', *Greener Times*, June 2005, p. 3.

over the next source of supply for Big Water revealed ongoing anxieties about the 'empty north' and reignited tensions between Perth and its rural hinterland over access to the southwest's groundwater reserves. Although water shortages were averted in the short-term, these technocratic measures served only to perpetuate Big Water's vulnerability to climate variability and water scarcity in the twenty-first century.

The government's efforts to secure Big Water against a drying climate further highlighted the gulf between those within Big Water and those without, particularly in the unreticulated areas of the southwest. Battle-weary from poor seasons in the 1990s, the droughts of the early 2000s exposed the financial vulnerability of many farmers to climate variability. The economic challenges facing many southwest farmers left them with few resources to invest in the land and water conservation measures that would improve their resilience to dry periods in the future. Those who were financially better-placed were able to implement changes to their farming strategies that reduced their vulnerability to climate variability as well as their anxiety about the prospect of a drier climate.

The resort to technocratic strategies to overcome climate variability and water scarcity has continued. The government has commenced a program to replenish Gnamptu Mound with treated wastewater in an effort to improve the condition of Big Water's groundwater reserves, which has declined significantly in recent years.<sup>146</sup> A 2008 study showed that some Perth suburbs were sinking at a faster rate – as much as 5cm a year – than anywhere else in the nation as a result of the widespread pumping from aquifers beneath the city.<sup>147</sup> Neither of these projects has been without controversy, but anxieties about a drier future for the southwest have outweighed the concerns of critics.

These fears were confirmed with Perth and other parts of the southwest recording their driest year in 2010. That year, the Government imposed total sprinkler bans during the winter months of June, July and August, and restricted bore use to three days per week – a policy that has continued.<sup>148</sup> Dry seasons hit farmers in the southern

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<sup>146</sup> J. Hammond, 'Too much water taken from Gnamptu Mound, audit finds', *West Australian*, 4 May 2009, <<http://au.news.yahoo.com/thewest/a/-/news/5795731/too-much-water-taken-from-gnamptu-mound-audit-finds/>>, (Accessed: 1 February 2012); and D. Mercer, 'Sharp fall in Gnamptu water levels', *West Australian*, 10 June 2011, <<http://au.news.yahoo.com/thewest/a/-/newshome/9615870/sharp-fall-in-gnamptu-water-levels/>>, (Accessed: 1 February 2012).

<sup>147</sup> D. Hatch, 'Suburbs sinking as water use gets blame', *West Australian*, 17 March 2008, p. 9.

<sup>148</sup> 'Permanent winter sprinkler ban for Perth and SW', *PerthNow*, 14 March 2010, <<http://www.perthnow.com.au/news/western-australia/permanent-winter-sprinkler-ban-for-perth-and-sw/story-e6frg13u-1225840557178>>, (Accessed: 20 October 2011).

districts particularly hard and further whittled away their finances.<sup>149</sup> Despite the enormous costs involved, the prospect of piping water from the north continues to inspire many Western Australians in the southwest.<sup>150</sup> The slow but growing involvement of Aboriginal people in water resource planning and management in both the southwest and northwest of the state may affect the development of such a scheme.<sup>151</sup>

The Federal election of 2007 was arguably the world's first climate change election and the success of the Australian Labor Party brought a greater political will to address the issue. The Commonwealth finally ratified the Kyoto Protocol, encouraged investment in renewable energy sources, and, much to the chagrin of the Western Australian government, announced its intent to put a price on carbon. The onset of the global financial crisis in 2008, however, pushed aside the issue of climate change as political attentions turned to preventing a recession in Australia. Despite the downturn affecting the global economy, Western Australia continues to serve as a quarry for the ravenous Chinese and Indian markets. In his provocative study of the future of Perth, *Boom Town*, Richard Weller reported in 2008, the city's rate of economic growth had exceeded that of China.<sup>152</sup> The strength of the state's economy has supported further population growth, particularly in the southwest, which has placed additional strain on Big Water and its supplies.<sup>153</sup>

Although seawater desalination appears to be the answer to the government's water woes, this is likely to change in the future. As energy prices continue to increase, the cost of water from desalination will also rise and these costs will inevitably be passed onto consumers.<sup>154</sup> Whether this will reduce demand remains to be seen. But with the southwest's population expected to reach nearly 2.5 million people by 2031,

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<sup>149</sup> T. Paddenburg, 'Drought-ravaged farmers head to WACA as WA's big dry hits hard', *PerthNow*, 23 October 2010, <<http://www.perthnow.com.au/news/western-australia/drought-ravaged-farmers-head-to-waca-as-was-big-dry-hits-hard/story-e6frg13u-1225942660195>>, (Accessed: 10 January 2011).

<sup>150</sup> L. Bartlett, 'Gone to water', *Sunday Times*, 12 February 2012, p. 54.

<sup>151</sup> S. Jackson, 'Background paper on Indigenous participation in water planning and access to water', *National Indigenous Water Planning Forum*, CSIRO, 2009, <[http://www.csiro.au/Organisation-Structure/Divisions/Ecosystem-Sciences/~media/CSIROau/Divisions/CSIRO%20Sustainable%20Ecosystems/IndigenousWaterPlan\\_CSE\\_Report%20Standard.pdf](http://www.csiro.au/Organisation-Structure/Divisions/Ecosystem-Sciences/~media/CSIROau/Divisions/CSIRO%20Sustainable%20Ecosystems/IndigenousWaterPlan_CSE_Report%20Standard.pdf)>, (Accessed: 5 February 2012), pp. 42-47.

<sup>152</sup> R. Weller, *Boom Town: scenarios for a rapidly growing city*, Crawley, UWA Publishing, 2009, p. 419.

<sup>153</sup> 'WA records biggest population growth in Australia', *ABC Online*, 29 September 2011, <<http://www.abc.net.au/news/2011-09-29/wa-records-biggest-population-growth/3050634>>, (Accessed: 1 February 2012).

<sup>154</sup> N. Bitá, 'Water charges are set to spiral in desalination squeeze', *Australian*, 23 January 2010, <<http://www.theaustralian.com.au/news/nation/water-charges-are-set-to-spiral-in-desalination-squeeze/story-e6frg6nf-1225822705341>>, (Accessed: 2 January 2011).

there will be additional pressures on water resources from urban development.<sup>155</sup> With the likelihood of the drying trend continuing, Big Water will inevitably feel the strain to meet consumer expectations of endless supplies. Those farmers who remain on the land and live outside the reticulated reach of Big Water, will continue to face the challenges of strengthening their hydroresilience to avoid running out.

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<sup>155</sup> Government of Western Australia, *Strategic Directions to 2030: Perth-Peel regional water plan discussion paper*, Perth, Dept of Water, 2009, p. 6.

## Conclusion

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*Water is not just an issue of technology, for the market or government regulation. It is something with which all humans are intricately bound, something that is shaped by and gives shape to our visions and dreams.*<sup>1</sup>

- Emily Potter and Stephen McKenzie, 2007

There has never seemed to be enough water between the desert and the sea for the visions and dreams of Western Australians in the southwest. Since at least the turn of the twentieth century, it seems as if Western Australians have possessed recurring fears that sooner or later, they would run out of water. It is largely this anxiety about running out that has prompted such ongoing support in the southwest for the near-continuous development of new sources, including grandiose plans to transport water from the north of the state. In spite of this fear, the water resources of the region are jealously guarded and development seems to trump their protection on most occasions. All the while Western Australians have maintained a profligate water culture, thereby living beyond the environmental limits of the southwest and rendering themselves vulnerable to running out.

The foundations for this vulnerability can be traced to the manner of the colonisation of the southwest. The very nature of permanent settlement rooted the colonists to a particular place, which limited their ability to adapt to variations in climate conditions and the availability of water supplies. It would also lead to the contamination of these supplies. The southwest's Nyoongar people, by contrast, had long moved around country according to seasonal rhythms, which ensured that their risk of thirst was minimised. The establishment of permanent settlements and infrastructure also affected the resilience of the Nyoongar people to environmental variability. The rapid transformation of their lands and the competition with colonists for resources severely affected their ability to maintain the hydroresilience that they had developed over thousands of years. Meanwhile, it took time for the colonists to develop local knowledge through the adaptation of Western science to antipodean conditions.

The discovery of gold in the eastern goldfields near the end of the century transformed the Colony. The construction of the Golden Pipeline to Kalgoorlie has

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<sup>1</sup> E. Potter and S. MacKenzie, 'Introduction', in E. Potter, S. McKenzie and J. McKay (eds), *Fresh Water: new perspectives on water in Australia*, Carlton, Melbourne University Press, 2007, pp. 6-7.



served as testament to Western Australian ingenuity and a stubborn refusal to adapt to the environmental limits of the land. The subsequent reticulation of the goldfields and later, the suburbs of Perth, coincided with a growing focus on the moral and physical hygiene of the state's citizens. The resultant discourses of public health would underpin a discriminatory sanitary order in the southwest, which served to stigmatise the region's Aboriginal people. Widely held aspirations to live beyond the environmental limits of the southwest also shaped visions for the region's agricultural development. Despite severe drought and scientific warnings to curb the extent of agricultural expansion after the First World War, the closer settlement project continued, much to the detriment of the Aboriginal peoples of the wheatbelt. Water was vital to this expansion as it provided the means for agricultural development and to transport produce via railway and dray. As droughts would show, the southwest's dependence on water, particularly where it was not naturally abundant, had rendered the region's people and agricultural industries vulnerable to climate variability and water scarcity.

After the Second World War, the rise of Big Water and its promise of endless supplies utterly transformed the expectations and aspirations of Western Australians in the southwest. Water was vital to the government's visions of agricultural and industrial development. New dams, irrigation channels and reticulated networks represented the state's post-war progress and prosperity as the government sought to clear 'a million acres a year'. For those farmers beyond the reach of Big Water, the government provided financial and technical assistance to improve their private water supplies but the wet winters and favourable post-war markets led many to neglect these aspects of their farming enterprises. In both rural towns and the suburbs of Perth, reticulated water represented civility and affluence, and differential access to it reinforced the marginalisation of Aboriginal people from post-war society. More homes now had access to hot-water at the turn of the tap, which combined with new consumer appliances to send water consumption soaring. The prevailing political ethos with its emphasis on the importance of the family and the home reinforced the illusion of a domestic sphere detached from natural processes, and independent of the vagaries of the weather. Instead, this dependency on large amounts of water to maintain a particular domestic standard served to render many households vulnerable to water scarcity because they were living beyond the ability of the environment to sustain such lifestyles in the medium to long term.

The devastating drought of 1969 marked the beginning of a dry decade for the region and exposed the vulnerability of many Western Australians to water scarcity.

The severity of this drought prompted scientific research into the neglected subject of droughts in the southwest, while some desperate farmers hoped that cloudseeding would overcome their plight. The combination of the dry conditions with the unprecedented restrictions on suburban water use sparked anxieties among the people of Perth that their city would run out. The engineers of Big Water were not immune to these concerns and sought new ways to manage water supply and demand in the region. The introduction of user pays produced a dramatic reduction in household water consumption in Perth, which would persist into the following decade. Fiscal austerity and the paucity of rivers to dam led Big Water to tap the groundwater reserves of the Swan Coastal Plain and to enact measures to protect its dam catchments from salinity. The ongoing dry conditions would combine with land degradation and the waning influence of countrymindedness to finally break the community's faith in the continued expansion of agriculture in the southwest.

By the 1980s, the extent of land and stream salinity in the southwest region had become too great for the government to ignore. Even Big Water was not immune to the creeping hazard, with the Wellington Dam becoming too saline to provide water to towns in the Great Southern. In addition to this degradation of land and water resources, farmers and Big Water faced persistent dry conditions, which scientists suspected were related to the greenhouse effect. Meanwhile, the thirst of the growing population of Perth was affecting the groundwater resources of the Swan Coastal Plain, which were proving an increasingly important source for Big Water. Local environmentalists fought for statutory protection of these reserves to conserve ecologically significant wetlands, which were threatened by groundwater abstraction and urban development. Although they also called on the government to curb domestic water use, the influences of economic rationalism and politicking on the Western Australian water sector allowed many of Big Water's customers to continue to their thirsty ways.

Despite state government assurances in the late 1990s that Perth was 'drought-proof', the unprecedented drought of 2001 triggered a so-called 'water crisis' in the suburbs. Although hysteria inevitably followed, the austerity measures facing householders were far from severe – they could still use sprinklers to water gardens twice a week and use their bores at night. Nevertheless, the fear of running out was palpable and played a deciding role in the 2005 state election. The promise of seawater desalination provided a technological fix that calmed the anxious masses and sustained their profligate water culture. Despite the Labor government's lip service to climate change policy, it made little progress on reducing the greenhouse gas emissions that

were associated with the region's drying climate. Meanwhile, in the agricultural areas, the run of dry seasons had exacted a heavy toll on the southwest's farmers and under the ethos of self-reliance, there was little relief in sight. How times had changed for the Western Australian wheatbelt.

### *The past, present and future*

In an updated edition of his 2010 study of the Murray Darling Basin, *The River*, journalist Chris Hammer described the experience of finding himself 'consigned to history'.<sup>2</sup> Browsing through his local bookshop in November 2010, he had realised that his volume had 'somehow migrated' from the Environment and Ecology section, where it had stood six months ago, to a new place on the History shelves. A significant influence on this move, he observed, had been the dramatic change in the weather affecting the east coast of the continent, from drought to devastating floods in late 2010. These conditions have since led some commentators to pillory climate change activists, particularly Tim Flannery, for predicting that the dams supplying Australia's largest city, Sydney, would never fill again. Similarly, the New South Wales government's decision to invest in desalination technology for its capital has also been roundly criticised as metropolitan storages increase.<sup>3</sup> Such are the challenges of planning for both climate variability and climate change on a continent of extremes.

In southwest Western Australia, however, the drying trend examined in this thesis can not be relegated to history: it is past, present and, seemingly, the future. The Federal government's Climate Commission confirmed in 2011 that the region had undergone a drying trend since 1970 and that almost all climate change models project continuing dry conditions for the southwest.<sup>4</sup> The 2012 *State of the Climate* report, the annual publication by CSIRO and the Bureau of Meteorology, restated these observations. The publication of these findings in March coincided with data from the Water Corporation, which revealed that since June 2011, over three thousand households had been fined for violating water restrictions – ten times the number of

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<sup>2</sup> C. Hammer, *The River: a journey through the Murray-Darling Basin*, Carlton, Melbourne University Press, 2011, p. ix.

<sup>3</sup> See for instance, 'Greens call for Sydney desalination plant shutdown', *ABC News*, 16 December 2011, <<http://www.abc.net.au/news/2011-12-16/greens-call-for-sydney-desalination-plant-shutdown/3735106>>, (Accessed: 1 February 2012); and 'Sydney desal output halved because of rain', *Sydney Morning Herald*, 29 February 2012, <<http://www.smh.com.au/environment/water-issues/sydney-desal-output-halved-because-of-rain-20120229-1u2pq.html>>, (Accessed: 1 March 2012).

<sup>4</sup> Climate Commission, *The Critical Decade: climate science, risks and responses*, Canberra, Dept of Climate Change and Energy Efficiency, 2011, p. 32.

finer issued during the 2009/10 financial year.<sup>5</sup> In contrast, the Department of Water reported that it had not charged any license holders on the Gngangara Mound since metering of the heaviest users began in 2007, despite reports that a quarter of them had exceeded their allowances during the previous year.<sup>6</sup> This contrast between the regulation of residential and horticultural consumers highlights the persistence of political sensitivities surrounding productive and unproductive water use, as well as the ongoing inadequacy of groundwater protection in the southwest. Furthermore, these statistics suggest that the people of Perth remain caught in a 'hydro-illogical cycle', where awareness of and concern over water scarcity soon fade to apathy when abundance, or at least its illusion, returns.<sup>7</sup>

The southwest's agricultural areas continue to grapple with their saline inheritance. According to the 2007 Western Australian *State of the Environment* report, over 14,000 hectares of land is lost to salinisation every year – the equivalent of nineteen football ovals each day. Similarly, salinity levels continue to rise in many major southwest rivers.<sup>8</sup> Meanwhile, thanks in part to average seasonal conditions in 2011, wheat farmers in the southwest recorded their largest harvest. But falling wheat prices meant that those farms without high yields will have difficulty recovering their costs of planting and harvesting.<sup>9</sup> Furthermore, in both rural and urban areas of the southwest, many Aboriginal families continue to face challenges in accessing public and private housing, which can contribute to homelessness and family breakdown.

Yet, as Richard White reminds his readers, 'things did not have to be this way'.<sup>10</sup> Although climate change appears to be playing a role in creating a drier future for the southwest, these changes do not mean that climate and water histories are not useful for informing our visions for the future. The climatic conditions that we will face might be 'new' to us, but change itself is not new and environmental history can reveal

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<sup>5</sup> D. Mercer, 'Bore users let off amid record fines', *West Australian*, 13 March 2012, <<http://au.news.yahoo.com/thewest/a/-/wa/13149057/bore-users-let-off-amid-record-fines/>>, (Accessed: 15 March 2012).

<sup>6</sup> Mercer, <<http://au.news.yahoo.com/thewest/a/-/wa/13149057/bore-users-let-off-amid-record-fines/>>. The Department of Water was formed in 2008 to replace the Water and Rivers Commission and the Office of Water Regulation. The role of the function is to manage the state's water resources in a sustainable manner.

<sup>7</sup> D. A. Wilhite, M. J. Hayes and C. L. Knutson, 'Drought preparedness planning: building institutional capacity', in D. A. Wilhite (ed.), *Drought and Water Crises: science, technology, and management issues*, Boca Raton, Taylor & Francis, 2005, p. 95.

<sup>8</sup> Environmental Protection Authority (EPA), *State of the Environment Report*, EPA, 2007, <<http://www.epa.wa.gov.au/AbouttheEPA/SOE/2007/Pages/default.aspx>>, (Accessed: 10 May 2012), pp. 56, 81.

<sup>9</sup> K. Matthews and H. Vandenberghe, 'WA growers have heralded the start of 2012 by delivering their biggest ever crop', *Countryman*, 19 January 2012, p. 1.

<sup>10</sup> R. White, *Railroaded: the transcontinentals and the making of modern America*, New York, W. W. Norton, 2011, p. 516.

how humans have responded to and understood environmental change in the past. By improving our understanding of the past, we can better assess how we might best adapt to environmental change in the future.

Western Australians of the present might have a greater level of hydroresilience had their forebears made different decisions. For instance, had previous state governments heeded scientific and environmental warnings about closer settlement in the southwest's marginal areas, many farmers might have opted for less risky ventures, such as pastoral development and forestry. Likewise, the salinisation of the southwest's land and water resources may not have been so extensive and severe had these same governments also acted on scientific concerns about the consequences of the widespread clearing of native vegetation.

In light of ongoing scientific monitoring of the declining groundwater levels of the Swan Coastal Plain, environmental protection authorities might also have been granted greater power to curb the thirst of Big Water for the precious reserves of the Gnangara and Jandakot Mounds. Similarly, backyard bores could have been licensed, monitored and even rated so that the amount of water privately abstracted could be measured and better regulated. More recently, state governments might have committed themselves to lowering Western Australia's greenhouse emissions, particularly in light of the association of the southwest drying trend with anthropogenic climate change. It is significant that these are not fanciful imaginings – these alternatives were advocated repeatedly over the past century.<sup>11</sup> There is still time for some of them to be acted upon.

Western Australians have reaped great spoils from the southwest but they cannot continue to be its spoilers. Although Western Australians in the present must live with the consequences of this past, there remains the need for discussion and decisionmaking about the ways in which they reduce their vulnerability to climate variability and water scarcity now and in the future. These are significant debates that affect current and future generations of Western Australians, as 'debates about water are really debates about the sort of society and the sort of environment we want to live in'.<sup>12</sup> They are debates about the state's sustainable development, to ensure that its economic development 'meets the needs of the present without compromising the ability of future generations to meet their own needs'.<sup>13</sup> These future generations include both

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<sup>11</sup> White, p. 516.

<sup>12</sup> Å. Wahlquist, *Thirsty Country: options for Australia*, Crows Nest, Allen and Unwin, 2008, p. 11.

<sup>13</sup> Brundtland Report, cited in L. Robin, *How a Continent Created a Nation*, Sydney, UNSW Press, 2007, p. 152.

Australians and citizens of other nations who stand to be affected by the decisions that are made today.

Central to such discussions about society and the environment will be a consensus on the economic aspirations of the current generation of (Western) Australians. Their aspirations, and the paths taken to achieve them, will shape the distribution of wealth, power and access to resources, as well as affecting the natural resources and biodiversity of the continent.<sup>14</sup> Libby Robin has suggested we consider the role of science in forming these aspirations, as '[s]cience has the potential to contribute new states of mind and to entrench old ones'.<sup>15</sup> In terms of anxieties about climate variability and water scarcity in the southwest, the 'old' state of mind has historically relied upon technocratic measures to 'tame chance'. The long-held faith in science and technology to predict, protect and provide has allowed many Australians to become detached from the basic environmental processes, which has diminished their hydroresilience. A 'new' state of mind, in contrast, might accept the futility of taming chance in a continent of extremes, and instead seek adaptive and flexible strategies, including cultural change, to reduce the vulnerability of present and future generations of (Western) Australians to running out of water. Furthermore, this mindset would temper economic aspirations with consideration for social equity and the environment. Such a state of mind would go some way 'to create a possibility of a home where we stop "battling" [the elements], and live in peace within our ecological limits'.<sup>16</sup>

How might such considerations of society and environment affect the ways that Western Australians understand and use the water resources of the southwest in the future? The development of Western Australia's urban and rural water supplies improved the health of the community, while the rise of Big Water provided the foundation for the state's post-war economic development.<sup>17</sup> Despite the irrefutable benefits of these projects, they have also produced significant drawbacks – 'an inflexible, institutionalised water and waste system based on a large-scale, engineered, "big pipe in, big pipe out" logic'.<sup>18</sup> As only a small proportion of the water now consumed needs to be of a potable quality, Big Water could invest in dual-flow water

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<sup>14</sup> L. Robin, 'Battling the land and global anxiety: science, environment and identity in settler Australia', *PAN: Philosophy, Activism, Nature*, no. 7, 2010, p. 8.

<sup>15</sup> Robin, 'Battling the land and global anxiety', p. 8.

<sup>16</sup> Robin, 'Battling the land and global anxiety', p. 8.

<sup>17</sup> P. Troy, 'Conclusion', in P. Troy (ed.), *Troubled Waters: confronting the water crisis in Australia's cities*, Canberra, ANU Epress, 2008, pp. 195-96.

<sup>18</sup> S. Dovers, 'Urban water: policy, institutions and government', in Troy (ed.), *Troubled Waters*, p. 91.

systems, while industrial, commercial and agricultural needs could be met through recycled wastewater.<sup>19</sup>

In addition, a large proportion of household water could be obtained from what might be called ‘Small Water’, such as residential rainwater tanks and greywater reuse. To encourage such measures, the state government could reconsider its lenient pricing policies to ensure that water is supplied to households at a minimum guaranteed volume per person each year at an equitable price to reward low use and to protect low income consumers. The price charged for consumption above this minimum could be set at a steep inclining rate to ensure that those who used more than this base amount paid significantly more for their water consumption.<sup>20</sup> In terms of the equity of water supply, state governments must work much harder to improve the housing, health and living standards of the southwest’s Indigenous peoples to overturn the insidious discriminatory sanitary order that has persisted in the region for far too long.

Reducing the need for Big Water to provide potable water for all uses and users would help to delay the need to develop new sources of supply and relieve pressure on groundwater reserves. Tighter regulation of all consumers of groundwater, both private and public, would curb the abstraction of these reserves and alleviate the strain on the wetland ecosystems of the Swan Coastal Plain. Better protection of these complex ecologies not only conserves their biodiversity, but also safeguards places that are of cultural significance, particularly to many of the southwest’s Indigenous peoples.

In the rural areas of the region, this thesis has highlighted the significant roles that markets, agricultural policies, and financial security play in shaping the resilience of farmers to climate variability and water scarcity. Further research into seasonal forecasting as well as drought-resistant and salt-tolerant crops is necessary, as well as greater investment in extension services to ensure farmers can better access and interpret the findings of this research. Although country-mindedness may have waned, Australian governments have a responsibility to farmers, having assiduously encouraged agricultural development during the twentieth century. With the support of their urban constituents, governments should increase their efforts to support farmers to reduce their vulnerability to the elements and to encourage restructuring the nation’s cropping areas for other forms of development, such as pastoralism and tree cropping.

The responsibility for fostering a ‘new’ state of mind for Western Australians should be shared among the present generation and bequeathed to the next. The state’s

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<sup>19</sup> Troy, pp. 195-96.

<sup>20</sup> Troy, pp. 198-99.

environmental history shows, however, that local visionaries have played central roles in shaping the aspirations of Western Australians and it is vital that their dreams do not create nightmares for the land, water and people of the southwest. Surrounded by the desert and the sea, they cannot afford to think otherwise.



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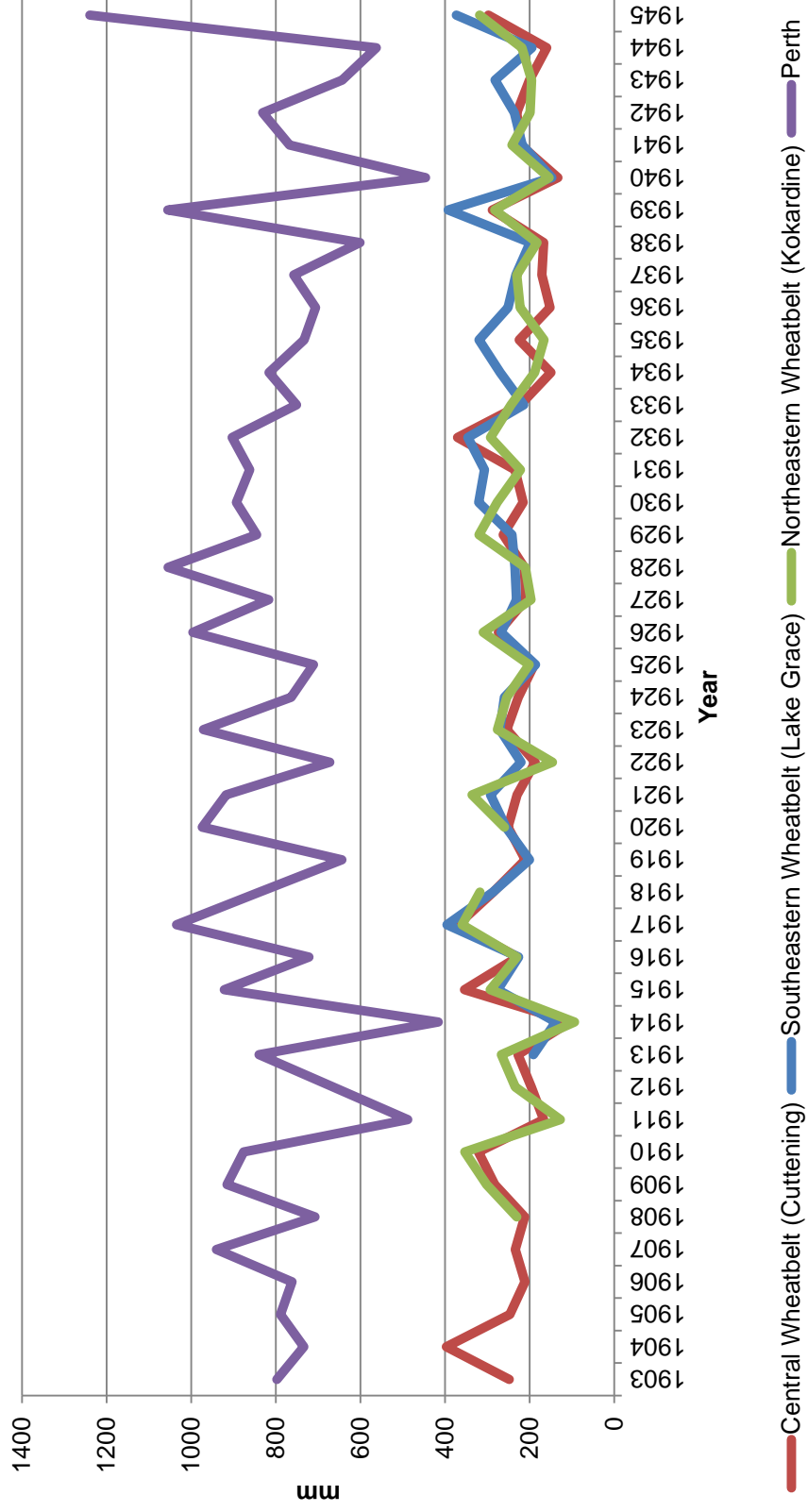
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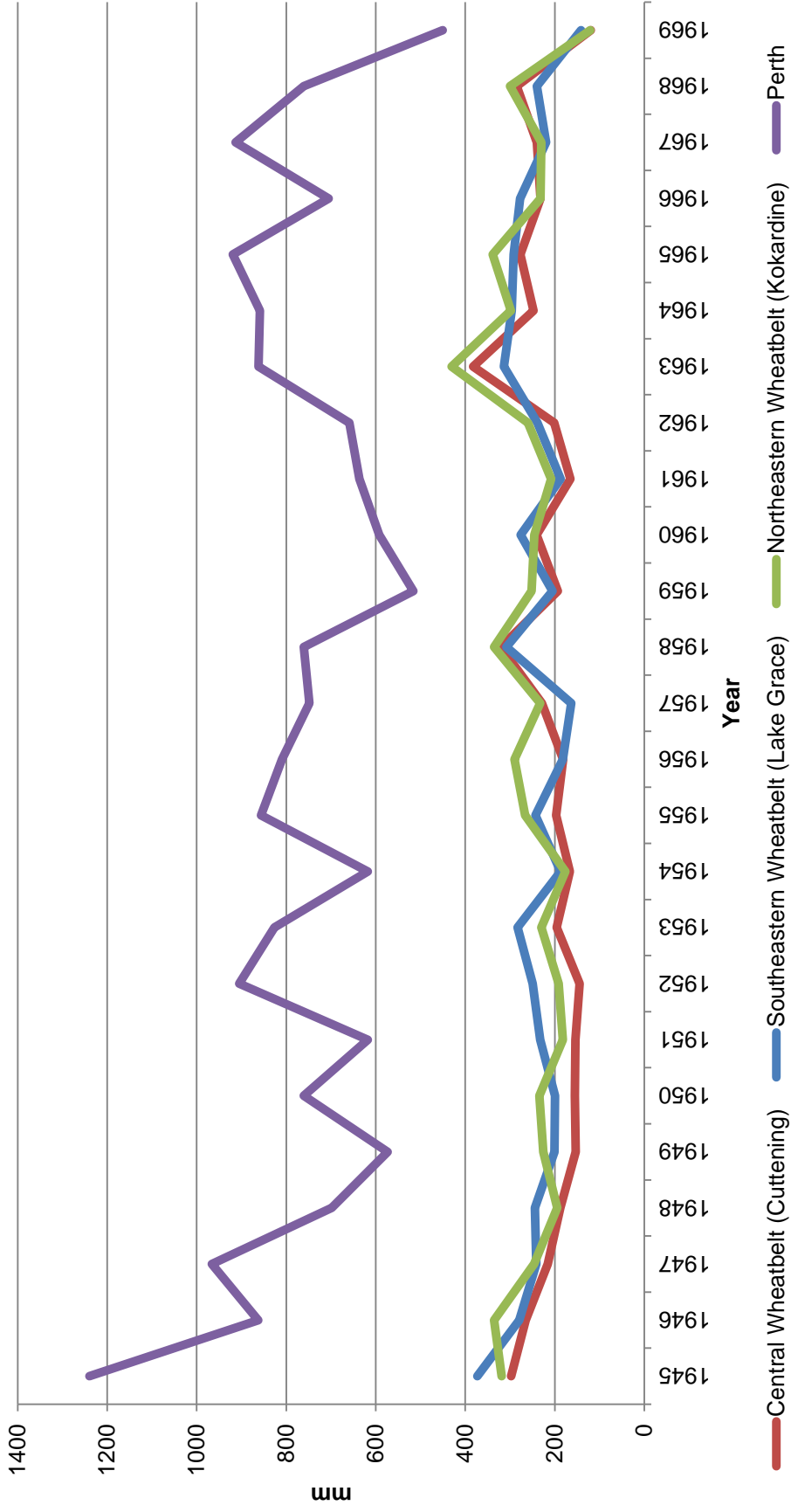
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Appendix I: May-October Rainfall, 1903-1945 (mm)<sup>1</sup>



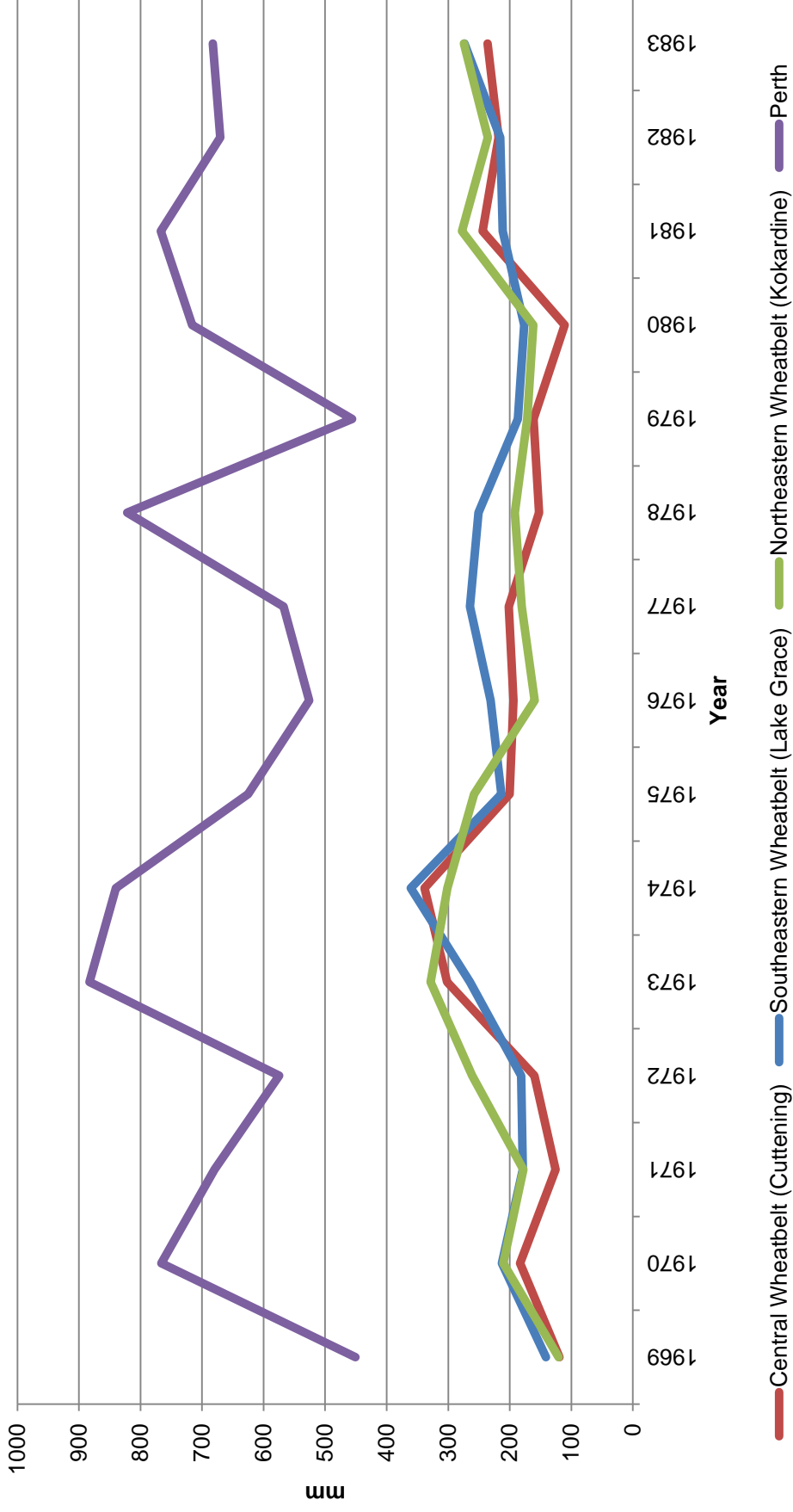
<sup>1</sup> Bureau of Meteorology, 'Monthly rainfall, 1903-1945, Perth (009034); Lake Grace (010592); Cuttening (010037); and Kokardine (08066), Climate Data Online, Bureau of Meteorology, <<http://www.bom.gov.au/climate/data/>>, (Accessed: 4 January 2012).

**Appendix II: May-October Rainfall, 1945-1969 (mm)<sup>1</sup>**



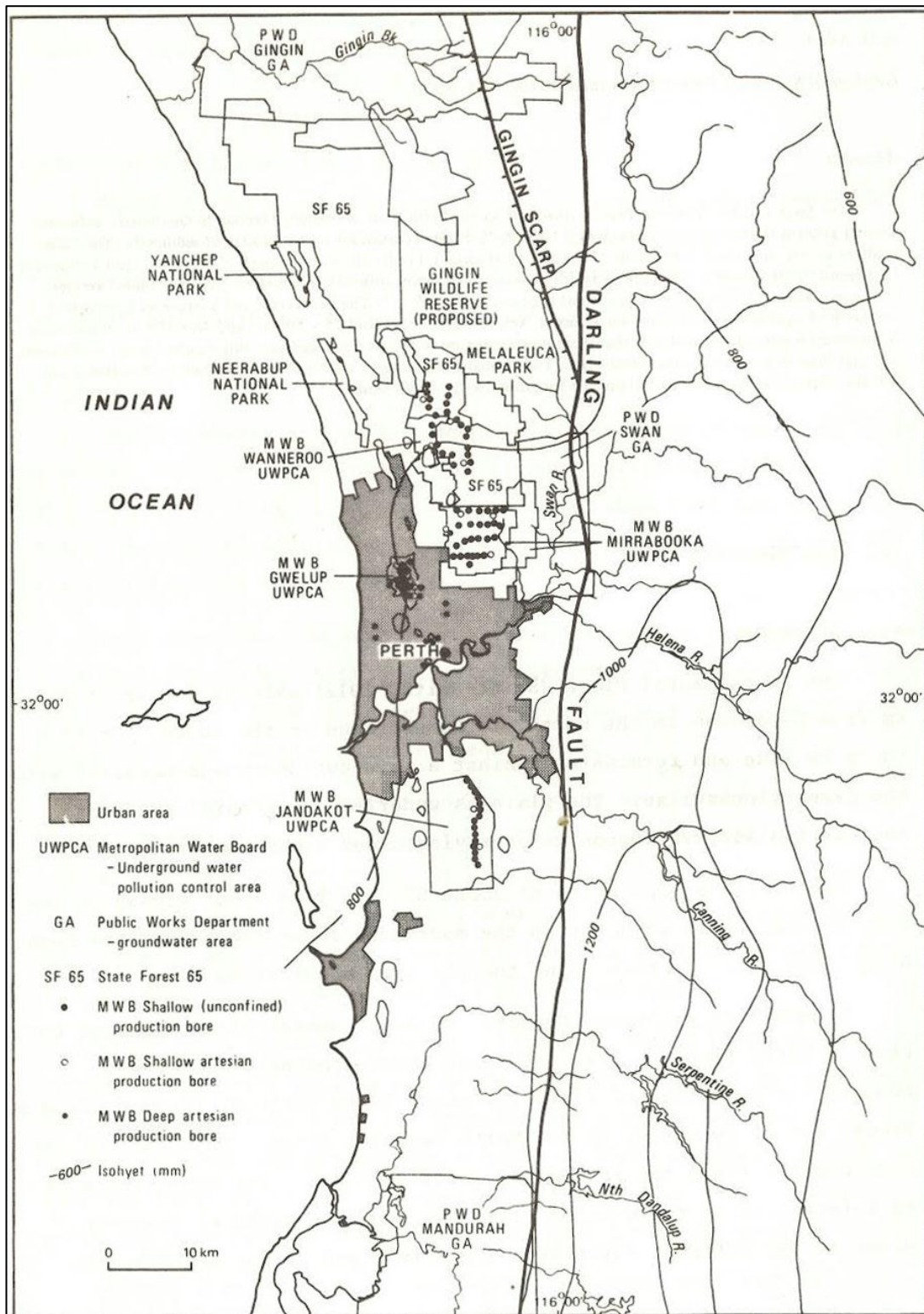
<sup>1</sup> Bureau of Meteorology, 'Monthly rainfall, 1945-1969, Perth (009034); Lake Grace (010592); Cuttening (010037); and Kokardine (08066), Climate Data Online, Bureau of Meteorology, <<http://www.bom.gov.au/climate/data/>>, (Accessed: 4 January 2012).

Appendix III: May-October Rainfall, 1969-1983 (mm)<sup>1</sup>



<sup>1</sup> Bureau of Meteorology, 'Monthly rainfall, 1903-1945, Perth (009034); Lake Grace (010592); Cuttening (010037); and Kokardine (08066), Climate Data Online, Bureau of Meteorology, <<http://www.bom.gov.au/climate/data/>>, (Accessed: 4 January 2012).

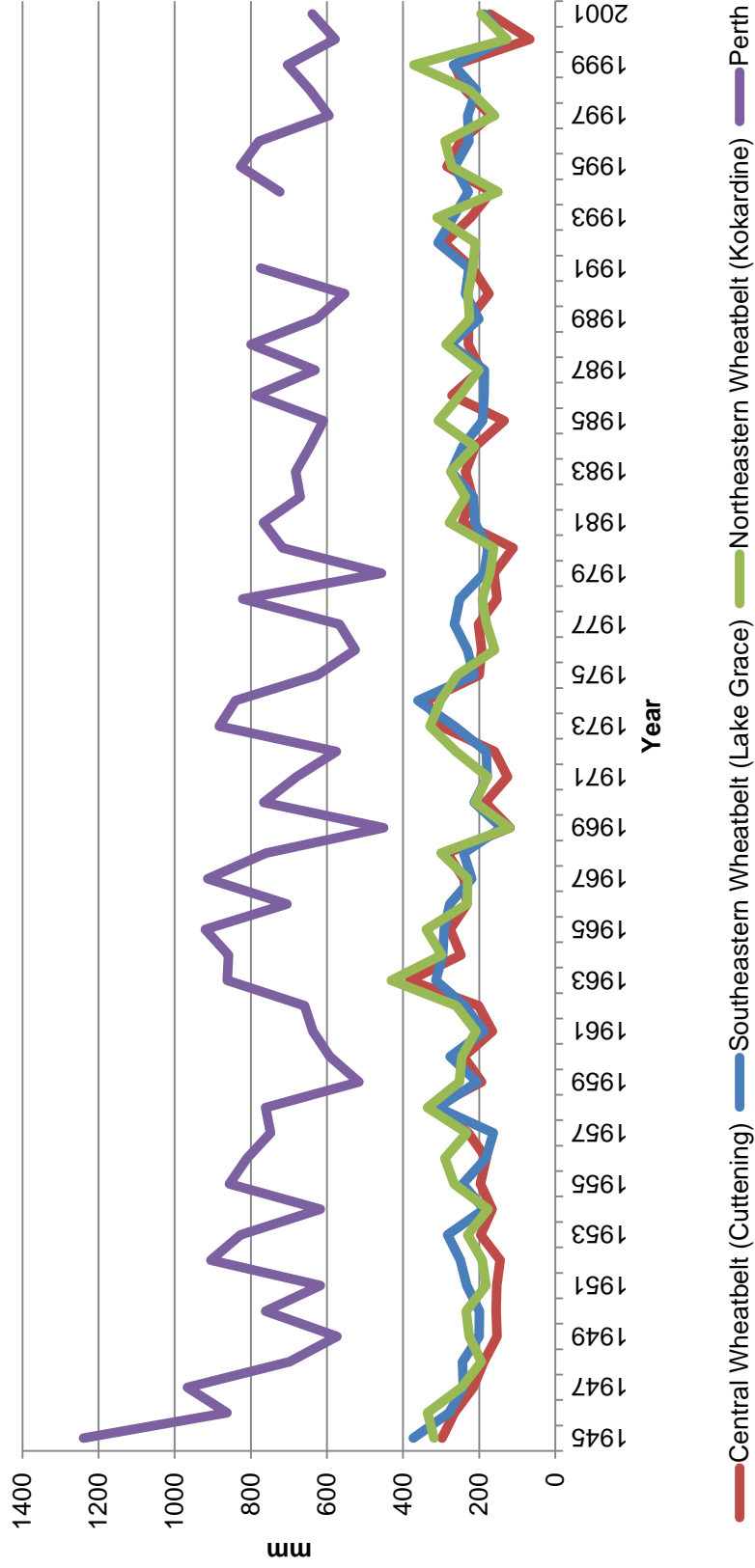
# Appendix IV: Groundwater resources of the Swan Coastal Plain<sup>1</sup>



<sup>1</sup> A. D. Allen, 'Groundwater resources of the Swan Coastal Plain, near Perth, Western Australia', in B. R. Whelan (ed.), *Groundwater Resources of the Swan Coastal Plain*, Perth, Water Research Foundation of Australia (WA), 1981, p. 30.

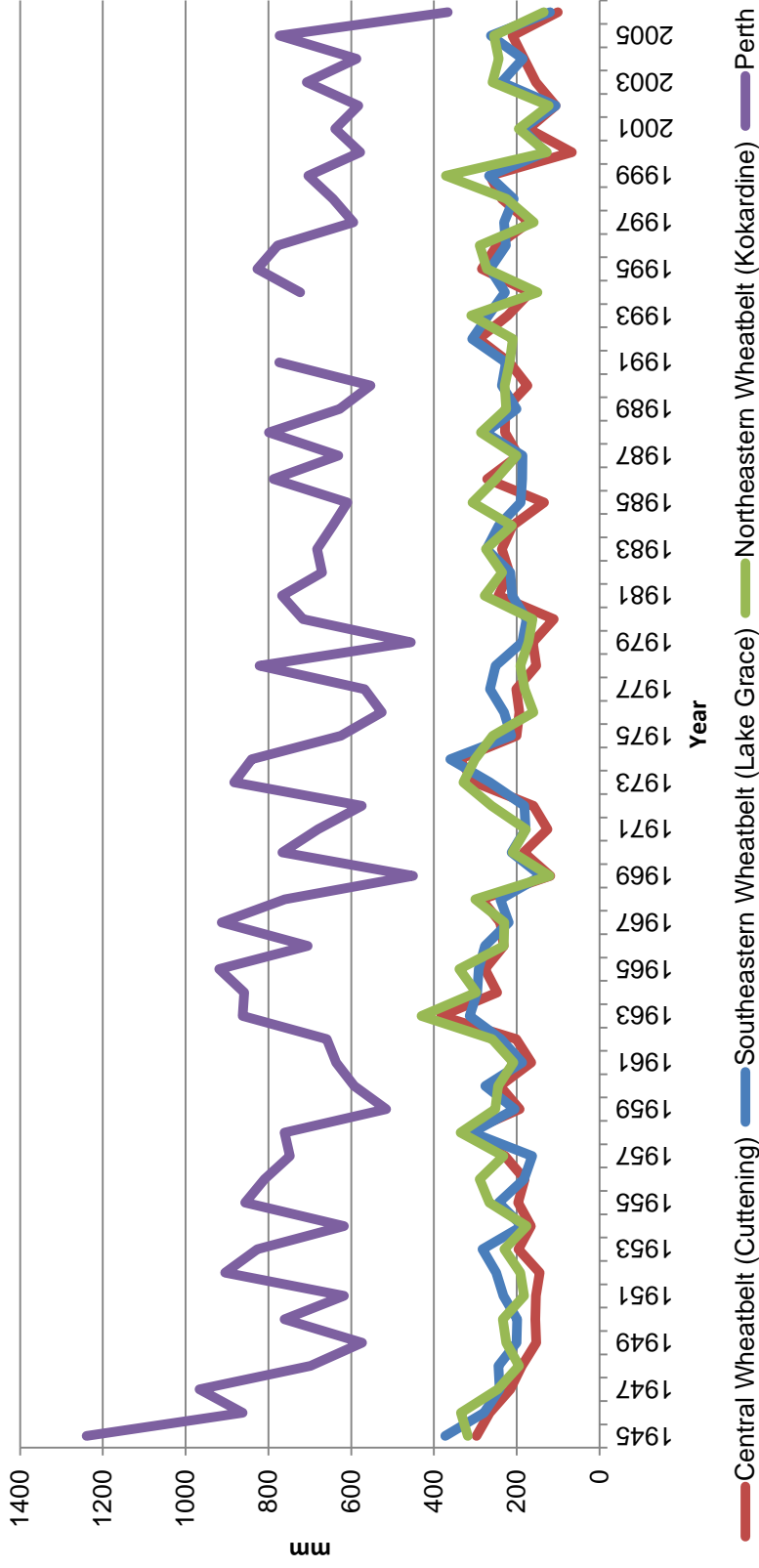


### Appendix V: May-October Rainfall, 1945-2001 (mm)<sup>1</sup>



<sup>1</sup> Please note, the Perth Regional Office station (009034) closed in 1992. Data for 1993 to 2001 is from the Perth Metro station (009225), opened in 1992. As there is no available data for the month of October 1993 at this station, the total for the period MJJASO (1993) has been omitted from this graph. Bureau of Meteorology, 'Monthly rainfall, 1945-2001, Perth (009034); Perth (009225); Lake Grace (010592); Cuttening (010037); and Kokardine (08066), Climate Data Online, Bureau of Meteorology, <<http://www.bom.gov.au/climate/data/>>, (Accessed: 4 January 2012).

**Appendix VI: May-October Rainfall, 1945-2006 (mm)<sup>1</sup>**



<sup>1</sup> Please note, the Perth Regional Office station (009034) closed in 1992. Data for 1993 to 2006 is from the Perth Metro station (009225), opened in 1992. As there is no available data for the month of October 1993 at this station, the total for the period MJJASO (1993) has been omitted from this graph. Bureau of Meteorology, 'Monthly rainfall, 1945-2006, Perth (009034); Perth (009225); Lake Grace (010592); Cuttening (010037); and Kokardine (08066), Climate Data Online, Bureau of Meteorology, <<http://www.bom.gov.au/climate/data/>>, (Accessed: 4 January 2012).