

Deakin Research Online

This is the published version:

Jones, David 2011, On the edge of the desert : design and planning for Roxby Downs, *in Proceedings of the 2011 International Conference of the Association of Architecture Schools of Australasia*, Deakin University, School of Architecture & Building, Geelong, Vic., pp. 94-109.

Available from Deakin Research Online:

<http://hdl.handle.net/10536/DRO/DU:30042334>

Reproduced with the kind permission of the copyright owner.

Copyright : 2011, David Jones

ON THE EDGE OF THE DESERT: DESIGN AND PLANNING FOR ROXBYS DOWNS

David Jones

¹⁾ Deakin University, Australia, david.jones@deakin.edu.au

ABSTRACT

The design and planning of settlements in arid Australia has long been wrought with difficulties because they are positioned in the extremes of environmental and social contexts. Historically many mining-related settlements in Western Australia (WA), South Australia (SA), Northern Territory (NT) and Queensland have struggled or failed in realising a quality design and plan, but also to sustain a robust and vibrant community who do not wish to escape to mainstream suburbia or simply operate as a fly-in fly-out employer commuter from this suburbia. Places like Mt Isa, Theodore, Moranbah, Broken Hill, Radium Hill, Leigh Creek, Roxby Downs, Paraburdoo, Shay Gap, Karratha are typical of these circumstances.

This paper reviews the design and planning origins of the villages at Olympic Dam, and critiques the future designs embedded in the Olympic Dam Expansion Environmental Impact Statement [EIS] (2009). These villages consist of Olympic dam village (a fly-in fly-out dong-go containerised community accommodating some 500 workers) and Roxby Downs (a mixed Adelaide-template suburb with temporary village and caravan park insertions accommodating some 4,500 ‘permanent’ residents and some 200 fly-in fly-out ‘workers’). The scenario presented in the EIS is to demolish the former and establish a new village for some 10,000 workers, and expand Roxby Downs from 4,500 to near 20,000 although whether this later figure will occur is unclear but certainly the infrastructure and facilities have to be increased as well as increasing residential accommodation units).

INTRODUCTION

With the recent release of the *Olympic Dam Expansion Supplementary Environmental Impact Statement* (SEIS) (2011) by BHP Billiton, following the earlier *Olympic Dam Expansion Environmental Impact Statement* (EIS) (2009), both the largest documents of their type in the world, it is not long before the Olympic Dam expansion – euphemistically called within BHP Billiton as simply ‘ODX’ – under the management of BHP Billiton and ARUP will commence. Hidden in both the voluminous *EIS* (2009), and associated *SEIS* (2011), is a small essay about the future of the extant Roxby Downs town. The town presently comprises approximately 4,000 residents together with the Camp 1 construction camp at Olympic Dam that caters for an additional 800 people. As part of the overall development it is envisaged that the town will expand to 10,000-15,000 residents with a projected 10,000 construction camp workers at the nearby new Hiltaba village and with Camp 1 being closed due to its incorporation within the mine expansion (Anon 2009: 49; Jones 2006: 231-244; Wordley 2005: 16).

Mining projections are to increase gold production “from 80,000 ounces a year to 500,000 ounces, making it the one of the largest gold mines in Australia.” Mining would also increase uranium production from “4,500 tonnes ... to 15,000 tonnes per year,” copper from 220,000 to 500,000 tonnes per annum of ore, silver from 800,000 to 2,900,000 ounces, and also increase the life of the overall mine from 70 years to 100 years (Wordley 2005: 16).

Situated in the arid zone of northern SA, Roxby Downs was originally developed by Western Mining Corporation (WMC) to accommodate their workers and their families involved in the Olympic Dam uranium mining project. The mine and town – comprising *Mark 1* -- were established through the *Roxby Downs (Indenture Ratification) Act 1982*, with subsequent amendments in 1996 – comprising *Mark 2* – by the South Australian state government, and Kinhill-Stearns Roger undertook the preparation of the *Olympic Dam Project Draft Environmental Impact Statement* (Kinhill-Stearns Roger 1982) on behalf of Roxby Management Services Pty Ltd for the overall project. Since 1982 all new Australian mining ventures have been predicated on the basis of a fly-in-fly-out lifestyle as typified in the Pilbara and Kimberley regions of WA in places like Paraburdoo and Argyle mines. So the decision to proceed with a new town was both a challenge as also a philosophical commitment by WMC in providing a quality and efficient working environment for its employees and their families (*Roxby Downs Act 1982*; Kinhill-Stearns Roger 1982).

By 1997 the re-named WMC Resources had decided to double the mining operations and commissioned a feasibility study and EIS as prepared by Kinhill Engineers (KBR 1997). This EIS validated the existence and role of Roxby Downs as servicing the mining operations but also proposed extensions to the town to the south and east that enabled a different town character to evolve. This was an important shift in the urban design philosophy of the town resulting in what can be termed the *Mark 2* expansion of the town. *Mark 1* town was seen as rotating from a central lineal core, with relatively standard typical Adelaide allotment sizes, curvilinear road patterns, conservation of significant Western Myall (*Acacia papyrocarpa*) trees, overall road and house construction and planting by WMC in a co-ordinated manner, and a single storey environment set within a parkland setting. *Mark 2* in contrast sought a much lower density, a set of subdivision estates that were further from the central core, varied allotment sizes, varied and more sweeping road patterns and introduced roundabouts, varied the logic of the parkland setting to one of a much more open landscape setting, and enabled individual builder developments in an estate that was constructed by WMC. Thus, the philosophical character of *Mark 2* developments were much different than *Mark 1* and today are also very different aesthetically and in terms of the appearance of density and housing form (Kinhill Engineers 1997).

On 1 September 2005 WMC Resources was officially acquired by BHP Billiton, and BHP Billiton has been proceeding to enable the expansion of the Olympic Dam and has determined that the fly-in-fly-out strategy is inappropriate wishing to create a quality residential environment adjacent to the mine for its employees and service contractors (Roxby Downs Act; Wilson 2005: 9).

The terms of reference and scope of the present Olympic Dam expansion are set out in the *Draft Guidelines / Issues Paper* (2005) prepared by Planning SA, and BHP Billiton has responded with *Olympic Dam Expansion Environmental Impact Statement* (EIS) (BHP Billiton 2009) and thereupon following a public consultation phase a *Olympic Dam Expansion Supplementary Environmental Impact Statement* (SEIS) (BHP Billiton 2011).

The re-development of Roxby Downs has come at an interesting time in enabling a re-consideration of arid zone planning and design in SA. With the proposed Olympic Dam expansion, the town will double in population, a new set of planning and design issues will now arise many of which are linked to the original ideas behind the siting, layout, planning and form of Roxby Downs town.

THE LANDSCAPE OF ROXBY DOWNS

Situated in the middle of northern SA, the landscape of Roxby Downs and Olympic Dam is arid. The town has an annual rainfall of 150mm and is located in a series of low dunal swales. Soils are mostly deep red sands varying from pH 7 to 8 with some clayey soils in the bottom of the swales with pH 8 to 9.5. On these dunes and swales grow a mixed open low woodland and tall shrubland vegetation community dominated by Native Pine (*Callitris glaucophylla*) on sand dunes, Western Myall (*Acacia papyrocarpa*) in swales and Mulga (*Acacia aneura*) in intermediate areas. Ground cover and shrub species include Native Apricot (*Pittosporum phylliraeoides*), Bullock Bush (*Alectryon oleaefolium*), various *Eremophila* species, Horse Mulga (*Acacia ramulosa*), Sandhill Wattle (*Acacia ligulata*), Narrow-leaved Hop Bush (*Dodonaea viscosa* ssp *angustissima*) and Quondong (*Santalum acuminatum*). Chenopods cover much of the heavier soils together with perennial grasses on the sands (Zwar 2004: 653-654).

Water supply for the mine operations and town is at present piped from bores at the Great Artesian Basin around Lake Eyre, and all other services are drawn in from the south via Pimba.

HISTORY OF PLANNING FOR TOWNS IN SOUTH AUSTRALIA:

THEORY AND CONTEXT

The theoretical position of the majority of towns in SA has been heavily influenced by the principles of a park land town model as devised by Surveyor General George Goyder in the 1860s. This model epitomised the systematic rationale settlement planning model upon which SA was envisaged by the SA Colonisation Commissioners, and that Goyder expressed in plan and word through instructions to his surveying teams in how to plan for the expansion of the colony's settlement. But it also draws from Light's now famous Adelaide city model which is deeply woven within and inspired this template.

Surveyed by Light, the template of Adelaide was apparently considered by Goyder an efficient model to transpose across the SA landscape. Goyder's tenure as Surveyor-General from 1861 to 1894 enabled the fruition of this agenda. This template underpins nearly every country town in SA. The essence of the template is a semi-rectangular town survey, positioned on a watercourse or reliable water source, with a surrounding park land or common, and the town was positioned somewhat centrally within the Hundred to enable ease of access.

With the appointment of Charles Reade as SA Government Town Planner in 1916, by the Labor administration, Reade sought to translate Ebenezer Howard's Garden City principles into SA situations, and in particular at Colonel Light Gardens and in the Riverland. Reade's presence re-awakened the Adelaide template, the theoretical model of Goyder, and the archetypal systematic settlement principles that underpin the spatial existence of South Australia (Garnaut 2002: 502-503; Bunker 1986: 21-33; Jones 2002: 269-270).

With a revival in strategic town planning allied to economic expansion following World War II these principles were re-visited in the design of Elizabeth. Elizabeth, modelled upon the garden city ideas of examples developed in England in particular Welwyn City, epitomises the rationalist systematic settlement model as expressed by the Liberal administration under Playford. Thus, the park land model was deconstructed but its theoretical agenda had still been ensured by its direct incorporation within the town or settlement (Ramsay 1956: 5-14; Hutchings 1986: 61-83).

To the casual observer, Roxby Downs does not express this model. It reads visually as outer suburban Adelaide transposed upon the desert landscape. This is a visual myth as the town exists with a central park land and recreational node and surrounding the commercial precinct each residential area has been draped over an east-west orientated low lying dunal system leaving the crests and vales of the dunes for park lands and drainage purposes. The term

'park land' has even been transposed upon the original *Mark I* master plan for these open space areas which is linked by a pedestrian circulation system.

ARID DESIGN & PLANNING IN AUSTRALIA: PRACTICE AND CONTEXT

Arid Design & Planning is a little researched and considered topic worldwide. The development of new communities in arid environments has often involved the imposition of garden city town principles to create something that is not conducive, relevant nor responsive to the arid landscape. In addition services, infrastructure, and building forms commiserate to non-arid environments are introduced. This strategy disregards historical precedents and was compounded with the advent of mining in arid Australia that sought to apply non-arid logic in town, house and landscape design in the 1950s-70s resulting in the transposition of a Canberra suburban model in the Pilbara (including Paraburdoo, Kambalda, Leinster), northern Queensland (Moranbah) and Northern Territory (NT) (Ranger).

In SA, the only deviation from this approach was the development of Woomera. Woomera was designed by the Commonwealth Government Department of Works & Housing in mid 1947 to accommodate a population of 6,500. The design is characterised by a series of interconnecting loop roads, the division of the town into quarters, clear zones for functions, and a central service and facility core shaped in an arc with an eastern outlook positioned on a 250ha site that is relatively flat and treeless.

A further precedent was the design for Monarto, in a semi-arid environment that was envisaged as new city to accommodate the growth of Adelaide. While such thought, designs and plans were not released, architect Philip Cox appropriated the knowledge and drew together several members of the Monarto planning and design research teams to devise the successful design for Yulara in arid NT adjacent to the Uluru-Kata Tjuta National Park (Jones 1998: 71-88).

Such knowledge was also applied in the design of Leigh Creek in 1979-82 for ETSA to accommodate staff and families working on the Leigh Creek coal mines. Completed in 1985, the town was proposed to accommodate 2,000 residents but has dropped to 600 recently. Following completion the town attracted design awards as being "an excellent example of arid zone town planning, incorporating effective water conservation techniques, whilst maintaining a high standard of public landscaping" (Wren 1987: 286-292). The model also informed the rationale of the *Development Guide for Arid Areas in South Australia* (de Ouden & Chandler 1983), around which water sensitive landscape design treatments were identified as essential. This rationale was more extensively detailed by Zwar & Jones (2003: 1-15) in 'Water Conservation and Arid Landscape Design' (2003).

Interestingly the design and planning agendas for Leigh Creek and Roxby Downs were very much the same but little communication occurred between the two teams that devised these towns. It is known that the Leigh Creek consultants together with staff from the SA Department of Environment & Planning provided report copies to WMC and visited the construction site of Roxby Downs, but they were not directly consulted on the design and planning of Roxby Downs. Despite this there were both similarities and dissimilarities in thought and approach applied in Leigh Creek and Roxby Downs (Mackay pers. comm.. 2005; Chandler pers. comm.. 2005; Harris pers comm. 2005).

DESIGN OF ROXBY DOWNS: MARK 1

In preparing the brief for a new settlement to service Olympic Dam, WMC consciously determined to vary from the traditional fly-in fly-out mining settlement model to adopt a permanent settlement model. Their aim was to service a perceived production capacity of 150,000 tonnes per annum of copper, a permanent on-site workforce of 2,400 with an additional 700 supporting services and government staff. This scenario gave rise to a proposed town of 8,000-9,000 residents supporting 3 pre-schools, 3 primary schools, 1 high school together with associated library, hospital, government services, commercial facilities, recreational facilities resulting in an overall land reservation “to accommodate an ultimate population of 30,000” (BHP Billiton 2009: 11-2)

With this scenario in mind, WMC commenced planning evaluation studies to identify a feasible town site. Interestingly, at this feasibility stage, WMC consciously expressed a “conceptual design” that paid attention “to the effects of climate, and to the preservation of vegetation and sand dunes at the town site” (Kinhill Stearns 1982: 2-54; BHP Billiton 2009: 11-2). Innovatively the EIS proposed a unique green habitat initiative that was later applied in the nearby Arid Recovery (<http://www.aridrecovery.org.au/>) initiative:

The town will be fenced within a buffer zone to prevent access by rabbits and other herbivores. Particular attention will be given to structural and other land use control measures to ensure the preservation of an adequate green belt. Harmful land uses such as trail bike riding will be directed to suitable locations outside the town to prevent nuisance problems such as vegetation destruction and dust generation (Kinhill Stearns 1982: 2-54).

This second statement highlights a concept to establish “green belt” or park land surrounding the town; thereby embracing the distinct South Australian systematic planning model of park

lands. The 16km long fence was erected, and is now in a semi-derelict condition. Within the town was established a series of internal park land segments that are interconnected by a system of pedestrian and cycle trails.

An assessment of alternative town sites, in an ethically true environmental evaluation methodological approach, was employed, that also had regard to the concerns of nearby Andamooka residents as well as the construction of their own eccentric vernacular. The criteria used in this evaluation makes interesting reading when compared against the criteria used by the Hassell team in formulating their *Mark 3* master plan

In evaluating sites for a new settlement, WMC also included Woomera and Andamooka as scenarios but quickly determined the inappropriateness of these existing settlements principally on the basis of distance – 80km and 30km respectively – to the Olympic Dam mine site as being unacceptable safe travelling distances for mine employees working a normal mine time regime. A second aspect was their visually poor and challenging environmental contexts – windswept open chenopod scrubland devoid of any trees, and an eroded, gullied gibber-covered terrain, respectively – that presented unattractive siting and difficult environments to host major infrastructure intrusions. Thus, distance – 8km to 16km – and quality environmental setting – predominated tree-vegetated ecosystem – became key determinants in a larger assessment of 6 sites examined (Kinhill Stearns 1982: 2-61). These sites, and their variables are summarised in Table 1.

Table 1

***Mark 1* Town Site Selection Performance Evaluation: (Site 4 highlighted was the selected town site)**

	Amount of Land Amenable to urban development	Impact of town location on land severance of adjoining pastoral properties	Proximity to existing services corridor	Ease of construction of urban facilities	Flood-prone areas	General amenity	Horticultural aspects
1 Lake Blanche	@ 1,600ha	Severance problems	Poor location	Reasonable ease of construction	Least disadvantaged	Abundant treed dune landscape; grazing damage	Better placed for horticultural activities

						evident	
2 Myall Dam West	@1,600ha	Severance problems	Poor location	Reasonable ease of construction	Minimal	Saltbush chenopod landscape	
3 Myall Dam East	@ 2,000ha	Severance problems	Poor location	Reasonable ease of construction	Minimal	Saltbush chenopod landscape	
4 Axehead Dam	@ 2,000ha	Least impact	Best location	Reasonable ease of construction	Least disadvantaged	Abundant treed dune landscape	Better placed for horticultural activities
5 Phillips Ridge	@700ha	Least impact	Best location	Steepness of dunes	Excessive areas of depressed land	Abundant treed dune landscape; grazing damage evident	
6 12 Mile Dam	@2,000ha	Severance problems	Poor location	High rock horizon	Least disadvantaged	Gibber plain landscape	

Source: abstracted from Kinhill-Stearns Roger (1982: 2-61 to 2-63)

In investigating sites for a town associated with the Olympic Dam venture, 6 sites were considered adjacent to the mine together with Woomera and Andamooka. Woomera was rejected due to distance and its stark landscape character. Andamooka was rejected due to distance, its existing community character, and its extant mining assemblage. The six other sites were evaluated in terms of amount of developable land, impact on adjacent pastoral leases, proximity to the existing infrastructure corridor, ease of construction, risk of occasional inundation by flash-flooding, general amenity, and horticultural aspects. Two sites, 1 (Lake Blanche) and 4 (Axehead Dam), were the most ideal with the latter providing the largest developable land tract as well as significantly achieving the last two factors. Thus, amenity and character in the first instance determined the actual siting of Roxby Downs which was to be developed on site 4 (Kinhill Stearns 1982: 2-62 to 2-63).

Town planning for the town of Roxby Downs was largely passed to staff at Kinhill by WMC to prepare under the principle direction of engineer Brian Mackay. The requisite given by WMC to Kinhill was to create “a typical South Australian country town or a suburb of Adelaide” in character, image, services and quality of lifestyle “to encourage people to stay” but which was “relevant and responsive to the arid environment” it was to be situated within. Mackay saw the planning in three threads – social planning, engineering, and economic – and correctly perceived engineering as the most important in determining a successfully structure for the town and informing the road and drainage networks (Mackay pers. comm.. 2005).

The main precedents used by Kinhill were Shay Gap, and Kambalda and Leinster in the Pilbara. The latter two were towns that had been developed by WMC so they very much informed the corporate premise of what Roxby Downs should be in the eyes of WMC. Lifestyle outcomes of these three towns were also informed by research by the CSIRO's Remote Communities Environment Unit and Division of Building Research (Kinhill Stearns 1982: 11-2 to 11-3; Mackay pers. comm.. 2005).

Leigh Creek was relevant but seen as a benchmark, and the *Development Guide for Arid Areas in South Australia* (1983) had not been published when planning was undertaken (den Ouden, Chandler & Dixon, 1983).

ROXBY MARK 2:

RETHINKING WITH CHANGES IN LIFESTYLE AND EXPECTATIONS

Arising from a WMC decision in the mid 1990s it was proposed to expand the Olympic Dam mine operation thus necessitating an expansion of the town. Immediately WMC fell back upon the now flawed assumptions as to town spread and form contained in the first EIS and commissioned Kinhill to prepare a further EIS that grappled with these flaws but did not come to a clear planning and design answer. Kinhill instead recommended a lower density allotment style development to enable choice to residents, a road pattern that was more curvilinear in form than previously applied echoing low-density contemporary suburbs in Adelaide, and expansion to the south. The difficulty with the latter decision was that the land opened up further with the swales getting wider, the greater propensity of coming across archaeological sites, there were less clumps and patches of Native Pines, and that any development to the south started inappropriately stretching the town and distancing residents and car movements further from the centre of the town.

These conclusions were not recognised at the time of the EIS preparation, did not draw upon the knowledge of Mackay and Harris who had shifted to the practice BC Tonkin and retired respectively. In Mackay's mind, the expansion southwards meant "roads carved in hollows resulted in an inefficient subdivision; very spread out; [with] no care for open space" (Mackay pers. comm., 2005; Harris pers. comm 2005; Boehm pers. comm.. 2005).

ROXBY MARK 3: RE-ENVISAGING AND RE-DESIGNING A NEW TOWN

As part of the EIS process for the Olympic Dam Expansion project, BHP Billiton contracted ARUP to co-ordinate the overall EIS preparation and formulation, including the preparation of a Master Plan or 'framework' for Roxby Downs township. This Master Plan, drawing upon the existing structure and footprint of the *Mark 1* and *Mark 2* versions of Roxby. Was

discised by a project team led by Andy Marks at ARUP and Alun Chapman at Hassell as Principal Urban Designer, and David Jones and Brian Tonkin as peer referees (BHP Billiton 2009: Appendix F4: 8).

Table 1
Mark 1 x Mark 3 Town Design Performance Criteria

Generic Aim	Mark 1 (1982) Aims	Mark 3 (2009) Aims
Cost efficient lot provision	Provision of usable allotments, at an acceptable cost, upon which it is possible to locate suitably oriented facilities	Lot consolidation to reduce infrastructure costs
Provision of social facilities	Provision for the social facilities outlined in Section 11.5	Provision of social facilities principally in the Town Core
Permeable road 'lattice' system	Provision of a hierarchical road layout, which enables ready access to all facilities, facilitates the flow of vehicles, minimizes vehicle/pedestrian conflict and eliminates through-traffic from residential areas	Provision of an overall permeable road 'lattice' system that can be incrementally developed
Cost efficient infrastructure provision	Economic provision of services	Cost efficient infrastructure provision
Town development threshold	Location of residential area within 2 km of the town centre	Location of residential area within 2 km of the town centre
Environmental responsiveness	Creation of an aesthetically pleasing physical environment	Creation of an aesthetically pleasing physical environment
Core node establishment	Establishment of the town centre as the commercial, social and cultural focus	Establishment of the town centre as the commercial, social and cultural focus
Residential neighbourhood locations	Siting of development on swale areas as a general rule	Siting of development on swale areas as a general rule
Environmental responsiveness	Minimization of development on sand ridges, in particular the avoidance of development of dune ridges sensitive to disturbance or likely to present sand drift problems	Minimization of development on sand ridges, in particular the avoidance of development of dune ridges sensitive to disturbance or likely to present sand drift problems
Flood minimization	Avoidance of development on drainage depressions	Avoidance of development on drainage depressions

Environmental responsiveness	Maintenance of existing vegetation, particularly myall groves, mulga, and Canegrass swamps and ensuring that significant vegetation has an adequate water supply	Maintenance of existing vegetation, particularly myall groves, mulga, and Canegrass swamps and ensuring that significant vegetation has an adequate water supply
Flood minimization	Prevention of flood damage	Prevention of flood damage

Source: abstracted from Kinhill-Stearns Roger (1982: 11-24)

The brief to Hassell was to devise a framework to facilitate and accommodate growth for Roxby Downs up to approximately 10,000 people. This increase was aside from the design and development of a new fly-in fly-out workers village, Hiltaba, that was proposed to be located adjacent to the proposed relocated Olympic Dam Airport on the Roxby–Andamooka Road.

The purpose of the Master Plan brief was to provide the “Vision for this Town of the Future” together with suitable strategies and guidelines to enable the creation of this Vision “on the ground”. Thus, the purpose of the Master Plan was “to be a design-based document” that articulated and provided for a suite of design principles and development guidelines (BHP Billiton 2009: Appendix F4: 6). Underpinning the preparation of the master plan was a community consultation process. A second facet was the desire for the plan to meet and satisfy BHP Billiton’s environmental sustainable development aspirations which is largely encapsulated in its policy:

We aspire to Zero Harm to people, our host communities and the environment and strive to achieve leading industry practice. Sound principles to govern safety, business conduct, social, environmental and economic activities are integral to the way we do business (BHP Billiton 2009: Appendix F4: 9).

While this is a generic statement by BHP Billiton, it does imply “intelligent siting and locating” and a suite of energy, environmental and design performance expectations (BHP Billiton 2009: Appendix F4: 9).

Performance parameters expected by ARUP included that the town expansion was predicated upon the continuation of the existing town demographic character and profile; to cater for some 10,000 residents; a town lifespan of 70 years; an assumed permanent mine workforce of

4,500 in the town; an assumed permanent employee 50% residency rate and Long Distance Commute of 50% residency.

Further, BHP Billiton's instructions to ARUP were to "acknowledge the significance and influence of the arid location," to "design for longevity and liveability" and to "design to respect the environment." Explicit cultural aspirations in this brief were to craft town pride, identity, permanency, opportunities, and a safe and diverse town culture comparable to that expected and occurred in Adelaide. Such included aspirations about upgrading "the overall design quality", introducing "good architectural design into the Town Core", and creating "useable and attractive public open space" while enhancing movement permeability and ensuring equitable car, cyclist and pedestrian use (BHP Billiton 2009: Appendix F4: 10).

In response, the master plan proposed a framework of urban neighbourhoods nestled within the east-west dunal 'drift' system within a larger concentric urban system. The design strategies included continuation of a single service/commercial core, a growth threshold of 2km radius, a road system that extended outwards enabling incremental neighbourhood expansion, a scatter of special single and couple unit accommodation groups, enabling residential expansion to the west of Olympic Way (the main north-south axis road on the western flank of the existing settlement), and to "design the open space structure ... to echo the 'drifts' of the dunal landscape" (BHP Billiton 2009: Appendix F4: 10).

Thus Hassell perceived the need to craft a settlement expansion strategy that engaged with the undulating dunal landscape embracing its ecological and microclimatic qualities and patterns rather than imposing a design upon the landscape. This inspiration drew exemplar lessons from the Mark 1 and Mark 2 versions of Roxby Downs, whereby *Mark 1* partially respected the dunal system and enabled a compact settlement whilst in part destroying this system but also lacked the commercial infrastructure to realise a quality town social and physical environment as envisaged in the 1982 EIS. From *Mark 2*, Hassell learnt not to permit broadscale expansion that little respected the dunal system, which supported a fragmented low density spatial pattern to pacify unique recreational vehicle requisites of this community, and to enable a more robust permeability strategy.

Chapman (BHP Billiton 2009: Appendix F4: 41) expressed the urban design strategy in terms of:

- *Improving the existing structure of the Town*: enabling westward town expansion, in contrast to the present "eccentric and unwieldy" south and south-east expansion, to enable "a manageable concentric urban framework";

- *Enhancing the permeability throughout the Town both for pedestrian and vehicles traffic:* recognising that ease of movement through a settlement was essential, the design strategy has sought to maximise permeability having regard to the existing Town morphology and the dunal system;
- *Actively Using the Streets of Roxby Downs:* allied with town permeability is a design desire to consciously encourage residents to use their streets rather than their cars;
- *Improving the Facilities within the Town Core:* recognising community antipathy to the 1980s period contemporary architecture and facility provision that manifests itself in the Town, the design strategy sought to encourage facility renovation and enhancement focused upon the central lineal core including its westward expansion;
- *Upgrading its overall design quality:* recognising the dearth of quality public and private architectural and landscape design exemplars in the Town, the design agenda recommended major “improvements” in these realms “especially within the Town Core” (BHP Billiton 2009: Appendix F4: 41);
- *Utilizing the ‘Good Residential Design’ and ‘Designing in an Arid Climate Guide [‘] published by PlanningSA as the basis for residential design:* the design agenda gave weight to the applicability to these key design performance guideline documents prepared specially for arid zone use but largely historically overlooked by past Planning SA regimes.
- *Embracing new technologies:* the design agenda sought to embrace the digital age by arguing for technological adaptability but also a comprehensive free public access wireless system for the Town.

With these design agendas in mind, the following spatial strategies were employed and recommended:

- the adoption of a concentric expansion strategy to enable progressive and a more sustainable incremental residential expansion in 5,000, 10,000 and 15,000 increments focused upon the Town Core and a cessation of the eastern expansion “eccentricity from Olympic Way” (BHP Billiton 2009: Appendix F4: 42);
- the imposition of a co-ordinated shared pedestrian and bicycle network focused upon the Town Core;
- the formulation of a road ‘lattice’ system to enable “easy and efficient movements back to the Town Core” (BHP Billiton 2009: Appendix F4: 43);
- the provision of pre-designated clusters of medium design and single person’s accommodation, and local commercial centres, having regard to the above concentric expansion strategy, with the former being with 1.5km walking distance of the Town Core; and, that
- the “urban structure of the Town will be designed to echo the ‘drifts’ of the arid landscape” thereby determining that the extant east-west aligned dunal system “strongly influences” neighbourhood creation and that the dunes “should not be viewed as barriers or ‘left over spaces’ seeking instead public open space connectivity” (BHP Billiton 2009: Appendix F4: 44-45).

This spatial strategy re-interprets the underlying parkland town model of Goyder by, instead of surrounding a settlement in a park land ring as epitomised by the National Heritage listed Adelaide Park Lands model, but threading the park land through the settlement as an

environmental lattice as employed in the design of Monarto and as physically executed at Leigh Creek. This theoretical translation was not comprehended by the Hassell consultant team at the time of their deliberations, but was well understood by Mackay in the Mark 1 prognostications and brought to bear by Mackay and Jones in the peer review process for the Master Plan.

Chapman re-translated this theoretical enlightenment as, the Master Plan embodies “a concentric expansion with a central commercial and recreational core [,] radiating roads and pathways and an open space system drifting across the Town” thereby crafting a “unique character as a ‘Town of the Desert’” (BHP Billiton 2009: Appendix F4: 48, 49). Implicit in this vision was a robust family environmental, efficiency of movement and services provision, physical expansion of the Town westward, the crafting of a more formal lineal ‘town centre’ roadscape, upgrading and quality treatment of public domain architecture and landscape design, 75% majority street and lot solar and vista alignment and orientation, high standard revegetation works, enhanced treated wastewater treatment use and recycling, robust water sensitive urban design use, renovation of the existing waste water system, wirelessing the town, and an upgrade of engineering standards.

Thus, the renovation of an ‘oasis’ in the desert as was originally envisaged by Mackay and the WMC environment team in the original EIS document in line with contemporary innovations and built environmental design performance standards. Thus, Mackay and his team were correct in their arguments as to the original town design. This foresight has also been validated in their correct integrated road-engineering–drainage design, cohesive town footprint, and their dunal framework embraced in the Mark 1 design but substantially disregarded in the Mark 2 design by KBR

DIRECTIONS

This discourse has reviewed the planning and design approach employed at Roxby Downs over the last 20 years. Demonstrably the design hypothesis employed by Mackay and the WMC environment team in the early 1980s in *Mark 1* has repeatedly proven its worth and foresightedness. Such hypothesis was lost when KBR, without continued engagement of and consultation to Mackay, sought to design *Mark 2*. But, it has been re-awakened in the Hassell proposal for *Mark 3* albeit influenced by the peer review roles of Mackay and Jones that directly influenced the overarching design strategy. Mackay’s ‘desert oasis’ strategy, directly responsive to the east-west dunal ecology, captures the essence of Ian McHarg’s ecological determinism theory embodied in *Design for Nature* (McHarg 1965) that was expressed in the conceptual design for Monarto in 1972. Monarto Development Corporation (MDC) staff and consultants consciously applied McHarg’s thesis in the formulation of their conceptual design for Monarto, a future semi-arid settlement to host some 500,000 residents,

and a unique architectural ethos was also devised by the MDC for which architect Philip Cox latter successfully appropriated in his acclaimed Yulara village design and building assemblage. Such was also carried forth in the Leigh Creek and Golden Grove exemplars for which the original Roxby town design was benchmarked against in terms of its environmental setting and social-physical design.

Hassell's *Mark 3* master plan therefore is environmentally relevant and has validated in part extant exemplars at Roxby Downs. Notwithstanding this design and planning conclusion, it has been state government political, commitment and inadequacy of financial resources to drive and achieve these philosophical and built environmental expectations that have thwarted the quality realisation of the original concept for Roxby Downs.

ACKNOWLEDGEMENTS

Andy Marks (ARUP), John Harris (Crafers SA), Brian Mackay (Tonkins SA), Rieck Shine (Port Augusta City Council), Dawn Hawthorn-Jackson (Arid Lands NRM, Port Augusta), Bill Chandler (City of Tea Tree Gully), Peter Johnson (ForestrySA), Pru Barrett (BHP B), Steve Green (BHP B), Bill Boehm (Roxby Downs Town Council), David Watson (Roxby Downs Town Council), John Zwar (TAFE SA).

REFERENCES

- Anon (2005), Proposed Expansion of the Olympic Dam Operations at Roxby Downs, *The Weekend Australian* November 19, p.49;
- BHP Billiton (2009), *Olympic Dam Expansion Environmental Impact Statement*, BHP Billiton, Melbourne.
- BHP Billiton (2011), *Olympic Dam Expansion Supplementary Environmental Impact Statement*, BHP Billiton, Melbourne.
- Bunker, R (1986), Town Planning at the Frontier Settlement, in A Hutchings & R Bunker, *With Conscious Purpose: A History of Town Planning in South Australia*, Wakefield Press, Adelaide, pp.21-33.
- Den Ouden, H, W Chandler & H Dixon (1983), *Development Guide for Arid Areas in South Australia*, Department of Environment and Planning, Adelaide SA.
- Garnaut, C (2002), Reade, Charles Compton, in R Aitken & M Looker eds, *Oxford Companion to Australian Gardens*, Oxford University Press, Melbourne, pp.502-503.
- Hutchings, A (1986), Comprehensive Town Planning comes to South Australia,' in A Hutchings & R Bunker, *With Conscious Purpose: A History of Town Planning in South Australia*, Wakefield Press, Adelaide, pp.61-83.

- Jones D & J Zwar (2003), Water and Landscape Design in Arid Environments, in *Environment Design Guide: DES 54*, Australian Council of Building & Design Professionals Ltd, Melbourne, pp.1-15
- Jones, D (2002), Goyder, George Woodrooffe', in R Aitken & M Looker eds, *Oxford Companion to Australian Gardens*, Oxford University Press, Melbourne, pp.269-270.
- Jones, D (2006), Planning an Oasis in the Desert: The Design and Planning of Roxby Downs, in *Proceedings of the 8th Australasian Urban History/Planning History Conference, Wellington NZ, 9-11th February 2006*, ed. CL Miller & MM Roche, pp. 231-244. University of Palmerston North: Palmerston North, New Zealand.
- Kinhill [KBR] Engineers (1997), *Olympic Dam Expansion Project: Environmental Impact Statement*, WMC (Olympic Dam Corporation) Pty Ltd, Keswick, SA.
- Kinhill-Stearns Roger [KBR] (1982), *Olympic Dam Project Draft Environmental Impact Statement*, Roxby Management Services Pty Ltd, Adelaide..
- Planning SA (2005), *Draft Guidelines / Issues Paper for an Environmental Impact Statement on the proposed extension of the Olympic Dam operations at Roxby Downs*, Planning SA, Adelaide.
- Planning SA, *Draft Guidelines/Issues Paper*; www.planning.sa.gov.au/md_panel or www.deh.gov.au/about/publications/index.html.
- Ramsay, A (1956), Factors affecting the siting and design of Elizabeth', in *Proceedings of the Royal Geographical Society of Australasia (South Australian Branch)*, no 57, pp.5-14.
- South Australia (1982), *Roxby Downs (Indenture Ratification) Act 1982*.
- South Australia (1993), *South Australian Development Act 1993*, p. 49.
- Wilson, N (2005), BHP to double Olympic Dam', *The Weekend Australian*, 20-21 August, p. 9.
- Wordley, B (2005), Think big', *The Independent Weekly*, 14-20 August, p.16.
- Wren, C (1987), Leigh Creek South: A New Town in the North of South Australia, *Landscape Australia* vol 9, no 4, pp.286-292, 294.
- Zwar, J (2004), Water sensitive urban design: a perspective from outback South Australia', in *Proceedings of the 2004 International Conference on Water Sensitive Urban Design, 21-25 November 2004, Adelaide, Australia*, ed T Daniell, Adelaide, SA, Engineers Australia, pp.653-654.