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## Evolution and Evaluation of Contemporary Greenways and Green Infrastructure in Sydney, Australia

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### Introduction

Greenways are as diverse in their contemporary forms as the geographical regions they sample. Within an Australian urban context this paper will outline how greenways have added to their culturally focussed intentions of recreation and active transport (Little, 1995; Walmsley, 1995) and could now be described as 'green infrastructure'. Described by Benedict & McMahon (2006) as essential and life-supporting, Australian green infrastructure follows Europe's lead (Jongman, Külvik, & Kristiansen, 2004) expanding the greenway remit to include vital hydrological functions (Ahern, 2007), the provision of valuable ecosystem services (Millennium Ecosystem Assessment, 2005) and a range of essential ecological benefits for urban regions across multiple scales. This paper begins by reviewing Sydney's open space and greenway history, policy and planning and culminates with a detailed study of its most recent greenway proposal, the *Sydney Green Grid* (Schaffer, 2015). As a multi-functional green infrastructure this city-wide framework aims to create a strategic open space network; to reinforce sense of place between citizens and landscape; and to promote multifunctional environmental, health, social and economic benefits. A series of drawings then explored one strand of this network, the *Mountains to the Sea* greenway where the shift from large (city) to small (neighbourhood) scale was explored in detail, revealing a potential green infrastructure that offered a spectrum of critical ecological, hydrological, cultural and transportation benefits. However, it also revealed the existing complexities in implementing such a scheme in the contemporary city. This paper argues that it is both timely and relevant that greenways be considered and reframed as essential 'green infrastructure', however that such networks must also be interrogated through mapping and design methods such as those demonstrated herein in order to facilitate their implementation and adoption.

### Background

Sydney's most recent metropolitan-scale greenway proposal, *The Sydney Green Grid* (SGG), has its origins in a sequence of historical events, key open space planning, greenway and green infrastructure projects that have shaped the city's form and character over the last 70 years.

In the years directly following the Second World War, Sydney quickly grew to house nearly a quarter of Australia's entire population (Winston, 1957). This growth led New South Wales Premier William McKell to introduce an additional tier of government, the *Cumberland County Council*, positioned between the local and state level in order to address urban issues and to guide holistic metropolitan planning strategy. Released in 1948, the post-war *County of Cumberland Planning Scheme* as a progressive and comprehensive planning model prioritised landscape as a means to organise the city (Dictionary of Sydney Staff Writer, 2008). As a statutory body, the Council was charged with overseeing the coordination, consolidation and conservation of Sydney's metropolitan form against the opportunistic privatised housing development occurring along the city's periphery. To counter the corresponding infrastructure expenditure to service these green-field locations (Winston, 1957) the Cumberland Plan proposed a system of land-use zoning, suburban employment precincts and open space acquisitions, together with the implementation of a city-scale green belt that further aimed to limit further peripheral sprawl (Ashton & Freestone, 2008). The council also sought to establish a unified open space system '*The Green Web*'. This comprised 'green lungs' or 'breathing spaces' as a network of greenways to link existing tracts of landscape and waterways, establishing landscape buffers between differential land zones. Within the web a range of social infrastructures including walking tracks, playgrounds, parks, sports fields, nature reserves and scenic areas were programmed connecting the city's centre to its edge (Winston, 1957). The Cumberland Plan was strongly opposed throughout the Council's 12 years and when the critical federal funding – deemed critical for the resumption of lands to link the green belt – was removed, its realisation stalled (Dictionary of Sydney Staff Writer, 2008). Replaced by the non-statutory *Sydney Regional Outline Plan* Sydney abandoned the green belt and web shifting towards singular landscape projects that nevertheless illustrate the potential of a greater system.

With the 1960s and 1970s heralding the introduction of ecology and sustainability into broader consciousness (Bull, 1996), the practice of landscape architecture in Australia began to serve as a kind of 'ecological infrastructure' that could critically reconstruct – or remediate the city – one project at a time. Two key greenway projects benchmark this shift. First, *Sir Joseph Banks Reserve*, designed and constructed between the late 1970s and early 1980s, is a 28ha linear parkland commissioned as part of the relocation of Sydney's port from to Botany Bay. Mediating a particularly problematic wedge of residual territory squeezed between the port's new freight roadway and residential surroundings, Mackenzie reconnected the community and foreshore through sculpting the site into an undulating landmass of sand dunes

and lagoons. These served to both reduce traffic noise and to provide a substrate for a constructed ecology of plant species once endemic to the area (MacKenzie, 2011). Importantly, this project illustrates the potential of the greenway as a typological model, ably mediating the often-competing interest of government, development, community and ecology. A decade later the *Restoring the Waters Project*, designed by Schaffer Barnsley Landscape Architects (1999), focused on the landscape restoration of a degraded water corridor. An early precursor to the Water Sensitive Urban Design (WSUD) projects now commonplace in Australia, engagement with a diverse range of interest groups, stimulated a revenue stream for the project, essential for a suite of recreational, ecological and social benefits, in addition to WSUD aims.

The use of the landscape project as a device for ecological infrastructure ultimately coalesced in the designed remediation of the degraded Homebush Bay site for Sydney's 'Green Olympic Games' in 2000 (Tyrrell, 2011). Here, principles tested in the aforementioned projects were super-sized on a scale never seen before in Australia, resulting in the total reclamation of 50 hectares of contaminated post-industrial wetland corridor (Lynch, 2000). As the key feature of the Olympic landscape, it was the greenway as a multi-scalar and infrastructural typology that became one of the principal design drivers behind many subsequent revitalisation projects in the inner city. This is particularly evident in the *Green Square Public Domain Strategy* (McGregor Coxall) and *The Goods Line* (Aspect Studios) which represent a catalytic shift in the approach to urban densification. *Green Square*, set within one of Sydney's largest ever urban renewal developments inverted the typical redevelopment staging model by prioritising the design and delivery of the public domain (MacGowan, 2008). Envisaged as a piece of 'ecological machinery', the project condensed the hydrological services of greenway design into a compact network of hydrological infrastructure to which future development could connect. This proposed the daylighting of an underlying drainage stream that had once flowed through the site as restored water corridor and proposed a new, ecologically-active civic heart for surrounding development (MacGowan, 2008). The recently completed *Goods Line*, linking Sydney's famed Darling Harbour with the rest of the city, connects a range of neighbouring institutions by reconfiguring a disused railway corridor as linear greenway park. This has increased pedestrian traffic and recreational use and incentivised commercial revitalisation while acknowledging the historical fabric of the site and providing a variety of visitor spaces and experiences.

With the ability of such projects to integrate social, ecological and economic benefits, the NSW State Government's Architect's Office developed a wider plan to advocate and choreograph future projects across Sydney, the *Sydney*

*Green Grid* or SGG (Fig. 1). Recognised and incorporated into the NSW State Government's non-statutory planning policy, *A Plan for Growing Sydney* (Schaffer, 2015), the SGG echoes the scale and form of the earlier *Green Web*, illustrating the potential of an interconnected network of metropolitan open space to improve citizen liveability and well-being. However, this 21<sup>st</sup> century plan is also a mechanism for urban adaption in the face of climate change, achieved primarily through the integration of green infrastructure systems (Schaffer, 2015). Identified through an analytical method that recalls McHarg (1969), a network of linkages coalesced previous topographical and hydrological phenomena, existing open space, proposed and existing bicycling and transit routes and neighbourhood and regional centres and sub-centres (Schaffer, 2015). In lieu of an additional tier of government, an independent advisory panel known as *The Greater Sydney Commission* acts as facilitator between state and local governments and advises, makes recommendations and assists government towards the implementation of planning strategies (Department of Planning & Environment NSW, 2014). However an ideological and design obstacle remains: how could the SGG move from plan and policy to implementation?

### Research Aims and Objectives

The review of Sydney's historical and contemporary open space, greenway, green infrastructure planning, policies and project precedents served to lay the critical ground-work for a range of mapping and design explorations. This research posits that it is only through the illustration or 'mapping' of constraints, opportunities and benefits at a multiplicity of scales and through further detailed design operations that the true potential of green infrastructures – such as the SGG – could be revealed. Here urban complexity requires adjusted designs that need to address a representative sample of place-specific constraints and obstacles as adjusted, or ground-truthed designs. These function as test case to assess the efficacy of the larger SGG network and assist with its potential implementation. This research therefore sought to answer two key questions. First, what benefits could be revealed by the overlay and visualisation of the SGG over existing urban condition/landscapes? Second, what complexity would be revealed and contingencies be made to ensure a robust design?

### Method

The research explored a single strand of the SGG – *Mountains to the Sea* greenway – in an attempt to resolve its spatially vague (and heretofore untested) design in two stages. First, a mapping process compiled spatial imagery and data through ArcMap, AutoCAD and Adobe Illustrator, creating a

suite of high quality maps to accurately illustrate and highlight both the SGG's spatial influence and to reveal potential conflicts. Second, three potential greenway design 'scenarios' were explored: 'Business-as-usual'; the 'Classic Greenway'; and 'True Green Infrastructure'. These documented a range of design possibilities from minimal impact, low cost to significant, high cost options as spatially accurate and visual illustrations.

## Results

The overlay of the selected *Mountains to the Sea Greenway* over the urban landscape of Sydney's Eastern suburbs revealed several findings, illustrated as annotated maps (Fig. 2). These document revealed benefits congruent with SGG aims including: the establishment of an interconnected network to provide active transport; potential reduction of the urban heat island effect; improvement of ecological connectivity; augmentation of property values; and, enhanced provision of recreational opportunities. However mapping also revealed the complexity involved in the SGG's potential implementation. Obstacles revealed included the significant limitations of a landscape replete with human occupation – namely built-form and existing land-use – however other aspects of the urban condition were noted, including political support and the existing hegemony of private vehicle use and consequent impacts upon the public realm. These challenges were then explored through the spectrum of design scenarios in a discreet local study area to illustrate and spatially articulate – in degrees of fidelity – the aspirations of the SGG (Fig 3).

## Discussion

The review of policies, projects and precedents revealed significant influence toward not only the evolution of Sydney's open space – including large-scale greenbelts, greenways and smaller interventions – but the overall configuration of the contemporary metropolis. Nevertheless, such planning has seldom been successfully legislated, nor fully implemented. Cognisant of the plans that preceded it – and also their shortfalls – a series of brief design exercises were undertaken to explore and investigate the latest plan: the *Sydney Green Grid*. Here, its potential was considered not at the broad city level, but at a fine (local) scale through a series of staged design scenarios which – arguably – could assist in the SGG adoption by both community and governance.

The discipline of landscape architecture is entwined with that of mapping (Corner, 1991) and a fundamental difference between mapping and the design processes that typically follow is that 'a survey drawing is projected from the ground, whereas the construction drawing is projected onto the ground' (Corner, 1992). The act of mapping offers a novel opportunity to consider

landscape afresh and from new perspectives, helping us to both understand existing landscapes as well as to generate new forms and ideas and drawing disparate information together (Cosgrove, 1999). This research thereby identified and documented the conflict between the aspirations of the SGG and the reality of the existing urban landscape across the study area. These challenges, however, revealed a range of obstacles commonly faced by greenway and green infrastructure schemes when retrofitted to urban environments, regardless of project location. These included existing land-use, transport infrastructure (such as road and rail) and overwhelmingly the existing urban built form.

In response, a detailed design process extended the potential of the SGG, highlighting an array of both obstacles and benefits across a complex urban landscape replete with human occupation and land-use. Recognising the SGG as a coarse and imprecise design (as revealed by the mapping) was not intended as a criticism but rather provided an opportunity for design exploration and iterative readjustment, from which a suite of potential detailed design possibilities were elaborated. Three ‘projective design strategies’ (Deming & Swaffield, 2011), commonplace within the landscape architectural discipline, responded to the inherent complexity of city and site, exploring a range of contingencies with increased degrees of resolution. The *Business-as-usual* scenario presented a conservative solution when faced with the socio-political and economic realities of existing human population and economic activities, single-occupancy motor transportation bias, political conservatism and high land cost. Such conditions suggest that the potential implementation of the SGG in its current form is difficult and that a limited ‘business-as-usual’ progress toward implementation is likely. In this instance, small pocket parks and minimal tree planting is probable; and, while benefits could include increase in shade over certain locations where actions occur (with slight increase in urban amenity), negligible impacts to active recreation, ecological connectivity and property values were foreseen. The *Classic Greenway* scenario reflected the greenway type described by Little (1995) and involved an increase of tree planting to form major vegetated avenues; as well as the distribution of green roofs and walls; and, the alteration of streetscapes to better accommodate increased non-vehicular and/or active transport modes (cycle routes and/or light rail). Over time, a staged change in land-use could be envisaged as the ecological and hydrological aspects of the linkages could be further deployed. The *True Green Infrastructure* scenario, as per the definition offered by Benedict & McMahon (2006), envisaged a ‘life supporting infrastructure’ with a wide array of benefits. Previously described in an Australian rural context by (Kilbane 2013), these could include: the potential to provide valuable ecosystem services and carbon sequestration; the ability to

deal with hydrology including WSUD and water security; as well as ecological connectivity; the possibility to enact indigenous corridors (commonly referred to as ‘songlines’) on a regional scale; and, the potential to positively impact upon property values. However in this urban context, health, active transport and further recreational opportunities were also envisaged. Overwhelmingly, such benefits were congruent with the SGG’s aims to *‘create greener, cleaner, healthier, socially cohesive and biodiverse urban environments within a connected city ecosystem for people and wildlife ... resilience measures against climate change ... management of stormwater, flood risk and water quality ... enhance our ability to adapt to, and mitigate the impacts of heat, noise and air pollution’* (Schaffer, 2015). Such qualities qualify this project clearly as a novel green infrastructure for the city of Sydney.

## Conclusion

This paper has explored the origins and latest development of open space planning and greenways in Sydney, Australia. Through its findings it posits that the potential of the SGG is through its consideration as a novel green infrastructure for the metropolis. This new addition to Sydney’s open space and broad scale landscape planning occupies a critical role as an overarching framework within which to situate local action and is argued as the next evolutionary step and continuation of Sydney’s explorative relationship with its landscape: offering a range of novel and multi-functional ecological, hydrological, cultural and transportation benefits nested within a spectrum of new public spaces. The mapping and design-based approach used here adds value to the initial historical evaluation survey and could potentially feedback into the conceptualisation and initial development processes as a framework for action over multiple scales. Such design resolution is especially important for such policy and schemes (such as the SGG) that are common globally. These frequently exist only as a planning overlay and could benefit from significant design refinement and resolution at the local scale (Kilbane, Weller, & Hobbs, 2016). Furthermore the retro-fitting of existing landscapes with proposed greenways and green infrastructure schemes is a task that has widespread potential application across an increasingly urbanised planet (United Nations, 2006). This study therefore shows that proposed greenways, open space and green infrastructure strategies – no matter where located globally – could benefit from a similar design-based method and critique.



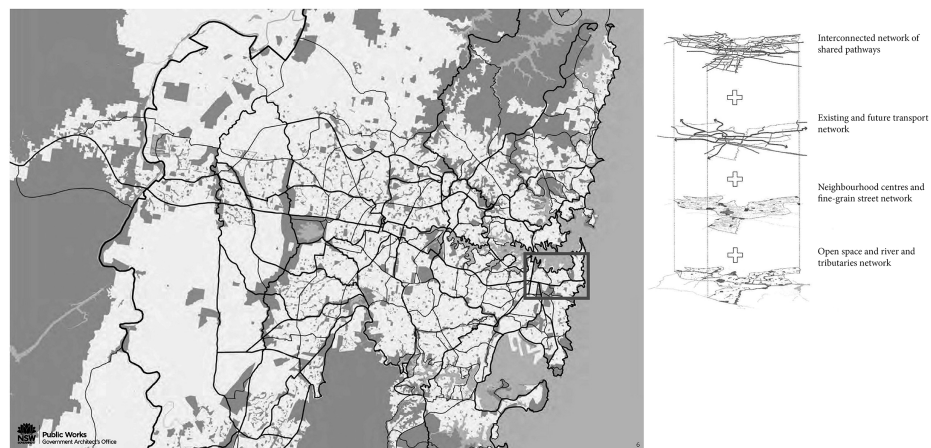


Figure 1. The Sydney Green Grid and its design genesis

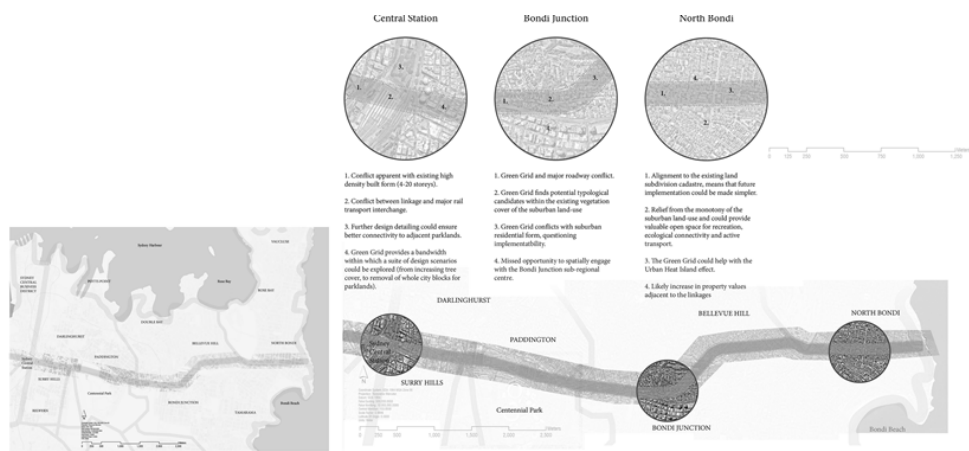


Figure 2. The ‘Mountains to the Sea’ Greenway mapping process



**Figure 3. Three design scenarios explored across detailed study area**

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