Water security and heritage integrity: ‘regreening’ the Adelaide park lands national heritage place

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Abstract

In the last thirty years Adelaide has engaged in a series of innovative water security strategies to harvest, store and re-circulate surface groundwater resources. Commencing with water harvesting through designed perennial wetlands, these initiatives include constructing the largest integrated urban storm water management system in Australia along the River Torrens, pioneering aquifer recharge systems, and more recently the Glenelg to Adelaide Pipeline (GAP) project that harvests, treats and transfers liquid effluent upstream to the Adelaide Park Lands.

Historically the Adelaide Park Lands, like much of the Adelaide Plains, are devoid of permanent surface water resources. The Aboriginal Kaurna seasonally harvested its bounties, and European colonisers transformed its attributes to harvest its vegetative properties and nurture its aesthetic qualities, but still were hampered by seasonality. The now completed GAP project commenced prior to the nomination of the ‘Adelaide Park Lands and City Layout’ to the National Heritage Register (NHR) by the South Australian state government in conjunction with the City of Adelaide Council. The Park Lands were successfully included in the Register in November 2008, but the GAP project was not declared to the Commonwealth in the nomination documentation despite considerable investigations into the project in 2008. The GAP project is relevant because it challenges and changes the premise of historically unreliable and seasonal water availability to the Park Lands by enabling permanency of supply and therefore greater propensity of vegetation longevity and changes in species profile. The implementation of GAP will have major impacts upon the ‘green’ appearance of the Park Lands, and the health and longevity of vegetation, but also upon the Indigenous and post-contact archaeological evidence and heritage values in the Park Lands. Implicit in the National Heritage Listing are heritage values embodying aesthetic and designed landscape themes – high degree of creative or technical achievement – that are constructed and planted on the basis of limited water supply and vegetation choice. The GAP project places these values at risk in the name of ‘greenness’ and sustainability imperatives based upon the false assumption that a permanent and cheap water supply will assist in conserving the values of this National Heritage Listed place.

This paper examines the Adelaide Park Lands thematically through water, having regard to considering places and curatorship, and applications that introduce a new layer of water security to this designed landscape. It raises serious concerns about the GAP project as it is in conflict with the nature of how and why this particular landscape evolved, was planted and created, by manipulating its aesthetic values to an artificial ‘green’ landscape that is in conflict with the theoretical basis of its successful National Heritage Listing and several of the values upon which it was inscribed, thus placing at risk the integrity of the Listing.
Introduction

In the curation of cultural landscapes the perception is that minor changes in infrastructure have little effect upon the quality and values of a landscape. In the case of the Adelaide Park Lands, changes in infrastructure to ensure water security of the landscape by way of reticulated treated stormwater and wastewater (GAP) was in train before the National Heritage Listing occurred (Australia 2008; REM 2006). Thus, no National Heritage and state-level heritage approvals were required (South Australia 2008). However the very essence of the Park Lands is that it has been historically watered by natural rainfall and surface runoff, and in select parts subject to intermittent mains water through c.1920-30s era irrigation systems (Jones 2007).

The Adelaide Plains was the Country of the Kaurna community before colonialisation, and continues to be subject to their cultural and environmental management oversight today (Draper et al 2005, Harris 2006, 2008; ACHM 2008; Jones 2007).

The ‘Adelaide Park Lands and City Layout’ which resides within the City of Adelaide Council in the state of South Australia, was included in the National Heritage List established by the Commonwealth of Australia under Section 324JJ of the Environment Protection and Biodiversity Conservation Act 1999 (Australia 1999). It is regarded as an international precedent of urban design that also signifies a turning point in the settlement of Australia. South Australia was the first place in Australia to be planned and developed, not as a penal settlement or military outpost, but as a place for free settlers. The ‘Adelaide Park Lands and City Layout’ was included in the National Heritage List on 7 November 2008.

While listed on the National Heritage List, the ‘Adelaide Park Lands and City Layout’ is not listed under the State Heritage Places Act 2009. Only components and a suite of built-form places are listed, and virtually no plan or landscape element is included in the State Heritage Register. While the ‘Adelaide Park Lands and City Layout’ as an integrated whole is not recognised in the Local Heritage listings under the City of Adelaide Development Plan (2009), the listings do place considerable merit upon both built and landscape features in the Park Lands.

The listed place includes 900 ha in total and is defined by the 1837 layout of streets including parks in the city centre and significant areas including Victoria Square, Hindmarsh Square, the Botanic Gardens, Palmer Gardens and Brougham Gardens in North Adelaide, but privately owned land between the road reserves in the city layout, the railway reserves and State Government lands and Institutions has not been included in the National Heritage Area. Surveyor Colonel William Light planned and founded the city of Adelaide in only eight weeks. His vision was for a metropolitan city surrounded by more than 900 hectares of park lands, with wide streets, several town squares, and the flowing Torrens River separating two major city areas. These elements of his 1837 plan still are still extant today. The ‘City Layout’ model, or template, has been used widely by other towns in Australia and overseas. It is recognised by the urban planning profession and by historians as a major exemplar that influenced the Garden City planning movement internationally (Howard 1898, 1902, 1946), and represents one of the most important Western urban planning initiatives in history (Bunker 1986; Freestone 2006, 2007; Garnaut & Round 2006; Hutchings 2006; Hutchings & Bunker 1986). The ‘Adelaide Park Lands and City Layout’ is a hallmark of the city’s original design, which has maintained elements of its historical layout for more than 170 years. Adelaide is the only Australian city to be completely enclosed by park lands and has the most extensive and intact 19th century parklands in Australia.

Over the past 20 years Adelaide has experienced drought conditions. During this time the City of Adelaide Council implemented a sustainability policy that included reducing mains water use throughout the City. When the ‘taps were turned off’ in the Park Lands the result was an escalation of tree decline and senescence. The majority of non-Australian ornamental trees that were planted in the 1860s-70s and in the 1920s-30s are reaching the end of their Australian-known lifespan. Thus, ‘turning off the tap’ has in fact escalated elderly tree stress, decline and senescence. The GAP project reputedly throws a ‘lifeline’ to the Park Lands but in fact it will cause major negative impacts. First, it suddenly supplies excess water to the now dry but previously fragmented irrigated areas and it adds chemicals to the soil structure. The core reference used
to justify the horticultural validity of the project was based upon an obscure Western Australia reference (Western Australia 2008) that has little relevance to the soil, water and vegetation of the Adelaide Park Lands. The issue of introducing a water supply to a solid structure that has never hosted a permanent supply, in addition to purification chemicals and a change in water pH, has not been seriously discussed in scientific research and secondly, the introduction of this treated water can have a detrimental impact upon European and Indigenous archaeological evidence through the Park Lands and in particular on human burial remains.

The GAP project comprised a $75 million joint state and Commonwealth Government funded project for which construction commenced in September 2008 and was completed in late 2010. The project sought to provide more than 3.8 billion litres of high quality recycled water annually. In addition to supplying existing SA Water customers, the project sought to provide a minimum of 1.3 billion litres each year to irrigate the Adelaide Park Lands.

Adelaide Park Lands and National Heritage

The Hon Peter Garrett MP, the then Commonwealth Minister for the Environment, Heritage & the Arts, announced the National Heritage listing of the ‘Adelaide Park Lands and City Layout’ on 7th November 2008, at the foot of a statue commemorating Colonel William Light. Garrett observed that the listing of the ‘influential urban design of Adelaide-Australia’s first planned city… recognises the 1837 Adelaide Park Lands and City layout as a technical masterwork which went on to influence the planning of other towns in Australia and overseas’ (Garrett & Ellis 2007: 1-2). The ‘Adelaide Park Lands and City Layout’ was included in the National Heritage List as fulfilling criteria a, b, d, f, g and h (see Table 1). The Minister concluded that the place fulfilled 6 of the 9 values for Listing under Section 324IJ of the Environment Protection and Biodiversity Conservation Act 1999, and that the ‘significance threshold’ was successfully fulfilled.

The National Heritage criteria against which the heritage values of a place are assessed are:

a. the place has outstanding heritage value to the nation because of the place’s importance in the course, or pattern, of Australia’s natural or cultural history

b. the place has outstanding heritage value to the nation because of the place’s possession of uncommon, rare or endangered aspects of Australia’s natural or cultural history

d. the place has outstanding heritage value to the nation because of the place’s importance in demonstrating the principal characteristics of:
   a. a class of Australia’s natural or cultural places; or
   b. a class of Australia’s natural or cultural environments;

f. the place has outstanding heritage value to the nation because of the place’s importance in demonstrating a high degree of creative or technical achievement at a particular period

g. the place has outstanding heritage value to the nation because of the place’s strong or special association with a particular community or cultural group for social, cultural or spiritual reasons

h. the place has outstanding heritage value to the nation because of the place’s special association with the life or works of a person, or group of persons, of importance in Australia’s natural or cultural history

Table 1: National Heritage Criteria met by the ‘Adelaide Park Lands and City Layout’
Source: www.environment.gov.au/heritage/about/national/criteria.html; viewed 7 October 2011
This nomination, the first for a designed landscape in Australia, recognises that:

The national significance of the Adelaide Park Lands and City Layout lies in its design excellence. The Adelaide Plan is regarded as a masterwork of urban design, a grand example of colonial urban planning. The city grid and defining parklands were laid over the shallow river valley with its gentle undulations, described by Light as the Adelaide Plains. The city layout is designed to take full advantage of the topography, an important innovation for the time. The streets were sited and planned to maximise views and vistas through the city and Park Lands and from some locations to the Adelaide Hills. A hierarchy of road widths with a wide dimension to principal routes and terraces and alternating narrow and wide streets in the east-west direction were featured on the historic plan. Features within the Park Lands area included a hospital, Government House, a school, barracks, a store house, a market and a botanic garden and roads (Australian Heritage Council no. 105758).

Having regard to Table 1 and the above citation, criteria a, b, c and f, it is clear that the GAP project directly impacts upon the vegetative fabric, and the species profile of the Park Lands, thus also impacting upon the aesthetics and historical layers of occupancy and the ‘designed landscape’, and may have a direct impact upon the archaeology and Kaurna heritage aspects and values of the Park Lands landscape and Country.

As recognised in the Listing, the Adelaide Park Lands is a ‘cultural landscape’ comprising approximately 900ha. It is a multi-layered tract of land possessing Indigenous and post-contact associations, meanings and physical expressions both tangible and intangible (Aplin 2007; Cleere 1995). Cultural landscapes fall within the definition of cultural heritage used by the former Australian Heritage Commission Act 1975 (Cwlth), and amendments 2003, 2008), the present Australian Heritage Council Act 2003 (Cwlth), and the Australia ICOMOS Burra Charter, 2013 (Burra Charter).

Internationally, the meaning of a ‘cultural landscape’ under the Operational Guidelines for the Implementation of the World Heritage Convention (World Heritage Committee 1991), as used by ICOMOS internationally in considering places for World Heritage List eligibility and inscription, is:

37. The term ‘cultural landscape’ embraces a diversity of manifestations of the interaction between humankind and its natural environment.

38. Cultural landscapes often reflect specific techniques of sustainable land-use, considering the characteristics and limits of the natural environment that are established in, and a specific spiritual relation to nature. Protection of cultural landscapes can contribute to modern techniques of sustainable land-use and can maintain or enhance natural values in the landscape. The continued existence of traditional forms of land-use supports biological diversity in many regions of the world. The protection of traditional cultural landscapes is therefore helpful in maintaining biological diversity.

39. Cultural landscapes fall into three main categories, namely:

(i) The most easily identifiable is the clearly defined landscape designed and created intentionally by man. This embraces garden and parkland landscapes constricted for aesthetic reasons which are often (but not always) associated with religious or other monumental buildings and ensembles. …

(iii) The final category is the associative cultural landscape. The inclusion of such landscapes on the World Heritage List is justifiable by virtue of the powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence, which may be insignificant or even absent (World Heritage Committee 1995, sections 37-42).

The National Heritage List listing for the ‘Adelaide Park Lands and City Layout’ includes the whole of the ‘park lands’ and the squares within the ‘layout’ as well as all roadways and several tracts of state government-administered land including the Adelaide Botanic Garden. Despite this over-arching listing, the majority of urban planning histories and discourses about the Park Lands separate the ‘park lands’ from the ‘squares’ in their narratives and definitions, whereas
the Listing includes both tracts of land and that this is spatial definition is used in this paper. In addition, most published literature about the Park Lands interchangeably uses ‘park lands’ or ‘parklands’ as a descriptor for this tract.

The ‘Adelaide Park Lands and City Layout’ was deemed as possessing ‘outstanding heritage value to the nation’ in influencing the ‘course [and] … pattern’ of the nation’s ‘cultural history’, as per criterion (a) (Australia 2008: 1-23; Bunker 1986: 7-20; Freestone 2006, 2007; Garnaut & Round 2005; Hutchings 1986, 2006; Jones 2007). In particular, it contained a physical expression of the Plan draped over the Adelaide Plain and retained a high degree of authenticity that had suffered minimal compromises to its overall configuration and road circulation system. Second, the Plan was a precedent of settlement planning in the Australian colonies, embodying an aesthetically embellished ‘city plan’, possessing wide boulevards, and generous open spaces reminiscent of London’s town squares. Third, the overall ‘Plan’ had been and continues to be guided by a single co-ordinated management regime (the Adelaide Parks Land Authority + the Corporation of the City of Adelaide Council) and this longevity of curatorial role, deemed valuable as part of the criteria, was equally matched by a citizen or community-based action group—the Adelaide Parklands Preservation Association. Continuity of management entity, only two phases of landscape planting activity (1860s-70s, and 1920-30s), the relative continuity of only five Parks and Gardens Managers/Superintendents ensured a consistency in planting philosophy and management approach (Jones 2007). Fourth, it was concluded during the Listing evaluation that the Plan exists as an international town planning precedent possessing the essential characteristics of the influential Garden City planning philosophy and movement, and continues to hold an international precedent role today in planning and landscape architecture literature.

Figure 1: Australia (2008), The Adelaide Park Land and City Layout’ national heritage list scope map.
The Glenelg to Adelaide Pipeline (GAP) Project

The GAP was administratively driven by SA Water, a state government agency, seeking to re-use treated wastewater from the Glenelg Wastewater Treatment Plant for irrigation in the Adelaide Parklands. Forming a part of the Water Proofing Adelaide Strategy (Waterproofing Adelaide 2005) that aimed to develop a 20-year plan for sustainable use of water in Adelaide, the GAP envisaged that recycled water would reduce the use of potable water for irrigation purposes with the added benefit of reducing the volume of treated wastewater discharged to the marine environment of the Gulf of St Vincent that is to the western flank of metropolitan Adelaide.

The Water Proofing Adelaide project was established to set a blueprint for the management, conservation and development of Adelaide’s water resources to 2025. In conjunction with this initiative, the state Government announced a number of parallel measures to implement the 20-year strategy. The Strategy (Waterproofing Adelaide 2005) is divided into three sections, each of which is supported by a series of goals which will achieve the aims stated above: 1. Management of our existing resources; 2. Responsible water use; and 3. Additional water supplies.

The GAP area consisted of SA Water’s planned recycled water pipeline route from the sea-side suburb of Glenelg to Adelaide and its supporting infrastructure locations. The GAP initiative was jointly funded by the Commonwealth and South Australian Governments. The stated aims were:

- Reducing the city’s dependence on water sourced from the River Murray, Adelaide Hills Catchments and ground water for watering the Adelaide Parklands;
- Reducing the flow of treated wastewater into the Gulf of St. Vincent;
- Providing suitable infrastructure for future users of treated and recycled waste water.

To address these aims, the GAP project sought to transport recycled water from a new tertiary treatment facility, located on land to the east of the existing Glenelg Wastewater Treatment Plant, to the Adelaide Parklands and Adelaide’s Central Business District using an underground network of pipelines. The project included:

- A new treatment facility at the Glenelg Wastewater Treatment Plant (WWTP);
- Recycled water storage tanks and pump station onsite at the Glenelg WWTP;
- Approximately 10 kilometres of (750 millimetres diameter) underground pipeline from Glenelg to the south west corner of the Adelaide Parklands;
- Approximately 35 kilometres of underground pipeline (diameters ranging between 100 millimetres and 600 millimetres) network throughout the parklands, including North Adelaide and the CBD; and
- A pump station and underground waste storage tank in the south west corner of the parklands.

The salinity level for the irrigation water envisaged by SA Water in 2005 was 350, 500, 700, 900 and 1200 milligrams per litre.\(^1\) Under agreed performance standards, all recycled water used in the Park Lands was to be treated to the standards outlined under the ‘Australian Guidelines for Water Recycling-Managing Health and Environmental Risks Phase 1-November 2006’ (Australia 2006), and that the water was to be classified as suitable for ‘unrestricted municipal use for irrigation’ enabling use on open spaces, sportsgrounds, and golf courses. The level of salinity in the irrigation water was proposed to be the same as the resulting level of salinity in the soil. It was envisaged in 2008 that the GAP Project recycled water would have a salinity level of between 1100 milligrams per litre-1300 milligrams per litre. Soil with a salinity of 1200 milligrams per litre was to be considered a saline soil for the purposes of the project. In order to monitor the process and the water management, the City of Adelaide Council sought to minimise salt accumulation in soils, delimit excessive runoff that may enter sensitive adjacent environments, and carefully balance individual plant sensitivity issues against the water needs of the majority of plants. The Council has since sought to apply a long-term sustainable irrigation policy guided by an ‘Adaptive Management Framework’ (AMF) based upon best available research and irrigation practices. The AMF is a structured, iterative process
of robust decision making in the face of uncertainty, with the aim of reducing uncertainty over time through system monitoring, involving Irrigation Management and Monitoring Plans (IMMPs) for each park, garden and open space requiring regular watering in the Park Lands.

**Water: lack of water and plenty of water**

As part of the initial investigations for the project, SA Water commissioned Resource & Environmental Management (REM) Pty Ltd (2006) to undertake a detailed evaluation and risk assessment of the project and in particular the use, treatment and application of the treated water. REM (2006), in evaluating the soils of the Park Lands, concluded that:

1. The sandy soils in the Parklands have lower salinity than the clay loam soils (because of their better drainage), but in general, the top 0.3 metres of all of the Parklands soil is currently of low salinity.

2. The ground water currently used to irrigate Park 20 has a salinity level of 1100 milligrams per litre and that used to irrigate Park 15 one of 1400 milligrams per litre. (REM 2006: 19).

3. Ground water is currently more than 4m below the ground surface of the Parklands, except for alluvial areas along the Torrens River where it is 3 metres below the surface. At low application rates (4 mega litres per hectare) the height of the water table would be unaffected in most areas of the Parklands and even become lower in the Torrens Valley alluvium (between North Adelaide and the city). At high rates of watering (8.5 mega litres per hectare) however the water table would be predicted to rise by 1.1 metres within 10 years ‘which significantly increases the risk of waterlogging especially along the River Torrens’.

4. Current irrigation rates are not consistently high or low. Using the current average rate of application the water table is predicted to show some rise in the long term.

5. Predictions have been made by REM of the effects of irrigating using different levels of salinity and different rates of application, on salt loads in the underlying aquifer. In general, they state that in the longer term a net accumulation of salt in the aquifer will occur if overwatering is used to reduce salt levels in the soil or if salt load applied in the irrigation water increases.

6. The average pH of the proposed irrigation water is 7.3. This is not likely to significantly alter the current soil pH of 7.5-8.5.

7. Soil nutrients other than salt can increase with irrigation using wastewater. Of these nutrients, phosphorous has been identified by REM as potentially above plant-uptake requirements.

8. Salinity in the soil (as against in the irrigating water or in the aquifer) is expressed by a measure of electrical conductivity (EC). This is not a pure measure as EC measures a combination of factors, only one of which is salinity. An accurate measure of salinity, in soil irrigated with a known level of salinity in the water, is not easy to assess.

Thus, while it is easy from an engineering perspective to shift water from one place to another, the increased amounts of salts and chemicals in the irrigation water will have a deleterious effect upon soil structure. What is not addressed in the above conclusions by REM (2006) is the consequential effects of this increased salt laden redistributed water, nor the increased amounts of water with a higher level of salinity, as such water egresses tree and vegetation root systems. Further increased salt levels may also impact human and non-human remains buried under the existing natural or artificially constructed surface of the ground. The real impacts of treated water re-distribution have not been addressed for this project.

**Trees, archaeology, heritage and water**

Harris (2006) concluded that salinity is a newly emerging issue in archaeology and Indigenous heritage. Though numerous Aboriginal heritage surveys and clearances have been associated
with salinity mitigation, the emphasis of these assessments and clearances has been on avoiding impacts on Aboriginal heritage sites in areas where salinity measures are being proposed, and their recording.

Dryland salinity is well understood as having environmental consequences for Australian landscapes. To Indigenous communities, salinity is distressing because they see the results of land degradation, the adverse changes in rivers and the death of iconic tree species in their Country. The link between this broad-scale environmental degradation and effects on archaeological heritage material and sites is little researched internationally and rarely comprehended at a professional practice level in Australia. Despite the high propensity of salt in Australian soils, the broad issue, even more so than the site level issue, is only now being recognised by some archaeologists and culturally-rich land managers.

The same conclusion can be drawn about wastewater re-use schemes. While the focus has been on finding construction routes which avoid archaeological sites, the potential effects of the wastewater on soils are just starting to be recognised. Salinity and Indigenous heritage is a point of contention, most obviously in the case of Lake Victoria in far western New South Wales. While the lowering of the Lake exposed large numbers of human remains, raising the water tables and increasing salt transpiration, re-filling resulted in additional exposure of the burial sites to further water damage as the new water, its salts, and the dramatic shift in the water table contributed to an escalation of salinity. A program of protection from severe wave action using sandbagging buffers was instituted as a compromise position with work carried out by the Aboriginal Barkindji people. This archaeological disaster was captured by English and Gay in Living Land Living Culture (2005) when discussing the Australian landscape. The Lake Victoria example illustrates the range of impacts that increased salinity can have upon Indigenous tangible and intangible heritage. English and Gay (2005) concluded that the main impact was felt by Aboriginal communities for land, particularly the sorrow and adverse impacts on health and culture when land disintegrates to a state of dryland salinity:

The whole catastrophe of land clearing, erosion and irrigation had led to dryland salinity and scarring of the country with salt scalds in just those areas near watercourses where Indigenous habitation is most evident. Erosion, which is part of the salinity progression, had killed trees, exposed burials, and created lag deposits of stone artefacts which then sat in salt scalds, leading to disintegration of their stone fabric as well as loss of spatial integrity through earth and water movement and via trampling by stock. They state that landforms, water bodies and vegetation which ‘embody the physical fabric of these places’, and which are part of stories and cultural places are destroyed and ‘associated biodiversity, including bush foods, medicines and totems can be affected/killed’ (English & Gay 2005: 63).

Past and potential future impacts and Country degradation for the Kaurna of the Adelaide Plains, began almost as soon as European settlement started, with large scale clearing of trees across Adelaide, including in the Parklands. River Red Gums (Eucalyptus camaldulensis) in particular, an iconic species in this landscape have been almost completely cleared. The most common name for the River Torrens, Karra wirra parri literally means ‘red gum forest river’. Therefore salinity levels, changes in water tables, and entrenched water-logging of an order that regularly occurred pre-colonial invasion, no longer supports this species in the manner the species was ecologically used to, and thus has placed considerable stress upon the species individually and collectively across the Park Lands.

Harris (2006) concluded that the Park Lands contain a number of areas where archaeological remains of traditional Kaurna occupation survive (or remain) and where there was continuous Kaurna use of the Park Lands in the early period of Adelaide’s survey, settlement, and landscape transformation. These culturally sensitive areas are alongside the Torrens River corridor and comprise camp and living areas: along the banks of the River; in the old water course routes of the River; and in a series of places linked to pre-contact and post-contact associations of both the Kaurna and other Aboriginal communities who met pre-colonisation and post-colonisation on Kaurna Country for various reasons and activities. Harris has identified that that the subsurface archaeological materials include stone and bone artefacts, burials, campsite materials
(cooking stones, food debris) and building materials (related to the ‘Aboriginal Locations’ which were like colonial protectorate encampments or ‘stations’ that Aboriginals could occupy on the Park Lands during the early years of colonisation under the jurisdiction of a colonial Protector).

Harris (2006) concluded that damage caused by salinity increases as salinity increases, where conditions are such that salt in solution dries, becomes crystalline, expands and breaks apart the material. Environmental conditions that can exacerbate this include increases in water salinity, continued use of sulphate fertilisers, insufficient flushing with fresh or rain-water, raising of the water table, and fluctuating water tables. At risk then is any sub-surface heritage material which is porous (such as bone, earthenware, brick and to some extent stone) and while it is most at risk of salt damage when exposed to drying in the atmosphere, the damage can occur sub-surface as well. The tolerance of trees to changes in urban salinity, and the impact of dryland salinity upon tangible cultural heritage is also discussed and documented by Spennemann (1997, 2001), raising parallel concerns to those articulated by Harris (2006).

A second major issue is tree health. As salinity levels, water levels, and micro-modifications occur to the soil structure, these can have a major impact upon tree root health and water and nutrient absorption. In its ‘assessment of the benefits and detriments to horticultural maintenance practices’, comprising only 2.5 pages, REM (2006: 35-37) concluded correctly that reclaimed wastewater contains considerable amounts of nutrients; that its use will likely reduce the amount of fertiliser required provided the nutrients are in a plant-available form; and, that the ‘other benefits’ to accrue include the:

- Ability to use more water thereby achieving the goal of greening the Parklands;
- Sustainable water use for the Parklands;
- Expansion of the irrigated area across the Parklands; and
- The use of available water resources more wisely, consistent with the Waterproofing Adelaide strategy.

The only discussion about detrimental impacts in the report (REM 2006) touched on issues of increased maintenance, increased costs associated with monitoring, and increased costs and visual pollution associated with signage. No mention was made of impacts upon the health and longevity of trees themselves. However, a limited discussion on the ‘salinity tolerance of turf grasses and Parklands flora’ stated that:

The plantings of native and exotic species are highly intermixed throughout the Parklands and several different species from the same genus often occur together. Each species can have a significantly different salt tolerance. For example, there are several species of Acacia that occur throughout the Parklands and a review of data concerning salinity tolerances from the Department of Agriculture, Western Australia (www.agric.wa.gov.au) for species of Acacia indicate that different species range from being salt tolerant to highly intolerant of salt. The various plant species across the Parklands are not spatially referenced and therefore physical locations of plants that may be more salt sensitive cannot be readily identified (REM 2008: 26).

This is an important flaw in the impact assessment. In overlooking and inadequately investigating this aspect, the consequences of changes in water regimes in the Adelaide Park Lands on vegetation are thereby based upon a Western Australian agricultural guideline that has little relevance to the soil structures of or vegetation in the Park Lands (Western Australia 2005). No research was undertaken to ascertain vegetation species in the Park Lands, no account was taken of research work that had mapped and temporally modelled vegetation change in the Park Lands, and no reference was made to cultural heritage assessments of the Park Lands in drawing this conclusion (Jones 2007; Peter 2008).

**Directions and issues**

The central argument in this paper is that science and heritage have failed to be adequately addressed in a major policy initiative and imperative driven by the water proofing of Adelaide.
With changes in climate for Adelaide, the cessation of the drought recently, and the increasing senescence of tree vegetation in the Park Lands, are we about to over-water this landscape and place it under an increased level of vegetation stress and archaeological deterioration in the belief of ‘doing the right thing’ in enabling water security? 

By changing the water regime of a landscape, in part enabling water security and reliability, one changes the water management regime upon which a designed landscape evolved, was planted and thereupon managed for several human and ecological generations. This act places at risk the essential aesthetic and ecological values of the place, as one aspect (or value) is artificially stabilised while at the same time several other values are destabilised. This paper questions the adequacy and scientific veracity of the risk management that was performed at the time the project was envisaged, launched, and implemented. One pertinent question is how this water security initiative impacts upon the qualities and values upon which the National Heritage Listing was predicated, the reliability of the management plan now in place as it deals with two water regimes – historical and artificial—and the accountability of this water management regime having regard to the obligations under the Environment Protection and Biodiversity Conservation Act 1999.

That being said, the core merit and innovativeness of the GAP project in re-circulating treatment water for a raft of public domain, and occasional private use, is to be applauded. But, the concern here is about the quality and veracity of information upon which judgments were made, the lack of specific information at the time, and the consequential effects arising from the project that have not been subject to a longitudinal evaluation.

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**Endnotes**

1 1 milligram per litre refers to 1 milligram of salt per litre of water, or one part per million. By comparison, drinking water has from 250-500 milligrams per litre and seawater contains 34,000 milligrams per litre.