

SHARING SWEET WATER: CULTURE AND THE WISE USE OF PERTH'S WETLANDS

*Hill A L,
Murdoch University
Western Australia*

Perth is an hydropolis, a city of wetlands. Perth's Whadjug people used these extensive wetlands and their diverse flora and abundant fauna, for more than 38 000 years. The Whadjug recognized the variability of rainfall and times of flood and drought. Perth's current population, in excess of 1.3 million, relies heavily on groundwater for water supplies. The Swan Coastal Plain extensive wetlands and internationally recognized mega diverse flora and fauna are also dependant on this groundwater resource. The region is experiencing the second extended drought of the last 120 years. As a consequence wetland, groundwater and storage levels are at historical lows. In the 1990's, Government usually required dwellings to be constructed on sand pads, 1.2m above the Average Annual Maximum Groundwater Levels (AAMGL). Short memories and the decline in the water table has contributed to a misunderstanding that this approach is no longer necessary. Drains through lowest points in the landscape (often wetlands) now remove storage and groundwater in a way that will be difficult to reverse. In addition drainage in areas containing acid sulphate soils result in perpetual annual episodes of acid and heavy metal pollution. This paper explores the view that the Whadjug concept of 'sharing sweet water' (with both people and the environment), under a variable climatic regime, needs to be re-visited as an appropriate paradigm for sustainable water management in Perth. It also considers this approach in light of Water Allocation Guidelines and Wise Use of Wetlands provisions of the Ramsar Convention to which Australia is a signatory.

1. Introduction

Perth is a modern metropolis and the capital of the State of Western Australia. Perth's first people, the Whadjug Nyoongar (Berndt, 1979a) lived in a Mediterranean climate beside wetlands as extensive and biologically diverse as those today in Kakadu National Park (Balla, 1993). Many of Perth's wetlands remain and extend through (Hill et al, 1996; EPA, 2004c) this modern city of 1.3 million people (ABS, 2002). Much of Perth's population is young or only first generation Australians (ibid). Surprisingly little acknowledged and recognized presently are the descendants of the First Nation Whadjug, (also spelt Wajuk (Horton, 2000a)). After many years of dislocation, the Perth Indigenous community also includes, many Indigenous people that are also descendents of the 130 other First Nations across Western Australia (Berndt, 1979b).

Early interactions of the British settlers (Wilson, 1835) and the generous Whadjug, and details of some of their traditional stories (Bates, 1992) are documented. Documentation of cultural information from other Australian peoples (Elkin, 1973; Stanner, 1965; Berndt 1964) help to fill gaps of understanding, translate and communicate cultural institutions that may still have insight and relevance today.

It is estimated the Whadjug people and their ancestors used Perth's extensive wetlands, its waterways and floodplains and diverse flora and abundant fauna, for more than 38 000 years (Hallam, 1987a; Pearce & Barbetti, 1981), and probably extending to a period approaching 60 000 years (Hallam, pers com).

The Whadjug recognized the variability of rainfall and times of flood and drought in their traditional narratives (Bates, 1929). The Walitj and Woordung traditional story about sharing of good water (Bates, 1928b) is an important narrative, elaborating an Indigenous approach to sharing water (and possibly the good things in life), in times of scarcity.

Perth's current population, industry and agriculture, rely heavily on groundwater for water supplies (EPA, 2006). The Swan Coastal Plain's extensive wetlands (Hill et al, 1996) and internationally recognized mega diverse flora and fauna (Hopper et al, 2004) are also dependant on this groundwater resource (Seddon, 1972; Balla, 1993; EPA, 2004c). The most recent State of the Environment report (EPA, 2006) reported 14% of the best wetlands remaining, conservation category wetlands, were being lost at a rate of two football ovals per day. Perth's other partly cleared wetlands are also being substantially and rapidly modified (ibid).

These extensive wetland areas have for millennia been critical and productive, regulatory parts of Perth's hydrologic system. However, they are not yet protected (EPA, 2004c) or acknowledged routinely on popular maps such as the Department of Lands Information (2006) Perth Street Directory, or on the large-scale Water Agency groundwater atlas maps (Department of Environment, 2004). In the current thirty year drought (Commander & Hauke, 2005), many companies and people generally, do not remember, are often not well informed, and will seldom consider selecting a house property away from Perth's wetlands, or in an informed way, design their houses with floor levels sufficiently high, to reduce the risk of flooding, when normal or heavier rainfall returns to recharge our groundwater system. These wetter conditions and a normal recharge period for Perth's groundwater and wetlands have occurred for sixty of the last one hundred and twenty years (ibid). Even higher groundwater levels can be expected with rising sea levels from climate change.

This paper explores the view that the Whadjug concept of 'sharing sweet water' (with both people and the environment; past, present and future), under a variable climatic regime, needs to be re-visited as an appropriate paradigm for sustainability and better wetlands, water and drainage management in Perth. The paper considers this approach in light of the international Water Allocation Guidelines and Wise Use of Wetlands provisions of the Ramsar Convention (Ramsar Convention Secretariat, 2004a) to which Australia is a signatory, and other Global institutions for water such as the Nature for Water initiatives of the Water Convention (UNECE, 2005a; 2005b), Convention for Biodiversity (Hails, 1996) and cultural and natural heritage protection on wetlands (UNESCO, 2005; Van de Noort et al, 2002; English Heritage, 2006).

2. Sharing Sweet Water: Traditional Indigenous Culture and the Wise Use of Whadjug Nyoongar Wetlands

Whadjug Land and Waters

At the time of British settlement, the Whadjug were a population estimated at 500 (Berndt, 1979b) with four patrilineal territorial clans called the Beeloo, Mooro and Beeliar (Lyon, 1833) and Jinjinuk (Bates, 1927; Armstrong, 1837). Wetlands were valued parts of inherited land or boodja, productive campsites important for meeting

needs for food, water, shelter and material needs (Hallam, 1987b). They were also places of the Serpent and areas of high aesthetic appreciation (O'Connor, 1989; Bates, 1925; 1926).

The Whadjug lands or boodja reflected the catchment boundaries of the Swan Canning Estuary with the addition of the high groundwater recharging areas of the Gingin Brook and Dandaragan Plateau.

The territory of these four clan areas parallel areas that are known in today's contemporary cultures as:

- Beeloo- Cloverdale Mound and Eastern Hills Foothills and Darling Scarp Catchments;
- Jinjinuk- Dandaragan Plateau and recharge areas of North Eastern Gnangara Mound, Northern Hills Catchments of Gingin wetlands and Gingin Brook, Lennard Brook, Yalyal Brook, Chandala Brook, Ellen, Brockman, and Julimar and Red Swamp brooks;
- Mooro- Gnangara Mound; and
- Beelias - Jandakot Mound and recharging Canning Hills Catchments.

Individuals and families from adjacent Yued, Ballardong and Pinjareb and more distant Nations regularly visited traditional camps on Whadjug land and were likely to have had important roles and responsibilities in Indigenous Law including occasional comment on wildlife, land and water management (Hallam, 1987b; Elkin, 1973; Maddock, 1972).

Use of warran or native potato grounds on alluvial soils was strongly valued by the Whadjug, with warran rights passed on along matrilineal lines (Hallam, 1989). These tended wetland areas were among the first to be appropriated by settlers on the coastal plain and in the hills. Alluvial areas along the river and many more extensive areas of these now unused and untended warren grounds are likely to be protected in new Regional Parks, Perth Hills National Parks and remaining State Forests.

The Whadjug nation spoke a dialect of Nyoongar that differed slightly but was comprehensible to all thirteen Nyoongar nations of the South West (Berndt, 1979b; Lyon, 1833; Bindon et al, 1992; Moore, 1884; Green, 1979; 1984). The words of old important traditional songs at ceremonies in Perth were often sung in desert languages (Lyon, 1833). Communication in the South West and with Wongai/ Yarnangu inland was probably maintained with complex diplomatic trade, festivals, friendship ceremonies, the beedawa or initiation travels of young men in neighbouring nations, and marriage (Vinnicombe, 1989).

Places of importance to Nyoongar people were named and many springs and most of the important wetlands of Perth were named (Lyon, 1833; Giblett et al, 1996). Base maps used by the Western Australian Water Resources Council (WAWRC, 1987:1991) in its water allocation work and presenting Wetlands of Environmental Significance (Leprovost Semeniuk & Chalmer, 1987) and Recreation Opportunity (Feilman, 1987) showed the traditional names and locations of hundreds of such named springs and other wetland places in Perth, Mandurah and Bunbury. Recent Geoscience Australia (2005) topographic map DVD's included a name database, which expedites the finding of such named areas. Cockburn sound was known as

Derbal Nara, the Swan River Estuary was known as Derbal Yarragan, the Upper Swan Wurerup, the Canning River as Djarlgarro, the Canning River flats Wadjup, the Helena River as Mandoon, and the Avon as Gogulger (Lyon, 1833).

Understanding the probable territorial extent of traditional areas is assisted by recognising names with *Waly* as a phonetic prefix, suggest people to the north (Moore, 1885) and names with a phonetic prefix of *Boorn* also suggest catchment and land boundary (and roof ridge and vessel) (Lyon, 1833).

The northern extent of the Beeloo appears to be Bungarah (Walyunga pool) and the Wooroloo Brook east to Boononging at Bailup. The southern and eastern extent of the Beeloo appears to be at Wadjup and the flats on north and south banks of the Canning River and then through Baboke gorge (Bates (1907, 1926) in Carter, 2006) to the source of the Canning near North Bannister, where festivals were held with the Wilmen (Hallam, 1998b). The boundary appears to proceed north, past Manaring Lakes to Bailup (ibid). The western extent is reported to include South Perth and the west bank of the Swan from Walyinup in Perth, to East Perth and Bassendean (Bates, 1929).

The northern most extent of the Jinjinuk appears to be Wannamal, and the Brockman and Julimar catchment to the Avon. Also including Boongaring Brook, Wallering Brook, Boongarup Lake, Walbing, and Wilgarup at Yanchep and east to Waylo (Cunningham, 2004), east of the Ellen Brook south to Walyunga and including the historic Shaw property (Hallam, 1998a; Statham, 1981) east from the Wooroloo confluence along the Brook to Wooroloo Pools and Boononging at Bailup (Hammond, 1935).

The northern extent of the Mooro appears to have been at below Wilgarup at Yanchep and south of Lake Chandala (Cunningham, 2004). The southern boundary was the south bank of the Swan River in Fremantle (Walyalup) and at Walyinup in the centre of Perth.

The northern extent of the Beeliar appears to have been just south of the Swan at Fremantle and Canning Rivers and at the southern extent Becher Point and Lake Walyungup, Rockingham and the Canning River Gorge (Bates, 1912). Significant activity appears to have occurred at Bibra, Thomson's, Lake Forrestdale and Mangles Bay.

Sharing Sweet Water

Complex layers of stories, songs, body art, dance and poetry were just some of the Nyoongar artistic mechanisms used to celebrate and pass on necessary insight and knowledge (Stormon, 1977; Bates, 1907a; 1907b; 1926).

The Walitj and Wordung (eagle hawk and crow) traditional story told by Jubitj to Daisy Bates concerns the sharing of good or sweet water (Bates, 1928a). Bates (ibid) attributes ownership of the story to the Ballardong people, although it appears to have important location references in Whadjug country. The story was also told as the Walitj and Wording sharing water in drought story by the Goreng Nyoongar in Jerramungup (Hassel, 1975). A complementary Walja and Manitch (eagle hawk and

white cockatoo) story is also told encouraging tolerance and understanding (Bates, 1928c).

Thomas Braidwood Wilson (1835) documents a pleasant and generous early interaction and sharing of water with the Beeloo clan at their winter village, on Munday Brook in Kalamunda, in October 1829, and a walk along Piesse Brook with the perhaps too quick to judge, and hard to satisfy, representatives of Perth's new arrivals. Some Nyoongar still refer to themselves as Sweet Water People (Stanton, pers comm.).

Sweet Water Festival

Wetlands near Gareenup or the South Perth Mill had a special role in Whadjug tradition. Gu'yag'gerup was a sandy area with a fresh water soak, facing Melville water, where the nectar of Mungyt (*Banksia menziesii*) was used to make a popular beverage at a festival (Hallam, 1987b; Bates, 1929). The Beeloo Whadjug Nyoongar, were also known as the Nectar or Mungyt people of the Perth Hills (Bates, 1927), and hosted this sweet water festival. Nectar from the abundant flowers of the Ngumbit (*Corrymbia calophylla* or Marri), Mungyt (*Banksia menziesii* or Firewood Banksia), Butyak (*Dryandra sessilis* or Parrot Bush) were all used to make sweet drinks (Hallam, 1998a; Hallam, 1987b; Cunningham, 2005). The behaviour of attendees and late leavers at the sweet water festival is also mentioned in the narrative in the Waugal and Munjallina flood tradition (Bates, 1929; O'Connor, 1989; Bennell, 1981).

Religious Associations and Totemism

Traditionally, the importance of making decisions to protect the health of country, the health of water and to protect the community was at the core of Australian Indigenous culture and religious belief (Stanner, 1965). Stanner (ibid) suggested the Indigenous religious systems strongly reflected design for nature.

The Serpent and other South West myths are central to the Whadjug creation epics and many of the other traditional Nyoongar religious stories of Perth (Bates, 1925). The personification or animalisation of the spirit of living water in Perth is represented and revered as the important creative spirit known as the Waugal (O'Connor, 1989).

Water sources and water bodies such as springs, stream pools, and wetlands, across Australia were often seen as places that were also life sources, places of the spirit of future beings, including people and other life (Berndt, 1964). They were considered places of mystery and as the resting place of the Waugal and were accordingly respected. In these special areas reeds were respectfully undisturbed with such admonitions as *don't tamper with the old man's beard* (Hayden C, pers com).

Undisturbed Whadjug natural lands and living waters often have religious associations because ancestral beings and their actions are believed to be manifest in their form (Berndt 1979a; O'Connor, 1989). Whadjug people had access to intricate traditional ecological knowledge of the biology of Perth. Knowledge might be general or esoteric.

The Nyoongar lands are still referred to by some Yamitji as *grey kangaroo* (Roger Harrison, pers comm. 2004). Gender totems led to Nyoongar men being referred to as *Yonga*, and women as *Yorga* (male and female kangaroo respectively). Traditionally individuals had many structural and functional totemic affiliations (Elkin, 1973).

Totem laws and examples were celebrated in important traditional stories, songs and dances. The structure of traditional totemism (Elkin 1973, 1933) was multi layered as Individual, Sex, Moiety, Clan, Local and Multiple totems. Totemic functions included Social, Cult, Birth and Conception, Dream, Classificatory and Assistant types (ibid).

Knowledge of the organisation of a number of Traditional Clan, Moiety, Sex, Skin and Individual totems remain in Perth (Elkin, 1973; Berndt, 1979b; Bates, 1927). The matrilineal family Clan totems of Perth include on Beeloo territory: **mungyt or nectar people**, Jinjinuk: **kuljak or black swan people**, Mooro: **yonga or male kangaroo people**, and the Beeliar: **budtallung or pelican people** respectively (Bates, 1927; White, 1985:p199).

Whadjug people were split into two moiety totems, Manitchmat (white cockatoo) and Wordungmat (crow) and four skin group sections and more subsections; Ballarok (crow), Tondarup (cockatoo), (and Waddarak subsection), and Ngotak and Naganok (crow)(and Didarok (cockatoo) and Dijikok subsections) (Moore, 1884: Bates, 1924a). The skin, local and classificatory totems normally included most important foods, plants, animals and some important environmental influences (e.g., water and rain) and materials (Elkin, 1973).

The totemic system enabled a very strong empathetic connection between man and nature and the past (Elkin, 1973).

Corridors, Native Pads and Dreaming Tracks

Winmar (1999) documents the seasonal travel of the neighbouring Ballardong down along the Native Pad or main run along the Helena and Avon rivers to traditional campsites near Beebo Moor (Guildford) (O'Connor, 1989; Bates, 1912; Hamersley, various letters), on the Swan between Helena River and the Middle or Upper Swan Bridge. These areas were encompassed in the main run along the Helena and Avon, and also the Munjallina creation narrative and dreaming track of the Swan, Helena and Avon Rivers (O'Connor et al, 1987; 1989).

The sweet water festival in South Perth also appears to be associated with Walja (Eagle Hawk) stories as does Wadjup and the Canning River flats (Bates, 1929; Lyons, 1833).

A path and story perhaps of the neighbouring Pinjareb or Beeliar people extends from Barragup to the Spectacles and also leads towards Calyute's traditional camp in South Perth, near the South Perth Mill (Bates, 1924b).

Other dreaming tracks have also been reported on the coastal plain and eastern hills. Well worn and semi cleared pads, were also used by the settlers for communication, linked campsites and often were territorial boundaries. Reference to early maps assists in their identification.

Protected Areas, Camping, Festival, Corroboree and Avoidance sites

The camps of the Whadjug and other Nyoongar from the South West of Western Australia were focused on littoral areas (Hallam, 1983) around the highly productive habitats of interlinked basin, channel and flat wetlands (Semeniuk, 1987), which cover 20 to 25% of the greater Perth area of the northern Swan Coastal Plain (Del Marco & Hill, 1992). Particular areas of high food productivity were very important to the Whadjug and appear to be where large and important festivals were held.

Some of the major festivals were the Mungyt or Sweet Water Festival of the River people (Beeloo or Canning Mills people) held at South Perth (Bates, 1929; Hallam, 1987b); the Black Swan eggs festival of the Jinjinuk or Lennard Brook people held at Gingin Lakes (Bates, 1927) and also at Bailup (Warran, Goomal, Gilgies & Coonaks with the Ballardong) (Hammond, 1935); the Kangaroo festival of the Mooro or Kings Park people held at Goonininup or Kings Park (Grey Kangaroo-Mooro) (Bates, 1929; Vinnicombe, 1989; Morrison, 1995), and probably Pelican (Hallam, 1987b) or the Whale meat festivals of the Estuary people (Derbal-gur now considered Beeliar or Mangles Bay people) held on Fremantle beaches (Pelican-Beeliar). The Whadjug also participated at neighbouring festivals in the headwaters of the Canning with the Wilmen people (Hallam, 1998b) and at Barragup (Fish trap with the Pinjareb people) (Hammond, 1935).

Such festival times allow people to trade, carry out law and religious business, hold friend making ceremonies and apprentice teenage boys for instruction to adjacent tribes before initiation (Bates, 1992). Areas within each of the patrilineal clans of the Whadjug appear to have also been recognised as corroboree areas and other areas set aside as initiation areas and as rain making sites (Bates, 1927; O'Connor, 1989). Some of these areas in Perth were protected sites and avoidance areas for women, children and the uninitiated (O'Connor, 1989; Bates, 1927).

Sustainability Strategies and Religion

Like the ancient Celts, Perth's Whadjug had an oral cultural tradition. Older people passed important songs and knowledge to the very young and later more specialised knowledge when they were ready as initiates. The stories and names of specific wetland sites around Perth were laden with cultural meaning (Bates, 1912).

Totemism as a cultural institution (Elkin, 1973), acted to make people aware, interested, desire and act responsibly to the environment, by instructing and delegating roles, responsibilities, principles and processes to all people (Dolman, pers comm.). The Whadjug Nyoongar people's religious laws and relation to respect for the past, protection and management are interesting and valuable counter points for sustainability today (Horton, 2000b).

The extensive wetlands of Perth were valued by the Whadjug Nyoongar people (Berndt, 1979; Hallam, 1975; 1987a; 1987b) for an estimated 60 000 years (Hallam, 2006 pers com). Perth's important archaeological sites (DIA, 2004), which celebrate and acknowledge Whadjug achievement as one of the world's oldest societies, are currently and unfortunately being rapidly destroyed.

Archaeological Sites include the Swan River floodplain at Upper Swan near Ellen Brook and Walyunga, carbon dated at 38000 years (Pearce & Barbetti, 1981; Hallam, 1989); and the multi layered carbon dated habitation sites on the Bellevue Wetlands on the Helena River floodplain, next to the State heritage listed Bellevue farm property (Heritage Council, 1998), carbon dated to 29400 years (Schwede, 1983; Hallam, 1989); and numerous early middle and late period artefacts scatters found on the wetlands on Register of the National Estate and Aboriginal Heritage lands surrounding Perth Airport (Hallam, 1983; 1989) and areas of high concentration in the Helena Valley (DIA, 2004; WAPC, 2003b).

3. Contemporary Australian Cultures and the Conservation and Management of Perth's Inland Waters

Wetlands as impediments to development and objects for conservation policy

The natural and cultural values of Perth's extensive wetlands have been under pressure since first European settlement (DCE, 1977; 1980; Morcombe et al, 1981; Seddon et al, 1986; Bala, 1993; EPA, 2004c). For more than thirty years, the State Government and talented people have been working to develop an effective policy response to this loss (DCE 1977; 1980; 1986; Arnold, 1990; EPA, 2004b).

The State Government released its State Wetland Conservation Policy in 1997 (Government of Western Australia, 1997) and affirmed the State's commitment to the Ramsar convention, the Japan and China migratory bird agreements, and the national strategy for the Conservation of Australia's biodiversity.

However, after twenty years of wetland inventory and policy development to implement better water and wetland management (Hill, 1996; EPA, 2004c), because of the lack of implementation of wetland protection laws due to opposition from property rights and town planning spheres, the Government has instead mapped the rapid decline of Perth's wetland habitat. Two State Governments have now baulked at implementing the critically important protection laws for the best remaining 14% or 3600 Swan Coastal Plain wetlands, after almost a decades of work preparation for each attempt, in 1998 (GoWA, 1998) and now in 2006. The wetland protection law for adjacent wetlands in the South West Agricultural Zone is also similarly not yet effectively implemented (WA Government Gazette, 1997) following radical changes acquiescing to rural interests during release.

Hopper et al (2004) reported the biodiversity of Perth, its wetlands and its scarp are among the most biodiverse on Planet Earth, and the mega diverse focal points of the UNESCO South-West Australia Global Biodiversity Hotspot.

Fortunately Western Australia currently has recent and good vegetation protection laws that may be used to protect some wetland vegetation (WA Government Gazette, 2004). Perth also has its Swan Canning Rivers Environmental Protection Policy that may also be used to protect wetlands linked biologically and hydrologically to the river system. There were groundwater protection policies (eg Jandakot Groundwater Statement of Planning Policy, SPP No 7) and previous environmental management areas (EMA's) determined for wetlands and their buffers and catchments on the

Jandakot Mound. These policy initiatives are seldom referred to and perhaps have been forgotten. At this stage the laws are not well known and probably not used creatively and effectively to slow the loss of Perth's valuable wetlands.

A promotional strategy may be required in Perth for its wetland and river protection. A more visible alignment with the leading Ramsar Wise Use of Wetlands and CEPA strategies (Ramsar Convention Secretariat, 2004i) by the State and Local Governments may assist in this task. The UNECE (2005a; 2005b) has developed a strategy called Nature for Water that recognises the importance, and economic value of the ecological services that vegetated wetlands and streams provide that might be useful for negotiations in Perth.

Water Allocation Planning: Droughts and Flooding Rains, Getting back to Water Balance

The Whadjug and early settlers used Perth's central wetlands as water supplies (Seddon et al, 1986). Groundwater wells were a valuable addition to these water sources when Perth's wetlands water quality declined (ibid; Hunt, 1980). These water supply sources were soon augmented by a number of small dams, including the Victoria Dam on Munday Brook, built in the vicinity of the village where Wilson (1835) met the Beeloo people in October 1829. In the last twenty years many small dams have been upgraded into much larger storage dams. A new Victoria dam was constructed in the mid 1990's. The Aboriginal village and the sharing of sweet water documented by Wilson, remains uncelebrated. Many of Perth's new storage dams have not filled.

Perth is still a city of wetlands with high groundwater (Del Marco & Hill, 1992; MWA, 1983; 1985). Perth was for a period negotiating effectively to protect its water balance (Cargeeg et al, 1987; Tan & Loh, 1989). However, currently groundwater is being drained to the river and ocean in increasingly unsustainable ways. This possibly wasteful use of Perth's current water must be acknowledged, to properly consider the appropriateness of new proposals for inter basin transfer. Such a proposal is currently being considered to redirect large quantities of the Yarragadee aquifer water that currently supports the native fish nurseries and other life of shallow wetlands on the Global and Australian National Biodiversity Hotspot of the Scott Coastal Plain wetlands (Hopper et al, 2004). This proposal is a low economic cost source for more first class water, for often second class purposes, including garden watering, in the already high groundwater, highly drained and not water recycling, City of Perth.

Contemporary Perth's continuous rainfall record approximates to 120 years. We also have useful anecdotal rainfall records extending from exploration of the Swan River by Stirling and Fraser in 1827. The current thirty-year drought is matched by a similar period of drought from 1885 to 1915 (Commander & Hauke, 2005).

Commander and Hauke (ibid) showed how useful the October 1968 photographic records were to provide sustainable development advice around Perth's groundwater mounds. Water Agencies and consultants, (eg GB Hill & Partners, 1995; Evangelisti et al, 1996, Rockwater, 1996) regularly provided advice on maximum groundwater levels and estimates of Average Annual Maximum Groundwater Levels (AAMGL) for drain inverts and benign integrated wetland friendly, water balance and water

quality planning advice recommending as well 1.2 m sand pads. The good sense of this approach is as obvious today as when required during and after the Perth's Urban Water Balance Study (Cargeeg et al, 1985).

Teakle and Southern (1937a, b) also commented on the difficulty of managing land and water with underlying bands of acid sulphate soils, below Herdsman Lake and the wetlands and peatlands of the Swan and Scott Coastal Plains. They document the effect of drainage of wetlands at Herdsman on natural sediments and the resulting sulphuric acid poisoning of plants.

The water table of fresh superficial groundwaters in the South West of Western Australia often lie vertically between sediment with a salt bulge above and a band of peat or mottled clay with acid sulphate soils below (ibid; Hammond & Mauger, 1985; Appleyard et al, 2004). Sustainable management of groundwater and groundwater dependent ecosystems and sharing of sweet water, may require not taking too much fresh water for too long and also having a more continual and dispersed extractive demand, by plants or distributed bores.

Strategic Drainage Planning, Urban Water Management and Water Sensitive Design

The program known as strategic drainage planning or water sensitive urban design once focused on water balance, water quality, water conservation, water related environment, water related culture and water related recreation (Tan & Loh, 1989; Tan, 1992; Whelans 1993, 1994; Del Marco & Hill et al 1992, Hill et al 1996).

There is currently a tendency in State Government away from responsible advocacy of water resource management, under the guise of requiring concurrence from and avoiding conflict with other Agencies. At senior government levels, what started with collaborative interagency work with the planners has led to water and wetlands issues being interpreted within the planning locus, and not within confident Environmental, Wetland /Water and Heritage Agencies.

Perth now has hundreds of water supply, sewerage and drainage managers in the Water Corporation, Department of Water, Swan River Trust, Local Governments and Department of Environment and Conservation. Unfortunately there are few integrated urban water management and wetland planners and only a few effective advocates for the Wise Use of Perth's Water and Wetlands.

Government Agencies have reportedly stopped asking for wetland water regimes to be protected from harm from drainage inverts placed below Average Annual Maximum Groundwater Levels (AAMGL). This may cause significant protection of people and pollution problems, particularly for flooding and acid sulphate soils strong acid, and mobilising annually nutrients and heavy metals (Appleyard et al, 2004).

Current Darling Scarp drainage practices are not reflecting water sensitive design' planning and management best practice. Hydrological research shows that healthy jarrah marri vegetation recharge approximately 75% of rainfall (Hammond & Mauger, 1985). Catchment modelling confirm natural catchment times of

concentration of 3 to 5 days after rainfall events in such areas with valuable recharge to shallow and deep aquifers (ibid).

Some upper slope wetlands and creek headwaters remain vulnerable to significant disruption from disruption of recharge, erosive flows from forest management practices, and from urban encroachment and poorly considered stormwater management practices. Stormwater from Urban catchments areas around the world tend towards a time of concentration one hour after rainfall events. The establishment of cuttings for roads and houses into hillside shallow aquifers and the construction of deep drains exacerbate this drainage and short circuiting of shallow aquifers reducing infiltration, shortening of the time of concentration and hence contributing to flooding and erosion risks.

In comparison and at significant cost Tokyo has for a few decades been trying to re-establish recharge and infiltration for groundwater cultivation and restoring the nature and flow of water to springs and other natural areas (Fujita, 1993)

Corridors, Greenways and Heritage Trails

The System 6 reports advocated the establishment of regional parks to act as regional greenways along important natural features including wetlands in Perth (EPA, 1983). Following a number of WAPC State and Metroplan initiatives in the 1980's, a number of Regional Parks are now established. More are planned and increasingly they are recognising and carrying out the valuable role originally envisaged. However, very few of the greenways identified by EPA (1983) or Alan Tingay & Associates (1997) are yet protected. The corridor concept was also visited by Perth Bush Forever (GoWA, 2000) and the Perth Biodiversity Project (Del Marco et al, 2003) and has been adopted by a number of Local Governments (EMRC, 1998). The State has recognised historic Heritage Trails, and has the famous Bibbulmun Walking track and new Munda Biddi cycling tracks.

Though mapped on DIA (2004) Heritage database, the State has also yet to commit resources and strategies to properly recognise and protect registered Whadjug dreaming tracks in parks and greenways. The dreaming tracks often follow the major water landscapes of waterways and wetlands and lend themselves to complementary protection in current and future regional parks.

Natural and Indigenous Cultural Heritage Conservation through Reserves and Site Protection

Recognising their responsibility to the community in this area, a major investment by the Water Authority and the Department of Environmental Protection to secure wetland conservation of the best remaining wetlands in reserves was undertaken for the System 6 Update program (Water Authority, 1995). Unfortunately this work (GoWA, 1998) stumbled when only 20% of the funds needed to purchase identified regionally significant areas was made available by government, to implement Perth's Bushplan. Eight years later, extensive areas of the best wetlands remaining as well as degraded areas have since, and are still being cleared and drained (EPA, 2006).

Following the decision in August 2006, not to implement the twenty year project on the Swan Coastal Plain wetlands protection law (EPA, 2004b), for the 14% or 3600 best remaining natural wetlands on the Coastal Plain, purchase of these conservation category wetlands for parks and conservation reserves might again be the best option.

The Western Australian Water Resources Council commissioned a consultant project on the Aboriginal Significance of Wetlands in the Perth to Bunbury region to allow due and appropriate recognition to Aboriginal cultural values in the State's water allocation and water planning work (O'Connor et al 1989). This provided one of the first opportunities for acknowledgement of the religious value placed by Perth's Whadjug people in living water, and in a number of special areas across Perth.

Whadjug Elders have spoken out in concern about threats to important Perth wetlands and waterways. However rather than treated respectfully, they have often been pilloried in the press. Some areas that this has happened include the Swan Brewery, Bennett Brook, Munday Swamp, Perth Airport, Wright Swamp and Kadina Brook.

Negotiating the dialogue to respectful recognition in decisions of important areas remains fraught with risk, and neglect, and continues to impoverish the community in terms of trust, understanding and sustainability. The interaction with the Whadjug Nyoongar at Gooningup for the Perth's Swan Brewery Reconstruction (Vinnicombe, 1989) as with the Narrandjerri in the Hindmarsh Island Affair (Simons, 2003) in South Australia were destructive, and very painful to those involved, but they also provide important opportunities for modern Australia to adjust to and learn from Indigenous Australians.

Some of Perth's best, registered, protected, and priceless archaeological sites, often also wetland sites are currently being destroyed, for instance by the Commonwealth Government at Perth Airport (Hallam, 1983) and more generally with tacit support and less than adequate recognition or constructive protection processes by the State's planning and environment and heritage Agencies (WAPC, 2003b; 2003a).

Sustainability Strategies, Religion and Intergenerational Equity

Perth has a legacy of good conservation and sustainability strategies, including the System 6 report, (EPA, 1983), and linkages to World, National, State, and some District Conservation Strategies (IUCN, 1992; Department of Home Affairs and Environment, 1982; Department Conservation and Environment, 1987; Shire of Kalamunda, 1995); and more recently the State Sustainability Strategy ((Department of Premier and Cabinet, 2002).

Perth has also had urban water balance studies, water allocation, water development and water conservation strategies (Webster, 1986; Hill & Nicholson, 1989) and sub regional water resource management strategies (Tan, 1992; GB Hill & Partners, 1995; Evangelisti & Associates, 1994a; 1995). It also has approaching three decades of Wetland Conservation strategies (Department of Conservation and Environment, 1977; 1980; 1986; Western Australian Government Gazette, 1997; 2004; EPA, 2004a). Perth also has an improving record of State of Environment Reporting (Chittleborough et al 1987, GoWA, 1998; EPA, 2006). The latest report drew

attention to the current very high loss rate of Perth's remaining natural wetlands (EPA, 2006).

Urgent implementation of existing laws (Western Australian Government Gazette, 1997; 2004) to protect these wetlands is now essential. The loss of Perth's natural and cultural wealth in the last decade reflects a breach of intergenerational stewardship that is surprising, not well reported or understood. The current and possible future loss of Swan and Scott Coastal Plain wetlands for Perth water supplies may also have relevance to the National EPBC Act and a number of International Treaties. An urgent improvement in public and government understanding and implementation of policy for sustainable outcomes by Government is needed in the water and wetland conservation area.

4. The Ramsar Convention and other Global Cultures and the Wise Use of Wetlands in Perth: Water Allocation and Management

Ramsar Wise Use of Wetlands

The Ramsar Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation as a contribution towards achieving sustainable development throughout the world"(Ramsar Convention Secretariat, 2004b). Initiated in 1971, and developed initially with sites and a migratory bird focus, the convention evolved considerably in 1987 to develop strength in the wise use of wetlands provisions.

Wise use of wetlands was defined as "the sustainable utilisation of wetlands for the benefit of mankind in a way compatible with the maintenance of the natural properties of the ecosystem" (ibid). The Ramsar Convention strong wise use of wetlands emphasis is supported by 14 Wise Use of Wetlands Guideline Handbooks (ibid, 2004c).

Wetlands and Water Allocation and Management

The Ramsar Convention has dedicated one of its Wise Use of Wetlands handbooks to water allocation and management (ibid, 2004o). The allocation and management of water guidelines were adopted by the convention in 2002 (ibid).

The RAMSAR Convention Wise Use Guideline handbook on Water Allocation and Management (ibid, 2004o) recognises wetlands as water providers and the types of functions that wetlands carry out as regulation, provision of transport and tourism, production and the provision of habitats and cultural attributes. Regulation includes hydrologic buffers, assimilation of waste and regulation of the hydrologic cycle, including the cycling of water for rain (ibid).

Water Towers and Nature for Water,

The Ramsar Convention World Wetlands Day theme for 2003 was *No wetlands-No water* (Ramsar, 2003), and the World Wetlands Day 2004 theme was *Wetlands at*

Work for Us, complemented by the brochure *Working for Wetlands* (Ramsar, 2004r). Perth water Agencies did not build on either of these promotion and education opportunities for the wise use of wetlands locally.

The Ramsar Convention recognises catchments as water towers and wetlands as water providers, which regulate and purify water, as well as being water users. Also that wetlands require a certain amount of water to continue to supply quality water, as well as the many other services and products now recognised (ibid). Ramsar is seeking ways to support appropriate allocations of water to wetlands as demands continue to rise in the face of increasing droughts and desertification (ibid).

Perth's wetlands can be seen to be water providers and regulators for its four water towers (ibid, 2003; 2004r): Cloverdale, Dandaragan, Gnangara and Jandakot. The wetlands of these water towers are the providers, filters and regulators of groundwater and surface discharge to streams. The evapotranspiration from these woodlands and wetland forests raises humidity and may contribute significantly to local rainfall. Just how much is contributed is an important question requiring investigation. Perth catchment managers have a responsibility to keep wetlands and woodlands healthy and to not harm the system with their management.

The recognition of the importance to sustainability and of the economic value of nature on water, and wetland ecological services, are being encouraged in Europe in the Water Convention's *nature for water* work (UNECE, 2005a; 2005b). A similar recognition is needed in Western Australia where wetlands the providers of many of these ecological services are being rapidly lost.

Corridors, Migratory Birds Flyways, and 40 Steps Restoration Case Study

Perth is part of international flyways of international and national migratory birds that feature stops on Perth wetlands. The State Wetland Conservation Policy (GoWA, 1997) recognises our responsibility in this area. Hails (1996) identified the complementary nature of Ramsar Convention and the Biodiversity Convention in this area. A Directory of Important Wetlands (Lane et al, 2001) provides coordinated National and State attention to protecting migratory bird habitat.

Protecting internationally and nationally recognised wetlands from inappropriate urban and commercial development in the province of State and Federal Governments and private property is not routine and major losses of important wetlands like are common. The absence of planning support and an agreed vision to protect the surrounds of important wetlands or rare species wetlands, or the linkage between wetlands in greenways or creeks in greenways and protecting surrounding upland habitat around conservation wetlands are the key drivers of Perth greenway wetland biodiversity loss

A modification of the culturally appropriate river restoration strategy developed for the Don River in Toronto (Hough et al, 1991) is considered valuable model for use in Perth in this area (Hill, 2004a). Particularly valuable features of this strategy are an elaboration of city greenways vision and steps for its implementation, and the importance and elaboration of roles, responsibilities, principles and processes for all city stakeholders.

Protected areas, the World Heritage Convention and Monuments at Risk in Englands Wetlands

At the Vincent Serventy lecture in Perth 2005/2006, a visiting speaker suggested a South West World Heritage Area was justified and should be a priority for the South West of Western Australia, based primarily on WA's national park and nature reserve system. The values of the Perth area's national parks and nature reserves alone (Morcombe et al, 1981) would also seem to me, to justify such a listing. The scale and number of current nominations of Perth wetlands and linked conservation estate to Ramsar and World Heritage natural and cultural heritage recognition systems, when compared to the nature and number of listings of a country like England are instructive. Western Australian nominations would seem to have been considerably neglected. More systematic listing for the natural and cultural value of the linked corridors of Perth waters, wetlands and conservation reserves system would appear warranted.

The distribution of registered Indigenous heritage sites along rivers and on the banks of wetlands (DIA, 2004), and regional investigations (Hallam, 1987a) confirm the extensive use of Perth's wetlands by the Whadjug over the millennia. However, recent disturbance and inadvertant losses of some of the early middle and late period at the valuable archaeological sites around Perth Airport wetlands (Hallam, 1983), indicate that a similar strategy to English Heritage (2006) perhaps called *Monuments at Risk in Western Australian Wetlands* appears also warranted for improved site protection and promotion and strategic policy in Perth. The Monuments at Risk on English Wetlands (MAREW) Strategy (English Heritage, 2006; Van de Nort et al, 2002) has improved perceptions concerning the protection of archaeological sites on British wetlands.

Sustainability Strategies and Indigenous Participation

The Ramsar Convention (Ramsar Convention Secretariat, 2004b) has been working with the Millenium Ecosystem Assesment (2005), the Convention for Biodiversity, and World Heritage Convention to harmonise these important global initiatives. The Ramsar Convention encourages Perth water planners to also work with these bodies on staff exchange programmes.

Perth's South East Corridor might provide an important Ramsar Case Study for improving the Wise Use of Wetlands (Del Marco & Hill, 1994; Hill, 1996; Evangelisti et al (1994a; 1995a; 1995b; 1995c; Heritage Country Development Agency, 1996) for continuing strategies in Byford Mundijong, Forrestdale Lake and Local Government and Urban Water Management.

The Swan Catchment Council (2004) has provided leadership in Perth for initiatives on establishing and strengthening local communities and Indigenous participation in the management of wetlands, waterways and catchments, also suggested by the Ramsar Convention Secretariat (2004h). Dr Noel Nannup (Swan Catchment Council, 2004) has been a leading influence contributing significantly to cross-cultural education and understanding in this area.

5. Discussion

The Ramsar Convention provides a valuable model for improved wise use of wetlands in Perth. Its work is well organised, credible and has authority. The State of Western Australia has the power in this area. A complementary combination of the two spheres would seem very desirable for improving sustainability outcomes in wetland protection.

The RAMSAR Convention (2004c) Wise Use of Wetlands guidelines should be used in future work in Western Australia. The reviewing of State practices to conform to Ramsar best practice for water allocation and management and to properly consider our responsibility as part of the millennium assessment process, will be even more necessary with further climate change. We should start now. The recognition of the importance to sustainability globally and the economic value of nature on water and wetland ecological services has been recognised in Europe (UNECE, 2005a; 2005b) and urgently also needs to be recognised in Western Australia.

A general improvement in sustainability approaches is required. Groundwater needs to be recharged and kept in storage during wet periods so that it is available for wetlands and people during dry periods. Ramsar recognise that evapotranspiration of woodland and wetland heath contributes to local rainfall, reduce evaporation and you may significantly reduce rainfall. Positive feed back loops are looked for and precaution is obvious. We need such an approach in Western Australia to avoid potential serious damage to our natural systems.

Establishment of drains beneath wetlands at times of historic lows, reduces evapo transpiration, wastes groundwater, permanently reduces water storage and risks groundwater, wetland and river water quality from acid sulphate soils (Appleyard et al, 2004; EPA, 2004a). Current State and Local Government drainage of this sweet groundwater to the Swan River and the Indian Ocean at a time of scarcity (EPA, 2006) is not responsible and is also not consistent with recent international best practice. Building houses on the base of wetlands, at levels that would have been underwater for sixty of the last 120 years is also not responsible, tried alternative good location planning and the appropriate use of sand pads can benignly and significantly reduce flooding and acid pollution risks.

A Hough et al (1991) 40 steps style strategy for Perth is recommended, to share a vision and to elaborate and seek agreement on roles, responsibilities, principles and processes for the restoration of the Swan River. Promotional strategies to share understanding with the public are also needed. The preparation of a Ramsar Convention Secretariat (2004i) CEPA style wetland conservation and public education strategy for Western Australia is recommended. The Ramsar and Hough strategies (ibid) support the engagement of local and Indigenous people in water and wetland planning. The Swan Catchment centre has projects developing understanding of catchment planning and traditional ecological knowledge in water and wetland planning and management. The development and alignment of this local and Indigenous knowledge and education work with International best practice in Perth, is an exciting and emerging area.

An equivalent to the Monuments at Risk on English Wetlands Strategy or (MAREW) work is needed in Perth to protect some of the world's oldest archaeological sites on and next to Perth's wetlands. Indigenous religious, ethnographic and archaeological sites and native pads might be more appropriately recognised as key candidates for appropriate protection in parks and greenways and heritage protection systems in Perth 2006, demonstrating a multi cultural respect for Whadjug heritage. Perhaps the special natural areas and wetlands in Table 1 should be nominated as Ramsar sites and also recognised because of their special natural and cultural heritage values. These areas might also be nominated as a World Heritage Area, and protected in the future.

Table 1: Possible Perth Nominations to the Ramsar List (ibid, 2004g)

The Beeloo Wetlands – The Cloverdale Mound Water Tower

1. Swan River from the Causeway to Walyunga and the Helena River with Darling Scarp Gorges (including Upper Swan and other archaeological and heritage areas);
2. Bellevue, Kadina Brook, Bushmead Catchment with Darling Scarp Gorges (including other archaeological and heritage areas);
3. Brixton St, Hartfield Park and Airport Bushland and Wetlands and Archaeological and heritage areas
4. Canning River with Darling Scarp Gorges (including Upper Swan and other archaeological and heritage areas);
5. Headwater Wetlands and National Parks, Regional Parks and State Forests Catchments (Darling Range Regional Park and National parks)

The Jinjinuk Wetlands- The Dandaragan Plateau Water Tower

1. Avon River, Wooroloo Brook, Julimar, Red Swamp Brook and Bailup wetlands,
2. Walyunga and Avon River Darling Scarp Gorges (including archaeological and heritage areas), Brockman wetlands Chittering, Wannamal to Mogumber,
3. Gingin Lakes, Wetlands and Brook,
4. Ellen Brook, Martyn reserve, Twin Swamps, Yalyal Brook and Lake Chandala,
5. Headwater Wetlands and National Parks, Regional Parks and State Forests Catchments (Walyunga, Avon, Julimar Boonaring & Wilbinga Parks)

The Mooro Wetlands – The Gnangara Mound Water Tower

1. Yanchep and Yellagonga Park Wetlands (including Yanchep and Orchestra Shell Caves and other archaeological and heritage areas)
2. Bennett Brook and Whiteman Park
3. Fremantle estuary, Swan River and Kings Park Foreshore
4. Marmion Marine Park and Perth Beaches
5. Headwater Wetlands and National Parks, Regional Parks and State Forests Catchments (Regional Parks and Proposed Gnangara Park)

The Beeliar Wetlands – The Jandakot Mound Water Tower

1. Shoalwater Islands Marine Park, Fremantle Beaches, Woodmans Point, Coogee and Cockburn Sound, Mangles Bay, Penguin Island, Garden Island, Rockingham

2. Becher, Rockingham Lakes Regional Park and Beeliar Wetlands Regional Park, Bibra, Thomsons, Spectacles, Wellard
3. Southern River, Forrestdale, Jandakot Regional Park
4. Headwater Wetlands in National Parks, Regional Parks and State Forests in the Canning River and Wungong catchments

6. Conclusion

The beautiful city of Perth is still an hydropolis, but its wetlands and groundwater are being lost, unsustainably drained and unwisely planned and managed by government. It is not too late to still use the decades of policy work to make important decisions to protect wetlands in the interests of the community, the environment and future.

Perth has a rich natural and cultural heritage that should be celebrated. The Whadjug stories of a sharing sweet water lifestyle in Perth are still valid. The Walitj and Wordung story can be seen as not only sharing water today, but wisely of sharing water with the future. Such an approach is consistent with keeping and maintaining wetlands and groundwater healthy, wetlands being able to continue to act as water providers and regulators, and is also consistent with international Ramsar Wise Use of Wetlands best practice.

Perth's response to its second thirty year drought, at the same time it tentatively recognises global climate change, needs to be thoughtful enough to recognise both natural fluctuation and climate change drivers at the same time. It is not currently. Our current approach is unsustainable, predisposes us to high property risks from floods, future water shortages and water pollution. We need to instead plan to benefit from recharging floods and for regular droughts, recognising their place in our system, past, present and future.

Serious attempts to improve the wise use of Perth's wetlands including Ramsar listings to protect and celebrate natural and cultural heritage values, might also be seen as signs of respect to Perth's Whadjug. It is clearly in the interest of present generations to sustain the City of Perth's water and wetlands for the future and will also contribute to eminently sensible International obligations to seek to protect the special heritage areas and water systems of Perth and planet Earth. I hope this paper on the sharing of sweet water contributes to such a future.

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8. Notes on the Author

Hill Alan is a PhD candidate at Murdoch University where he works on Culture and the Wise Use of Wetlands.

Alan worked with Perth's Metropolitan Water Authority on a GIS mapping based hydrology and salinity research and modelling project in the Ellen, Jane and Susannah Brook catchments from 1982 to 1984. He prepared the 1984 and 1985 reviews of Annual Water Consumption in Perth and used this knowledge in 1986 in the development of water conservation initiatives including the modelling of the new water conserving water tariff for the Water Authority of Western Australia.

As a Research Officer and Senior Water Resource Planner, Alan provided advice from 1986 to 1993 on Environmental and Cultural projects in support of Regional Water Allocation Planning in the Perth to Bunbury Region and for more than a decade, provided strategic water planning and strategic drainage planning development control advice on Perth's urban planning strategies. Alan was one of the people who developed and established water conserving design and water sensitive design in Western Australia from 1986 to 2000.

After facilitating the Perth Bunbury Region wetland studies from 1986 to 1987, Alan initiated the program of Swan Coastal Plain detailed wetland mapping in 1988, and was for many years, the State Scientific Custodian of stream and wetland mapping classification and evaluation data. Alan was the principal author of **Wetlands of the Swan Coastal Plain Wetland Mapping Classification and Evaluation Report** and **Wetland Atlas** in 1996. Alan worked on Perth's System 6 Update Program, Urban Bushland Strategy, Perth Greenway Strategy and Perth Bush Forever Study.

Alan has recently worked in the School of Environmental Science at Murdoch University and with the Land Management section of the Aboriginal Land Trust. He was recently a member of the panel addressing Inland Waters in the Environmental Protection Authority (2006) State of Environment Report.