Putting the D back in WSUD.

_Invisible engineering: a collaborative design approach to integrating water management with liveable public open space at “The Ponds”_

Authors:

_Martin O’Dea. Associate Director. CLOUSTON Associates, Sydney NSW_

_Ken Nakkan. Senior Civil Designer. J Wyndham Prince, Penrith NSW_

Abstract:

This paper investigates how considered design and a multidisciplinary collaborative approach to integrated WSUD elements can lead to an aesthetically pleasing landscape with high functionality for public open-space, environmental innovation, visitor enjoyment and use through holistic water management meeting best practice.

INTRODUCTION

As Landscape Architects dealing with public open space, we face a range of complicated issues with residential development. The open spaces and recreation corridors for residential estates were described to me by a planning colleague once as SLOAP. That is “Space Left Over After Planning” In other words, it is pretty much the land you can’t build upon, because it is either too steep, floods, or has a large tree stand etc. Because flooding and riparian corridors are essential and have quite a large land take, the trunk drainage corridor often becomes the primary “open space” for residential developments, to maximize housing opportunities elsewhere on site.

Balancing competing uses in the public domain

The difficulty here is how these trunk drainage corridors can also become livable, useful recreation spaces that encourage residents to leave their home cinemas and XBOXes behind, get outside in the fresh air, and do something for their health and well being.

There are multiple and often conflicting uses, needs, desires, and statutory requirements for these spaces including:

- Creek line protection
- Statutory requirements for riparian vegetated filter areas and tree planting.
• Tree removal for fire asset protection.
• Flooding and inundation impacts.
• Potential Aboriginal artifact sites.
• Existing threatened vegetation communities to be retained and protected.
• Heavily weed infested areas to be managed and restored.
• Walking and cycling needs.
• Lawn spaces for kickabout, play and picnics.
• Substantial active sport demands in our suburbs.
• Detention basin needs.
• Raingardens / bioswales placement.
• Trunk Sewer lines and pits
• Electrical transmission towers and lines

There were times when these riparian and drainage areas were the forgotten spaces with residential development backing onto creeklines. This created a wide range of problems from weed infestation, to potential crime. Fortunately now this has largely changed as riparian areas are now typically divided from private properties by a street. This makes the bushland / riparian corridor the front address, provides ample public surveillance, and the street provides a very clear distinction between the public and private domain. The street also provides a valuable unplanted space that can form a large proportion of the asset protection zone, and makes it easier to fight bush fires should that ever be necessary.

As water naturally makes its way to the creekline valley, our WSUD measures such as raingardens, bioswales and detention basins also find their way into this space. These will often have a considerable land take themselves, along with their associated maintenance, management access and infrastructure requirements. To work efficiently they also need to be near level, and it is still amazing how many of these are shown in conceptual planning drawings on sloping land. As they need to treat the water before they reach the creek line, they typically end up immediately adjacent to the street between the creekline and the residential estate.

Given the residential land will often be lifted to raise it out of the 1:100 flood level, quite often with a relatively steep 1:4 batter, this further divides the residences from easy access to the “open space” corridor.

How sensitive are we?

So while we call it Water Sensitive Urban Design, these flood mitigation and water management measures can be somewhat anti-urban themselves in that they divide the
residential communities from the recreational parkland resources that are across the street right outside residents’ front doors.

The late Steve Jobs once commented that ‘Design is a funny word. Some people think design means how it looks. But of course, if you dig deeper, it's really how it works.’

When you look closely at some WSUD infrastructure elements, they are sometimes not that sensitive either. They can often be poorly considered in terms of how they use space, what they look like and how management requirements for these assets are covered. They might function on a purely engineering and water quality level, but at a social, aesthetic, economic and cultural level they might fail. This is where the Design part of WSUD often seems to be left out. Given the substantial design life that many of these structures have, this is a considerable impact – particularly for the residents that have to live with these assets every day.

Good design should not necessarily cost any more than bad design. In the end it is still all the same concrete, filtration media, drainage systems and planting. Take Steve Jobs iPhone - It’s a great bit of design. It’s not just an ordinary phone; of course it makes phone calls, but it’s also a map, a web interface, a calculator, an mp3 player, a camera, the list goes on. It’s so intuitive to use that my friend’s three year old thinks you interface with all screens by swishing your fingers. But its success arguably owes a lot to the fact that it’s beautiful; it fits nicely in your hand or your pocket, doesn’t need a stylus that you can lose, and doesn’t have buttons that take up valuable multifunctional screen space. In other words it is a complete package and you can tell they put a lot of thought into it. So much so that everyone else is copying them.

**Putting the D in WSUD**

This paper is entitled “Putting the D back in WSUD” and is about good design, early collaboration and giving places value. The subtitle “Invisible engineering” is from my co-collaborator, Ken Nakkan of J. Wyndham Prince (JWP), who has worked with CLOUSTON Associates for the last six years on The Ponds, as well as other sites such as Bunya Estate. His view is that the engineering elements should be so seamlessly built into the landscape that you hardly notice them. The result should be liveable open space that that is accessible, useful, meaningful, attractive and enjoyable.

**THE PONDS**

The Ponds is a benchmark sustainable development by Landcom and Australand comprising 3200 residential lots and over 88 Ha of parkland along Second Ponds Creek within the Blacktown Local Government Area in Sydney’s North West.
The site is underlain with Wianamatta shale which produces the rolling landform so typical of Western Sydney and clay soils which have low permeability and poor drainage.

Originally comprising Cumberland plain woodland, the site had been largely cleared by the mid 1880’s. The lower lying areas of the drainage system have high salinity in the B horizon, from salt migration, and approximately one third of the creekline was affected by erosion and salt when the site was acquired by Landcom in the late 90s. [1, p13]

The project began over a decade ago and CLOUSTON Associates and JWP’s involvement began in 2006, after the masterplan had been established, and early creek restoration works commenced. The 320Ha site is located in the upper section of the 1440 Ha catchment for Second Ponds Creek, a tributary of Cattai Creek, which flows into the Hawkesbury Nepean River.

The site is subject to high variation in rainfall, with an average of 700mm /pa, and a summer evaporation rate of around 150mm –180mm / month. When we began the project, the site had been suffering from an extended El Nino induced dry period that begun in 2001, which influenced our ideas. [2. p6]. This is quite different to today where we are enjoying a short wet period.

A COLLABORATIVE APPROACH TO THE DESIGN OF THE PARKLANDS’ ICM / WSUD MEASURES

An essential part of the approach we took at The Ponds, was the close interaction between the principal Engineer and the Landscape Architect, with a focus on not only the engineering performance but aesthetics, functionality of the parklands, economic benefits to the client and social benefits to residents. This was achieved by:

- A shared understanding of the system and measures employed.
- Establishing design principles to guide the aesthetic development of the stormwater measures as well as maintaining pedestrian accessibility
- A desire to ensure that the WSUD measures benefitted not just the environment, but provided social and economic benefits to residents as well.
- Clearly communicating ideas with diagrams and illustrations to the client.
- Using 3d modelling to design complicated concrete geometries and using perspective illustrations to assist with client and team visualisation.

ESTABLISHING DESIGN PRINCIPLES

In developing The Ponds, we established a series of overall guiding principles for the parklands. These were based around five key interconnected ideas of:

- Creating a memorable Experience.
- Engaging with Water - A Living Creek.
• Joining People and Places.
• Places to Play and Learn.
• An Environment for All.

Specifically the idea of “Engaging with water” in a semi ephemeral environment was seen as important, where creek systems can often be relatively unseen. Key objectives were to:

• Utilise best practice water management throughout the park land spaces.
• Utilise water and its permanent and ephemeral qualities as a key identifier for the ponds.
• Mimic the natural pattern of holding and releasing water.
• Use strong, simple geometries in the design of raingardens and water bodies.
• Ensure a permeable parkland, that maximized pedestrian accessibility.

There were a number of key objectives for the integrated catchment and WSUD measures for The Ponds which included:

• Protecting the downstream environment from the impacts of flooding
• Ecosystem health and protecting downstream water quality
• Conserving and limiting water usage in the residential development and the parklands

PROTECTING THE DOWNSTREAM ENVIRONMENT FROM THE IMPACTS OF FLOODING

LIMITING FLOODING TO PRE-DEVELOPMENT LEVELS.

Landcom’s objective with all of its projects is to maintain a maximum peak discharge 1.5year ARI event and a stream erosion index of 2. These targets were adopted for the ponds. [3. p9]

The Ponds release area has in place 3 large detention basins situated within the corridor, that provide detention for the 5yr and 100yr ARI storm events. Typically, the detention system for the Ponds and upstream catchments has been designed to treat the smaller 6 month ARI event. The aim of the system is to closely mimic pre development flow
conditions for smaller more frequent storm events. The system complies with Landcom’s sustainability targets for stream erosion index.

The 100 yr ARI Detention basins are both off line and online within the corridor and Rain gardens have storage capacity above the extended detention treatment zone to attend 6 month post development flows.

ECOSYSTEM HEALTH AND PROTECTING DOWNSTREAM WATER QUALITY

In 2004 the targets for the ponds were set at 80%Total suspended solids, 45%Total Phosphorous and 45%Total Nitrogen. [1. p14]

In 2006-2008 when much of our design work was undertaken the water quality targets were set by statutory requirements and Landcom’s own WSUD guidelines at 85%Total suspended solids, 65%Total Phosphorous and 45%Total Nitrogen. [2. p9] The intention was to meet these targets and where possible exceed them. In April 2009 Landcom adopted even higher stretch targets.

This aim was to carefully design WSUD elements to enhance the parkland aesthetic and resident experience. In some cases, the WSUD components were intended to be signature elements, and in other areas to seamlessly fit into the landscape, allowing maximum permeability for pedestrian access and park use. The intention was to create an identifiable image for The Ponds that emphasised water in its limited permanent presence as well as ephemeral events.

Key water quality measures for the Ponds have included;

- Vegetation lined riparian filter strips
- Vegetation and grass lined swales
- Creek line re-construction mimicking natural systems
- Extensive bio retention “rain gardens” all lined to prevent saline incursion
- Gross pollutant traps
- Sand filters
- Constructed wetland Macrophyte planting
- Open water for maximum UV exposure in water quality ponds
- Aeration of water by small cascades driven by gravity
- Limited mechanical systems including reticulating pumps and UV disinfection of some ponds
RAINGARDENS

Working with a masterplan prepared by previous consultants, one of the first changes made by the team was removing linear roadside bioswales. They had been planned for and sited on the road verges running perpendicular to the contours and ending up in the creek within the central corridor. These were proving difficult to provide the necessary treatment and extended detention on the sites grades of 5-6%, particularly in the western release areas. They could only provide for catchments off roads and lots adjacent and could not provide for any piped drainage to enter as they would need to be too deep within the allotted space. These swales were consolidated into raingardens at the bottom of the catchment within the central corridor. While this placed some pressure on the parkland spaces and riparian corridor, it freed up additional development space that increased the lot yield for the development. This was a substantial economic benefit to the client.

The eastern release area had encompassed within the masterplan a continuous ribbon of raingarden between the road edge and the riparian corridor. When the constructability of this system was investigated by the parklands team, it presented a complete divorcing of the riparian corridor from the public. This was due to large pipes entering the raingarden system that was immediately adjacent the road formation. This created a wall of between 1.5m-2.0m high for the entire length of the ribbon raingarden. The solution was to consolidate the raingardens into strategic positions and increase the width into the corridor. The result was to maximize space for passive recreation and increase controlled permeability into the riparian corridor.

*Raingarden locations shown in purple*

The Raingardens were seen as the primary water quality control measure for the estate and in total they occupy approximately 10.2Ha of the 88Ha parklands network. At $200/m² these represent a sizable investment for the client. As not all sub catchments could be managed by raingardens due to geometric and levels constraints, some of the rain gardens are oversized to compensate for areas not treated. In addition the raingardens also manage un-treated stormwater runoff from other developments. As a result, the generation one raingardens were sized to approximately 2% of the catchment.

*Attractive raingarden vegetation maximizing the varied qualities of texture, colour and height of indigenous sedge planting species.*

Where possible the raingardens were designed to have simple clean geometric shapes and lines. Complementing these shapes were attractive planting patterns using the strappy textures and range of colours available with indigenous sedgeland species, so they became attractive landscape features in their own right.
Maximising connectivity in the parklands

Our design principle for “Connecting People and Places”, covering walkability and health and well being objectives, identified that it was essential to easily access the parklands as well as cross the creek in a number places to maximize connectivity within the suburb. We wanted kids to be easily able to get to school or visit their friends who might be on the other side of the creek, or for parents to walk to the shops or community hub. We identified five key creek crossing points that tied in with the proposed road footpath network, as being the most convenient movement route for residents down to the creek. All of these cross creek connections were lit to enable safe and convenient crossings back home after the sun had set.

These links complemented three primary road bridge crossings. As the road networks also incorporate the stormwater drainage to the creek, it was seen as important to off-set the raingardens to ensure that any pedestrian connections were not cut off by their placement. In some cases the raingardens were split to better cater for the linear creek line shared pedestrian cycleway.

Simple design geometries

Throughout the parklands we developed a design language that explores the use of very simple and bold geometric shapes in the landscape – to make the parkland spaces appear clearly deliberate gestures in what will eventually appear to be a natural bushland setting. This simple geometry was applied to lawn spaces, sports fields raingarden and ponds.

Raingarden and media design

All of the raingardens incorporate a 200mm storage volume and a 200mm extended detention volume above the rain garden media bed. The raingarden media was designed to have a high initial flow rate of 500mm/hr to allow for some degradation of capacity by sedimentation and therefore to provide an ultimate capacity of around 150mm -100mm/hr.

One of the issues we faced here was the limited elevation between the road network pipe inverts and the creek line. In order to fit them in the constraints of Riparian corridors, wall edges were used in some instances. These included gabion wall and class 2 concrete walls.

Improving the system

The raingarden excavations functioned as siltation basins while residential construction was undertaken. The raingardens / media beds were normally installed after 80% of dwelling construction was completed. However, on the western side they were installed substantially earlier at the request of the client to improve the amenity for land sales. However, as a
result of heavy rains, and extensive construction areas, the raingardens have been substantially damaged by siltation and will need to be cleaned out and possibly replanted at a later date.

THE EXPRESSION OF WATER ON SITE

In this dry western Sydney landscape it was seen an opportunity to utilize the expression of water in both its ephemeral and permanent state as a way of providing meaning and identity to this particular place. There was a particular desire by the client and joint venture partner Australand for opportunities for visible water on the site. Given the saline nature of the soils, any water bodies need to be effectively “off line” and a range of sites were reviewed with the view to using water as a signature element in creating a memorable experience for the Ponds, engaging people with water, and extending habitat and environment opportunities.

There is something quite special about water particularly in the relatively dry western suburbs. Given the additional cost of such measures of around $200/m2 over raingarden costs it was seen as important to maximize the benefits of open water to the residents for aesthetic and amenity values as well as the marketing potential, land values and re-sale values opportunities, and not just their environmental efficiency. Five sites were chosen that spread the water measures through the sub catchments and maximized the visibility as well as gateway and place-making? (locality) potential of water for the development.

Given that the stormwater drainage design was mostly resolved or already under construction, the water bodies needed to be fed by conventional underground pipes that would tend to depress the static water level, particularly given Blacktown Council’s requirements for dry pipes.

As such we developed as series of design principles to guide the use of water, which were as follows:

- Ensuring people could see the water
- Making the water safe
- Maximizing clear water visibility
- Using open water areas for their aesthetic appeal and reflections
- Playing upon the controlled architectural qualities of macrophytes
- Water systems being primarily gravity driven with minimal or no pumps or equipment where possible
- Creating permeable parklands and not dividing the park from pedestrian usage
While the water bodies could have been built more or less like earth farm dams, a number of considerations including space constraints and a desire to manage the edges for safety, led the team to edge all the ponds with concrete. We developed a design language for the use of concrete and took the opportunity to make these elements into very bold, simple, and sometimes heroic gestures.

**Typical design elements**

We wanted the water bodies to be as safe as possible and were intended to be easy to get out of, should you accidently fall in, as well as making it difficult to get yourself into deep water. As such all of the batters down to the waterbodies are a maximum of 1:6 and all of the edges are controlled with concrete to keep them from being muddy and slippery. They all have a shallow drop into 350mm of water, with pebble walk out zones extending at 1:8 to a depth of approximately 1.2m from all edges before becoming steeper. To maximize water visibility, the sides furthest from the road are the ones with macrophyte planted edges. These are 250-450mm deep. Dividing walls in the water control the macrophyte extent and separate them from deep water. So to get into deep water you need to deliberately wade out quite some way, or fight your way through spiky macrophytes. We realised however, that adventurous children could potentially walk out along the dividing walls which are all adjacent to deeper water. As a result we devised a chisel top to deter walking, but this also challenged the construction ability of our contractors. This design language element was used throughout the ponds for the exposed concrete walling.

**The Dragonfly Pond**

The Dragonfly Pond was located to align with a vista from the main entrance road into The Ponds. The intention was to create series of reflective water bodies that mirror the sky and provide an appealing water view on arrival at the Ponds. The pond treats 2.5 million litres of urban stormwater and at over 85m long, it was important that such a sizeable functional element have a high aesthetic quality. The need to reticulate the water to limit algal growth in the summer months provided the opportunity to locate top sections of the pond up out of the landscape, with the water only 50mm below the edge, to make them clearly visible from the arrival road and adjoining footpaths into The Ponds.

**Dragonfly pond operation**

Rainwater is collected by a stormwater network (1) in a relatively small 6 Ha catchment. A Gross Pollutant trap (2) collects large debris on its way to the pond. Water was initially going to flow directly from the GPT into the top pond, but the built inverts of the street pipe network prevented this. Instead, the water now flows through pipes bored under retained remnant bushland (4) and delivers all low flows to the pond. When the water volumes reach that of a 3month event, any excess flows are diverted into Second Ponds Creek. The water enters the pond via a linear open channel with contains a submerged wetland filter and macrophytes.
A heroic blade wall forms a key design element and provides a powerful gesture in the landscape. A 36 metre long series of 12 Corten steel decorative panels along the wall depicts dragonflies, which rely on clean fresh water to breed – a reference to the pond’s water quality function.

A Sculptural chute (5) contains high flows that will have a maximum rate of 345 litres/second and delivers water to the main pond. Once the water reaches its static water level (6) it then flows into a 100,000 litre underground balance tank (7) that provides evaporation free storage. When the tank is full it overflows to a small raingarden (8) for treatment. In very high rainfall events the lawn bowl also detains an additional 350mm of water to a point where it spills over into the raingarden. The raingarden media bed (9) filters water prior to it entering Second Ponds Creek.

If the static water level in the balance tank drops below 50% a mechanical float valve opens a solenoid valve (10) allowing water to be drawn into the balance tank through a sand filter (11) to refill the underground storage tank.

To reticulate the water, two 17.5 Litres/sec pumps deliver water to top ponds (13), where it is split 5litres/sec into the macrophytes and 30 litres/sec into the clear water zones. These run on average for around 5 hours a day. Water flowing through the macrophytes finds its way back to the bottom pond and is aerated by three 500mm drop downs in pond system (14). Water flowing through the clear water zones does the same. They combine in a lower pond (15) where water falls about a metre over a veil cascade / aeration edge, back into the lower pond where the cycle repeats. A shallow sparkling channel was deleted due to cost.

**Paddle Street Pond – off line pond**

The Paddle Street Pond, is effective due to its large catchment and fully gravity fed system with no moving parts.

Rain is collected by the stormwater network in a 66.2 Ha catchment (1). Part of the upper catchment flows into an existing dam (3) in a park in a neighbouring development and then by overland flow in a grass lined swale (4).

The piped water flows through a Gross Pollutant Trap (2) and a diversion pit (5) directs all low flows up to the one month event to the Paddle Street Pond (6) at a maximum rate of 1200 litres a second. Water in excess of this amount is diverted down a rebuilt tributary channel (7) to Second Ponds Creek.

Water flowing to the pond is split three ways (8) into three sculptural chutes which contain peak flows of approx 400litres/sec and deliver water to the macrophyte beds (9) in the pond. Water flows back to the far end of the macrophyte beds before entering the clear water zones. Constrained gradients between the street invert and the creek invert prevented the inlet pits from being at the far bottom end of each pond, which would have maximized journey length.
Water flows over into the clear water area (10) from the far end of each macrophyte zone and drops down a 150mm cascade into each subsequent pond. A grated drain at the bottom pond collects the water where it is piped (11) to a raingarden. The water flows through the raingarden filter media (12) before being collected in subsoil drains where the filtered water enters Second Ponds Creek (13). In extended hot, dry spells, a portable pump can be installed to reticulate water in a ready made sump.

System improvements

For both ponds, there were very fine design tolerances for the concrete work and this was delivered to a very high standard by the contractors. As all the water was piped into the systems, we could calculate exact tolerances and invert levels.

For both the Dragonfly Pond and Paddle Street Pond there was a 50mm tolerance from the static water level to the lips of the concrete walls. When the dragonfly pump system is running this tolerance drops to only 30mm, with the invert level being managed by small stainless steel weirs or concrete apertures in the wall.

While algae is a key part of the treatment train, one of the issues that arose was filamentous algae coming to rest on the weirs in the Dragonfly Pond and around the apertures in the Paddle Street Pond. This had the effect of lifting the static water level by 20mm in the Dragonfly Pond, leading to water overflowing the concrete walls causing staining. In the Paddle Street Pond, it was raised by as much as 50mm meaning that some of the water in the macrophyte zone could short circuit into the open water zone. This was solved with the introduction of stainless steel skimmer boxes to each outlet. An additional 50mm metal weir was also added to the macrophyte bed walls. The skimmer boxes have proved successful and have been added to the other ponds.

The Jilluk Pond – on line pond

The Jilluk Pond is a 2.0M litre water body, fed by a 50Ha catchment. Unlike the other ponds in the system, the Jilluk Pond is an on line pond, and caters for a peak event of 7500/litres per second.

The pond is located in a narrow finger of parkland, containing remnant Meleleuca vegetation and an area of indigenous cultural heritage significance. In line with the principle for connecting people and places, we identified that there was a likely need to be able to take a short cut across the tributary. As a result one of the key design moves was providing a curving pathway that effectively forms a dam to the pond and detention basin edge. This was designed as a sculptural concrete form that was effectively conical in profile, making for some tricky construction. In the end it was built with shotcrete that was trowelled to make the curving form.
Due to the constraints of width established many years earlier by the street layout, a wall was required to maximize detention capacity. Mirroring the Dragon Fly Pond is a long blade wall, but this time constructed of gabions. In normal situations the water flows through the open water and wetlands and then into a long pair of rain gardens. These have up to 300mm of extended detention space above the normal operating level. Water is then piped to Second ponds creek.

In low flows, water is pumped back up into the open water and macrophyte beds to provide a recirculation system, to minimize algae growth.

In high flows the water will overtop the 2.4Million litre extended detention volume and flow through a rock weir down an energy dissipating cascade and directly into the rain gardens, and use the 300mm of extended detention capacity to flow down into Second Ponds Creek. In an event this large, the water level of the creek will have risen to be sitting a little below the bottom rain garden weir level.

CONSERVING AND LIMITING WATER USAGE IN THE RESIDENTIAL DEVELOPMENT AND THE PARKLANDS

REDUCING POTABLE WATER DEMAND FOR RESIDENTIAL HOUSES.

In line with statutory requirements through BASIX, the houses at the ponds all have high efficiency water devices, from showers to dishwashers, as well as Rainwater tanks. They are part of the Rouse Hill Recycled Water scheme and are targeted at a 50% reduction, some 10% greater than BASIX of potable water use over existing development.

LIMITING POTABLE WATER DEMAND IN THE PARKLANDS – MINIMIZING TURF AND MAXIMIZING BUSHLAND

To minimize water demand in the parklands, over 71% or 62.9Ha of the parklands are indigenous bushland, comprising approximately 35ha of retained existing bushland habitat supplemented with 27.4 Ha of newly created bushland and riparian corridor habitat.

As part of our design principles to provide “Places to Play and Learn” for the 3800 likely residents, as well as to provide interest with a parkland, it was seen as important to provide lawn areas for rest and recreation opportunities. As such there are approximately 22 open lawn spaces located primarily in strategic view corridors, typically at the end or road vistas and pedestrian catchments. Many of these areas are allied with facilities such as seats, shelters, play equipment and BBQ’s and are key destinations for residents. Building upon our geometric design language, to make them appear to be deliberately carved out of the bush/ regenerated bushland, all of these spaces utilize an elliptical shape intersecting with
the road network. We have termed these “managed lawns” as they each have a 1.2m surrounding path that clearly separates the mown lawn, irrigation and fertilizing management regime from the adjacent bushland. This stops lawn areas encroaching on the bush, and similarly, the bushland from encroaching on much needed lawn space.

The managed lawns have been strategically located to maximize visibility of lawn open space to residents and limited in extent to reduce the overall water demand for the parklands.

Perhaps because our consultancy began at the end of an extended El Nino induced dry period, all of the lawn areas have been set up to be irrigated with sub surface, wide spaced KISSS (Kapillary Irrigation Sub Surface Systems) irrigation systems to provide resilient parkland lawn spaces during dry times. The irrigation system draws recycled treated wastewater off the Rouse Hill Water Re-use Scheme. In periods of extended hot and dry weather, the total water consumption for all 22 lawns can be provided by the waste water from approximately 4-6% of the houses on site. For the majority of the time, this usage level will be considerably less. The ability to draw upon the highly predictable waste water stream was seen as a way to climate proof the lawn areas for many years to come, in what are anticipated to be hotter and drier periods for Western Sydney.

LIMITING POTABLE WATER DEMAND IN THE PARKLANDS –

STORM WATER CAPTURE AND RE-USE FOR SPORTS FIELDS

While street trees capture their own water from the kerb gutter system, the most significant measure here is the capture of stormwater and excess irrigation water and its re-use in irrigating the large 5.9 Ha of Playing fields. For the 2.3Ha Eastern Playing field this system captures storm water off the sports fields themselves, the adjoining spectator embankments, and pedestrian paving areas (providing a 2.8Ha catchment) through surface collection pits and an extensive subsoil drainage network under the field. This water is collected in a 100,000 litre underground tank that limits evaporative losses and provides the irrigation water supply for the ovals. If during an extended dry period the tank reaches a point close to empty, the irrigation system then draws re-cycled water from the Rouse Hill Water Recycling scheme, until the tank is filled past a preset level by rainfall. Any water provided by the Rouse Hill Recycled Water Scheme is done so under license and is limited to a preset capped amount.

The system can work with such a small storage tank as the irrigation is all provided by a highly efficient KISSS subsurface textile irrigation system providing efficiencies of up to 60% over conventional surface irrigation systems. The underground lines have been spaced to maximise efficiency for the specific soil type used here. In addition the system can safely deliver recycled, treated water. Any water not utilised by the turf for growing, is recaptured through the extensive sub surface drainage network.
RESULTS

We know from observation that the waters leaving this system appear to be pretty clear. The new raingarden and wetland communities have increased the range of habitat on site and we have seen a number of animals, birds and insects, including darters, ducks, dragonflies and turtles colonising these areas.

While real world testing data is not yet available, we are hoping that in the future, once the large proportion of residential development has been completed, that water quality testing can be undertaken in a number of locations throughout the catchment to provide an analysis of how effective the predicted theoretical modelling actually is. This would provide valuable data that could be used to more efficiently size raingardens and other measures for future developments. While not used in any calculations by Blacktown City Council we would also hope that we could ascertain how much water quality work the rebuilt creek line is also adding to the system.

As part of Landcom’s Triple Bottom Line reporting, independent evaluation indicates the water quality outcomes are meeting best practice targets with reductions of 94% in TSS, 76% in TP and 46% in TN [3. p63].

Despite the extensive raingarden network at the ponds, the parklands are highly permeable and with the creation of extensive walking and cycling networks, it has become an environment for healthy living. Indeed it is attracting regional visitors and not just locals. The ponds have become a symbol for the site and provide much need visual amenity in an otherwise dry landscape.

SUMMATION

At the Ponds, considered design and a multidisciplinary collaborative approach to the integrated WSUD elements have led to an aesthetically pleasing landscape with high functionality for public open-space, environmental innovation, cost effective maintenance and holistic water management meeting best practice.

The conference theme may be maintain focus, but we all need to be pushing the boundaries, and making good design an essential part of our work.

The opportunities that exist here to put the D back in WSUD include:

To look at the design of WSUD measures beyond their engineering efficiency and integrating them into the landscape as valuable elements that also

- Promote pedestrian circulation and connectivity
- Are aesthetically pleasing
- Provide and extend habitat
• Tell a story to residents that brings awareness and understanding
• Add value to the landscape

Secondly to ensure early collaboration between the design team members to maximize the opportunities for integration of WSUD measures into livable parklands as part of residential developments. Given their significant footprint requirements, they have a considerable urban impact, and early planning rather than adding them as an afterthought is essential.

Finally, if we as designers of the built environment, wish to give places meaning and enhance value and enjoyment for the residents who live there, we need to take another piece of advice from the late Steve Jobs;

“Be a yardstick of quality. Some people aren’t used to an environment where excellence is expected.” Steve Jobs

Let’s create that environment together.
Bibliography / Sources


