CRCWSC Research Synthesis

Reporting document | CRC for Water Sensitive Cities

IDEAS FOR TONSLEY

Adelaide 30/31 October 2013

CRC for
Water Sensitive Cities

Background of the CRC for Water Sensitive Cities

Prof. Tony Wong
CEO, CRC for Water Sensitive Cities

Cities are dynamic systems that are constantly changing and reinventing themselves. The transformation occurring at Tonsley will see an industrial site repurposed as an education and residential precinct, and is a wonderful example of vibrancy and urban renewal in South Australia. The Tonsley redevelopment project also provides an opportunity for the CRC for Water Sensitive Cities (CRCWSC) to introduce water sensitive innovations into an urban redevelopment setting. Urban environments are burdened by varied and complex sustainability challenges, but they also contain enormous potential to use design ideas and solutions to ameliorate these issues. The integration of these solutions across research disciplines is best expressed through urban design.

Many of the research activities undertaken by the CRCWSC are relevant to the Tonsley redevelopment, and our research could guide design decisions that address a wide range of potential social and environmental challenges – from restoring the ecological health of urban waterways and creating biodiversity corridors, to implementing decentralised technologies for integrated urban water management. Our approach to delivering water sensitive cities follows the urban design led platform without diluting the rigour of the individual research disciplines that generate the ideas and solutions in the first place.

The Tonsley redevelopment was an engaging case study for the CRCWSC's Industry Partners Workshop in October 2013. Our workshop set a number of challenges for the 128 researchers and practitioners that attended. These delegates represented our 75 partner organisations, which include water utilities, local and state governments, land development businesses, engineering consulting groups, landscape and building architects, urban planning organisations and community groups. The results of the two-day workshop are captured in this report, which provides a collation and illustration of the ideas generated at the workshop. It is founded on the research insights gained thus far from CRCWSC research as well as the knowledge and experience of the workshop attendees.

Background of Tonsley

Philip Donaldson
Renewal SA

In 2010 the Government of South Australia purchased the former Mitsubishi site at Tonsley with the ambition of creating a high value manufacturing industry cluster of innovation and collaboration, facilitating the transition of manufacturing jobs in South Australia to high-technology, knowledge intensive, specialised products and services that can compete in a high cost environment.

The redevelopment of the 61 hectare site, located 10 km south of Adelaide's CBD will deliver an integrated mixed use precinct that combines industry, education, training, research, and residential living and community amenities. It will be supported by low carbon and climate resilient infrastructure, technology and systems that will demonstrate innovation and excellence in urban design, governance and delivery models.

Tonsley will be a demonstration of sustainability and innovation in urban growth, seeking the Green Building Council of Australia (GBCA) 'Green Star – Communities' rating - independent verification that Tonsley is one of the world's most sustainable communities. It will be energy and water efficient, while connecting people to urban centres through close proximity to a transport corridor, revitalising a former industrial site and creating a vibrant mixed use precinct with an emphasis on design excellence.

Workshop intent and methodology

Jon Shinkfield
CRC for Water Sensitive Cities , Program D5.1

The intent of the workshop was to bring together and articulate the most current thinking of the CRCWSC, recognising this as an undertaking with a degree of immediacy: to record and apply this thinking across the Tonsley site and its contextual area, to provide an independent review of the Tonsley site as considered through the lens of results coming from the various research programs within the CRCWSC, and to test the merits of the current master plan against CRCWSC findings.

The method was simple:

- present current CRCWSC findings, developments and thinking
- distil and interpret these findings for relevance to the Tonsley site and its context
- diagram this thinking into a spatial and readible form and to understand what the priorities might be moving forward
- develop a range of options with varying priorities through group work and collaboration
- demonstrate the value and values of the water sensitive city and what that might mean for Tonsley.

The outcomes of the workshop were never intended to be master plans in their own right or to compete with the master plan that is currently approved for the site. Rather it was to firstly pose a series of 'what if' scenarios where the results would be able to be used to test and inform further detailed development across the site, with the view to creating a more livable, sustainable and resilient Tonsley, and to establish a series of directives that could find application in other developments across South Australia .

←
Ideas of integrated urban forest and water systems delivering an urban coolth.

a. Society

Prof. David Pannell
The University of Western Australia, Centre for Environmental Economics and Policy (CEEP)

We feel intuitively that water features and green space are valued by the community, but quantifying these values is challenging. There is no market for urban wetlands, so we cannot simply observe the prices that people are willing to pay for them. However, economists have observed that the values are often built into other prices, especially the prices of houses. With some clever statistical analysis, and enough data about house sales in an area, it can be possible to determine how much of a house price is attributable to proximity to a wetland or green space, as opposed to the number of bedrooms, the size of the block and how fancy the kitchen is.

These studies have consistently found that people place a high value on water-related and green features. For example, a 2007 study by CSIRO in Perth found that the premium in house prices close to a 20 hectare wetland totalled $140 million dollars. This captures a combination of benefits that people derive, probably including aesthetic, recreational and perhaps social benefits. You might expect that values would be higher for houses that are closer to the wetland or green space, and this is borne out by the research. Water-sensitive infrastructure is also valued by the community.

A recent study of the effect of rainwater tanks on house prices, again in Perth, showed values well above the cost of installing a new tank.

→
Daylighted water systems add biodiversity and urban climate benefits.

b. Water sensitive urbanism

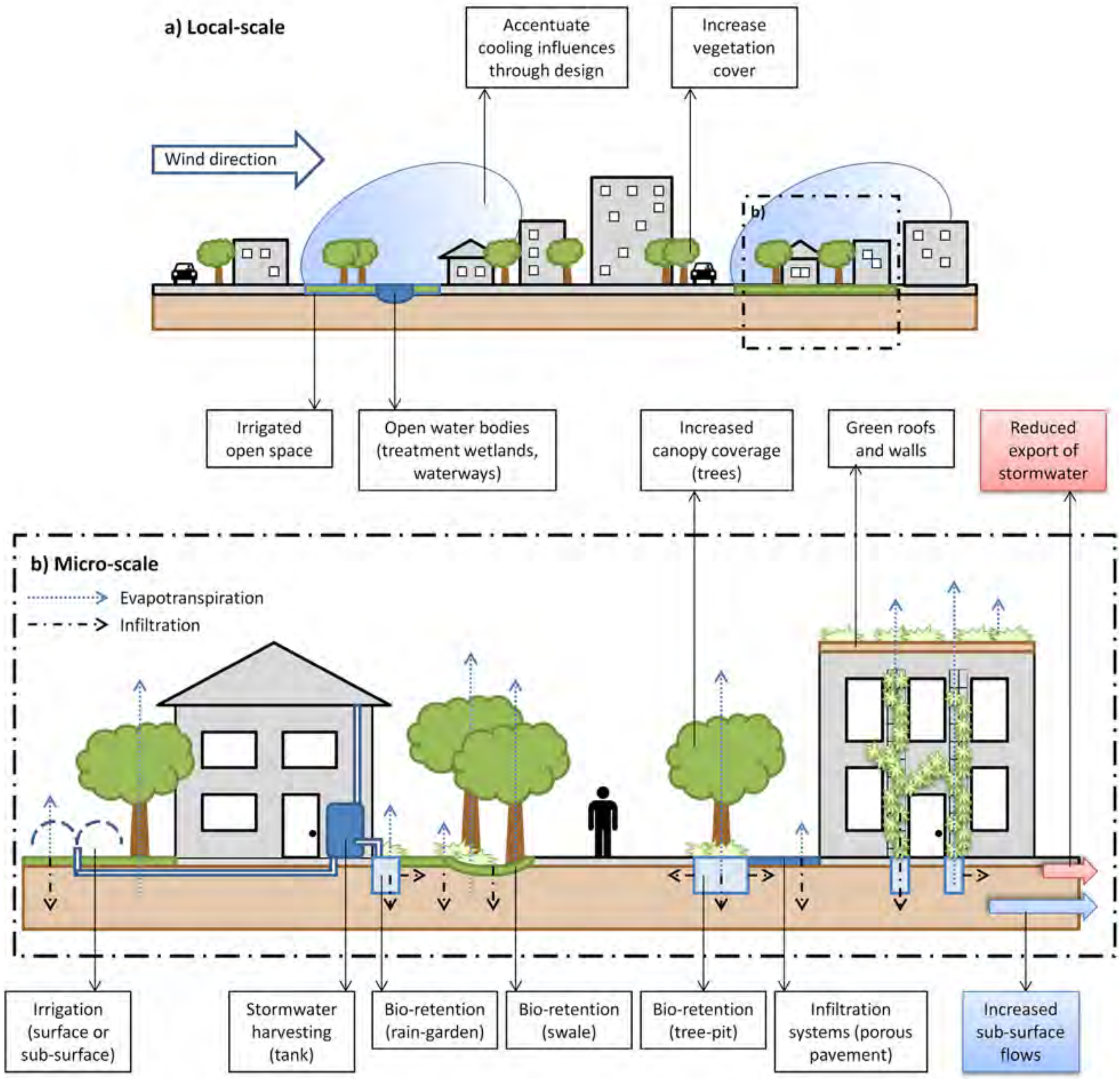
Prof. Nigel Tapper
Monash University, Chair of Environmental Science

Generally high temperatures with occasional intense heat waves characterise the Adelaide summer. For a range of reasons, including human health, these summer heat waves that include extremely high overnight temperatures are becoming a major issue for Adelaide. Climate change is likely to make these heat waves more severe in the future. Our research has shown that Tonsley is one of the most heat-vulnerable areas in Adelaide.

Water sensitive urban design (WSUD) offers a unique opportunity to improve the microclimate of Tonsley by utilising urban stormwater to return the hydrology and landscape to a more natural state and to support trees and other green infrastructure. Provided winter rainfall can be harvested and utilised, the low summer humidity offers probably the best capital city climate in Australia for WSUD to improve urban microclimate and human thermal comfort.

Within the Tonsley development, irrigated green space including tree canopy should be maximised to reduce surface temperatures and radiant heat loadings on people during the day. Within the constraints of the design guidelines, building height to canyon width (H:W) ratios should be minimised to maximise surface cooling, and open space should be provided for heat refuges. The natural wind regime should be used to Tonsley's advantage, by drawing the prevailing west to southwest sea breezes and occasional hot northerly winds across wetlands, water bodies and irrigated green infrastructure on the western and northern boundaries. Airflow corridors should allow the cooled westerly flow to be brought into the middle of the Tonsley development. Cool nocturnal airflow from the east and southeast should also be funneled into the development. Finally, WSUD should be strategically designed into the landscape, prioritising areas of high temperature, high solar radiation, public vulnerability and heavy usage. To maximise the cooling benefit of WSUD and green infrastructure it should be distributed throughout the landscape, not clustered.

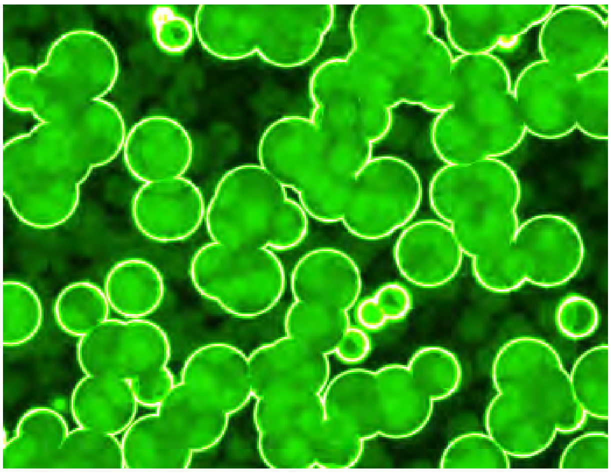
→
WSUD features that can impact the urban climate at a range of scales.

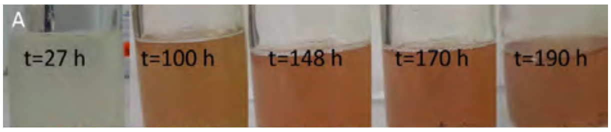

a) Local-scale
Accentuate cooling influences through design
Increase vegetation cover
Wind direction
b)
Irrigated open space
Open water bodies (treatment wetlands, waterways)
Increased canopy coverage (trees)
Green roofs and walls
Reduced export of stormwater
b) Micro-scale
Evapotranspiration
Infiltration
Irrigation (surface or sub-surface)
Stormwater harvesting (tank)
Bio-retention (rain-garden)
Bio-retention (swale)
Bio-retention (tree-pit)
Infiltration systems (porous pavement)
Increased sub-surface flows

c. Future technologies

Dr. Damien Batstone
The University of Queensland, Advanced Water Management Centre

Historically, wastewater treatment has focused on removal of nutrients, organics, and pathogens with a focus on human health and local environmental impacts. However, this requires complex centralised treatment systems and is wasteful of nutrients and the inherent chemical energy in the wastewater, as well as expensive and energy consuming. This is motivating a change in wastewater treatment technology that focuses on recovery of energy and nutrients for fertiliser, while maintaining treatment quality and preparing water for reuse purposes. A number of options are available for smaller communities such as Tonsley, which mainly include centralised (sewer based) collection of wastewater, and treatment to generate sustainable fertiliser for local application, and water for reuse purposes.



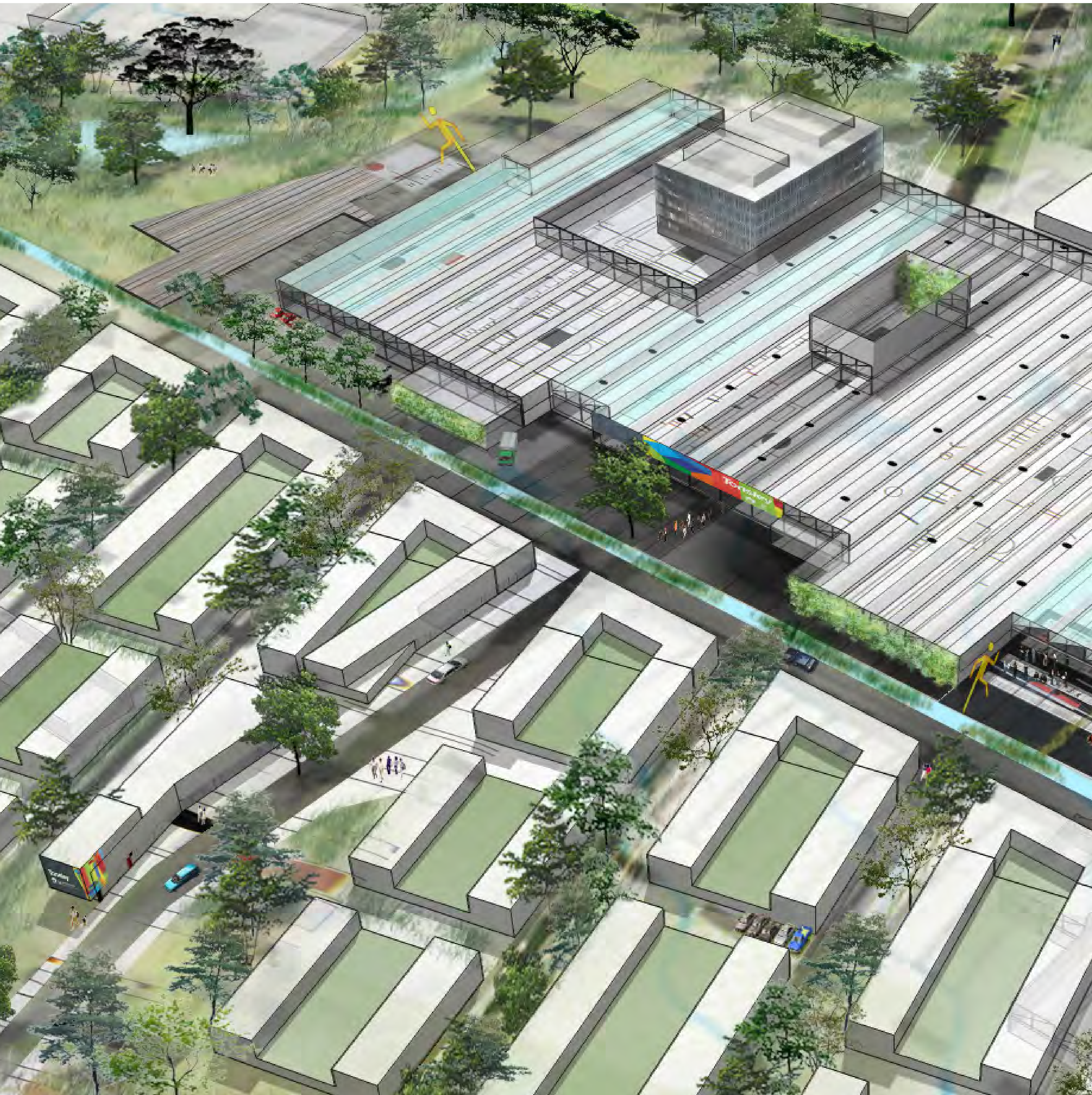


An option being developed by the CRCWSC is the application of specialised bacteria that grow in red light – purple phototrophic bacteria, which assimilate nutrients during growth and are filtered out as a solid product. These can be directly used as an organic fertiliser, or digested to recover energy and nutrients as a concentrate stream. The nutrients available would be more than required for local reuse, and can either be traded locally, or exported for further agricultural use. This kind of process potentially has a lower and less visible footprint compared to existing wastewater processes, and can readily be integrated into local developments such as Tonsley.

↑
Natural wastewater treatment may include algae.

↑
Growth of Rhodobacter bacteria with infrared light.

→
Residential layouts providing for green spaces and solar orientation.



d. Adoption pathways

Ross Allen / Cintia Dotto
Monash University , Water for Liveability Centre

—

The Water Sensitive Cities Modelling Toolkit is a numerical modelling tool developed to support the strategic planning and conceptual design of stormwater management initiatives in a water sensitive city.

What is the Water Sensitive Cities Modelling Toolkit?

The Toolkit contains a number of individual but connected modules based on CRCWSC research outputs accessed via a graphic interface that supports spatial and temporal data input and inquiry, and presentation of results (Figure 1).

The Toolkit incorporates new stormwater and green infrastructure research developed by the CRCWSC to support sustainable, liveable and resilient water sensitive cities and towns. It also accesses industry standard techniques for the quantification of stormwater quality (pollutant load reductions) and the conceptual design of stormwater harvesting systems by dynamically linking to MUSIC (Model for Urban Stormwater Improvement Conceptualisation, developed by eWater). UrbanBEATS (a numerical modelling tool for exploring strategic water sensitive urban design scenarios under development by Peter Bach, Monash University) will be incorporated in the next version of the toolkit (Beta 1 in April 2014).

Currently, users define stormwater management scenarios in MUSIC. These scenarios are imported to the Toolkit and might be linked to a high resolution rainfall dataset corresponding to the catchment location. Rainfall datasets represent predicted variability and uncertainty in current rainfall for a specified location. Simulation and assessment of different stormwater management strategies against a range of measures can then be performed. The Toolkit interacts directly with MUSIC to simulate (run) each scenario and produce specific outputs required for each assessment module.

→
Water Sensitive Cities Modelling Toolkit – overview.

→→
MUSIC model setup.

→→→
Water Sensitive Cities Modelling Toolkit – Microclimate outputs from the model.

Current assessment measures include:

1. treatment and harvesting performance
2. stream health (erosion, hydrology and water quality) impacts
3. micro-climate impacts.

Water Sensitive Cities Modelling Toolkit – Tonsley site

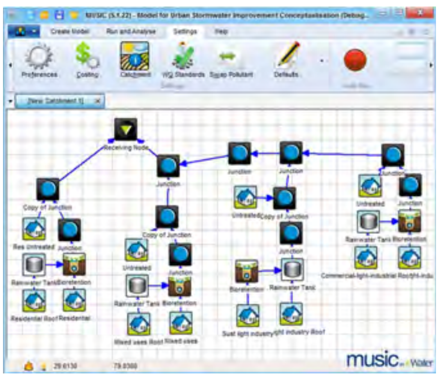
We have used the Toolkit to estimate the possible water quality, stream health and microclimate benefits of a hypothetical stormwater management scenario for the Tonsley site. Stormwater management interventions were designed to cope with the stormwater generated from 80% of the total impervious area of the site assuming that this would be a feasible proportion to treat. Rain tanks were used to harvest stormwater for residential non-potable indoor and outdoor uses such as garden watering, with a reliability of 70% of the time. Rain gardens were used to treat stormwater to achieve pollutant load reductions of 85% for total suspended solids (TSS) and 45% for both total phosphorus (TP) and total nitrogen (TN). Figure 2 shows the MUSIC model representation of the tested scenario.

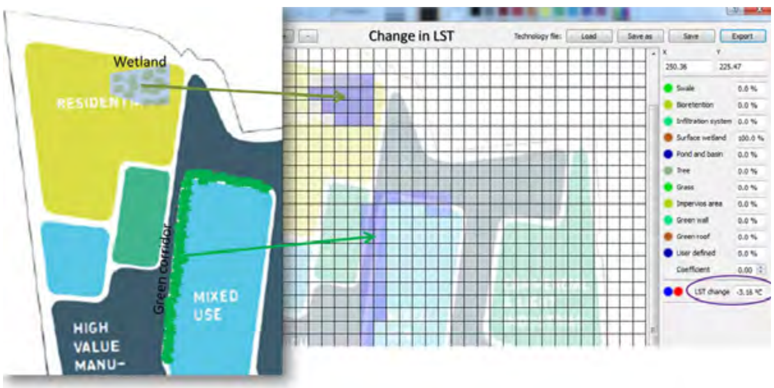
This source control based strategy (i.e. reducing runoff volumes and associated pollutants at or close to where they are generated) achieved the desired pollutant load reductions for the 80% of the total impervious area treated. However, outcomes from the model indicated that the tested strategy enabled a reduction of only 20% of the total runoff volume from the impervious area and there was only limited improvement (reduction) in the number of days with surface runoff. These stream health parameters could be greatly improved in a scenario where a much larger volume of stormwater is stored and re-used. The scenario investigated only considers some outdoor irrigation, but did not account for any demand related to larger parks or ovals.

These results show that different stormwater interventions contribute to achieve different targets; while basin based strategies are efficient in reducing peak flows, they might not improve the frequency of runoff as desired. Therefore, we suggest that an integrated approach should be tested. For instance, it would be very interesting to test an adoption strategy that includes the recommendations provided by the different areas of expertise.

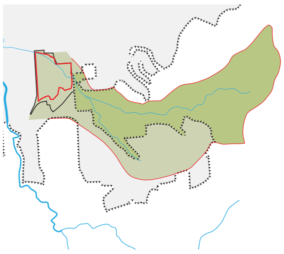
To investigate the possible enhancement of microclimate through green infrastructure, the microclimate module in the Toolkit uses a correlation between surface coverage and summer land surface temperatures based on data measured at 11 am in a south-eastern suburb in Melbourne. We evaluated possible cooling effects generated by a green corridor if implemented in the north-west side of the education centre and also by a surface wetland constructed within in the residential area (Figure 3).

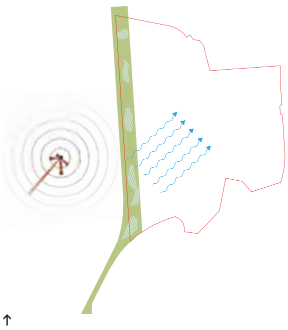
We found that, in addition to the functional and aesthetic benefits provided by these green infrastructure interventions, there is an estimated a reduction of land surface temperatures of up to 3 degrees Celsius.





25 ways to think about creating a water sensitive Tonsley





↑
Tonsley forms part of a larger catchment on the boundary of suburbia and the Adelaide Hills.

↑↑
Use the prevailing winddirection wth a green buffer to reduce heat island effects.

→
Clear road access and circulation support a unique identity.

→→
East-west residential streets shade public open space and provides for optimal building orientation.

→→→
Promote multiple integrated water sytems.

The principles adopted by the groups at the Industry Partners Workshop to guide their development of Ideas for Tonsley were collated and consolidated and are summarised in the following 25 points.

Envisioning

1 **Envisioning** processes are valuable for the visions they produce, as well as the process of bringing people together to develop shared understandings, recognise interdependencies, challenge perspectives and stimulate collective learning.

2 Develop a vision for **orientating short-term actions that lay the foundation towards achieving long-term goals** but to do so they need to be translated to have meaning for different stakeholder groups (e.g. engineers, economists, communities, politicians).

3 Nothing happens in isolation. It always happens in a region or catchment. When **downscaling visions** to focus on a specific project, consideration should be given to potential synergies that could be realised because of the regional context, and the effect that any trade-offs might have on the surrounding region or catchment.

4 Acknowledge and recognise the **traditional owners.**

Business Case

5 **Understand** the implications of current economic regulation, social equity and the need (of key stakeholders) to maintain a low risk profile.

6 **A strong business case** is required to capture both tangible and non-tangible benefits of an innovative approach. It should quantify the environmental and social benefits in a monetary form so that they are properly weighted in the decision-making process.

Public Realm

7 Orientate residential development to the north **capitalising on east/west multifunctional streetscapes.**

8 **WSUD and green infrastructure** should be strategically designed into the landscape to capitalise on reducing summer temperatures.

9 **Take advantage of the natural wind regime** and the availability of water and land along the western and northern perimeter to reduce the impacts of summer heat.

10 Trees should be promoted wherever possible **for reduced urban heat, greater thermal comfort** and reduced energy consumption.

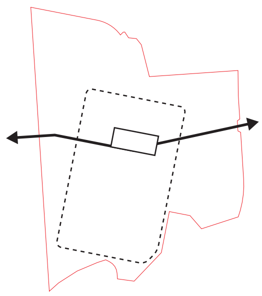
11 Green space at ground level should be maximised and **irrigated wherever possible.**

12 **Waterways in urban catchments have undergone major degradation processes** over many years. It has been argued that most urban waterway restoration projects in highly modified catchments have adopted poor modification templates.

13 Past modifications to waterways often mean pre-development rehabilitation or restoration targets and templates that are no longer relevant. **A remediation approach is proposed to improve the value and function of urban waterways.**

14 **Re-establish natural watercourses** and rebuild environmental corridors to create an ecological link to the northern parkland, slow water flow, and reduce downstream flooding while maintaining overflow access to the existing culvert for flood conveyance during large events.

15 **Active transport routes, including walking and cycling to key destinations,** should be provided and landscaped to provide a good experience and for safety.



Built Form

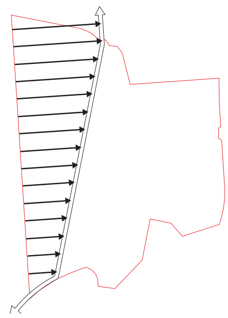
16 Within the constraints of the existing design, **minimise the height to width** (H:W) ratios in built canyons and provide some open space heat refuge.

17 If **green roofs or green/living walls** are used then they must comprise actively transpiring plants supported by stormwater harvesting.

18 **Store excess winter rainwater** for use in evaporative cooling and spray misting techniques in summer heatwaves.

19 Utilise water storage tanks within the large shed to **provide thermal mass** to store and radiate winter warmth and summer coolth.

20 All residents and workers should have **easy access to spaces** that provide opportunities for physical health, mental health and social connection.



Water

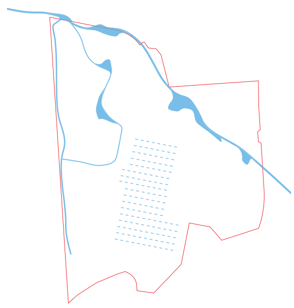
21 **Two types of alternative water** sources are available at Tonsley - stormwater (from the site and from the underground pipeline that transects the site) and wastewater (from localised water recycling and sewer mining). Technologies to harvest water from these sources can complement each other, and moving away from sole reliance on traditional water sources could make the development more resilient to climate shocks.

22 Alternative water supplies should be secured and available for **irrigating public spaces** and for effective transpiration during periods of dry hot weather.

23 **Fit-for-purpose uses** for water from alternative sources include the maintenance of strategically placed, multi-use green open spaces to mitigate the urban heat island effect.

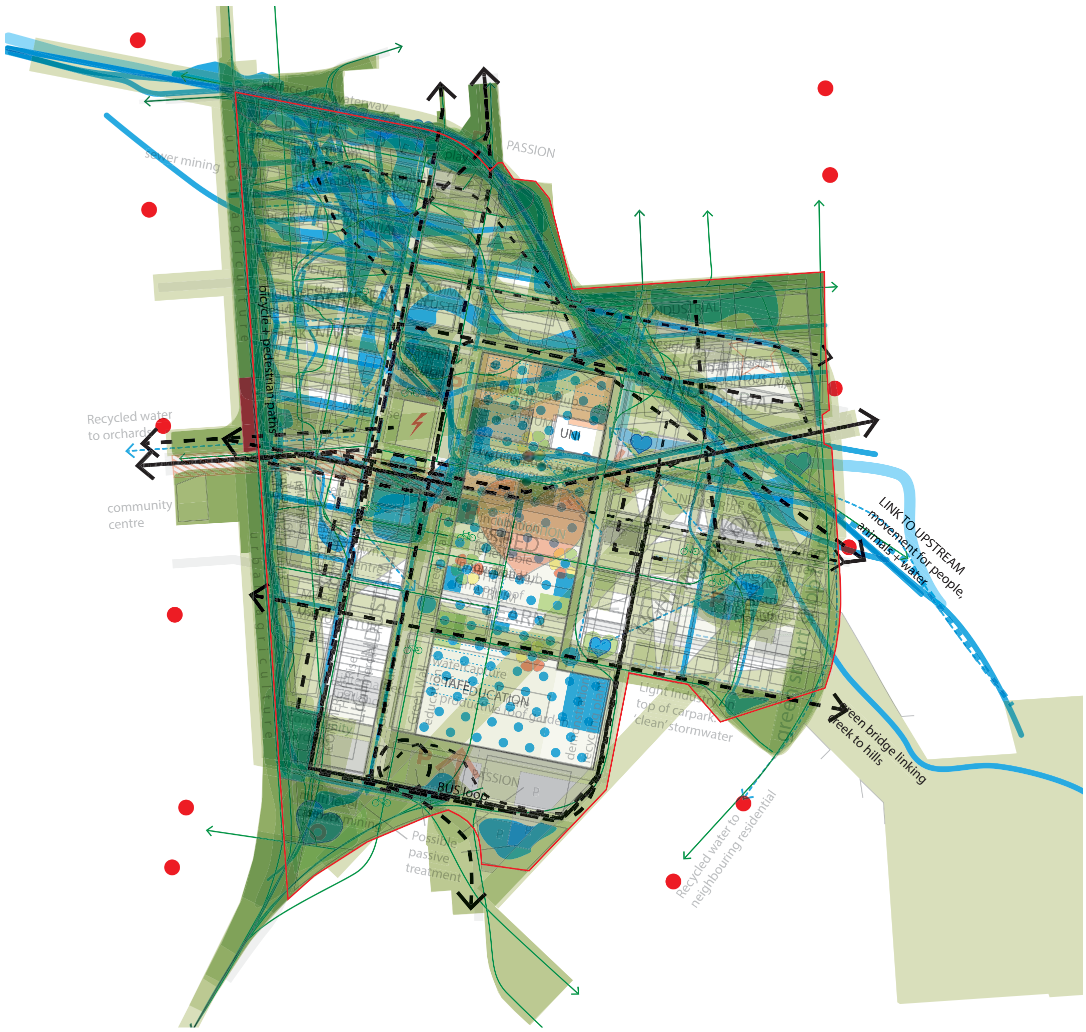
24 Direct stormwater management along major pedestrian and cycle routes to passively **irrigate avenues of shade trees.**

25 **Early engagement** between the developer and the water utility is required to enable strategic planning of the development and exploration of alternative solutions.



Composite diagram

The many layers of thinking compressed and overlain revealing a series of transitions, from dry to wet, green to grey, formality to informality - a representational diagram.



Sketch 1

The current stormwater drain is partially daylighted and expressed through a series of articulated green spaces to the north along the alignment of the drain.

Water is diverted through the centre of the site and conveyed through three consecutive wetlands, functioning as both a cleaning and a cooling device. The green spine along the railway is broadened to accomodate living walls, urban forests, community gardens and underground sewer storage.

Centralised community facilities are incorporated in the existing shed, but reorientate a new frontage toward the diverted reinstated creek. There is a suggestion of a triangulated Live-Learn-Work cycle through the site.

Sketch 2

Reinstate the creek and cleanse the water along the northern boundary of the site and redirect water via a split stream into the residential area for increased amenity and uplift in property value. Introduce a secondary series of wetlands from the south along the railway embankment.

Use this railway embankment as a green connector to neighborhoods west of the site. Five green bands cross the site as green infrastructure services and access corridors.

A residential quarter is situated closest to the greatest green/water amenity. A light industrial area surrounds the existing shed that has a retail precinct at its northern edge.

Sketch 3

A main water system is conceived on the western edge of the site. Three stormwater retention areas are connected through a water system that includes a reinstated creek. Secondary water catchment networks are integrated with small pocket parks/ raingardens to create a dispersed arrangement of parks and water cleansing devices. Significant green spines along the northern and western edges of the site combined with water management and ecosystem services provision. Major access into the site circumnavigates the shed. Secondary access and slow speed traffic follows the edges of the site. Parking fields are dispersed along the main circular road. Streets follow the structure of the shed except in the residential neighbourhood where the layout follows the neighbouring residential structure.

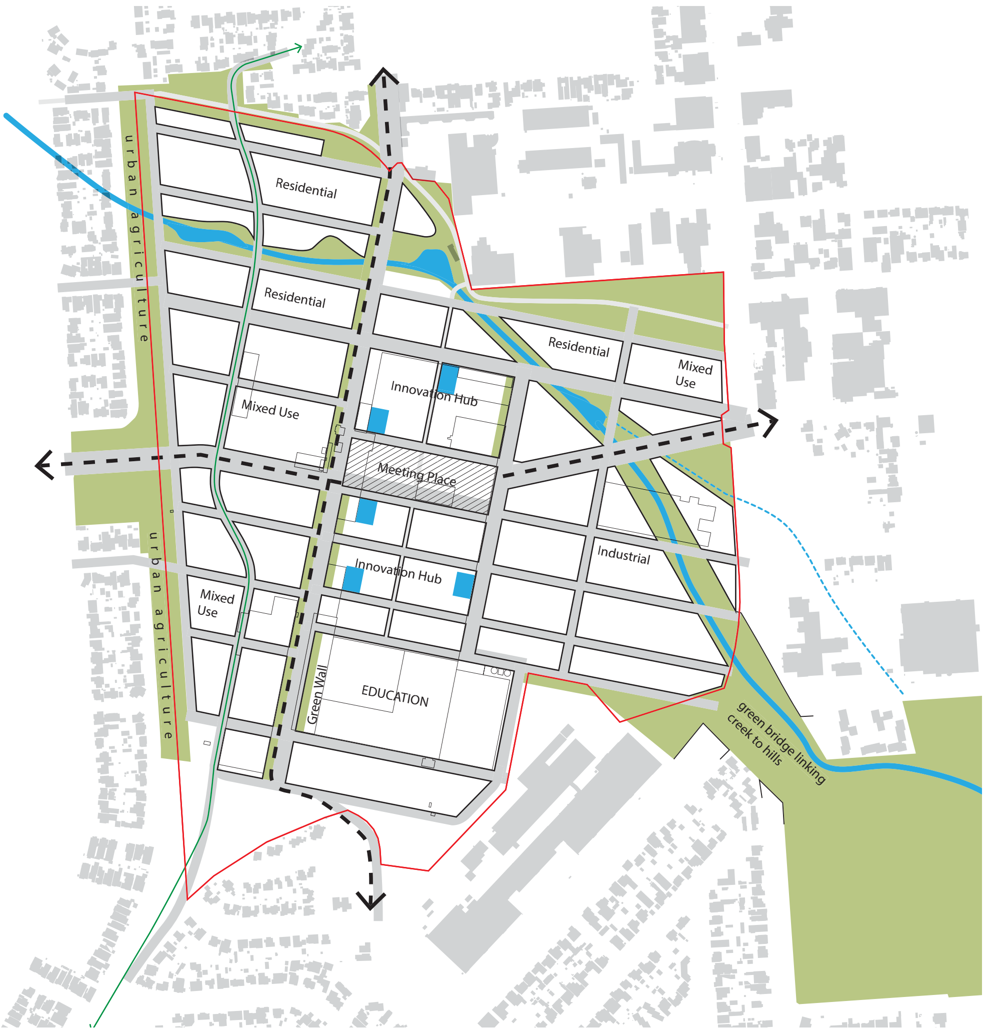
Sketch 4

The creek is reinstated and integrated into the site and rerouted through the residential area to maximise amenity. The shed structure incorporates a variety of urban water elements for cooling and amenity.

Connected green links are incorporated to link areas outside of the site, including ultimately the Adelaide Hills.

East/west and north/south accessways intersect at a covered meeting place at the centre of the shed. Buildings along the north/south spines demonstrate green living walls.

A slow traffic street has been inserted away from this main spine. The streets are all realigned to the existing build form of the shed. The shed is seen as central in a series of places innovatively designed to be conducive to education and meeting.



Sketch 5

The creek is daylighted and connected to a series of conveyance style streetscapes as part of an integrated street forest and biodiversity program. North/south swales filter stormwater before being discharged into the creek. A secondary system flows southwards to collect, cleanse and store water for reuse. Water captured on the roof of the shed is collected in storage tanks and urban forest spaces to cool the building.

Green spaces are divided along the streets facing east/west providing shade and cooling throughout. A green space to the south is used as a site for high tech sewage treatment and storage for reuse prior to any discharge south. Street alignment reflects the orientation of the shed structure.

Site entry and access are aligned with the central technology expression and community hub on the site.

Sketch 6

A creek is reformed to the centre of the site. Multiple water systems are tested along the open creek including recycling, retention, tri generation and ASE. Peak overflow in the system is aligned in a series of wetlands along the railway corridor.

Green parks follow the water system. Large roofscapes are proposed with urban forests or urban farms. In the commercial zones large blank walls are fronted with green walls. A bus loop circulates the southern side of the shed and provides public transport access into the site.

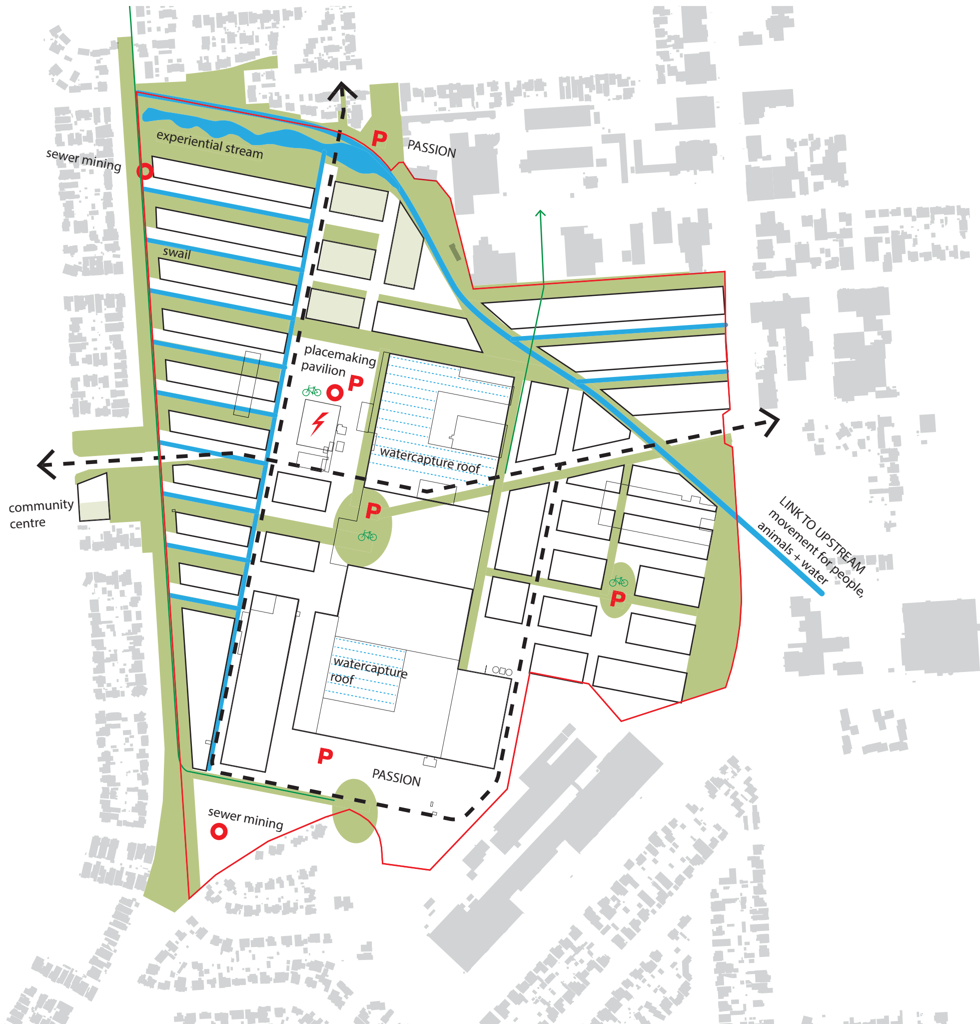
Light industrial buildings are (partly) raised to provide for carparking underneath and the reduction of runoff from carparks. Residential and commercial areas differ in their street orientation - commercial references the alignment of the shed, residential stays consistent with adjoining neighborhoods.

Sketch 7

The creek is reinstated and presents as an experietial stream at the northern edge of the site. Water is captured on the roof of the shed and converted to provide local cooling of the building. East/west running swales provide cool air in streets and clean runoff into the creek.

The urban forest, as part of the water sensitive urban design strategy, provides cooling of up to 3 degrees celcius across the site.

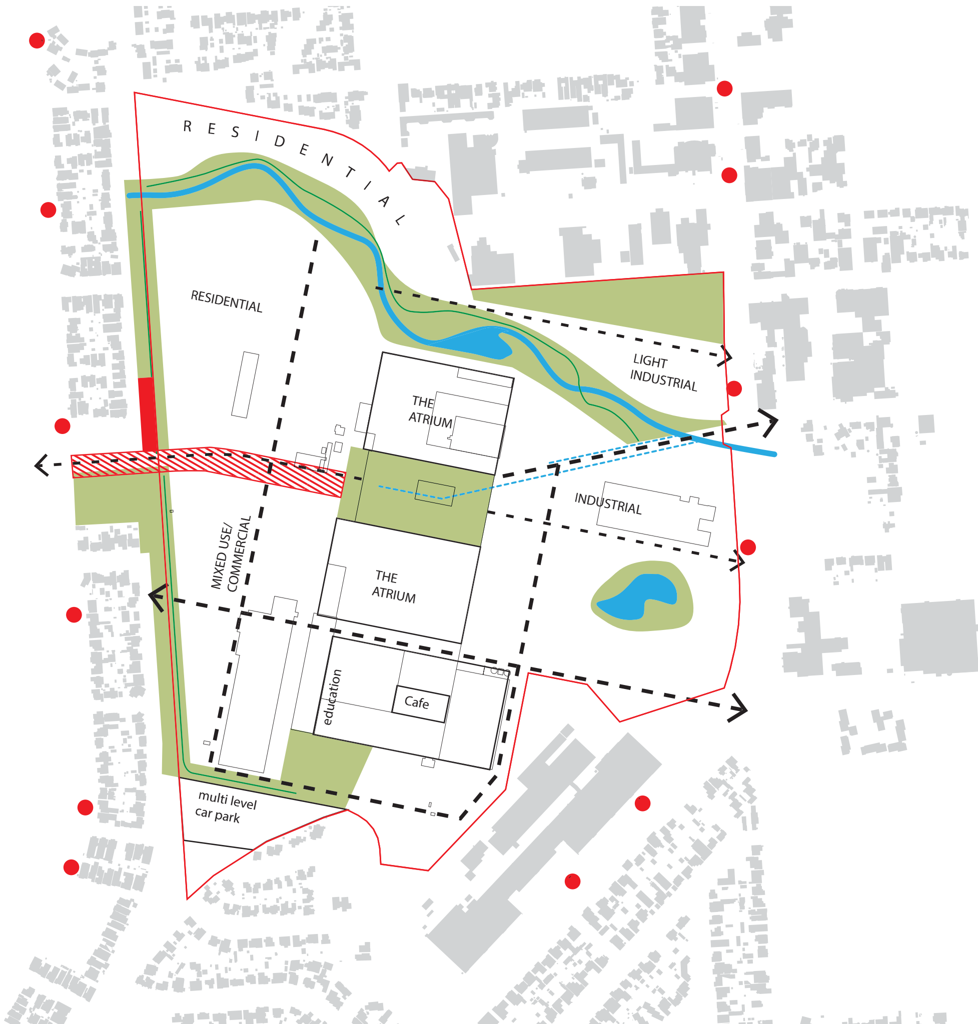
Dispersed urban pocket parks function as green heat pumps and places of gathering and social exchange. Buildings are realigned east/west for a simple reading of the site structure and orientation. A community centre is proposed in the park outside of the site as a strong attempt to connect to the existing neighbourhood to the west of the site.



Sketch 8

The creek is reinstated and realigned with a large retention basin just north of the shed. A secondary series of swales follow the creekbed but with three separated areas that serve as an identity for specific areas in the site, draw focus to the railway reserve, and connect the site to the neighbourhood to the west. The access road to the west is proposed as a shared street connecting to a reinstated railway station. A multi-level carpark is proposed to the south of the site.

The shed is divided into four main parts that separate different functions within the site. The southern quarter is given over to education. The central green space is fronted on both sides by the Atrium.



Sketch 9

Water-based infrastructure is evident across the site and revolves around two reinstated creekbeds which in turn respond to the topography of the site.

A secondary network of smaller retention basins and stormwater overflow infrastructure is combined with smaller pocket parks that provide a human scale, a network of space and an identity throughout.

Access roads east/west lead to and through the covered shared space in the shed. Built form is diverse in scale and organised around open spaces rather than having a strong alignment to streets. Slow traffic trails are weaved through connecting the pocket parks.

Sketch 10

Reinstate the creek including waterbodies, wetlands and retention basins offering the residential precinct clear access to the water system. A secondary arm that includes retention joins the creekbed from the centre of the site. A third arm follows the railway reserve.

Three storage tanks are located for water capture and reuse across the commercial/industrial zone.

The green network provides for both site accessibility and ecosystem services with a significant green space to the north/west of the shed structure. Residential streets run east-west for solar orientation and green common spaces are proposed to the north of each residential block with southern loading streets. Industrial and commercial buildings are clustered in higher density to release space for green edges.

Sketch 11

The creekbed is reinstated and brought into the site incorporating wetlands and retention basins.

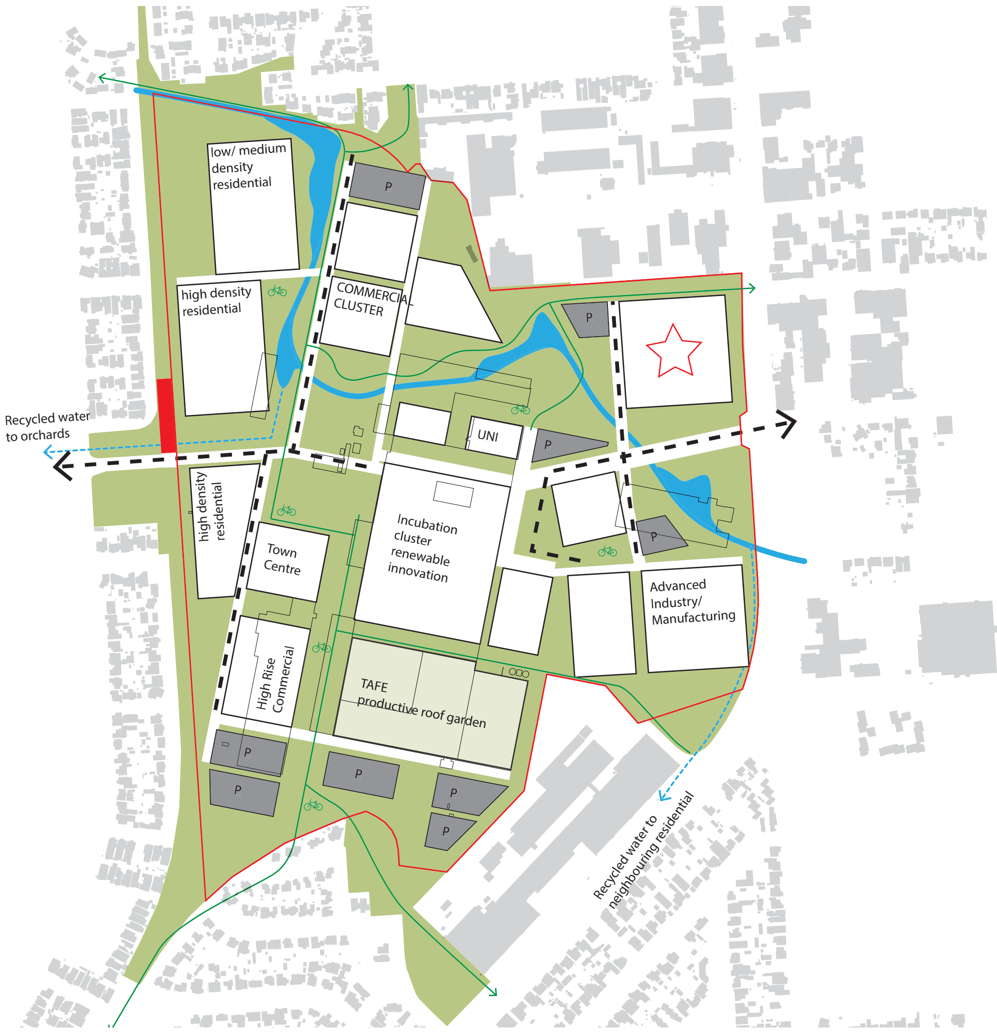
Compact built form releases more of the site for water function, urban forest cooling, ecosystem development and amenity.

Part of the captured and recycled water from the site can filtrate west towards the urban orchards.

The site is conceived as built form in the park rather than parks within the built form. The large roof of the TAFE is conceved as an urban farm.

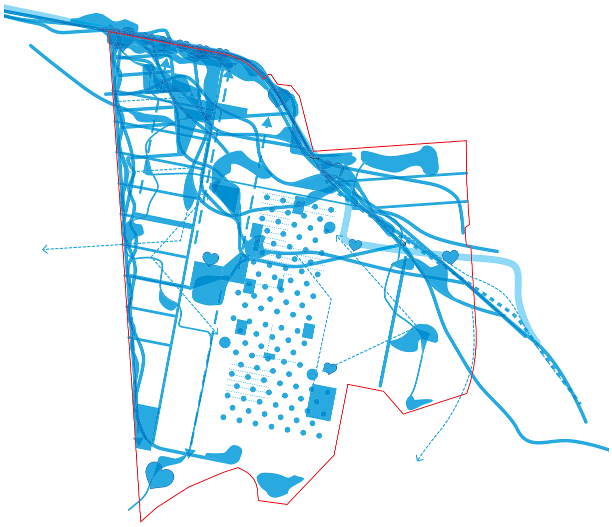
Access is seperated in the site.

Parking is centralised in specific areas attached to the the build form.



Water

A recognisable gradient of intensity is formed toward the northern boundary of the site as the catchment intensifies around a reinvisioned creekline. Water from the roof of the shed structure plays an important role in heating and cooling the new building and the public space under the roofline. Water and its associated landscape were considered critical to the cooling of the broader site through air movement and evaporation.



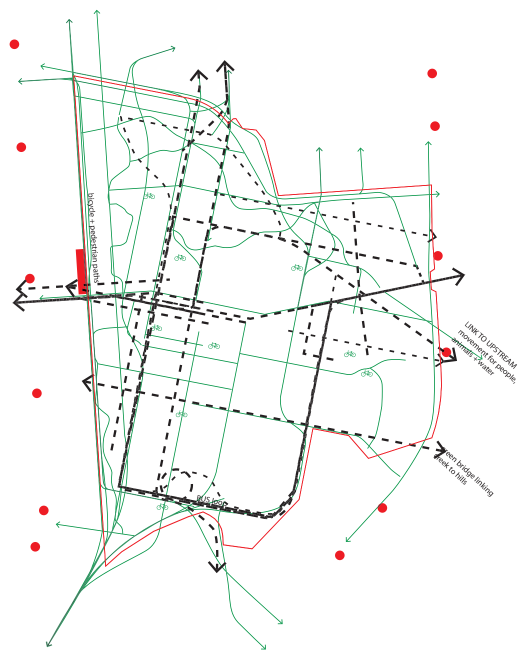
Green

Increased vegetation (wetlands and urban forest) corresponds with the water pattern above and the reduced footprints of the built form in the residential zones allowing greater vegetation penetration and coverage. Connecting the green spaces with green areas in adjoining neighbourhoods was considered desirable.

Circulation

Almost all sketches follow the existing shed outline as a circular primary collector with east and western access roads.

Many schemes add another access to the neighbourhoods to the north of the site. Secondary connections follow the rail and edges of the site.



Structure

Two distinct patterns emerge for the residential and the commercial/ industrial.

The residential is aligned in conjunction with neighbourhoods to the west. Industrial and commercial align with the shed but are bisected by primary access roads in and out of the site.

Conclusion

Prof. Tony Wong
CEO, CRC for Water Sensitive Cities

The Industry Partners Workshop generated 11 set of ideas, expressed through an urban design lens, which could help to make the Tonsley redevelopment more water sensitive. There are three common themes that run through these sets of ideas. The first is the reinstatement of an old watercourse through the site to create a blue/green corridor that would be the visual centrepiece of the development, and would reconnect the site with the parkland area to the north. The second theme that arose was around embracing the opportunity to influence and enhance the micro-climate of the development by taking advantage of the prevailing wind, keeping water in the landscape through the use of water features and well irrigated landscapes, and introducing green living walls that would be supported by water generated from the development itself. The third and final theme that runs through the 11 sets of ideas is the use of a diverse range of water sources, including stormwater and any number of combinations of recycled greywater, or recycled water obtained from a local treatment plant or through sewer mining. A large number of delegates felt that these approaches were well-suited to the site, and these themes recurred in many of the discussions at the workshop.

The creation of a central drainage line through the reinstatement of an old watercourse that runs through the site came up over and over again in discussions and drawings. Along with establishing a beautiful visual centrepiece for the development, creating this central corridor can be expected to result in improved downstream flood mitigation, without reducing flood protection for the Tonsley site. A key strategy raised during the workshop was to use the surface corridor to convey the runoff from everyday storm events (all events up to the 3 month ARI event) while retaining the underground culverts as an overflow system to provide up to 100 year ARI flood protection.

The potential influence of water sensitive urban design on the urban micro-climate generated particular interest amongst the delegates. CRCWSC research has provided new and locally-derived empirical evidence on the significance of temperature reduction in land surfaces and air temperatures through such practices. Through the use of strategies such as ensuring high levels of tree canopy coverage across the site, Renewal SA can improve the liveability and amenity of the Tonsley redevelopment, making it a more pleasant, safe and cool urban environment.

By strategically designing the layout of the development, Tonsley's streets could be laid out to facilitate passive watering of vegetation by stormwater runoff, as it flows towards the central water corridor. Creating breezeways and boulevards to capitalise on this alternative water source for irrigation will reduce reliance on centralised, potable water sources for irrigation.

Even the buildings at Tonsley have the potential to be water sensitive. The buildings at Tonsley could be designed with green living walls to clean and filter the greywater generated by building occupants, using biofiltration technology that is actively being researched and enhanced by the CRCWSC. Along with filtering this greywater, these vertical landscapes influence local micro-climate, potentially provide a level of insulation for buildings and enhance the passive cooling of buildings. Living walls also create a beautiful façade for buildings. The multiple benefits that can be gained through their use could once again improve the liveability and amenity of the redevelopment.

There were also a lot of ideas that came out of the workshop that could not be adequately captured in urban design illustrations. Delegates discussed at length the possible emergence of a new type of water and energy utility (operating at a highly decentralised scale) to capture the synergy of the water energy nexus, and the water reform agenda that would be necessary to facilitate this. It should be noted that Adelaide has probably issued more minor water retailer licences to local government organisations than any other city in Australia, owing to the significant expansion of aquifer storage and stormwater harvesting schemes. This could quite easily be expanded to cover local energy production and effective tri-generation schemes. Another discussion that should be highlighted was around fostering the co-design of the public realm in the site, with the aim of reconnecting the community to the natural environment and the history of the site through the use of envisioning workshops.

The Tonsley redevelopment project has immense potential as an opportunity to implement water sensitive urban design innovations. We hope that the ideas in this report can help guide decision makers in utilising the latest research and technological innovations to make Tonsley, and other comparable urban re-development projects, a more water sensitive urban environment.

CRC-WSC Industry Partners Workshop Participants:
Adelaide 30-31th October 2013

Tanveer	Adyel	The Univesity of Western Australia
Ross	Allen	CRC for Water Sensitive Cities
Karsten	Arnbjerg-Nielsen	DTU
Richard	Ashley	UNESCO IHE
Peter	Bach	Monash Water for Liveability
Terry	Banks	Natural Resources SA MDB
Damien	Batstone	The University of Queensland
Kieron	Beardmore	Brisbane City Council
Leah	Beesley	The Univesity of Western Australia
Paul	Belz	Queensland Urban Utilities
Yvette	Bettini	Institute for Social Science Research, UQ
Phillip	Birtles	Blacktown City Council
Terry	Blanchard	City of Mandurah
Lisa	Blinco	University of Adelaide
Pat	Bourke	Brisbane City Council
Annette	Bos	Monash University
Matthew	Bower	Queensland urban utiltities
Peter	Breen	E2Designlab
Jeddah	Breman	Monash University
Jean	Brennan	Marrickville Council
Christoph	Brodnik	Monash University
Graham	Brook	SA Murray Darling Basin NRM Board
Rebekah	Brown	CRC for Water Sensitive Cities
Barry	Cayford	CRC for Water Sensitive Cities
Fiona	Chandler	International WaterCentre
Peter	Coad	Hornsby Shire Council
Liah	Coggins	The University of Western Australia
Rhys	Coleman	Melbourne Water
Lisa	Currie	City of Sydney Council
Brenton	Curtis	City of Unley
Lisa	Curtis-Wendlandt	Mind Your Way
Fjalar	de Haan	Monash Water for Liveability
Lorenzo	de la Fuente	Monash University
Rodney	Dedman	Victorian Department of Health
Ana	Deletic	Monash Water for Liveability
John	Devine	City of Unley
Ashis	Dey	eWater
Meredith	Dobbie	Monash University
Philip	Donaldson	Renewal SA
Cintia	Dotto	CRC for Water Sensitive Cities
Jennifer	Edwards	Monash University
Jamie	Ewert	CRC for Water Sensitive Cities
Peter	Failes	Marrickville Council
Ben	Fallowfield	Warringah Council
Abby	Farmer	Office of Living Victoria
Briony	Ferguson	CRC for Water Sensitive Cities
Kelly	Fielding	University of Queensland
Judy	Fisher	SERCUL
Justin	Fitzpatrick-Barr	Marrickville Council
Tess	Flottmann	CRC for Water Sensitive Cities
Peter	Freewater	Hawkesbury Nepean CMA
Steve	Frost	CRCWSC Board Member
Soren	Gabriel	Orbicon
Lata	Gangadharan	Monash University
Alex	Gardner	University of WA Law School
Anas	Ghadouani	CRC for Water Sensitive Cities
Sarah	Goater	International WaterCentre
Mark	Goodlet	City of Nedlands Council
Bronte	Grant6	City of Greater Geraldton
Ana	Guzman	Monash University
Ebony	Henderson	CRC for Water Sensitive Cities
Carol	Howe	ForEvaSolutions
Bronwen	Hutchinson	City of Boroondara
Md Sayed	Iftekhar	The Univesity of Western Australia
Greg	Ingleton	SA Water
Ian	Johnson	South East Water
Phillip	Johnstone	CRC for Water Sensitive Cities
Jay	Jonasson	Ku-ring-gai Council
Catrin	Jones	NSW Dept. of Planning & Infrastructure
Jurg	Keller	CRC for Water Sensitive Cities
Sarah	Kneebone	Monash Sustainability Institute
Olivia	Koschade	Griffith University
Diana	Kureen	Central West CMA (NSW)
Jane-Louise	Lampard	Griffith University
Vernon	Langdon	Department of Housing
Terry	Leckie	Flow Systems Pty Ltd
Nadine	Leckie	Flow Systems
Jo	Lindsay	Monash University
Darryl	Low Choy	Griffith University
Shirin	Malekpour	Monash University
Chris	McCulloch	Central West CMA (NSW)
Janine	McDonald	Department of Water
Glenn	McGregor	University of Auckland
Barnaby	McIlrath	Maddocks
Robyn	McLachlan	CRC for Water Sensitive Cities
Reid	McNamara	Metropolitan Water Directorate
Richard	Mueller	Veolia Water Australia
Sarah	Murphy	KBR
Peter	Newton	Swinburne University
Jessica	Nott	CRC for Water Sensitive Cities
Carlos	Ocampo	The University of Western Australia
Jan	Orton	Marrickville Council
David	Pannell	The Univesity of Western Australia
Rutger	Pasman	Monash University
Valentijn	Pauwels	Monash University
Ralf	Pfleiderer	City of Melbourne
Sam	Phillips	DEWNR Natural Resources AMLR
Yvan	Poussade	Veolia Water Australia
Diego	Ramirez-Lovering	Monash University
Malcolm	Robb	Department of Water
Carlos	Salinas Rodriguez	UNESCO-IHE Institute for Water Education
Matt	Sanderson	City of Unley
Paul	Satur	Monash University
John	Savell	Department of Housing
Silvia	Serrao-Neumann	Griffith University
Jon	Shinkfield	CRC for Water Sensitive Cities
Angus	Simpson	University of Adelaide
Peter	Skinner	University of Queensland
Liam	Smith	Monash Sustainability Institute
Nina Donna	Sto. Domingo	DTU
Lavanya	Susarla	Queensland Urban Utilities
Nigel	Tapper	Monash University
Jeannette	Taylor	University of Western Australia
Amelia	Tendler	Office of Living Victoria
Olivia	Thorne	KBR
Shane	Tyrrell	GHD
Christian	Urich	Monash University
Jianbin	Wang	CRC for Water Sensitive Cities
Mark	Webb	Department Education
Peter	Wegener	International WaterCentre
Lara	Werbeloff	Monash University
Paul	Whatnell	GHD
Don	Williams	Monash University
Tony	Wong	CRC for Water Sensitive Cities
Roslyn	Wood	University of Western Australia
Sam	Yu	UniSA
Zhiguo	Yuan	AWMC
Fan	Zhang	The Univesity of Western Australia

Design Research Development - Program D5.1:

Diego Ramirez Lovering (contributing editor)
Jon Shinkfield (coordination)
Rutger Pasman (reductive synthesis diagrams and projective research)

CRCWSC Research Synthesis

Reporting document | CRC for Water Sensitive Cities

CRC for Water Sensitive Cities

Email	admin@crcwsc.org.au
Phone	+61 3 9902 4985
Address	CRC for Water Sensitive Cities
	Level 1, Building 74 — Monash University
	Clayton, VIC 3800, Australia

CRC for
Water Sensitive Cities