Institute for Sustainable Futures

UTS UNIVERSITY OF TECHNOLOGY, SYDNEY

Australian Water Recycling Centre of Excellence

ROSEVILLE

Roseville stormwater recycling scheme is located on the Upper North Shore of Sydney, 14 Kms from Sydney. It commenced operation in 2009/10.

CAPACITY
26 ML
(Dam Capacity)

CLASS OF WATER
C

TYPE
Stormwater harvesting; Gross Pollutant Trap

USAGE
Urban golf course and oval irrigation, and toilet flushing

Roseville Case Study

Stormwater recycling for urban golf course and oval irrigation

This case study is an example of a successful small scale private-public collaboration around stormwater recycling used mainly for golf course and oval irrigation. The scheme was relatively easy in terms of transition from concept to operation but still took nearly 10 years.

Instigated in drought and gaining multiple grants during that time, the scheme finally became operational in 2010 during wet weather. With schemes taking so long to get on the ground and grant funding drying up recycling is vulnerable to such changing circumstances. Both the Council and golf club have identified that without grant funding they might not have gone ahead with the scheme despite multiple benefits. This highlights how important it is to fully explore and clearly articulate the broader costs and benefits to aid decision making.

This study is funded by the Australian Water Recycling Centre of Excellence under the Commonwealth's Water for the Future Initiative

ABOUT THE PROJECT

This national collaborative research project entitled "Building industry capability to make recycled water investment decisions" sought to fill significant gaps in the Australian water sector's knowledge by investigating and reporting on actual costs, benefits and risks of water recycling **as they are experienced in practice.**

This project was undertaken with the support of the Australian Water Recycling Centre of Excellence by the Institute for Sustainable Futures (ISF) at the University of Technology Sydney (UTS), in collaboration with 12 partner organisations representing diverse interests, roles and responsibilities in water recycling. ISF is grateful for the generous cash and in-kind support from these partners: UTS, Sydney Water Corporation, Yarra Valley Water, Ku-ring-gai Council, NSW Office of Water, Lend Lease, Independent Pricing and Regulatory Tribunal (IPART), QLD Department Environment & Resource Management, Siemens, WJP Solutions, Sydney Coastal Councils Group, and Water Services Association of Australia (WSAA).

ISF also wishes to acknowledge the generous contributions of the project's research participants – approximately 80 key informants from our 12 project partners and 30 other participating organisations.

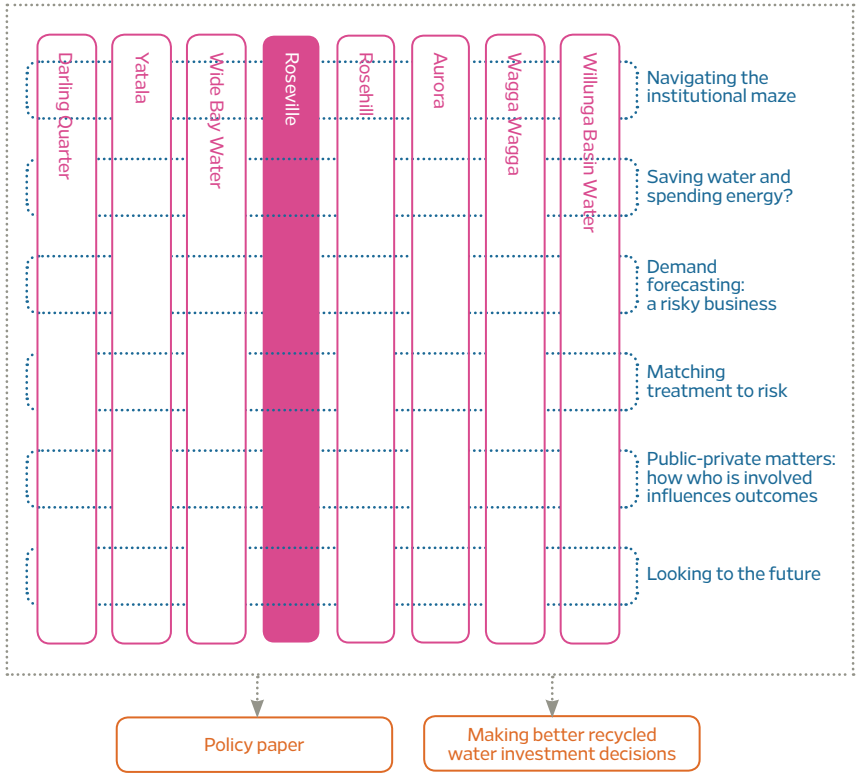
Eight diverse water recycling schemes from across Australia were selected for detailed investigation via a participatory process with project partners. The depth of the case studies is complemented by six papers exploring cross-cutting themes that emerged from the detailed case studies, complemented by insights from outside the water sector.

For each case study and theme, data collection included semi-structured interviews with representatives of all key parties (e.g., regulators, owners/investors, operators, customers, etc) and document review. These inputs were analysed and documented in a case study narrative. In accordance with UTS ethics processes, research participants agreed to participate, and provided feedback on drafts and permission to release outputs. The specific details of the case studies and themes were then integrated into two synthesis documents targeting two distinct groups: policy makers and investors/planners.

The outcomes of the project include this paper and are documented in a suite of practical, accessible resources:

- 8 Case Studies
- 6 Cross-cutting Themes
- Policy Paper, and
- Investment Guide.

For more information about the project, and to access the other resources visit www.waterrecyclinginvestment.com



ABOUT THE AUTHORS

The Institute for Sustainable Futures (ISF) is a flagship research institute at the University of Technology, Sydney. ISF's mission is to create change toward sustainable futures through independent, project-based research with government, industry and community. For further information visit www.isf.uts.edu.au

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Summary

This case study is an example of a successful, small scale private-public collaboration around stormwater harvesting and recycling. The water is used to irrigate a private golf course and a public oval, and to supply pubic toilets.

The case study is an example of a relatively easy approvals process (due mainly to the high quality source water used, low-risk end uses and Council being a partner in the scheme) and smooth transition from concept to operation, although, this can take time (nearly 10 years in this case). It also highlights how changing circumstances can make or break such schemes. For example, the need for this scheme, emerged in the 2001 restrictions, construction started in 2007/08 after multiple grants were secured, but operation finally started in 2009/10 in wet weather conditions.

The golf club and Council have both said that without grant funding they might not have gone ahead with the scheme even though there are multiple benefits to multiple stakeholders and relatively low risks in such stormwater schemes. Now with more wet weather conditions such grants are under threat and and consequently, so to are schemes like this one if the broader costs and benefits are not explored.

What is the scheme?

The scheme is a collaboration between the privately-owned Roseville golf cub and Ku-ring-gai Council. It includes a 26 ML dam and associated infrastructure built on the golf club site, in Roseville on the Upper North Shore of Sydney, where stormwater is used to irrigate a golf course built in the 1920s. It also includes pumps and piping to link the dam to a 120 kL storage tank, which feeds the adjacent oval and amenity toilets (backed up by mains supply) managed by the Council. Modifications made to the oval mean that drainage from the oval feeds back to the collection dam. The map shows the dam in relation to the golf course and oval.

Due to the good quality source water, treatment is limited and involves a gross pollutant trap (GPT), settlement in the dam and a number of filters. No disinfection is currently used, as it was deemed unnecessary by Council (refer to risks section).

Roseville golf course and surroundings

How did the scheme come about?

Drought was the initial driver

The driver for the scheme emerged when restrictions were introduced in Sydney in 2001. The golf club had to consider alternatives to meet irrigation demand and ensure its viability. To do this, it needed to maintain a club and greens standard acceptable to its paying members. At the time it was using about 70 ML/a for irrigation, with 80% to 90% drawn from Sydney Water supplies. During the first set of restrictions the golf club was restricted from irrigating any of the fairways and was subsequently required to drop demand by half.

Stormwater was chosen over sewer mining because it was perceived to have lower costs and risks

The golf club created a sub-committee to decide whether stormwater or sewer mining was preferable, and to investigate storage options, an issue of primary concern regardless of which type of source was chosen. A specialisist architect was employed to develop a master plan in collaboration with the sub-committee to determine the best location for the storage, any course changes required and the feasibility of extending the length of the course.

> "With the sewer mining there was always going to be a set price of how much it was going to cost us and it was going to be equivalent to what we were paying for the water [from] Sydney Water anyway, so we weren't really getting any cost savings for the sewer mining."

The golf club has a sewer running under the golf course and a stormwater drain through the bottom of the site. Hence, the golf club could choose which option worked for them. After investigation the stormwater option was chosen primarily because sewer mining technology was not well established at the time, costs were uncertain and there were no perceived cost savings due to the price being similar to potable water from Sydney Water. In addition, the site is located downstream of the Moore's Creek catchment. Hence there were two additional advantages to using stormwater: the good harvesting potential and the ability to collect debris in a GPT to reduce pollution to the waterway entering Middle Harbour.

During scheme discussions Council saw the benefits of becoming a collaborator

The golf course is located on 70 hectares. It is bordered by bushland and residential properties with the Roseville Chase sporting oval and cricket ground located in the middle. Half of the land is owned by the golf club. The other half is leased Crown land managed by Council. When the recycling scheme was being considered the lease only had a few years to run and so before the golf club could proceed with the scheme it needed to renew the lease and go through the Council development application (DA) process. It also needed to locate a GPT and sort legal requirements and thus started to discuss its plans with Council. During these discussions Council saw the opportunity to collaborate on the scheme and potentially obtain potable water savings on the oval for relatively low cost. The scheme could provide an alternative source during a time of drought and water restrictions, and an alternative supply into the future.

When recycled water is provided to a public open space, a common driver is that it extends functionality during drought. This was not the case here. In fact, some Council staff questioned why this oval should receive funding for a recycling scheme, considering it was mostly rain fed and had coped relatively well with the drought and water restrictions. However, the opportunity of working with the golf club and obtaining longer term benefits from having access to recycled water meant the Council decided to proceed with collaborating with the golf club. The project is part of Council's innovative water recycling initiative for local parks and ovals.

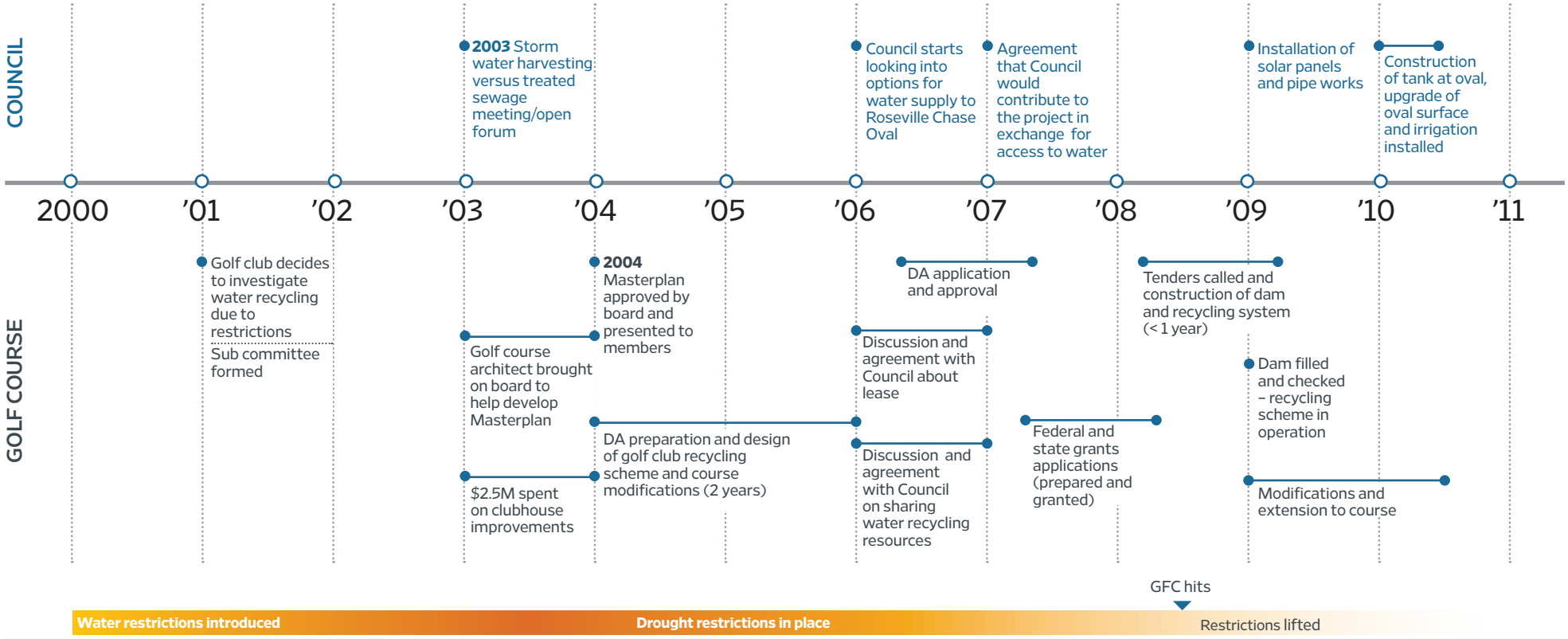
There were hurdles along the way

Stakeholder consultation and collaboration took time

The stakeholders involved in this case study seem straightforward, compared to some recycling schemes. However, this simplicity in terms of there being just two primary organisations masks the multiple departments and individuals that needed to be consulted, which took considerable time.

Significant stakeholder consultation and collaboration was undertaken by the golf club from 2001 until the scheme was finally brought to fruition in 2009/2010. This consultation ranged from board members, sub-committees, club members and ground staff through to discussions with Council and funding organisations. The golf club had to use specialist architects and consultants in designing the new scheme and navigating complex legal and regulatory issues. These issues included the renewal of the lease of Crown land through the arrangement with Council, approvals from the NSW Government Dam's Safety Committee, and procuring an extraction licence from the NSW Office of Water. In addition, development application approval from Council involved fauna and flora studies, traffic management, landscape requirements in relation

Timeline



to the dam, and remediation with respect to returning the land to its former state in case it ceased to be a golf course

From Council's perspective discussions about becoming a collaborator only really commenced in 2007 with two core departments involved: Strategy and Operations. The Council component of the scheme, involving modifications to the oval, toilet facilities and holding tank, which required design, construction and operation, were relatively simple in comparison to the golf club modifications. For example, community consultation was deemed unwarranted for this particular site due to the limited number of adjacent properties affected, the high quality of the water used, and general community support for such schemes, which was evident in previous community surveys that had already given Council the mandate to set up an environmental levy to assist in contributing to such schemes.

Collaboration and grant funding were key

Council had previously considered the oval for stormwater harvesting funding programs but due to the topography, irrigation would have relied on pumping which was cost prohibitive. However, when a new round of grants came out in 2007, Council saw that by collaborating with the golf club it could obtain a stormwater source for the oval and put in solar panels to offset the ongoing energy consumption of pumping to the oval.

During the golf club's discussions with Council on various aspects of the regulatory process, Council prepared a water balance model and a concept design to see if the golf club was prepared to share the recycled water. It was agreed to proceed with the partnership if Council funded the Gross Pollutant Trap (GPT) and 50% of the associated GPT installation costs. When the golf club lease agreement with Council was renewed at the time the scheme was being planned a clause on 'resource sharing' was written into the contract to give the Council rights to access the recycled water.

For the golf club the recycling elements such as the GPT, pump, excavation and concrete cost $340k. As agreed, this cost was partially paid by Council (i.e. GPT - $180k and 50% of the associated GPT installation - $50k to $60k). The dam cost the club $550k. Changes to the golf course cost $1.25m, so the total cost was about $2.2m. The golf club received funding through the federal Community Water Grants Scheme ($450k) and the NSW Government's Water Saving Fund ($50k). Without this funding, assistance from Council, and the use of staging and capitalising of the project over quite a few years, the golf club would have found it difficult to proceed due to recent expenditure of over $2.5m on regulatory clubhouse improvements and associated cash flow limitations.

> "Now if we had to come up with that sort of money... straight away that would have been very difficult. Our cash flow would have been [overcommitted] ... so we were lucky we got a grant from the government... lucky we got a grant from Council... lucky we got Council involvement because they wanted the water as well."

> "It's uncertain if we would have done it without external funding."

Council's expenditure on the scheme included: $180k for the GPT, half of the GPT installation costs ($50k to $60k), project management for approvals etc. and communication $11k, solar panels $26k, giving a total cost of approximately $290k. This was offset by Council receiving a grant from the NSW Government's Climate Change Fund, Public Facilities Program ($113k). The scheme was also in part funded by Council's environmental levy, which requires households in the Council area to pay for environmental schemes. Similar to the golf club, it is uncertain whether Council would have proceeded with the scheme if external funding hadn't been secured.

Significant opportunities and benefits appeared

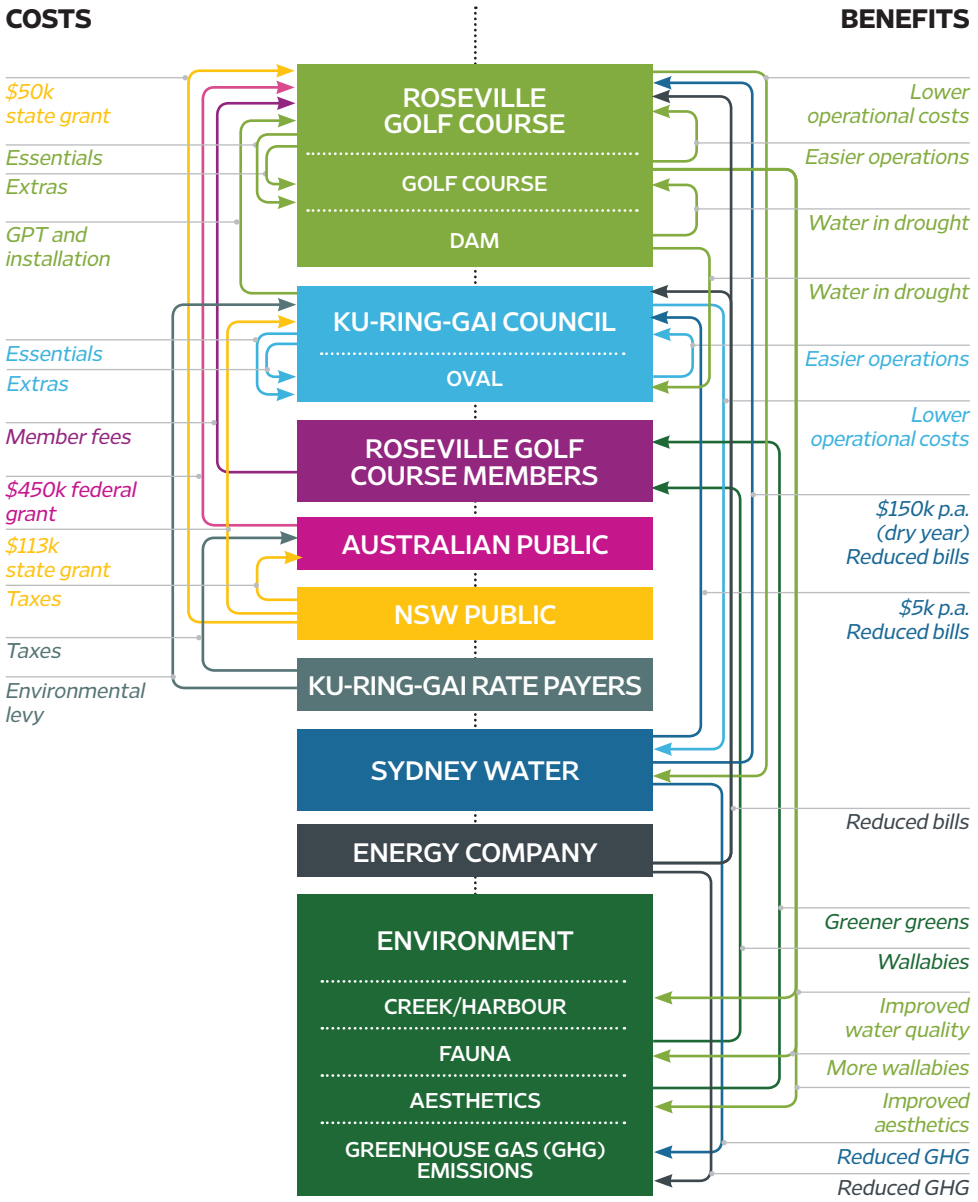
Some of the more obvious benefits include the reduced costs of not purchasing mains water supply

There are both quantifiable and non-quantifiable benefits associated with the recycling scheme. The most obvious quantifiable benefit is that the golf club now avoids the cost of purchasing mains water from Sydney Water for irrigation. As with most irrigation systems water usage and thus the size of such a saving will vary from year to year. The golf club has an extraction licence provided by the NSW Office of Water which gives them permission to use 180 ML of stormwater over any three-year period with up to 70 ML in any one year. In 2009, the golf club used over 30 ML, which at approximately $1.45/kL for mains water (as it was then) would have cost about $45k to $50k. At 70 ML/a, in a dry year, with the current mains water price of $2.13/kL this could be closer to $150k.

Council's water usage is significantly less than the golf club's, but the scheme still provides noticeable savings. Estimated demand for the oval and toilets is in the order of 2.5 ML/year. If all 2.5 ML/year was stormwater this would amount to a saving of over $5k a year at current Sydney Water prices.

Interestingly however, despite the dam being full, only about half the water used by Council in 2011/12 was sourced from stormwater (about 1.3ML). This illustrates how important it is to check that the details of design objectives (e.g. saving water and maximising the use of non-potable supplies) are translated into the construction and operational phases of individual schemes. In this case study, inadvertent over-use of mains water occurred possibly due to incorrect float switch settings, incorrect top-up valve connections, upgraded irrigation systems and the associated pressure and volume increases. Since discovering the higher than anticipated use of mains water, Council has been investigating and rectifying the situation (refer to risks section).

Costs and benefits



Other benefits include integration of saving energy into the system design

The golf club anticipates there will be savings in energy because they are upgrading the 20 year-old irrigation system so that they no longer triple handle the water. As part of this upgrade the golf club has completed a new pumping station to pump water directly from the dam onto the golf course, thereby eliminating one unnecessary use of electricity.

On the Council component of the scheme solar panels have been installed to offset the electricity usage of their pumps. The estimated energy usage of the pumps is between 5.5 and 7.2 kWh/day, typically the lower end. In 2012 the volume of recycled water pumped by Council was 2.4 ML. Over this period the solar panels which produce 6.6 to 8.8 kWh/day balanced the pump electricity usage.

Several opportunities resulting from the scheme have created important benefits for the golf club, which are difficult to quantify

The golf club's investment in stormwater recycling has improved the aesthetics of the golf course. The dam now acts as a water feature and the upgraded watering and irrigation system has facilitated significant improvements to the extent and quality of the greens. High quality greens require significant horticultural management, including the addition of chemicals, which need to be watered in well. Having more water available at a lower cost makes this feasible. These improved aesthetics provide a better quality golf course, which in part has has assisted the golf club to maintain a profit through the difficult times of the Global Financial Crisis. The golf club's membership has remained steady in a declining market with the majority of membership being local residents.

The dam and improved greens have also had beneficial impacts on the local environment. The golf course is now attracting more fauna which in turn provides further aesthetic benefits to the golf club members and the community more broadly.

The upgraded water and irrigation system, which was in part triggered by the recycling system, has also improved the ease of watering. When water was limited, the golf club relied on poorer quality bore water and at some points

> "We've got wallabies coming up now onto the golf course and drinking out of it [the dam]"

volunteers hosing patches to keep the grass alive. Now the golf club can water when needed more easily and will eventually be able to water specific areas as required when all the upgrades are complete. This means that staff and volunteers can invest their energies in other activities.

Council is also experiencing additional benefits

When putting in the new recycling system Council decided to regrade the oval, which had serious drainage issues. Regrading resolved these issues and had the added benefit of feeding the runoff back into the dam.

> "Couch grass doesn't live up to expectations... elsewhere in Ku-ring-gai there were lots of negative reports – the grass didn't come back quick enough. In hindsight couch was probably not the best for local councils as ovals are being used constantly."

When regrading the oval Council took the opportunity to replace the kikuyu turf with more sustainable couch grass. Previously Council had to re-turf 25-30% of the oval each year at the end of the rugby season, which could cost up to $10k/a. The new couch grass was expected to avoid this re-turfing, providing a substantial operational cost saving. However, in retrospect, the couch grass may not have been the best choice for this location. The changeover from the rugby season to the cricket season is just two weeks and couch grass takes longer than this to re-establish properly. So although Council is saving money by not re-turfing between seasons, the turf quality is not always as good as expected.

Council staff also now save time when irrigating because the new scheme has better water pressure. Previously staff would have to wait 30 to 40 minutes to water the field and then another 40 minutes to fill the tank but now there is no need to wait.

Risks identified during the planning stage were well managed during construction and operation

A key concern for the golf club was the need to keep their members happy. Members were promised an 18-hole golf course, no temporary greens (i.e. high quality greens during the whole construction period), and no impact on membership fees. Keeping the members happy was paramount.

"If the golf course isn't any good we lose membership... the whole circle breaks down."

The golf club were also concerned about keeping the neighbours happy during construction, for example, due to the trucks and dirt related to the large amounts of earth movement required. The golf club was very happy with the way the construction project turned out: there was limited wet weather and no environmental or neighbour issues, in part due to the DA traffic and other management requirements.

For Council, one of the reasons for collaborating in the scheme was to obtain reasonably high water savings from potable water supplies for the oval for relatively low cost during a time of drought and water restrictions and ongoing access to alternative supplies into the future. However, stormwater is not a guaranteed source during times of drought (unlike sewer mining) and the fact that Council was relying on the golf cub to share a potentially limited supply introduced an additional risk. This prompted the inclusion of a 'resource sharing' clause in the lease agreement between the golf club and Council for the Crown land on which the golf course is located. Although the clause does not specify volumes, it does provide Council with access to water from the dam to irrigate their oval as long as the golf club has enough water to irrigate their fairways and greens. In the event of water shortages the golf club can cut back Council access to the dam supplies.

An additional risk borne by Council is the use of stormwater for toilet flushing and irrigation without the use of disinfection. No one regulates or has enforcement power over Council in regard to water quality/treatment risk considerations. Council assessed the risk according to the Australian Guidelines for Water Recycling (2006) and assumed a low risk. For the irrigation end use this was because there is a low probability of anyone being on the field during irrigation because it is irrigated at night and has signs advising the public not to enter during times of irrigation. For the toilets, the risk of ingesting the toilet water, cross contamination and consequences of drinking the water were all considered low. The risks were discussed with the NSW Office of Water, who suggested installing a UV system but recognised a lower risk exposure compared to for example where recycled sewerage is piped throughout a residential subdivision. Council have not ruled out disinfection and will revisit their decision whilst developing the scheme's management plan. If it is decided that disinfection is required then their preference is to use chlorine tablets as a cheaper and simpler alternative to UV. The UV would only cost about $5k but would involve ongoing costs associated with lamp replacement and the need for regular checking and maintenance.

"Even though the national guidelines on stormwater are pretty good... it is somewhat complicated... not as complicated as reuse... The issue of disinfection is an ongoing discussion – when you need it and how much – what sort of quality of water you need for your usage."

A key risk that manifested during the project, and which Council wishes to improve for similar projects in future, is the need to keep greater control of the project when it is handed from one department to another (design, construction, operations and maintenance). As this project was moved through departments, well-intentioned but problematic changes were made to key scheme elements during design and construction. Individuals were apparently not aware of either the reasons behind a design or the implications of their changes on the scheme's ability to meet its objectives (e.g. changes related to mains top-up and higher pressures in the system, which resulted in

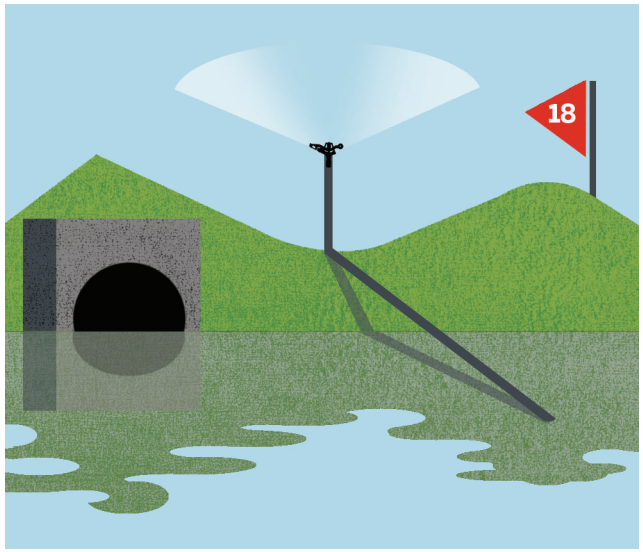
significant mains water use despite the golf club dam being full). Finding a way to keep tighter control as the scheme is transferred between departments, and ensuring the transfer of knowledge about important decisions, are now seen as essential by Council.

Reflections

Even though this is a relatively simple example of a recycling scheme it took nearly 10 years to come to fruition after significant stakeholder consultation on the golf club's side. For both the golf club and Council the scheme has offered significant opportunities to improve their existing golf course and oval.

Some of these benefits are readily quantifiable and others can be readily described and experienced but are harder to monetise. Even though such benefits cannot be quantified they at least need to be clearly articulated so that they can help councils and other possible proponents of recycling schemes determine whether to proceed with them.

From the Council's perspective a major barrier to future similar recycling schemes is the perception there will never be another drought and that there is no need for recycling when the dams are full. However these situations can change rapidly and if the value of having access to



alternative water supplies is not recognised then funding is likely to dry up. Without exploring the costs and benefits fully, and without being eligible for funding, it is difficult to justify building such schemes.

The combination of the financial barriers and the inability to easily quantify additional quantifiable and non-quantifiable benefits is potentially a major stumbling block for future schemes.

Costs, risks and benefits

GOLF CLUB (COSTS AND RISKS)

CAPEX[1]

- 0.5 GPT installation, pumps, excavation and concrete $340k
- Dam $550k
- Changes to golf course $1.25m

Total cost (estimate)
$2.2m

OPEX

- 2 people for 1 day after rain to clean GPT
- Electricity costs for pumps

RISKS/EXPOSURE (QUAL.)

- Keeping members and neighbours happy during the construction

GOLF CLUB (BENEFITS)

Monetised

- $150k/year (dry year) for not paying Sydney Water for potable water (70ML/year x $2.13/kL)
- Energy bill saving for not triple handling water

Non-monetised

- Aesthetics of golf course increasing club membership
- Better quality grass
- Improved ease of watering

COUNCIL (COSTS AND RISKS)

CAPEX[2]

- GPT ($180k) + 0.5 GPT installation cost($50k)
- Project management for approvals and communication $11k
- Solar panels $26k

Total cost (estimate)
$290k

RISKS/EXPOSURE (QUALITATIVE)

- Not being able to access the water when the dam is low
- Using stormwater for toilets without disinfection
- Not being able to keep control of projects during construction and operation which might mean they don't achieve their objectives

COUNCIL (BENEFITS)

Monetised

- $5k/year (dry year) for not paying Sydney Water for potable water (2.5ML x $2.13/kL)
- $10k/ year turf saving

Non-monetised

- Improved the quality of oval grounds
- Reduced operations crew time
- Reduced oval drainage issues
- Improved ease of watering

1. Part reimbursed by Council and Government (federal and state grants)
2. Part reimbursed by Government (state grants)

Costs, risks and benefits (cont.)

GOVERNMENT (COSTS AND RISKS)

CAPEX

- To golf club
  - Federal Community Water Grant Scheme $450k
  - State Water Saving Fund $50k
- To Council
  - State Government's Climate Change Fund, Public Facilities Program $113k

Total cost (estimate)
$613k

CLUB MEMBERS (COSTS AND RISKS)

CAPEX

- Contribute through membership

OPEX

- Contribute through membership

CLUB MEMBERS (BENEFITS)

Non-monetised

- Improved aesthetics of golf course
- Improved environmental features of golf course

LOCAL PUBLIC (COSTS AND RISKS)

CAPEX

- Environmental levy contribution

PUBLIC (COSTS AND RISKS)

CAPEX

- Contribution to the Federal and State grants through taxes

ENVIRONMENT (BENEFITS)

Non-monetised

- Improved ecosystem (i.e. more wallabies)
- Improved water quality in downstream harbour