BUSINESS-TO-BUSINESS STORMWATER CAPTURE AND REUSE – DEVELOPMENT OF AN APPROPRIATE GOVERNANCE MODEL

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ABSTRACT

City West Water has been working with two industrial sites located in a major industrial suburb in west of Melbourne to assess the potential for a business-to-business stormwater reuse scheme. The proposed scheme involves the capture of stormwater from a warehouse facility owned by Goodman for reuse in cooling towers at a nearby chemical manufacturing plant owned by Orica Chloralkali.

While the scheme only involves simple engineering designs, the main challenge relates the long-term viability of the project, which depends largely on the ability to develop appropriate risk mitigation measures and governance arrangements between the project partners. Two potential scheme governance models have been identified and assessed, with one of the models involving City West Water (the local water retailer) as a scheme manager to share the anticipated long-term contractual risks.

This paper outlines the project outcomes focussing on regulatory gap analysis, project partners' risks evaluation, governance model evaluation and project technical viability assessment.

INTRODUCTION

Business-to-business stormwater capture and reuse involves capturing water from large roofed or built sites for treatment and reuse at nearby sites having different owners. Under current Victorian legislations Melbourne private entities are entitled to capture and use water runoff within their properties for their own use. The trading of that captured water has remained unexplored due, in part, to the associated regulatory uncertainties.

Project Partners

City West Water (CWW) is one of the three water retailing authorities in Melbourne servicing the western metropolitan area. The company's core business activities have traditionally been around the provision of sewerage and drinking water services and in recent years have included the development of alternative water schemes to service major industrial and non-industrial developments.

Orica is a global Australian-based company with operations in around 50 countries. The key brand names for the company's various businesses include – Orica Mining Services, DuluxGroup, Minova and Orica Chemicals. One of its three major chemical manufacturing plants in Australia, the Orica Chlroalkali, is located in Laverton North in west of Melbourne and is specialised in the manufacture of chlorine-based disinfection products.

Goodman is an integrated property group that owns, develops and manages industrial property and business space globally.

Project Background

In 2006, CWW initiated a study through Victoria University to examine the potential to replace potable water within the cooling towers at the Orica Chloralkali in Laverton North.

The alternatives examined included recycled water from sewerage systems, groundwater extraction, and rainwater and stormwater capture from onsite and offsite drainage systems. The study identified the capture of water from roofs and hardstand areas from the Orica Chloralkali site and a nearby warehouse facility owned by Goodman as a preferred alternative water option based on water quality, ease of engineering solution and cost.

STORMWATER REUSE SCHEME DESIGN

Stormwater Capture: Concept Development

Significant consultation among the project partners has been undertaken to assess and identify potential project governance arrangements for a preferred water harvesting scheme, including the review of the associated regulatory implications and assessment of the project risks.
In late 2008, the consultant Parsons Brinckerhoff (PB) was jointly engaged by Orica and CWW to

refine the earlier water harvesting concept to a functional level. The evaluation confirmed the option of capturing stormwater from the Goodman and Orica properties as the most preferred option based on multi-criteria analyses performed on a range of water capture options identified.

The proposed process train includes diverting stormwater from major drains within the two properties into balancing tanks where the water is pumped into an open storage, via a sedimentation pond for suspended solids removal. The stored water will then be chlorinated prior to use in the cooling towers for controlling micro-organism growth. It is estimated that up to 35 million litres of 'fit-for-purpose' treated stormwater can be captured per annum. This is equivalent to substituting 50% of the potable water consumption of the Orica cooling tower, estimated at 70 million litres per annum. A layout of the preferred scheme concept is shown in Figure 1.

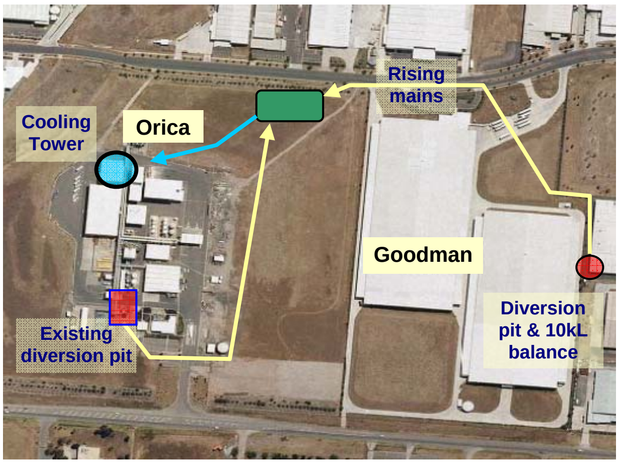

Figure 1: concept layout

Can Supply = Demand?

The stormwater capture potential is primarily limited to the storage capacity, rainfall intensity within the collection areas, and the water demand profile.

The amount of water that can be captured under different scenarios was determined by using average monthly cooling tower water demand data (Figure 2 and Table 1) in MUSIC (Model for Urban Stormwater Improvement Conceptualisation) simulations. Long-term average rainfall data corresponding to the years 1970 to 2006 was used for preliminary options assessment and screening. The preferred option was then modelled and optimised using hourly rainfall data for the year 2000, which showed a rainfall pattern consisting of more intense rainfall events with shorter durations compared to the average longterm rainfall patterns. This approach is expected to be beneficial since future rainfall is expected to continue to deviate from historical trends in a similar way as a result of climate change.

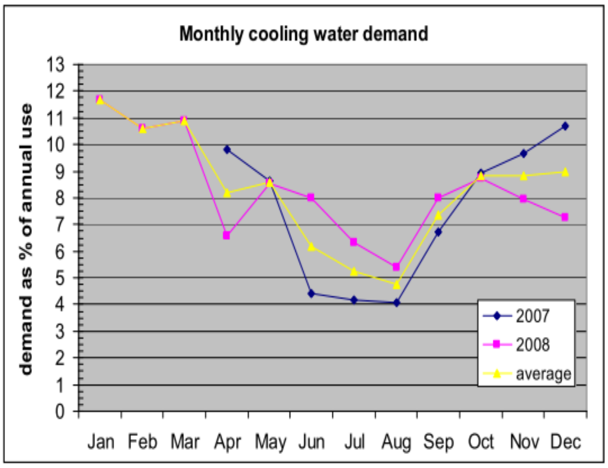

Figure 2: Orica Chloralkali cooling towers monthly water demands

Table 1: Stormwater/rainwater capture potentials

Location	**Area (ha)**	**Maximum Water Capture (kL/year)**
Orica Site		
Roof	*0.89*	*3,400*
Hardstand	*3.11*	*12,200*
subtotal	**4.00**	**15,600**
Goodman Site		
Roof	*6.61*	*25,700*
Hardstand	*2.03*	*8,200*
subtotal	**8.64**	**33,900**

The screening of options was mainly based on the following criteria:

- Estimated security of water supply
- Quality of source water (i.e. proportion of rainwater to stormwater captured)
- Least 'dollar per kilolitre of water captured' design option
- Minimal site disruption design option

Water Quality v/s Quantity

Figure 3 depicts the water balance of a typical cooling tower system. The water demand for the cooling tower is driven by the amount of water lost from the system through evaporation, 'drift' and cooling tower blowdown.

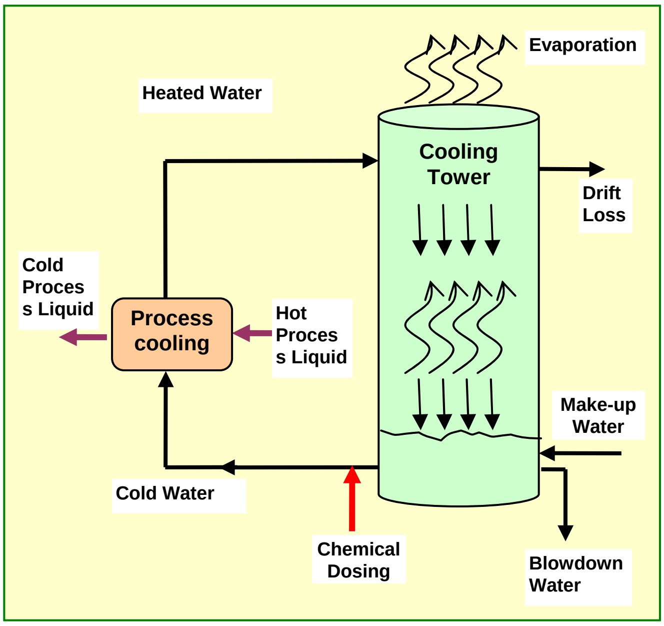

Figure 3: Cooling Tower Water Balance

While cooling tower water demands are fairly seasonal, changes in the cooling tower water quality can significantly affect its water requirements. One of the key parameters is the electrical conductivity of the cooling water. Elevated conductivity level in the captured water can lead to increase blowdown cycles, thus increasing the overall cooling tower water demand. The advantage with this scheme is that 70% of the captured water will originate from roofs, thus potentially providing reasonably high quality water (i.e. low conductivity) with minimal treatment required.

Figure 4 shows the proposed treatment process train to achieve the desired cooling tower water quality. Primary treatment will consist of Gross Pollutant Traps and meshed screens to remove gross solids, followed by sedimentation in a pond for suspended solids removal. Some optional tertiary treatments, such as carbon filtration followed by chlorination, can be considered to control total organic levels if necessary. High organic levels can promote biological growth within the cooling water system leading to significant bio-fouling issues.

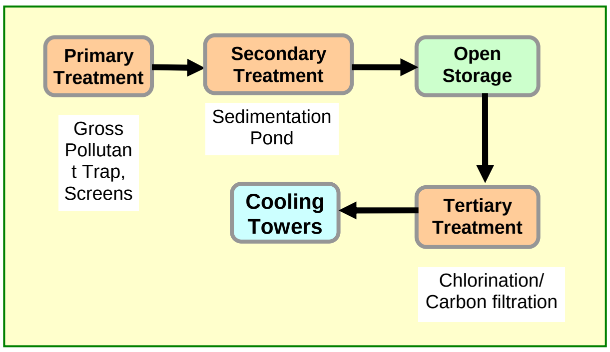

Figure 4: Proposed treatment train

SCHEME IMPLEMENTATION AND GOVERNANCE

Innovation and Strategic Fits

This scheme is the first stormwater reuse scheme under investigation in Victoria where a business-to-business arrangement is being explored. The key incentive for the scheme follows from the anticipated high drinking water substitution potential in industrial areas where large roofed sites can be used to harvest rainwater and stormwater for reuse at nearby high water use sites. The project aims to assess the governance viability of such a scheme at a pilot scale to demonstrate its potential adoption on larger scales. In addition, the project can be used as test case to assist with regulatory reforms around the trading of stormwater between private businesses.

A preliminary assessment of the Laverton North industrial catchment, which covers an area of about 400 hectares, indicated that up to 2.25 gigalitres of potable water could potentially be substituted annually through similar scheme arrangements.

The environmental cost benefits can also be significant in relation to the diversion of significant industrial runoff from receiving waterways as a result of a wider implementation of similar schemes. Substantial reduction in pollutant loads reaching existing waterways treatment systems (e.g. wetlands) can be achieved. This can result in substantial cost reduction for operating and maintaining these assets.

From an annualised project cost perspective, the scheme seems to be fairly economical compared to using drinking water supplied by CWW. The low project cost is mainly related to the minimal water transfer infrastructure requirement as the water source is located next to the point of use. Also, as most of the water to be captured will originate from roofs and controlled hardstand areas the water is expected to be of a generally good quality, thus requiring minimal treatment. However, the main challenge for the scheme relies in the development of an appropriate governance arrangement, which underpins the long-term viability of the scheme.

The project has also received ‘in principle’ support for funding from the state’s Stormwater and Urban Recycling fund based on these innovative and strategic fits.

Scheme Governance Review

Two potential scheme governance models have been identified and assessed in consultation with the project partners. Model 1 involves a bipartite contractual arrangement between Goodman and Orica for implementing the scheme without any input from CWW. This can be achieved through a contractual arrangement to agree on the project's design, implementation and operation requirements.

The model presents a good opportunity for the private businesses involved to demonstrate leadership on addressing the ongoing water scarcity concerns facing the wider industry. It also presents a good opportunity for both Goodman and Orica to build on their sustainability profiles, which can potentially enhance their green customer base.

Preferred scheme governance model

Model 2 involves a tripartite arrangement involving CWW as a scheme manager to provide for a more robust project governance arrangement. As a water company operating under the *Water Industry Authority Act 1994*, CWW can consider various financial and operational arrangements to best meet the business objectives of all parties involved.

This option was found to be most preferred as it allows the project risks to be adequately shared among the three project partners (CWW, Goodman and Orica). The proposed contractual arrangement can essentially involve two agreements – one between CWW and Goodman and another between CWW and Orica. The agreement between CWW and Goodman can stipulate responsibilities for the installation, operation and maintenance of the portion of the assets located within the Goodman property and likewise for the contract between Orica and CWW. The key project evaluation criteria identified for assessing the overall project risks includes:

- Secure access to water
- Infrastructure ownership
- Site accessibility
- Water quality responsibility
- Financial risks mitigation

A schematic representation of this proposed governance arrangement is shown Figure 5.

Secure access to water

The main issue with guaranteeing access to stormwater to be harvested relates to the regulatory uncertainties around the ownership of stormwater. A review of existing legislations, based on the two potential governance models, suggested that as a private entity Goodman is entitled to use rainwater or stormwater that originates from its property as long as the water is captured before it leaves the property. The captured water can also be used at another site not owned by Goodman, in this case the Orica Chloralkali site, by establishing a mutual agreement between both parties on the proposed use. This arrangement can also include recovery of all costs incurred by the two project partners in developing and maintaining the scheme.

The key risks as seen by the industrial companies relate to potential early termination of the contractual agreements as a result of change of ownership or tenancies at the sites. New owners or tenants may have different needs and as such may not be willing to continue with the scheme. Given the high significance of these risks the preferred model from the industrial partners was to involve CWW as a scheme manager to manage this risk from the institutional perspective as being the local water authority and operationally with the provision of potable water back-up to Orica in the worst case scenario.

Infrastructure Ownership

As the water extraction infrastructure and part of the water transfer infrastructure are located within Goodman property, site access arrangements for constructing, operating and maintaining these assets by another party other than Goodman can be quite complex. Under the preferred governance model arrangement, CWW can own and maintain the scheme assets located within the property of Goodman with the provision of appropriate access arrangements such as easements. Furthermore, given CWW's expertise with water reticulation systems, this arrangement is seen as more practicable by the project partners.

Water quality responsibility

The risks associated with water quality issues relate to the potential deterioration of the captured water if stored for prolonged periods. This can be in the form of contamination from airborne pollutants. As the storage and treatment system will be located on the Orica property, which also has high technical expertise in the water treatment fields, it was proposed that Orica operate and maintain the treatment and storage systems, including all reticulation within its property.

From a water source control perspective, the existing site management controls (e.g. having appropriate bunding within areas prone to chemical spills) as required under Environment Protection Authority Victoria guidelines are deemed sufficient for managing any potential water contamination risks within the Goodman property. However, to provide long-term assurance on water quality it is envisaged that Goodman can establish new tenancy requirements for its site to ensure any future changes to current business activities do not significantly elevate the risks of water contamination at the site.

Financial risks mitigation

The key financial risks relates to the potential early termination of contracts that can lead to the scheme assets becoming stranded. The approach has been to adopt a shorter contractual term, with full recovery on investments to be achieved within the agreed term. A ten year contractual term has been proposed compared to the typical 25-year term which is usually used by CWW on projects with larger organisations or government entities.

In addition, the involvement of CWW as a scheme manager, being a large organisation with responsibilities and authority for the provision of water services, can make possible the recommissioning of stranded assets through new arrangements with new tenants or site owners or through enforcement of existing contractual agreements.

Further Investigation

While a preferred governance model has been identified by the project partners, further works are required to assess the details of the potential contractual conditions. This will include full business risks assessments by the individual project partners, expected by February 2010.

CONCLUSION

The investigation concluded that business-to-business stormwater scheme can be very economical due mainly to the simplicity of the engineering system involved. However, the long-term viability of the project will depend largely on the ability to develop appropriate risk mitigation measures and governance arrangements between the key stakeholders as oultined from the governance models presented in this paper.

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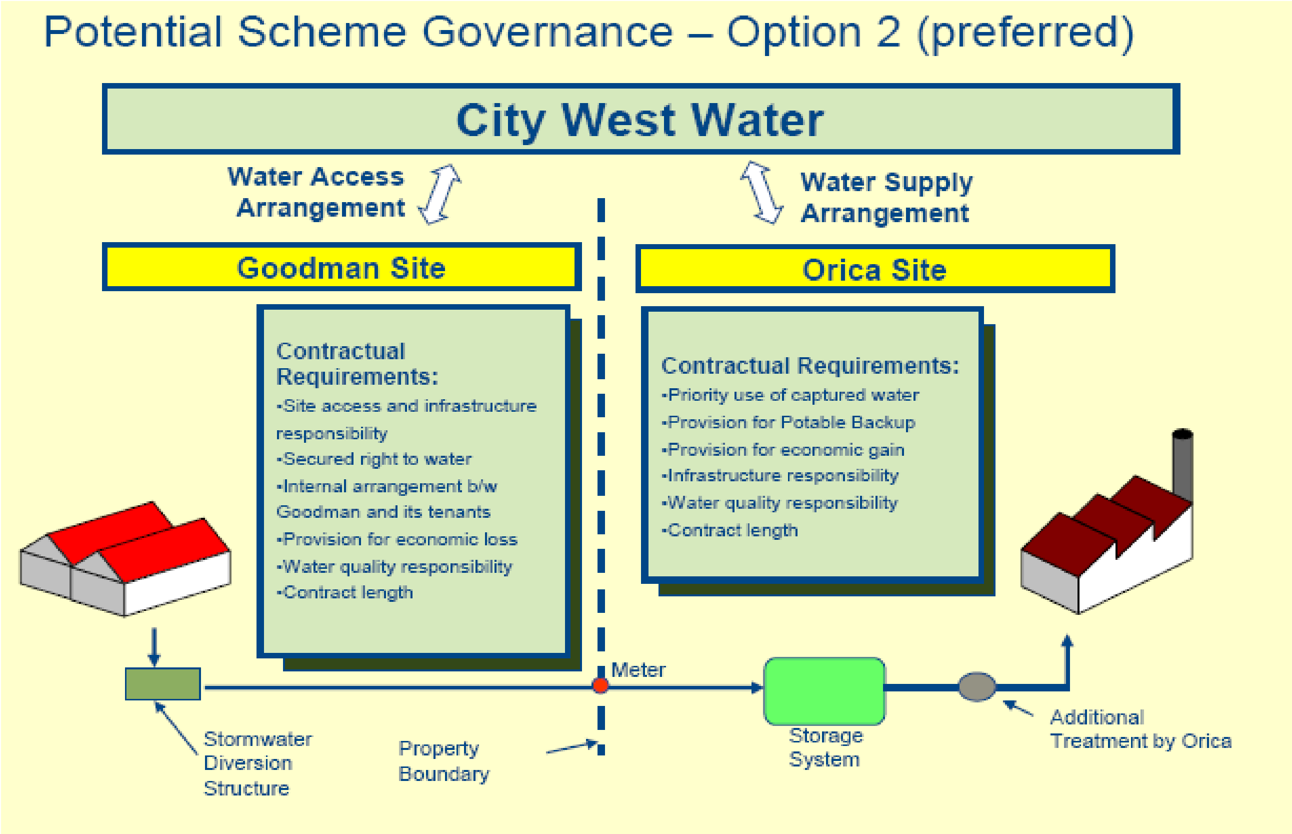

Figure 5: Potential Tripartite Scheme Governance Model