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Simpson Street Stormwater Management System Stage 2 – Catchment diversion and stormwater harvesting to provide flood protection

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ABSTRACT: This paper presents the integrated catchment management scheme adopted by Council to address a flood management problem, in the East Warrnambool / Simpson Street area. The Warrnambool City Council was presented with a significate flooding problem in this fast developing catchment, with both retail development and residential growth filing in the last green filed site. The Simpson Street catchment is serviced by an unlined drainage tunnel located in a low point. Constructed as a Whitlam era RED employment Scheme. The Tunnel is both under capacity and failing due to the increased run-off and surcharging storm event from a developing catchment.

A total catchment upgrade was designed, to divert up to 100 ha of catchment away from the tunnel, into the neighbouring Russel Creek catchment. To address potential flooding issues in the Russell Creek Catchment, a large retarding basin was constructed in the centre of the Warrnambool racecourse to store and discharge major storm in a controlled manner. The diversion of water to the racecourse also provided an opportunity to harvest water for irrigation needs at the race course. The Race Course uses up to 200 ml per annum irrigating the track and environ of the course. Much of the water was being sourced from ground water bores at the Racecourse, however the quality of the ground water is rated as poor with high salt and calcium levels leading to stunted turf growth and leaf burn. A better source of water was needed.

The project is comprised of diversion drain, gross pollutant trap, sediment basin, retarding basin, stormwater harvesting pump station and storage basin. The project was first conceived in 2008, and after an extended period of negations was signed into agreement in August 2018. With the agreement of Council, the Warrnambool Racing Club and Department of Environment, Land, Water and Planning (DELWP).

1 Introduction

Warrnambool City Council was faced with a significant issue. A failing Simpson Street Tunnel presented a significant liability risk and a flood risk to the surrounding community. Through the development of this project, Council identified, although complex, these risks presented an opportunity for an integrated solution to provide a community water source whilst minimising the flood risk.

Today everyone is concerned about the potential water scarcity with the effect of climate change and in the face of increasing, mainly population-driven, water demands, and its consequences on our energy and food production.

During times of extreme rainfall, the discussion centres on flood risk and its management as soon as damage and disruption to people and property occurs.

Until recently, stormwater harvesting was primarily considered as a solution to reduce potable water consumption in public areas. The impact of stormwater harvesting practices on drainage systems, mainly during extreme rainfall events, has been a secondary consideration. This paper presents the approach and outcomes adopted by Warrnambool City Council to develop and implement catchment scale stormwater harvesting to mitigate large scale flood management issues, by diverting a large catchment into an already flood affected creek.

2 Warrnambool

Warrnambool City is located on the Victorian south-west coastline, 265km from Melbourne, at the western end the Great Ocean Road and home to 34862 [1] residences.

Significant natural features include the estuaries of the Merri and Hopkins rivers and the expansive Lady Bay which in winter and spring is a nursery for southern right whales.

The municipality is also situated within Victoria's most productive farming region.

Prior to the arrival of Europeans, Warrnambool was home to a significant indigenous population. In 1918 Warrnambool was declared a city. In recent years Warrnambool's population has grown rapidly and the Council is planning for the population to reach 50,000 by 2036.

Warrnambool is a major employment base with significant dairy and meat processing factories along with a range of industries which service agricultural enterprises. Warrnambool generates a gross regional product of about $1.6 billion which accounts for over 20 per cent of the Great South Coast region's economic output despite the municipality covering less than one per cent of the region's total area.

Each year Warrnambool City Council manages operating budgets of between $70 million and $90 million, depending on the capital works projects being undertaken

3 Highlights

- Failing tunnel with limited capacity impacting on a large number of residences causing frequent flooding.
- Development of a flood mitigation option to divert over 100ha catchment away from the tunnel.
- Integration of stormwater harvesting to provide in a water source for Warrnambool Racecourse.
- Outlet larger flows into a flood affected catchment, ensure early release to not alter peak flood heights in the receiving creek.
- Provide holistic and integrated solutions incorporating multiple stakeholders.

4 Methodology

Catchment wide flood modelling identified a significant flood issue within the Warrnambool Racecourse catchment, with a number of properties being flooded during frequent rainfall events. This was caused by flat drainage within low lying areas and the capacity of the downstream Simpson Street tunnel. Council recognised that these problems would be further exacerbated by increasing urbanisation and climate change.

A review of the Simpson Street tunnel showed that it presented a significant risk of structural failure. The tunnel, primarily a semi lined sandstone tunnel, had a capacity of less than 1.8m3/s, but conveyed runoff from a large inland catchment (>100ha) to the Hopkins River. Council has re-lined the worst sections of the tunnel to resolve part of the issue, however a long term flood protection option was required to protect surrounding properties and infrastructure where capacity was exceeded. The only feasible option for alleviation was to divert water from the tunnel to an adjacent catchment, before discharging into an already flood prone Russell's Creek.

This project was proposed as early as 2003, however Council required agreement from a number of stakeholders to implement it. Many concepts and iterations of the project were developed between this time and 2016, however none of these progressed due to disagreements across stakeholders.

Recognising that Warrnambool Racecourse was one of Warrnambool's biggest water users, a stormwater harvesting component was added to the proposed flood management project, which enabled agreement across Council, the Victorian Government, Racing Victoria and the Racecourse itself. Integrating stormwater harvesting into this flood management project, provided the key to unlocking this project, with the system constructed in 2018/19.

Diversion was provided through a large underground reverse graded drainage pipeline, which intercepted existing underground drainage assets, and conveyed the water to a retarding basin within the Racecourse. This removed the stormwater from the Simpson Street Tunnel catchment up to the 10% AEP. The system was designed to offset the Racecourse's potable water usage (approximately 200 ML), whilst limiting the 1 EY flows of 1.1m3/s to Simpson Street Tunnel.

A large retarding basin was implemented to control the outflow into Russell's Creek. The additional flow from the diverted Simpson Street would have a significant flood impact on the Russell's Creek catchment, which was already flood prone, with large floodwalls constructed immediately downstream section of Racecourse. As a result, the discharged water could not impact the creeks peak flood levels. Modelling of the designed retarding basin and outlet, indicated that the retarded flow from Simpsons Street catchment, would occur prior to the peak flood from the remainder of the catchment.

An integrated flood and water balance model was completed to assess water harvesting potential and flood impacts. The modelling incorporated future scenarios, including climate

change and increased urbanisation. The water balance model assessed rainfall versus storage requirements, stormwater harvesting potential and the supply of water to Warrnambool Racecourse. The system was shown to have the potential to provide 130ML/year, approximately 72 per cent of demand for the site. Natural treatment was proposed to remove sediment before entering into the retarding basin, to ensure it was fit for purpose, with a sump and pump system used to divert water to a storage within the Racecourse.

5 Outcomes

Until recently, stormwater harvesting was primarily considered as an option to reduce potable water consumption. Its impact on flood management was quite often a secondary consideration. One reason being that these two functions, i.e. supplying water and managing floods, appear to be contradictory. In general, stormwater harvesting requires a storage to be more full than empty to meet the potable demands. Whereas, it should be nearly empty to be able to store the significant runoff occurring during larger rainfall events. However, integrating stormwater harvesting with retarding basins removes this competing interest. Warrnambool City Council demonstrated that integrating stormwater harvesting and flood management can provide multiple outcomes to the community.

Overall, the upgrade and development will mitigate further flooding in the area, providing protection to residents affected by previous flooding. The investment in the upgrade of new infrastructure will ensure the longevity of the Warrnambool Racecourse and surrounding drainage infrastructure.

Table of cost

Description	Budget (Ex GST)	Amount (Ex GST)
Simpson St Stage 1 Tunnel Relining	$2,250,000	$1,990,831
Simpson St Stage 2 Racecourse Civil Works	$4,750,000	$4,448,608
Total	**$7,000,000**	**$6,439,439**

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References

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2. Cardno Lawson Treloar, Report LJ5519 – Warrnambool Drainage Investigation Photos 2006.
3. Cardno Grogan Richard, Marc Noyce, Simpson street tunnel options analysis, Warrnambool 2008. pp 4-5.

Fig 1: Locality Plan

Fig 2: 28/11/2018

Fig 3: 17/12/2018

Fig 4: 22/03/2019

Fig 5: GPT Installation 14/05/2019