

Leopold LFR Stormwater Management Report

Prepared for: Lascorp

18 October 2019

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1 Introduction

Biofilta Pty Ltd was engaged by Lascorp Pty to prepare a concept stormwater management plan for a proposed development on land at 601-619 Bellarine Highway and 21-39 Clifton Avenue, Moolap.

The report has been prepared by Mr Marc Noyce, of 11 Rhone Grove, Skye who has a Degree in Civil Engineering and 20+ years' experience in the water industry with 10+ years' specific experience in hydrology and hydraulic modelling. Mr Noyce has worked for Melbourne Water for 7 years as a Project Manager overseeing the design and implementation of 20+ stormwater treatment wetlands across Melbourne, was a Principal with multinational engineering firm Cardno for 7.5 years leading a stormwater design team undertaking similar assessments using 1d and 2D flood modelling software and has since spent 5 years with Biofilta undertaking similar stormwater modelling, design and construction work.

A site visit has been undertaken to familiarise myself with the site and I have direct experience in the design of the existing stormwater treatment system opposite the subject site.

This report supports the development and shows that the resulting outcome would:

- improve existing flood conditions for the site and surrounding properties
- provide a regional drainage solution that cannot be solved without the proposed development and purchase of land to the south of the Bellarine Highway
- reduces ongoing Council costs of maintaining the existing drainage solution that services the Gateway Plaza extension
- improves water quality outcome for the downstream ecologically sensitive Reedy Lake system
- establish much needed additional flora and fauna habitat adjacent to the Gateway Sanctuary wetlands
- create new and connected community walking trails through a proposed wetland system

It is my opinion that the water sensitive urban design features proposed for this development has multiple social, environmental and economic benefits to the wider community of Leopold and should be supported by the Panel.

I confirm that I have made all the enquiries that I believe are desirable and appropriate and that no matters of significance, which I regard as relevant here, have been withheld from the Panel.



18/10/2019

2 Site Description

The subject site is located at 601-619 Bellarine Highway and 21-39 Clifton Avenue, Moolap.

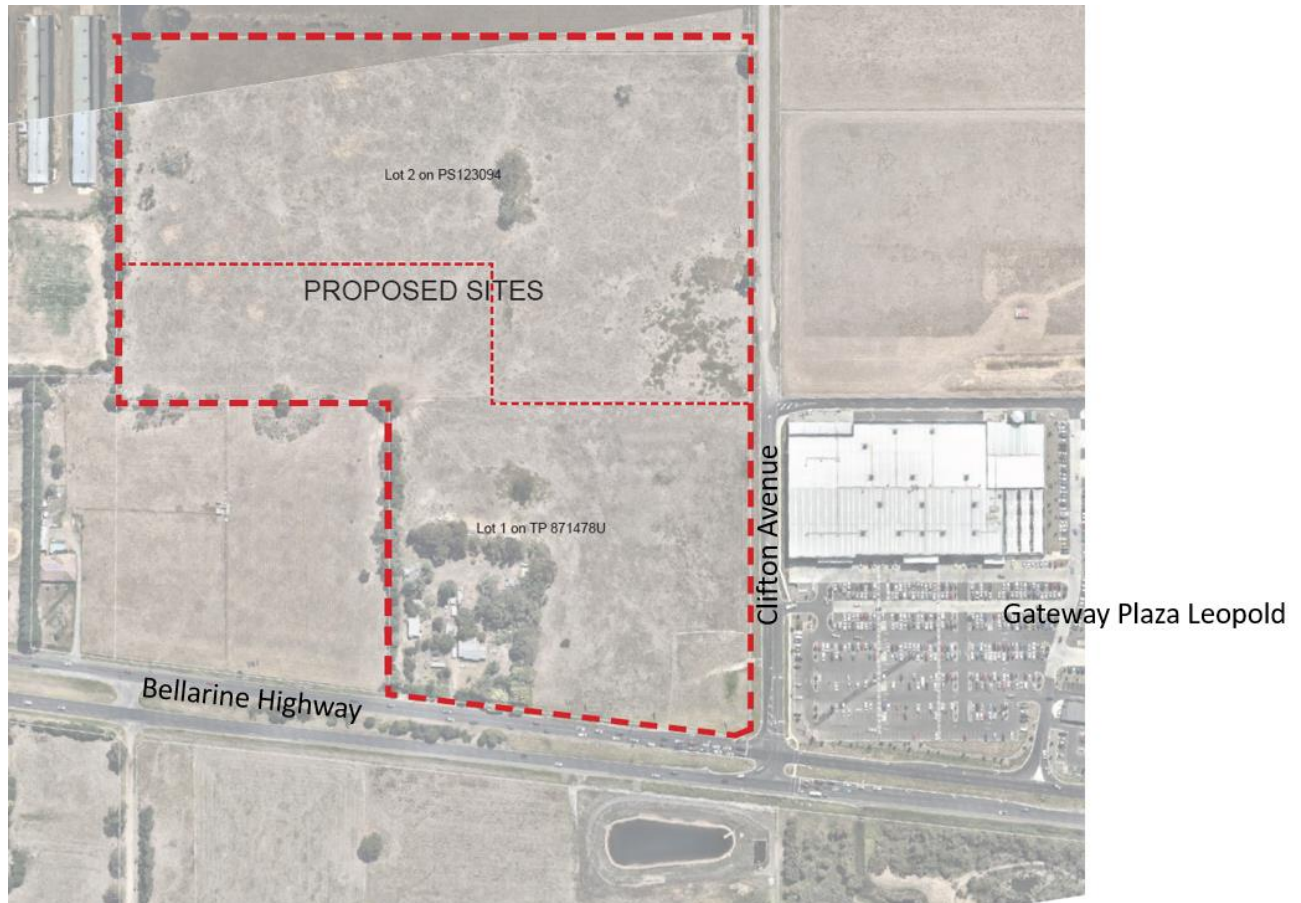


Figure 1: Subject Site

The site comprises 2 Lots and totals an area of approximately 12.4ha.

The site is currently farmland with sparse vegetation coverage and an existing dwelling abutting the Bellarine Highway.

Aerial laser survey was obtained for the site and surrounds for the purposes of providing survey data for the hydraulic modelling contained in this report.

From the aerial survey, the site generally falls from west to east towards Clifton Avenue from RL 9.0m AHD to RL 7.6m AHD along the northern boundary.

Along the southern boundary, the site falls west to east from RL 9.1m AHD to RL 7.53m AHD at the corner of Clifton Avenue and the Bellarine Highway.

In the north-south direction, a portion of the site falls north along Clifton Avenue and forms the top of the local catchment for the site with the majority of the site falling south towards the Bellerine Highway.

A representation of the fall of the site looking in the direction of the green arrows:

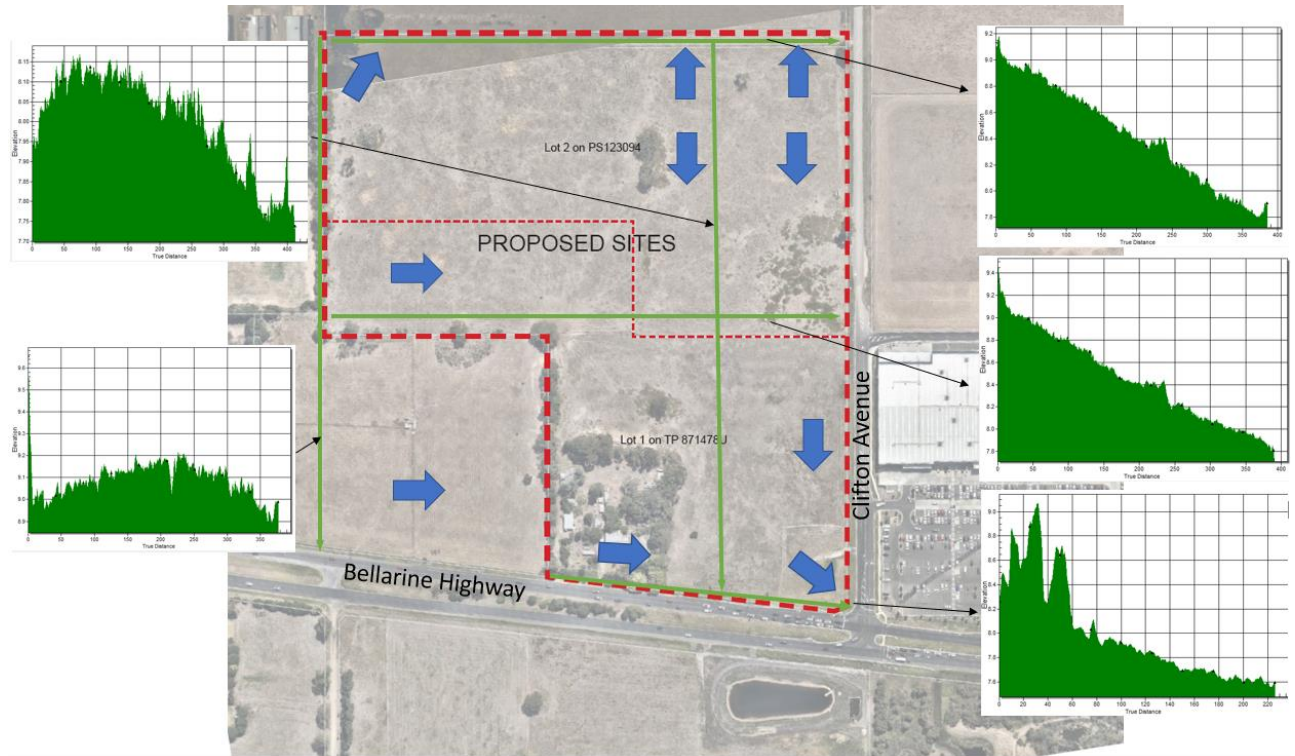


Figure 2: Site Topography

The Bellerine Highway currently forms a barrier to overland flow from the subject site currently and the subject site is known to flood.

From the street, the south east corner is currently dammed by the Bellarine Highway and Clifton Grove.



Figure 3: Site Picture Cnr Bellarine Highway and Clifton Ave

2.1 Adjacent Gateway Plaza Drainage

Drainage of land is restricted in the local area due to topography and a lack of appropriately sized drainage infrastructure. In 2015, plans were endorsed to construct an extension to the Gateway Plaza with a 1 in 100year flood basin, bioretention treatment system and conveyance culverts crossing the Bellarine Highway to implement a flood management and treatment solution to the site.

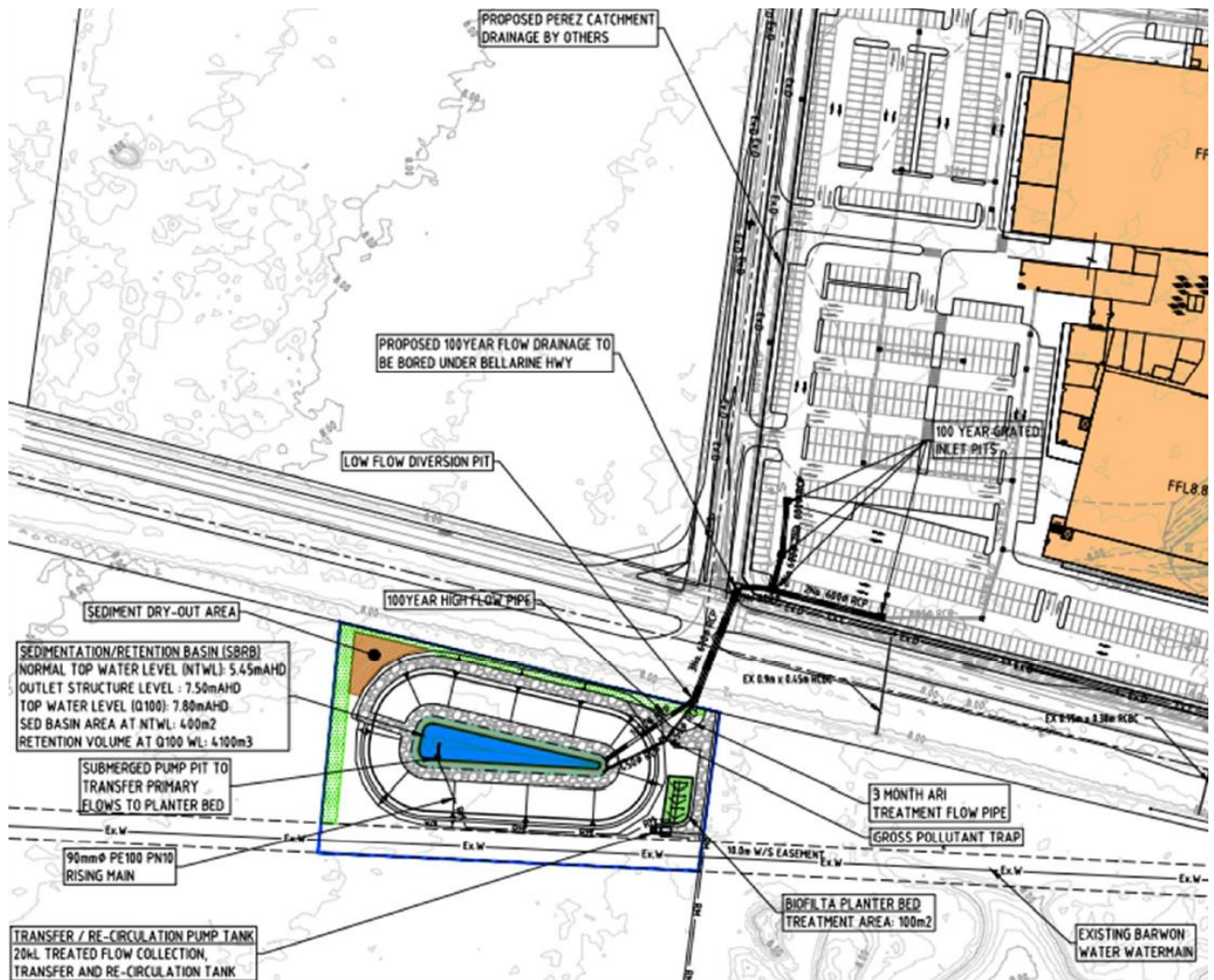


Figure 4: Drainage for Site East of Clifton Avenue

The drainage solution for the site east of Clifton Avenue provides for 3no. 600mm diameter culverts crossing of the Bellarine Highway and conveying stormwater into a large retarding and sediment basin on the south side of the Bellarine Highway and adjacent to the Gateway Sanctuary wetlands.

Stormwater drainage from the Gateway Plaza extension could not be directed into the existing Gateway Sanctuary wetlands as the wetlands were already considered to be at capacity. The drainage solution currently involves pumping stormwater from the detention basin, into a bioretention basin and then treated stormwater is pumped via a rising main to the outlet of the Sanctuary wetlands some 260m away and into an open channel that ultimately leads to Reedy Lake.

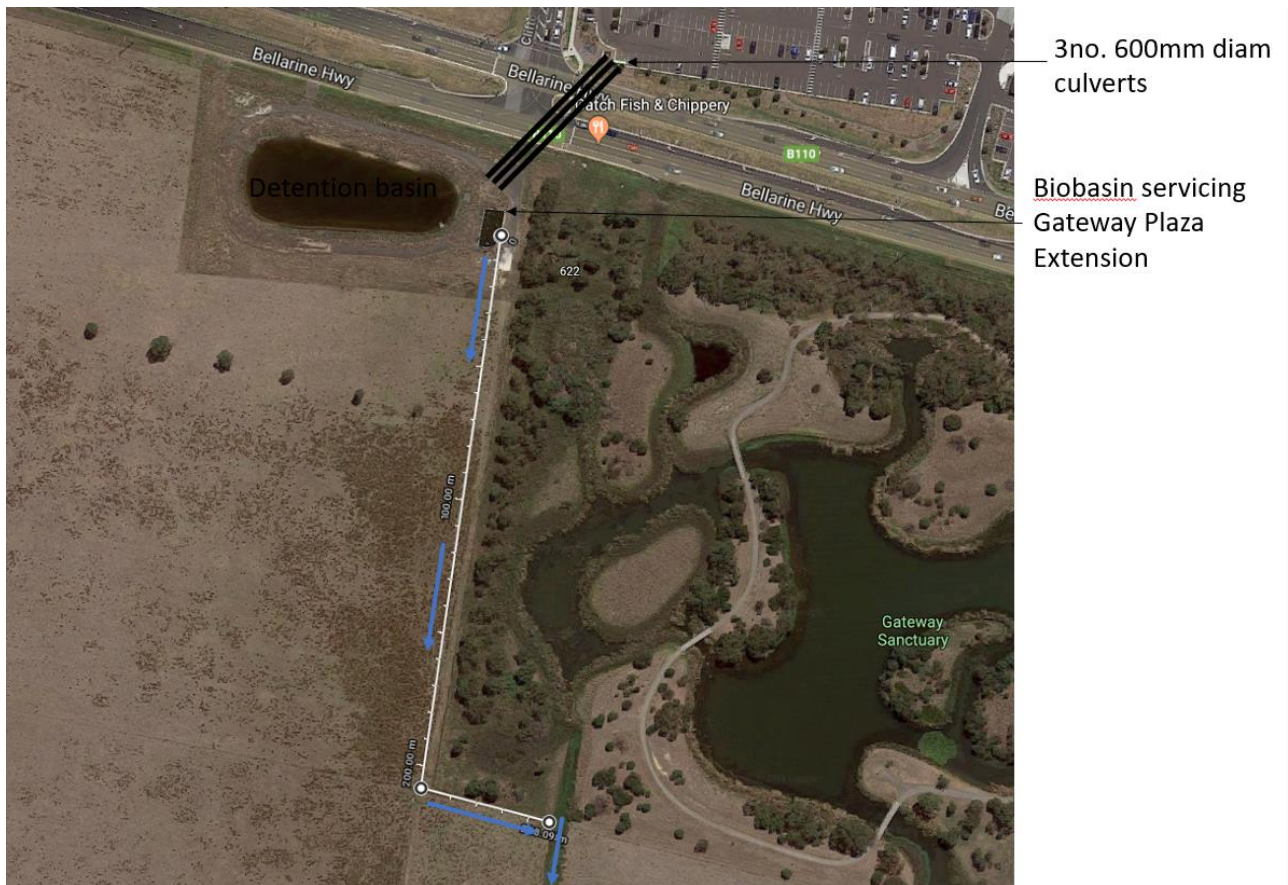


Figure 5: Rising Main to open channel downstream of Gateway Sanctuary

Due to the constraints of the discharge capacity into the Gateway Sanctuary, one downside to the pumped solution is that it is an energy intensive solution for drainage and Council officers have expressed a view that a wetland solution not needing pumps and power would be desirable.

3 Existing Flood Modelling

Flood mapping from the City of Greater Geelong (2011) was obtained for the subject site as part of a study undertaken by Cardno for the Gateway Plaza extension.

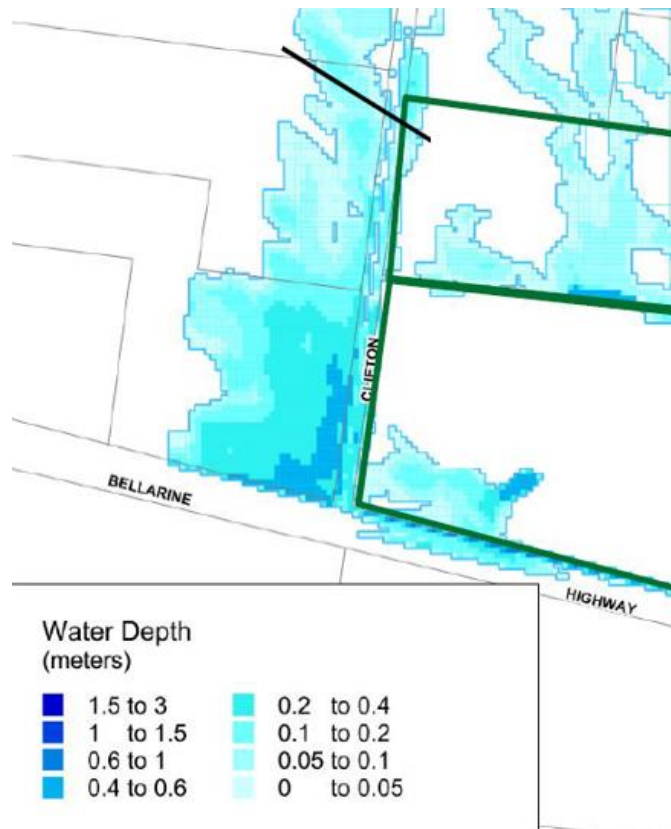


Figure 6: Existing Q100 Flood Modelling (Cardno 2007)

From Figure 6, the subject site was inundated during the 1 in 100 year AEP event.

Previous sub-catchment delineation by others indicates that catchments to the west of Clifton Avenue (shown as BQ and BR below) previously contributed to flows into the Sanctuary Wetland system:

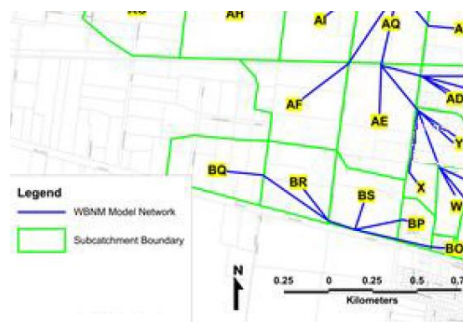


Figure 7: Previous Catchment Delineation (Cardno report 2015)

Recent flood mitigation works as described in Section 2 of this report intercepts flood flows from the east of Clifton Avenue and no longer enters the subject site to the west of Clifton Avenue. Hence, the previous flood modelling is now out of date.

Contributing flow to the subject site is now contained to the site itself and an external catchment from the west.

3.1 Existing Flows

For the subject site, Lidar data was obtained to provide a digital terrain model for the subject site and surrounds.

ARR2016 values for hydrological inputs were downloaded from the Bureau Of Meteorology and an ensemble of flows created to determine the critical 1 in 100 year storm duration for the site using XPStorm 2019 v1.

Parameters used for the existing case:

Initial loss:	19mm
Continuing loss:	2mm
Catchment area:	12.4ha (subject site only)
Routing method:	Laurenson
Catchment slope:	0.4%
Fraction imp:	0%

For this large site with minimal development, XPStorm predicts that the critical storm is the 1 in 100 year 3hr event:

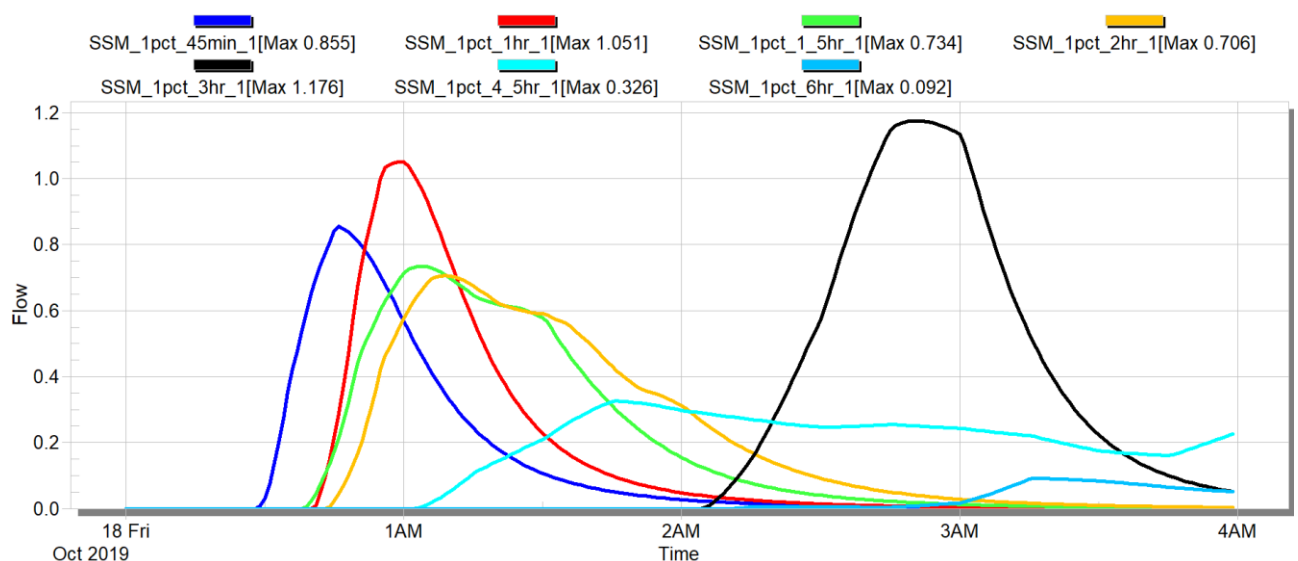


Figure 8: Existing Flows Q100 AEP

From Figure 8, maximum existing flow from the total subject site is 1.18m³/s assuming that there is a sufficient outfall to convey flows. In reality, this flow would pond at the corner of Clifton Avenue until it reached the roadway level.

A 2D surface model of the existing scenario shows ponding of up to 500mm in the south east corner of the site:

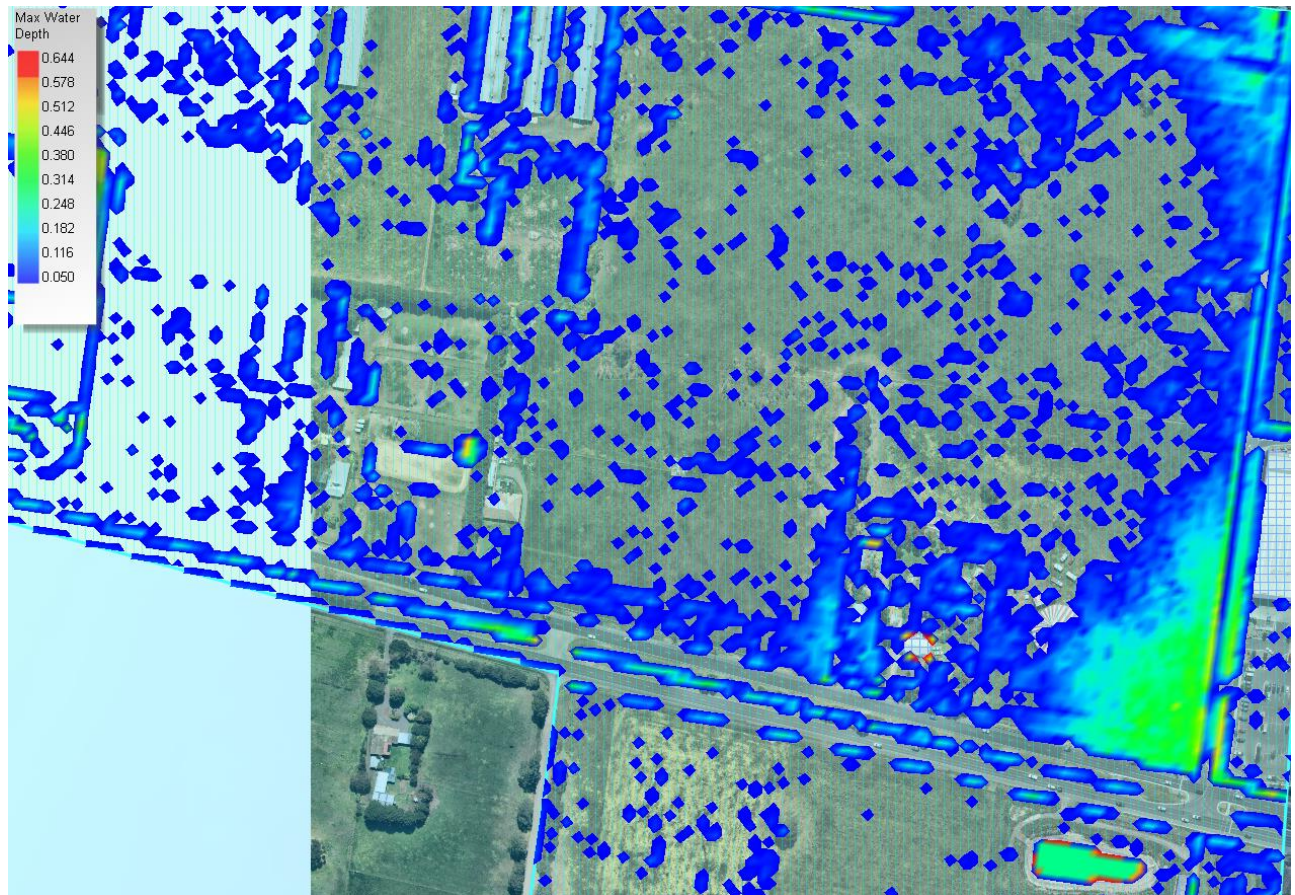


Figure 9: Existing Scenario Q100 AEP

Figure 9 is consistent with the predicted flood levels from previous reports (Refer Fig 6 previously).

For the developed state, the site's fraction impervious was modified to 0.9 and the modelling repeated:

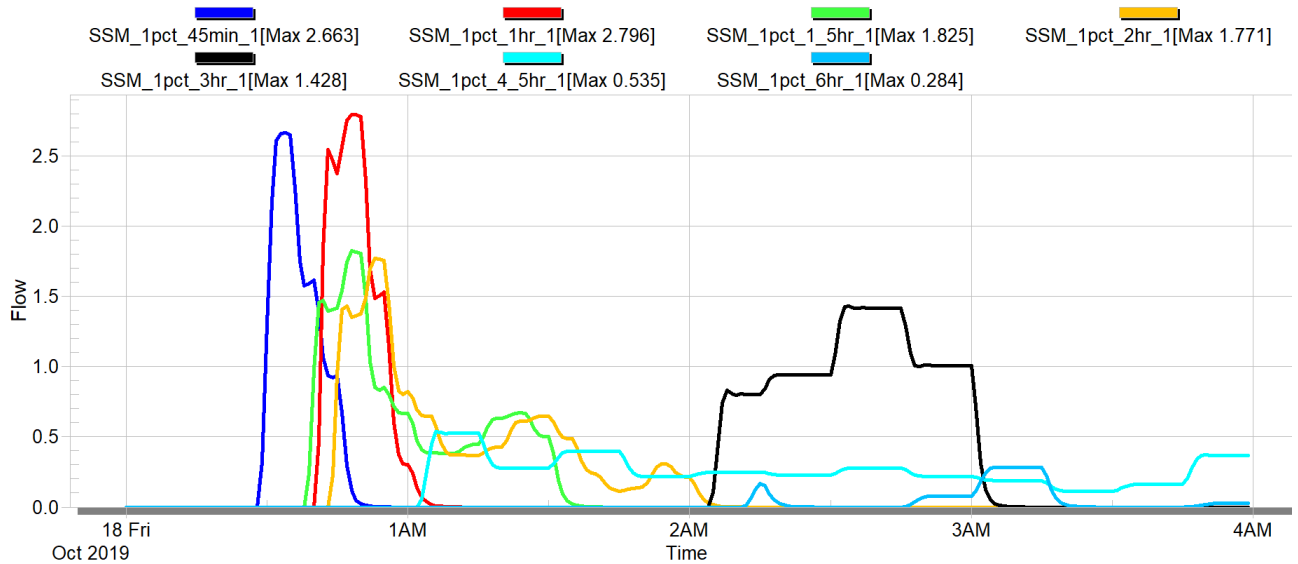


Figure 10: Developed Flows Q100 AEP

Developed flows from the site peaks at 2.8m³/s (cf 1.18m³/s undeveloped) and critical duration drops to the 1hr duration due to the developed nature of the runoff.

4 Proposed Development

I have been asked to consider the drainage required for a potential development of an aged care facility for the northern portion of the site and a retail development for the southern portion abutting Bellarine Highway and Clifton Avenue.

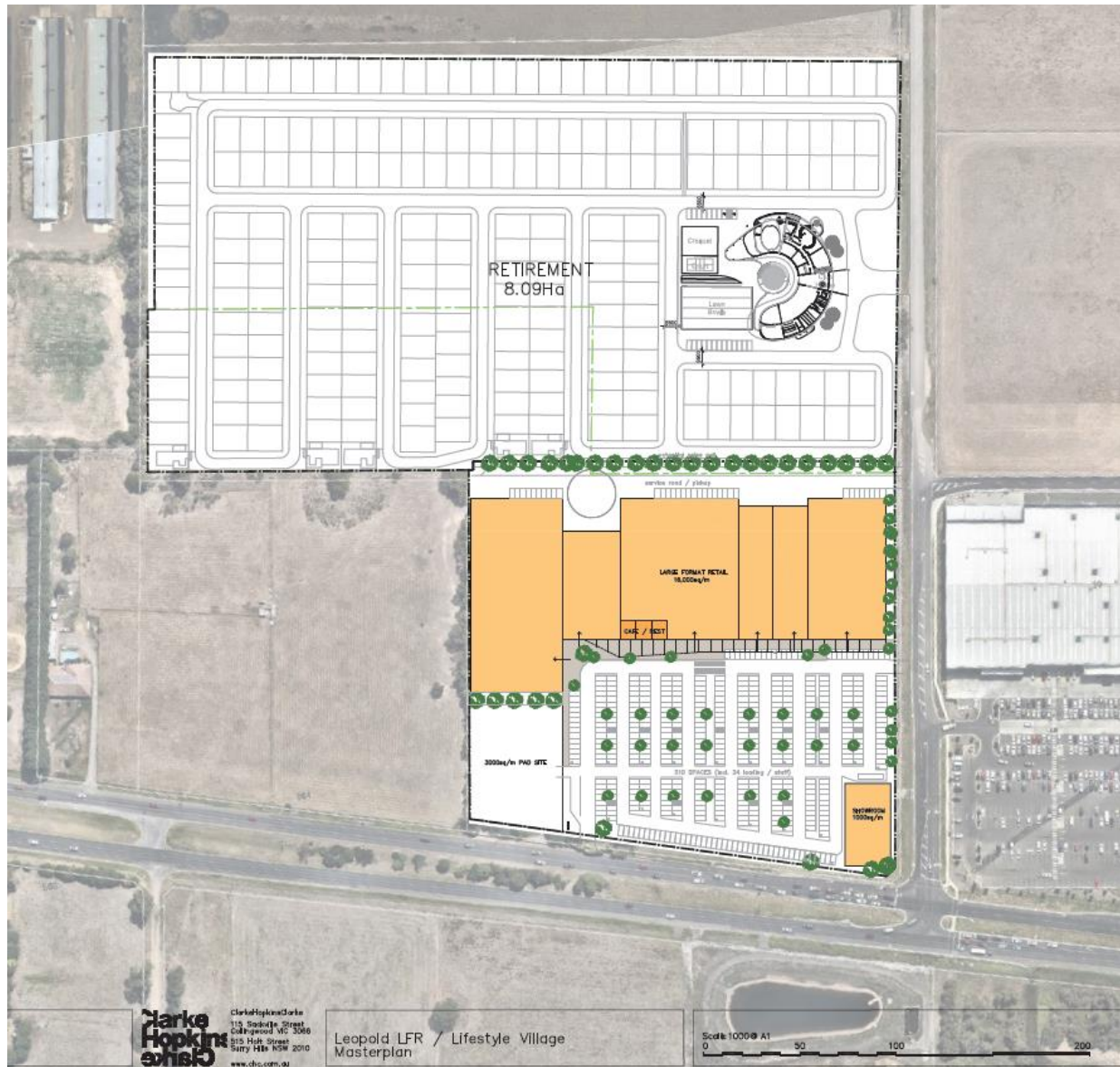


Figure 11: Development Plan

Key features of the proposed development:

- Retirement Village 8ha
- Majority of the site is either roof area or car park
- Large retail and carpark similar to the eastern side of Clifton Avenue
- Fraction impervious change from 0 to 90%

4.1 Proposed Drainage Solution

As stated previously, the subject site has no outfall and to enable development, a new outlet would be required.

Culverts to the east of Clifton Avenue servicing the Gateway Plaza extension are dedicated to that catchment and therefore unavailable for any new development.

To enable a discharge of stormwater, land to the south of the Bellarine Highway and adjacent to the retarding basin built for the Gateway Plaza extension will be acquired for the purpose of constructing a large wetland that services the subject development and also the Gateway Plaza extension.

It is proposed that flows from the subject development will be directed to a new drainage crossing be constructed under the Bellarine Highway and new drainage facilities created to the south of the Bellarine Highway.

New culverts would be set at invert RL 6.0 and bored under the Bellarine Highway to discharge into the existing basin at RL 5.5m AHD noting that the basin has a floor level of RL 5.0m AHD.

The new basin configuration will fill to RL 7.5m AHD and maximum water level will be set at RL 7.8m AHD to match the previously adopted Q100 design level to provide extended detention of 300mm and flood storage volume. The basin will then spill into a newly constructed wetland which is excavated into the land to discharge into the existing channel downstream of the Sanctuary Wetland at a normal top water level of RL 7.3m AHD thus providing 0.2m fall for the wetland to flow into the channel downstream of the Sanctuary wetlands. The entire wetland system will be able to pond to RL7.8m AHD which is below the existing surface on the south side of Bellarine Highway.

Upstream gross pollutant traps will be required to prevent litter and debris entering the sediment pond and wetland system.

Preliminary 2D modelling of the proposed development with revised surface parameters for the developed site modelled as a roof with a 90% fraction impervious, 2mm initial loss and no ongoing loss for the shows significant benefit to local flooding and compared to the existing scenario.

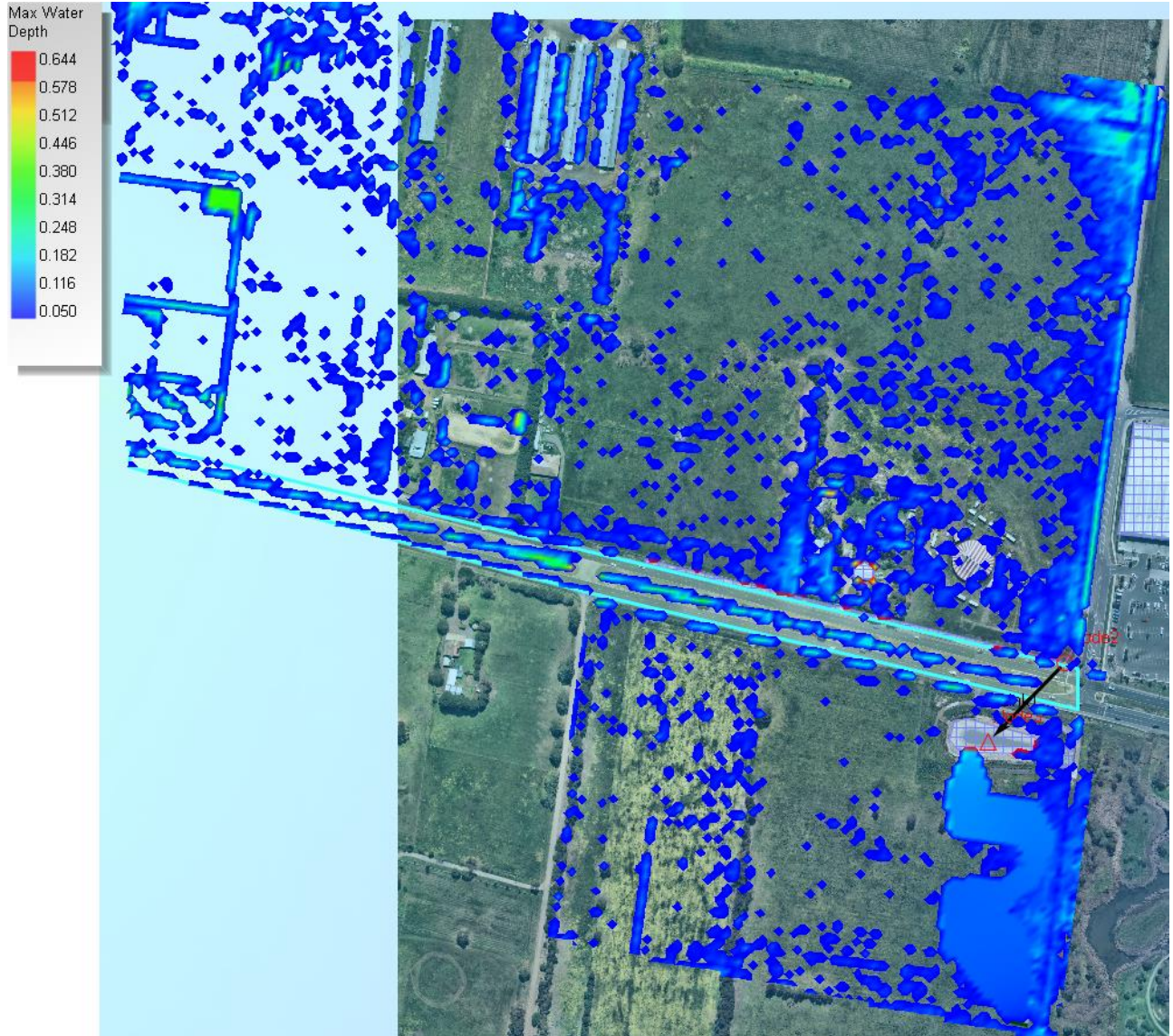


Figure 12: Developed Case Flood Mitigation

From Figure 12, the flood impacts on the corner of Clifton Avenue have been significantly reduced over the current scenario as flood water is transferred via pipes into the basin and new wetland south of Bellarine Highway. Further detailed modelling would result in the site being fully mitigated from flooding.

5 New Wetland Sizing

MUSIC V6 was used to size a sediment basin / wetland to service the development site and 6.5ha of the existing adjacent Gateway Plaza Extension as total system.

	Rainfall/6 Minutes	Evapo-Transpiration
mean	0.006	3.031
median	0.000	2.340
maximum	8.750	5.320
minimum	0.000	1.000
10 percentile	0.000	1.090
90 percentile	0.006	4.810
mean annual	513	1106

Figure 13: Rainfall Data

Rainfall for the Bellarine area is simulated with continuous rainfall for the area and a mean annual rainfall of 513mm.

A total of 12.4ha + 6.5ha = 18.9ha will be serviced by a new combined wetland / retarding basin and utilising the existing 1,500m² basin as a deep sediment pond.

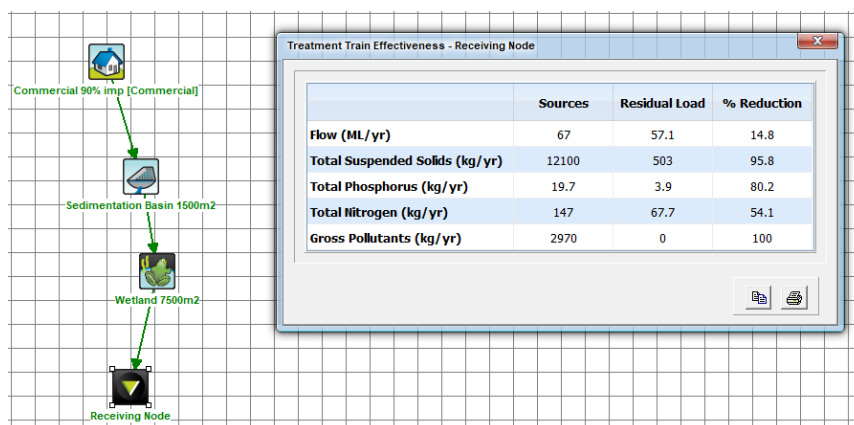


Figure 14: Wetland Sizing Outcome

MUSIC results indicate that a constructed wetland of 7,500m² surface area in conjunction with the existing 1,500m² sediment pond will be sufficient to exceed Best Practice Environmental outcomes.

Output vs Best Practice Environmental Performance:

Parameter	Best Practice removal %	Modelled Removal %
Total Suspended Solids	80	95.8
Total Phosphorus	45	80.2
Total Nitrogen	45	54.1

In all parameters, the proposed system exceeds Best Practice environmental requirements.

A sketch of the proposed wetland system area meeting the required macrophyte area:



Figure 15: Wetland Concept Sketch

In the broader context, the site and wetland would be located as shown in Figure 15.



Figure 16: Wetland Concept Context

There is sufficient land area available to provide the required macrophyte area to treat runoff from both the proposed site and Gateway Plaza.

Material won from the wetland excavation could be used as a fill pad material (subject to geotechnical advice) for the new development.

Area within the dark green wetland band shown above provides 8,800m² of area for the wetland which is more than the required 7,500m².

Walking tracks and habitat planting areas have been incorporated into the concept sketch to compliment the Gateway Sanctuary walking trail and plantings.

Excavation of an average of 0.5m across the site would yield 4,400m³ of volume to provide for flood detention and treatment.

5.1 Cost Savings To Council

The existing stormwater treatment system costs over \$15,000 to maintain per annum, predominantly due to the power consumption of the pumps required to bypass the Sanctuary wetlands some 260m.

The new wetland system will effectively remove all ongoing power costs from this system which is a positive economic outcome.

The wetland proposed will have costs associated with it's maintenance, however the client will be responsible for establishing the wetland system to Council's satisfaction and ongoing costs are expected to be lower than current.

5.2 Benefits to neighbouring properties

Properties to the west of the subject site cannot develop their land due to a lack of stormwater outfall.

The proposed development offers a solution to neighbours as provision to accommodate overland flows into a swale system enables a legal point of discharge to be formalised.

Historic flooding of the corner of Clifton Avenue and Bellarine Highway can be solved and is no longer an area that is prone to flooding and a potential hazard with standing water 500mm deep.

The parkland features of the outcome also enhances recreational opportunities.

6 Conclusions

Based on a detailed hydraulic assessment it is my opinion that the proposed development would result in a win-win scenario for regional drainage, historic flooding west of Clifton Avenue and cost savings to Council through rationalisation of drainage assets associated with the existing Gateway Plaza stormwater system.

The land south of the Bellarine Highway enables the proposed development to create a viable drainage solution that can enhance the natural beauty of the area and provide greater habitat and community function through developing a stormwater quality treatment wetland that links to the downstream end of the Gateway Sanctuary but does not impact on its function in any way.

The proposed drainage solution makes better use of a large existing detention basin and turns it into a conveniently located sediment collection pond and pre-treatment basin for a new 8,000m² wetland downstream servicing the subject development site of 12.4ha and the existing Gateway Plaza.

In my opinion, allowing the development to occur will have a positive impact on historic flooding issues in this area and offers benefits to the wider community and environment.