Bellbrae Stormwater Masterplan
Proposed Re-Zoning West of School Road

Introduction

Surf Coast Shire Council is proposing to rezone approximately 14 hectares of land west of School Road, within the township of Bellbrae. The purpose of this document is to provide an integrated stormwater master plan for the future infill area to ensure best practise stormwater management principles, as required under Clause 56 of the Surf Coast Planning Scheme can be met.

Scope of Works

- Review of existing catchments
- Fraction impervious estimation
- Catchment analysis for proposed rezoning based upon design philosophy
- Calculations to the size the required infrastructure to provide adequate protection at a development scale
- Preparation of Stormwater Master Plan

Existing Conditions

A catchment analysis has been completed; Figure 1 shows the entire catchment contributing to Location A. Location A is a point located on the northern side of Cunningham Drive, which all the stormwater from the land proposed for rezoning must pass through. For the purposes of this catchment analysis the catchment has been divided into two separate sections, representing the different land uses currently in place.

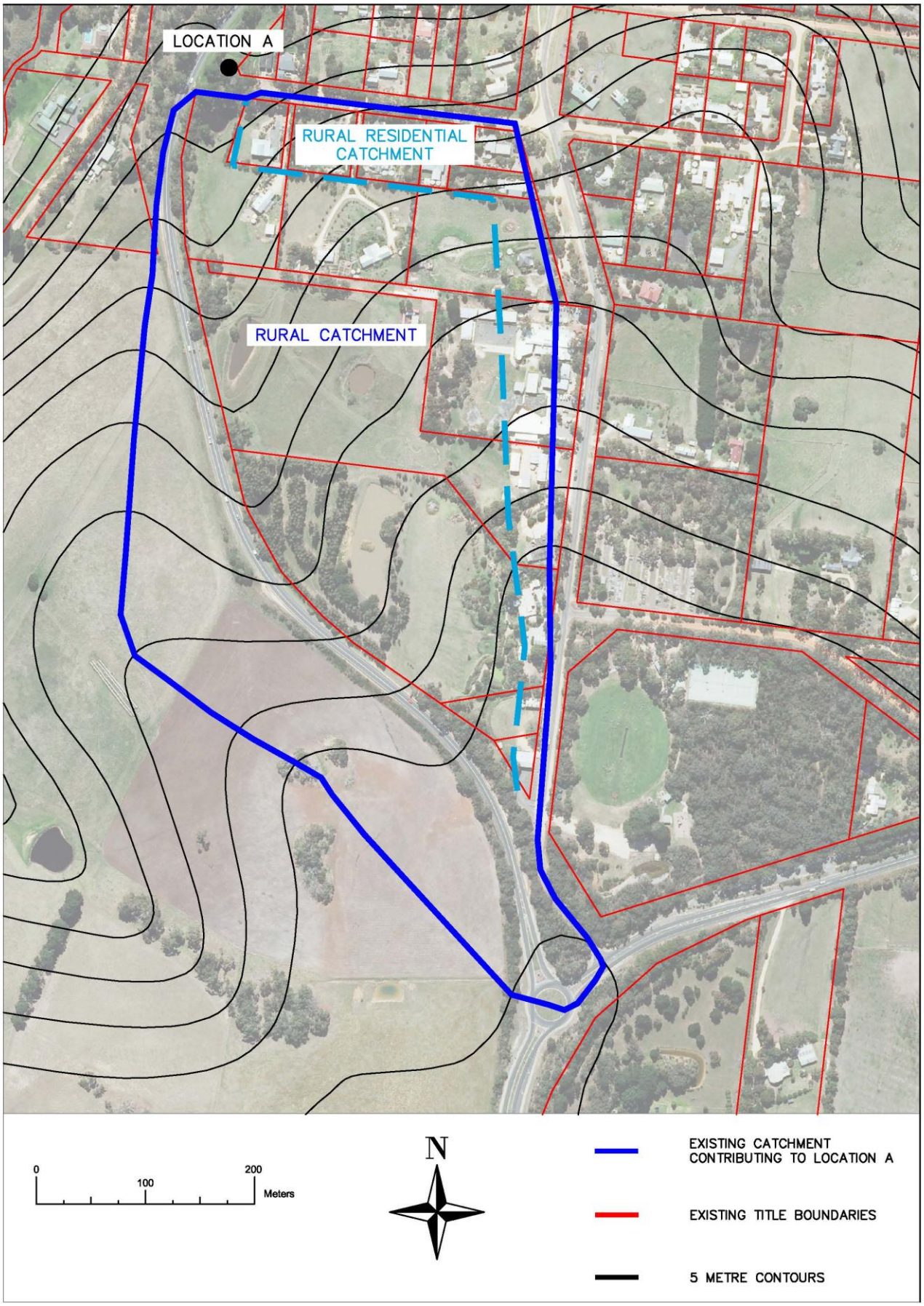

Figure 1: Existing Catchment

Existing Conditions Analysis

$Q = C.I.A/360$

Total Catchment Area: 24.7 Ha (20.9 Rural, 3.8 Rural residential)

Time of Concentration: $T_c = 0.76A^{0.38}$
$T_c = 27$ minutes

Intensity: $I_{27\ min\ 100\ yr} = 72.15$ mm/hr

Co-efficient of runoff: $C_{5\ Rural} = 0.2$ $C_{5\ Rural\ residential} = 0.3$

(Based upon Melbourne Water runoff coefficients)

Frequency Factors: $FF_{5\ year} = 0.95$
$FF_{10\ year} = 1.00$

(Adjusting C5 to get C10)

$C_{10\ Rural} = 0.2 \times 1.00/0.95$ $C_{10\ Rural\ residential} = 0.3 \times 1.00/0.95$
$C_{10\ Rural} = 0.21$ $C_{10\ Rural\ residential} = 0.32$

$C_Y = C_{10} \times FF_Y$

$FF_{100\ year} = 1.3$

$C_{100\ Rural} = 0.21 \times 1.3 = 0.27$ $C_{100\ Rural\ residential} = 0.32 \times 1.3 = 0.42$

$$Q_{100} = \frac{72.15 \times ((0.27 \times 20.9) + (0.42 \times 3.8))}{360} = 1.45\ m^3/sec$$

Design Philosophy

It is proposed that the rezoning and subsequent subdivision of the infill area will result in the creation of 19 individual lots with an average size of 4000 m2 and 9 individual lots with an average size of 2500 m2. The key aspect of the design philosophy is to plan for an appropriate drainage system with the following attributes:

- To provide a drainage solution that is suitable within a rural residential environment.
- To provide 100 year average recurrence interval (ARI) flood protection to building areas, existing and proposed.
- To convey flows along existing and proposed road reserves and/or existing and proposed easements.
- To maximise the use of open drains and swales to convey runoff, as is consistent with the local area, while reducing runoff velocities, capital cost and having a positive effect in relation to stormwater treatment.
- Where underground drainage pipes and property culverts are proposed ensure that they convey an appropriate peak flow, while ensuring additional flows over the pipe capacity are catered for in a controlled and defined overland flow path.
- Stormwater treatment to achieve Best Practice treatment targets, best achieved through the use of swales and one central wetland

Proposed Development

A conceptual plan of sub-division has been provided to Council, as shown in Figure 2 (next page).

Figure 2. Proposed new title boundaries

Stormwater Conveyance

The objective for the conveyance of stormwater through the precinct was to obtain no increase in the peak 100 year ARI flood flows from existing conditions. As shown previously, peak flow occurs during a design storm event with a duration of 27 minutes, and discharges at a rate of 1.45 m3/second. Retardation will need to be designed to limit post development discharge to match this flow rate.

Fraction Impervious / Runoff Coefficient for Developed Estate

In order to accurately estimate flows emanating from the proposed development it is necessary to determine an impervious fraction for the developed estate. An audit of similar developments within Surf Coast Shire shows that lots in the order of 4000 m2 typically are developed to include 26% hard stand area (inclusive of driveways, sheds etc). For all stormwater calculations in relation to this proposed development Council will adopt a value for runoff coefficient (C5 value) of 35% to account for the increased development on the 2500 m2 lots and road reserve.

Stormwater from 40 School Road

The proposed minimum lot size to be applied to the infill area through the application of a Design and Development Overlay Schedule 24 will potentially allow the subdivision of 40 School Road into three (3) 2500 m2 lots fronting School Road, and a further one (1) 4000 m2 lot at the rear, as shown in Figure 3 (below). St Quentin Consulting undertook MUSIC modelling for this site and propose that future development within 40 School Road could discharge to School Road, and thus be excluded from the centralised stormwater treatment infrastructure outlined in this report.

This option may be considered provided all development occurs above the 57 metre contour line, so that all impervious areas can be drained to School Road via gravity. A separate Stormwater Management Plan will need to be prepared for this site and submitted with the plan of sub-division, clearly showing how the entire site will achieve no additional peak discharge to School Road, and meet stormwater quality requirements. Building envelopes should also be provided to ensure that future development of the site can meet the requirements of the stormwater management plan.

In addition, the development at 40 School Road will need to cater for, and transfer surface water emanating from the School, not captured within the Schools existing stormwater system.

Figure 3: 40 School Road

Developed Conditions for Remainder of Proposed Subdivision.

In order to achieve an integrated stormwater management solution for the remainder of the infill catchment it is recommended that a wetland and retarding basin be designed and constructed adjacent to Location A (as shown in Figure 1). Providing for a design storm of 27 minutes the peak discharge in an unmitigated (without construction of any retarding basin) scenario from the entire infill area will be:

$Q = C.I.A/360$

Total Catchment Area: 24.7 Ha 10.2 Rural, 14.5 Rural residential

(40 School Road is included in the "Rural" catchment; this assumes the developer will discharge to School Road at a maximum of pre-development levels)

Time of Concentration: $T_c = 0.76A^{0.38}$
$T_c = 27$ minutes

Intensity: $I_{27\ min\ 100\ yr} = 72.15$ mm/hr

$C_{5\ Rural} = 0.2$

$C_{5\ Rural\ residential} = 0.35$ (as discussed previously)

$FF_{5\ year} = 0.95$
$FF_{10\ year} = 1.00$

$C_{10\ Rural} = 0.2 \times 1.00/0.95$
$C_{10\ Rural} = 0.21$

$C_{10\ Rural\ residential} = 0.35 \times 1.00/0.95$
$C_{10\ Rural\ residential} = 0.37$

$C_Y = C_{10} \times FF_Y$

$FF_{100\ year} = 1.3$

$C_{100\ Rural} = 0.21 \times 1.3 = 0.27$

$C_{100\ Rural\ residential} = 0.37 \times 1.3 = 0.48$

$$Q_{100} = \frac{72.15 \times ((0.27 \times 10.2) + (0.48 \times 14.5))}{360} = 2.03\ m^3/sec$$

Council's initial estimate of the volume required to achieve retardation to pre development flows is in the order of 1300 m3 (subject to detailed design) this will need to be verified in the stormwater management plan and detailed engineering design prepared as part of any future plan of subdivision submitted for the infill area.

Stormwater Quality from Developed Subdivision

As per the design philosophy it is proposed to convey the majority of stormwater in open swales. These major swales would be constructed along the main road servicing 60 and 70 School Road, and at the rear of the lots adjacent to Anglesea Road. These swales would then discharge to the proposed retarding basin as shown in Figure 4 (next page).

Figure 4: Proposed WSUD treatments

A preliminary MUSIC model has been created and run for the catchment based upon the layout shown in Figure 4. Initial modelling results using rainwater tanks on each lot, and grassed swales with a total width of 5 metres, indicate that best practice can be achieved with a single wetland with a surface area of approximately 350 m2 (assuming 1m extended detention depth). A wetland of this size can be facilitated within the footprint of the required retarding basin. The detailed design of the wetland needs to consider existing effluent disposal areas for adjoining properties, the eastern embankment should be raised to protect against surface runoff emanating from 65 Cunningham Drive.

Lot Scale Easements and Stormwater Infrastructure Requirements

As shown in Figure 5 (below) lots adjacent to Anglesea Road will need two easements created; one for the large swale at the rear of the lot (estimated at 5.0 metre wide), and a second smaller easement (3.0 metres wide) on the low side to protect the neighbouring property from surface flows not captured within a properties individual stormwater system.

This smaller easement is also required on all other lots. The infrastructure within this smaller easement can take the form of either a mound or grassed swale – the aim is to convey surface water to the nearest main swale.

Effluent disposal areas need to be constructed in accordance with EPA guidelines to achieve no contamination with the lot scale stormwater infrastructure.

Figure 5: Proposed drainage easements

At the rear of the 2500 m^2 lots within 60 School Road a piped drainage solution is proposed as shown in Figure 6 (below). This will allow conveyance of increased flows from these smaller lots through the adjoining property with minimal impact on the downstream property.

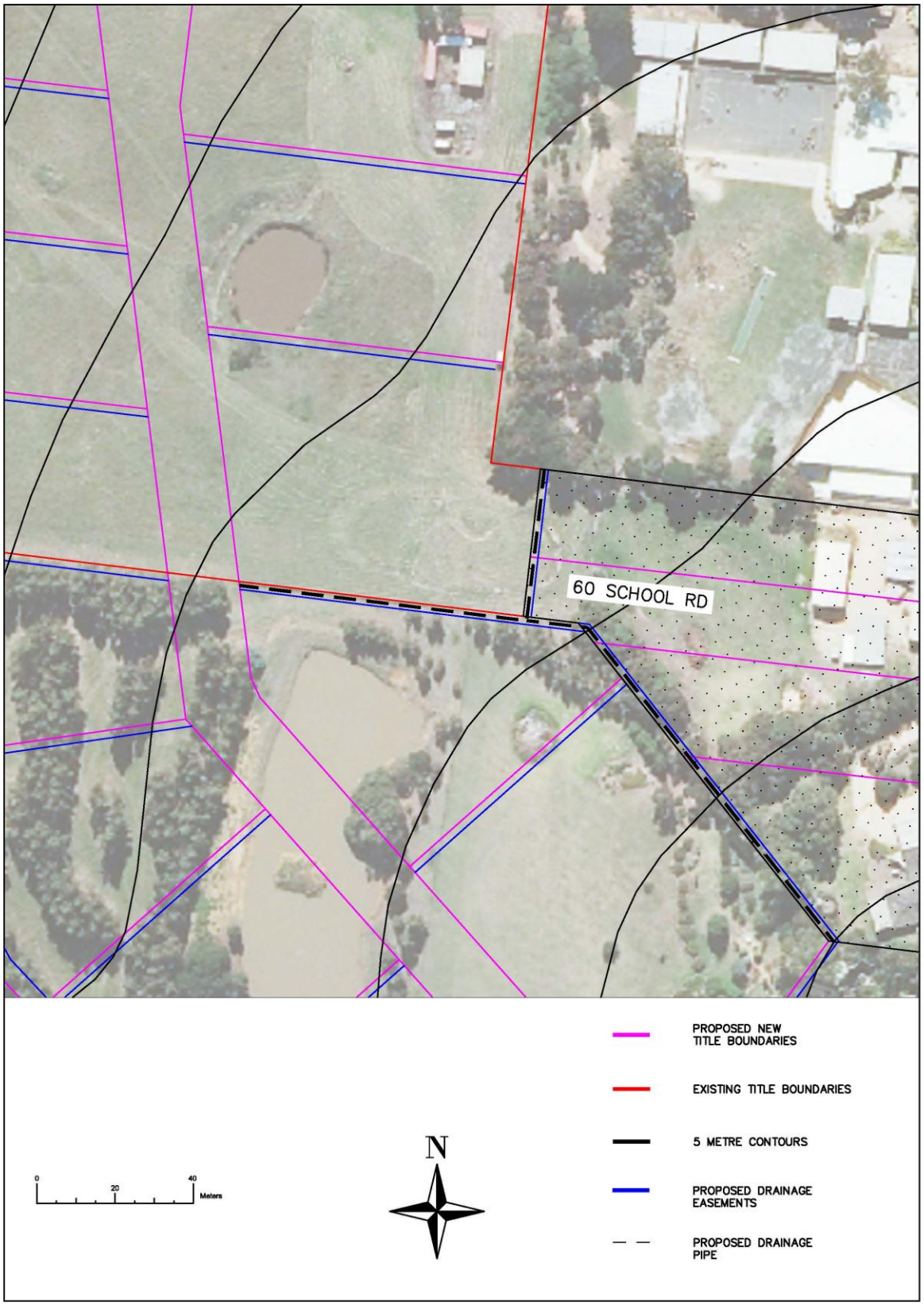

Figure 6: Proposed pipe solution

Conclusion.

All of the 14 hectares Surf Coast Shire Council is proposing to rezone west of School Road, within the township of Bellbrae, can be serviced with appropriate stormwater infrastructure and through detailed design, best practise stormwater management principles, as required under Clause 56 of the Surf Coast Planning Scheme can be met.