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Drainage Analysis Report

93 Campbells Lane, Coolamon, NSW 2701

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1 INTRODUCTION

This report evaluates drainage conditions of the site located at 93 Campbells Lane, Coolamon, NSW 2701. The report is structured by site conditions, followed by flow capacity calculations and analysis, and finally an executive summary.

An aerial photo of the site plan is shown in Figure 1. As it can be seen, the site is bounded by Bartletts Lane to the north, residential properties and farmland to the south, and private roads to the east and west.

The topography of the region is derived from government data available online. This information will be used in the next section to calculate flow capacity of the available drainage system.

Figure 1. Site plan

2 Calculations and analysis

In this section, the stormwater conditions which flows through the site from the catchment area in a major storm event is assessed. Accordingly, the approach flow rate to the site from the catchment and total flow rate generated in the entire catchment is determined and the impact on future developments are assessed, refer figure 2.

2.1 Calculations of Peak Flood

The catchment plan is shown in Figure 2. Topography of the local region is derived based on GPS data of Coolamon region and other local government areas (LGA). It is worth mentioning the accuracy of calculations in this report is obviously dependent on the accuracy of contours and data obtained from the government websites. From the topography and contours, the catchment area is determined and shown by the blue border, the area is approximately 180 hectares. The mainstream waterway from furthest point of the catchment to the outlet is shown by a red line and measured to be 2035m in length. The elevation levels at start and end of this waterway are 269m and 232m, respectively, based on the contours. Therefore, there is a 37m fall in elevation in a matter of 2035m length from which the average slope of the ground is worked out to be 1.8% or 18 m/km.

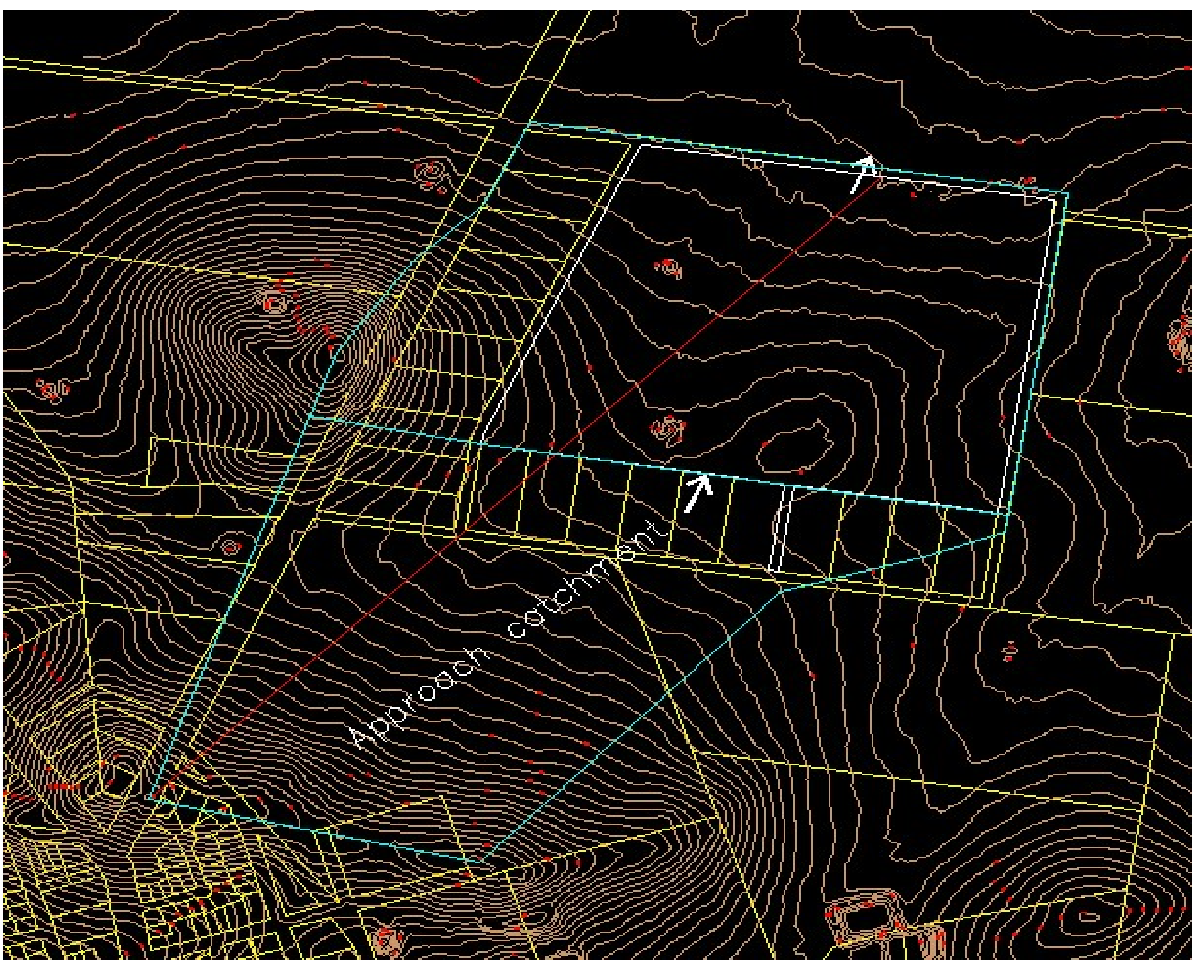

Figure 2. Catchment plan

The Rational Method is used to determine the maximum or peak flood value generated by rainfall based on the local council guidelines. According to the Rational Method, the peak flood discharge value is given as:

$$Q_r = \frac{CIA}{360} \qquad \text{Equation 1}$$

where Q_r is peak flood discharge in $m^3/_s$, *C* is runoff coefficient which is determined based on percentage of the impervious area over the whole catchment area, *A* is catchment area in ha, and *I* is rainfall intensity in $mm/_{hr}$ with the selected recurrence interval in years and duration equal to the catchment's time of concentration in minutes. The time of concentration is defined as the time which would be required for surface runoff from the remotest part of the catchment to reach the outlet or the point of interest on the water course. The time varies depending on the slope and characteristics of land surfaces.

The Bransby Williams formula is used to calculate time of concentration for the catchment. The Bransby Williams is the least biased formula and quite straightforward to calculate (French et al. 1974) which is provided in Australian Rainfall and Runoff guideline as well. The formula is as follows:

$$t_c = \frac{58\,L}{A^{0.1} S_e^{0.2}} \qquad \text{Equation 2}$$

Where:

- t_c is the time of concentration in minutes
- S_e is the equal area slope of the mainstream projected to the catchment divide (m/km)
- L is the mainstream length measured to the catchment divide (km)
- A is the area of the catchment (km^2)

Utilizing The Bransby Williams formula, t_c is calculated to be 1hr and shown in Table 2.

Rainfall intensity can be determined based on time of concentration using Intensity-Frequency-Duration (IDF) table or curve available at Australian Bureau of Meteorology (BOM) website. Rainfall intensity is determined for the event of major storm (ARI = 100 years) and presented in Table 2. In addition, runoff coefficient (*C*) is determined based on 10 percentage of the impervious area over the whole catchment area which results in $C_{major} = 0.275$, as shown in Table 2. Having the rainfall intensity, the peak flow from the approach catchment to the site and the peak flow generated from the total catchment is determined accordingly and shown in the table 2.

Table 1. Runoff coefficient

Name	Runoff coefficient 'C'	Adopted	Percentage %	'C' value
Grass	0.05-0.35	0.2	90	0.18
Concrete	0.7-0.95	0.95	10	0.095
				0.275

Table 2. Rainfall intensity and peak flow calculations

	Catchment area (ha)	Mainstream length (m)	Slope (%)	Time of Concentration (min)	ARI (years)	Intensity (mm/hr)	Runoff coeff. factored (C)	Rational flow Q, (m^3/s)
Total catchment	180	2035	1.8	60	100	48	0.275	6.6
Approach catchment	88	1219	1.8	40	100	63	0.275	4.235

The total catchment peak flow or the peak flow leaving the lot is 6.6 m^3/s, in that 4.235 m^3/s flow is approaching the lot which is not a huge amount and is inadequate to flood the lot. There is a natural depression on the land starting from the south part to the north-eastern corner of the lot, refer figure 2. For future developments the existing peak flow needs to be retained and the increase in the flow needs to be controlled by providing detention basin.

3 RESULT ANALYSIS AND SUMMARY

This report assessed the drainage conditions of the site located at 93 Campbells Lane, Coolamon, NSW 2701. Stormwater intensity corresponding to major storm (ARI = 100 years) was calculated 48 (mm/hr). Accordingly, stormwater peak flows were calculated for approach catchment 4.235 (m^3/s), and total catchment 6.6 (m^3/s), which will travel overland through the site in an event of major storm.

The peak flow approaching the catchment will not flood the lot. For future developments the increased flow needs to be controlled by providing detention basin on site.

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