



SEEC

Preliminary Flood Assessment

**for the Proposed Lot Size Amendment For
Pt Lot 29 & Lot 75 DP 750008, Lots 20 & 21 DP 777962
& Lots 5, 6, 11, 13, 17 DP 264152
Breadalbane Road,
Collector, NSW**

Prepared by:

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Document Certification

This report has been developed based on agreed requirements as understood by SEEC at the time of investigation. It applies only to a specific task on the nominated lands. Other interpretations should not be made, including changes in scale or application to other projects.

Any recommendations contained in this report are based on an honest appraisal of the opportunities and constraints that existed at the site at the time of investigation, subject to the limited scope and resources available. Within the confines of the above statements and to the best of my knowledge, this report does not contain any incomplete or misleading information.

Jason Armstrong (AMIEAust)
Senior Civil Designer

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10 December 2015

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TABLE OF CONTENTS

1	Introduction	1
2	The Planning Proposal	2
3	Site Description	2
3.1	General Location	2
3.2	Topography and Drainage.....	2
3.3	Catchment Area Description	2
4	Peak Flow Calculations	7
4.1	Rainfall Data.....	7
4.2	Peak Flow Results.....	7
5	Flood Modelling.....	9
5.1	HEC-RAS Site Pre-Development Flood Modelling.....	9
5.2	The Village Of Collector Flood Study	9
6	Results.....	10
7	Conclusion	11
8	References	12
9	Appendices	13
9.1	Appendix A - IFD Table	13
9.2	Appendix B - Probable Rational Method Calculation Summary	14
9.3	Appendix C - Pre Development Flood Plan	15

1 Introduction

SEEC has been commissioned to provide this Flood Potential Assessment to accompany a planning proposal for the reduction in the minimum lot sizes for Pt Lot 29 & Lot 75 DP 750008, Lots 20 & 21 DP 777962 & Lots 5, 6, 11, 13, 17 DP 264152 Breadalbane Road, Collector. This report has been prepared in accordance with the following guidelines and recommendations:

- *Australian Rainfall & Runoff - A Guide to Flood Estimation 1998;*
- *Upper Lachlan Shire Council Local Environmental Plan 2010, Section 6.1 - Flood Planning;*
- *Upper Lachlan Shire Council Development Control Plan 2010, Section 4.5 - Flooding & Stormwater.*

This report outlines the procedures used to determine the approximate flood extent for the 100 year ARI flood event within the boundaries of the existing property. This flood analysis is based on a desktop study and visual interpretation of the upstream and downstream catchment areas and topographical information. This flood study is a preliminary guide only and the accuracy is controlled by the level of detail obtainable from the desktop study. A detailed assessment should be undertaken and submitted with any future development application submission to Council for the subdivision of the site.

Any results, assumptions or conclusions provided within this report are suitable only for the purpose of a planning proposal and should not be used for any other reason. This flood study will provide the relevant flood information in order to help with future planning including lot layout and define the appropriate location of any proposed residences and associated effluent management areas based on the extent of the 100 year flood event.

This flood study includes:

- (i) A general description of the site and the surrounding catchment area;
- (ii) A catchment analysis to determine the peak flows for the main water course through the site;
- (iii) Flood calculations and results using HEC-RAS 4.1, a one dimensional, Quasi- 2D modelling package that calculates the depth and velocity of flows; and
- (iv) Conclusions and recommendations based on the flood results.

2 The Planning Proposal

The planning proposal proposes to change the minimum lot size of Pt Lot 29 & Lot 75 DP 750008, Lots 20 & 21 DP 777962 & Lots 5, 6, 11, 13, 17 DP 264152 Breadalbane Road, Collector. This includes reducing the existing minimum lot size of 40ha to 2ha under the Upper Lachlan Local Environmental Plan 2010 (LEP 2010).

The subject properties are included in the preferred study area identified by Upper Lachlan Shire Council and as indicated in the report by Kingsdale Consulting Pty Ltd, Annexure O in Table 2.

3 Site Description

3.1 General Location

The subject properties are located on the fringe of the existing Collector residential area and surrounded by a mixture of rural and residential allotments. The properties have a total combined site area of approximately 130.6 Ha. (**Figure 1**). The subject site is located approximately 1.9km to the north east of the main centre of Collector.

3.2 Topography and Drainage

The majority of the site is moderately undulating along the south-eastern boundaries with grades ranging from 10-25% with the site becoming flatter towards the western boundary along Breadalbane Road. The site, east of Baxters Lane, mostly falls to an existing intermittent watercourse (Byrnes Creek) flowing through the site from east to west (**Photo 1**) predominately through Lot 5 DP 264152 and Lot 26 DP 750008 before crossing under and over Breadalbane Road through an existing pipe culvert.

The site west of Baxters Lane

Byrnes Creek which is the subject of this Flood Report continues west and eventually joins into Collector Creek located approximately 1.2 km downstream of the property. Collector Creek ultimately flows into Lake George which is located approximately 10 km to the south west of the site.

3.3 Catchment Area Description

The catchment area contributing storm flows to the watercourse consists of a mixture of mainly rural allotments (**Figure 2**). Slopes are similar to the site and range from 10-25%. The catchment area has been separated into three sub-catchments with the largest catchment CA1 being located mainly to the south-east of the federal highway. This is fed into the site via three 900mm diameter concrete pipe culverts

under the Federal Highway (**Photo's 2 & 3, Appendix C**). Catchment CA3 is a smaller catchment that includes mainly the inside lanes and central island of the Federal Highway. Flows from CA3 flow into the site via a 375mm concrete pipe under the north bound lanes of the Federal Highway (**Photo 4 & Appendix C**). Catchment CA2 is located wholly within the site itself. Based on a desktop study using existing topographical information the total combined upstream catchment area is approximately 107 ha.



Figure 1 - Plan showing development boundaries and other relevant features



Photo 1 – Byrnes Creek within the Site Looking West



Photo 2 – Location of the 3x900 Dia. Pipes outlet into Site with The Federal Highway in the Background

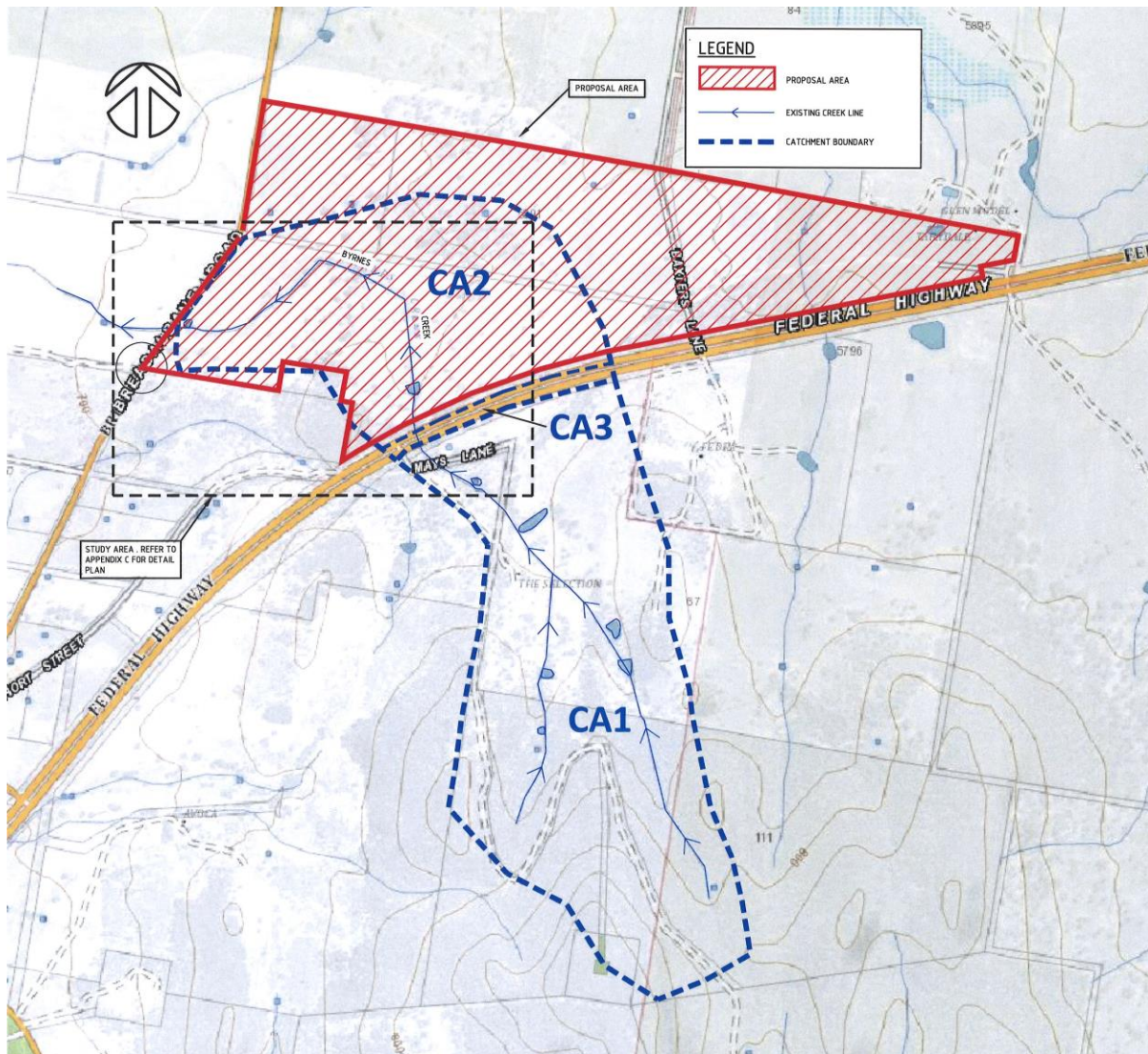


Figure 2 – Site Catchment Plan



PHOTO 3 – 3 x 900 Dia. Culverts under the Federal Highway East of Site (Catchment CA1)



PHOTO 4 – 375 Dia. Culvert under North Bound Lanes (Catchment CA3)

4 Peak Flow Calculations

The Probable Rational Method was used to determine the peak flows for the catchment. The procedures for this are set-out in Australian Rainfall and Runoff (1998) (ARR 1998). The calculations were based on the formula below:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{t_c,y} \times A \dots\dots\dots(1)$$

Where:

Q_y = peak flow rate (m^3/s) of average recurrence interval (ARI) of Y years

C_{10} = runoff co-efficient, (dimensionless) for ARI of Y years, Figure 5.1 in ARR 1987

$I_{t_c,y}$ = Average Rainfall Intensity, (mm/hr) for the design duration of t_c hours and ARI of Y years

FF_y = frequency factor, Table 5.1 of ARR 1987

A = area of catchment (ha)

4.1 Rainfall Data

The Intensity Frequency Duration (IFD) rainfall data for the site is based on data presented in Australian Rainfall and Runoff and site specific calculations for the Collector area. A copy of the IFD table for the site is attached in **Appendix A**.

4.2 Peak Flow Results

Estimates for the 2, 5, 10, 20 and 100 year ARI peak storm flows for the contributing catchment area are shown in **Table 1**. A copy of the peak flow calculations is attached in **Appendix B**.

Table 1 - Peak Flow Estimates

Catchment Name	Catchment Area (Ha)	Peak Flows (m ³ /s)					
		2 Year	5 Year	10 Year	20 Year	50 Year	100 Year
CA1	107	1.72	2.32	2.81	3.5	4.61	5.53
CA2	59.7	1.10	1.49	1.81	2.22	3.01	3.60
CA3	1.3	0.06	0.09	0.11	0.13	0.18	0.21

5 Flood Modelling

5.1 HEC-RAS Site Pre-Development Flood Modelling

From the desktop topographical information a 3D digital terrain model (DTM) was produced using *Autodesk Civil 3D*. This model included a design reaches along the Byrnes Creek so that a series of cross sections could be extracted and exported into *HEC-RAS*. Refer to drawing **15000303-FS01 (Appendix C)** for the location of the reach alignments and the locations of the extracted cross sections.

A value of 0.035 was adopted as the Manning's coefficient for both the channel flow and the over-bank areas. From the topographical information it was determined that the watercourse has an average grade of approximately 1.8 percent.

The calculated peak flows were entered into the *HEC-RAS* Model and a Mixed Flow Regime was adopted to determine the flow extents within the watercourse for the worst case 100 year ARI storm event. This was then exported back into *Civil 3d* to produce a pre-development flood plan, refer to drawing **15000303-FS01 (Appendix C)**.

5.2 The Village Of Collector Flood Study

A review of the Upper Lachlan Shire Council '*The Village of Collector Flood Study 2014*' was undertaken which shows that the site is located within the contributing catchment of this specific flood study, but is located outside of the Collector Creek and Boyds Creek Flood Plain which is predominantly on the Western side of Breadalbane Road.

6 Results

The flood extents across the site for the 100 year ARI storm event have been determined and are displayed on Drawing 15000303-FS01 (Appendix C). It can be seen that this major storm event is contained wholly within the existing creek alignment.

The plan showing the extent of the the 100 year ARI flood is to be used as a guide for planning purposes only and a more detailed assessment including detailed ground survey should be undertaken for any future development application for subdivision so that flood planning levels (FPL's) can be determined for the future lots. The FPL is 0.5 m above the 100 year ARI flood level. The floor level of any new dwelling should be set at a height on or above this FPL.

7 Conclusion

This report provides preliminary flood information to aid with future planning of the site with regards to future lot layout and building envelope locations. It is a study of the major water course flowing through the site only and does not include other minor tributaries/ drainage depressions within the site. Modelling of these should be included in a future detailed drainage assessment of the site along with other considerations such as stormwater and effluent disposal from future dwellings and site stability assessments.

Section 6 and the plan in **Appendix C** of this report detail the results. They illustrate the flood extents within the site and critical flow details for the worst case, pre-development, 100 year ARI flood event.

The results show the extent of the 100 year flood event within Byrnes Creek would be retained mainly within the existing creek alignment leaving sufficient areas for siting future building envelopes with levels above the future flood planning levels. The site also sits outside of the flood plain as described in the recent *Collector Flood Study, 2014*.

8 References

Institution of Engineers Australia. *Australian Rainfall and Runoff, A Guide to Flood Estimation, Volume 1 and Volume 2*: 1998

SMEC Urban Detailed Survey Plan of Lots 1, 2, 7, 8 & 9 DP 877774 & Lot 132 DP 851807

U.S. Army Corps of Engineers. *HEC-RAS River Analysis System Version 4.1.0*

Upper Lachlan Shire Council. *Local Environmental Plan 2010*

Upper Lachlan Shire Council. *Development Control Plan 2010*

Upper Lachlan Shire Council. *The Village of Collector Flood Study 2014*

9 Appendices

9.1 Appendix A – IFD Table

Intensity-Frequency-Duration Table

Location: 34.900S 149.450E NEAR.. Collector Issued: 1/12/2015

Rainfall intensity in mm/h for various durations and Average Recurrence Interval

Average Recurrence Interval							
Duration	1 YEAR	2 YEARS	5 YEARS	10 YEARS	20 YEARS	50 YEARS	100 YEARS
5Mins	55.3	73.1	99.3	116	139	169	194
6Mins	51.6	68.2	92.5	108	129	157	181
10Mins	42.1	55.5	74.7	87.1	103	126	144
20Mins	30.7	40.2	53.5	61.9	73.1	88.4	101
30Mins	24.8	32.4	42.9	49.4	58.2	70.1	79.7
1Hr	16.6	21.6	28.3	32.4	38.0	45.5	51.5
2Hrs	10.8	14.0	18.1	20.6	24.0	28.6	32.2
3Hrs	8.36	10.8	13.8	15.7	18.2	21.6	24.3
6Hrs	5.35	6.87	8.70	9.81	11.3	13.3	14.9
12Hrs	3.39	4.35	5.47	6.13	7.04	8.26	9.22
24Hrs	2.11	2.71	3.40	3.81	4.37	5.13	5.71
48Hrs	1.27	1.63	2.05	2.30	2.64	3.11	3.46
72Hrs	.920	1.18	1.48	1.66	1.91	2.24	2.49

(Raw data: 22.03, 4.42, 1.19, 43.84, 7.98, 2.16, skew=0.19, F2=4.29, F50=15.61)

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9.2 Appendix B – Probable Rational Method Calculation Summary

Peak flow is given by the Rational Formula:

$$Q_y = 0.00278 \times C_{10} \times F_y \times I_{y,tc} \times A$$

- where: Q_y is peak flow rate (m³/sec) of average recurrence interval (ARI) of "Y" years
 C_{10} is the runoff coefficient (dimensionless) for ARI of 10 years.
 F_y is a frequency factor for "Y" years.
 A is the catchment area in hectares (ha)
 $I_{y,tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

$$\text{Time of concentration (t}_c\text{)} = 0.76 \times (A/100)^{0.38} \text{ hrs}$$

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent. Place an x in the appropriate row below to automatically halve the time of concentration for that sub-catchment.

Structure Details								Notes
Name	CA1	CA2	CA1A					
Catchment Area (ha)	107	59.7	1.3					
Place an x here to halve tc			X					Place an x if disturbed catchment
Time of concentration (tc)	47	37	4					minutes

Rainfall Intensities

1-year, tc	19.3	22	55						Enter the relevant rainfall intensities (in mm/hr) for each of the nominated rainfall events. The time of concentration (tc) determines the duration of the event to be used
2-year, tc	25.1	28.8	73						
5-year, tc	32.9	37.9	99						
10-year, tc	37.9	43.7	116						
20-year, tc	44.4	51	138						
50-year, tc	53	62	169						
100-year, tc	60	70	194						

C10 runoff coefficient	0.25	0.25	0.25						Use AR&R or Table F3, pg F-6
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Frequency Factors

FF, 1-year	0.89	0.89	0.8	0.8	0.8	0.8	0.8	0.8	Can use 0.8 for a construction site
FF, 2-year	0.92	0.92	0.85	0.85	0.85	0.85	0.85	0.85	Can use 0.85 for a construction site
FF, 5-year	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	Can use 0.95 for a construction site
FF, 10-year	1	1	1	1	1	1	1	1	Generally always 1
FF, 20-year	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	Can use 1.05 for a construction site
FF, 50-year	1.17	1.17	1.15	1.15	1.15	1.15	1.15	1.15	Can use 1.15 for a construction site
FF, 100-year	1.24	1.24	1.2	1.2	1.2	1.2	1.2	1.2	Can use 1.2 for a construction site

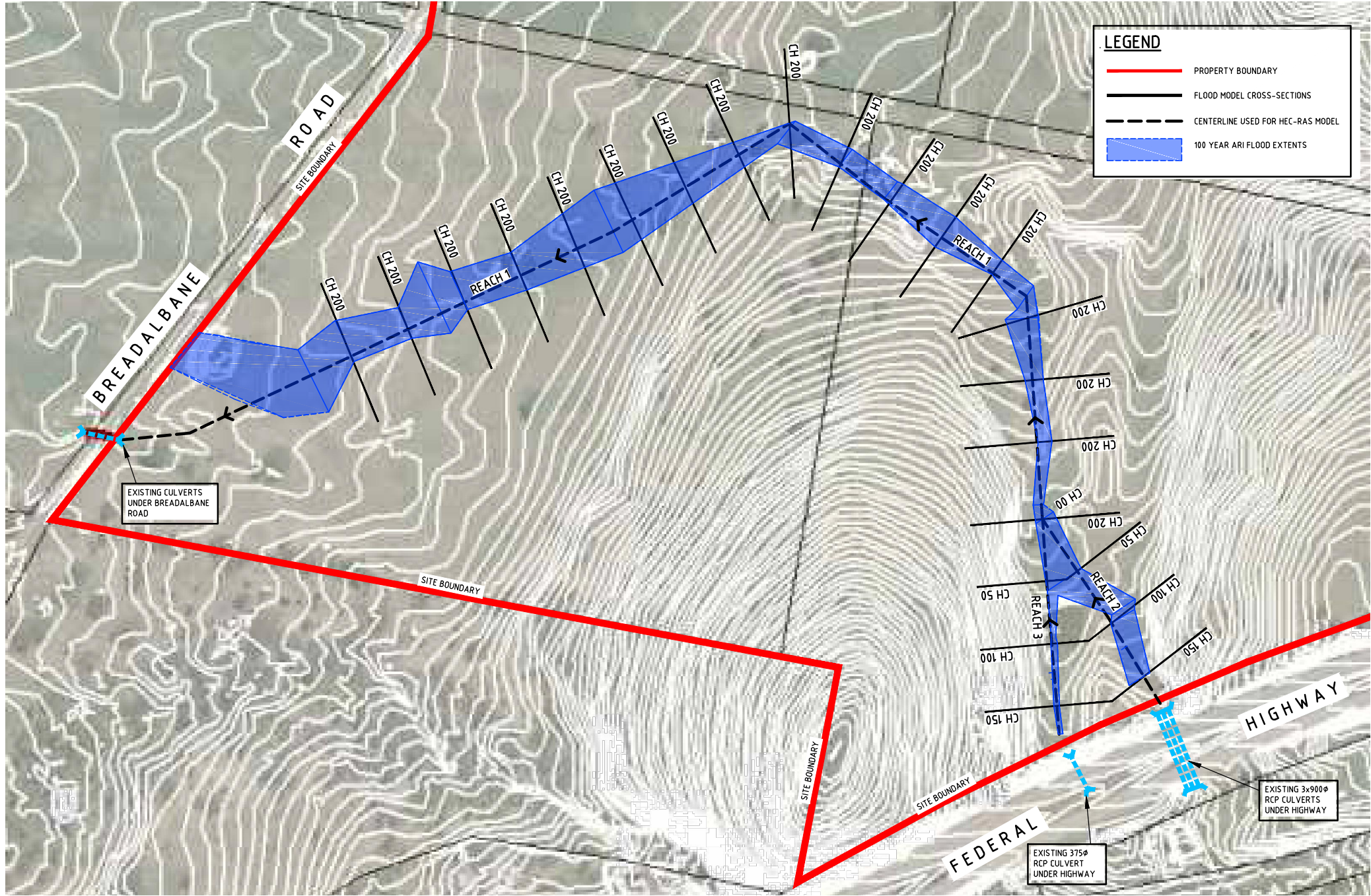
Flow Calculations

Flow Calculations								Notes
1-year, tc (m ³ /s)	1.277	0.812	0.04					
2-year, tc (m ³ /s)	1.717	1.099	0.056					
5-year, tc (m ³ /s)	2.324	1.494	0.085					
10-year, tc (m ³ /s)	2.818	1.813	0.105					
20-year, tc (m ³ /s)	3.467	2.222	0.131					
50-year, tc (m ³ /s)	4.611	3.01	0.176					
100-year, tc (m ³ /s)	5.533	3.601	0.21					

NB for flow calculations on sediment basin spillways, see Worksheet 3 (if required).

9.3 Appendix C – Pre Development Flood Plan

- (i) Flood Map Showing the Pre-Development 100 Year Flood Extents for Byrne Creek (Drawing 15000303-FS01);



REV	DATE	BY	APP.	REVISION DETAILS	DRAWING STATUS	North	CLIENT	PROJECT TITLE	DRAWING TITLE
					DESIGN BY		J.J.M McINERNEY	PLANNING PROPOSAL	CONCEPT 100 YEAR FLOOD EXTENTS
					DRAWN BY			LOTS 26 & 75 DP 750008	
					FINAL APPROVAL			LOT 20 DP 777962 & IOT 5 DP 264152	PROJECT NO.
					SCALE:	AS SHOWN		BREADALBANE RD, COLLECTOR	15000303
					(on A1 Original)				SHEET NO.
									FS01
									REV