

PLANS AND DOCUMENTS

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SUCE Stages 2 and 3

Flood Study

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Cardno (Qld) Pty Ltd
ABN 57 051 074 992

Level 11 Green Square North Tower
515 St Paul's Terrace
Fortitude Valley Qld 4006
Locked Bag 4006 Fortitude Valley
Queensland 4006 Australia

Telephone: 07 3369 9822
Facsimile: 07 3369 9722
International: +61 7 3369 9822

cardno@cardno.com.au
www.cardno.com.au

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Version	Date	Author		Reviewer	
		Name	Initials	Name	Initials
1	23 March 2011	Nadia Guterres	NG	Martin Giles	MG
2	29 March 2011	Nadia Guterres		Martin Giles	

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1 INTRODUCTION

This report assesses the flooding impact of developing Stages 2 and 3 of the proposed Ripley Valley Secondary Urban Centre East (SUCE) development. Stages 2 and 3 include residential development, the regional detention basin, bio-retention basin, sportsground and active space areas.

The flood strategy outlines the requirements to develop the SUCE whilst not compromising the flood immunity provided for existing buildings located in the area.

The strategy has been developed using the flood model created for the assessment of the entire SUCE development. This model has been further refined to better model the local impacts of development.

Since the submission of the Stage 1 report (Cardno, November 2010) modifications to the Barrams Road crossing design have been made, so as to address the concerns of the neighbouring resident. In order to reduce the height of the bridge, and the subsequent aesthetic impacts, it has been agreed that an increase in flood level resulting from the bridge would be considered acceptable, so long as sufficient freeboard was still provided for the existing residences. As such, it has also been shown that the compensatory excavation that was previously proposed, which was also of concern to neighbouring residents, would no longer be necessary.

For further details of the updates to the modelling refer to SUCE Stage 1 Flood Study (Cardno, 23 February 2011).

2 PROPOSED DEVELOPMENT

Stages 2 and 3 of the Secondary Urban Centre East are located to the north-east of Stage 1, and to the south of the Centenary Highway Extension (CHE). The area of the development is 15.6 hectares. When the CHE was constructed it effectively blocked the flow across the eastern floodplain (a 1200mm RCP currently drains the low flows) and raised peak water levels in the area of the proposed development by up to 1260mm.

To ensure that peak flows from the developed area are attenuated back to existing case levels a detention basin is required. The proposed detention basin is located approximately 250 metres south of the CHE. A sportsground will be located between the detention basin and the CHE. The flows from the detention basin will be directed into Bundamba Creek. To ensure that the detention basin can freely drain some earthworks will be required within a small section of the creek buffer to install the culvert and weir outlets. The outlets will need to be appropriately designed to minimise the potential for scour and erosion.

As part of the proposed development the carpark and active open space area to the south of the detention basin will also be constructed.

3 STAGES 2 AND 3 TUFLOW MODEL SETUP

3.1 Inflows

To determine the impact of increased impervious areas on the timing of peak flows, the WBNM model was modified to account for the development. A detention basin will be used to attenuate peak flows. As the detention basin will also capture runoff from future stages, it was assumed that all of the contributing catchment area and Stage 1 was developed, not just Stages 2 and 3. The percentage impervious used was 70 percent. The following modifications to the WBNM catchments were made:

- Catchment D2 is now 63.6% impervious;
- Catchment E3 is now 18.6% impervious; and
- Catchment E2 is now 2.1% impervious.

The detention basin was included in the TUFLOW model. The TUFLOW model was then used to quantify the impact of the detention basin on regional flood levels, velocities and flows by using the developed case WBNM inflows.

To ensure that the development does not result in an increase in flows from the local catchment, which has a time of concentration of around 60 minutes, an XP SWMM model of the detention basin was also established. The results of this modelling are outlined in the Stages 2 and 3 Stormwater Management Plan (Cardno, March 2011). The results of this modelling showed that the development did not increase peak flows for all local catchment events up to and including the 100 year ARI event.

3.2 Roughness Values

The proposed uses in the flood plain consist of sportsgrounds and parks. The area will be mainly grassed with a few trees. Therefore the existing roughness values in this area, i.e. Manning's n value of 0.05 was still considered appropriate to use.

3.3 Proposed Development

The proposed development plan is shown in Figure 1 and includes the following:

- The residential areas were raised to provide 100 year ARI immunity;
- The sportsground was raised to a minimum of 43.1m AHD (graded at 1 in 200), to provide it with 10 year ARI immunity;
- The local active park on the eastern side of the basin, which will include sporting facilities such as courts and clubhouses was be raised to provide 100 year ARI immunity;
- The carpark area located on the southern side of the detention basin was raised to provided 100 year ARI immunity;

- The active open space areas surrounding the playground were raised to levels of 43.25 to 44.0m AHD to provide 5 year ARI immunity; and
- The playground (included in the Stage 1 analysis) was raised to 44.3m AHD to provide 10 year ARI immunity.

A vegetated swale will be located around the active open space areas and carpark to provide a low flow drainage path towards the proposed detention basin. In major flood events flow will also be directed across the active open space areas.

A bund will not be required along the western side as the existing ground surface levels along the creek buffer provide a natural bund.

The invert of the detention basin will be graded from 42.0m AHD to 41.7m AHD. The outlets of the detention basin include:

- 7/825mm RCPs;
- 75 metres length;
- Upstream invert level = 41.70m AHD;
- Downstream invert level = 40.5m AHD; and
- 30 metre wide weir at 42.7m AHD.

4 TUFLOW MODEL RESULTS

4.1 TUFLOW Model Scenarios

The 100, 50, 10 and 5 year ARI events were modelled, using the 2, 3 and 4.5 hour storm durations for each event.

Previous analysis has investigated the impact of filling Stage 1 and the construction of Barrams Road (Cardno, February 2011). For this study it was necessary to look at the additional impact of the Stages 2 and 3. Therefore the following scenarios were used:

- Case 1. BarrBr_Stg1 - filled Stage 1 area and playground, Stage 1 developed case inflows used. Barrams Road bridge also upgraded.
- Case 2. BarrBr_Stg123 – filled Stages 2 and 3 detention basin, sportsground, active open space areas and playground. Developed case inflows. Barrams Road bridge also upgraded.

4.2 TUFLOW Results

4.2.1 Peak Water Levels

The peak water levels at several reporting points around the development are shown below in Tables 1 and 2. The reporting points are shown in Figure 2.

Table 1 100 and 50 Year ARI Peak Water Levels

Location	Ground /Floor Level	100 Year ARI Peak Water Level (m AHD)			50 Year ARI Peak Water Level (m AHD)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)
BLDG1	46.22 (floor)	45.64	45.72	89	45.23	45.28	46
BLDG2	45.95 (floor)	46.08	46.09	11	45.83	45.84	1
BLDG3	46.59	47.01	47.01	0	46.77	46.77	2
BLDG4	47.60	N/A	N/A	N/A	47.60	N/A	N/A
BLDG5	48.21	48.33	48.33	0	48.27	48.27	-1
BLDG6	50.54	51.04	51.04	0	50.90	50.90	0
BLDG7	55.16	N/A	N/A	N/A	55.23	N/A	N/A
us_BarrL		45.56	45.65	88	45.18	45.29	105
RB1		45.73	45.82	88	45.34	45.31	-27
RB2		45.70	45.80	96	45.17	45.21	35
RB3		45.64	45.74	100	45.13	45.17	43
RB4		44.76	45.02	258	44.39	44.71	318
RB5		45.06	45.17	100	44.81	44.87	57
RB6		44.47	44.70	230	44.05	44.18	131
RB7		44.16	44.33	169	43.79	43.98	193
RB8		44.07	N/A	N/A	43.74	N/A	N/A
RB9		44.06	44.31	254	43.74	43.97	233
RB10		44.05	44.29	240	43.73	43.97	235

Location	Ground /Floor Level	100 Year ARI Peak Water Level (m AHD)			50 Year ARI Peak Water Level (m AHD)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)
RB11		44.05	44.26	205	43.73	N/A	N/A
BUND18847		47.18	47.19	11	46.98	46.98	4
BUND18986		47.14	47.15	12	46.93	46.94	4
BUND19131		47.00	47.02	17	46.76	46.77	6
BUND19395		46.05	46.11	54	45.67	45.71	35
BUND19710		45.64	45.73	89	45.24	45.28	46
BUND19760 Barrams Rd		45.63	45.72	92	45.21	45.26	49
BUND19805		45.19	45.27	77	44.96	45.00	35
BUND19940		45.11	45.20	85	44.89	44.93	38
BUND20161		44.36	44.52	164	44.14	44.25	109
BUND20433		43.93	44.10	174	43.64	43.78	141
BUND20527		43.64	43.61	-35	43.34	43.32	-24
BUND20570 CHE		43.62	43.60	-21	43.33	43.32	-15
BUND20618		43.29	43.30	2	43.10	43.10	6
BUND20717		43.01	43.01	2	42.85	42.85	5
BUND20864		42.87	42.87	3	42.69	42.69	6

Table 2 10 and 5 Year ARI Peak Water Levels

Location	Ground /Floor Level	10 Year ARI Peak Water Level (m AHD)			5 Year ARI Peak Water Level (m AHD)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)
BLDG1	46.22 (floor)	N/A	N/A	N/A	N/A	N/A	N/A
BLDG2	45.95 (floor)	N/A	N/A	N/A	N/A	N/A	N/A
BLDG3	46.59	N/A	N/A	N/A	N/A	N/A	N/A
BLDG4	47.60	N/A	N/A	N/A	N/A	N/A	N/A
BLDG5	48.21	N/A	N/A	N/A	N/A	N/A	N/A
BLDG6	50.54	N/A	N/A	N/A	N/A	N/A	N/A
BLDG7	55.16	N/A	N/A	N/A	N/A	N/A	N/A
us_BarrL		44.69	44.71	16	44.27	44.24	-30
RB1		45.28	45.25	-27	45.25	45.24	-14
RB2		44.89	44.88	-7	44.82	44.81	-10
RB3		44.80	44.80	1	44.72	44.73	5
RB4		43.81	44.11	297	N/A	N/A	N/A
RB5		44.29	44.27	-23	43.97	43.95	-16
RB6		43.34	43.38	37	43.01	42.95	-62
RB7		42.89	43.11	219	N/A	42.78	N/A
RB8		42.50	N/A	N/A	42.06	N/A	N/A
RB9		42.50	43.11	606	N/A	42.78	N/A

Location	Ground /Floor Level	10 Year ARI Peak Water Level (m AHD)			5 Year ARI Peak Water Level (m AHD)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Afflux (mm)
RB10		42.50	N/A	N/A	42.06	N/A	N/A
RB11		42.50	N/A	N/A	42.06	N/A	N/A
BUND18847		46.31	46.30	-5	45.89	45.90	1
BUND18986		46.24	46.23	-5	45.78	45.78	1
BUND19131		46.06	46.06	-5	45.60	45.61	1
BUND19395		44.95	44.94	-12	44.60	44.60	-3
BUND19710		44.56	44.55	-7	44.22	44.22	-5
BUND19760 Barrams Rd		44.52	44.52	-4	44.18	44.18	-3
BUND19805		44.33	44.34	6	44.00	43.99	-14
BUND19940		44.27	44.27	-1	43.93	43.94	7
BUND20161		43.69	43.67	-17	43.38	43.38	3
BUND20433		43.06	43.07	12	42.83	42.81	-20
BUND20527		42.73	42.75	16	42.55	42.54	-13
BUND20570 CHE		42.73	42.74	17	42.55	42.54	-14
BUND20618		42.62	42.63	12	42.46	42.45	-13
BUND20717		42.39	42.40	9	42.24	42.23	-10
BUND20864		42.31	42.32	11	42.14	42.13	-10

As this table demonstrates, the impact of the filling required for Stages 2 and 3 is an increase in 100 year ARI peak water level of around 200mm adjacent to the proposed development and around 90mm upstream of Barrams Road bridge. The only existing buildings impacted upon by the proposed development are buildings 1 (89mm) and 2 (11mm). Building 1 will still have 500mm of freeboard to the floor level, which is above the minimum of 300mm which should be provided. The impact downstream of the development is negligible, with an increase in peak water levels of around 2mm.

For the 10 and 5 year ARI events the impact is mainly contained to areas adjacent to the development and the peak water levels upstream of Barrams Road bridge are reduced.

The 20 year ARI peak flood level in the detention basin (RB9) during the regional flood event will be around 43.33m AHD, based on the 50 and 10 year ARI peak water levels. This means the peak depth during the regional flood event will be 1.63m. The peak depths during the local storm event are lower. Although this regional value is higher than the 1.20m depth recommended by QUDM for the 20 year event, the basin will be designed to allow for safe egress during a flood event. The batters of the basin are 1 in 4. The existing 20 year ARI peak flood depths in this area are around two metres.

During the regional 5 year ARI event the maximum depth is around 1.1m, and the peak dV product reaches 0.2m²/s near the outlet of the basin. In the 10 year ARI event the peak depth is around 1.4m and the dV product reaches 0.25m²/s. In the 50 year ARI event the peak depth is around 2.3m and the dV product reaches 0.7m²/s. In the 100 year ARI event the peak depth is around 2.6m and the dV product reaches 1.5m²/s. Therefore during the 50 and 100 year ARI events the detention basin would be considered hazardous.

The active open space areas have 5 year ARI flood immunity. In the 10 year ARI event they would only be inundated by around 100mm and the dV product would be around 0.03m²/s which is considered safe. In the 50 year ARI event the peak depths are up to 1 metre and the dV product is a maximum of 0.7m²/s which is above the recommended limit of 0.6m²/s. In the 100 year ARI event the peak depths are up to 1.5 metres, and the dV product is around 1.4m²/s. Therefore during the 50 and 100 year ARI event it would not be safe for people to remain in this area. However, it is considered that there would be ample opportunity for evacuation and that the higher depths associated with the 50 and 100 year events will not pose a significant flood risk. Further, rainfall sufficient to cause flooding of Bundamba Creek would also be expected to cause people (and particularly young children) to leave the open space areas prior to the peak flow occurring in the creek.

The playground area has 10 year ARI immunity. In the 50 year ARI event the peak depths would be around 400mm across the playground area and the dV product is around 0.2m²/s. In the 100 year ARI event the peak depths are around 700mm and the dV product is around 0.5m²/s which is less than the recommended limit.

The sportsground area has 10 year ARI immunity. In the 50 year ARI event the peak depths are up to around 900mm, and the dV product is up to 0.2m²/s. In the 100 year ARI event the peak depths are between 300 and 1200mm, and the dV product is between 0.05 and 0.8m²/s. Only the south-western corner of the sportsground experiences high dV values. The majority of the sportsground would not be considered hazardous during the 100 year ARI event. Again, it is not expected that the sportsground would be in use should a rainfall event sufficient to cause flooding occur. Those sports that are played in the rain (e.g. rugby) are typically winter sports and major flooding would not be expected in the winter months. The summer sports (e.g. cricket) tend to be cancelled in the event of rainfall. It is therefore reasonable to assume that the sports fields would not be in use were a flood to occur. Further, ample evacuation time is available for the sportsground.

To maximise public safety, it would be recommended that all open space areas be evacuated. The critical storm duration for the regional flood event is around 3 hours in the proposed development area. This should provide sufficient warning time after the start of a storm event to evacuate the at risk areas.

4.2.2 Peak Flows

The peak flows at several reporting points around the Stages 2 and 3 development are shown below in Tables 3 and 4.

Table 3 100 and 50 year ARI Peak Flows

Flow Comparison Line	Location	100 Year ARI Peak Flow (m³/s)			50 Year ARI Peak Flow (m³/s)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference (m³/s)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference (m³/s)
Q_BUND19460		386.2	385.0	-1.2	309.2	308.6	-0.6
Q_BUND19740		342.5	340.4	-2.1	288.2	279.5	-8.7
Q_BUND19790	Barrams Rd Bridge	255.4	251.6	-3.8	241.2	239.3	-1.9
Q_BUND20030	d/s of Barrams Rd Bridge	379.9	379.6	-0.3	307.8	307.9	0.1
Q_BUND20360		377.8	377.6	-0.2	305.2	305.3	0.1
Q_BUND20590		379.5	377.4	-2.1	306.4	304.9	-1.5
Q_BUND20615	u/s of CHE	375.8	377.3	1.5	302.9	304.9	2.0
Q_BUND20680		378.7	376.5	-2.2	305.7	304.2	-1.5
Q_BUND20880		382.4	380.0	-2.4	308.5	307.1	-1.4
Q_BUND20990		381.1	379.0	-2.1	307.3	306.0	-1.3
Q_BUND21440		381.7	379.4	-2.3	307.2	306.2	-1.0
Q_BUND21570		381.3	379.4	-1.9	307.6	307.1	-0.5
Q_BUND21700		381.5	379.4	-2.1	307.3	305.8	-1.5
Q_BUND21990		378.9	376.7	-2.2	304.4	303.0	-1.4
Q_BUND22300		447.3	445.0	-2.3	360.4	360.5	0.1

Table 4 10 and 5 Year ARI Peak Flows

Flow Comparison Line	Location	10 Year ARI Peak Flow (m³/s)			5 Year ARI Peak Flow (m³/s)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference (m³/s)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference (m³/s)
Q_BUND19460		187.5	186.3	-1.2	156.5	156.7	0.2
Q_BUND19740		191.7	187.3	-4.4	160.0	158.5	-1.5
Q_BUND19790	Barrams Rd Bridge	176.1	176.5	0.4	146.7	146.5	-0.2
Q_BUND20030	d/s of Barrams Rd Bridge	197.4	195.8	-1.6	161.3	160.6	-0.7
Q_BUND20360		191.2	192.7	1.5	160.1	157.6	-2.5
Q_BUND20590		189.5	190.7	1.2	161.4	157.0	-4.4
Q_BUND20615	u/s of CHE	187.4	190.9	3.5	159.5	156.9	-2.6
Q_BUND20680		189.5	190.5	1.0	160.7	156.7	-4.0
Q_BUND20880		191.5	192.1	0.6	161.8	158.1	-3.7
Q_BUND20990		191.3	191.6	0.3	161.5	157.7	-3.8
Q_BUND21440		190.6	191.0	0.4	159.8	154.9	-4.9
Q_BUND21570		190.8	191.2	0.4	158.9	154.7	-4.2
Q_BUND21700		189.9	190.4	0.5	158.0	153.9	-4.1

Flow Comparison Line	Location	10 Year ARI Peak Flow (m³/s)			5 Year ARI Peak Flow (m³/s)		
		Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference (m³/s)	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference (m³/s)
Q_BUND21990		189.1	189.6	0.5	157.3	153.4	-4.0
Q_BUND22300		223.2	222.2	-1.0	182.0	176.0	-6.0

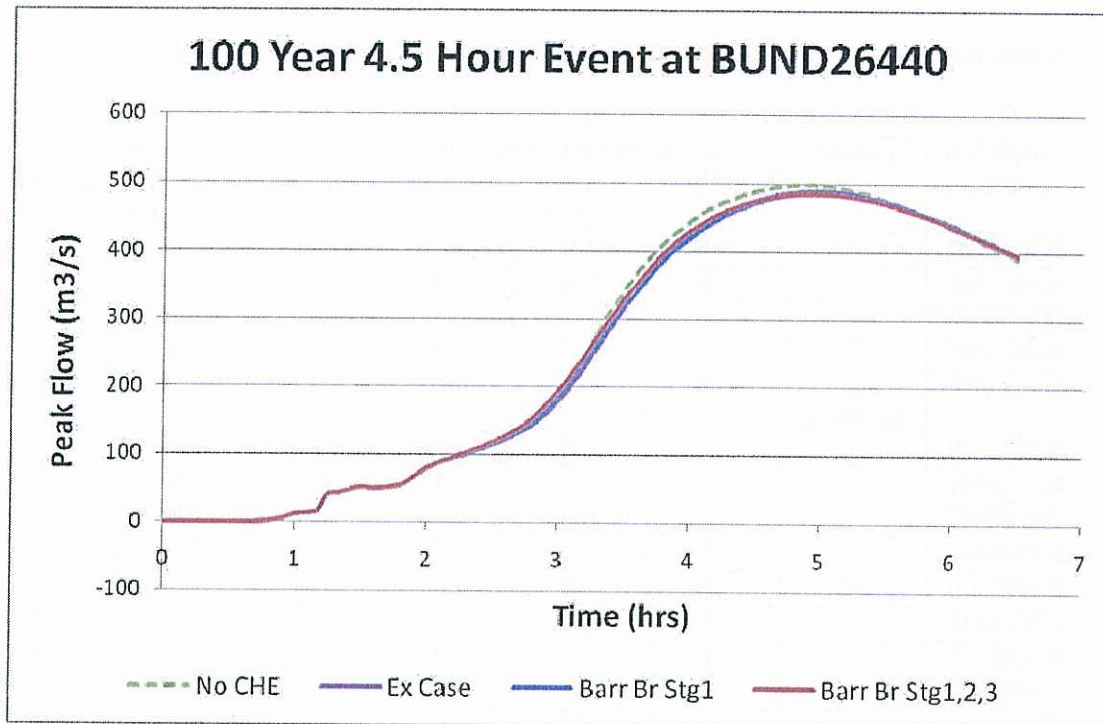
As the previous tables demonstrate, for the 100 year ARI event the peak flows downstream of the development are reduced. Just upstream of the CHE the peak flows are increased by 1.5m³/s due to the location of the outlet of the detention basin. For the minor flood events the peak flow downstream of the development is reduced. This is because the backwatering that occurs into the detention basin provides more flood storage in these minor events.

The tables demonstrate that the proposed increase in impervious area, detention basin construction and filling associated with the development do not result in an increase in peak flows downstream.

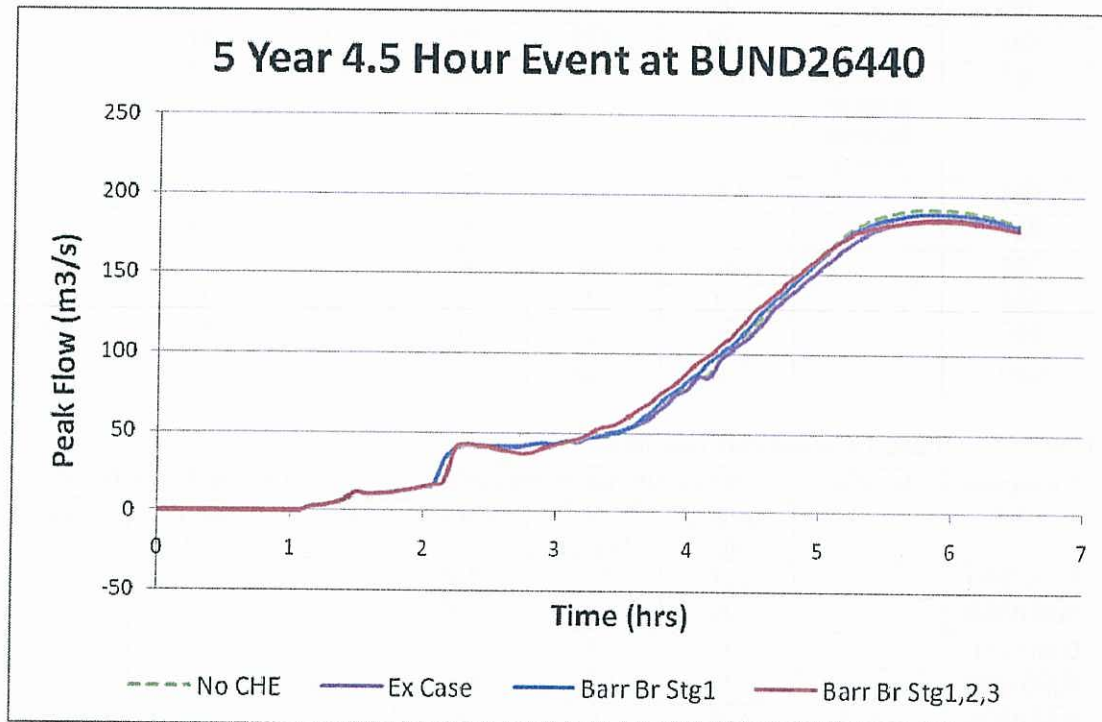
Flow hydrographs (for both the 100 and 5 year ARI events) at a downstream location (BUND26440) show the peak flows for the two cases run in this study as well as the case without the CHE constructed, and the existing case with the CHE in place.

As these graphs demonstrate the construction of the CHE provided some minimal attenuation of the peak flow at the downstream end of the model. The construction of Barrams Road bridge and Stage 1 (including developed case flows) resulted in a minimal further decrease in peak flows for the 100 year ARI event. The construction of Stages 2 and 3 works resulted in a further slight decrease in peak flows for the 100 year ARI event, and a reduction in the 5 year ARI event. However, the attenuation provided by the CHE before the peak occurs is slightly reduced. Given that the peak flows are still less than the existing case with the CHE in place, this is considered acceptable.

Graph 1 100 Year ARI Peak Flow at BUND26440



Graph 2 5 Year ARI Peak Flows at BUND26440



4.2.3 Peak Velocities

The peak velocities at several reporting points around the development are shown below in Tables 5 and 6.

Table 5 100 and 50 Year ARI Peak Velocities

Comparison Point	Location	100 Year ARI Peak Velocity (m/s)			50 Year ARI Peak Velocity (m/s)		
		Barr Br & Stg1	Barr Br & Stg1,2,3	Difference	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference
BUND18847		2.44	2.43	-0.01	2.37	2.42	0.05
BUND18986		0.86	0.86	0.00	0.85	0.85	0.00
BUND19131		1.55	1.56	0.01	1.54	1.54	0.00
BUND19395		0.51	0.31	-0.20	0.53	0.55	0.02
BUND19710	u/s of Barrams Rd	1.22	1.20	-0.02	1.24	1.22	-0.02
BUND19940		0.91	0.88	-0.03	0.89	0.88	-0.01
BUND20161		2.81	2.68	-0.13	2.71	2.64	-0.07
BUND20433		1.38	1.61	0.23	1.49	1.61	0.12
BUND20527		1.83	2.30	0.47	1.84	2.07	0.23
BUND20570	CHE	1.31	1.42	0.11	1.30	1.37	0.07
BUND20618		0.90	0.93	0.03	0.78	0.83	0.05
BUND20717		2.00	2.00	0.00	1.91	1.92	0.01
BUND20864		1.58	1.58	0.00	1.50	1.50	0.00
RB1		0.47	0.66	0.19	0.6	0.66	0.06
RB2		0.30	0.34	0.04	0.29	0.32	0.03
RB3		0.68	0.70	0.02	0.48	0.67	0.19
RB4		1.05	0.93	-0.12	0.97	0.82	-0.15
RB5	channel d/s of eastern floodplain culverts	0.58	1.27	0.69	0.73	1.23	0.50
RB6		1.22	1.11	-0.11	0.94	0.95	0.01
RB7		1.37	1.46	0.09	0.88	0.82	-0.06
RB8		0.01	N/A	N/A	0.00	N/A	N/A
RB9		0.40	0.44	0.04	0.25	0.23	-0.03
RB10		0.32	0.39	0.07	0.22	0.30	0.08
RB11		0.33	0.29	-0.04	0.24	N/A	-0.24

Table 6 10 and 5 Year ARI Peak Velocities

Comparison Point	Location	10 Year ARI Peak Velocity (m/s)			5 Year ARI Peak Velocity (m/s)		
		Barr Br & Stg1	Barr Br & Stg1,2,3	Difference	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference
BUND18847		2.30	2.30	0.00	2.38	2.25	-0.13
BUND18986		0.82	0.82	0.00	0.85	0.80	-0.05
BUND19131		1.41	1.41	0.00	1.55	1.39	-0.16
BUND19395		0.51	0.55	0.04	0.52	0.52	0.00
BUND19710	u/s of Barrams Rd	1.07	1.05	-0.02	1.22	1.00	-0.22

Comparison Point	Location	10 Year ARI Peak Velocity (m/s)			5 Year ARI Peak Velocity (m/s)		
		Barr Br & Stg1	Barr Br & Stg1,2,3	Difference	Barr Br & Stg1	Barr Br, Stg1,2 & 3	Difference
BUND19940		0.83	0.85	0.02	0.90	0.83	-0.07
BUND20161		2.62	2.65	0.03	2.77	2.57	-0.20
BUND20433		1.44	1.32	-0.12	1.49	1.42	-0.08
BUND20527		1.66	1.65	-0.01	1.83	1.48	-0.25
BUND20570	CHE	1.19	1.17	-0.02	1.30	1.04	-0.27
BUND20618		0.61	1.02	0.39	0.87	0.80	-0.07
BUND20717		1.94	1.86	-0.09	1.96	1.89	-0.07
BUND20864		1.37	1.34	-0.03	1.55	1.34	-0.21
RB1		0.53	0.76	0.23	0.52	0.73	0.21
RB2		0.25	0.28	0.03	0.24	0.26	0.02
RB3		0.51	0.54	0.03	0.47	0.51	0.04
RB4		0.43	0.60	0.17	N/A	N/A	N/A
RB5	channel d/s of eastern floodplain culverts	0.70	0.99	0.29	0.70	0.97	0.27
RB6		0.31	0.60	0.29	0.04	0.18	0.14
RB7		0.28	0.20	-0.08	N/A	0.07	N/A
RB8		0.00	0.00	0.00	N/A	N/A	N/A
RB9		0.02	0.24	0.22	N/A	0.22	N/A
RB10		0.01	N/A	N/A	0.01	N/A	N/A
RB11		0.02	N/A	N/A	0.01	N/A	N/A

As shown in the tables above the peak velocities in the 100 year ARI event are increased by around 0.47m/s approximately 100 metres downstream of the outlet of the detention basin (BUND20527). In minor flood events the peak velocity at this location is reduced. The outlet of the detention basin will need to be appropriately designed to reduce the potential for erosion and scour as the peak velocity in the outlet culverts is around 3m/s. Such a velocity will be relatively straight forward to provide protective works for.

At other locations within Bundamba Creek the difference in peak velocities is negligible. Along the right bank, around the proposed development, the flow patterns have been altered which has resulted in changes to the flow velocities. The peak velocities reported are relatively low.

5 CONCLUSION

The works required as part of Stages 2 and 3 include the filling of residential areas, construction of a detention basin, sportsgrounds and active open space areas. As these works have the potential to impact on the flow patterns and peak flood levels within Bundamba Creek a flood analysis in TUFLOW was required. This report summarises the results of this analysis.

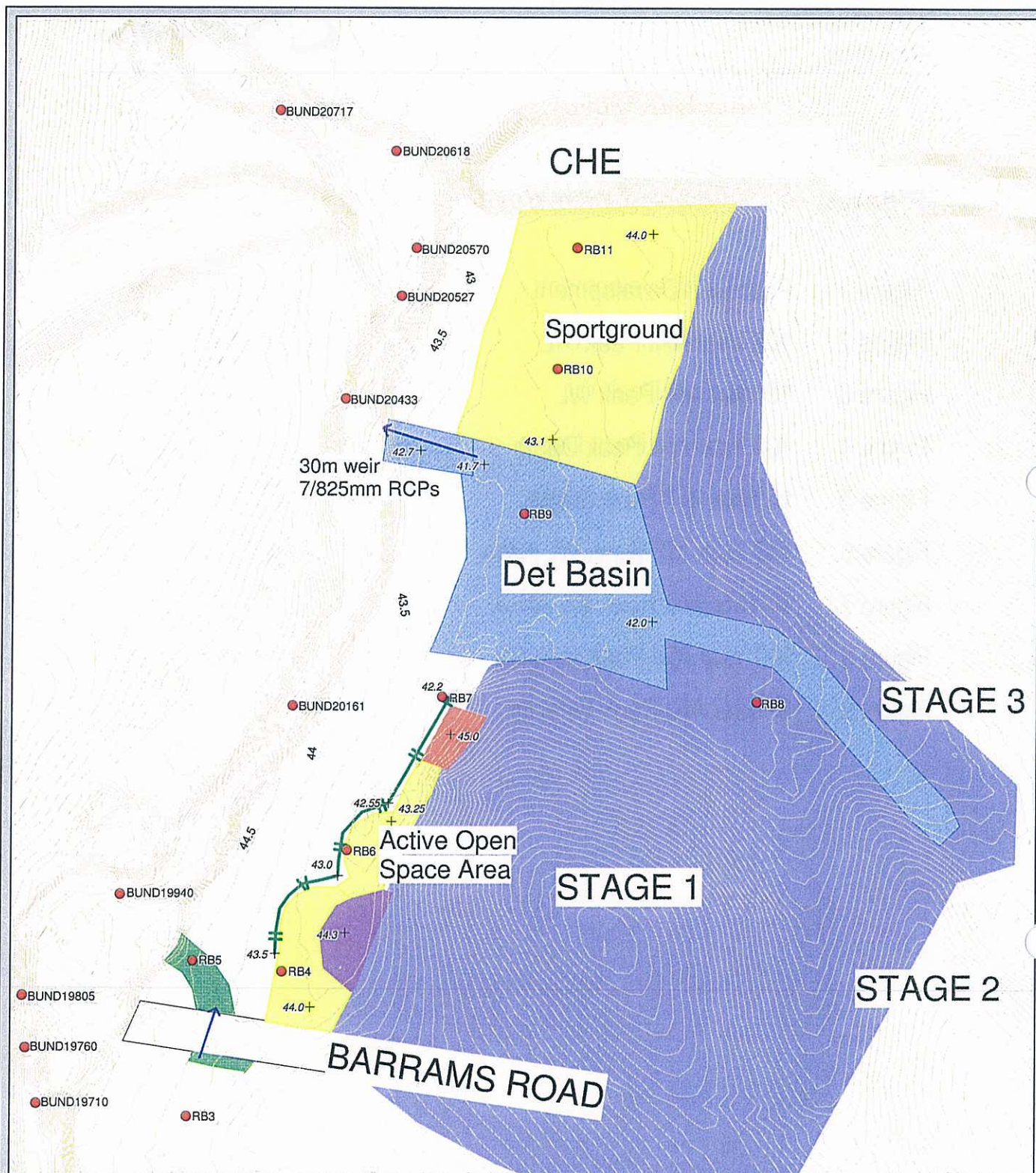
The results show that the 100 year ARI peak water levels are increased by around 200mm in areas adjacent to the development and by 90mm upstream of Barrams Road bridge. The peak water level at building 1 is increased by 89mm. However, there is still around 500mm of freeboard provided to the floor level. The impact at the other existing buildings is negligible.

The peak flows downstream of the development have been shown to be reduced for the 5, 50 and 100 year ARI events, and slightly increased by around 0.5m³/s in the 10 year ARI event. The impact of the development on the timing of peak flows has been negligible. At the location of the detention basin outlet there is a slight increase in peak flows and velocities. The outlet will need to be appropriately designed to reduce the risk of erosion and scour.

The proposed development provides the sportsground and playground with 10 year ARI immunity, the active open space areas with 5 year ARI immunity and the carpark and residential areas with 100 year ARI immunity.

Figures

- Figure 1 Proposed Development
- Figure 2 100 Year ARI Peak WL
- Figure 3 10 Year ARI Peak WL
- Figure 4 100 Year ARI Peak Depth
- Figure 5 10 Year ARI Peak Depth
- Figure 6 100 Year ARI Peak WL Afflux
- Figure 7 10 Year ARI Peak WL Afflux
- Figure 8 100 Year ARI Peak Velocity
- Figure 9 10 Year ARI Peak Velocity



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Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
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SHEET	A3
Project No:	7901-47-22
Date:	March 2011
Revision Number:	
Designed by:	
Client Name:	AMEX Pty Ltd

LEGEND

- Reporting Point
- + Proposed Level
- Culverts
- Detention Basin
- Sportsground and Active Open Space Area
- Playground
- Carpark
- Vegetated Channel
- Channel
- Proposed Fill Area
- 0.5m Existing Contour

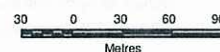


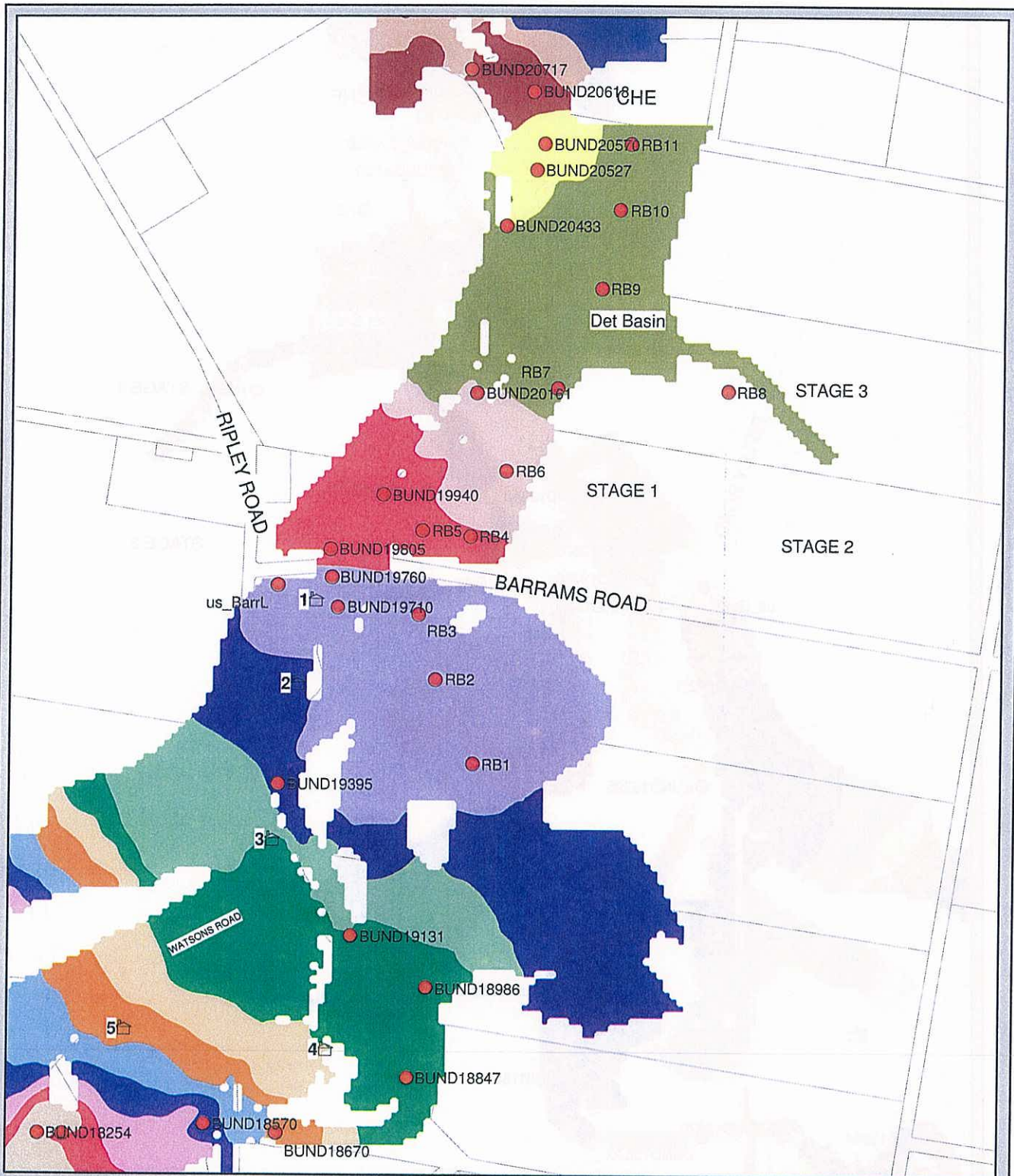
**Figure 1
Proposed Development**

SUCE Stages 2 & 3

Flood Study

Scale: 1:3,000





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LEGEND

Peak Water Level
(m AHD)

40.50 to 41.00
41.00 to 41.50
41.50 to 42.00
42.00 to 42.50
42.50 to 43.00
43.00 to 43.50
43.50 to 44.00
44.00 to 44.50
44.50 to 45.00
45.00 to 45.50
45.50 to 46.00
46.00 to 46.50
46.50 to 47.00
47.00 to 47.50
47.50 to 48.00
48.00 to 48.50
48.50 to 49.00
49.00 to 49.50
49.50 to 50.00
50.00 to 50.50

● Reporting Point

🏠 Building

□ DCDB



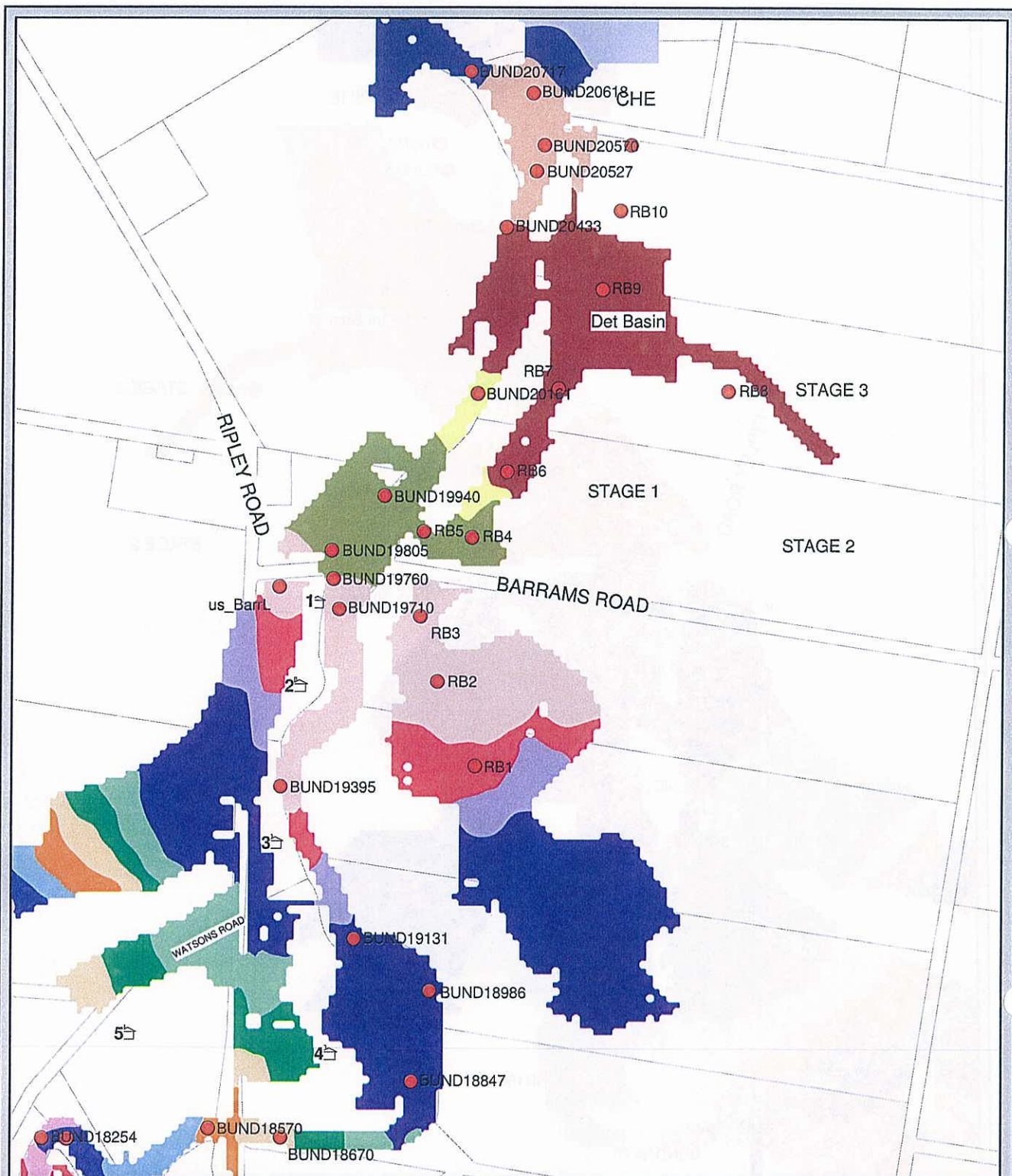
Figure 2
Barr Br Stage 1, 2 & 3
100 Year ARI
Peak Water Level

SUCE Stage 2 & 3

Flood Study

Scale: 1:8,000

80 0 80 160 240
Metres



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LEGEND

Peak Water Level
(m AHD)

40.50 to 41.00
41.00 to 41.50
41.50 to 42.00
42.00 to 42.50
42.50 to 43.00
43.00 to 43.50
43.50 to 44.00
44.00 to 44.50
44.50 to 45.00
45.00 to 45.50
45.50 to 46.00
46.00 to 46.50
46.50 to 47.00
47.00 to 47.50
47.50 to 48.00
48.00 to 48.50
48.50 to 49.00
49.00 to 49.50
49.50 to 50.00
50.00 to 50.50

● Reporting Point

□ Building

□ DCDB



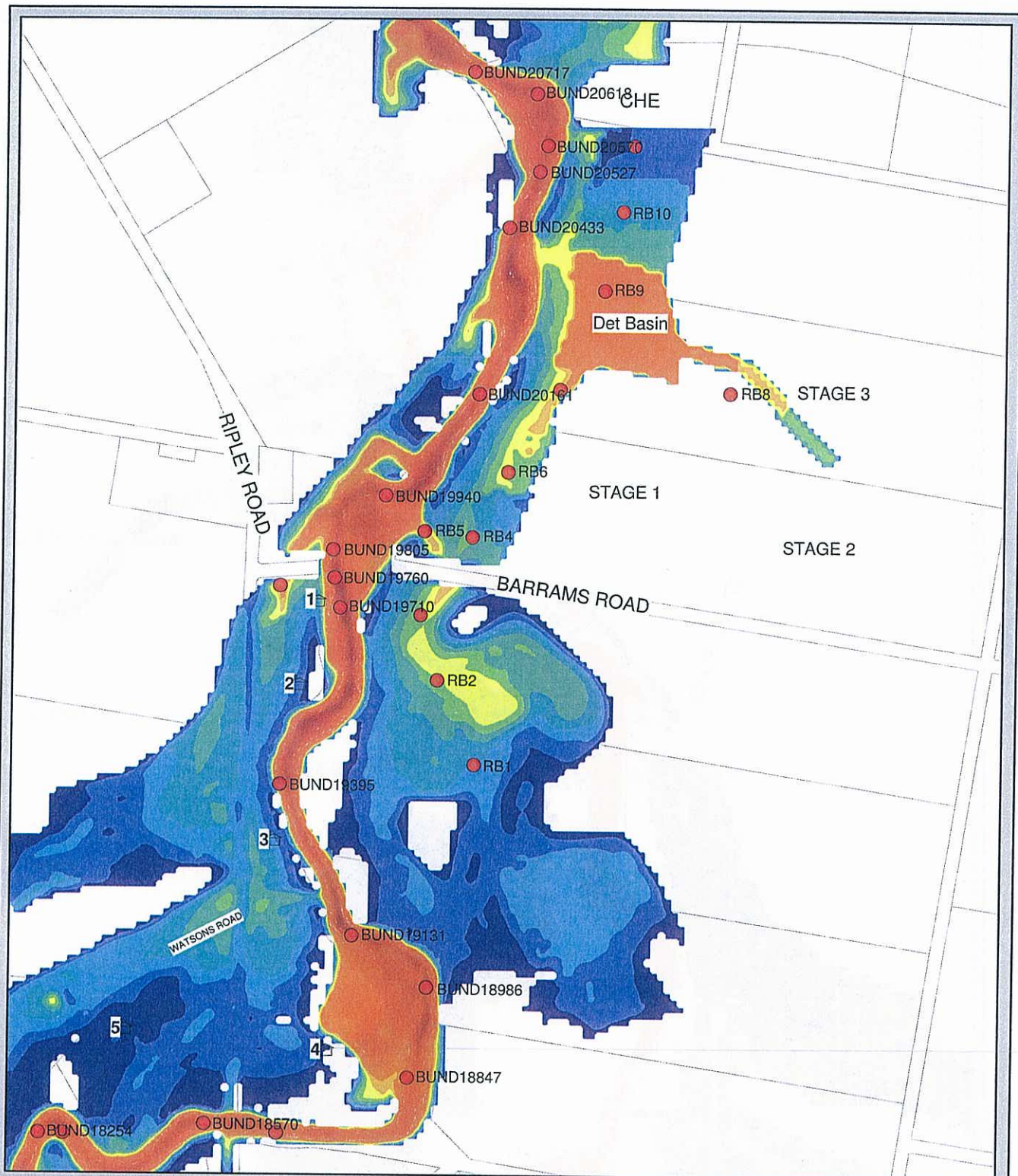
Figure 3
Barr Br Stage 1, 2 & 3
10 Year ARI
Peak Water Level

SUCE Stage 2 & 3

Flood Study

Scale: 1:8,000

80 0 80 160 240
Metres



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LEGEND

Peak Depth
(m)

0.00 to 0.25
0.25 to 0.50
0.50 to 0.75
0.75 to 1.00
1.00 to 1.25
1.25 to 1.50
1.50 to 1.75
1.75 to 2.00
2.00 to 2.25
2.25 to 2.50
2.50 to 2.75
2.75 to 3.00
3.00 to 3.50
3.50 to 4.00
4.00 to 4.50
4.50 to 5.00
> 5.00

- Reporting Point
- Building
- DCDB

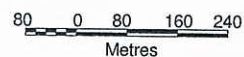


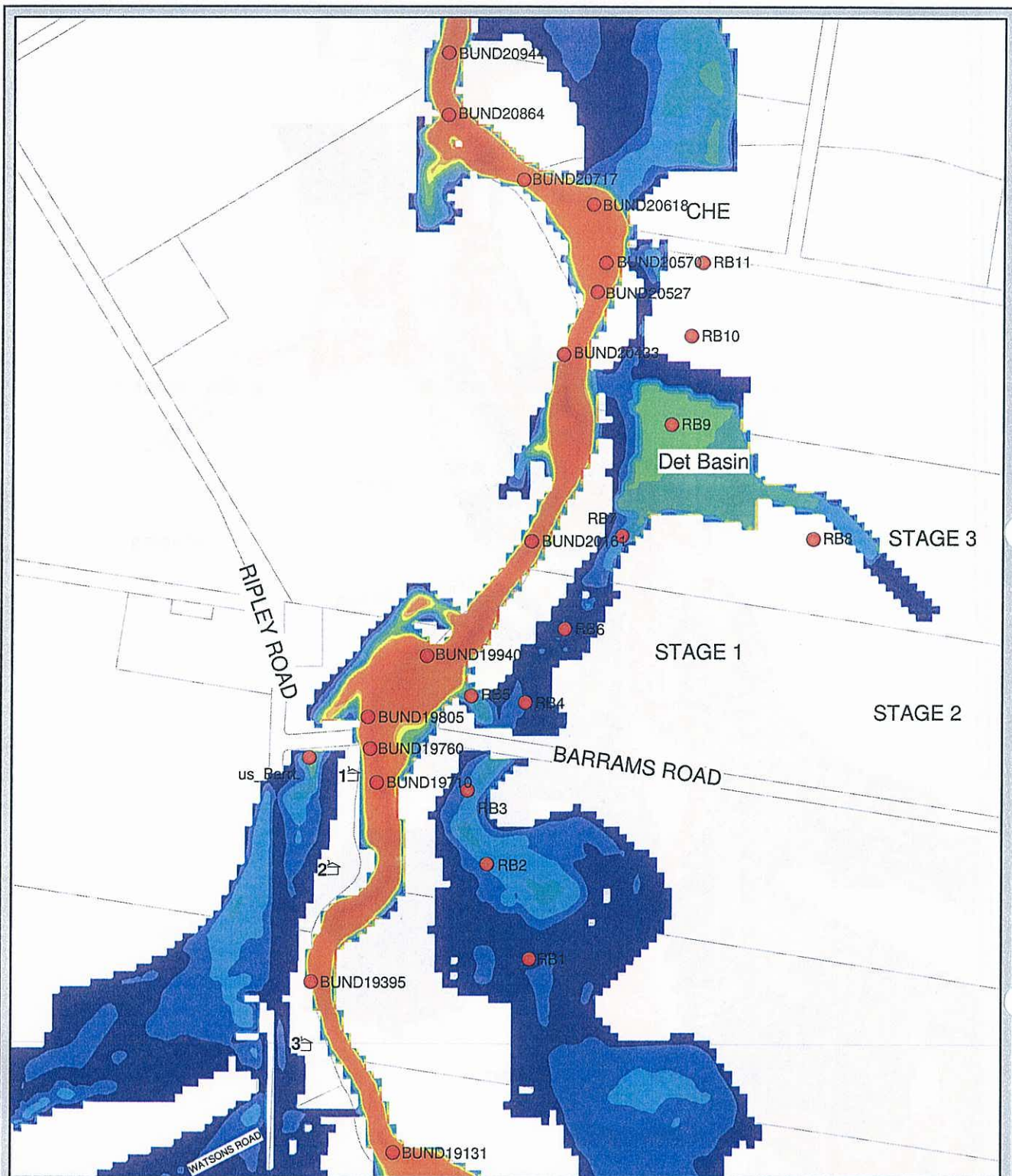
Figure 4 Barr Br Stg 1, 2 & 3 100 Year ARI Peak Depth

SUCE Stages 2 & 3

Flood Study

Scale: 1:8,000





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LEGEND

Peak Depth (m)

0.00 to 0.25
0.25 to 0.50
0.50 to 0.75
0.75 to 1.00
1.00 to 1.25
1.25 to 1.50
1.50 to 1.75
1.75 to 2.00
2.00 to 2.25
2.25 to 2.50
2.50 to 2.75
2.75 to 3.00
3.00 to 3.50
3.50 to 4.00
4.00 to 4.50
4.50 to 5.00
> 5.00

● Reporting Point

□ Building

□ DCDB



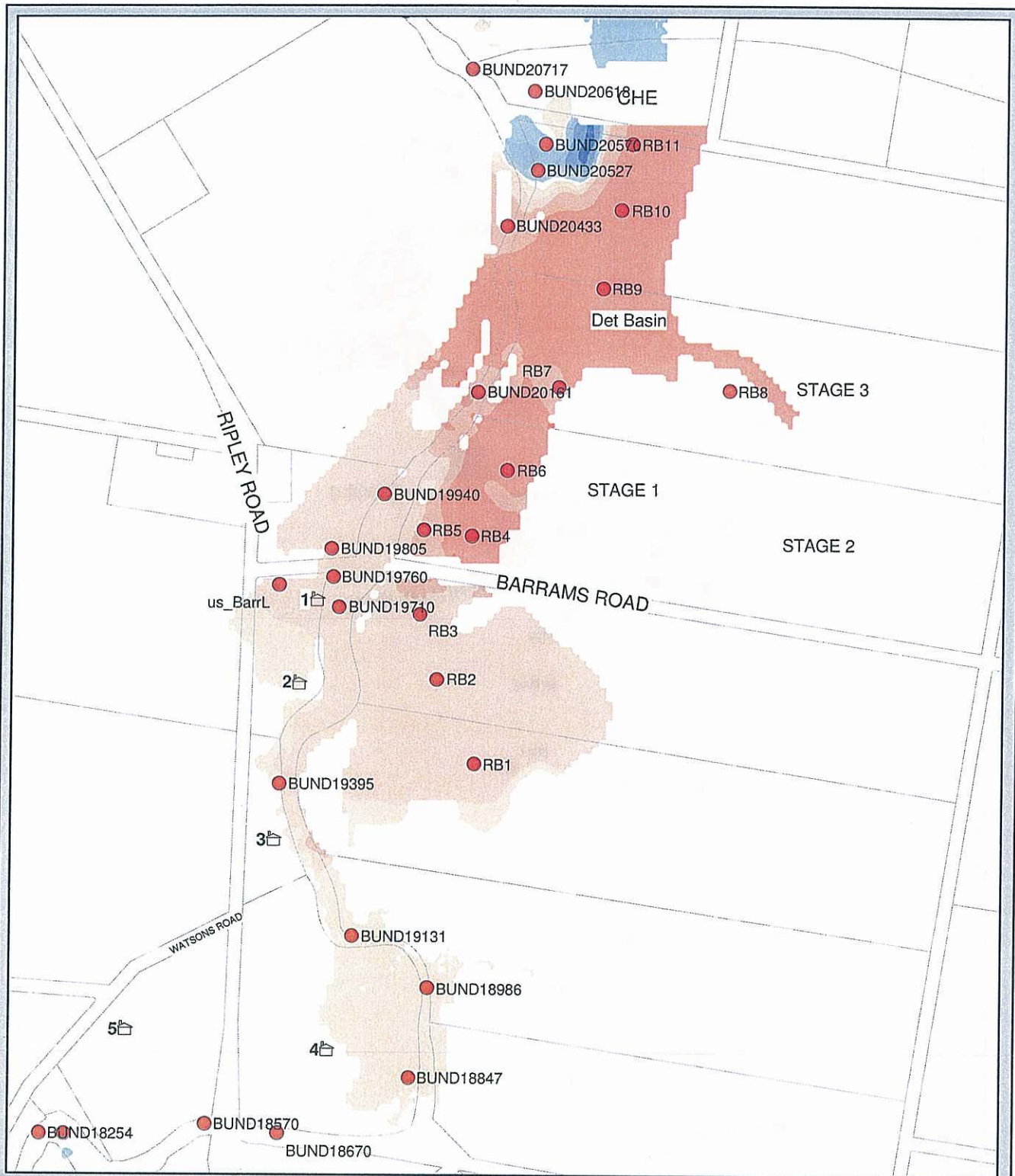
Figure 5 Barr Br Stg 1, 2 & 3 10 Year ARI Peak Depth

SUCE Stages 2 & 3

Flood Study

Scale: 1:8,000

80 0 80 160 240
Metres



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LEGEND

Peak Afflux
(m)

Blue	<-0.20
Light Blue	-0.20 to -0.10
Light Blue	-0.10 to -0.05
Light Blue	-0.05 to -0.01
Light Blue	-0.01 to 0.01
Light Blue	0.01 to 0.05
Light Blue	0.05 to 0.10
Light Blue	0.10 to 0.20
Light Blue	0.20 to 0.30



Reporting Point



Building



DCDB

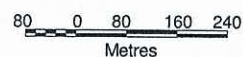


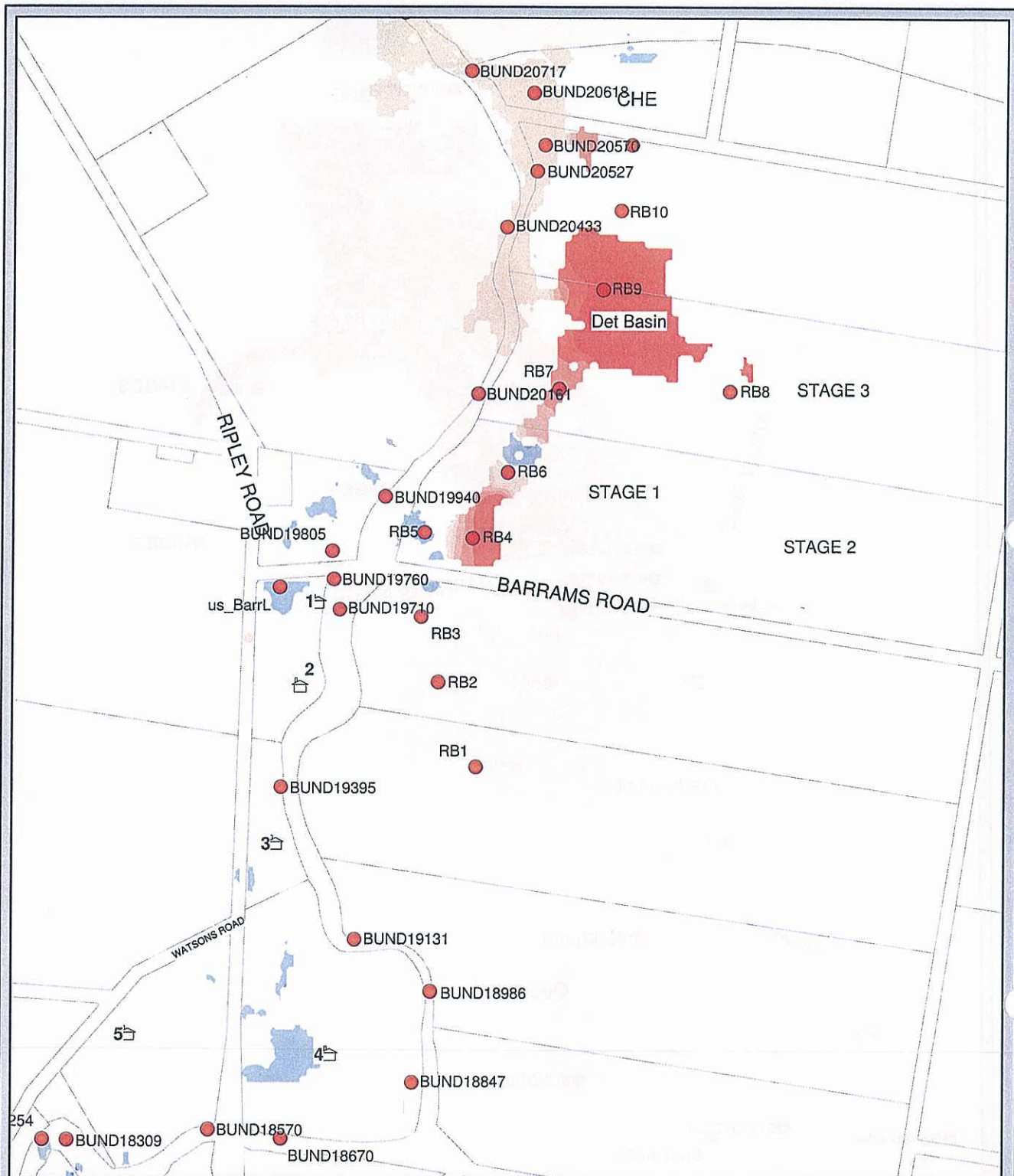
Figure 6
Barr Br Stg 1, 2 & 3
100 Year ARI
Peak WL Afflux

SUCE Stages 2 & 3

Flood Study

Scale: 1:8,000





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LEGEND

Peak Afflux (m)	
<-0.20	Blue
-0.20 to -0.10	Light Blue
-0.10 to -0.05	Medium Blue
-0.05 to -0.01	Dark Blue
-0.01 to 0.01	White
0.01 to 0.05	Light Green
0.05 to 0.10	Medium Green
0.10 to 0.20	Dark Green
0.20 to 0.30	Red

- Reporting Point
- Building
- DCDB

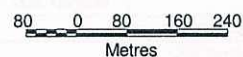


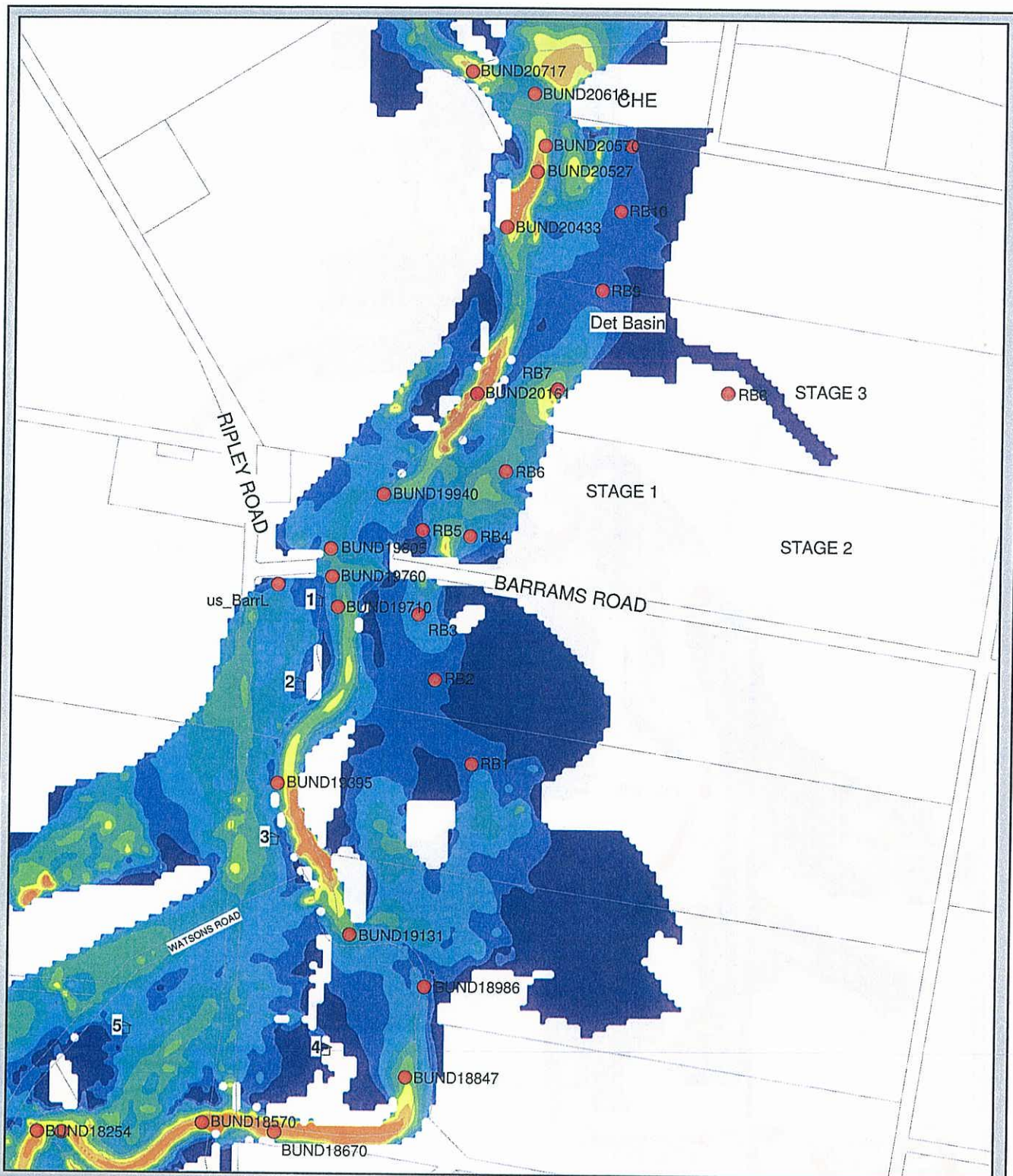
Figure 7 Barr Br Stg 1, 2 & 3 10 Year ARI Peak WL Afflux

SUCE Stages 2 & 3

Flood Study

Scale: 1:8,000





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LEGEND

Peak Velocity
(m/s)



● Reporting Point

□ Building

□ DCDB

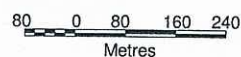


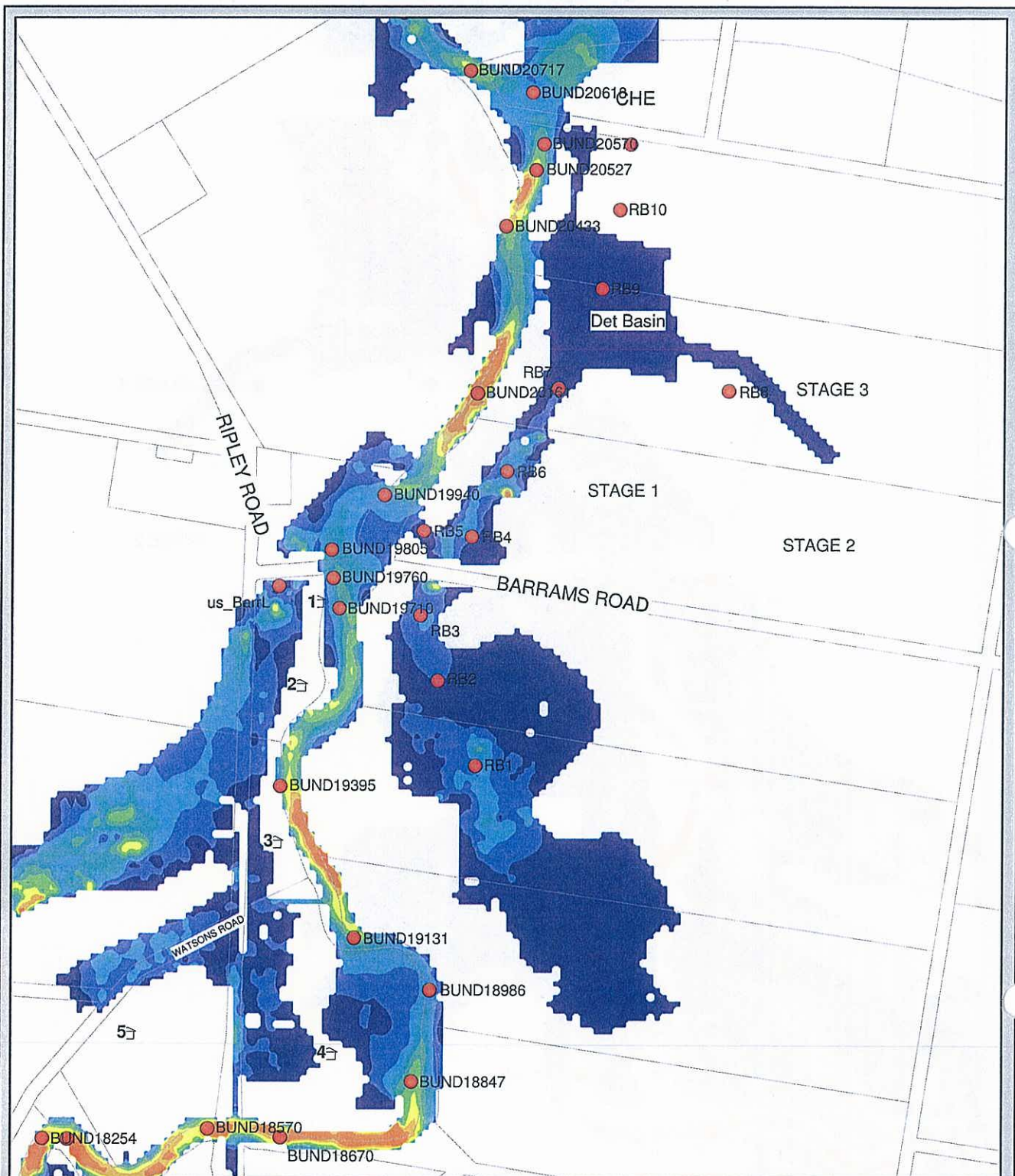
Figure 8
Barr Br Stg 1,2 & 3
100 Year ARI
Peak Velocity

SUCE Stages 2 & 3

Flood Study

Scale: 1:8,000





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LEGEND

Peak Velocity (m/s)



● Reporting Point

□ Building

□ DCDB

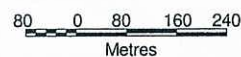


Figure 9
Barr Br Stg 1, 2 & 3
10 Year ARI
Peak Velocity

SUCE Stages 2 & 3

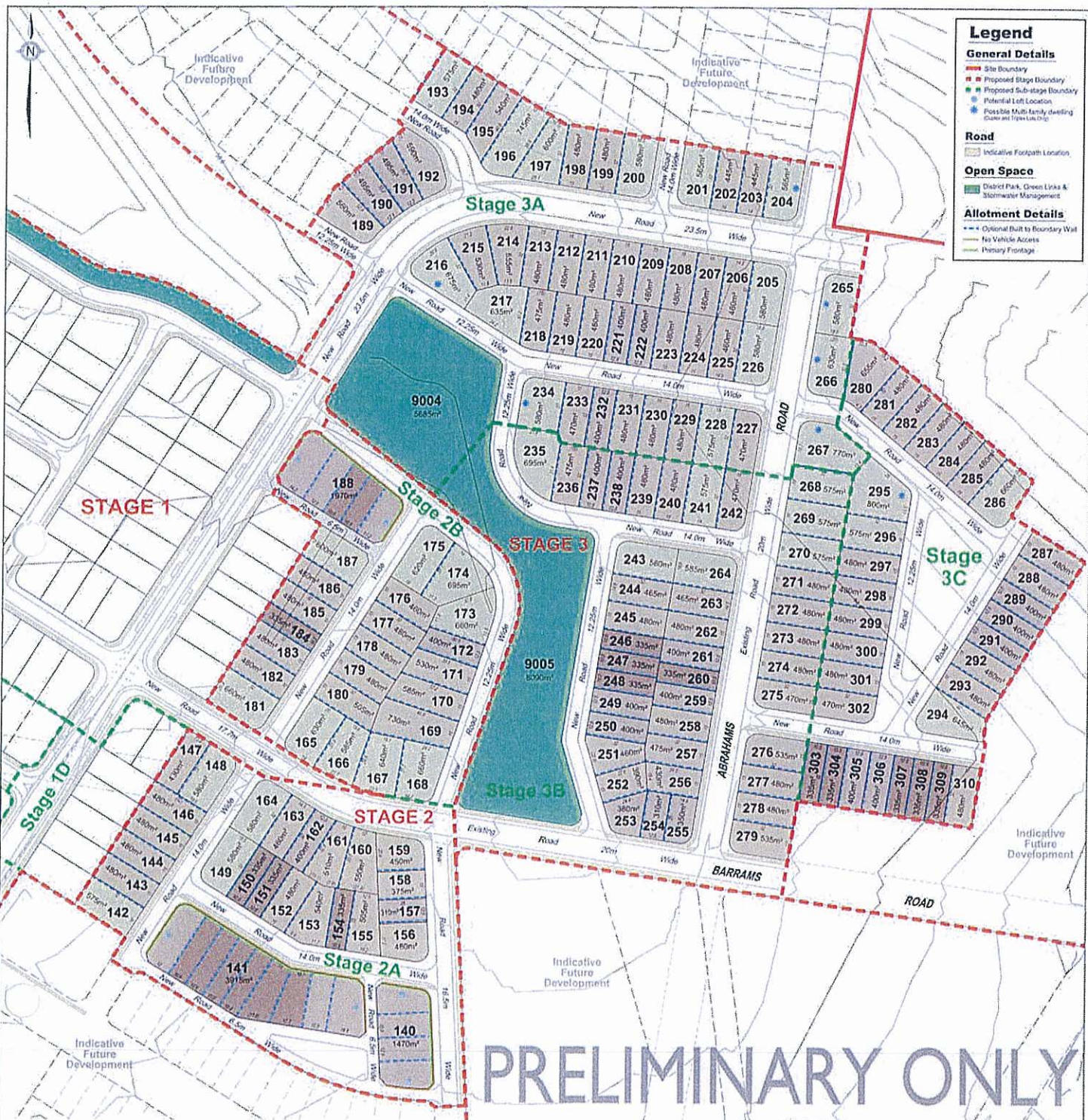
Flood Study

Scale: 1:8,000



Appendix A

Proposed Development Layout



Legend	
General Details	
Red dashed line	Site Boundary
Red solid line	Proposed Stage Boundary
Green dashed line	Proposed Sub-stage Boundary
Blue dashed line	Potential Lot Location
Blue solid line	Potential Multi-family dwelling cluster and flowlinking
Road	
Yellow line	Indicative Footpath Location
Open Space	
Green area	District Park, Green Links & Stormwater Management
Allotment Details	
Blue line	Optional Built to Boundary Wall
Yellow line	No Vehicle Access
Green line	Primary Frontage

Plan of Development Table		Village Allotments 10m		Premium Village Allotments 12 & 12.5m		Courtyard Allotments 11-15m		Traditional Allotments 15m	
		Ground Floor	First Floor	Ground Floor	First Floor	Ground Floor	First Floor	Ground Floor	First Floor
Front/Primary Frontage		2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Garage		4.5	n/a	4.5	n/a	4.5	n/a	4.5	n/a
Rear		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Side - General Lots									
Built to Boundary		0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0
Not Built to Boundary		0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0
Corner Lots - Secondary Frontage		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Lane-way Lots									
Rear of Lot (from lane-way boundary)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Garage (from lane-way boundary)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
On site parking requirements (minimum)		1 space to be covered and enclosed	1 space to be covered and enclosed	1 space to be covered and enclosed	1 space to be covered and enclosed	1 space to be covered and enclosed	1 space to be covered and enclosed	1 space to be covered and enclosed	1 space to be covered and enclosed
		Single or tandem garage acceptable	Single, tandem or double garage acceptable	Single, tandem or double garage acceptable	Single, tandem or double garage acceptable	Single, tandem or double garage acceptable	Single, tandem or double garage acceptable	Single, tandem or double garage acceptable	Single, tandem or double garage acceptable
Garage location		Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall	Garages are to be located along the built to boundary wall
Site Cover (maximum)		70%	70%	70%	70%	70%	70%	70%	70%

Notes:

- All development is to be undertaken in accordance with the Development Approval.
- Left Handed are permissible over garages where noted.
- The maximum height of buildings shall be in the order of 9 metres.
- Setbacks are as per the Plan of Development Table unless otherwise specified. Built to boundary walls are optional. The location of the built to boundary walls are indicated on the Plan of Development. Where built to boundary walls are not abutted side setbacks shall be in accordance with the Plan of Development Table.
- Built to boundary walls are to have a maximum length of 15 metres and a maximum height of 3.5 metres.
- Boundary setbacks are measured to the wall of the building or edge of balcony.
- Eaves (except on a wall that is built to the boundary) should not encroach within 450mm of the side or rear boundaries. Gutters may not extend beyond the boundaries of the lot.
- First floor setbacks on single and multi-family allotments must not exceed the minimum ground floor setbacks.
- Garages must not project forward of the front building setback and must be setback a minimum of 4.5m from the front property boundary.
- A minimum of 0.5m off street car park is required per dwelling.
- Site Cover and Amenity
- Site cover for each lot is not to exceed 70% of the lot.
- Dwellings with their main living areas located at ground level should have a minimum area of private open space consisting of at least 12m² with a minimum width of 2.4 metres, preferably accessible from a living room.
- Dwellings with their main living areas above ground floor level should have a minimum area of private open space consisting of a balcony or roof area open to the sky, with a minimum area of 5m² and a minimum dimension of 1.2 metres, directly accessible from a living room.
- Loft Apartments
- Each loft apartment must have a clearly identifiable and addressed front door.

- Incorporate in all walls adjoining the main dwelling and private open space areas of the main dwelling:
 - Windows with a minimum sill height of 1.5 metres or privacy screening.
 - Low maintenance building materials and non reflective finishes.
 - No external drainage or other pipes.
- Incorporate an area of private open space such as a balcony or verandah with a minimum depth of 1.2 metres and a minimum area of 5m², preferably overlooking the lane, and including a screened drying area.
- Incorporate at least 2 openings to all habitable rooms, including internal windows and louvre windows to facilitate cross ventilation.
- Fencing
- Fencing on all Street Frontages, to be 50% transparent or not to exceed 1.2 metres in height.
- Definitions:
 - Left Handed - A dwelling built above a garage with its own entry door at ground level.
 - Lane-way Allotment - Allotments serviced by a lane-way.

Note: All dimensions and areas are approximate only, and are subject to survey and Council approval. Dimensions have been rounded to the nearest 0.1 metres. Areas have been rounded down to the nearest 5m². The boundaries shown on this plan should not be used for final detailed engineers designs.

Scale 1:1000

REVISION: A: 16/03/11 Amended Layout		Level Datum Origin		Date 18 March 2011		CLIENT AMEX		PROJECT SECONDARY URBAN CENTRE EAST	
Scale 1:1000		Sheet A1		Comp By: JLS:VNW		DWG Name: 6837-134B Stage 2 & 3		Plan Ref: 6837-136	
				Local Authority: IPSWICH CITY COUNCIL		Locality: RIPLEY		Rev A	
				Job Reference: 6837		PLAN OF DEVELOPMENT		RPS	



EXISTING
CULVERT

CENTENARY
HIGHWAY

FUTURE
TREATMENT
AREA

FUTURE SPORTSGROUND
(Q10 IMMUNITY)

FUTURE
STAGE

FUTURE FACILITY AREA
AROUND BASINS ASSUMED
TO HAVE Q100 IMMUNITY

FUTURE
STAGE

DRAINAGE SWALE

LOT FLOW
DRAINAGE
SWALE

BUNDAMBA CREEK

FUTURE
BIORETENTION
AREAS

STAGE 2/3
BIORETENTION AREA

Sub-Stage 2A
REFER SWALE
SECTION

STAGE 1

FUTURE
STAGE

BARRAMS ROAD

1
6

8m

6
1

TYPICAL SWALE SECTION
N.T.S.

LEGEND

- 50m CREEK BUFFER
- LOT BOUNDARIES
- KERB AND CHANNEL
- VEGETATED SWALE DRAIN
- STORMWATER DRAINAGE
- PRECINCT BOUNDARY
- STAGE 2/3 BOUNDARY
- STAGE BOUNDARY
- SUB-STAGE BOUNDARY
- FUTURE STAGE BOUNDARY
- DIRECTION OF STORMWATER FLOW
- INLET PIT, GULLY PIT, MANHOLE
OUTLET HEADWALL
- BERM

PRELIMINARY
Date 27 March, 2012

RIPLEY VALLEY - DRAFT

RIPLEY VALLEY
SUICE STAGES 2 AND 3
FLOOD STUDY

DATE PLOTTED: 27 March, 2012 - 12:18pm

REV.	DATE	DESCRIPTION	REVISIONS
A	27/03/2012	GENERAL AMENDMENTS	
B	27/03/2012	DESIGN UPDATE	
C	27/03/2012	CURRENT/FUTURE STAGES DIFFERENTIATED	

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DESIGNED: N.G.	DRAWN: B.V.	CHECKED: D.T.	RECOMMENDED: PROJ. MAN.	APPROVED: PROJ. DIR.
A1	DATUM: A.H.D.			

Cardno (Qld) Pty Ltd
111 North Quay, Brisbane, Queensland 4000
Locked Bag 4006, Fortitude Valley QLD 4006
Web: www.cardno.com.au

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