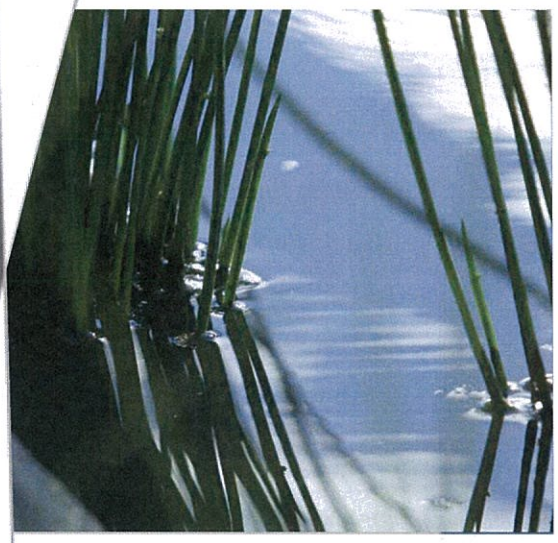
Ripley Valley Secondary Urban Centre East

Stages 1-3 Addendum Flood Report

7901/47-027



Prepared for
AMEX Corporation Pty Ltd

23 January 2014

Cardno
Shaping the Future

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Version	Date	Author	Author Initials	Reviewer	Reviewer Initials
1	20 December 2013	Netsanet Ejigayehu/ Helen Doherty	NE HMD	Martin Giles	MG
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1 Introduction

This addendum flood report has been prepared to detail the flood modelling undertaken with respect to Stages 1 to 3 of the proposed Ripley Valley Secondary Urban Centre East (SUCE) development.

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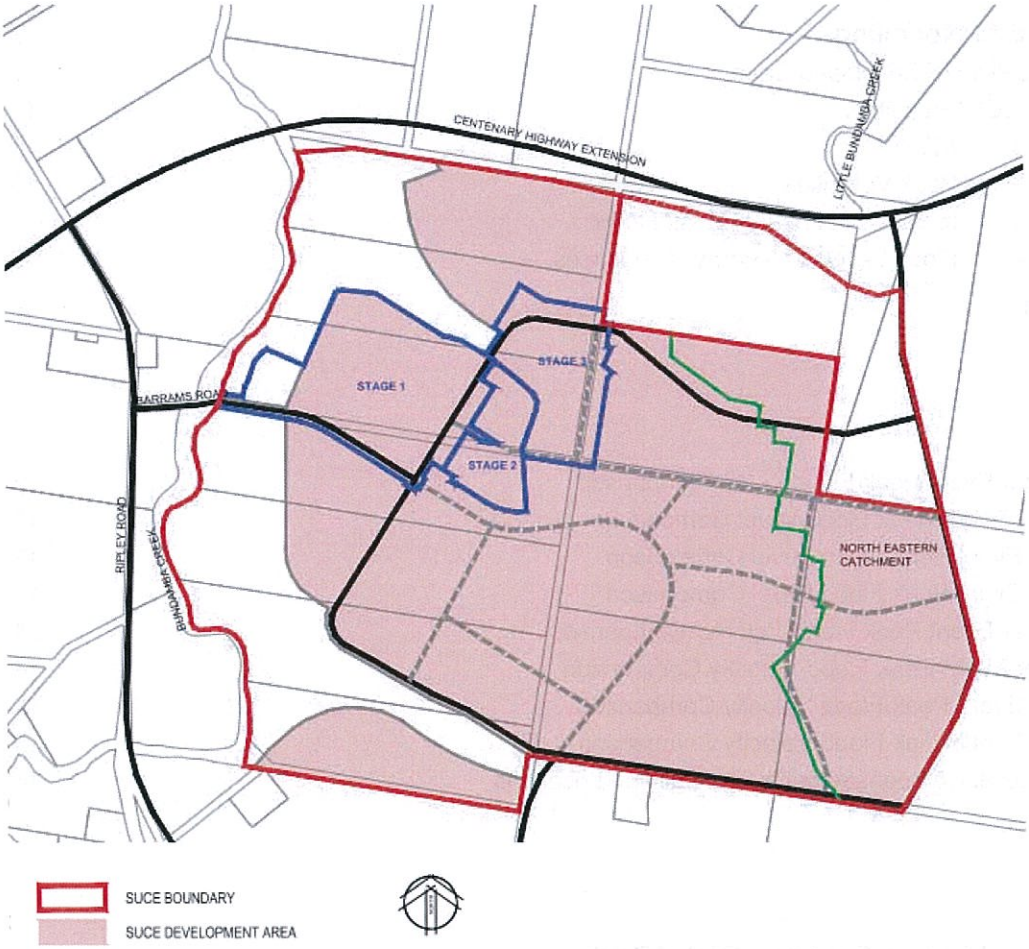

Image 1 SUCE Area and Key Features

Stages 1 to 3 of the development are located immediately to the north of Barrams Road.

Flood modelling of the impact of Stages 1 to 3 of the SUCE development has been based on the flood study of the entire Bundamba Creek area completed by consultants acting on behalf of Council. Additional work was completed by the consultants at the request of the former ULDA to improve the resolution of the model in the vicinity of Ripley Valley. Previous flood modelling was completed based on a model of Bundamba Creek developed for AMEX Corporation by Cardno.

A full description of the modelling that was undertaken is provided in the Cardno report *Ripley Valley Secondary Urban Centre East Flood Study* (Version 5, February 2013).

For consistency purposes, the ULDA and Council have recommended that any proposed development in Ripley Valley be tested using the new Bundamba Creek model (referred to as the KBR model). As the model extends downstream to the mouth of the creek, the model also offers the ability to confirm the nature of any impacts with respect to flood levels, flows, and timings in areas presently subject to flooding which are located well downstream of Ripley Valley.

2 Previous Approval for Stage 1

When approval was gained with respect to Stage 1 of the development, queries were raised with regard to a number of flood-related issues. A response was ultimately prepared in relation to the issues (Cardno August 2011). For consistency with the previous approval, the previously raised issues are discussed below.

2.1 Bridge and Road Levels

As part of the Stage 1 approval process, a review was completed with respect to the potential for the Centenary Highway Extension to flood and for Bundamba Creek to break its banks and cross Barrams Road to a point to the east of Bundamba Creek.

In both cases, it was previously demonstrated that adequate immunity existed with respect to both the Centenary Highway and Barrams Road. As the flood levels calculated for Bundamba Creek using Council's model are lower than those previously calculated with respect to Stage 1, it can be concluded that adequate immunity will continue to exist based on the results presented in the current flood study.

2.2 Adjacent Properties

With reference to Figure 1, a number of properties are located adjacent to Bundamba Creek. For the Stage 1 approval, attention was paid to the conditions at each property to confirm that development will not produce an actionable nuisance.

Firstly, an afflux is recorded on the property to the south of Barrams Road owned by Mr Keith Oades. Buildings noted as BLD1 and BLD2 (refer Figure 1) are located on the property. An agreement has been reached with the property owner to accept an increase in level subject to maintaining a minimum 300 mm freeboard to the floor level of his dwelling. With reference to Table 4-9, a freeboard of over 900 mm will be achieved following the works, thereby satisfying the requirements of the owner.

To the south of this property is the Brennan property. The images below show the predicted afflux and depth of flow for the 100 year event in the vicinity of the property.

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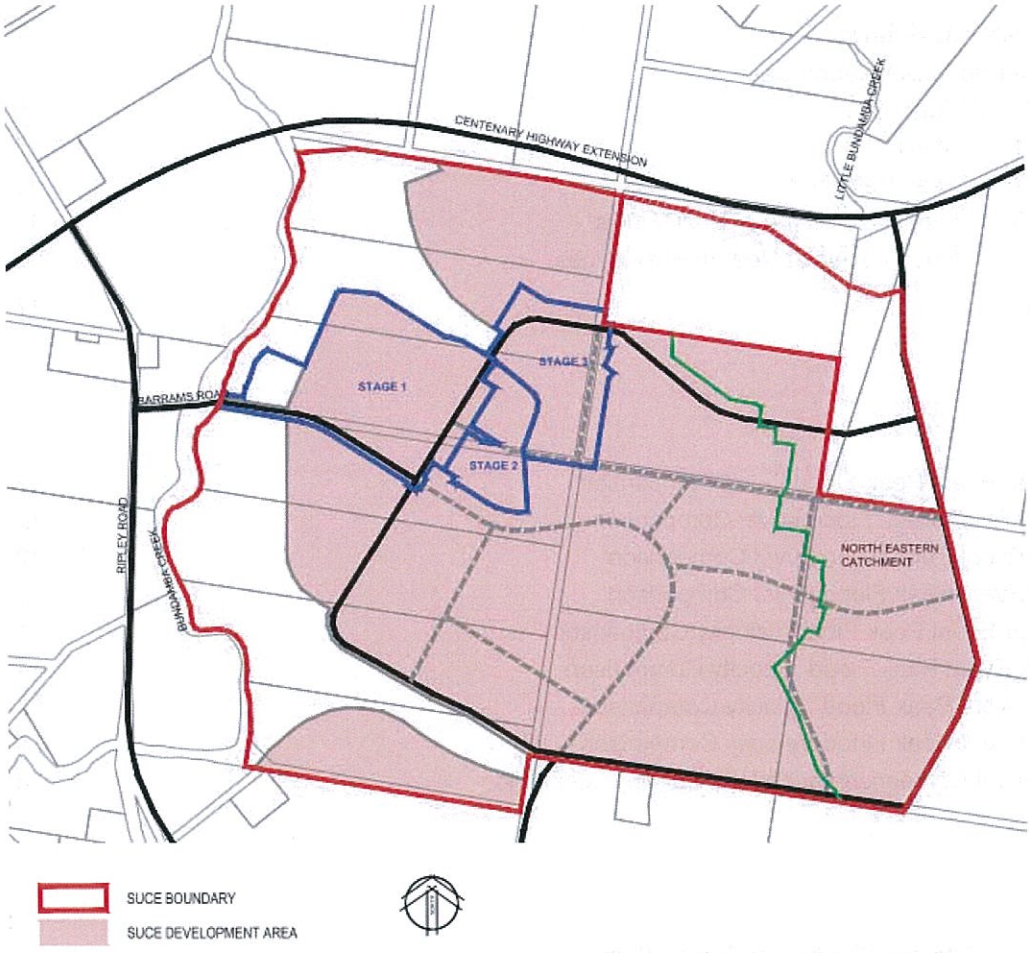

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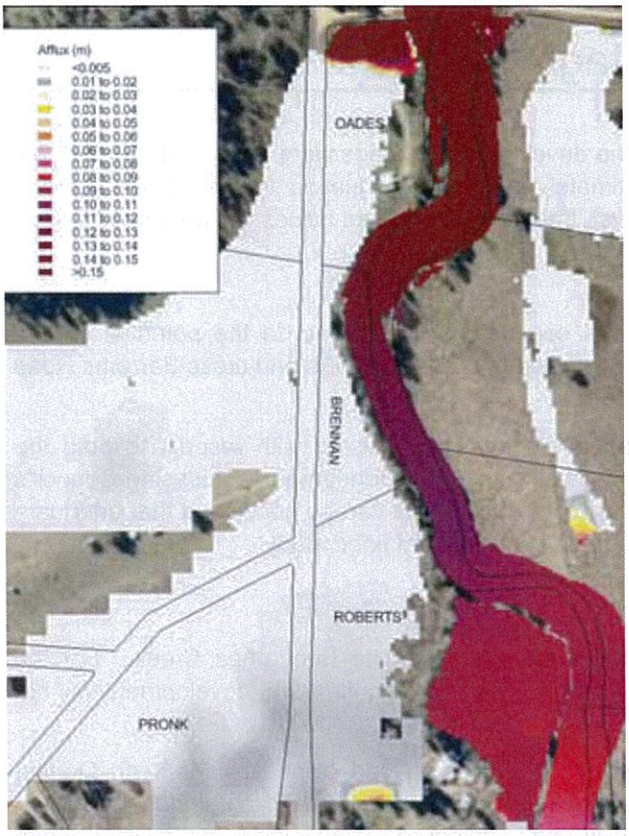
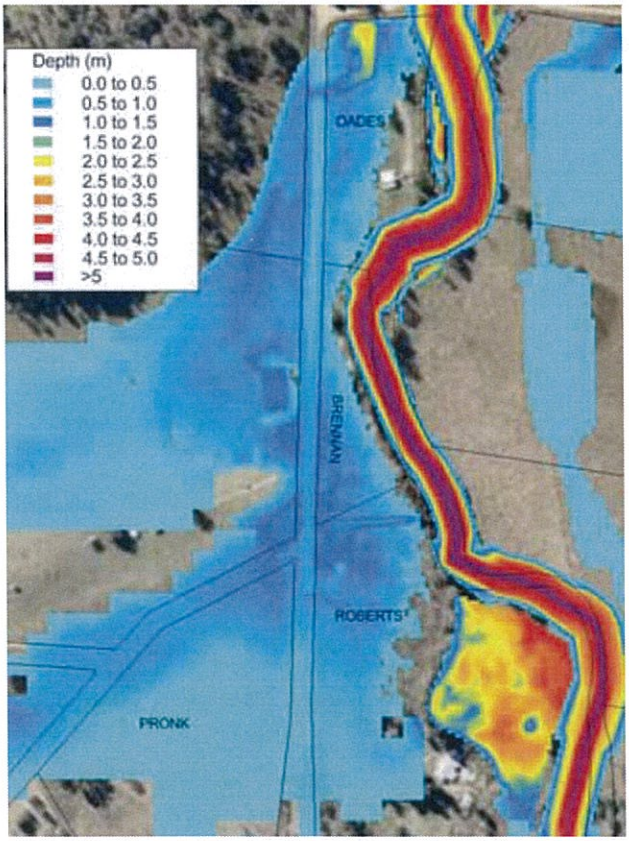


Afflux in Vicinity of Brennan Land



Peak Water Depths- 100 Year Event in Vicinity of Brennan Land

With respect to the Brennan Land, the main channel of Bundamba Creek extends into the property. As per the previous Stage 1 approval, an increase in flood level is predicted within the main channel of the creek. However, as per the conclusion accepted as part of the previous Stage 1 approval, any increase in the depth of flow in the main channel is considered insignificant with respect to flood level increases as the area in question would not be able to be used for any purpose by the land owner.

On the Roberts property further to the south, the predicted approximate increase in flood level is no greater than 90 mm. However, the existing depth of flow within the property is of the order of 2.5 metres or more for the 100 year event, reflecting the fact that the site forms a significant floodplain area for Bundamba Creek.

Given the above, as per the previous Stage 1 approval, it is therefore concluded that for such an inconsequential change in the depth of flooding, the minor impacts on the existing open space and gardens are not sufficient to produce an actionable nuisance with respect to flooding, particularly given the rural nature of the properties and the intended ultimate land use. In any event, this land is designated future park in Part 15 of the Ipswich City Council Planning Scheme (refer Section 2.3.3) and therefore has no urban development potential.

A similar conclusion is drawn with respect to the land to the north of Barrams Road owned by Francis (refer Section 2.3.3). It is noted that at present there is no building on the land. An afflux is predicted within the Francis land, within an area that already acts as a flow path. As the area currently affected by flooding is identified as future open space and is not presently used, as per the previous Stage 1 approval it is considered that the increase in level is not of significance.

In preparing the previous Stage 1 response, a review was made of recent judgements in relation to court actions that featured flooding issues. The results of the review are repeated below.

While precedent exists with respect to impacts in urban areas, the potential for damage to occur in rural areas is considerably different and less than that associated with urban development. Whilst there are a number of potentially relevant cases, e.g. that of Marshall vs Department of Transport (Land Court 1998, Case A92-77) which involved a claim in relation to the impact of a flood level increase in a non-urban area, the judgements have not been specific in nominating a particular extent of flood level increase in relation to actionable nuisance.

QUDM Section 3.1 outlines that a nuisance occurs where *there has been a substantial or unreasonable interference with another person's use and enjoyment of land. If a person's actions result in the concentration of additional surface water over and above flows that would occur naturally which cause a direct impact to another person's land, liability for nuisance may arise. The impact may be in the form of actual physical injury to land or impairment of the owner's ability to enjoy their land*.

Given that the increase in the depth of flooding is a small fraction of the overall flood depth and is over non-habitable land, it is considered that this does not constitute 'unreasonable interference' and will not result in 'physical injury' or 'impairment'.

Further, available flood damage guidelines such as the Department of Natural Resources and Water (DNRW) publication *Guidance on the Assessment of Tangible Flood Damages* (September 2002) and the CSIRO publication *Floodplain Management in Australia: Best Practice Principles and Guidelines* (SCARM Report 73, 2000) indicate that the impact of flood damage in rural areas is generally much less than in urban areas.

While the DNRW publication provides damage figures for residential and commercial property, for rural and other areas the consideration of flood damage is limited to impacts on roads. The CSIRO publication notes that 'compared to urban flood damage, *the cost of rural flood damage per unit area of affected land is significantly less'*, noting that '*in addition to obvious losses, such as crop and stock losses, other types of flood damage suffered by rural enterprises include loss of topsoil and fertiliser, damage to fences and weed infestation'* (p84). The guideline notes that flood damage depends on '*both the type and growth stage of crops, and duration and depth of flooding*'.

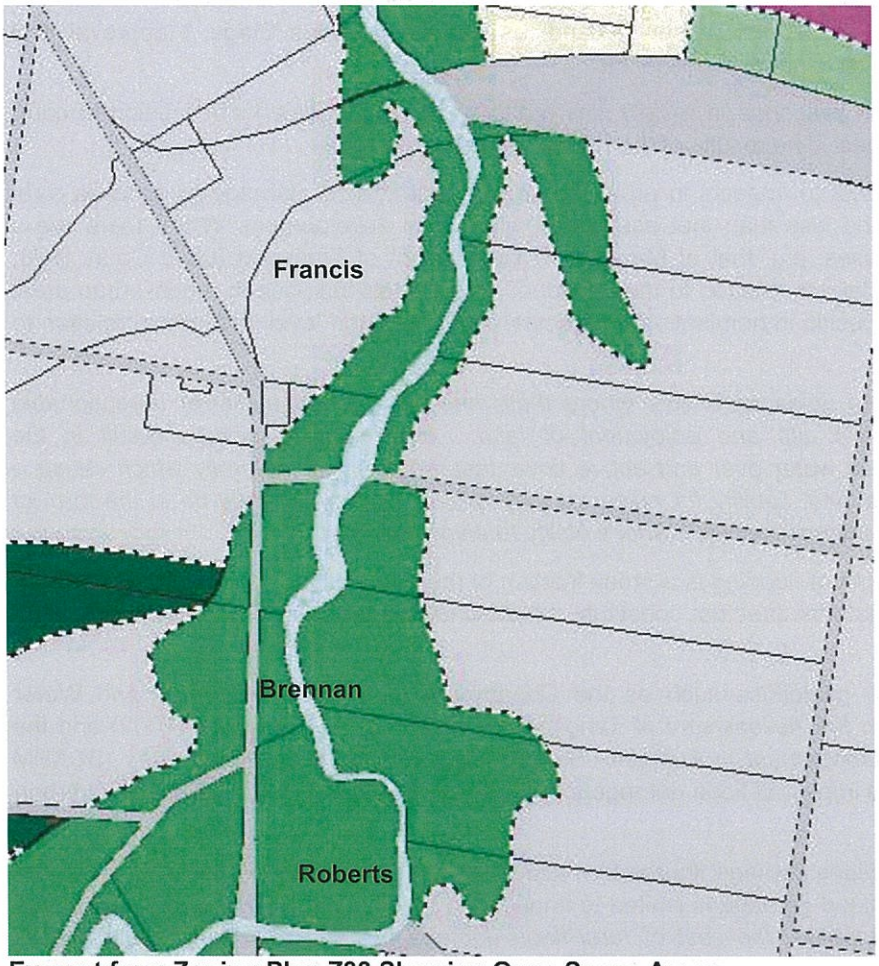
In this case, the area in question is not under cultivation. However, using the elements listed in the CSIRO publication, it is considered that the slight increase in flood depth would not result in any measurable change in the amount of topsoil and fertiliser loss, damage to fences, or weed infestation resulting from flooding. Further, the duration of flooding will essentially not change from that occurring at present. Given this, it is considered that the additional flood impacts resulting from the change in flood level will be negligible, again reinforcing the conclusion that the change in level will not cause an actionable nuisance.

It is considered that this conclusion remains valid for the results obtained from the updated modelling reported in this report.

2.3 Development Potential

In addition to the review of flood level impacts, for the previous Stage 1 approval consideration was also given to the potential loss of development potential on lots impacted by any change in flood level.

The Ipswich City Council Planning Scheme Zoning Plan Z33 (excerpt below) indicates that the properties to the south of Barrams Road that are impacted by flooding are designated open space areas. It is therefore considered that in these locations an increase in flood level will not impact upon the development potential of the lots.



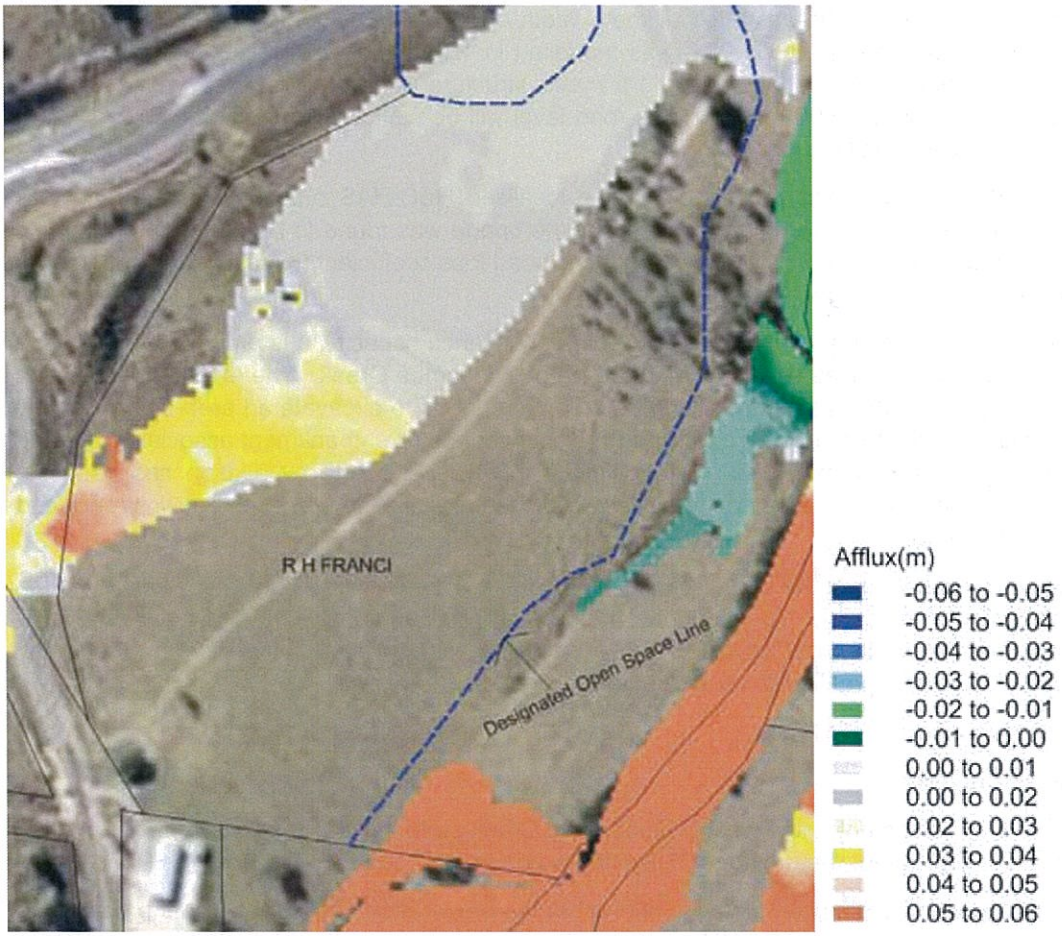
Excerpt from Zoning Plan Z33 Showing Open Space Areas

The open space area to the north of Barrams Road shown on the Francis land only extends partially into the site, with the remainder potentially available for development. The potential impact of the AMEX development upon the development potential of the Francis land is limited to the increase in the extent of inundation within the area otherwise available for development.

For the Stage 1 approval, it was determined that the impact of the AMEX development on the development potential of the site was negligible. Based on the results obtained from the use of the model supplied by Council, an even more certain outcome is obtained. The image below shows the increase in level caused by the AMEX development. Adjacent to Bundamba Creek, the extent of inundation is contained within the open space area next to the creek. Consequently, the AMEX development has no adverse impact whatsoever on the development potential of the site.

It can be noted that the image shows a small increase in level within a flowpath that passes through the northern part of the site. Following a detailed review of the model it was determined that the change in level can be attributed to model stability issues rather than being the result of any impact of development.

Given this, it is considered that the development potential of the Francis land is not adversely impacted by the proposed construction of Barrams Road and the development of SUCE land owned by AMEX.



Afflux at Francis Property

2.4 One Year Event

Detailed flood modelling of the 1 year recurrence interval event determined that the impact of development on conditions in Bundamba Creek for the 1 year event is negligible (refer Section 4.6 of the Cardno February 2013 report for greater detail).

3 Developed Site Modelling

The specific elements added to the developed case TUFLOW model for the analysis of Stages 1 to 3 are detailed below for each development scenario.

3.1 Modelling of Developed Case

The works considered for Stages 1 to 3 of the development include the construction of the Barrams Road Bridge and culverts. The works considered for Stages 1 to 3 are shown in Figure 3 and are described below.

- **Barrams Road Bridge**

  The proposed Barrams Road crossing includes a three 25 metre span bridge of 75 metres total span across Bundamba Creek. The assumed ultimate width of the bridge was 30 metres. The bridge, located at model cross section BC1.251, was modelled in 1D. To minimise afflux, the bridge soffit level was set at 44.38 mAHD. Allowing a 1.5 metre structure depth, the resultant minimum road level across the bridge is 45.90 mAHD. This road level will be sufficient to provide the road with a 100 year ARI flood immunity.

  The main bridge crossing was modelled using a localised HEC-RAS model to quantify the loss produced by the crossing. The afflux produced by the bridge was found to be 250 mm in the main channel. To match this afflux in TUFLOW a dynamic head loss coefficient (K) of 2.5 was adopted for the 1-D channel representing the proposed bridge.

  To ensure that the three-span bridge has adequate conveyance capacity, it is proposed to excavate beneath the span that crosses the eastern floodplain of Bundamba Creek. The extent of excavation is shown on Figure 3. With reference to Figure 3, it is proposed to excavate an area approximately 20 metres wide to a depth of less than two metres, removing the fill embankment associated with the existing alignment of Barrams Road. The resultant invert level of the excavation has been set relative to levels downstream of the bridge to allow for free drainage of flow at the downstream end of the excavated area.

  The excavation will not affect the bed or banks of Bundamba Creek and will be wholly located in the eastern floodplain of the creek. Consequently, the excavated area will only convey flow when events of sufficient magnitude to cause the creek to overtop occur. The works will therefore not have any impact on the conveyance of low flows in Bundamba Creek.

- **Barrams Road Culverts**

  - **Western Culverts**

  Flow from a local catchment to the west of Bundamba Creek currently crosses Barrams Road. It will be necessary to provide for the drainage of this flow as part of the upgrading of Barrams Road.

  Based on hydraulic modelling completed in support of the preparation of this report, it is proposed to construct culverts with the following configuration:

  - 2/ 3.0 x 1.5 m RCBC;
  - 40 metre culvert length (at an angle in the ultimate configuration);
  - Upstream invert level = 42.90 mAHD; and
  - Downstream invert level = 42.50 mAHD.

  The area just upstream of these culverts will have to be excavated by around 500 mm so that the slope of the culverts can be reduced and the fill embankment of the existing unmade Barrams Road removed. The headwall will also need to be rounded to reduce the entrance losses at this point. An entrance loss of 0.2 and exit loss of 1.0 were adopted for the culverts.

A channel of approximately 20 metres width and 1 metre depth will be provided to link to the culverts at Ripley Road. The channel will be vegetated, except for a rock-lined low flow channel. The alignment of the channel was designed to minimise disturbance to existing vegetation.

- **Eastern Culverts**

Barrams Road is also crossed by flow produced by runoff from local catchments to the east of Bundamba Creek. It is proposed to provide for the drainage of minor flow as part of the upgrading of Barrams Road. For the eastern floodplain crossing the following culvert configuration was found to be necessary:

- 1.5 x 1.5 m RCBC;
- 72.5 metre culvert length;
- Upstream invert level = 41.26 mAHD; and
- Downstream invert level = 40.90 mAHD.

The eastern culvert will be located approximately 63.5 metres to the west of the existing low point in the floodplain. This is to allow for future development of this area for sportsgrounds. A trapezoidal channel will be constructed to convey flows from the low point to the culvert. The characteristics of the channel are provided as follows:

- 5 meter base width;
- 1(V):4(H) batter slope; and
- 2% longitudinal slope

In addition it is proposed to construct a trapezoidal diversion channel to the west of the eastern culvert. This channel will utilised to convey the major flow in excess of the culvert flow to the west into the compensatory channel beneath the bridge. It will also provide an alternative flow path in the event of culvert blockage.

The characteristics of the channel are provided as follows:

- 5 meter base width;
- 1(V):4(H) batter slope; and
- 0.5% longitudinal slope.

The western side of this drainage channel has been more steeply graded, with appropriate scour protection provided.

The proposed channels and culvert are shown in Figure 3.

- **Filling for Stages 1 to 3**

The area of the Stage 1-3 works will be filled above the 100 year ARI flood level. To allow for earthworks batters, a 10 metre buffer around the boundary of these works was also assumed to be filled.

- **Open Space Flood Immunity**

In accordance with the requirements of the ULDA *Park Planning and Design Guidelines* (November 2011), sports fields will be provided with 20 year ARI flood immunity. The clubhouses, toilet and amenities blocks will be provided with 100 year ARI flood immunity. The recreation parks will be provided with 5 year ARI flood immunity. The formal playground area will be set at the 20 year ARI flood level.

- **Revegetation**

The modelling included an allowance for revegetation of the creek as part of the SUCE development. For the analysis, only the revegetation of the buffer along the eastern side of the Creek was included as part of the impact assessment. A manning's 'n' of 0.1 was adopted for the proposed revegetation.

In addition to the works detailed above, for the modelling completed to define minimum development levels for the SUCE site, it was assumed that the western side of Bundamba Creek would ultimately be revegetated, with an adopted Mannings 'n' roughness value of 0.1.

3.2 TUFLOW Results

3.2.1 Flood Mapping Outputs

The results obtained from the TUFLOW model are presented graphically in Appendices A, B, C, and D.

Appendix A Hydrograph at Reference Points

Appendix B contains existing and developed case flood extent maps:

- Figure B1 Existing Case Q100 Flood Extent
- Figure B2 Existing Case Q20 Flood Extent
- Figure B3 Existing Case Q2 Flood Extent
- Figure B4 Existing Case Q1 Flood Extent
- Figure B5 Stages 1-3 Q100 Flood Extent
- Figure B6 Stages 1-3 Q20 Flood Extent
- Figure B7 Stages 1-3 Q2 Flood Extent
- Figure B8 Stages 1-3 Q1 Flood Extent

Appendix C presents the afflux (change in flood level) plots for the developed case:

- Figure C1 Stages 1-3 Q100 Afflux
- Figure C2 Stages 1-3 Q20 Afflux
- Figure C3 Stages 1-3 Q2 Afflux
- Figure C4 Stages 1-3 Q1 Afflux

Appendix D presents flood depth mapping for the existing and developed cases:

- Figure D1 Existing Case Q100 Flood Depth
- Figure D2 Existing Case Q20 Flood Depth
- Figure D3 Existing Case Q2 Flood Depth
- Figure D4 Existing Case Q1 Flood Depth
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- Figure D6 Stages Stages 1-3 Q20 Flood Depth
- Figure D7 Stages Stages 1-3 Q2 Flood Depth
- Figure D8 Stages Stages 1-3 Q1 Flood Depth

3.2.2 Afflux

For the 100 year and 20 year ARI events afflux plots show that the development will not cause any significant adverse impacts downstream and upstream of the subject site. While for the minor events, a slight increase in flood level was obtained, with any increase contained within the creek. Given the minimal impacts obtained overall, it is considered that the results are acceptable.

Following the reporting convention of KBR, flood levels were compared at 11 downstream catchment control points. The approximate locations of these points were provided by KBR and are shown in Image 2 below. The results are summarised in the following tables.

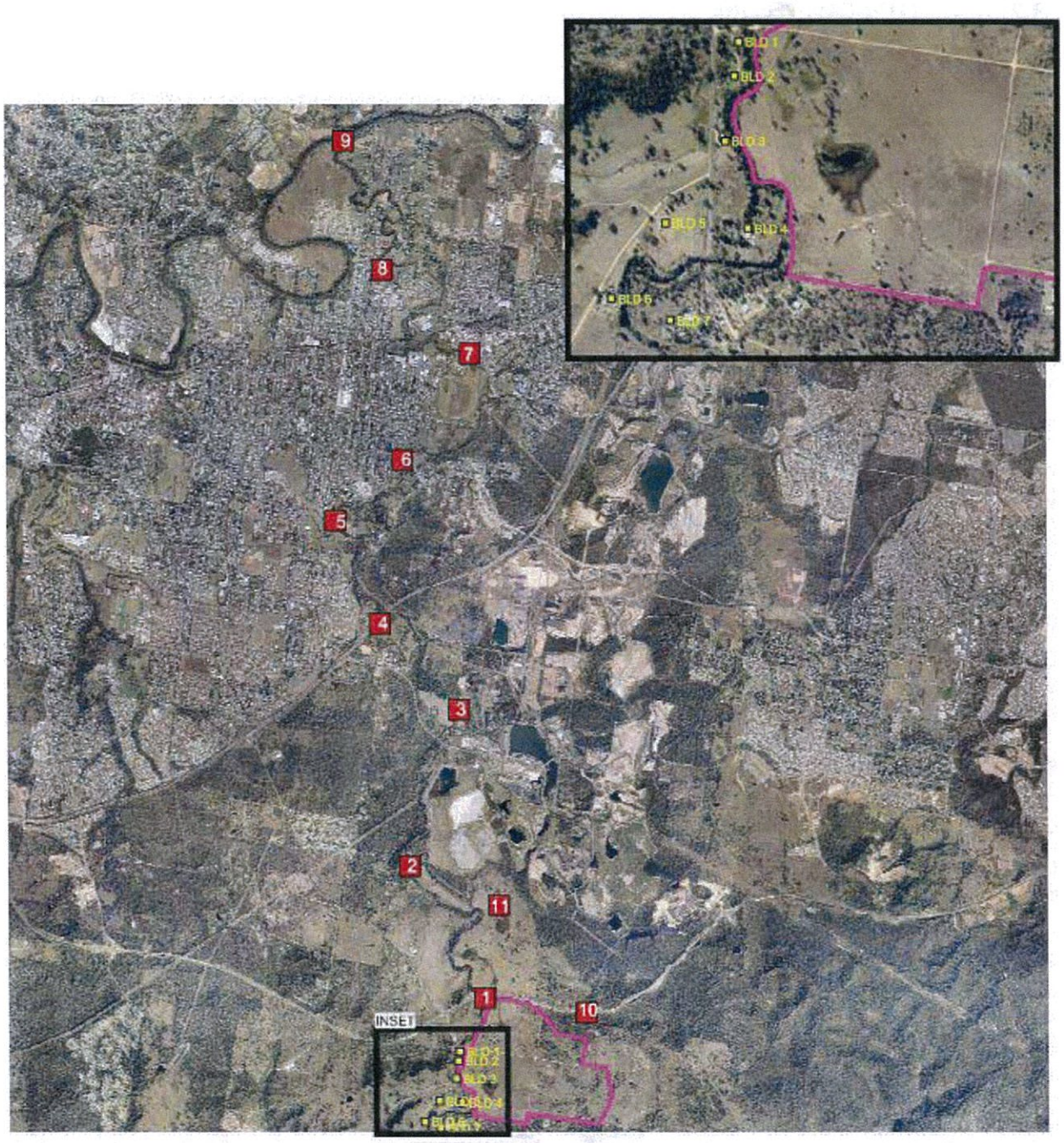


Image 2 Location of Reporting Points and Existing Buildings

As discussed above, it is considered that the results obtained from the analysis indicate that the development will have a minimal impact on flood levels external to the site. It can be noted that a slight increase in level (up to 29 mm) is reported for the 1 year event. It can be noted that the change in depth at the point (point 6) where the increase was determined represents less than 3 percent of the overall depth of flow. This, combined with the negligible change in velocity obtained for the 1 year event indicates that the change in level for the 1 year event is not of consequence.

Table 3-1 100 Year Event Peak Flood Level Comparison

Catchment Control point	Corresponding 1D Node Name	Flood Level (mAHD)		Impact (m)
		Existing	Stages 1-3	
1	BC1.262.2	42.532	42.528	-0.008
2	BC1.305.2	37.373	37.365	-0.008
3	BC1.336.2	30.874	30.869	-0.005
4	BC1.367.2	26.846	26.844	-0.005
5	BC1.418.2	23.568	23.564	-0.004
6	BC1.443.2	21.007	21.004	-0.003
7	BC1.481.2	17.186	17.187	0.001
8	BC1.519.2	10.988	10.990	0.002
9	BC1.561.2	6.163	6.166	0.003
10	N/A	47.395	47.395	0.00
11	N/A	38.868	38.860	-0.008

Table 3-2 20 Year Event Peak Flood Level Comparison

Catchment Control point	Corresponding 1D Node Name	Flood Level (mAHD)		Impact (m)
		Existing	Stages 1-3	
1	BC1.262.2	42.144	42.144	0.000
2	BC1.305.2	36.881	36.878	-0.003
3	BC1.336.2	30.474	30.472	-0.002
4	BC1.367.2	26.332	26.330	-0.002
5	BC1.418.2	23.057	23.055	-0.002
6	BC1.443.2	20.401	20.401	0.000
7	BC1.481.2	16.554	16.554	0.000
8	BC1.519.2	9.972	9.973	0.001
9	BC1.561.2	5.198	5.200	0.002
10	N/A	47.117	47.117	0.000
11	N/A	38.294	38.289	-0.005

Table 3-3 2 Year Event Peak Flood Level Comparison

Catchment Control point	Corresponding 1D Node Name	Flood Level (mAHD)		Impact (m)
		Existing	Stages 1-3	
1	BC1.262.2	40.262	40.302	0.040
2	BC1.305.2	35.682	35.684	0.001
3	BC1.336.2	29.791	29.791	0.000
4	BC1.367.2	25.295	25.299	0.004
5	BC1.418.2	21.953	21.967	0.014
6	BC1.443.2	19.049	19.066	0.016
7	BC1.481.2	14.870	14.889	0.020
8	BC1.519.2	7.969	7.987	0.018
9	BC1.561.2	3.182	3.205	0.023
10	N/A	46.502	46.502	0.000
11	N/A	37.659	37.636	-0.023

Table 3-4 1 Year Event Peak Flood Level Comparison

Catchment Control point	Corresponding 1D Node Name	Flood Level (mAHD)		Impact (m)
		Existing	Stages 1-3	
1	BC1.262.2	39.439	39.488	0.049
2	BC1.305.2	34.845	34.878	0.033
3	BC1.336.2	29.449	29.462	0.014
4	BC1.367.2	24.776	24.791	0.016
5	BC1.418.2	20.956	20.982	0.026
6	BC1.443.2	18.087	18.115	0.028
7	BC1.481.2	13.861	13.885	0.024
8	BC1.519.2	6.953	6.976	0.023
9	BC1.561.2	2.386	2.402	0.016
10	N/A	46.294	46.294	0.000
11	N/A	37.259	37.273	0.014

With reference to the results presented in the above tables, it is considered that the impact of the development is acceptable.

3.2.3 Peak Velocities

The velocity impacts at the 11 downstream catchment control points are summarised in the following tables. The results show that change in velocity due to the proposed development is not considered to be significant. Although relatively small, the largest increase is noted at point 1 which is located at the Centenary Highway Extension bridge.

The increase noted in the table was derived based on a review of flow velocities and flow rates. It is noted that the review indicated that the results at point 1 were not representative of conditions in the creek given the relatively small change in level and peak flow caused by development.

Table 3-5 100 Year Event Peak Flood Velocity Comparison

Catchment Control point	Corresponding 1D Node Name	Peak Velocity (m/s)		Change (positive for increase) (m/s)
		Existing	Stages 1-3	
1	BC1.567	3.64	3.76	-0.12
2	BC1.306	1.61	1.60	-0.01
3	BC1.337	0.88	0.88	0
4	BC1.570	2.80	2.80	0
5	BC1.418	1.30	1.29	-0.01
6	BC1.571	1.67	1.67	0
7	BC1.482	1.95	1.95	0
8	BC1.519	1.11	1.11	0
9	BC1.563	3.87	3.87	0
10	N/A	3.05	3.05	0
11	N/A	1.08	1.06	-0.02

Table 3-6 20 Year Event Peak Flood Velocity Comparison

Catchment Control point	Corresponding 1D Node Name	Peak Velocity (m/s)		Change (positive for increase) (m/s)
		Existing	Stages 1-3	
1	BC1.262.2	3.29	3.23	-0.06
2	BC1.305.2	1.27	1.27	0
3	BC1.336.2	0.75	0.75	0
4	BC1.367.2	2.35	2.35	0
5	BC1.418.2	1.25	1.24	-0.01
6	BC1.443.2	1.58	1.58	0
7	BC1.481.2	1.38	1.38	0
8	BC1.519.2	0.97	0.97	0
9	BC1.561.2	3.31	3.32	0.01
10	N/A	2.90	2.90	0
11	N/A	0.98	0.97	-0.01

Table 3-7 2 Year Event Peak Flood Velocity Comparison

Catchment Control point	Corresponding 1D Node Name	Peak Velocity (m/s)		Change (positive for increase) (m/s)
		Existing	Stages 1-3	
1	BC1.262.2	3.09	3.21	-0.12
2	BC1.305.2	0.80	0.80	0
3	BC1.336.2	0.64	0.64	0
4	BC1.367.2	2.32	2.32	0
5	BC1.418.2	0.97	0.97	0
6	BC1.443.2	1.41	1.41	0
7	BC1.481.2	0.70	0.70	0
8	BC1.519.2	0.73	0.73	0
9	BC1.561.2	1.44	1.45	0.01
10	N/A	1.42	1.42	0
11	N/A	0.65	0.63	-0.02

Table 3-8 1 Year Event Peak Flood Velocity Comparison

Catchment Control point	Corresponding 1D Node Name	Peak Velocity (m/s)		Impact (m/s)
		Existing	Stages 1-3	
1	BC1.262.2	2.98	2.97	-0.01
2	BC1.305.2	0.65	0.66	0.01
3	BC1.336.2	0.55	0.56	0.01
4	BC1.367.2	2.31	2.31	0
5	BC1.418.2	0.87	0.87	0
6	BC1.443.2	1.10	1.14	0.04
7	BC1.481.2	0.70	0.73	0.03
8	BC1.519.2	0.63	0.68	0.05
9	BC1.561.2	0.82	0.83	0.01
10	N/A	0.53	0.53	0
11	N/A	0.21	0.22	0.01

3.2.4 Impact on Timing of Peak Flows

Based on the flow hydrographs calculated at the 9 reporting points, it is considered that the development of Stages 1 to 3 will not have a significant impact on the timing of the peak flows at all locations of interest and therefore no significant impact on current warning times with respect to flooding of downstream areas.

3.2.5 Flood Levels at Nearby Residences

For consistency with previous reports, flood levels have also been calculated at each of the nearby residences to the SUCE area. The location of these residences/buildings is shown on Image 2.

The following table lists the floor/ground level applicable to each location, together with the peak flood levels calculated for the 100 and 20 year recurrence interval events.

With reference to the table, the location of buildings in most cases is such that the building is not affected by flooding (hence the N/A value). In those cases where a building is potentially affected by flooding, the development does not increase flood levels.

Further, agreement has been reached with the owner of BLD1 and BLD2 (immediately upstream of Barrams Road on the western side of Bundamba Creek) in relation to the acceptance of the increase in level noted for BLD1 due to the fact that the developed case flood level is approximately a metre below the floor level of BLD1 and the flood immunity of the building is adequate given the freeboard typically adopted to the 100 year flood level.

It is therefore considered that the development is acceptable with respect to existing residences.

Table 3-9 Flood Level Comparison at Nearby Building Locations

Building	Floor /Ground Level (mAHD)	100 Year Peak Flood Level (mAHD)		20 Year Peak Flood Level (mAHD)	
		Existing	Stages 1-3	Existing	Stages 1-3
BLD1	46.22 (floor)	45.13	45.26	45.02	N/A
BLD2	45.95 (floor)	N/A	N/A	N/A	N/A
BLD3	46.59	46.73	46.73	N/A	N/A
BLD4	47.60	N/A	N/A	N/A	N/A
BLD5	48.21	48.14	48.14	N/A	N/A
BLD6	50.54	N/A	N/A	N/A	N/A
BLD7	55.16	N/A	N/A	N/A	N/A

Note: N/A indicates no flooding at site for event being considered.

4 Conclusion

Detailed modelling has been completed in support of the development of Stages 1 to 3 of the AMEX Secondary Urban Centre East site.

This modelling, which has been completed using the calibrated model of Bundamba Creek provided by Ipswich City Council, has indicated that development can proceed without producing a significant change in flood level external to the site and certainly no change in level sufficient to cause an actionable nuisance.

Further, the development will not produce any significant change in the rate of rise or peak flood level in downstream areas, thereby protecting existing flood immunity and flood warning times.

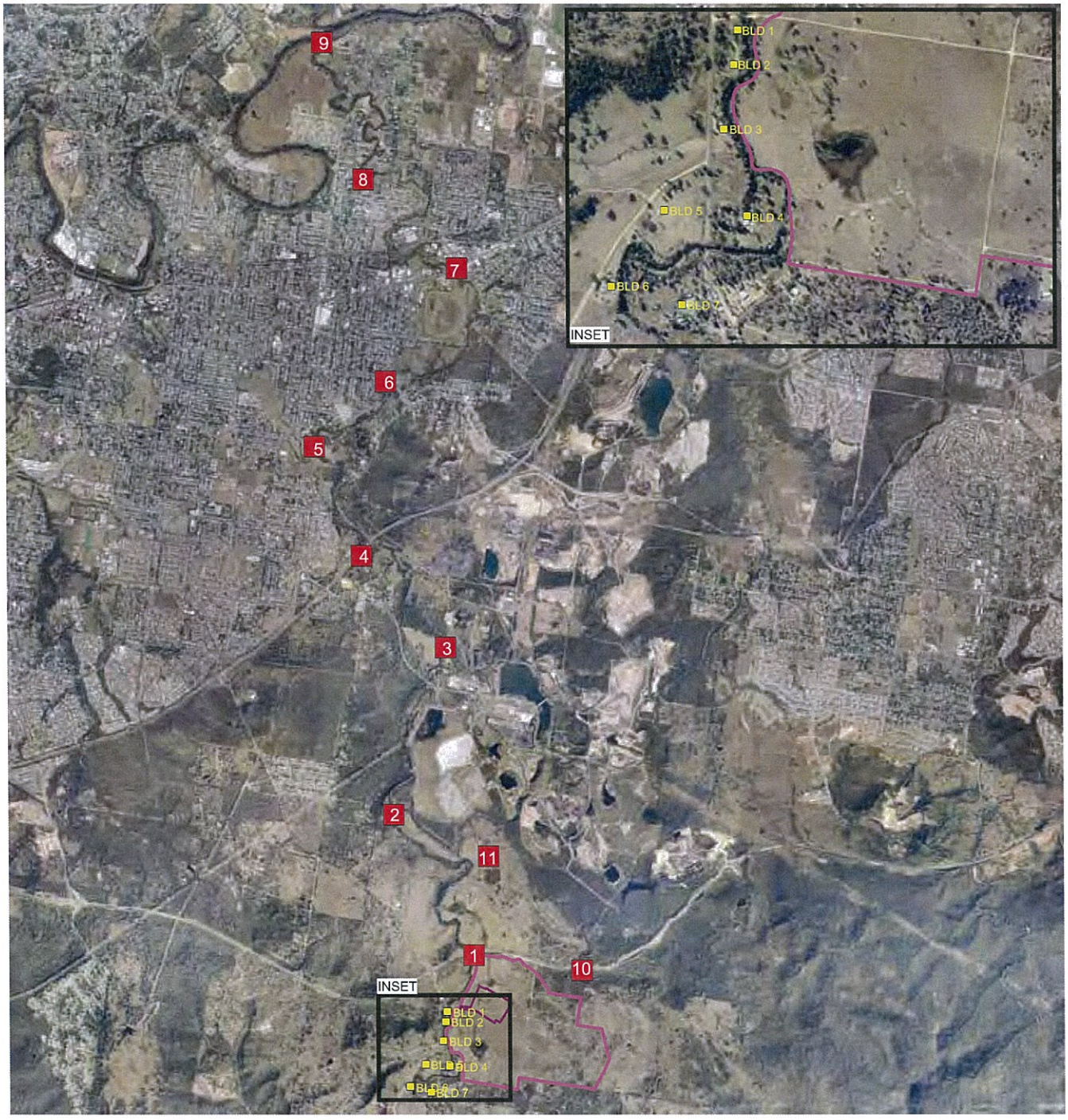
Finally, the development and its associated open space areas achieve the levels of flood immunity required under ULDA guidelines. This includes the Barrams Road crossing of Bundamba Creek, which will be immune to flooding for the 100 year event.

Given this, it is considered that the development can proceed as proposed and will not produce unacceptable impacts with respect to flooding.

Stages 1-3 Addendum Flood Report

FIGURES

Cardno
Shaping the Future



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SHEET	A3
Project No:	7901-47-027
Date:	22 January 2014
Revision Number:	1
Designed by:	NE
Client Name:	Amex Corporation Pty Ltd

LEGEND

N
W E
S

- Existing Building
- Catchment Control Point
- SUCE
- Stages 1 to 3

Figure 1

Location of Site and Catchment Control Points

Ripley Valley Secondary Urban Centre East

Scale: 1:50,000

500 0 500 1000 1500
Metres