

REPORT

FRASERS PROPERTY AUSTRALIA Eastern Creek Quarter Stage 3 Flood Assessment

December 2020


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1 EXECUTIVE SUMMARY

Frasers Property Australia has engaged J. Wyndham Prince to undertake a flood assessment for the proposed Eastern Creek Quarter (ECQ) Stage 3 development, located on Rooty Hill Road South (RHRS). The site consists of approximately 34 hectares of commercial zoned land located within the Blacktown City Council Local Government Area.

This Flood Assessment Report has been prepared for Frasers Property Australia to support a State Significant Development Application (SSDA) submitted to the Department of Planning, Industry and Environment (DPIE) relating to Lot 3 of the Eastern Creek Quarter Site at Rooty Hill Road South, Eastern Creek. The application seeks Concept Plan approval for the staged construction of a new retail outlet centre at Lot 3 with supporting food and beverage tenancies, and ancillary entertainment and recreation usages.

The results of the flood assessment investigations are:

- Under existing conditions, overland flow from the upstream catchment breaches the eastern kerb along RHRS and traverses the ECQ Stage 3 site in all modelled events.
- Under developed conditions, the proposed ECQ Stage 3 development redirects some flow to RHRS and Church Street. Flood Difference mapping indicates that there would be negligible flood level increases within Church Street and RHRS due to this redirection of flow. It is anticipated that the future street drainage design will comfortably manage any flow increases.
- In the design 1% AEP event, flood hazard mapping confirms that the proposed ECQ Stage 3 development would be safe to occupy. There is no over floor flooding and ponding within the carpark will likely be alleviated by the future drainage design. Overland flows in Beggs Road are adequately managed in a 1.5 m wide channel between the Stage 1 and Stage 3 buildings.
- While there is some minor over-floor flooding in the PMF event, the flood hazard mapping for this event demonstrates that the majority of the proposed development is located within a low hazard zone which is generally safe for people, vehicles and buildings. There are some high hazard areas within the internal trunk drainage channels (which is to be expected). It is also noted that some high hazard area also occurs at the ECQ access road intersection with RHRS, on Beggs Road, and within the Stage 1 loading dock in both existing and developed conditions.
- The flood evacuation strategy previously outlined in the Water Cycle Management Strategy (JWP, 2013) to evacuate the site remains valid, however it is recommended that a continuous rising grade out of the PMF flood extent be provided from all areas of the site to RHRS in the southwest near the intersection with the Great Western Highway rather than directly to RHRS, or at very least provide a route that does not direct pedestrians to an area of higher flood hazard.

Yours faithfully

J. WYNDHAM PRINCE



DAVID CROMPTON

Manager – Stormwater & Environment

2 INTRODUCTION

This Flood Assessment Report has been prepared for Frasers Property Australia to support a State Significant Development Application (SSDA) submitted to the Department of Planning, Industry and Environment (DPIE) relating to Lot 3 of the Eastern Creek Quarter Site at Rooty Hill Road South, Eastern Creek. The application seeks Concept Plan approval for the staged construction of a new retail outlet centre at Lot 3 with supporting food and beverage tenancies, and ancillary entertainment and recreation usages.

This report addresses the Department's Environment, Energy and Science Group (DEESG) comments dated 6 May 2020 referred to in Condition 15 of the Planning Secretary's Environmental Assessment Requirements (SEARs). This assessment will also ensure compliance or otherwise with Council's development standards.

A description of the study area and the existing developed conditions catchment characteristics is described in detail below.

2.1 Study Area

2.2 Existing ECQ Site Conditions

The 34ha Eastern Creek Quarter site is situated to the north of the Great Western Highway between Rooty Hill Road South and the M7 Motorway. Church Street marks the site's northern boundary. The site forms part of the Western Sydney Parklands and is located within the Blacktown Local Government Area. It is located approximately 1.5km south east of Rooty Hill Station. This SSDA relates to Lot 3 of the ECQ site, which is the final lot proposed to be developed. It is located in the northern part of the site and has an area of approximately 7.29ha (refer to Plate 2-1 below).

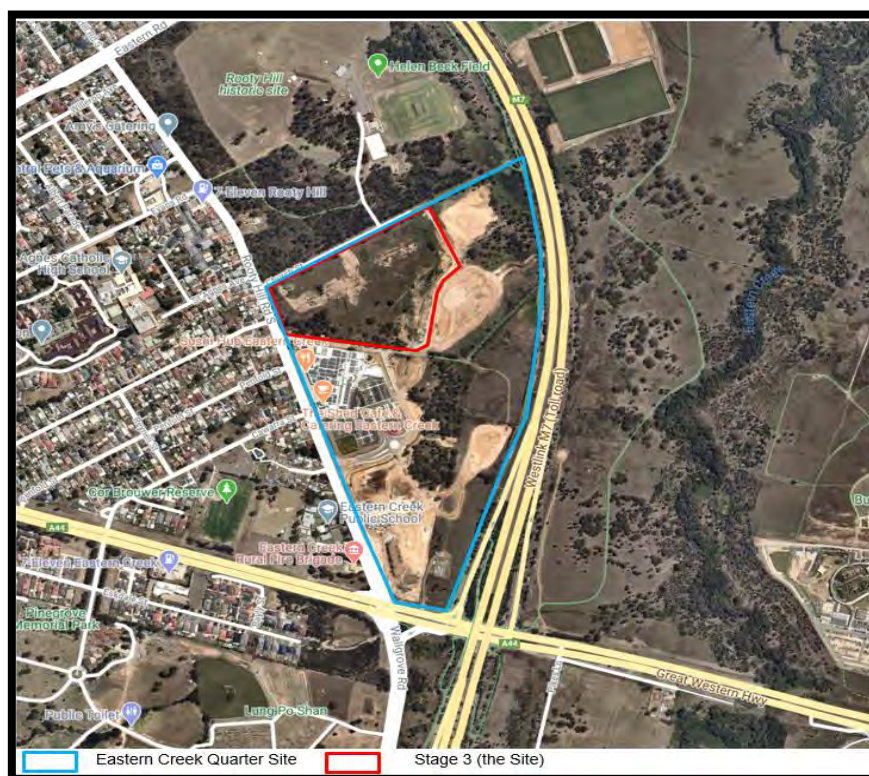


Plate 2-1 – Site Location

The ECQ Stage 3 site is predominantly undeveloped remnant grazing/agricultural land. Review of past aerial imagery indicates that a number of dwellings/structures located off Church Street and Rooty Hill Road South (near the Beggs Road intersection) were demolished in 2016, with only one (1) existing dwelling currently remaining at corner of RHRS and Beggs Road.

2.3 ECQ Stage 3 Development

The proposed State Significant Development Application (SSDA) seeks Concept Plan approval for a new retail outlet centre at Lot 3 of the Eastern Creek Quarter site. The Concept Plan will establish the following framework to guide the future detailed design of the Lot 3 development:

- Land uses, including retail (factory outlet), food and drink premises, amusement centre and indoor recreation facility;
- Building footprints, including basement, with a maximum height of 12m;
- A maximum GFA of 39,500m² at Lot 3 which will be staged as follows:
 - Phase A: 29,500m²
 - Phase B: 10,000m²
- Upgrade of Church Street for vehicular access, including traffic signals at the Church Street/Rooty Hill Road South intersection;
- Modifications to the Cable Place/Rooty Hill Road South/Site Access intersection; and
- Modifications to the Francis Street/Eastern Road/Rooty Hill Road South intersection.

It is also proposed to seek consent for a series of early works including:

- Removal of up to 0.73 ha of Cumberland Plains Woodlands in the south west corner of the site;
- Bulk earthworks within Lot 3; and
- Extension of the internal access road to connect to the basement car park.

The proposed outlet centre at Lot 3 will necessitate the inclusion of conditions of consent which requires the modification of SSD 5175 (the existing Concept Plan for the broader ECQ site) to amend the overall allocation of GFA and associated uses, relevant Concept Plans and the existing Design Guidelines.

This report is based on the Concept Plan prepared by i2C, shown in Plate 2-3 below.



Plate 2-2 – ECQ Stage 3 Concept Plan

3 PREVIOUS RELEVANT STUDIES

3.1 Eastern Creek Business Hub – Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design Techniques

(JWP, March 2013)

The Water Cycle Management Strategy report was prepared to inform and integrate with the State Significant Development Application process for the Eastern Creek Business Hub site. The strategy consists of a treatment train consisting of on lot treatment, street level treatment and subdivision / development treatment measures.

The ECQ Stage 3 portion of the site was then identified as the Northern Catchment Stage 2 development in the Indicative Layout Plan (ILP) for the site.

The hydrology modelling confirmed that post development case peak discharges up to the 1% AEP (100-year ARI) storm event from the site can be managed to existing levels via on-lot detention management in the order of 430 m³/ha of developed area. As we understand it, two (2) detention basins (designed by others) have already been constructed in the eastern portion of the site and will provide the required detention management for the broader site.

An upstream catchment of approximately 35 ha was identified as draining to the site. The majority of this catchment (30.6 ha) was identified as discharging toward the southern portion of the site. A grass lined channel was sized to convey post-climate change flows from the upstream catchment through the site. The remaining upstream catchment (approximately 4.4 ha) would need to be considered in the northern portion of the site.

The report noted that the development would be above the regional Probable Maximum Flood (PMF) level of 38 m AHD at the northern culvert Crossing of the M7 Motorway and that a local PMF assessment had not been undertaken. Given the likely flash flood nature of a local PMF event in an urban catchment, little warning time would be available. The need for continuous rising grade evacuation was noted, and a number of potential evacuation routes were identified.

The report concluded that the Water Cycle Management Strategy for the developed site provides a basis for the detailed design and development of the site to ensure that the environmental, urban amenity, engineering and economic objectives for stormwater management and site discharge are achieved.

3.2 Eastern Creek Business Hub – Local Probable Maximum Flood Assessment

(JWP, June 2014)

The PMF flood assessment was prepared to address comments received from the Office of Environment and Heritage during the Public Exhibition phase of this development.

An investigation of the existing drainage arrangement noted that most of the upstream catchment would discharge to the site via an existing 2 x 750 mm diameter culvert crossing of Rooty Hill Road South (RHRS) near Cable Place, with flows in larger storm events overtopping RHRS at a localised low point and entering the site. An existing channel within the site conveys these flows through the site to a relatively large culvert under the M7 Motorway in the East. The investigation noted that a smaller upstream catchment would discharge through the northern portion of the site near the alignment of Beggs Road, and ultimately discharge under the M7 Motorway via a second relatively large culvert in the east.

The development of the northern portion of the site was anticipated to be approximately 7.9 hectares in size and consist of bulky goods/commercial sites. A TUFLOW model was prepared for the site and the local PMF extents, depths, levels and hazards were mapped for the site. The underlying terrain information utilised photogrammetry and detail survey data, together with a series of terrain modification reflecting the anticipated development within the TUFLOW model.

The results indicated that the majority of the site was located within a low flood hazard zone. There were some high hazard areas within car parking areas, channels and the far eastern extents of the site. High flood hazard in portions of Beggs Road were noted. It was anticipated that the built form of the northern portion of the site might change, however it was assumed that the Beggs Road alignment would convey the bulk of the flows and therefore the final built form of the northern portion of the site was not anticipated to have any material effect on PMF extent and hazard categorisation.

The report concluded that the risk to life throughout the development is low, and that the flood evacuation strategy outlined in the Water Cycle Management Strategy (JWP, 2013) remains valid.

3.3 Eastern Creek Business Hub – Local Probable Maximum Flood Assessment Update

(JWP, August 2018)

To support the bulk earthworks stage of the site, Frasers Property Australia engaged J. Wyndham Prince to update the Local Probable Maximum Flood Assessment (JWP, 2014) to address the condition B3 of the development consent (SSD-5175) for the bulk earthworks on the site. Condition B3 required the following to be addressed in accordance with the NSW Floodplain Manual (2005):

- Rare floods between 1 in 100-year event to the probable maximum flood event;
- Impact of development on flood behaviour, levels, velocities, duration on adjacent and upstream areas;
- Impact of flooding up to the probable maximum flood event on the proposed development; and
- A sensitivity analysis to determine the impact from climate change.

The conclusions of the 2018 investigations were:

- In a PMF storm event, the depth of flooding within the proposed development is generally less than 0.5 metres. The depth in the far eastern extents of the development is up to approximately 2.4 metres as a result of the downstream culvert capacity being exceeded.
- Flood difference mapping indicated that there would be no flood impacts external to the site due to the proposed bulk earthworks development in a PMF event, and therefore it was also concluded that impacts would not occur in a more frequent (but still rare), smaller magnitude flood event such as a 1% AEP.
- The flood hazard mapping undertaken in accordance with Australian Rainfall and Runoff 2016 demonstrated that the majority of the proposed development is located within a low flood hazard H1 zone which is generally safe for people, vehicles and buildings.
- High flood hazard in the Beggs Road alignment and the channel in the southern portion of the site were identified, and it was recommended that occupants of the northern portion of the site evacuate to the north on foot or by vehicle to Rooty Hill Road South.
- The flood evacuation strategy previously outlined in the Water Cycle Management Strategy (JWP, 2013) to evacuate the site remains valid, and recommendations on pedestrian evacuation routes were provided.
- Given that an appropriate flood evacuation strategy is feasible in an extreme local PMF flood event, climate change sensitivity and testing of other rare events between the 1% AEP and PMF event were not considered necessary.

3.4 Eastern Creek Business Hub – Stage 1 Construction Certificate Flood Letter

(JWP, December 2018)

J. Wyndham Prince were engaged by Frasers Property Group Australia to update the TUFLOW flood model for the site to specifically address Condition B26 of Development Consent SSD 8588 (20 July 2018) for the Stage 1 development of the site.

Condition B26 of development consent SSD 8588 which states:

“Prior to the issue of a Construction Certificate, the applicant is to provide a report and plans by a suitably qualified person to the satisfaction of the Certifying Authority demonstrating the floor levels will comply with the relevant requirements in the New South Wales Floodplain Development Manual 2005, and the site gradient levels have been designed to ensure a safe path of egress from the site to Rooty Hill Road South, which is more than 1000mm above the height of the possible flood extents.”

The report concluded that:

- The finished floor levels adjacent to the drainage network and ponded areas will need to be 44.3 m AHD to provide the required freeboard to the internal drainage infrastructure.
- Overland flood protection in both Rooty Hill Road South and Beggs Road with a minimum freeboard of 0.3 m to the adjacent 1% AEP overland flood level would need to be provided to support the internal civil works assumption that overland flows external to the site would not enter the site.
- If alternate evacuation routes were provided to the south of the Stage 1 site, safe evacuation in an extreme PMF flood event could be managed via a route 1000 mm above the adjacent PMF flood levels.

4 DIGITAL TERRAIN MODEL AND CATCHMENT DELINEATION

The Study Area encompasses approximately 117 hectares of residential and commercial land and extends from the Great Western Highway in the south to a ridgeline from Evans Road to the Eastern Road/M7 intersection in the north, and from Beaconsfield in the west to the M7 motorway in the east.

Elevations range from 37 m AHD in the relatively flat area in the east of the ECQ site near existing culverts that discharge under the M7 motorway, to 74 m AHD within St Agnes Catholic School (located off Evans Road) in the north.

A 3D digital terrain model was developed within the TUFLOW hydraulic model for both existing and developed conditions. These surfaces formed the basis of the TUFLOW model and informed the catchment delineation for both scenarios respectively.

4.1 Existing Conditions

The existing conditions surface was prepared using:

- a) ALS (June 2019); and augmented with
- b) Combined triangulated design surface information provided by Henry & Hymas (November 2020) comprised of:
 - i. RHRS Upgrade;
 - ii. Stage 1 design including internal access road;
 - iii. Stage 2 Bulk earthworks.

Some minor surface modifications to reflect Stage 1 finished floor levels and solid walls/loading dock entry areas were made within the TUFLOW model. Resultant contour information was used to delineate sub-catchments generally in the order of three (3) to six (6) hectares in area.

An existing conditions catchment plan is provided in Figure 4-1 in Appendix A.

4.2 Developed Conditions

The developed conditions surface was prepared by updating the existing condition surface to reflect the Stage 3 concept design surface grading.

Some minor surface modifications to reflect finished floor levels and solid walls/loading dock entry areas were made within the TUFLOW model. Resultant contour information being used to delineate conditions sub-catchments within the ECQ site.

It is also assumed that the roof of the Stage 3 development will grade east/west, with a similar ridgeline to the existing Stage 1 development.

A developed conditions catchment plan is provided on Figure 4-2 in Appendix A.

5 HYDROLOGIC MODELLING

The hydrologic analyses for the study area were carried out using the rainfall-runoff flood routing model XP-RAFTS (Runoff and Flow Training Simulation with XP Graphical Interface) (Willing, 1996 & 1994).

To maintain consistency with the previously approved modelling for the site, the Australian Rainfall & Runoff 1987 methods have been adopted.

The key purpose of the hydrologic modelling was to inform local inflow hydrographs for each sub-catchment for use in the TUFLOW model described in Section 6. However, for completeness, we have ensured that lag link times are appropriate to allow assessment of peak flow values at key locations within the site. Modelling considers detention basin data for the ECQ site prepared by Henry & Hymas and an existing detention basin on Assunta Street to the north west of the ECQ site.

5.1 Rainfall Data & XP-Rafts Parameters

5.1.1 Intensity-Frequency-Duration (I.F.D.)

Design rainfall intensity-frequency-duration (I.F.D.) data for the site was extracted from the Australian Bureau of Meteorology for Blacktown and is documented in Table 5-1.

Table 5-1 – IFD Data

Event	Rainfall Intensity (mm/hr)		
	Duration		
	1 hr	12 hr	72 hr
2% AEP	59.24	12.84	4.32
0.5 EY	30.53	6.58	1.97
G=001, F2 = 4.3, F50 = 15.81			

5.2 Calibration

It is normal practice for flood routing models such as XP-RAFTS to be calibrated with historical rainfall and stream flow data for the catchment being investigated in order to produce the most reliable results. The model parameter values (in particular Bx) in XP-RAFTS are adjusted so that the model adequately reproduces observed hydrographs. However, no stream flow records were available for the local catchment.

Without stream gauge data to inform a Bx calibration, there is no basis on which to make any adjustment of the Bx factor. Therefore, the Bx factor was set to the default value of 1.0 for this assessment. Other XP-RAFTS model parameters which can be adjusted are the Manning's' (n) roughness and soil infiltration values, and routing link timing. The soil loss parameters have been set to the ARBM values documented in Blacktown City Council's Engineering Guidelines (BCC, 2020). The adopted Mannings' n roughness values are documented in Table 5-2.

Table 5-2 – Adopted XP-Rafts Parameters

Parameter	Value
Mannings n	
Rural Lands	0.035
Urban Pervious	0.025
Urban Impervious	0.015

The lag time between each sub-catchment was determined based on interrogation of average flow velocities within the TUFLOW model (described in Section 6) and the main flow path length for each sub-catchment.

5.3 Discharge Estimates

The XP-RAFTS model was run for all storm durations from 10 minutes to 72 hours for each Annual Exceedance Probability (AEP) to determine the peak flow at key locations within the ECQ site and to extract critical duration hydrographs for use in the TUFLOW model.

Table 5-3 provides details of developed conditions discharge estimates at the key reporting locations shown on Plate 5-1 below.

Table 5-3 – Developed Flow Estimates at Key Reporting Locations

ID	Location	XP-RAFTS Node	5% AEP	1% AEP	PMF
			Dev	Dev	Dev
1	Head of Channel at RHRS Sag	Dum_01	9.05	11.59	59.77
2	RHRS at Cawarra Street	5.00+RHRS3	6.26	7.79	41.31
3	RHRS at Penfold Street	6.00+RHRS4	1.36	1.63	11.96
4	Beggs Road Cul-de-Sac	Beggs1	0.82	0.99	4.93
5	RHRS at Minchinbury Street	7.00+RHRS5	1.44	1.72	8.47
6	Church Street to site near RHRS/St Agnes Ave.	N1.00+Church1	0.83	1.02	5.35
7	Church Street to site northern boundary	N2.00+Church2	1.21	1.52	8.98
8	M7 Culvert (north ECQ site)	Dum_03	2.71	4.01	36.92
9	M7 Culvert (south ECQ site)	ECQ6	11.13	14.47	77.36
10	M7 Culvert (north of Church Street)	N4.00	5.22	6.94	39.35

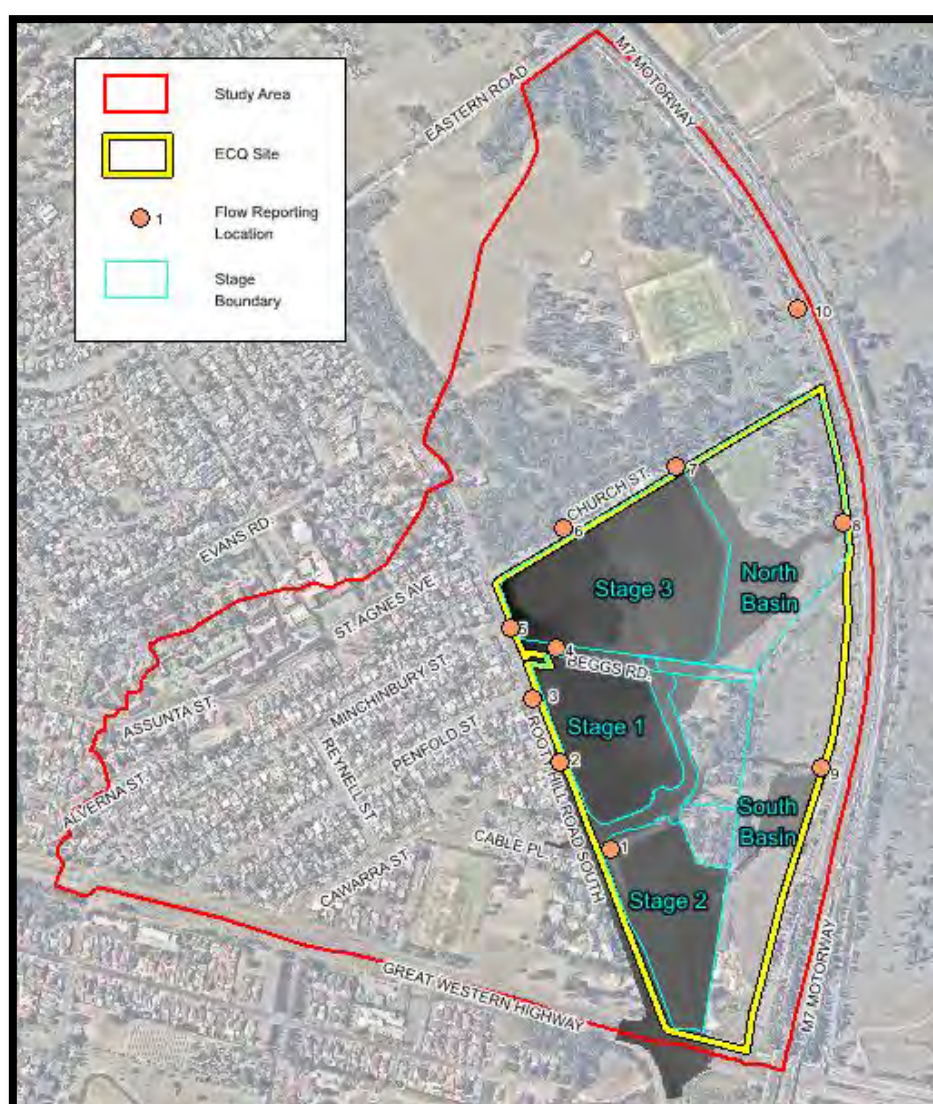


Plate 5-1 – Site Overview and Reporting Locations

6 HYDRAULIC MODELLING

TUFLOW modelling software has been utilised to determine the existing flood level, depths and hazards within the study area.

TUFLOW has the ability to accurately model the complex interaction of pipe drainage networks on the adjoining floodplain. TUFLOW has the ability to dynamically link 1D and 2D flow regimes together with mainstream and local overland flows all in one model, making it an ideal software package for the assessment of flood impacts for the ECQ development.

TUFLOW model build 2020-10-AA was utilised with sub-grid sampling and Heavily Parallelised Compute (HPC) solver functionality to enable faster model run times and utilise the latest software developments.

6.1 TUFLOW Modelling Assumptions

To the west of RHRS, the study area comprises an existing residential development serviced by local roads and a number of parks. The north eastern portion of the study area comprises a park (accessed off Church Street), native vegetation and remnant grazing land.

The Stage 1 retail centre, Rooty Hill Road South upgrade and the Stage 2 bulk earthworks landform have already been constructed and are considered in both the existing and developed conditions ECQ Stage 3 flood modelling. Please refer to Plate 2-2 for locations of the various stages.

The M7 motorway forms a barrier to natural west to east overland flow from the ECQ site. A three (3) cell (2 x 2.4 x 0.75 + 1 x 2.4 x 0.9 m) Reinforced Concrete Box Culvert (RCBC) under the M7 (approximately 220 m south of Church Street) allows flows from the northern portion of the ECQ site to discharge further east to Eastern Creek.

Existing conditions detail survey information provided for the ECQ site indicates that a large 900 mm trunk drainage line enters the ECQ site under RHRS near Cable Place, however the origin of this line is not documented. This trunk drainage line discharges into an existing formalised channel which traverses the ECQ site generally from west to east to an existing 2 x 1.8 x 0.9 m RCBC which passes under the M7 motorway in the east (approximately 600 m south of Church Street).

A site inspection was conducted in 2019 to confirm key elements within the study area and the site which are likely to affect flood behaviour within Rooty Hill Road South and the ECQ site.

As part of this inspection:

- The 900 mm trunk drainage line under RHRS was traced to its apparent origin at an existing detention basin in a Park on Assunta Street near the top of the catchment in northwest of the Study Area.
- Kerb lintel openings to this trunk drainage line were measured on site.
- Relative levels and dimensions of the Assunta Street detention basin were measured on site. (Chapters 4 and 5 provides details on how these structures have been considered in the modelling).
- An additional five (5) cell (3 x 2.4 x 0.9 + 2 x 2.4 x 1.2 m) RCBC passing under the M7 motorway (located approximately 120 m north of Church Street) was identified.

A further site inspection was undertaken on 20 November 2020 to gain an appreciation of the constructed Stage 1 retail centre and supporting infrastructure, together with the landform of the existing Stage 3 site and Church Street formation.

6.1.1 Digital Terrain Model Modification

The digital terrain model information described in Section 4 was adopted as a base elevation model for use within the TUFLOW model.

A 1.5 m grid size was adopted for this assessment as this provides better definition of flood behaviour within the road reserves and around adjacent residential allotments when compared with the previous coarser 4 m grid adopted in the 2014 PMF assessment (JWP, June 2014). Sub-grid sampling at 0.5 m was adopted to ensure key features of the design surface (also provided at 0.5 m grid) were accurately reflected.

Some modification within the TUFLOW model was made to ensure that critical areas that are likely to affect flood behaviour are more accurately reflected in the model. These include:

- Existing buildings and fences within the upstream floodplain;
- Stage 1 and Stage 3 building levels at 44.3 m AHD and external walls; and
- Stage 3 basement at 41.0 m AHD.

It should be noted that the flood model focuses on flood behaviour at ground level, and therefore the Stage 3 basement and channel below the Stage 3 shop/plaza are reflected in the flood model.

6.1.2 Catchment Roughness

A review of the available aerial photography together with the proposed development layout for the ECQ Stage 3 site was used to determine the various roughness for different land uses external to the ECQ site. Details of the adopted Mannings “n” roughness are provided in Table 6-1.

Table 6-1 – TUFLOW Material Roughness

Mannings n	Value
Roads, concrete surfaces	0.015
Dams with no vegetation	0.02
Gravel Road	0.025
Dams with vegetation or short grass	0.03
Default (grass)	0.035
Light Vegetation/Landscape	0.05
Drainage channel	0.07
Medium vegetation	0.08
Alfresco/equipment	0.1
Buildings or houses in floodplain	0.3

Figures 6-2 and 6-4 in Appendix A provides details of the areas where these Manning’s roughness values have been applied.

6.1.3 Boundary Conditions

Inflow hydrographs were extracted from the XP-RAFTS hydrology model for the peak storm durations for existing and developed conditions and applied as Source Area (SA) catchments within the TUFLOW model.

Roof catchments are applied external to the building footprint. As such, any flooding shown within the Stage 3 building is due to water ingress through anticipated doorways and carpark entry ramps, not from roof water from above.

For the 5% and 1% AEP modelled events, a free discharge tailwater condition was assumed at the M7 culverts.

For the PMF event, peak fixed tailwater conditions for the existing culverts under the M7 motorway were extracted from the Eastern Creek 1% AEP (100 year ARI) flood surface prepared as part of the *Bungaribee Estate Precinct 2 & Bunya community Resource Hub Stormwater Management Strategy report Incorporating Water Sensitive Urban Design Techniques* prepared by JWP for Landcom in January 2011. Adopted tailwater conditions are provided in Table 6-2 below. Locations are shown on Figures 6-1 and 6-3 in Appendix A.

Table 6-2 – Adopted 1% AEP Tailwater Level for PMF Event

ID	Location	Tailwater (m AHD)
A	M7 Culvert (north of Church Street)	35.80
B	M7 Culvert (north ECQ site)	37.74
C	M7 Culvert (south ECQ site)	38.57

Given that the development is situated approximately 3 m above the Eastern Creek 1%AEP tailwater, there is unlikely to be any material effect of this tailwater on the development.

A HQ boundary (height/flow) for a small portion of the Great Western Highway discharging to the east is automatically calculated within TUFLOW using an adopted 1% terrain slope.

6.2 ECQ Hydraulic Structures

6.2.1 Existing Conditions (Base Case)

Engineering plans together with 12d drainage models provided by Henry & Hymas for Stage 1 and the RHRS upgrade were interrogated and relevant pit and pipe infrastructure details were extracted and represented within the 1d_nwk layers of the data TUFLOW model. Where available, works as executed information was reviewed and invert levels were updated accordingly.

The street drainage network and major culvert crossings reflected in the TUFLOW model are shown on Figure 6-1 in Appendix A.

6.2.2 Developed Conditions

For the developed case modelling the existing drainage network was augmented to include a 1.5 m wide concrete channel between the Stage 1 and Stage 3 buildings. A 1.5 m wide x 0.6 m high RCBC which maintains conveyance of the trunk drainage channel under the ECQ Stage 3 basement entry/internal access road was also included in the model. The channel was reflected within the 1d model domain as a 1.5 m wide channel with upstream invert 42.65 and downstream invert 40.6 m AHD (approx. 52 m long) adopted based on interrogation of the design surface provided by Henry & Hymas

It should be noted that the street drainage system for Church Street and the ECQ Stage 3 carpark has not been designed at this stage, and therefore is not reflected in the modelling. Given the street drainage system will be designed for the 5% AEP, a significant portion of flow will be piped to the detention basin within the ECQ site, and therefore any apparent flood impacts within Church Street are likely to be alleviated when this drainage system is connected to the existing detention basins within the site.

6.3 Flood Mapping

Flood extent, depth and level mapping has been prepared for the existing and developed case scenarios. The mapping incorporates the peak flood result of all modelled storm durations.

Flood level difference mapping has been prepared comparing the developed condition with existing condition to identify areas external to the ECQ site where flood level impacts may occur, and to inform mitigation options to reduce or eliminate these impacts.

Flood hazard mapping has also been prepared for the modelled events completed as part of this study. Hazard grids are developed directly out of the TUFLOW model and have been used to produce the hazard maps presented in this report. The hazard zones consistent with the Australian Rainfall and Runoff Revision 2016 (ARR, 2016) are shown in Plate 6-1 below.

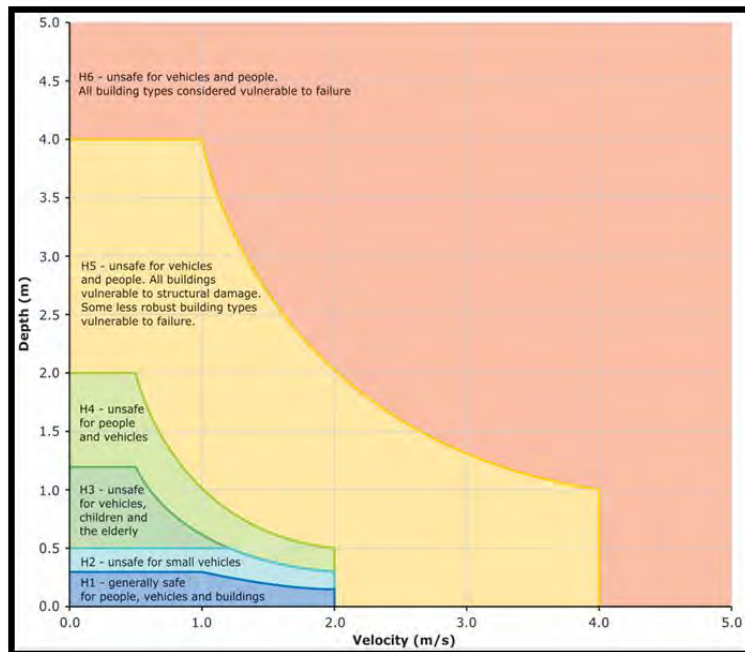


Plate 6-1 – ARR 2016 Hazard Categories

Hazard maps are useful to obtain an appreciation of the relative depth and velocity of floodwater within a locality and are a critical element in determining:

- The locations of critical public infrastructure such as hospitals and aged care facilities.
- The areas in the floodplain for which public safety is “at risk”.
- Assist in the Flood Emergency response and Evacuation Management Process.

It is noted that the nature of the local PMF that may result in the need to evacuate the proposed development will be short in duration (typically less than a 1 hour event), which does not allow for a flood evacuation and emergency response strategy to be implemented.

The hazard mapping for the modelled events, consistent with Australian Rainfall and Runoff 2016 is provided in Appendix A

6.4 Discussion of Flood Modelling Results

6.4.1 Flood Extent, Depth, Level and Difference Mapping

Existing conditions flood depth and level mapping shown on figures 6-5, 6-8 and 6-13 indicate that flow from the upstream catchment predominantly follows an overland flow path from the existing detention basin on Assunta Street through properties in a generally south easterly direction to Marlene Sewell Park and Cor Brouwer Reserve on Cawarra Street.

On RHRS itself, overland flow is generally conveyed between St Agnes Avenue in the north to a sag near Cable Place. Figure 6-5 indicates that even in the 5% AEP drainage design event, existing conditions overland flow breaches the eastern kerb of RHRS and continues through the ECQ Stage 3 site.

In developed conditions, the flood depth mapping presented on Figures 6-6, 6-9 and 6-14 indicates that the proposed ECQ development will redirect flow south along RHRS where it follows the kerb return into Beggs Road and east along the proposed reconstruction of Church Street.

The flood level difference mapping provided on Figure 6-7 in Appendix A indicates that there are flood level increases generally in the order of 20 to 80 mm along the Church Street frontage in the 5% AEP drainage design event. It should be noted that the future Church Street drainage is not reflected in the current modelling, and therefore it is likely that these 'impacts' would be mitigated once local drainage is considered. Some minor flood level increases (20 mm) within RHRS are due to a landscaped berm along the frontage of the ECQ Stage 3 site re-directing flow to the south along RHRS. These increases are inconsequential and appear isolated to the gutter flow within RHRS. Figure 6-10 indicates similar flood level increases in the 1% AEP event.

Flooding within the ECQ Stage 3 site

Within the ECQ Stage 3 site, flood level changes are expected due to the formation of the development surface and inclusion of the future buildings. The key flood information pertinent within the ECQ Stage 3 site is the developed conditions 1% AEP flood level to inform appropriate finished floor levels of buildings and flood hazard mapping to inform appropriate flood evacuation of the site up to and including the PMF event.

Blacktown Council' *Engineering Guide for Development* (2020) requires 0.3 m freeboard to be provided from overland flow to adjacent industrial/commercial development. Figure 6-10 provides details of the 1% AEP developed conditions flood level. Appropriate freeboard will need to be added to these flood levels as part of the final building design to ensure compliant finished floor levels, particularly at the building entry locations.

Flow reporting

A series of flow reporting locations within the TUFLOW hydraulic model have been interrogated to provide an appreciation of flows adjacent to the Stage 3 development. It is noted that there are some differences between the flows reported here and the hydrologic model flow estimates documented in Table 5-3. This is due to differences between the software packages and how flows are routed through the models. Generally speaking, TUFLOW provides a more realistic reflection of cross-connections between catchments and how flows are routed through the model. Therefore, the TUFLOW model flows in Table 6-3 will provide improved guidance to inform the future drainage design of the ECQ Stage 3 site. Reporting locations are close to the locations identified in Plate 2-2.

Table 6-3 – Flow Reporting Adjacent to Stage 3

ID	Location	1% AEP	PMF
4	Beggs Road Cul-de-Sac	0.98	6.33
5	RHRS at Minchinbury Street	1.40	7.04
6	Church Street mid. North Stage 3	0.93	5.81
7	Church Street to site northern east corner of Stage 3	1.59	9.84
n/a	Channel between Stage 1 & 3 Buildings	1.44	5.63

6.4.2 Flood Hazard Mapping

The flood hazard mapping undertaken is consistent with the Australian Rainfall and Runoff 2016 methodology and provides more refined and detailed hazard categorisation for this development.

Figure 6-11 indicates that the existing ECQ Stage 3 site is generally low H1 hazard in the 1% AEP event. In the existing conditions PMF event, Figure 6-15 indicates some High H5 hazard areas within RHRS, Beggs Road, Church Street, the Stage 1 loading dock, and the detention basins/channels which is expected.

In developed conditions, the 1% AEP flood hazard mapping on Figure 6-12 indicates that flood hazard within the site is generally low H1 hazard. Some high H5 hazard areas are evident where flows from the carpark at the Church Street frontage enter the basement ramp. However, the basement itself is generally low hazard.

In the PMF event, developed conditions flood hazard mapping shown on Figure 6-16 indicates that the majority of the proposed ECQ Stage 3 development is located within a low hazard H1 and H2 zones which is generally safe for people, larger vehicles and buildings. However, the high hazard H5 zones in RHRS, Church Street, Beggs Road and the ECQ Stage 3 northern carpark/basement ramp will need to be considered as part of the evacuation strategy for the site.

7 FLOOD EMERGENCY RESPONSE RECOMMENDATIONS

The flood assessment indicates that there are negligible flood impacts external to the ECQ Stage 3 site up to the 1% AEP event.

The time series results from the PMF assessment confirm that occupants will have limited warning time to evacuate, with the peak flood level in Rooty Hill Road South occurring approximately ten (10) minutes after the start of a PMF storm event. Developed conditions PMF flood hazard mapping presented Figure 6-20 in Appendix A indicates sufficient areas of low H1 hazard within the ECQ Stage 3 development and elsewhere within the broader ECQ site where pedestrians could take refuge. Given the high hazard surrounding the site, it is our opinion that it would be safer for pedestrians to take refuge within the site.

Notwithstanding, the results of the local PMF assessment do not alter the previously proposed flood evacuation strategy documented in the Water Cycle Management Strategy (JWP, 2013) which is to provide a continuous rising grade from the development to allow people to escape rising floodwater. However, now that this more refined flood assessment indicates that it is unsafe to evacuate directly to Rooty Hill Road South between Beggs Road and Cable Place, and given the limited warning time is insufficient to allow vehicular evacuation, we make the following recommendations based on the developed conditions PMF hazard mapping shown on Figure 6-17:

- Occupants of the Stage 3 Church Street carpark and building evacuate south on foot through the Plaza and into the Stage 1 development;
- Occupants of the ECQ Stage 3 basement carpark evacuate south along the internal access road;
- Occupants of Stage 1 and (together with the traversing Stage 3 occupants) are directed to evacuate on foot south along the internal access road and over the internal bridge and through Stage 2 toward the Rooty Hill Road South/Great western Highway intersection;
- The development be designed to provide the above-mentioned pedestrian evacuation routes unimpeded (i.e. no locked gates etc.) with a continuous rising grade out of the PMF floodwater, or at very least provide a route that does not direct pedestrians into areas of higher hazard;
- The site manager should prepare to implement a site-specific flood evacuation strategy when either a severe storm warning or a flood warning for the Eastern Creek catchment is published by Australian Bureau of Meteorology or as directed by local emergency services personnel;
- Appropriate floodway signage should be provided on channels and culverts;
- Appropriate flood evacuation signage should be provided within the development at strategic locations across the site;
- The culvert/bridge crossing over the trunk drainage channel between Stage 1 and Stage 2 should:
 - be designed to withstand flood forces up to the PMF event;
 - form part of a continuous rising grade for pedestrian evacuation if possible.

8 REFERENCES

BMT WBM Pty Ltd (2018). TUFLOW User Manual

BMT WBM Pty Ltd (2020). TUFLOW Build 2020-10-AA release notes

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) Australian Rainfall and Runoff: A Guide to Flood Estimation, © Commonwealth of Australia (Geoscience Australia), 2019.

Blacktown City Council (2020), Engineering Guide for Development 2005, as amended July 2020.

Commonwealth of Australia (Geoscience Australia) 2019. Australian Rainfall and Runoff – A Guide to Flood Estimation.

J. Wyndham Prince (2013). Eastern Creek Business Hub – Water Cycle Management Strategy Report Incorporating Water Sensitive Urban Design Techniques [JWP ref. 8801 Rpt1F]

J. Wyndham Prince (2014). Eastern Creek Business Hub – Local Probable Maximum Flood Assessment [JWP ref. 8801 Rpt2A]

J. Wyndham Prince (2018). Eastern Creek Business Hub – Local Probable Maximum Flood Assessment Update [JWP ref. 110512-02 Rpt1B]

J. Wyndham Prince (2018). Eastern Creek Business Hub – Stage 1 Construction Certificate Flood Letter [JWP ref. 110512-02-Stage 1 Flood Letter]

NSW Government (2005). NSW Floodplain Development Manual

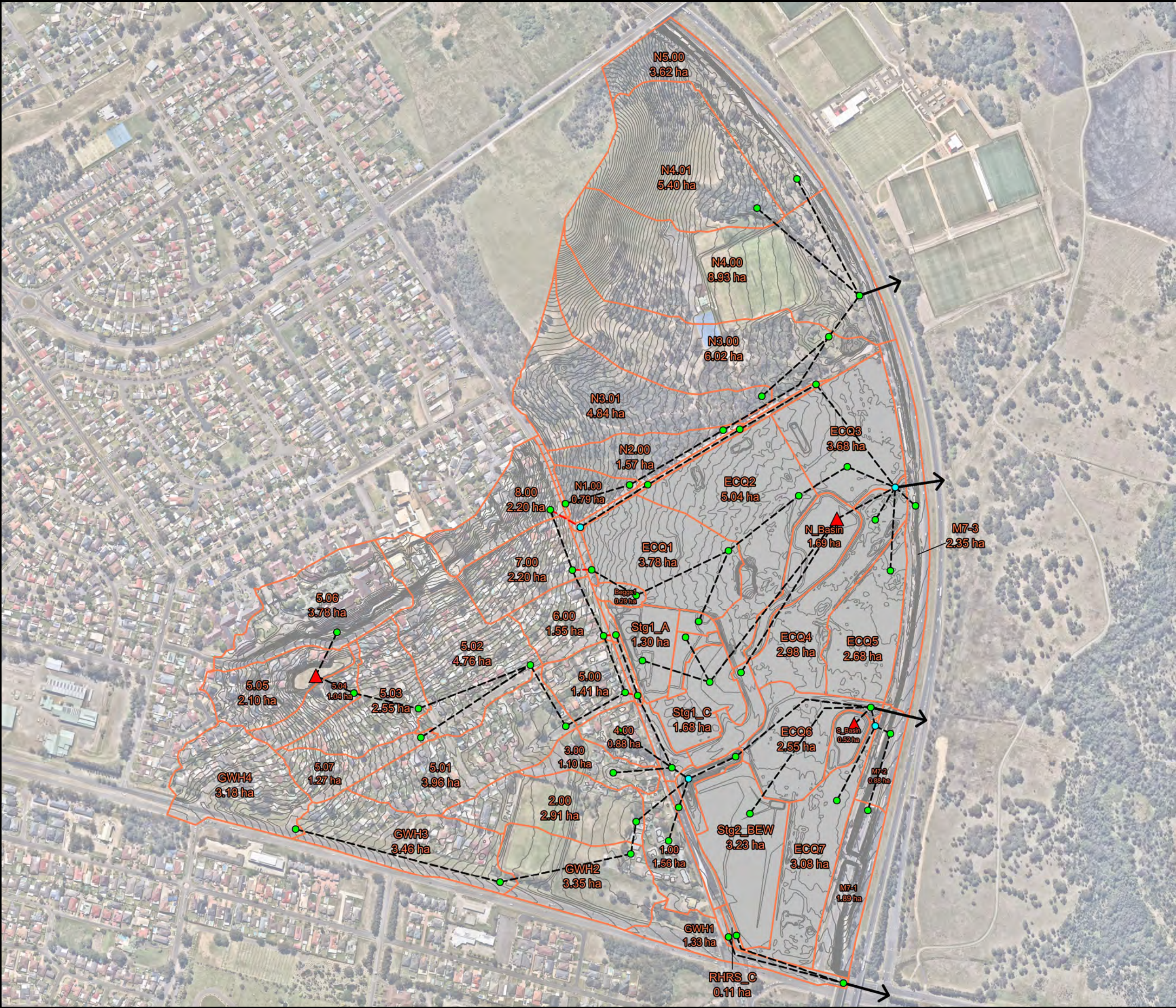
Willing & Partners Pty Ltd (1994). Runoff Analysis & Flow Training Simulation – Detailed Documentation and User Manual, Version 4.0

Willing & Partners Pty Ltd (1996). Runoff Analysis & Flow Training Simulation – Addendum Version 5.0

APPENDIX A

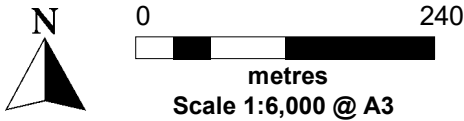
FIGURES

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LEGEND

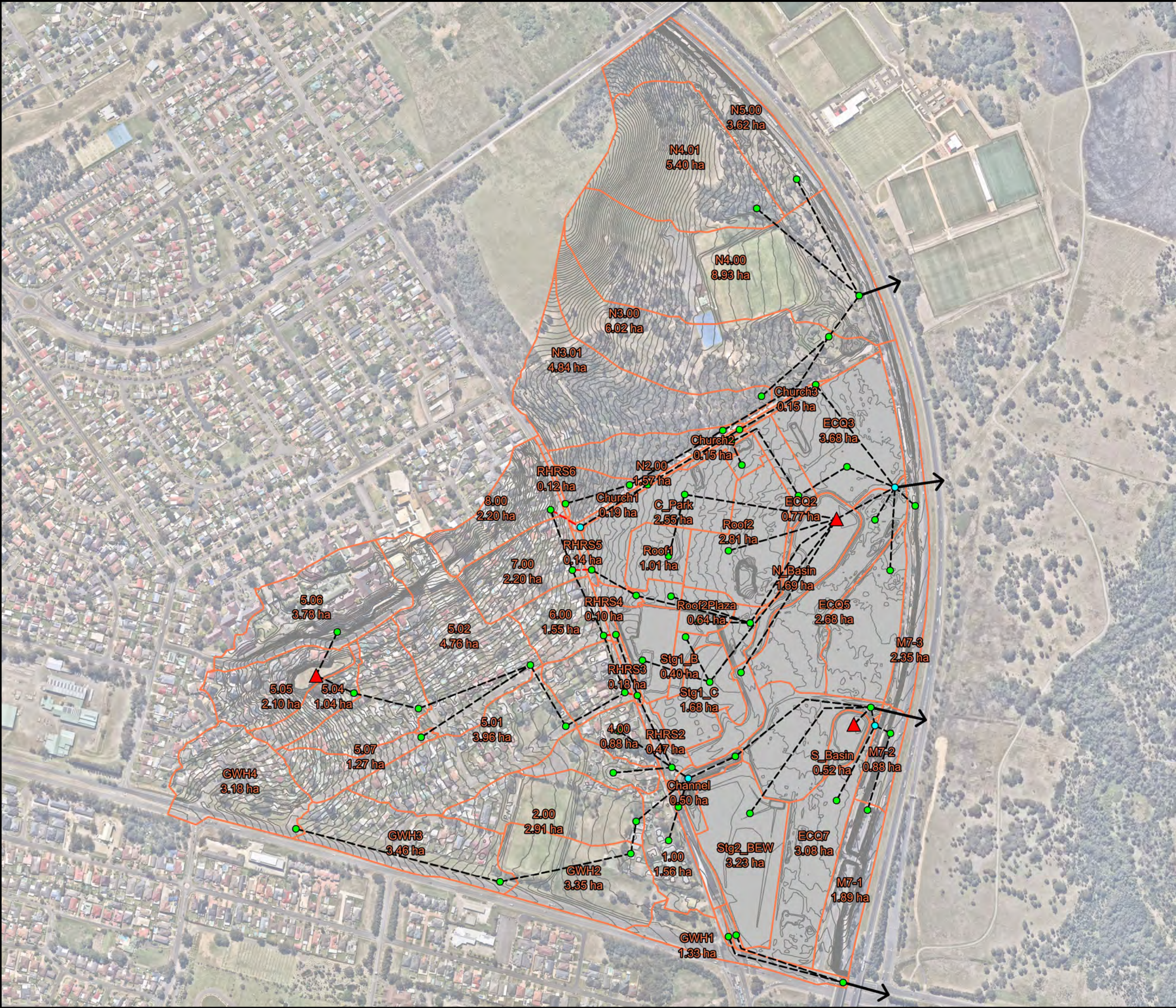
- Sub-Catchment Boundary
- ECQ Site
- Detention Basin
- Catchment Node
- Dummy Node
- Link
- Diversion Link
- Model Outlet
- 0.5 m Surface Contours



Projection: GDA 1994 MGA Zone 56

Figure 4-1
Eastern Creek Quarter
Stage 3 Flood Report
Existing Conditions Catchment Plan

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LEGEND

- Sub-Catchment Boundary
- ECQ Site
- Detention Basin
- Catchment Node
- Dummy Node
- Link
- Diversion Link
- Model Outlet
- 0.5 m Surface Contours

N

0240

metres

Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 4-2
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions Catchment Plan

Date: 14/12/2020

Issue: A

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LEGEND

TUFLOW MODEL ELEMENTS

TUFLOW Model Boundary

SA Catchment Inflow Boundary

IWL Initial Water Level Area

2d ZSH - Buildings in Floodplain

2d V-ZSH - Fences in Floodplain

2d LFCSH - Layered Flow Constriction

2D ZSH (Line)

2d Connection Line (CN)

1d NWK Culvert

2D SX Connection (Line)

2D SX Connection (Point)

1d NWK Pit

1d BC Boundary Condition

N

0240

metres

Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-1

Eastern Creek Quarter

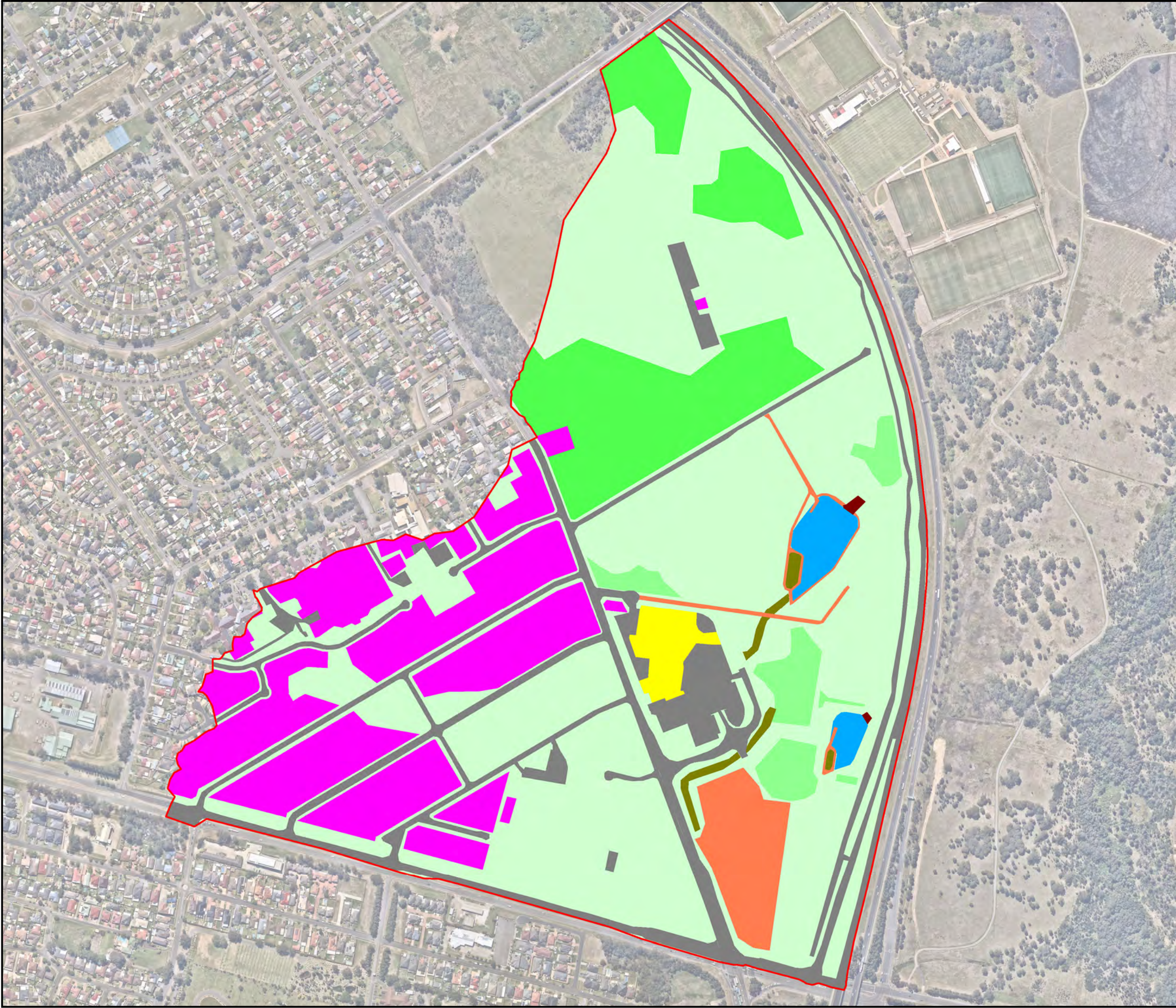
Stage 3 Flood Report

Existing Conditions TUFLOW Setup

Date: 14/12/2020

Issue: A

Filename: J:\110512 - Eastern Creek Business Hub\04 - Stage 3 Flood Assessment\SW&EDrawings\Figures\110512-04_Fig6-2_EX01_All_MAN_A.wor



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LEGEND
Mannings (n) Roughness

	0.035 Floodplain (default)
	0.05 Light Vegetation
	0.08 Medium Vegetation
	0.30 Residential Areas
	0.30 Significant Buildings
	0.015 Concrete Surfaces, Roads
	0.06 Rock Armouring
	0.07 Drainage Channel
	0.04 Detention Basin
	0.025 Gravel Road/Bare Earth
	TUFLOW Model Boundary

N

0240

metres

Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-2
Eastern Creek Quarter
Stage 3 Flood Report

Existing Conditions Mannings
Roughness














Date: 14/12/2020

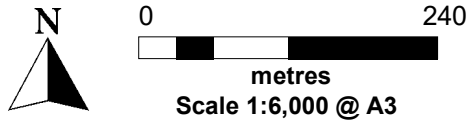
Issue: A



LEGEND

TUFLOW MODEL ELEMENTS

-  TUFLOW Model Boundary
-  SA Catchment Inflow Boundary
-  IWL Initial Water Level Area
-  2d ZSH - Buildings in Floodplain
-  2d V-ZSH - Fences in Floodplain
-  2d LFCSH - Layered Flow Constriction
-  2D ZSH (Line)
-  2d Connection Line (CN)
-  1d NWK Culvert
-  2D SX Connection (Line)
-  2D SX Connection (Point)
-  1d NWK Pit
-  1d BC Boundary Condition

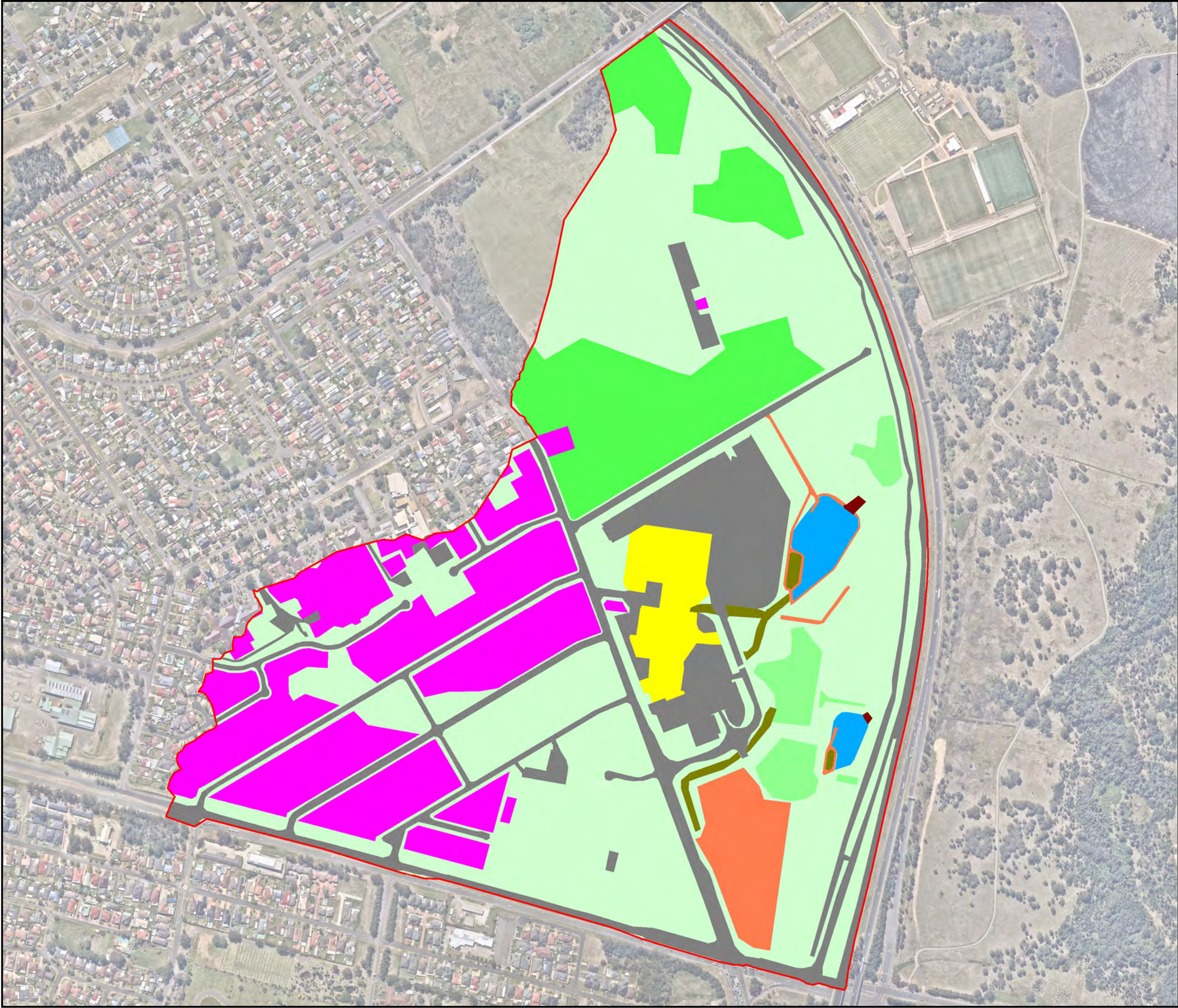


Projection: GDA 1994 MGA Zone 56

Figure 6-3
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions TUFLOW
Setup

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LEGEND
Mannings (n) Roughness

	0.035 Floodplain (default)
	0.05 Light Vegetation
	0.08 Medium Vegetation
	0.30 Residential Areas
	0.30 Significant Buildings
	0.015 Concrete Surfaces, Roads
	0.06 Rock Armouring
	0.07 Drainage Channel
	0.04 Detention Basin
	0.025 Gravel Road/Bare Earth
	TUFLOW Model Boundary

N

0240

metres

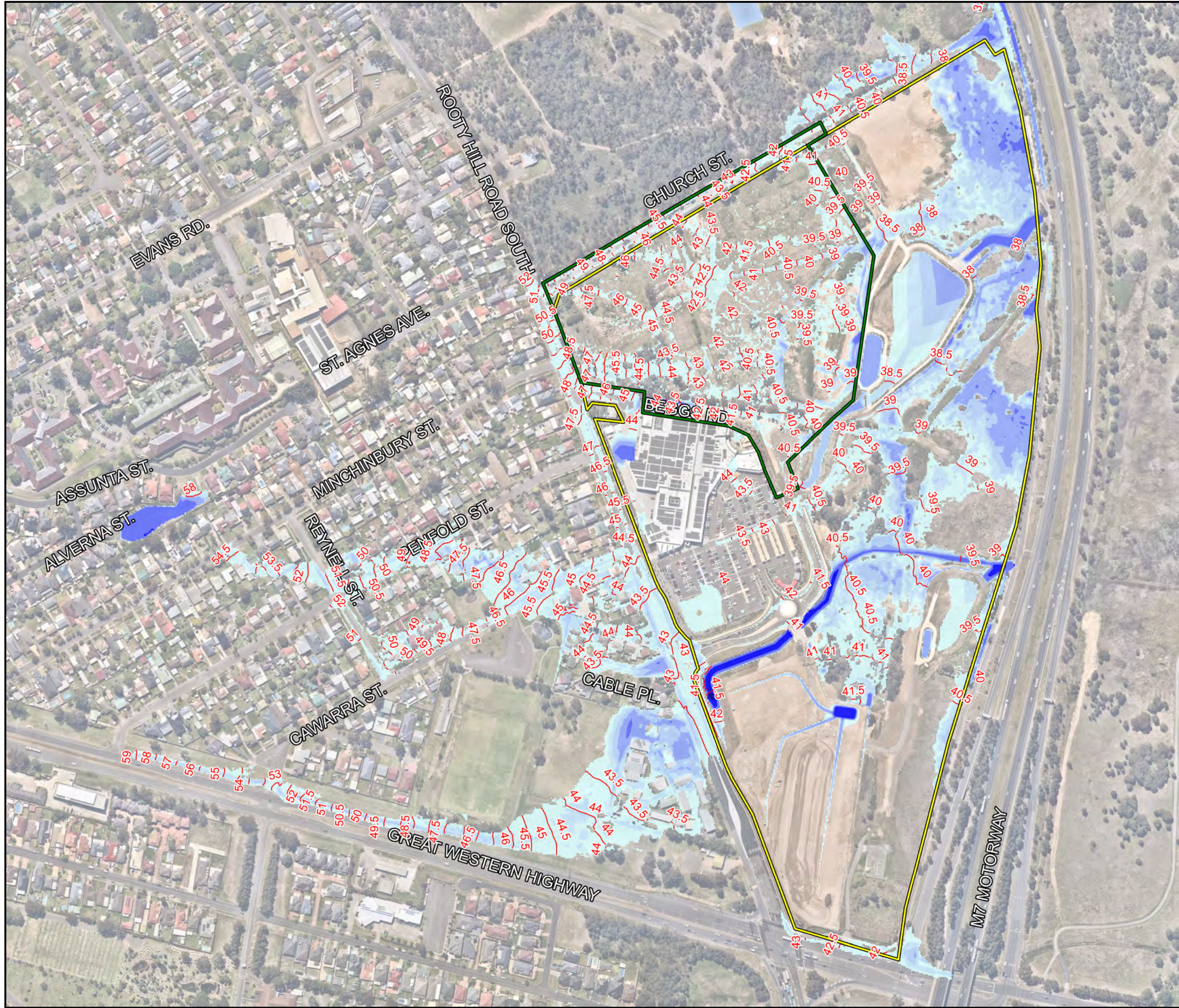
Scale 1:6,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-4
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions Mannings
Roughness

Date: 14/12/2020Issue: A



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LEGEND

FLOOD DEPTH (m)

0.0 to 0.1	0.1 to 0.2	0.2 to 0.3	0.3 to 0.5	0.5 to 1.0	1.0 to 2.0	2.0 +
------------	------------	------------	------------	------------	------------	-------

35.0 0.5 m Flood Contours (m AHD)

Study Area

Stage 3 Works Boundary

N

0 160

metres

Scale 1:4,000 @ A3

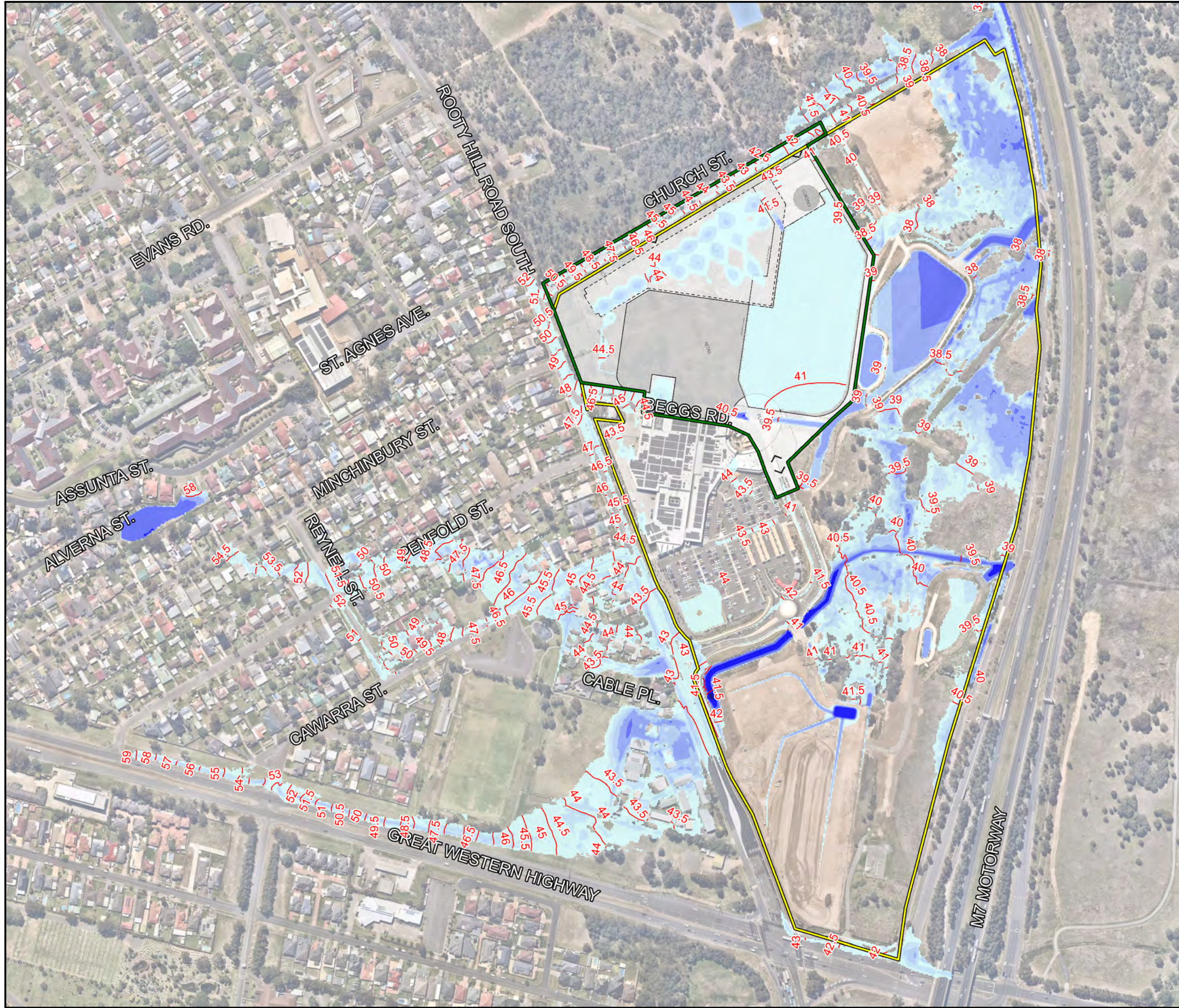
Projection: GDA 1994 MGA Zone 56

Figure 6-5
Eastern Creek Quarter
Stage 3 Flood Report

Existing Conditions
5% AEP Flood Extent
Depths and Levels

Date: 14/12/2020 Issue: A

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LEGEND
FLOOD DEPTH (m)

0.0 to 0.1	0.1 to 0.2	0.2 to 0.3	0.3 to 0.5	0.5 to 1.0	1.0 to 2.0	2.0 +
------------	------------	------------	------------	------------	------------	-------

35.0 0.5 m Flood Contours (m AHD)

Study Area

Stage 3 Works Boundary

N

0 160

metres

Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-6
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions
5% AEP Flood Extent
Depths and Levels

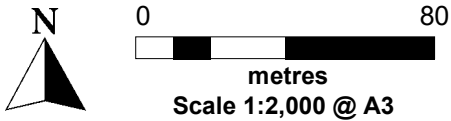
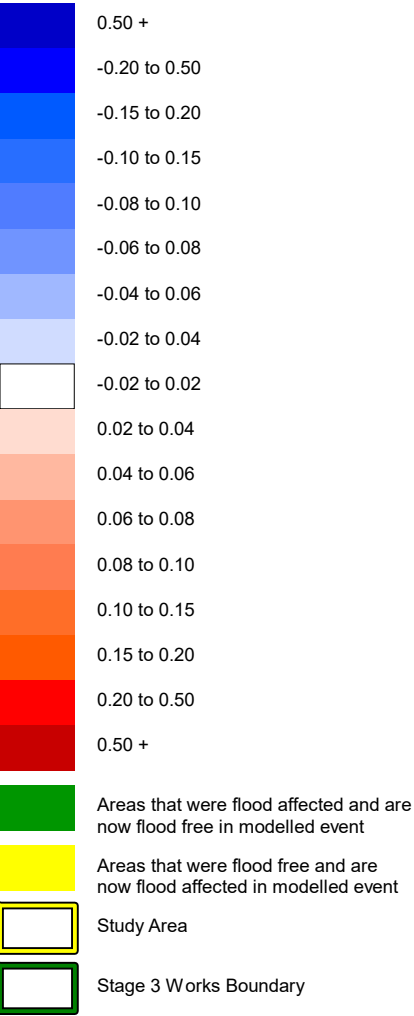
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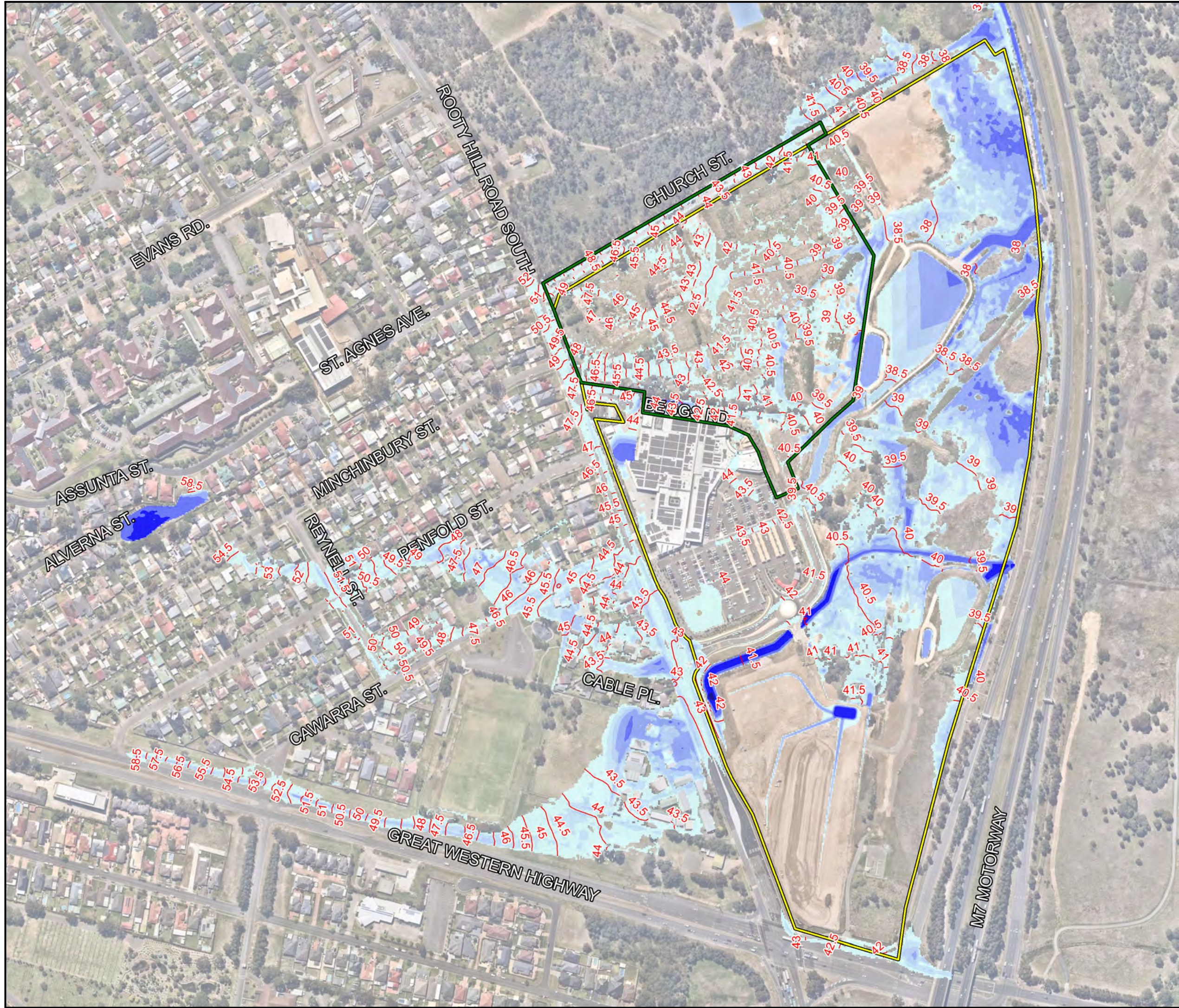
LEGEND
FLOOD DIFFERENCE (m)



Projection: GDA 1994 MGA Zone 56

Figure 6-7
Eastern Creek Quarter
Stage 3 Flood Report

5% AEP
Developed - Existing
Flood Difference Map



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LEGEND

FLOOD DEPTH (m)

	0.0 to 0.1
	0.1 to 0.2
	0.2 to 0.3
	0.3 to 0.5
	0.5 to 1.0
	1.0 to 2.0
	2.0 +

35.0 0.5 m Flood Contours (m AHD)

Study Area

Stage 3 Works Boundary

N

0 160
metres
Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-8
Eastern Creek Quarter
Stage 3 Flood Report

Existing Conditions
1% AEP Flood Extent
Depths and Levels

Date: 14/12/2020 Issue: A

LEGEND

FLOOD DEPTH (m)

	0.0 to 0.1
	0.1 to 0.2
	0.2 to 0.3
	0.3 to 0.5
	0.5 to 1.0
	1.0 to 2.0
	2.0 +

35.0 0.5 m Flood Contours (m AHD)

Study Area

Stage 3 Works Boundary

0 160

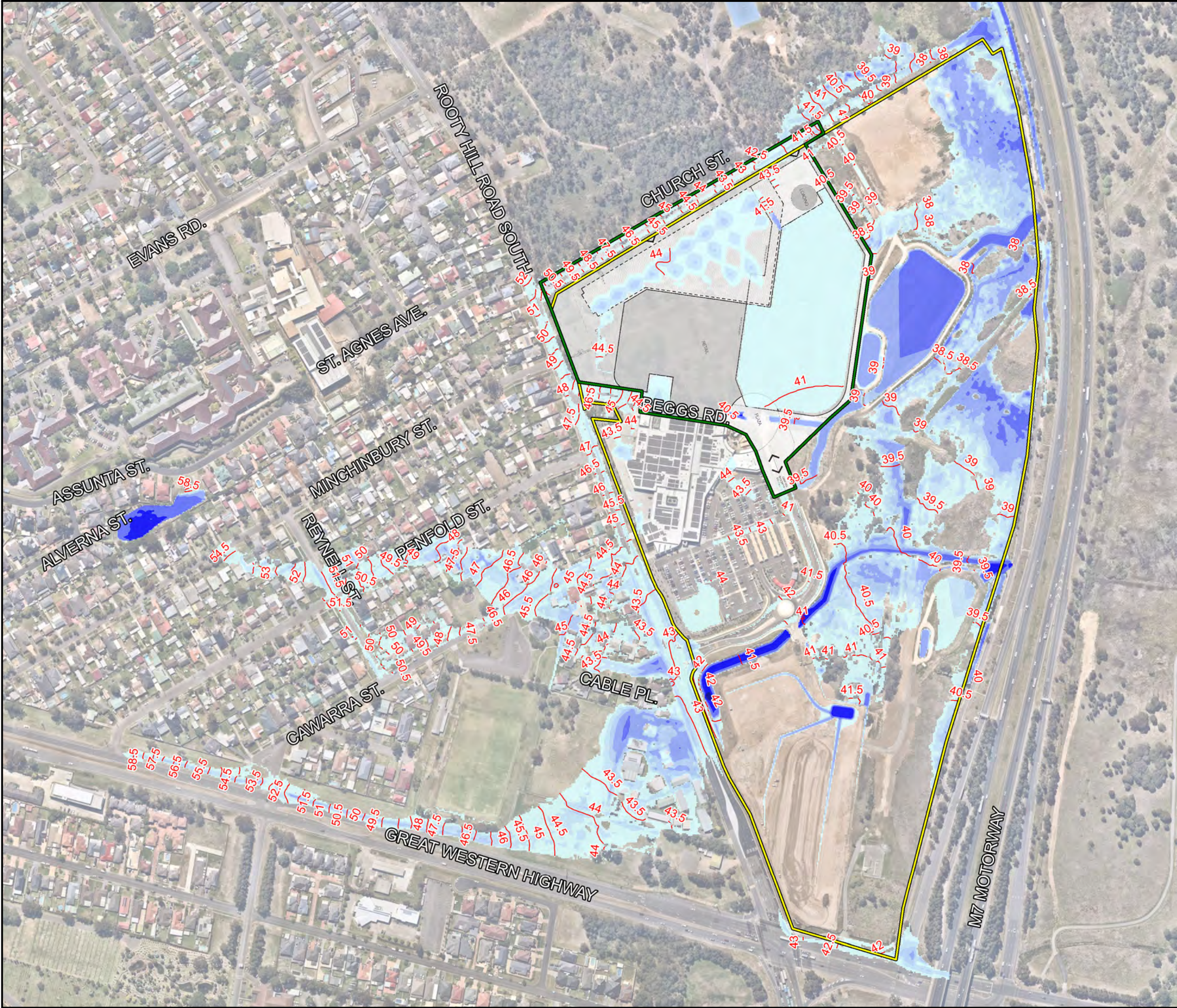
metres
Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-9
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions
1% AEP Flood Extent
Depths and Levels

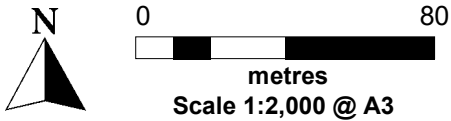
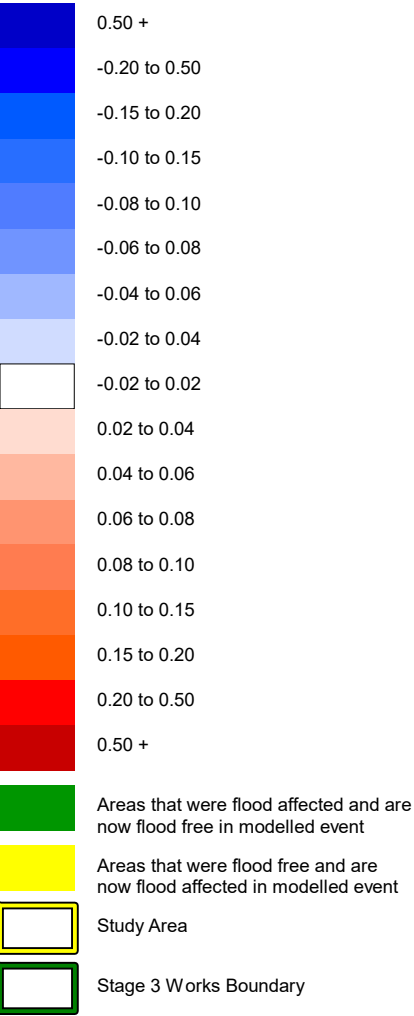
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LEGEND
FLOOD DIFFERENCE (m)

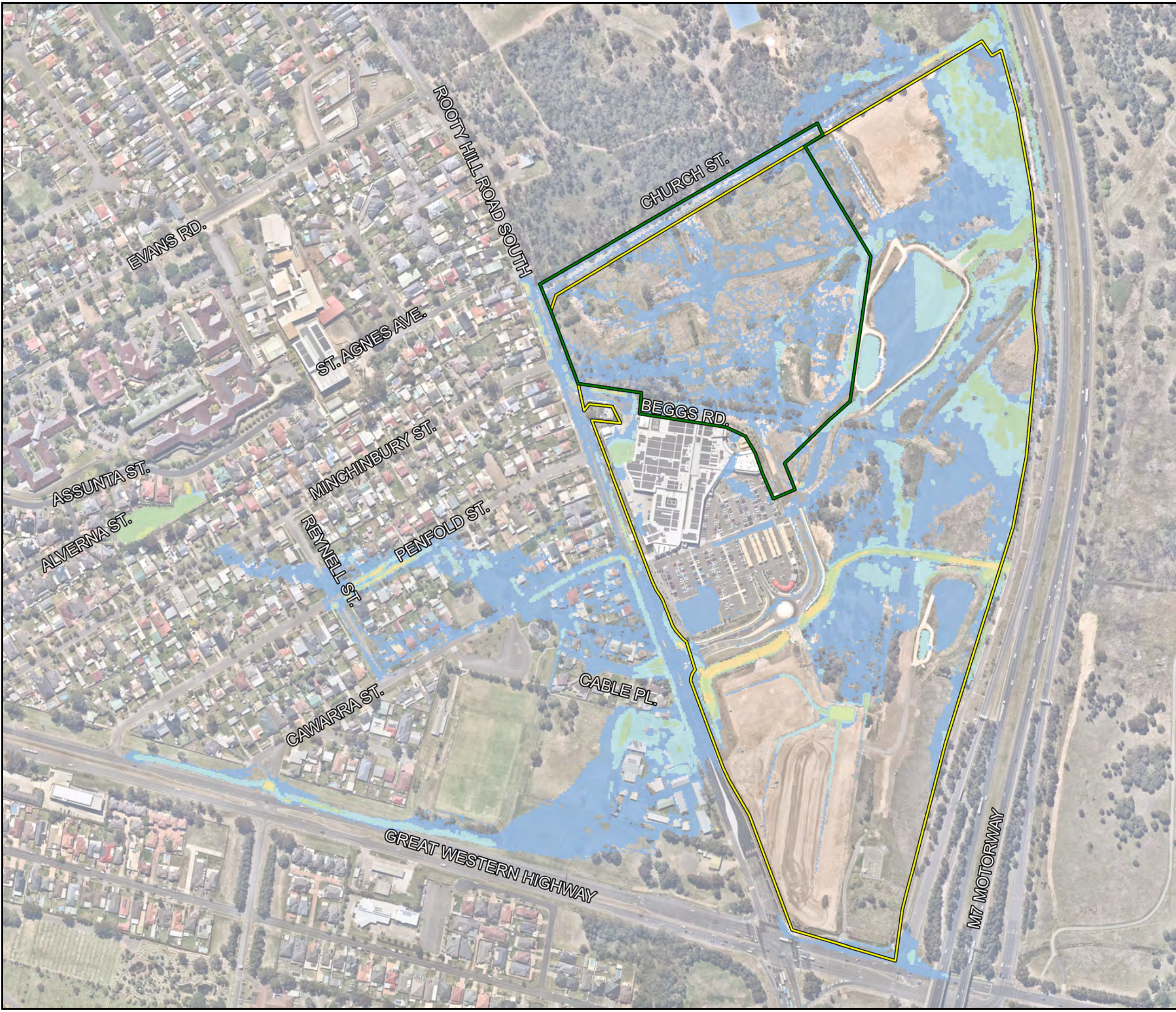


Projection: GDA 1994 MGA Zone 56

Figure 6-10
Eastern Creek Quarter
Stage 3 Flood Report

1% AEP
Developed - Existing
Flood Difference Map

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LEGEND
FLOOD HAZARD
H1 - Generally safe.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4- Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
Site Boundary
Stage 3 Works Boundary

N

0 160

metres

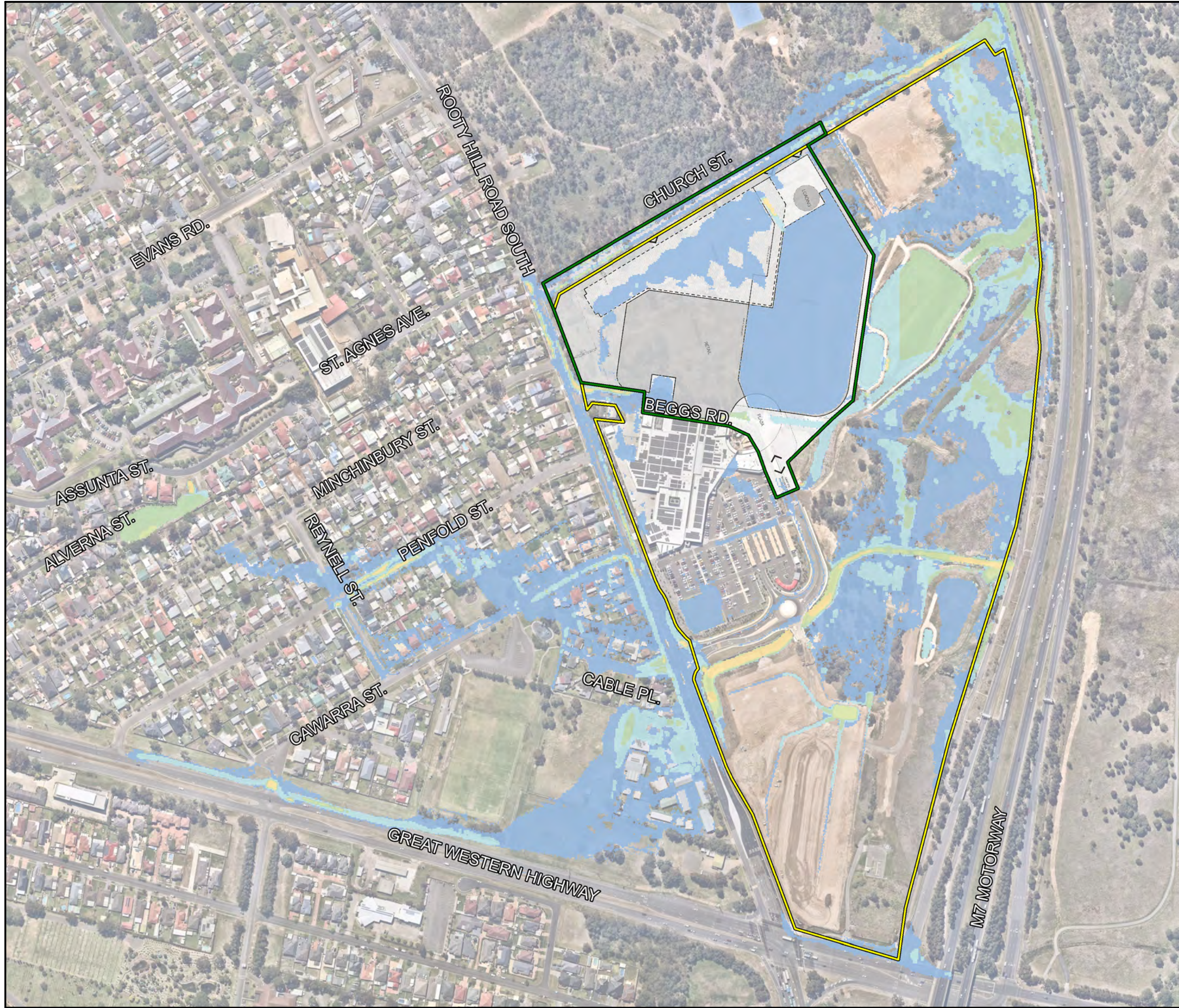
Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-11
Eastern Creek Quarter
Stage 3 Flood Report

Existing Conditions
1% AEP Flood Hazard Map

Date: 14/12/2020
Issue: A



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LEGEND
FLOOD HAZARD
H1 - Generally safe.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4 - Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
Site Boundary
Stage 3 Works Boundary

N

0 160

metres

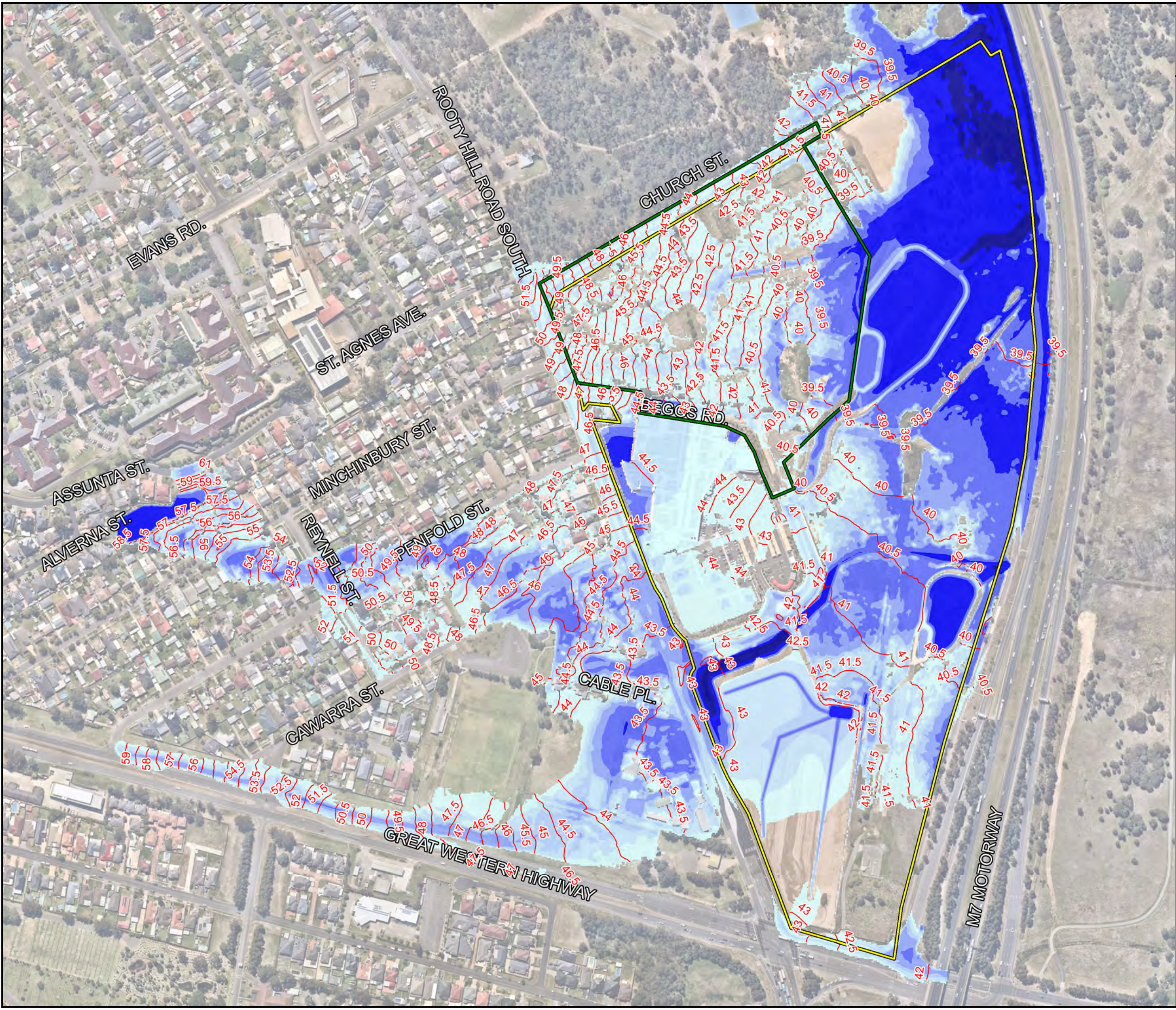
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Projection: GDA 1994 MGA Zone 56

Figure 6-12
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions
1% AEP Flood Hazard Map

Date: 14/12/2020
Issue: A



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LEGEND
FLOOD DEPTH (m)

0.0 to 0.1
0.1 to 0.2
0.2 to 0.3
0.3 to 0.5
0.5 to 1.0
1.0 to 2.0
2.0 +

35.0 0.5 m Flood Contours (m AHD)

Study Area

Stage 3 Works Boundary

N

0 160

metres

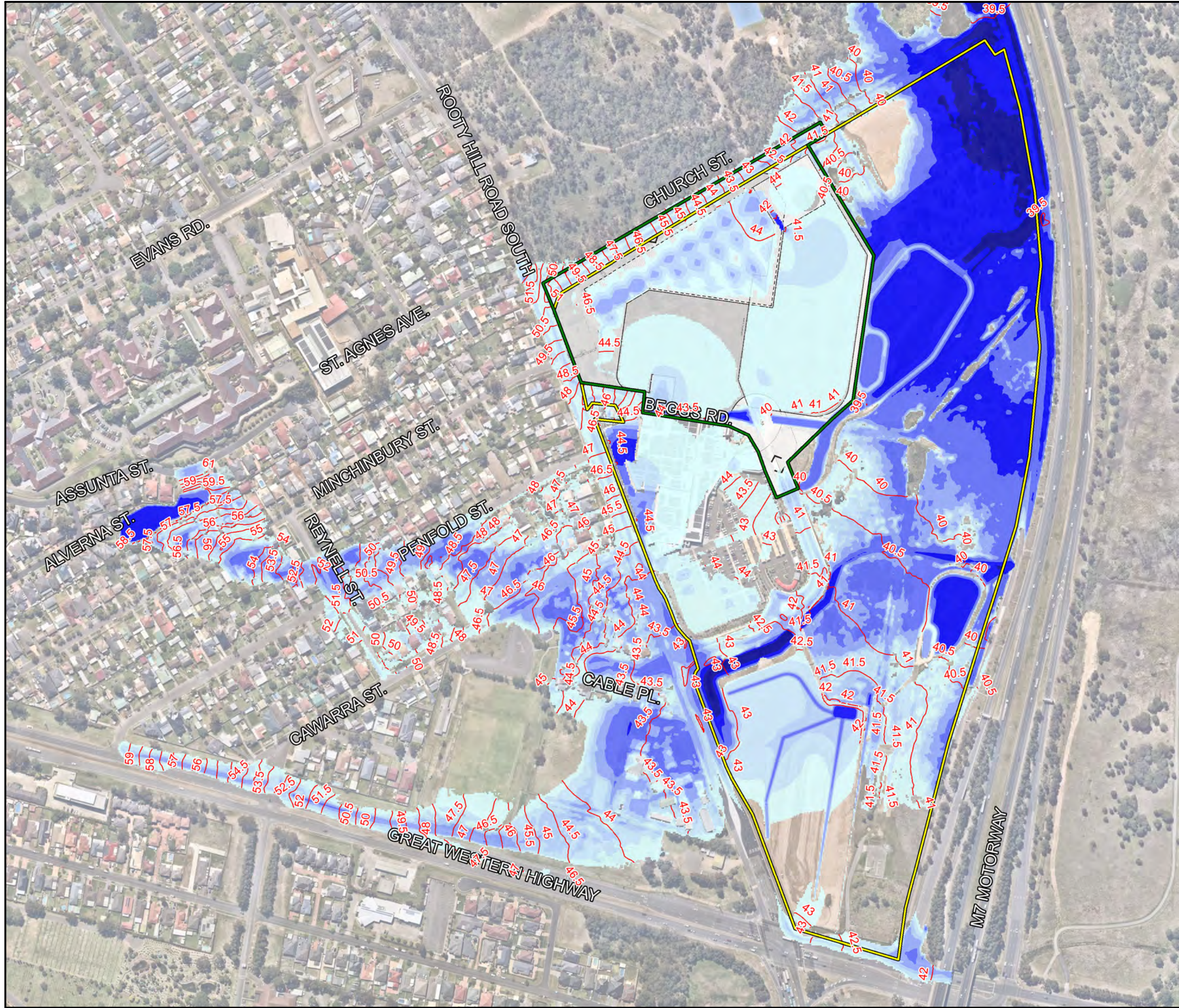
Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-13
Eastern Creek Quarter
Stage 3 Flood Report

Existing Conditions
PMF Flood Extent
Depths and Levels

Date: 14/12/2020 Issue: A



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LEGEND
FLOOD DEPTH (m)

	0.0 to 0.1
	0.1 to 0.2
	0.2 to 0.3
	0.3 to 0.5
	0.5 to 1.0
	1.0 to 2.0
	2.0 +

35.0 0.5 m Flood Contours (m AHD)

Study Area

Stage 3 Works Boundary

N

0160

metres
Scale 1:4,000 @ A3

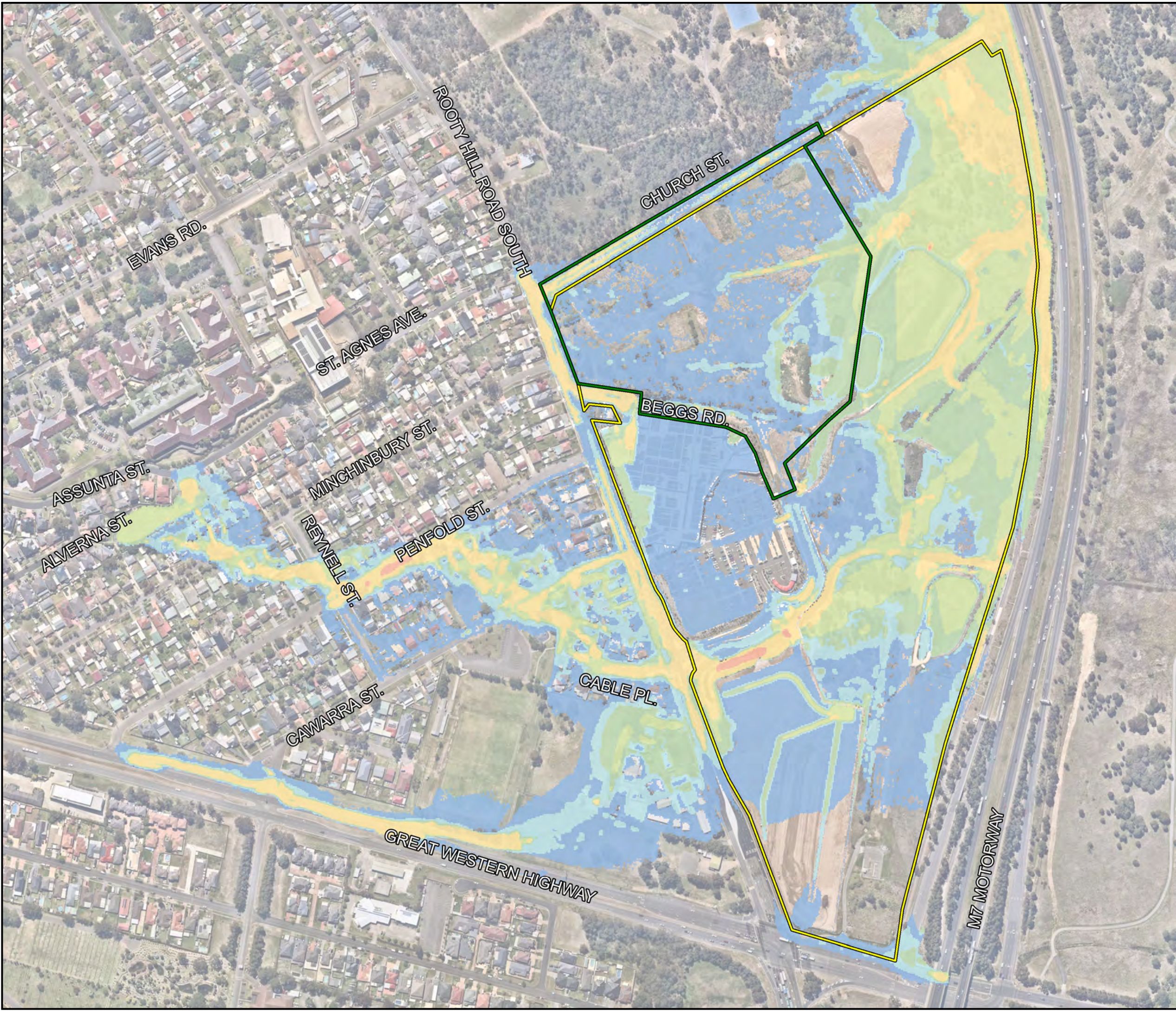
Projection: GDA 1994 MGA Zone 56

Figure 6-14
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions
PMF Flood Extent
Depths and Levels

Date: 14/12/2020 Issue: A

Filename: J:\110512 - Eastern Creek Business Hub\04 - Stage 3 Flood Assessment\SW&EDrawings\Figures\110512-04_Fig6-15_EX01_PMF_HAZ_A.wor



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LEGEND
FLOOD HAZARD
H1 - Generally safe.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4- Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
Site Boundary
Stage 3 Works Boundary

N

0 160

metres

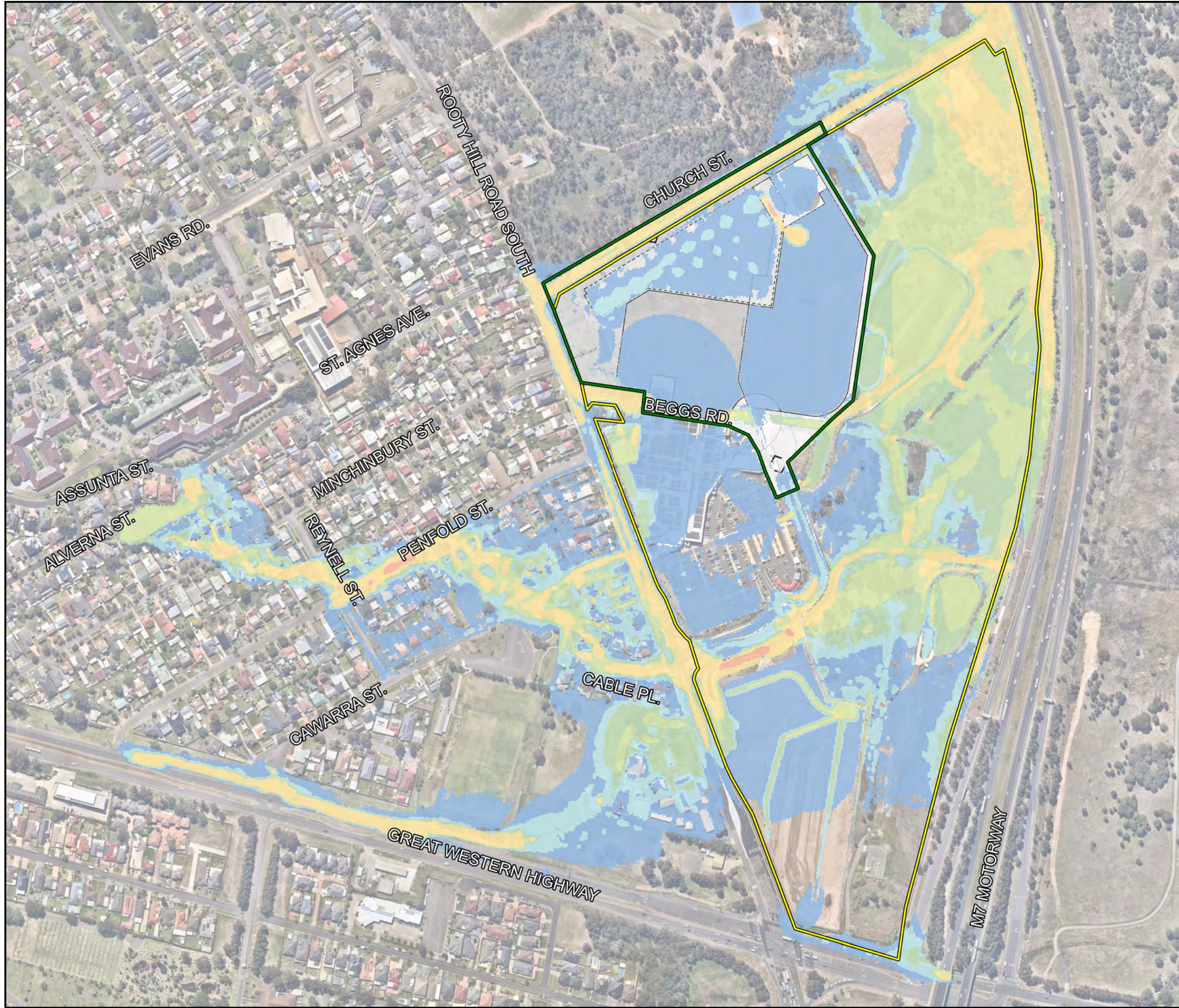
Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-15
Eastern Creek Quarter
Stage 3 Flood Report

Existing Conditions
PMF Flood Hazard Map

Date: 14/12/2020 Issue: A



J. WYNDHAM PRINCE
CONSULTING CIVIL INFRASTRUCTURE ENGINEERS
& PROJECT MANAGERS

LEGEND
FLOOD HAZARD
H1 - Generally safe.
H2 - Unsafe for small vehicles.
H3 - Unsafe for vehicles, children and the elderly.
H4- Unsafe for people and vehicles.
H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage.
H6 - Unsafe for vehicles and people. All buildings vulnerable to failure.
Site Boundary
Stage 3 Works Boundary

N

0 160

metres

Scale 1:4,000 @ A3

Projection: GDA 1994 MGA Zone 56

Figure 6-16
Eastern Creek Quarter
Stage 3 Flood Report

Developed Conditions
PMF Flood Hazard Map

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LEGEND

FLOOD HAZARD

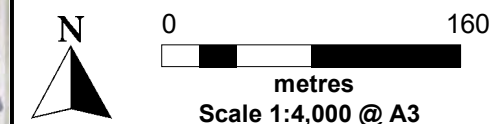
- H1 - Generally safe.
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- H4 - Unsafe for people and vehicles.
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Lot Boundaries

Flood Evacuation Route

Flood Evacuation Route
(Carpark/Shop Level)

Flood Evacuation Route
(Basement Level, under Plaza)



Projection: GDA 1994 MGA Zone 56

Figure 6-17 Eastern Creek Quarter Stage 3 Flood Report

Developed Conditions
PMF Flood Hazard Map
Flood Evacuation Route

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