Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

OVERLAND FLOW REPORT
STAGE 2

PROPOSED DEVELOPMENT:
MAMRE WEST PRECINCT
ORCHARD HILLS NSW

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1. INTRODUCTION

Costin Roe Consulting Pty Ltd has been commissioned by Altis Property Partners to undertake an overland flow assessment to accompany a planning application submission to amend the State Environmental Planning Policy (Western Sydney Employment Area) 2009 and rezone land IN1 General Industrial. Altis Property Partners are the Developer of 585-649 Mamre Road, Orchard Hills (Lot 2171 DP 1153854), a 48.35 hectare parcel of land ("Site") within what is known as the Mamre West Precinct ("Study Area").

The Study Area has been identified by Penrith City Council in their *Updated South Creek Flood Study (rp6033rg_crt150128-Updated South Creek Flood Study (FINAL – Volume 1))*, as being affected by overland flow associated with the adjacent South Creek. This report will be referred to as the South Creek Study from hereon.

Consultation with Penrith City Council has been undertaken to confirm the flood planning requirements for the rezoning. Meetings were held with the respective stakeholders, including the developer, Costin Roe (Civil Engineers), Hansen Yuncken (Project Manager), Department of Planning & Environment, council engineers and council planners, on 24 November 2014, 4 August 2015 and 24 August 2015, at Penrith City Council. During these meetings the scope of the development and the requirements for the required overland flow assessment, as it relates to the proposed rezoning, were discussed.

The scope and primary objectives of the overland flow assessment, as agreed with Council, are as follows:

- Determine the 1% Annual Exceedance Probability (AEP) Flood design flow generated by the contributing external catchment. Hydrology would be based on the flows completed in the South Creek Flood Study;
- Assess the pre-development overland flow path through the development site for a range of storms including the 1% AEP event;
- Assess the post-development overland flow path through the development site for the 100-year ARI event so that potential impacts on the development can be assessed and mitigated; and
- Confirm the flood planning level for the development and the hazard category in accordance with the adopted policy of the consent authority.
- Confirmation of the Probable Maximum Flood (PMF) storm event (post construction) and discussion on flood evacuation from the development during a PMF event.

The modelling is to be undertaken in two stages (as discussed below) and this report provides details and summary of the Stage 2-Scenario Testing component of the modelling.

Stage 1 – Model Build and Validation

Refer to *OVERLAND FLOW REPORT STAGE 1, Proposed Development: Mamre West Precinct ORCHARD HILLS, NSW, Revision A, dated 22 September,* for Stage 1 modelling and scope items noted below.

- Build of a 2D hydrodynamic flood model of South Creek in the vicinity of the proposed development area for the existing scenario;
- Modelling will be performed using the TUFLOW modelling engine with the main creek channel and overbank areas being modelled in 2D;
- Modelling of 5%, 2%, 1%, 0.5% AEP storms for the existing site with validation being completed against the modelling produced in the Council Flood Study;
- The Digital Terrain Model (DTM) used in the modelling will be based on a combination of detailed ground survey completed during later 2014 and mid-2015 and LIDAR information;

- Reporting of Stage 1 modelling to be provided to Penrith City Council for a peer review to be undertaken by Worley Parsons, who compiled the South Creek Flood Study; and
- Reporting and modelling to be utilised in the Stage 2 Scenario Testing described below following peer review of the Stage 1 model results.

Stage 2 – Scenario Testing

- Scenario testing of pre and post construction configurations utilising the model build as defined in the Stage 1 report;
- Scenario testing will be undertaken for the range of AEP events defined in Stage 1 Report;
- Scenario testing is to include differences in flood levels, velocity and general hydraulics; and
- The scenario testing will be undertaken for the development of The Site (48.5 Ha) and extended study area including residential properties to the north.

This report has been produced to present the Stage 2 component of the modelling.

The Stage 2 report is to be read in conjunction with *OVERLAND FLOW REPORT STAGE 1, Proposed Development: Mamre West Precinct ORCHARD HILLS, NSW, Revision A, dated 22 September,* for Stage 1. The Stage 1 report provides a summary of the modelling methodology, model parameters and model results for the existing conditions.

The development site has been considered in the context of the Study Area (Mamre West Precinct) being proposed for rezoning in the State Environmental Planning Policy (Western Sydney Employment Area) 2009 and forming part of Precinct 11 "Broader Western Sydney Employment Area".

The information provided in this Report is intended to inform the relevant stakeholders including the landowner, surrounding property owners, council officers, planners and the property developer of the opportunities and constraints associated with the development in relation to overland flow and flooding within South Creek. The report will form part of a Precinct Planning Package to be exhibited and considered by the Department of Planning & Environment to inform them on the rezoning of the Study Area.

The Department of Planning and Environment are the consent authority for the rezoning in the State Environmental Planning Policy (Western Sydney Employment Area) 2009 and Penrith City Council are a key authority to be consulted; as such the guidelines for flood liable lands, as stipulated in Section C3.5 of Penrith City Council *Development Control Plan 2014,* apply. The planning application will be made through the NSW Department of Planning and Environment with Penrith City Council as a major stakeholder.

2. DEVELOPMENT SITE

2.1. Site Description and Study Area

Mamre West Precinct (Study Area) is approximately 193ha with the subject site (Lot 2171, 585-649 Mamre Road) approximately 48ha, located on the western side of Mamre Road in the suburb of Orchard Hills as shown in **Figure 2.1**.

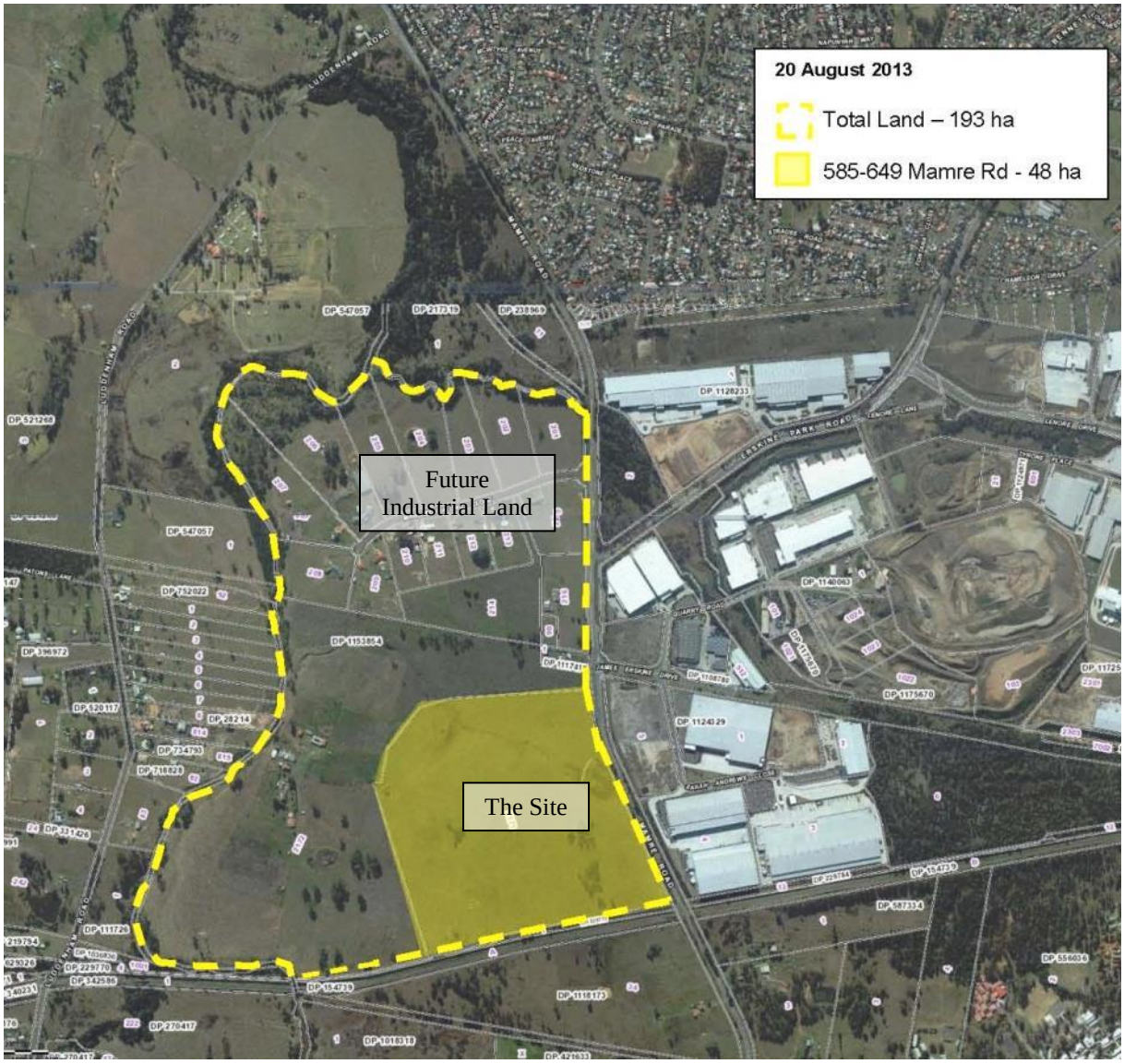

Figure 2.1 Locality Plan of 'The Site', 'Future Industrial Land' and Study Area

Lot 2171 (hereby referred to as 'Site') is approximately 48Ha in area and generally rectangular in shape. The study area also comprises the properties which surround Mandalong Close on the northern side of the Site as represented by the dashed yellow perimeter in **Figure 2.1**.

The Site is bounded by rural residential development to the north, Mamre Road on the east, rural land to the south and rural land to the west. South Creek is located some 300m to the west of the development site boundary and a large diameter pipeline owned by Sydney Water is present on the southern boundary of the development site.

The rural residential development to the north of The Site is included in the study area and is referred to as Future Industrial Land from hereon.

The land on the Eastern side of Mamre Road comprises industrial development known as the Erskine Park Employment Area.

Access to the site can be made via Mamre Road.

The land use over the precinct is currently rural residential. No formal drainage systems or development is present on the land. Review of the survey information shows that the land falls from the south and south-east to the west and north-west. Grades are low and in the order of 0.25% (1 in 400) to 0.5% (1 in 200). The highest level, at RL 39.0m AHD, is located at the south-east corner of the precinct and the lowest level is RL 31.5m AHD at the north-west corner. The low point coincides with a natural low point or gully in the land which currently acts as overland flow path.

2.2. Proposed Development

The proposed development on The Site is for a subdivision of the land, infrastructure works and bulk earthworks and the construction of warehouse and logistics facilities to the Stage 1 Development.

The layout of the development will be confirmed as design progresses. The indicative master-planning for the site incorporates an access road which bisects the site and provides access to development lots within the site. Large development lots will flank either side of the access road. Development lots will vary in size, typically in the order of 2.5 Ha to 8 Ha. The final layout will be subject to market demands, access location from Mamre Road and the preferred architectural layout. Development lots will be sympathetic to the topography of the land and allowing for the minimum 500mm freeboard to the 1% AEP flood level of South Creek.

Access to all lots would be made via the new access road which intersects with Mamre Road. The new access road and associated intersection will be constructed to Penrith City Council requirements and ownership transferred to Penrith City Council.

The Future Industrial Land to the north of The Site is included in the study area however not considered part of the proposed development discussed in this section of the report.

3. STUDY METHODOLOGY

The overall objectives of the Flood Study have been defined in the Stage 1 Report. The Stage 2 Report focusses on the scenario testing and the Differences in flood regime as they relate to the proposed development and upstream and downstream properties; Flood Planning Levels for the flood-affected areas; and confirmation of the flood planning requirements for the development.

A numerical modelling tool was developed in the Stage 1 modelling to convert runoff hydrographs into water levels and velocities throughout the study area. The model simulates the hydraulic behaviour of the water within the study area by accounting for flow in the major channels as well as the potential for overland flow paths, which develop when the capacity of the channel is exceeded. It relies on boundary conditions which include the runoff hydrographs and appropriate downstream boundary level.

The Stage 1 model was used for scenario testing relating to the proposed development over The Site (Scenario A) and The Site plus future Mandalong Industrial Area (Scenario B). The scenario testing has been completed within the bounds of Penrith City Council DCP Part C3 Water Management and discussions with Penrith City Council as listed following:

i) Flood levels are not increased by more than 0.1m by the proposed filling;
ii) Downstream velocities are not increased by more than 10% by the proposed filling;
iii) Proposed filling does not redistribute flows by more than 15%;
iv) The potential for cumulative effects of possible filling proposals in that area is minimal;
v) There are alternative opportunities for flood storage
vi) The development potential of surrounding properties is not adversely affected by the filling proposal;
vii) The flood liability of buildings on surrounding properties is not increased;
viii) No local drainage flow/runoff problems are created by the filling;
ix) The filling does not occur within high hydraulic hazard areas; and
x) The filling does not occur within the drip line of existing trees.

Section 4 of the report provides the results of the design flood estimation for the catchment which were completed in Stage 1.

Sections 5 summarise the results of the scenario assessment and Section 6 provides discussion on the various aspects of the results and validation of the proposed design against councils Development Control Plan while Section 7 provides concluding remarks to the overall study.

A number of figures are included to illustrate the study results.

We also confirm that the model output and scenario testing includes the recommendations contained in the Stage 1 Peer Review completed by Worley Parsons for Penrith City Council.

4. PRE-DEVELOPED SITE FLOOD MODELLING RESULTS

The predicted peak flood levels, depth and velocities were determined in the Stage 1 Report as contained in Section 7 of the report and reproduced below for context with the post-development scenario testing.

The water surface profile for the 1% AEP event has been presented below in **Figure 4.1**. Reference to the Stage 1 Report should be made for water surface profiles, flood depth estimates and velocity output for the 5% AEP, 1% AEP, 0.5% AEP and PMF storm events.

Predicted 1% AEP flood levels and depths at key locations (defined in **Figure 4.1**) are also presented in **Table 4.1**.

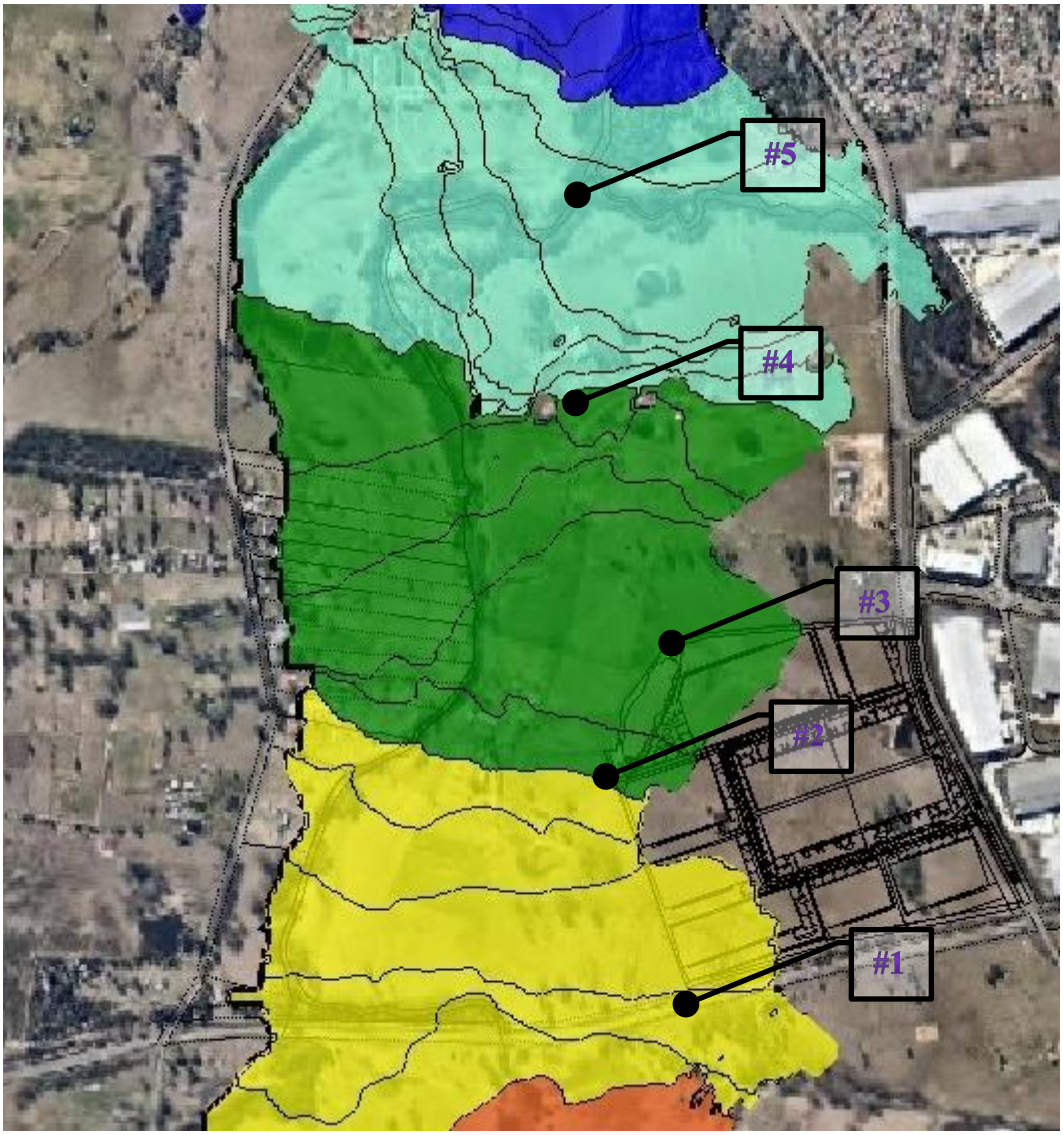

Figure 4.1. Predicted 1% AEP Peak Flood Level Profile

No.	TUFLOW			South Creek Study		
	Ground Level (m)	Flood Depth (m)	Flood Level (m)	Ground Level (m)	Flood Depth (m)	Flood Level (m)
1	33.11	0.48	33.59	33.09	0.44	33.53
2	31.94	0.99	32.93	32.03	0.81	32.84
3	31.66	1.03	32.69	31.49	1.08	32.57
4	31.44	0.68	32.12	31.40	0.55	31.95
5	29.54	1.72	31.26	29.71	1.74	31.45

Table 4.1. Predicted 1% AEP Peak Flood Parameters at Key Locations

Table 4.1 shows the predicted flood depths and levels in five key locations through the study area. The flood depths compare well with differences of 100mm or less at four of the five locations. Location 2 has a higher difference of 180mm however this is considered within the accuracy of the two models.

The predicted extent of flood inundation can be seen to extend across the floodplain for a considerable distance from the main channel of South Creek. This can be seen to comprise high and low hazard areas. The flood extent within The Site can be seen to be generally shallow and low velocity. The exception to this is at the north-west corner of the site where, although low velocity is present, depth of flow is in the order of 0.8-1.1m. This area has been categorised by Penrith Council in the South Creek Study as being high hazard zone.

Flood planning levels for future development will be based on the 1% AEP flood levels plus freeboard of 500mm, and any change in flood levels as a result of development, as defined in Section 3 of Penrith Councils Water Management DCP.

5. SCENARIO FLOOD MODELLING RESULTS

5.1. Options Assessment and Development

A comprehensive options and assessment process was undertaken to identify reasonable and feasible level of development over The Site.

A number of scenario models for the filling of land were undertaken. Initially the modelling was completed based on 100% development of the site which is located outside of the high hydraulic zone identified in the South Creek Study. The extent of development was then adjusted to a point where the objectives nominated in Section 3 of this report have been achieved. The main method for the initial assessment was completed using the flood depth afflux mapping between the pre and post developed 1% AEP flood scenarios. The difference in 1% AEP flood depth provided a consistent measure of differences between the different development scenarios. The remaining flooding objectives for filling within flood zone were then confirmed for the development scenario which meets the requirements of council's development control plan.

A number of scenarios were assessed and results for three scenarios are presented below. The options presented are:

- **Scenario A** - Filling up to the high hydraulic zone defined in the South Creek Flood Study over The Site;
- **Scenario B** - Filling up to the high hydraulic zone defined in the South Creek Flood Study over the site and future Mandalong Industrial Land;
- **Scenario C** - Filling within the flood zone over The Site which meets councils Development Control Plan; and
- **Scenario D** - Filling within the flood zone over The Site and future Mandalong Industrial Land which meets councils Development Control Plan.

5.2. Scenario A

Scenario A is based on filling up to the high hydraulic zone defined in the South Creek Flood Study over The Site. Filling of the site has been represented as an inactive flow area in the TUFLOW model.

This scenario produced the following results for the 1% AEP storm event:

- Generally the change in flood surface levels between the existing and developed scenario were seen to be less than 25mm;
- A change in the flood surface level was seen to occur locally at the south-western corner of The Site. The change in flood surface levels is predicted to be in the range of 100-150mm and is associated with blockage and redistribution of the existing flow path;
- A change in the flood surface level was seen to occur locally on the western boundary of The Site. The change in flood surface levels is predicted to be in the range of 150-200mm and is associated with a high velocity zone which is exacerbated by flood zone which is now inactive;
- Change in flood surface levels and or flow regime are confined, locally to proposed areas of filling. There is no change to flood surface levels or flow regime seen within the main South Creek channel, or on the western side of South Creek; and
- This scenario has been concluded to be unacceptable in terms of the criteria for filling within flood affected land defined in the Penrith Council Development Control Plan C3.

Figure 5.1 shows the 1% AEP flood levels and **Figure 5.2** shows 1% AEP flood surface afflux results. Further results and output can be found in report **Appendix A**.

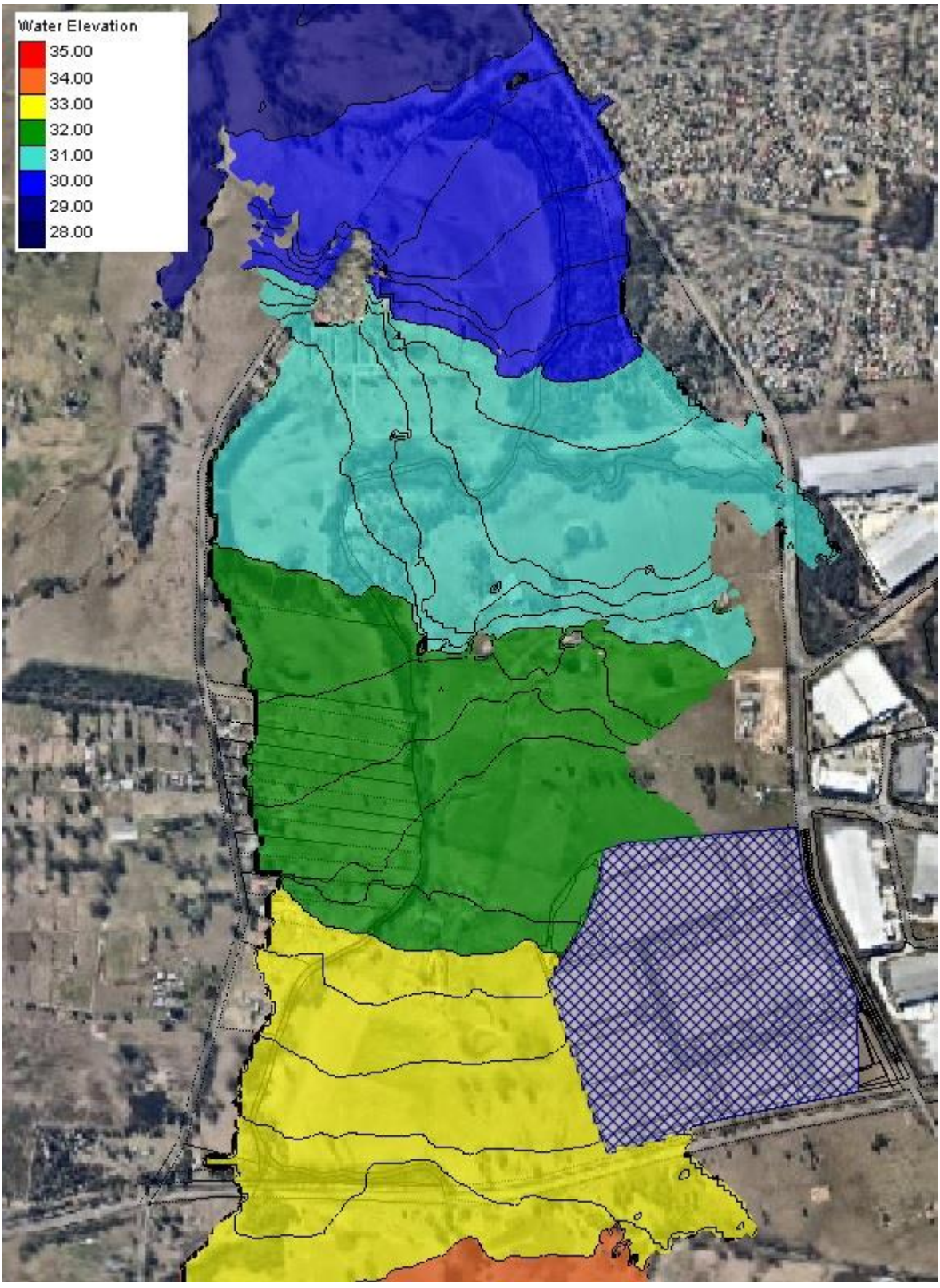

Figure 5.1. Scenario A - 1% AEP Flood Surface Levels

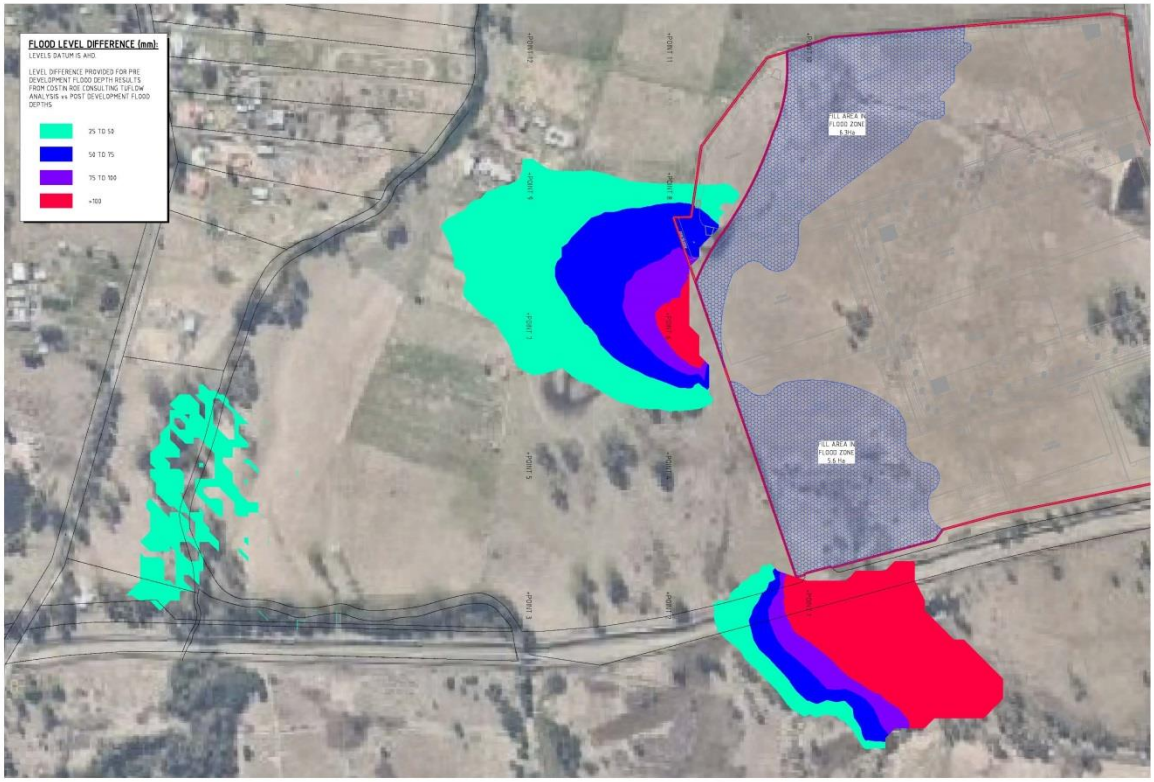

Figure 5.2. Scenario A – 1% AEP Flood Surface Level Afflux

5.3. Scenario B

Scenario B is based on filling up to the high hydraulic zone defined in the South Creek Flood Study over The Site and future Mandalong Industrial Area. Filling of the site has been represented as an inactive flow area in the TUFLOW model.

This scenario produced the following results for the 1% AEP storm event:

- The change in flood surface levels between the existing and developed scenario were seen to be greater than 50mm through an extended area with an increase in the range of 100-150mm extending from the midpoint of The Site's western boundary through to the midpoint of the Mandalong Industrial area. Locally higher increases up to 150-200mm can be seen in two locations;
- The local change in the flood surface level at the south-western corner of The Site shown in Scenario A remains consistent. This shows that there will not be any cumulative effects due to filling associated with the southern area of The Site;
- The change in the flood surface level seen to occur locally on the western boundary of The Site in Scenario A remains generally consistent in Scenario B. It can be seen that the extent of flood afflux on the southern side of this zone is consistent before afflux on the northern side is affected by the filling of the future industrial area;
- Other than the southern area noted in Dot Point 2, the change in flood surface levels and or flow regime are no longer confined locally to proposed areas of filling. The change to flood surfaces levels extend through the main South Creek channel and to the western side of South Creek; and
- This scenario has been concluded to be unacceptable in terms of the criteria for filling within flood affected land defined in the Penrith Council Development Control Plan C3.

Figure 5.3 shows the 1% AEP flood levels and **Figure 5.4** shows 1% AEP flood surface afflux results. Further results and output can be found in report **Appendix B**.

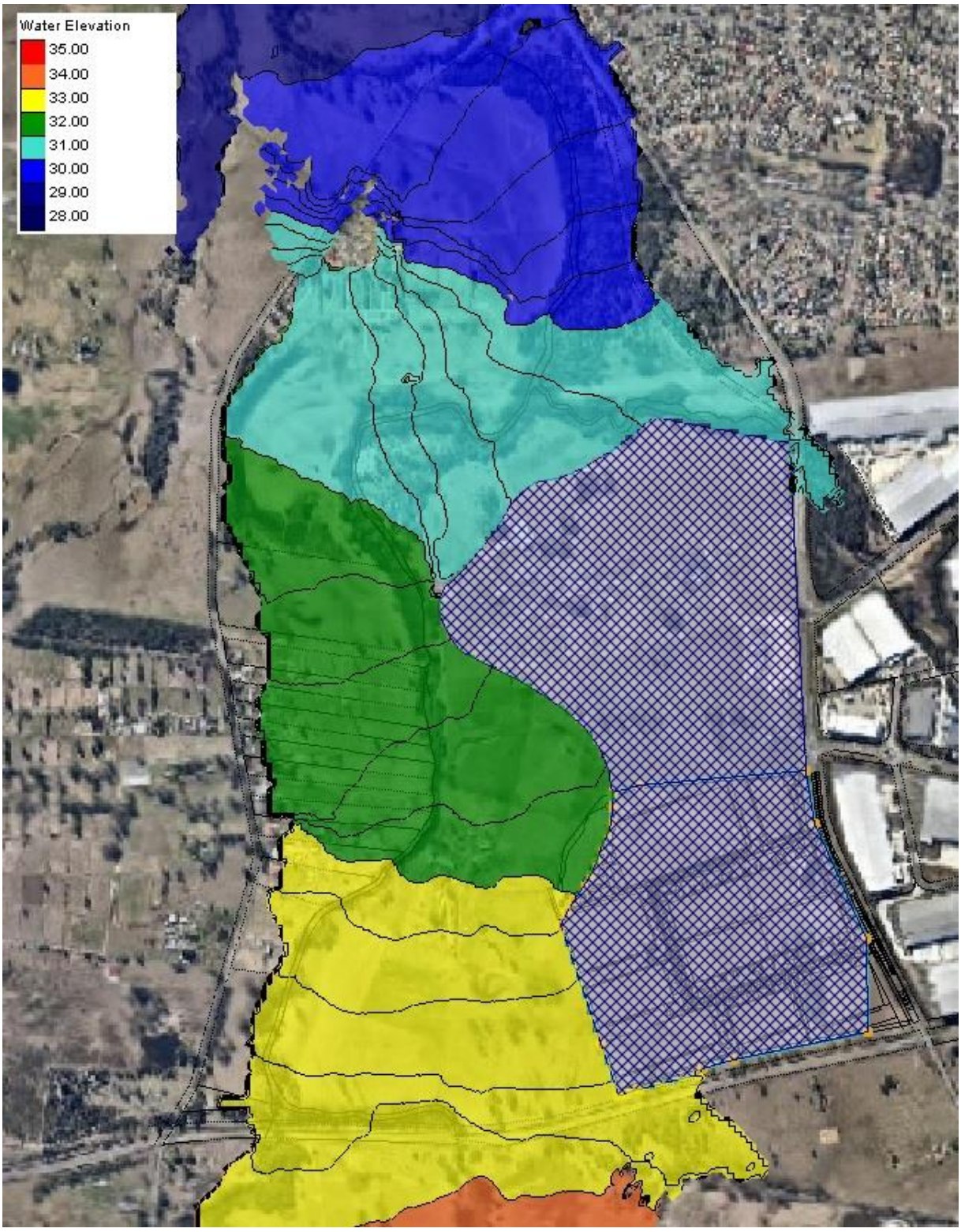

Figure 5.3. Scenario B - 1% AEP Flood Surface Levels

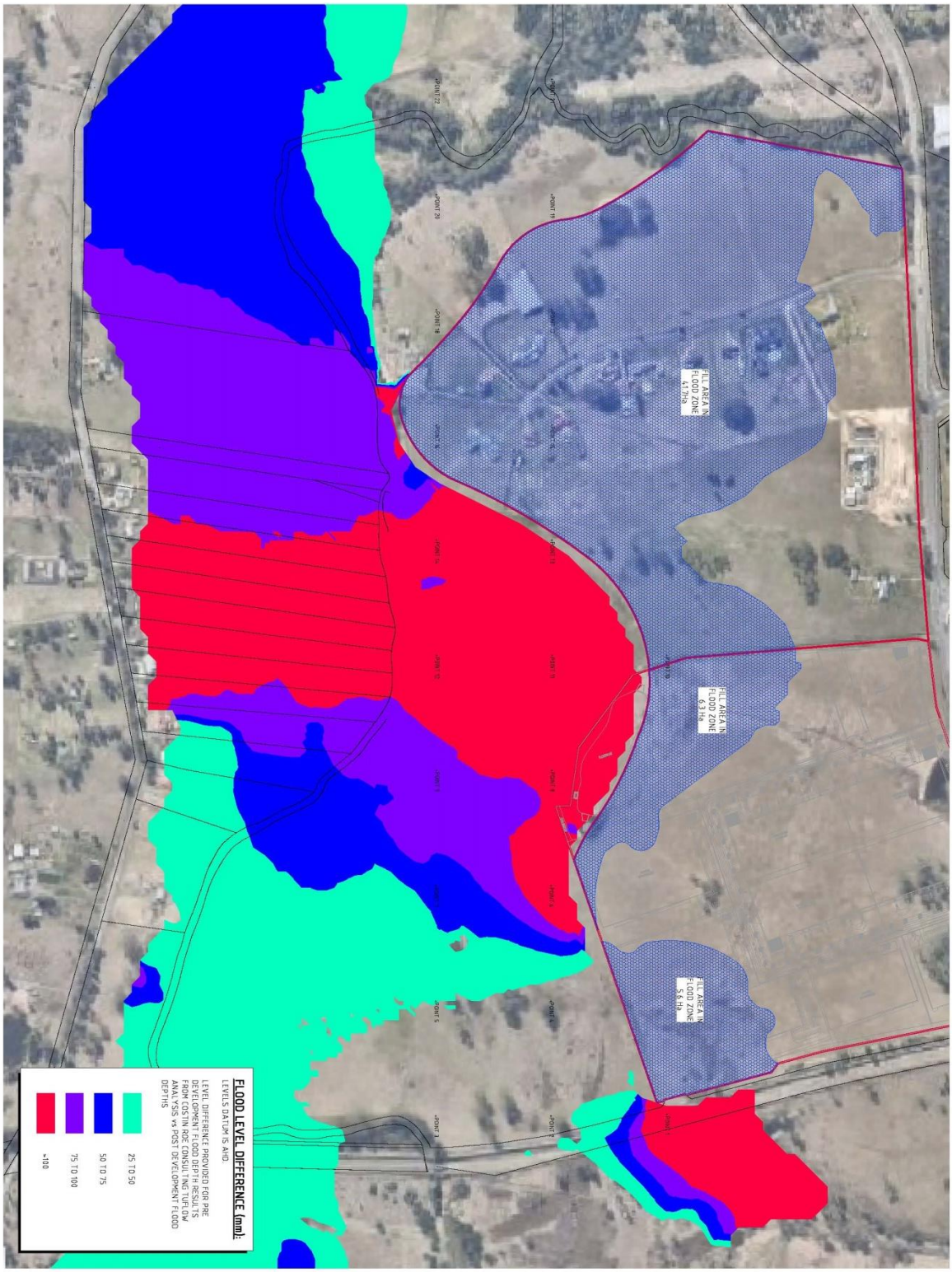

Figure 5.4. Scenario B – 1% AEP Flood Surface Level Afflux

5.4. Scenario C

Scenario C is based on filling over The Site up to a point, outside of the high hydraulic zone (defined in the South Creek Flood Study) which meets the requirements of the Penrith Council Development Control Plan C3. Filling of the site has been represented as an inactive flow area in the TUFLOW model.

This scenario produced the following results for the 1% AEP storm event:

- Generally the change in flood surface levels between the existing and developed scenario were seen to be less than 25mm;
- The change in the flood surface level seen to occur locally at the south-western corner of The Site in Scenario A has been reduced by adjusting the shape of proposed filling to better facilitate the conveyance of flows. The change in flood surface levels is predicted to be less than 100mm. The adjusted filling shape allows for flows to pass less restricted through the blocked and redistributed flow path identified in Scenario A;
- The change in the flood surface level seen to occur locally on the western boundary of The Site has been reduced by adjusting the shape of proposed filling to better facilitate the conveyance of flows. The change in flood surface levels is predicted to be less than 100mm;
- The change in flood surface levels and flow regime remains confined, locally to proposed areas of filling however these are minor and meet the requirements of Penrith Council Development Control Plan C3. There is no change to flood surface levels or flow regime seen within the main South Creek channel, or on the western side of South Creek; and
- This scenario has been concluded to be acceptable in terms of the criteria for filling within flood affected land defined in the Penrith Council Development Control Plan C3 and a total of 9.4 Ha of flood affected land is able to be filled and developed.

Figure 5.5 shows the 1% AEP flood levels and **Figure 5.6** shows 1% AEP flood surface afflux results. Further results and output can be found in report **Appendix C**. Further discussion on validation of Scenario C is included in Section 6 of the report.

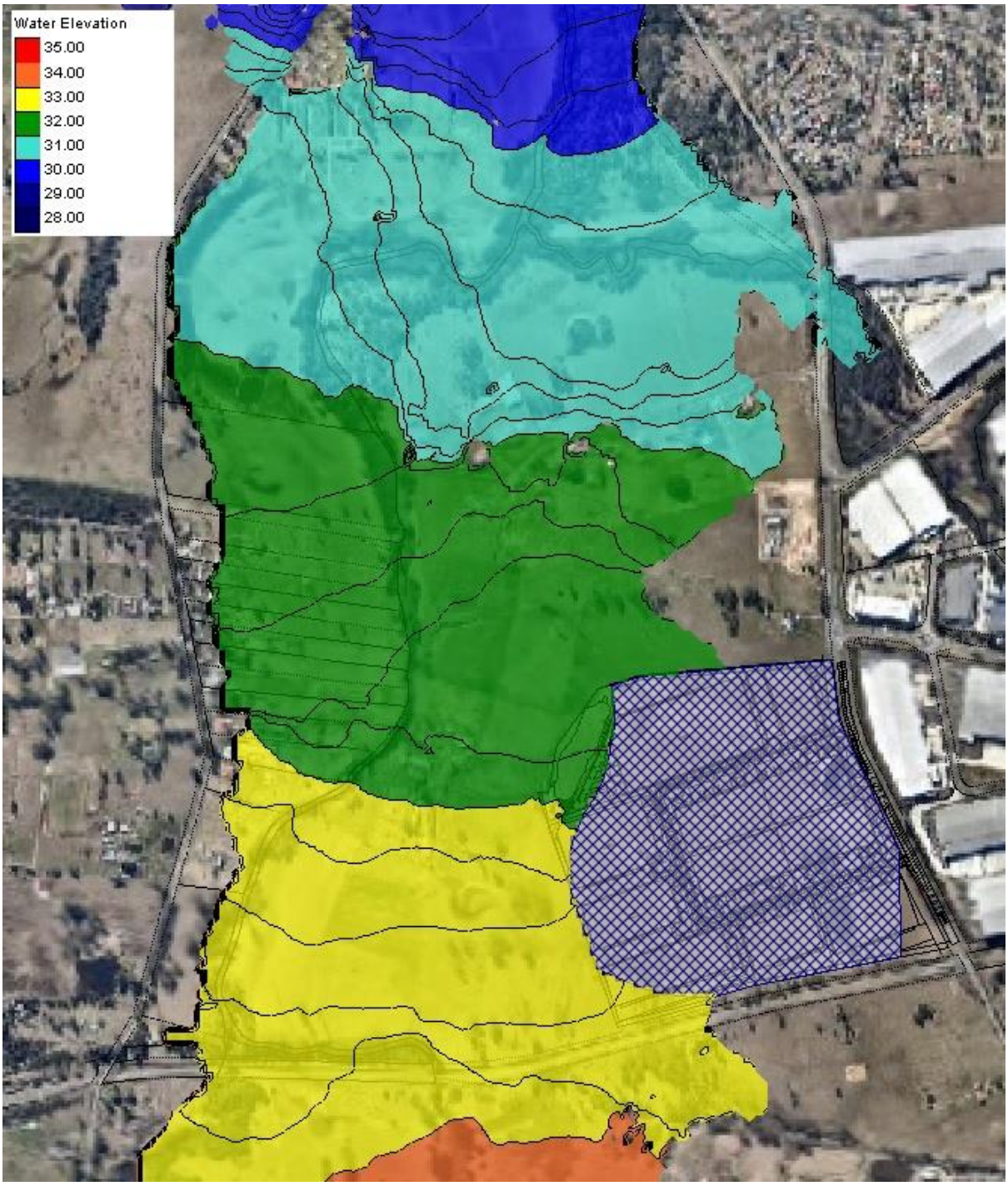

Figure 5.5. Scenario C - 1% AEP Flood Surface Levels

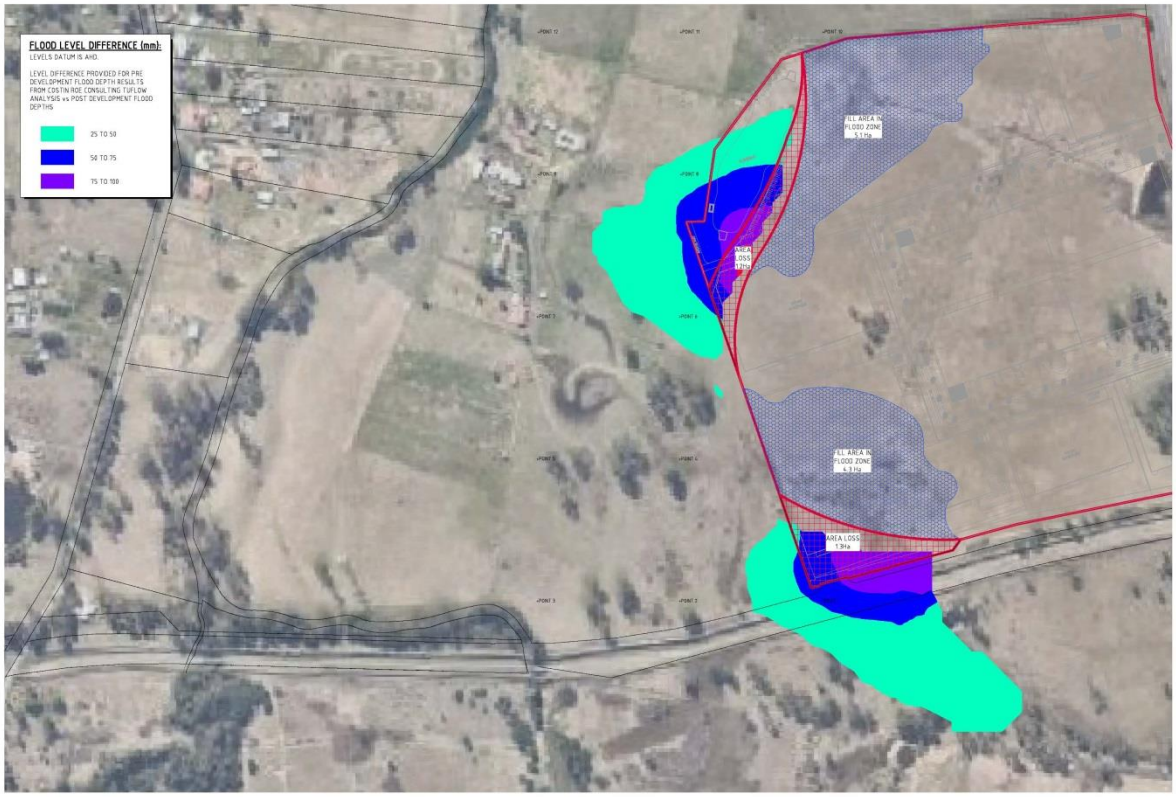

Figure 5.6. Scenario C – 1% AEP Flood Surface Level Afflux

5.5. Scenario D

Scenario D is based on filling over The Site and future Mandalong Industrial Areas, outside of the high hydraulic zone defined in the South Creek Flood Study to a point which meets the requirements of the Penrith Council Development Control Plan C3. Filling of the site has been represented as an inactive flow area in the TUFLOW model.

This scenario produced the following results for the 1% AEP storm event:

- The change in flood surface levels between the existing and developed scenario were seen to be less than 100mm and generally less than 50mm;
- The local change in the flood surface level at the south-western corner of The Site shown in Scenario C remains consistent. This confirms there is no hydraulic relation between the different areas of development and that there will not be any cumulative effects due to filling associated with the southern area of The Site and precinct;
- The change in the flood surface level seen to occur locally on the western boundary of The Site in Scenario C remains generally consistent in Scenario D. It can be seen that the extent of flood afflux on the southern side of this zone is consistent before afflux on the northern side is affected by the filling of the future industrial area;
- The change in flood surface levels and flow regime are now confined locally to the proposed areas of filling. The change to flood surfaces levels are clear of the main South Creek channel and do not extend to the western side of South Creek; and
- This scenario has been concluded to be acceptable in terms of the criteria for filling within flood affected land defined in the Penrith Council Development Control Plan C3 and a total

of 35.2Ha of flood affected land is able to be filled and developed including 9.4 Ha within The Site.

Figure 5.7 shows the 1% AEP flood levels and **Figure 5.8** shows 1% AEP flood surface afflux results. Further results and output can be found in report **Appendix D**. Further discussion on validation of Scenario D is included in Section 6 of the report.

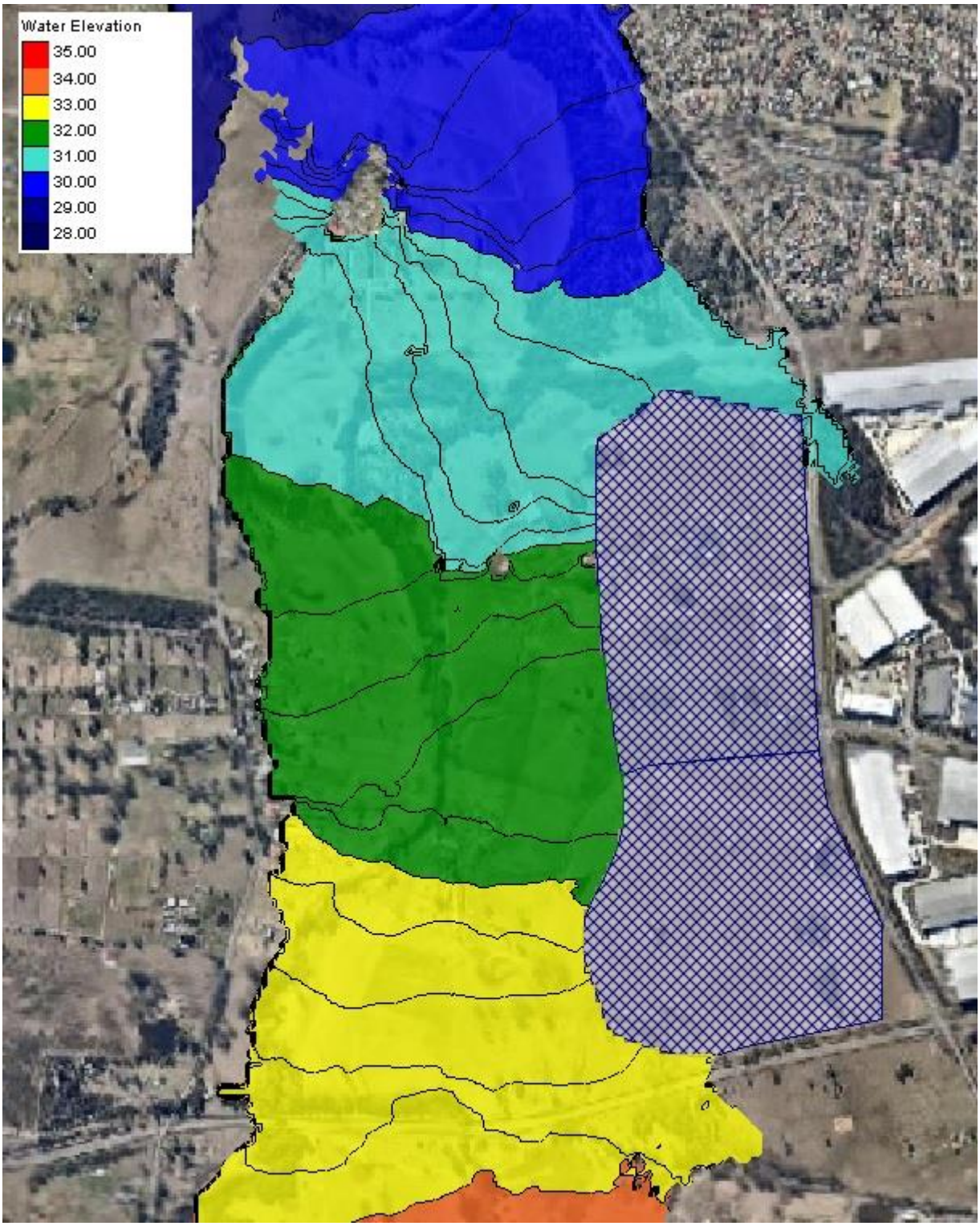

Figure 5.7. Scenario D - 1% AEP Flood Surface Levels

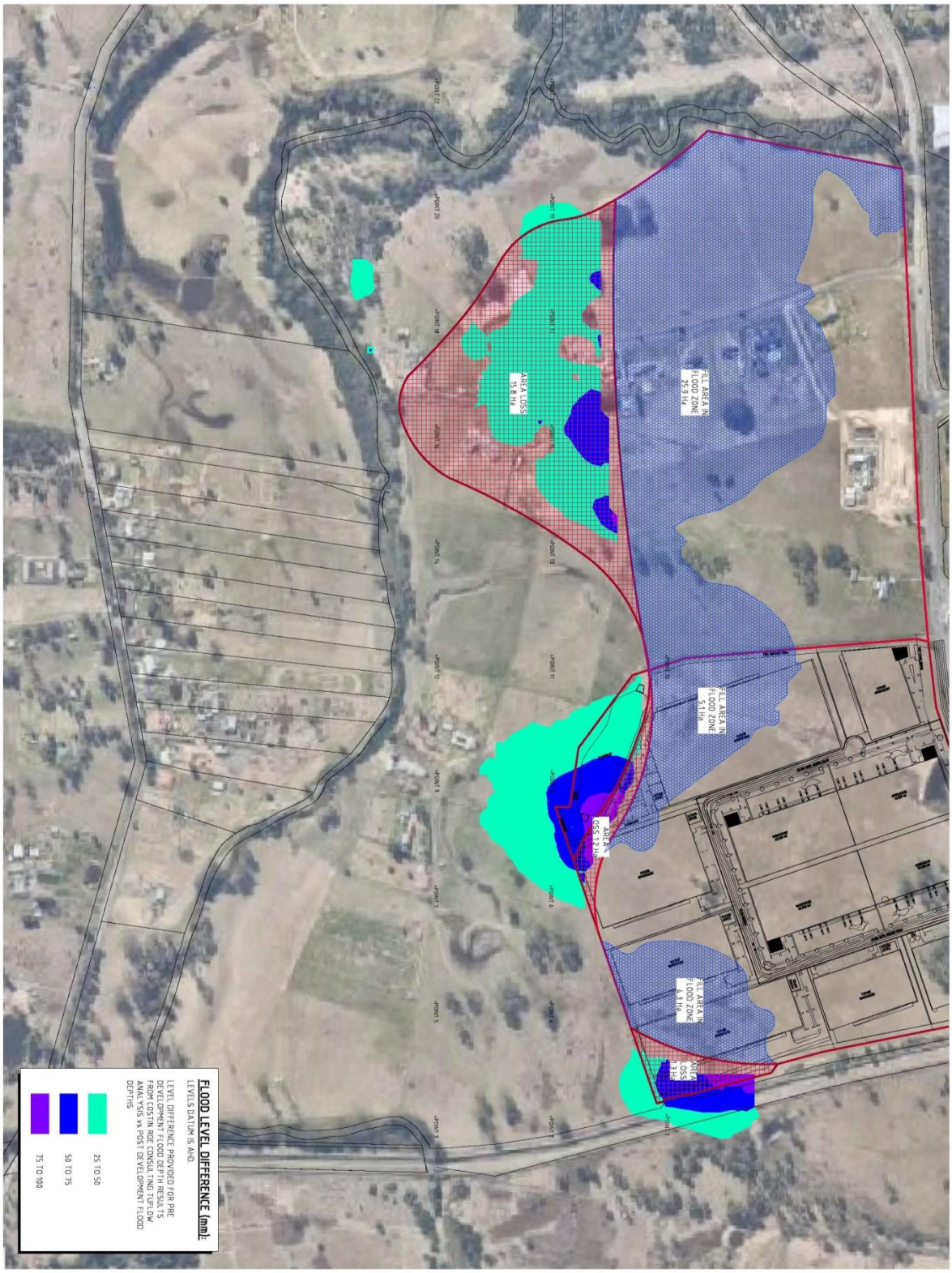

Figure 5.8. Scenario D – 1% AEP Flood Surface Level Afflux

6. VALIDATION OF PROPOSED FILLING SCENARIO

6.1. Introduction

Scenario C and D have been assessed as meeting the requirements of Penrith Council Development Control Plan C3 for filling within flood affected land. It is proposed that rezoning of the land, shown by Scenarios C and D, be made to allow for future industrial development of the land. Table 6.1 and 6.2 confirm that Penrith Councils criteria for filling within flood affected land have been met.

Discussion relating to safety and flood evacuation during the PMF event are also included in **Section 6.4**.

6.2. Scenario C

With reference to **Section 5** and modelling results contained in **Appendices C** and **E** we provide confirmation in **Table 6.1** that each of the criteria set out in the Penrith Council Development Control Plan C3 for filling within flood affected land.

Criteria	**Scenario C Confirmation**
Flood levels are not increased by more than 0.1m by the proposed filling	1% AEP flood surface afflux mapping shows that the change in flood surface levels between pre and post development/ filling is less than 0.1m.
Downstream velocities are not increased by more than 10% by the proposed filling	We confirm that the proposed filling does not increase downstream velocities by more than 10%. Refer to pre and post development velocity comparisons included in **Appendix E**.
Proposed filling does not redistribute flows by more than 15%	We confirm that the proposed filling does not redistribute flows by more than 15% where flows are greater than $0.4m^3/s/m$. Refer to pre and post development flow comparisons included in **Appendix E**.
The potential for cumulative effects of possible filling proposals in that area is minimal	The analysis shows that changes to flood surface levels and hydraulics are localized to the proposed filling areas. We confirm that cumulative effects of filling are not applicable to the proposed filling and development.
There are alternative opportunities for flood storage.	The flooding in South Creek comprises mainstream flooding with overbank topping and flow within the flood plain on the eastern side of the creek. Appropriate flood storage is available within the remaining flood plain and no additional flood storage is proposed
The development potential of surrounding properties is not adversely affected by the filling proposal	There is no effect on development potential of surrounding properties as a result of the proposed filling proposal.
The flood liability of buildings on	Surrounding building and properties are not

Criteria	Scenario C Confirmation
surrounding properties is not increased	affected by flooding changes due to the proposed filling and no reduction in flood immunity has been shown in the analysis.
No local drainage flow/runoff problems are created by the filling	We confirm that no local drainage flow/runoff problems are created by the proposed filling.
The filling does not occur within high hydraulic hazard areas	Filling is proposed outside of high hydraulic areas.
The filling does not occur within the drip line of existing trees	Filling is proposed within rezoned rural land and existing trees are not affected by proposed filling activities.

Table 6.1. Scenario C - Confirmation of Penrith Council DCP C3 Criteria

6.3. Scenario D

With reference to **Section 5** and modelling results contained in **Appendices D** and **E** we provide confirmation in **Table 6.2** that each of the criteria set out in the Penrith Council Development Control Plan C3 for filling within flood affected land.

Criteria	Scenario D Confirmation
Flood levels are not increased by more than 0.1m by the proposed filling	1% AEP flood surface afflux mapping shows that the change in flood surface levels between pre and post development/ filling is less than 0.1m.
Downstream velocities are not increased by more than 10% by the proposed filling	We confirm that the proposed filling does not increase downstream velocities by more than 10%. Refer to pre and post development velocity comparisons included in **Appendix E**.
Proposed filling does not redistribute flows by more than 15%	We confirm that the proposed filling does not redistribute flows by more than 15% where flows are greater than $0.4m^3/s/m$. Refer to pre and post development flow comparisons included in **Appendix E**.
The potential for cumulative effects of possible filling proposals in that area is minimal	The analysis shows that changes to flood surface levels and hydraulics are localized to the proposed filling areas. We confirm that cumulative effects of filling are not applicable to the proposed filling and development.
There are alternative opportunities for flood storage.	The flooding in South Creek comprises mainstream flooding with overbank topping and flow within the flood plain on the eastern side of the creek. Appropriate flood storage is available within the remaining flood plain and no additional flood storage is proposed.
The development potential of surrounding	There is no effect on development potential of

Criteria	Scenario D Confirmation
properties is not adversely affected by the filling proposal	surrounding properties as a result of the proposed filling proposal.
The flood liability of buildings on surrounding properties is not increased	Surrounding building and properties on the western side of South Creek are not affected by flooding changes due to the proposed filling and no reduction in flood immunity has been shown in the analysis. Residential properties located on Mandalong Close, to the west of the proposed fill area, currently experience flooding with depths in the order of 500-700mm during the 1% AEP event. A small change in depth of 20-30mm (refer Points 15,16, 17 in Appendix E) has been modeled in the vicinity of the residential buildings following filling. As the buildings are currently subject to flooding, the small increase in the 1% AEP flood level does not impact the flood immunity of the dwellings.
No local drainage flow/runoff problems are created by the filling	We confirm that no local drainage flow/runoff problems are created by the proposed filling.
The filling does not occur within high hydraulic hazard areas	Filling is proposed outside of high hydraulic areas.
The filling does not occur within the drip line of existing trees	Filling is proposed within rezoned rural land and existing trees are not affected by proposed filling activities.

Table 6.2. Scenario D - Confirmation of Penrith Council DCP C3 Criteria

6.4. Land Rezoning & Future Development

Rezoning of the Mamre West land to IN1 Industrial is proposed to the land which is outside of the existing flood zone and which has been shown in Scenarios C and D to meet Penrith Councils requirements for filling of flood effected land.

The area of land outside the high hydraulic zone but outside of proposed filling zone shown in Scenario C, on the south-western corner of The Site, will be excluded from rezoning and no further assessment would be made in this location. The area on the western side of The Site, which is outside of the high hydraulic zone and the currently shown filling area will however be rezoned IN1. The expectation for development associated with this area is that development can be considered in this area subject to further modelling and assessment which shows the outcomes of this report have been met. Measures which may be considered to assist in facilitating development in these zones include culverts, flood storage, suspended floors, open channels, surface roughness improvements or other hydraulic improvement measures. Further separate flood modelling specific to the development in this area would need to be undertaken to confirm that the flood level, velocity and flow distribution remain consistent with this report and councils Development Control Plan Criteria.

6.5. Flood Safety and Evacuation

The flood level during the PMF event for Scenarios C and D are shown in **Figures 6.1** and **6.2** below.

The evacuation route during a PMF flood event, for both Scenario C and D, will be able to be made via the new estate road and Mamre Road. To the north of the development area, Mamre Road will be flood affected however safe evacuation in a southerly direction can be made.

As discussed in the South Creek Flood Study, the main flood peak in South Creek will occur 20-24 hours after the flood producing storm. Given the timing of flooding in the creek after the storm event, it is expected that suitable warning time for evacuation can be made prior or during flooding events.

It should be noted that local inundation of Mamre Road are likely from local tributaries and industrial catchments on the east of Mamre Road. Evacuation from The Site will be available to the south along Mamre Road. Evacuation from the northern Mandalong Industrial precinct would need to be made via Erskine Park Road to the north and east of the development site.

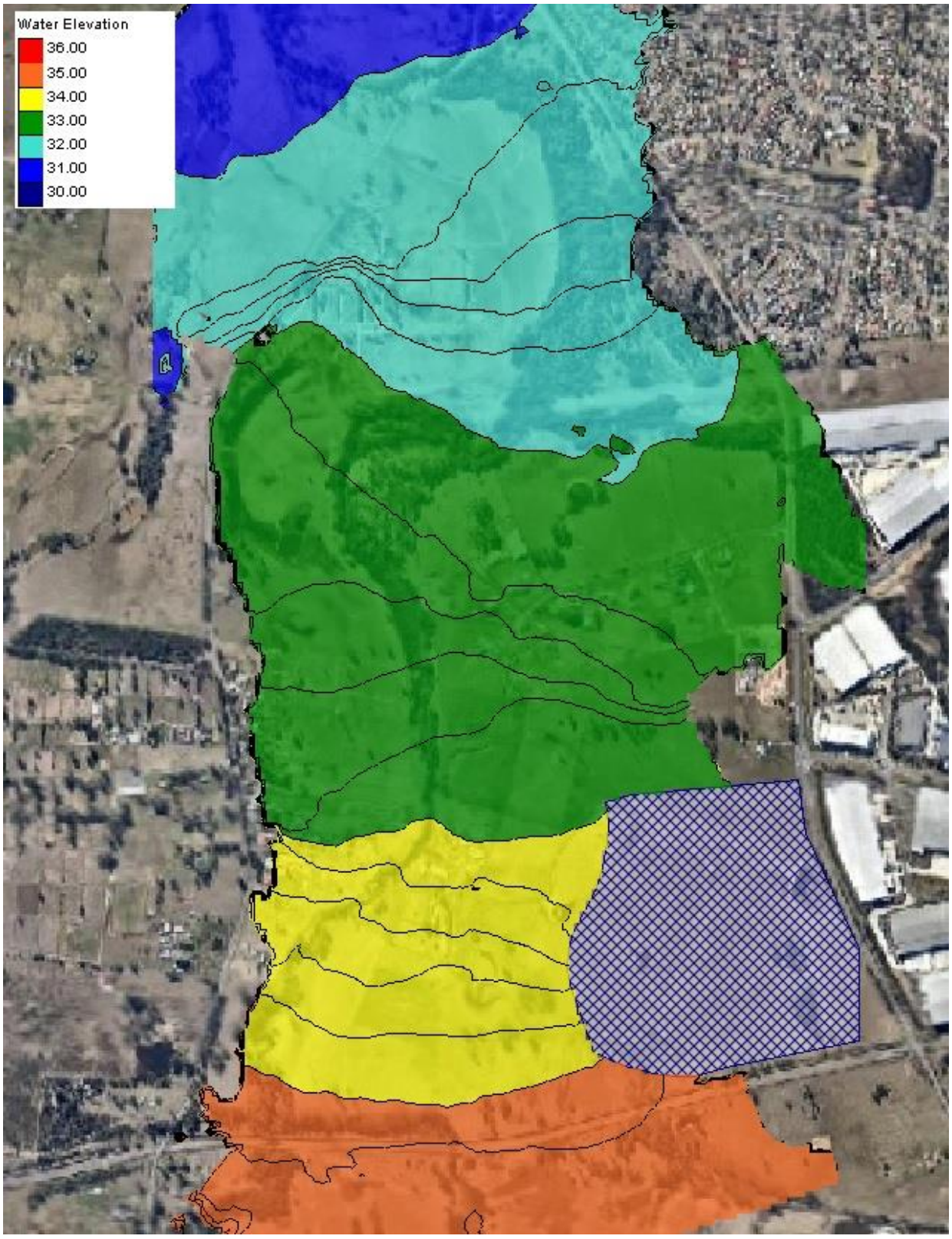

Figure 6.1. Scenario C - PMF Flood Level

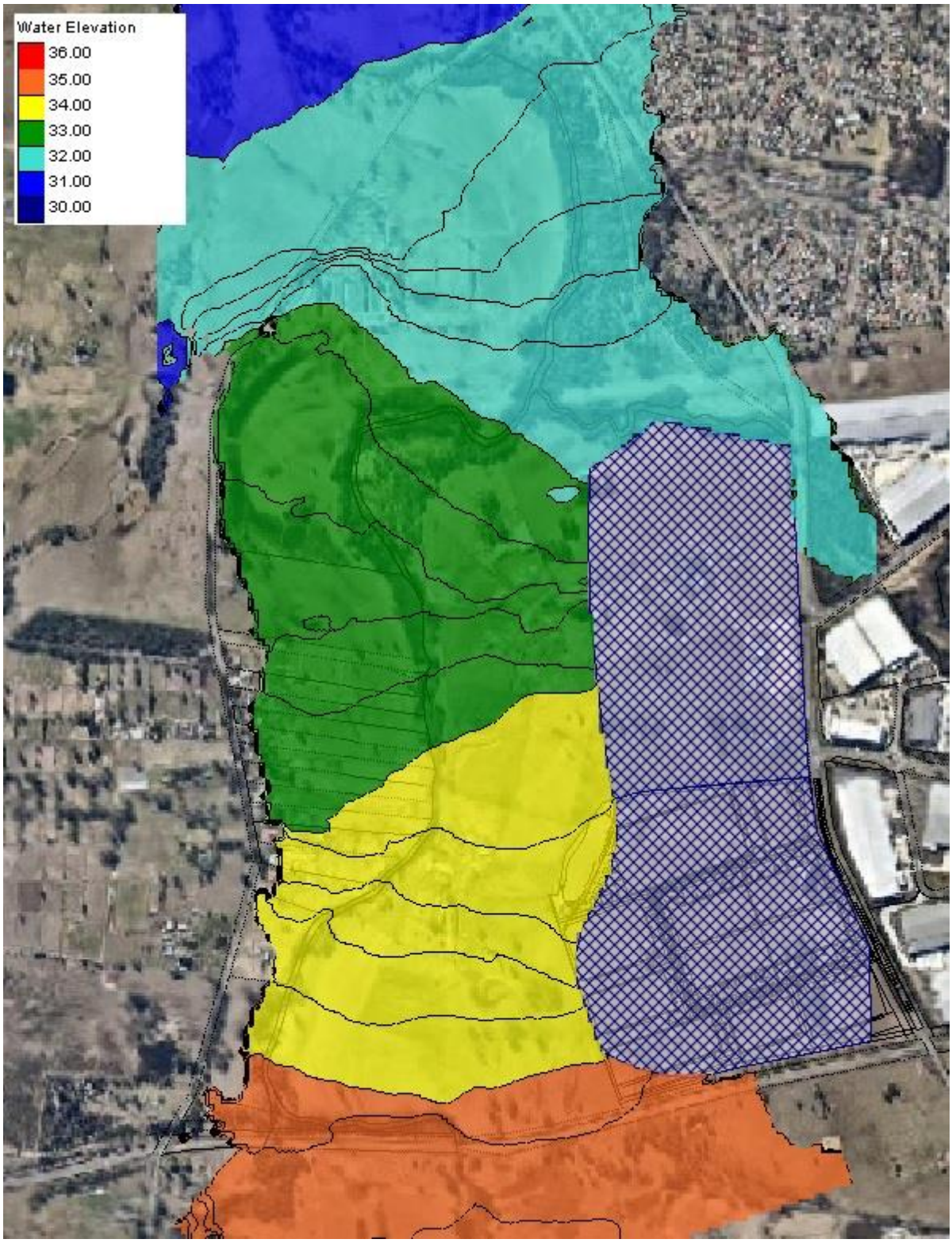

Figure 6.2. Scenario D - PMF Flood Level

7. CONCLUSION

This Overland Flow Report has been prepared in support of a development and rezoning of a parcel of land at 585-649 Mamre Road, Orchard Hills.

The Site has been identified by Penrith City Council as being affected by overland flows associated with South Creek. Stage 1 Modelling and reporting has been produced by Costin Roe Consulting and this report has been prepared in the Stage 2 modelling of the existing creek, within the zone of the development. This modelling has been undertaken to complete scenario modelling relating to the development of the land and its effect on the flooding as a result of development. The development site has been considered in the context of an extended land area being proposed as the Subject Land for inclusion in the final structure plan for the Broader Western Sydney Employment Area and subsequent rezoning as part of the State Environmental Planning Policy (Western Sydney Employment Area) 2009 as appropriate.

The TUFLOW hydrodynamic flood model of South Creek produced in the Stage 1 modelling has been used for scenario testing of The Site and The Site in conjunction with the Future Industrial Land (current Mandalong Residential Area) The Stage 2 Scenario modelling has been completed following inclusion of the recommendations contained in the Worley Parsons Peer Review of the Stage 1 model build and report.

The TUFLOW modelling shows that filling of flood effected land can be made which meets the criteria set out in the Penrith City Council Development Control Plan C3. Two filling and development scenarios, Scenario C and Scenario D, are available which suits the proposed staging of development in the precinct between The Site and Future Industrial development area.

The rezoning will be completed such that area on the south-western corner of The Site will be excluded from rezoning and no further assessment would be made in this location. The area on the western side of The Site, which is outside of the high hydraulic zone will be rezoned IN1. The expectation for the development associated with this area is that development may be undertaken in this area subject of the outcomes of this report being met. Measures which may be considered to assist in facilitating development in these zones include culverts, flood storage, suspended floors, open channels, surface roughness improvements or other hydraulic improvement measures. Further separate flood modelling specific to the development in this area would need to be undertaken to confirm that the flood level, velocity and flow distribution remain consistent with this report and councils Development Control Plan Criteria.

The information provided in this Report is intended to inform the relevant stakeholders including the surrounding property owners, Department of Planning and Environment, council engineers and planners, and the property developer of the opportunities and constraints associated with the development and rezoning of the land in relation to overland flow and flooding within South Creek.

APPENDIX A

SCENARIO A TUFLOW RESULTS

(Figures represent predicted values at the peak of each event)

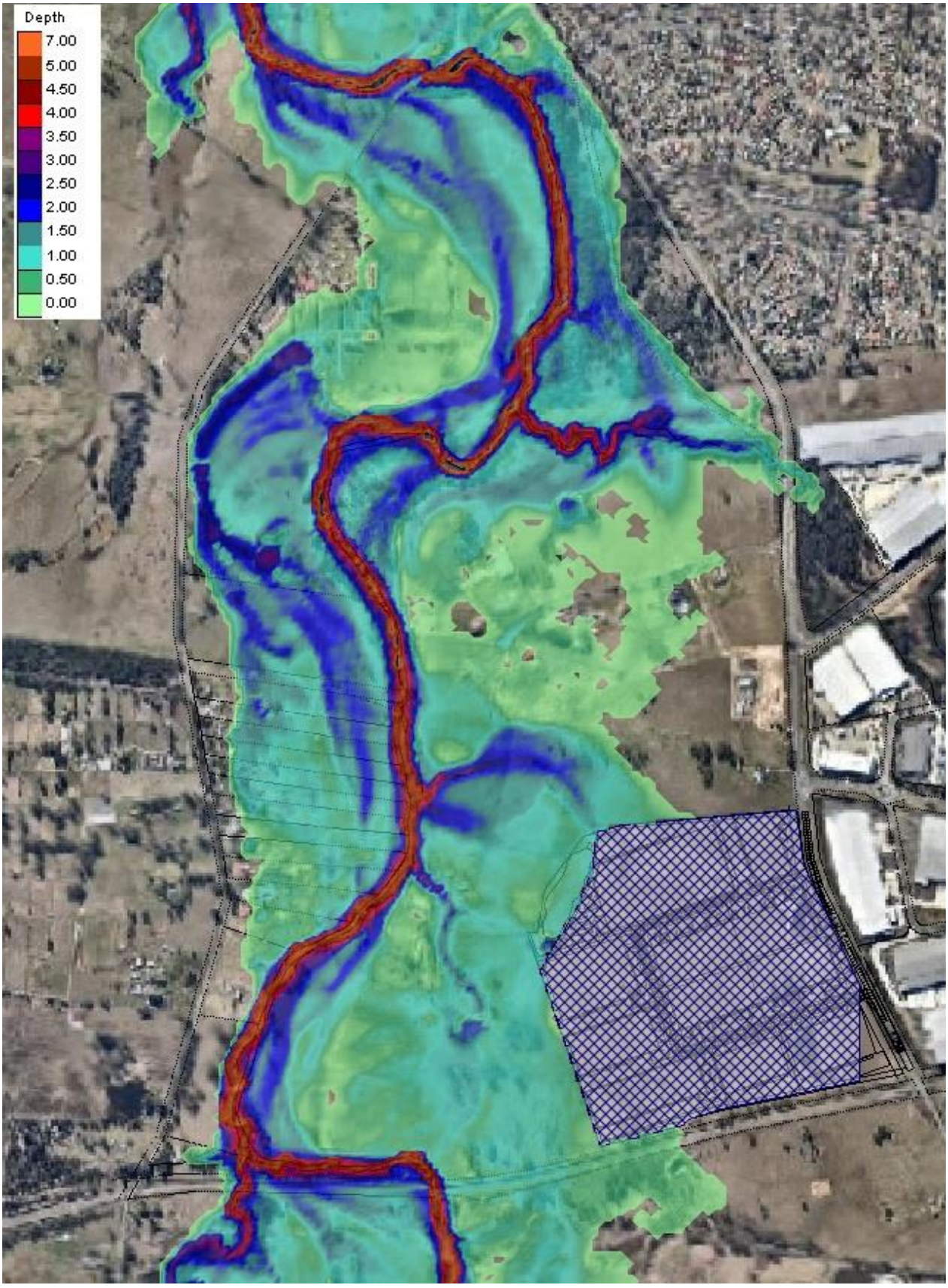

Figure A1 – 5% AEP Flood Depths

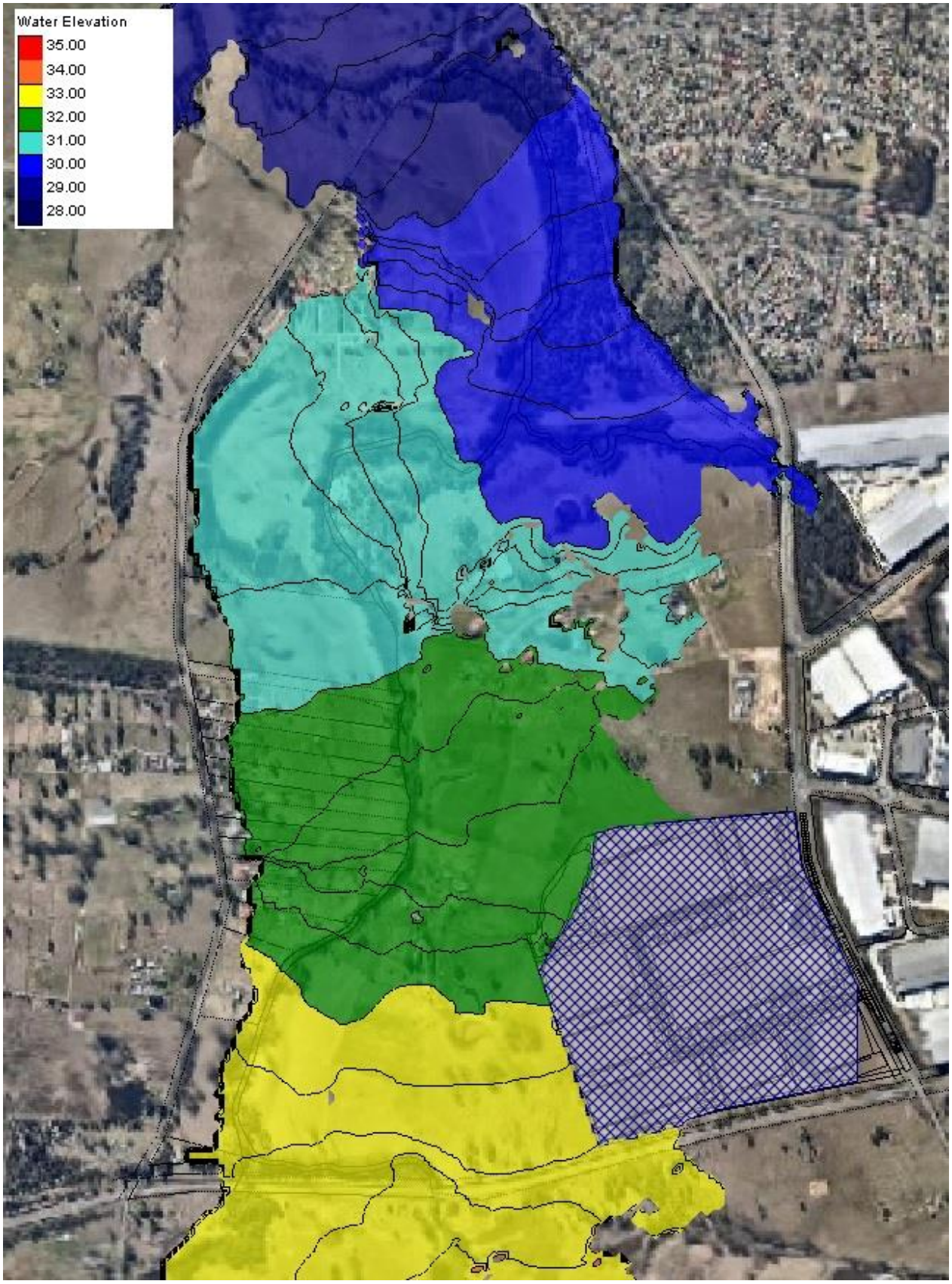

Figure A2 – 5% AEP Flood Levels

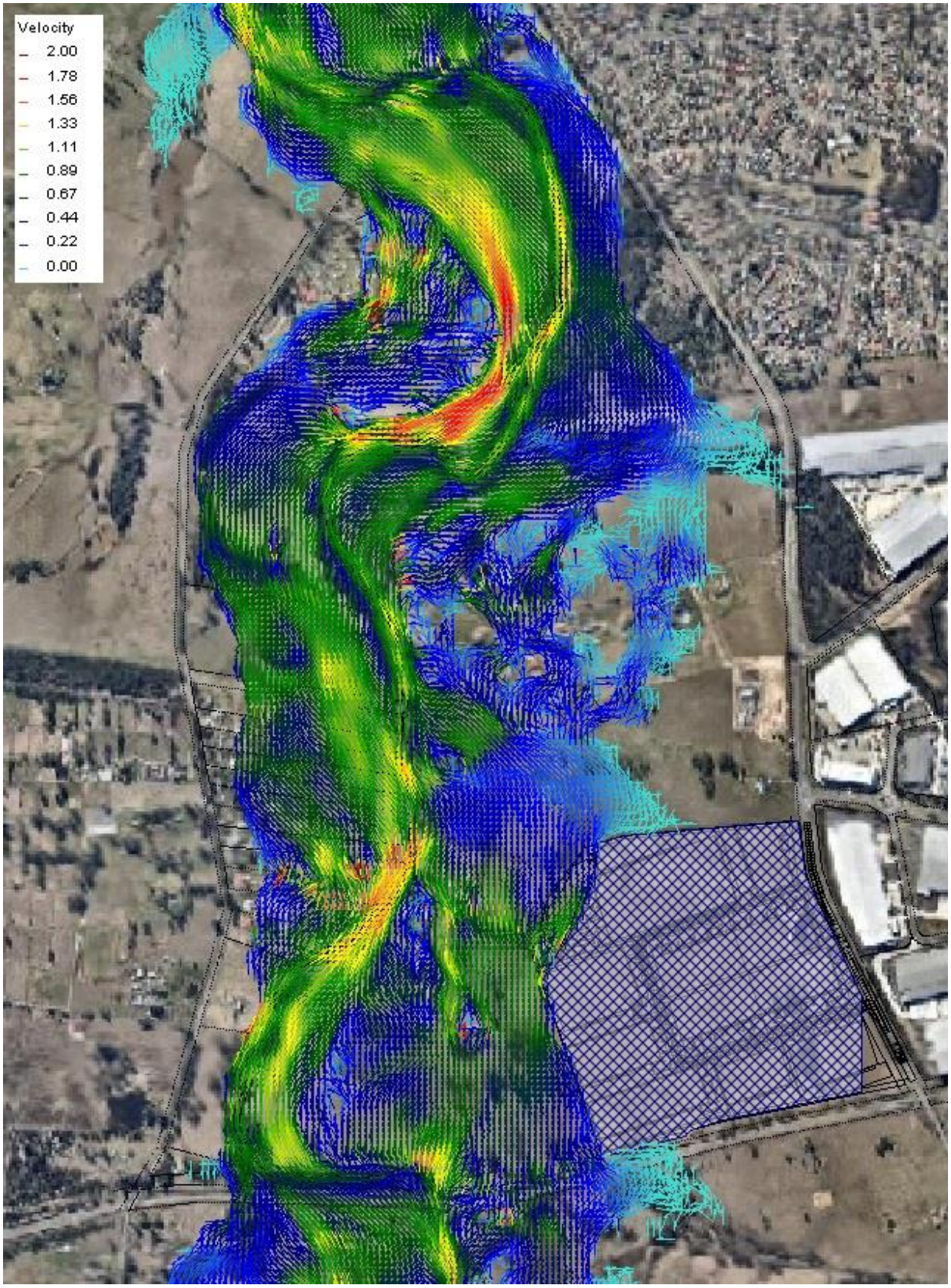

Figure A3 – 5% AEP Flood Velocity

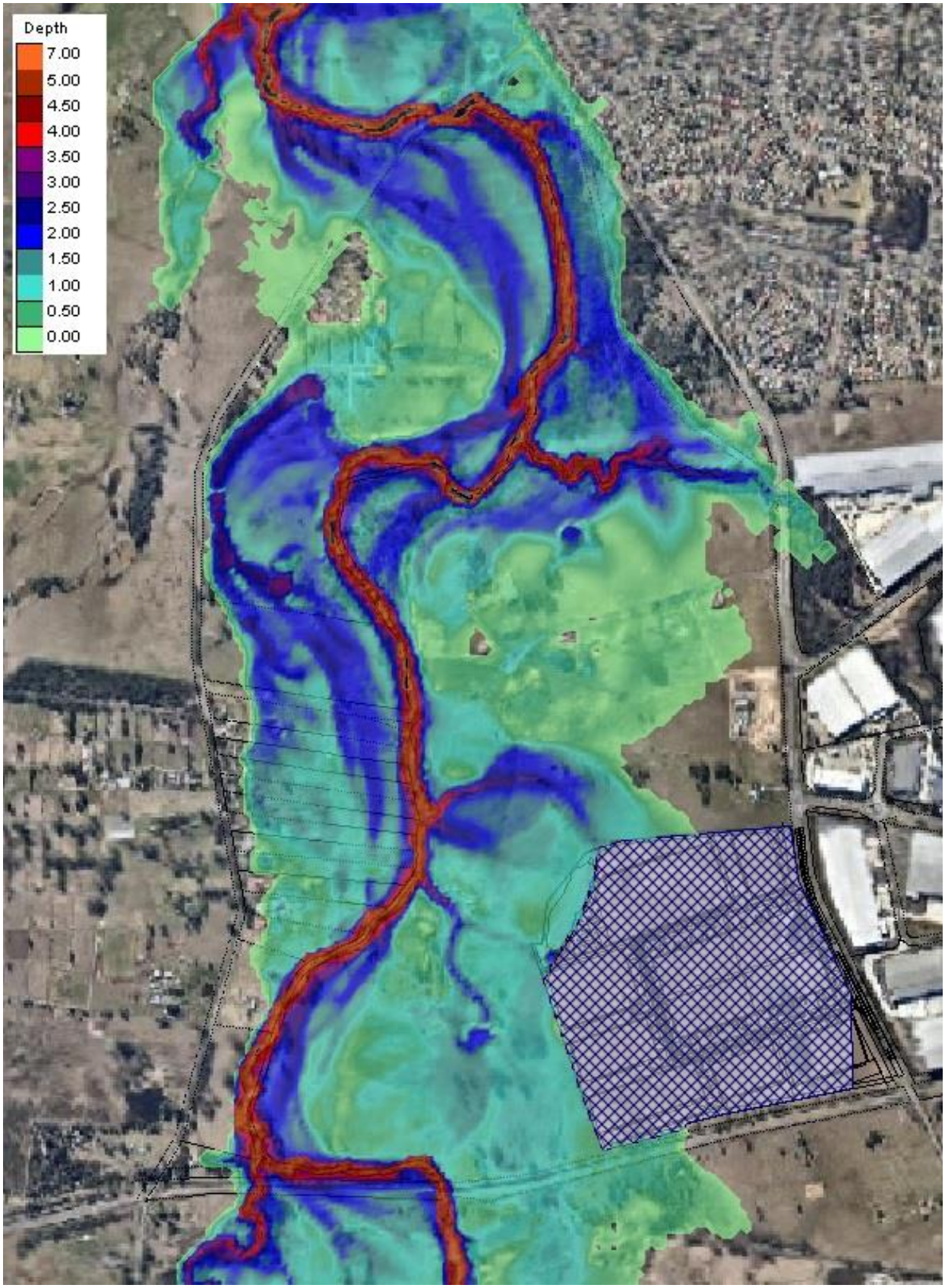

Figure A4 – 1% AEP Flood Depth

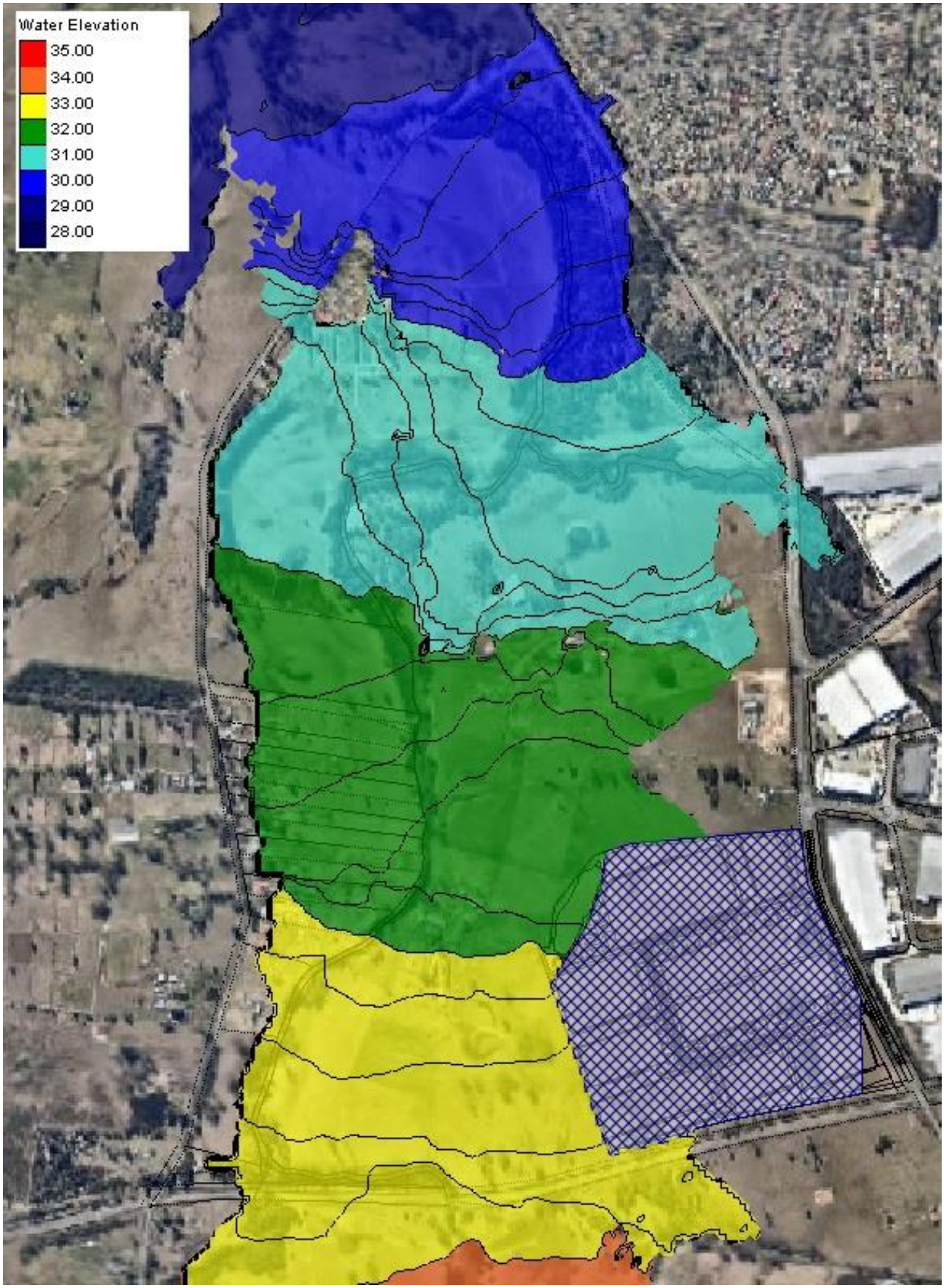

Figure A5 – 1% AEP Flood Levels

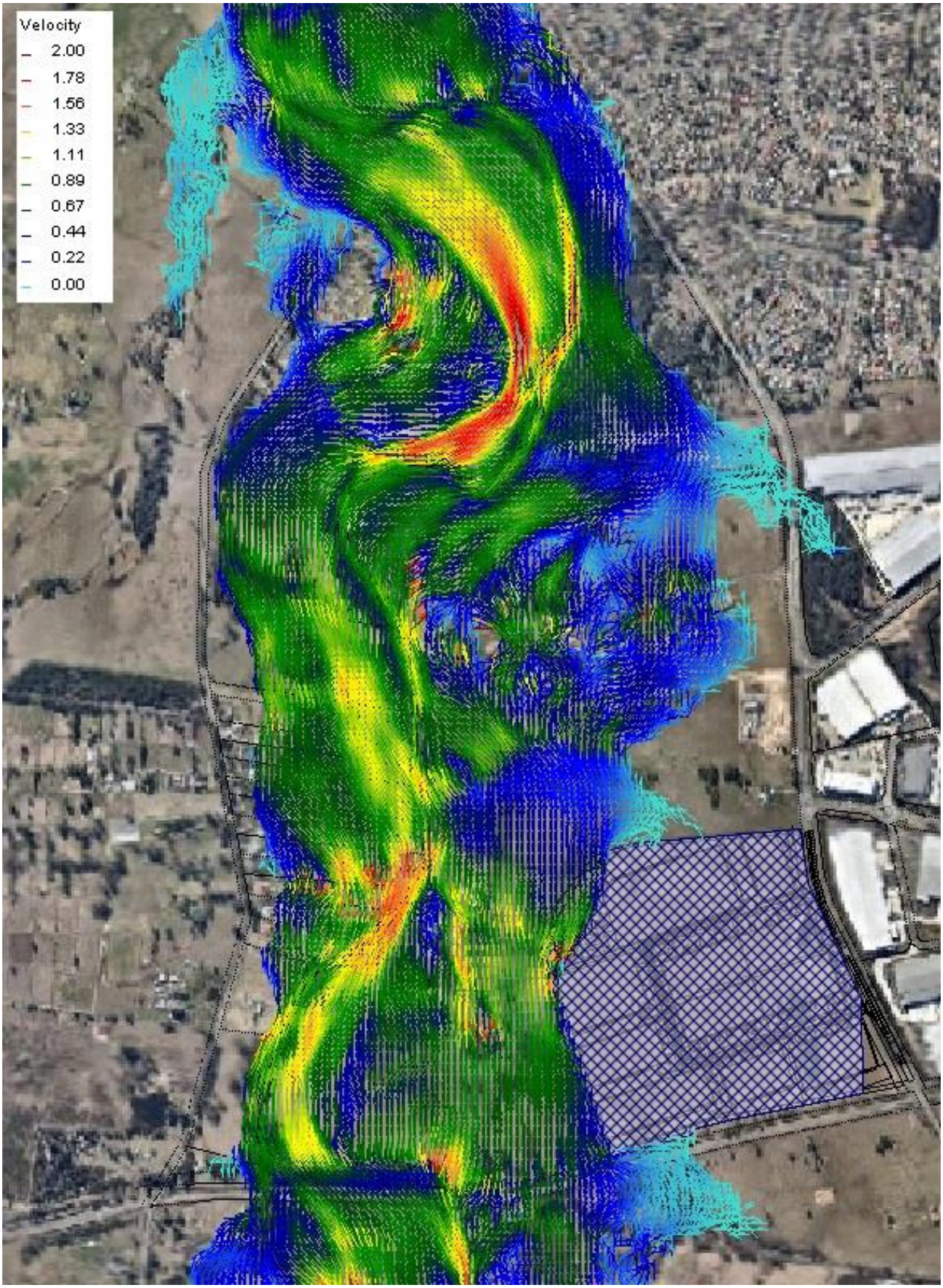

Figure A6 – 1% AEP Flood Velocity

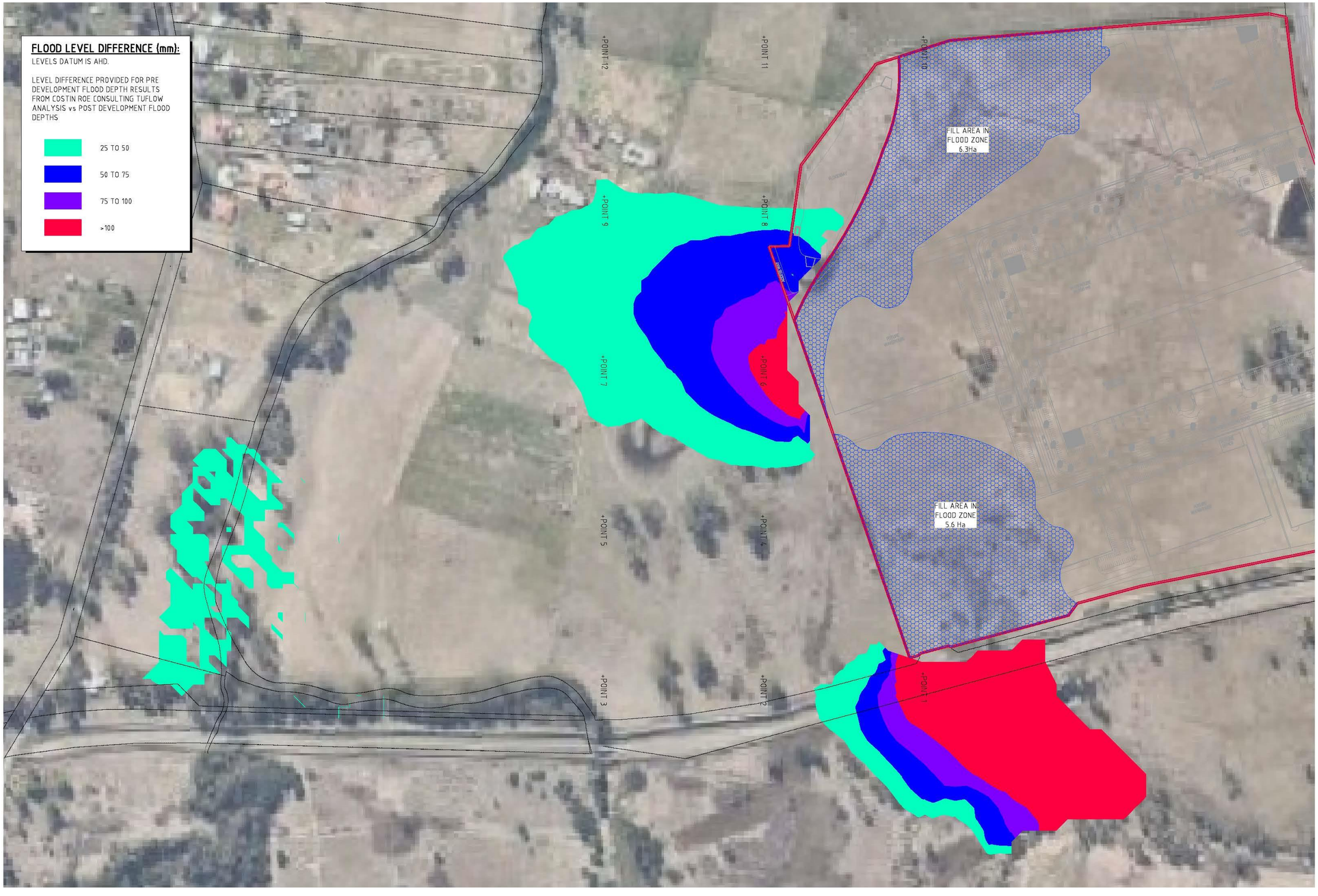

Figure A7 – 1% AEP Flood Level Afflux

APPENDIX B

SCENARIO B TUFLOW RESULTS

(Figures represent predicted values at the peak of each event)

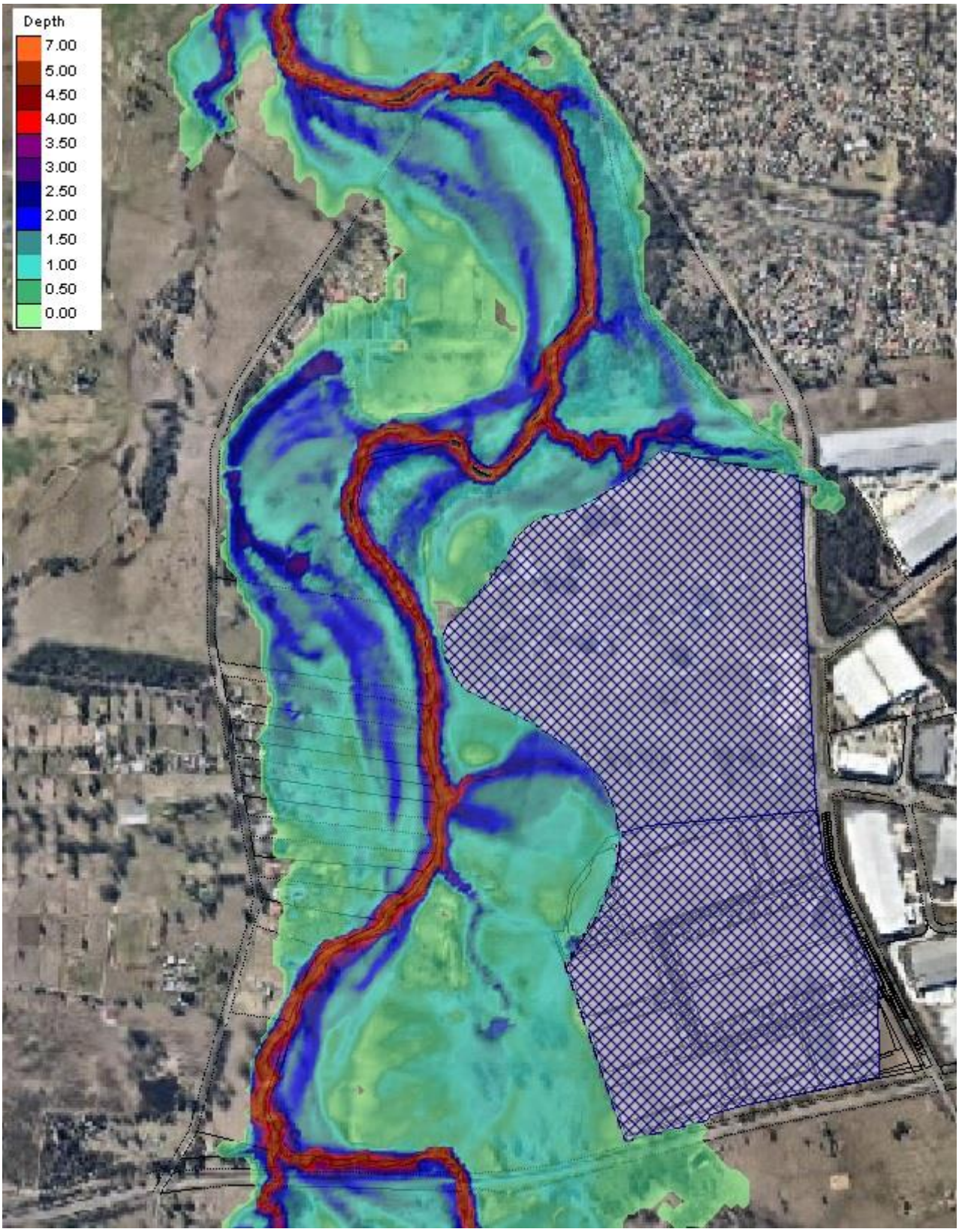

Figure B1 – 5% AEP Flood Depths

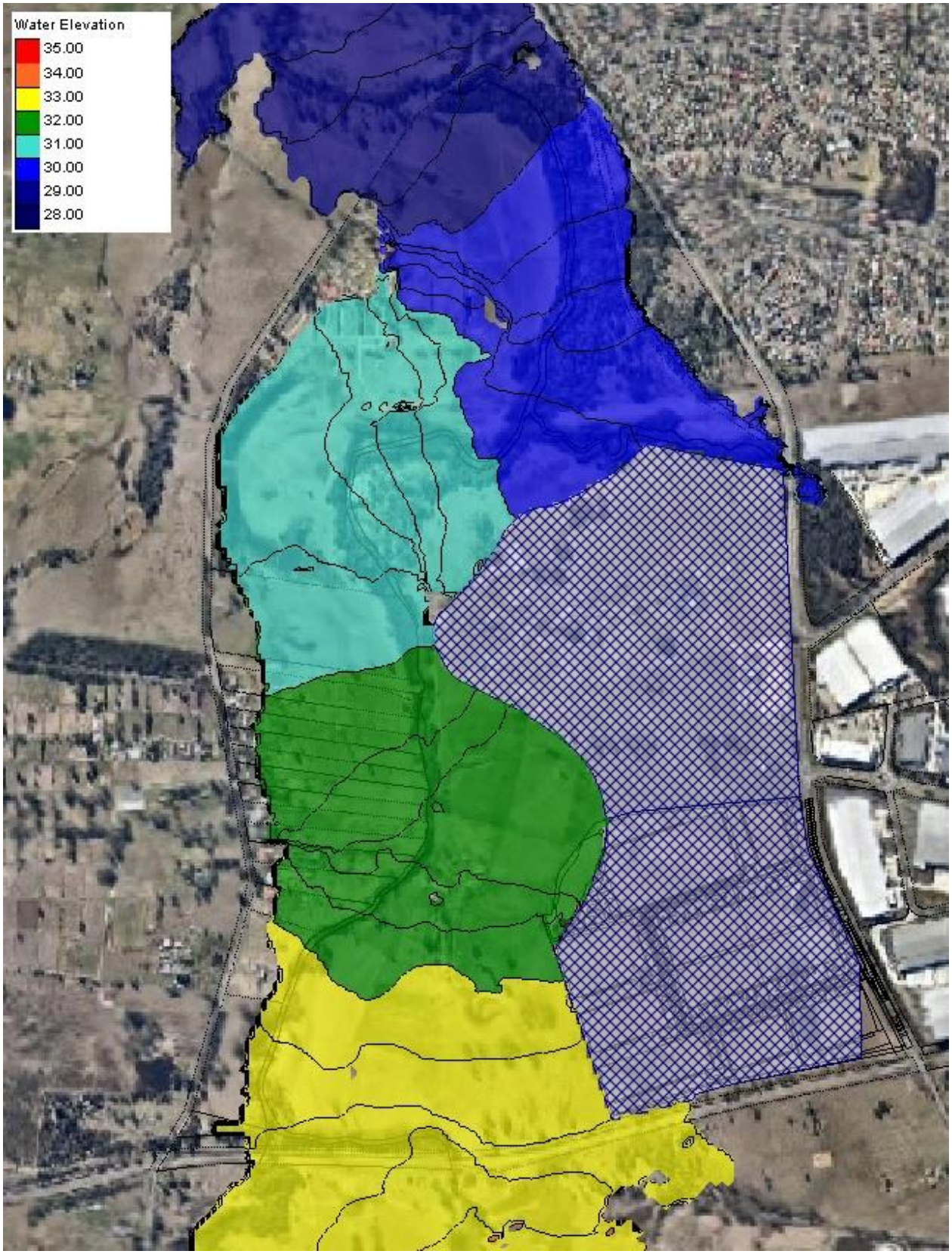

Figure B2 – 5% AEP Flood Levels

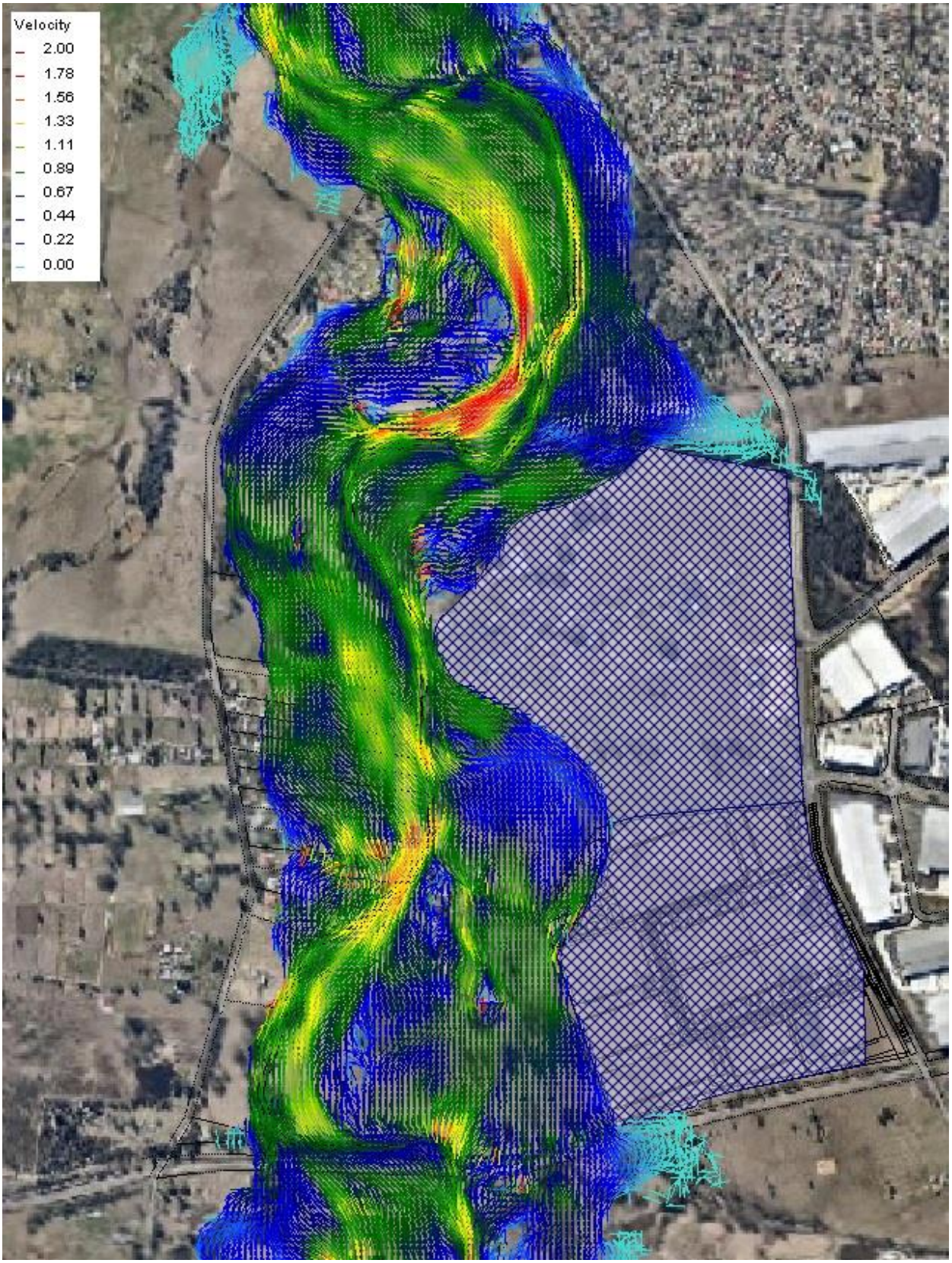

Figure B3 – 5% AEP Flood Velocity

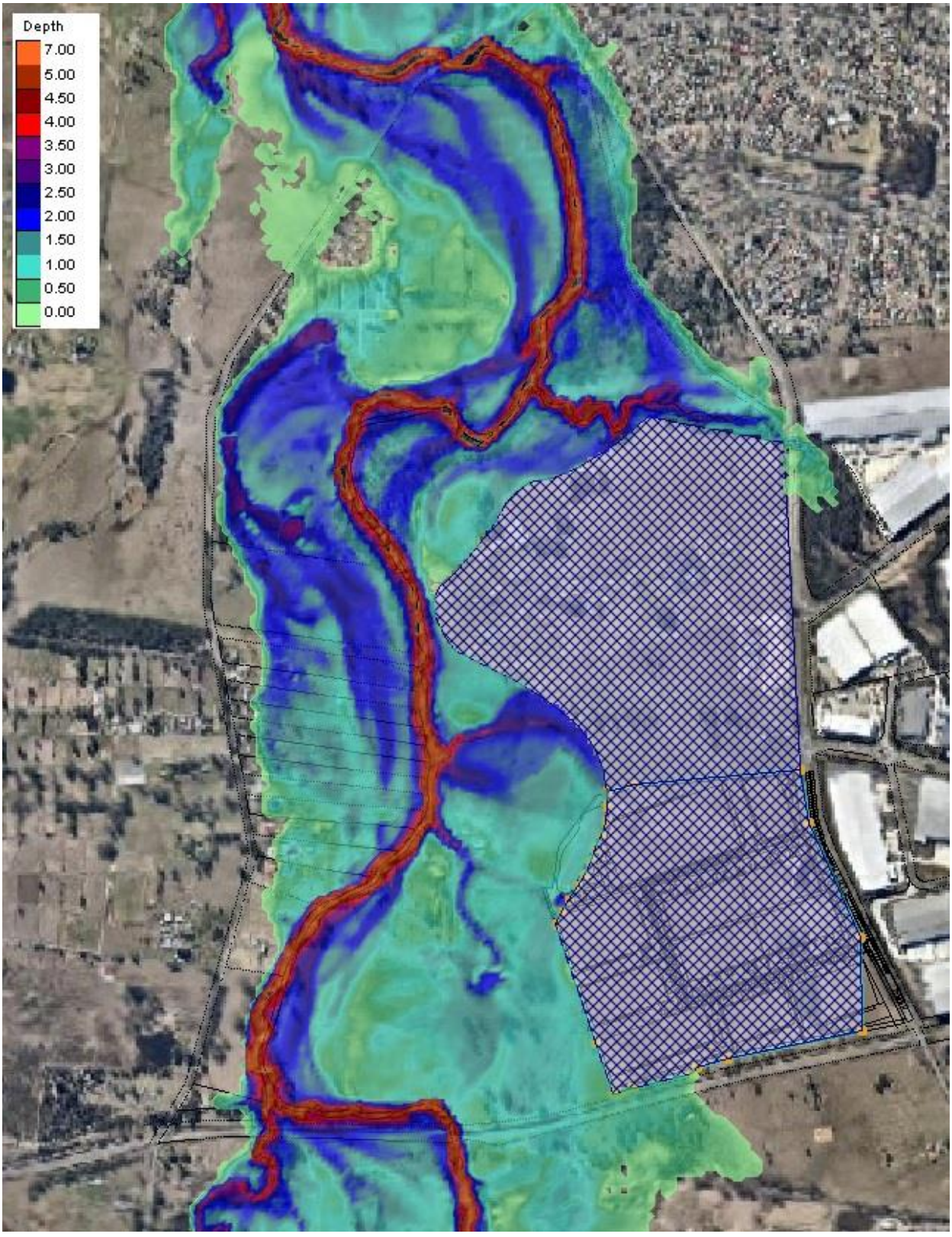

Figure B4 – 1% AEP Flood Depth

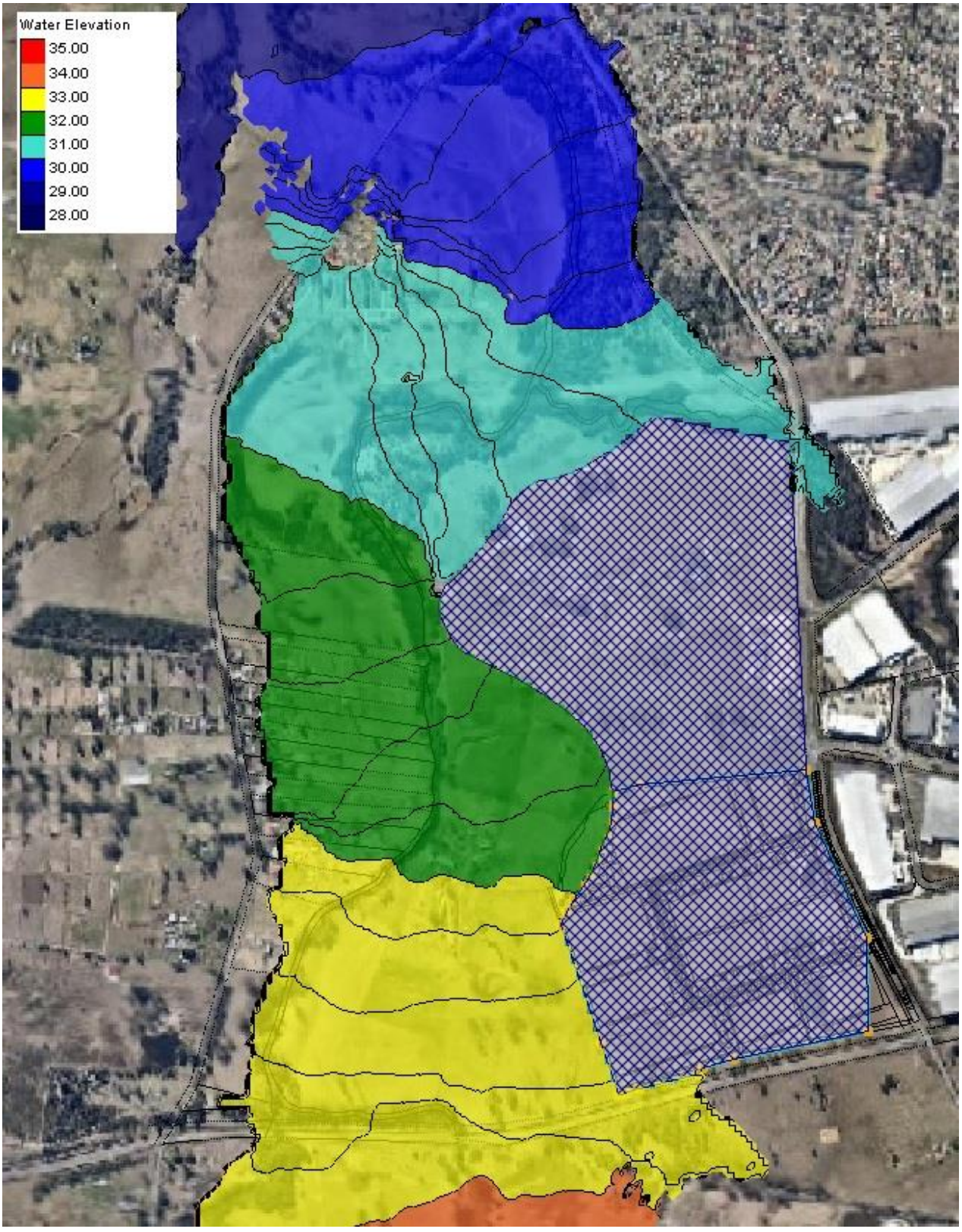

Figure B5 – 1% AEP Flood Levels

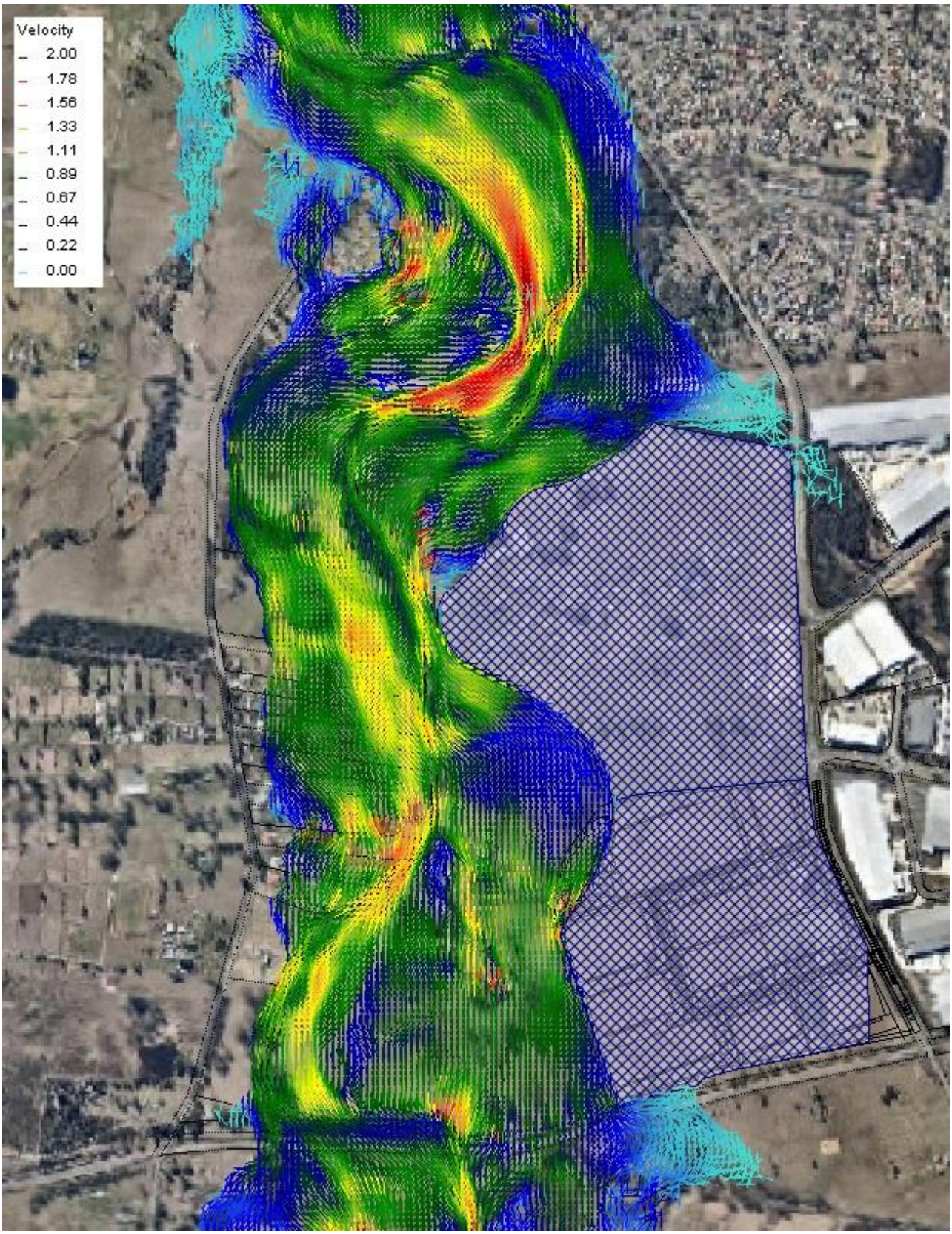

Figure B6 – 1% AEP Flood Velocity

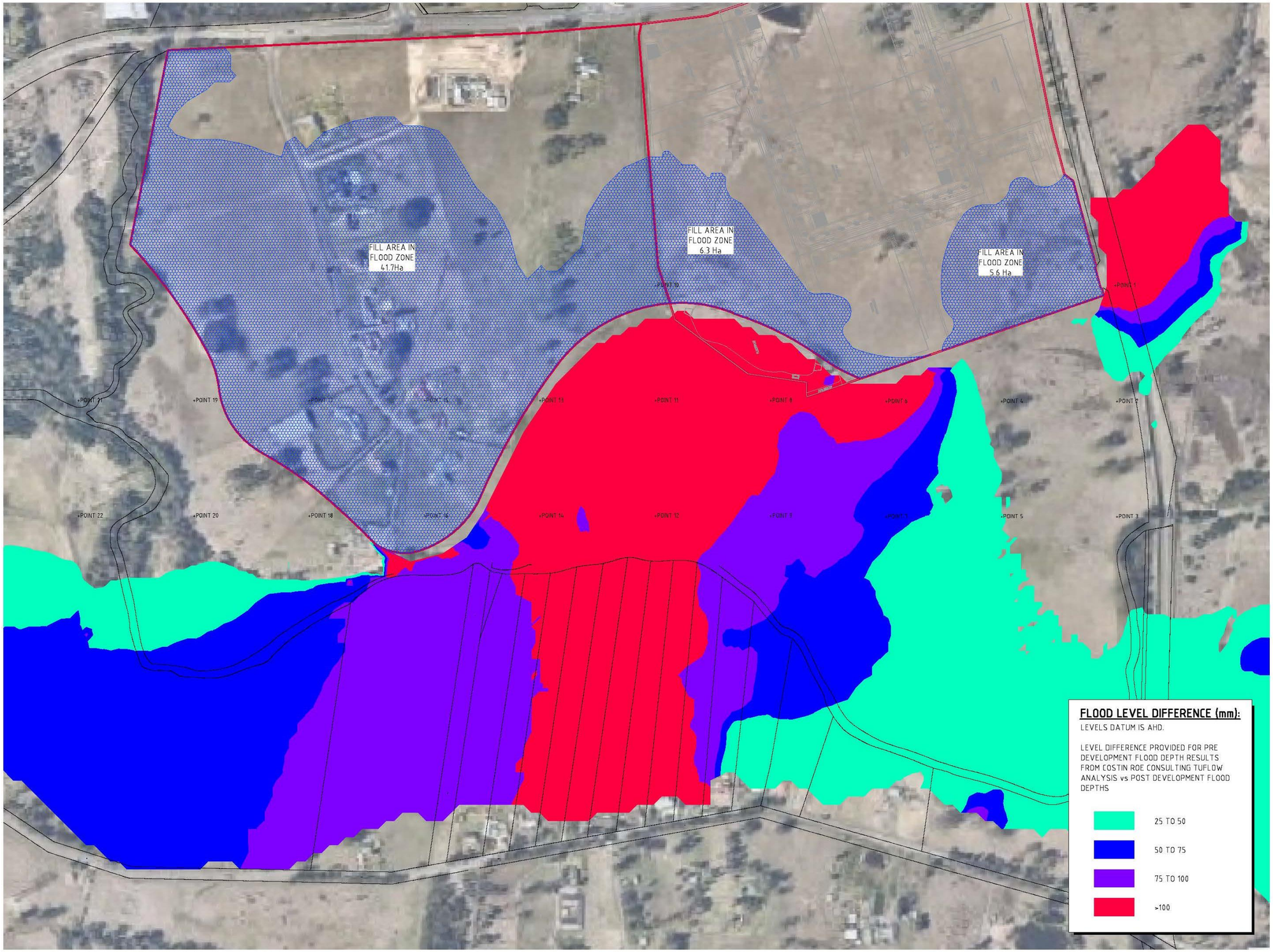

Figure B7 – 1% AEP Flood Level Afflux

APPENDIX C

SCENARIO C TUFLOW RESULTS

(Figures represent predicted values at the peak of each event)

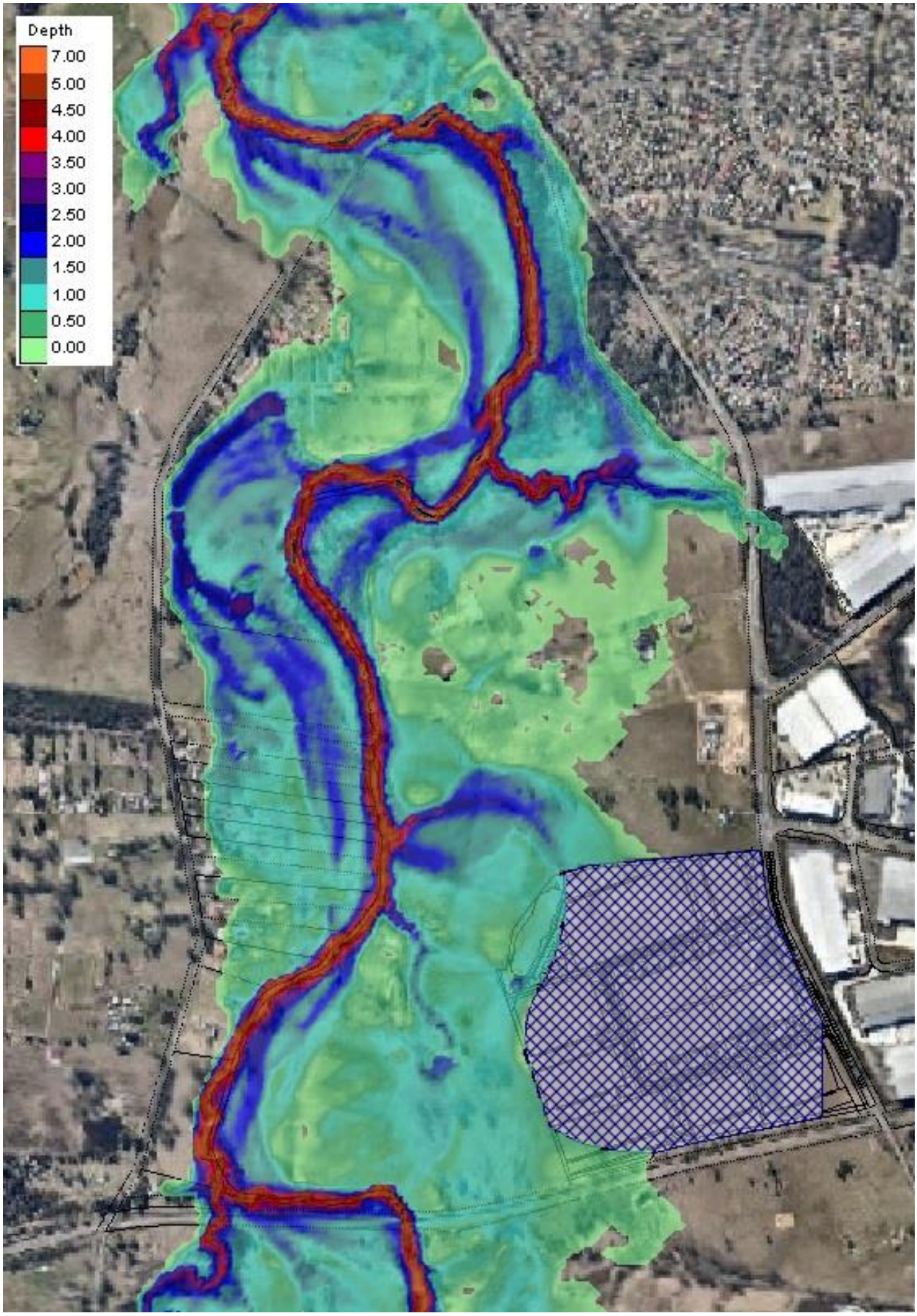

Figure C1 – 5% AEP Flood Depths

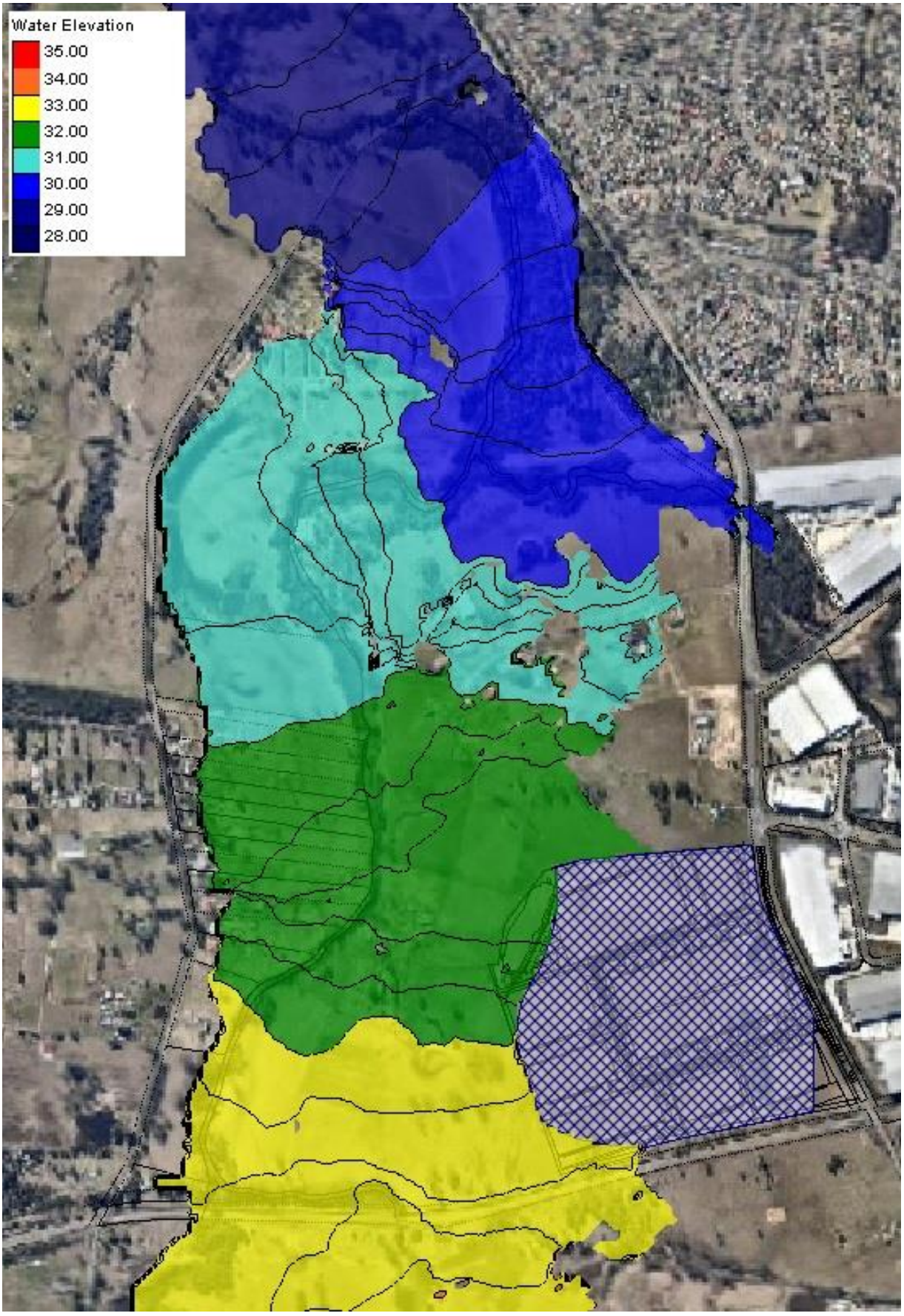

Figure C2 – 5% AEP Flood Levels

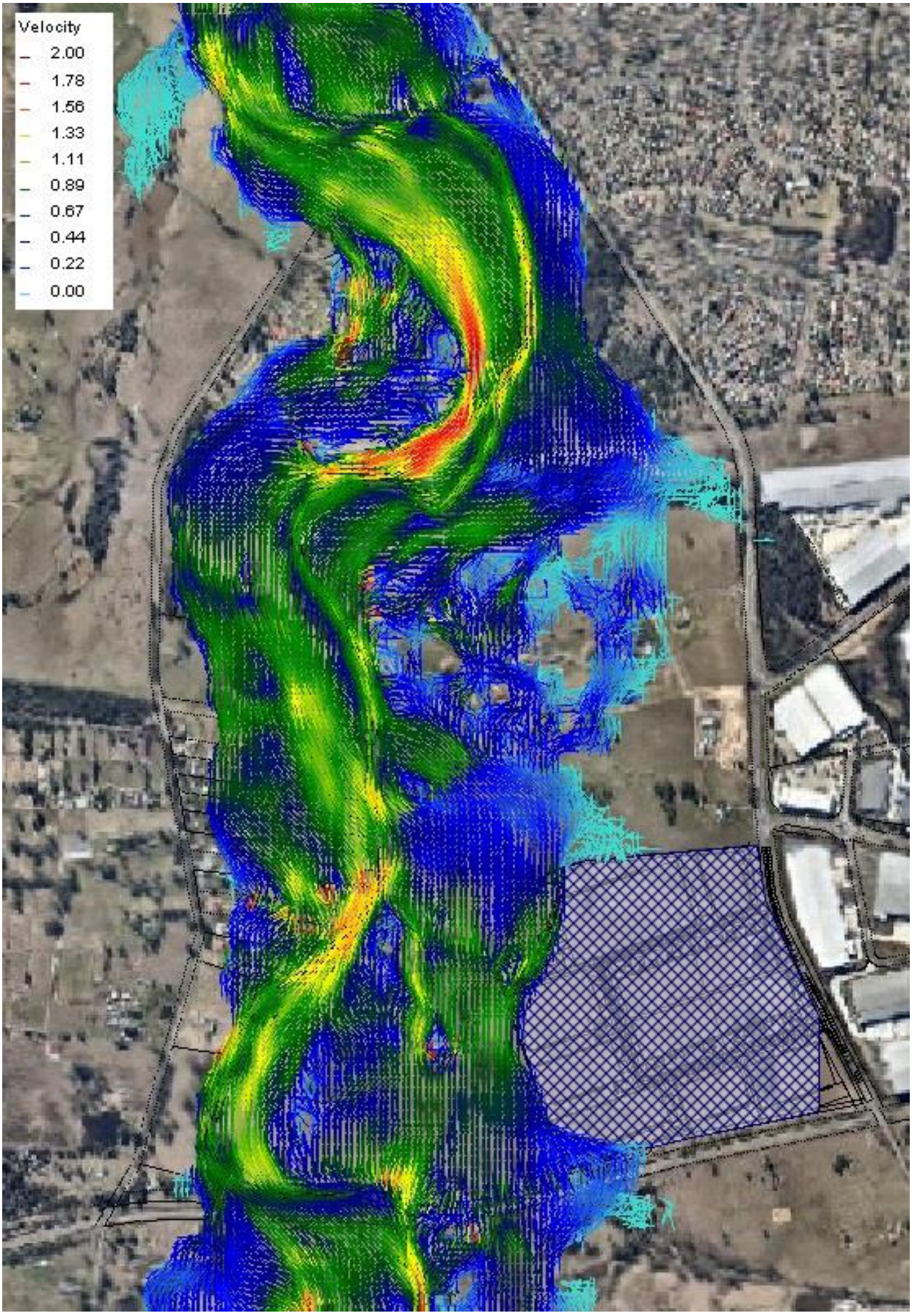

Figure C3 – 5% AEP Flood Velocity

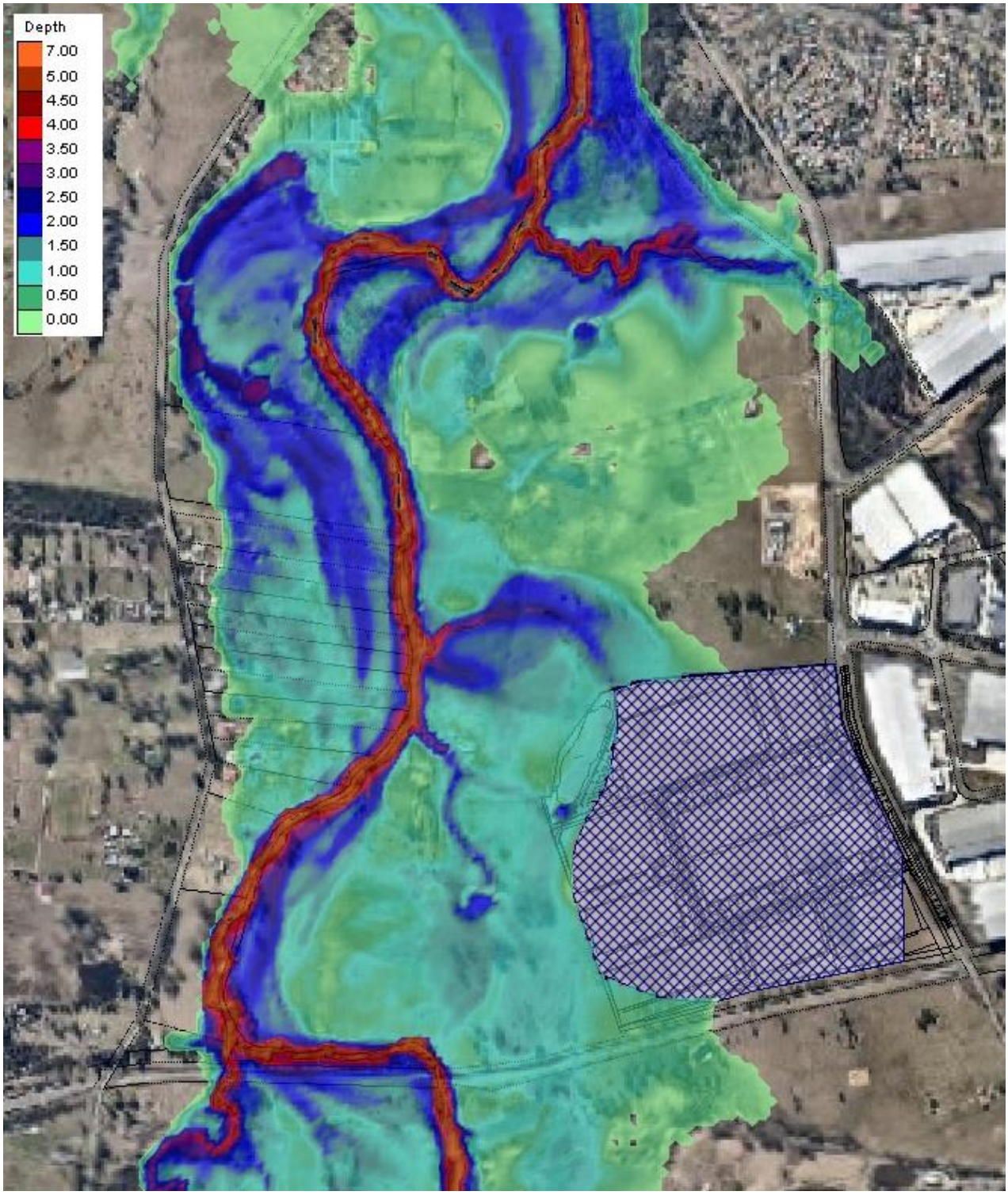

Figure C4 – 1% AEP Flood Depth

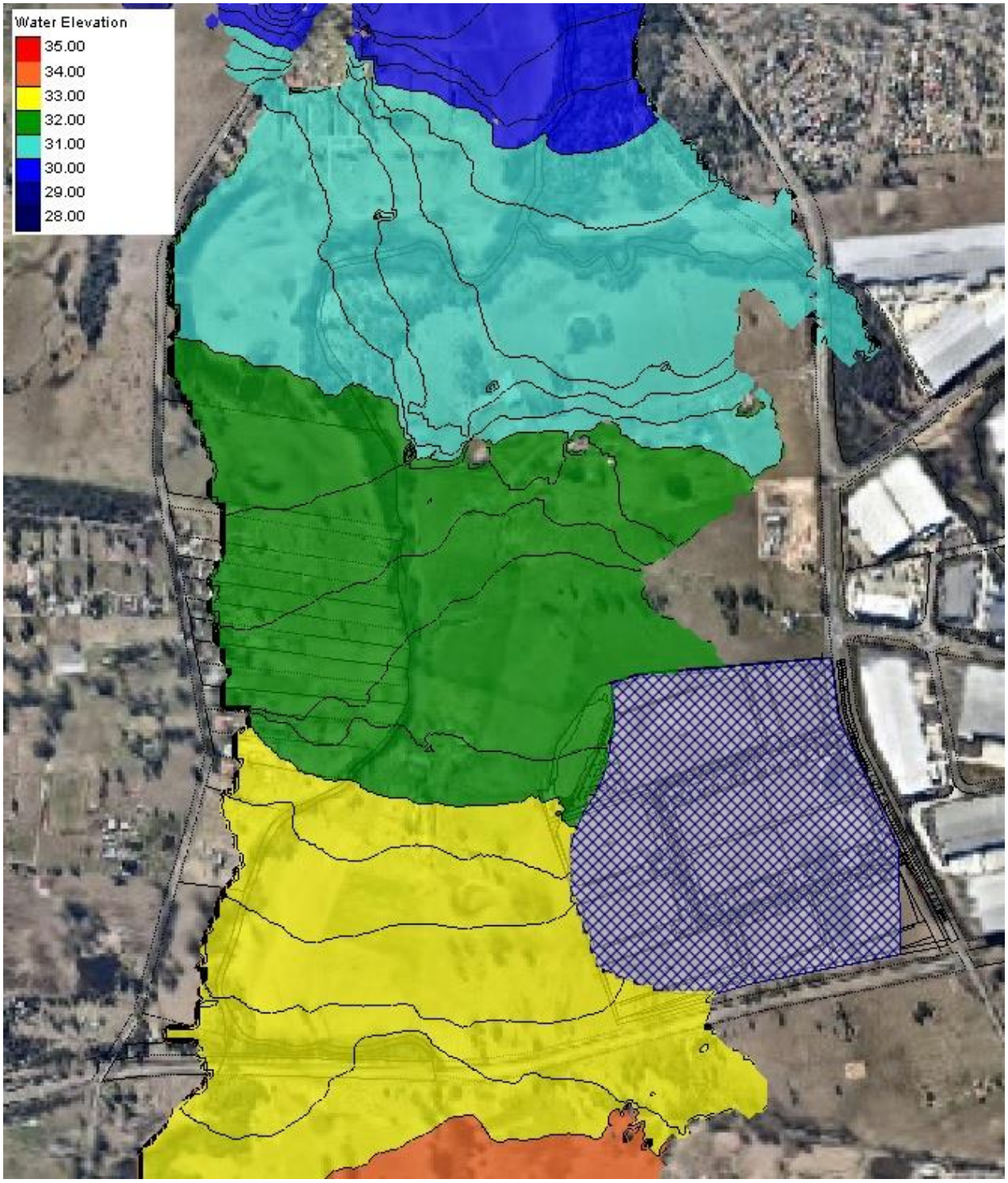

Figure C5 – 1% AEP Flood Levels

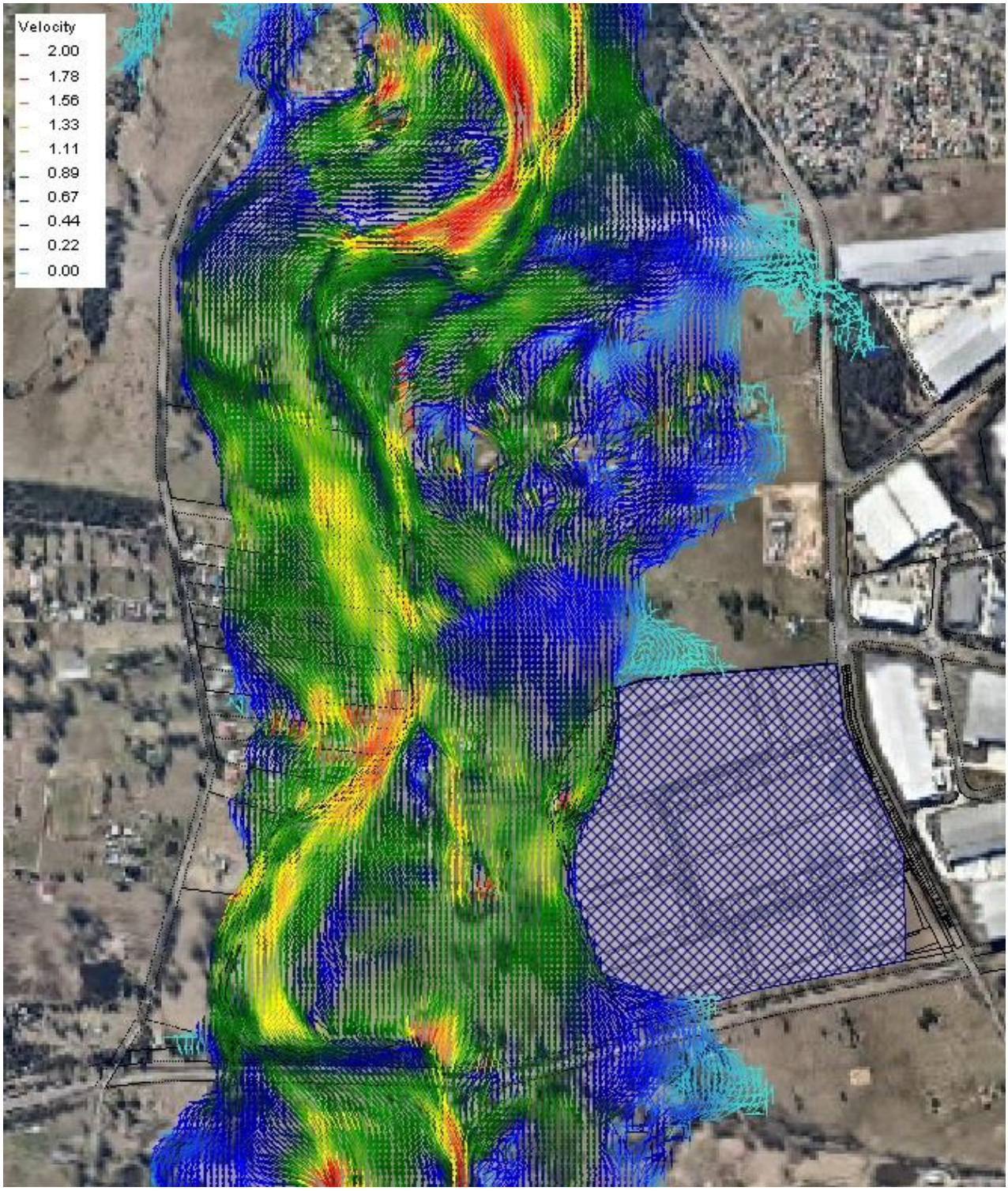

Figure C6 – 1% AEP Flood Velocity

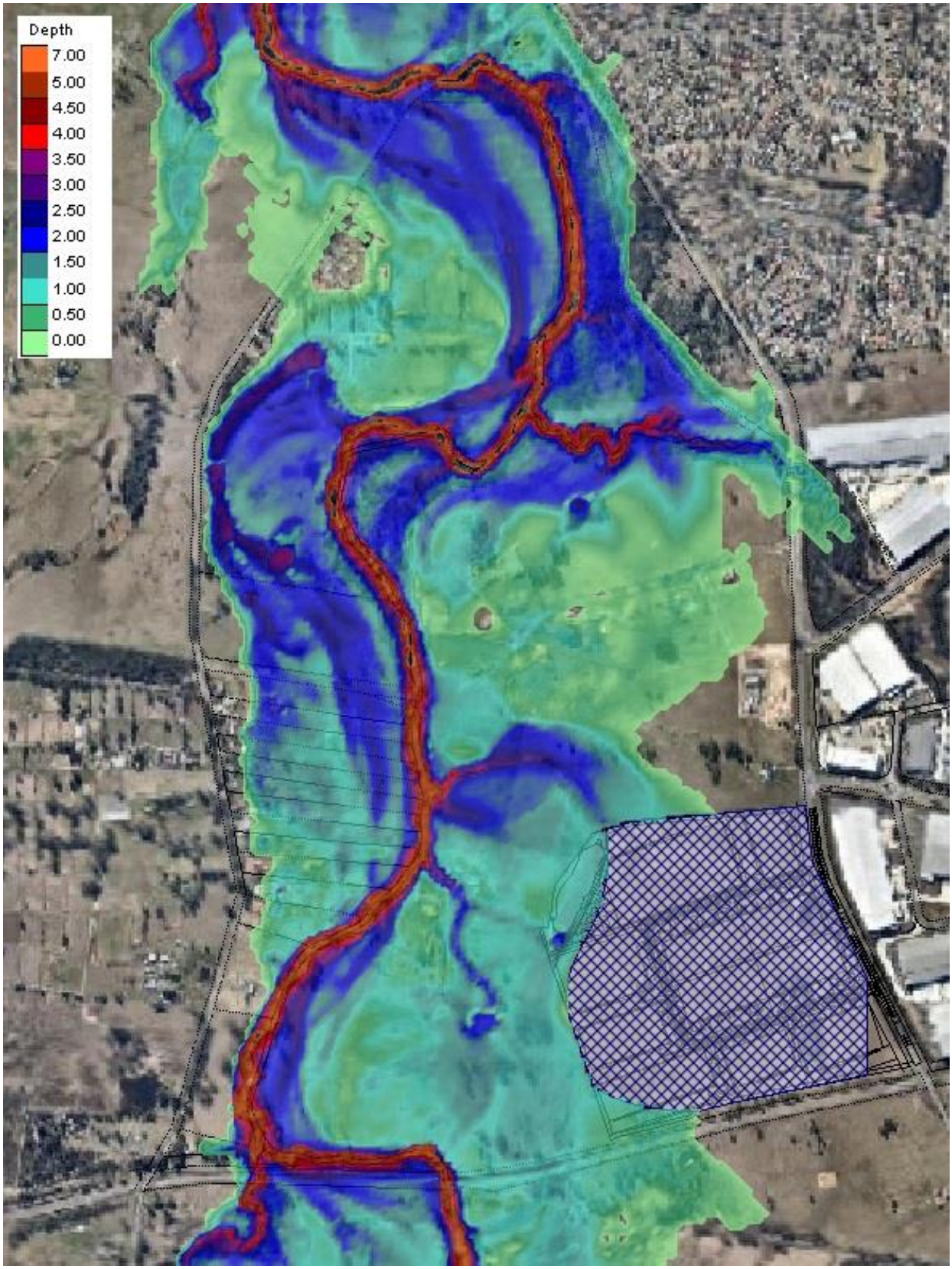

Figure C7 – 0.5% AEP Flood Depth

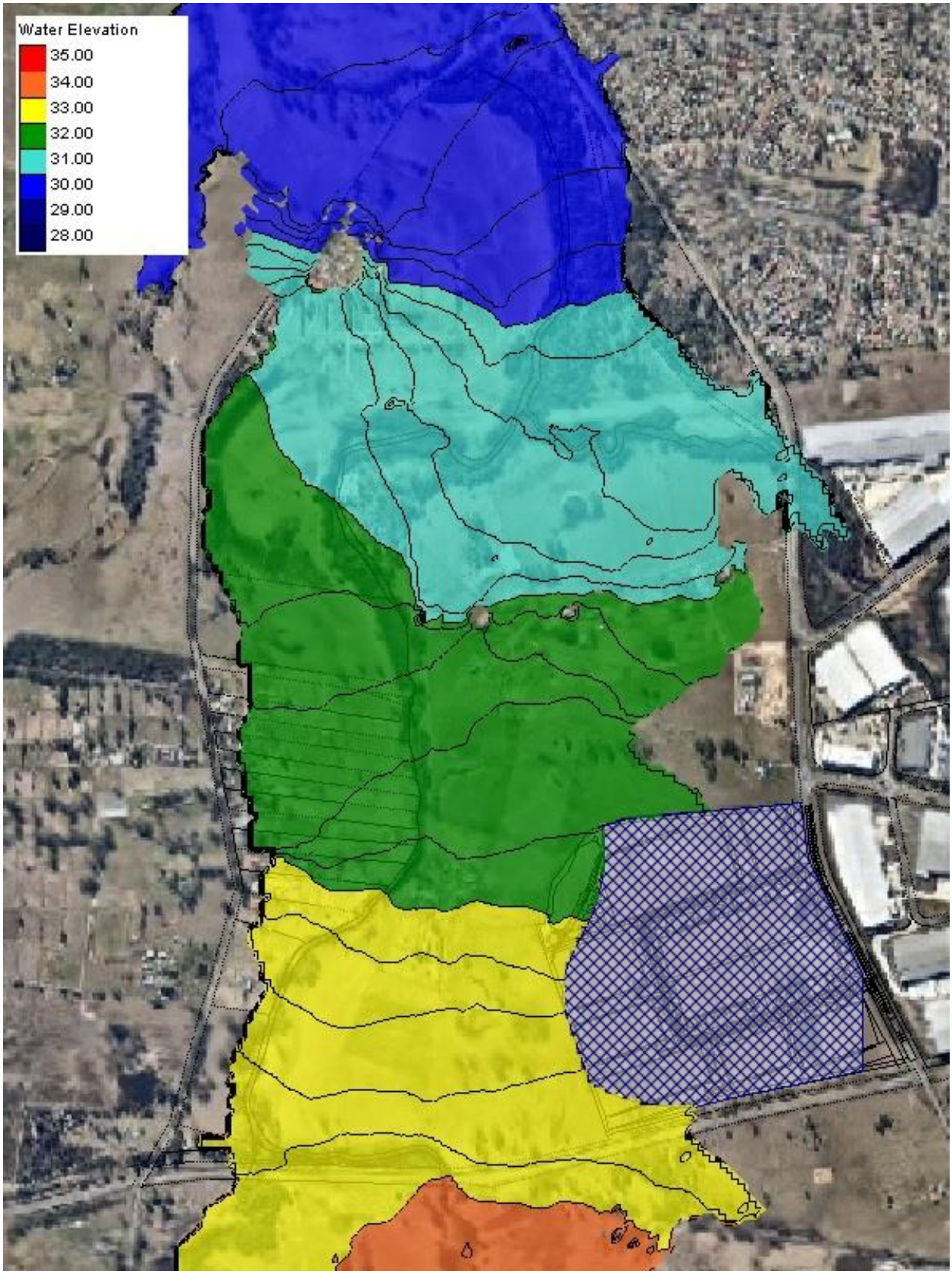

Figure C8 – 0.5% AEP Flood Levels

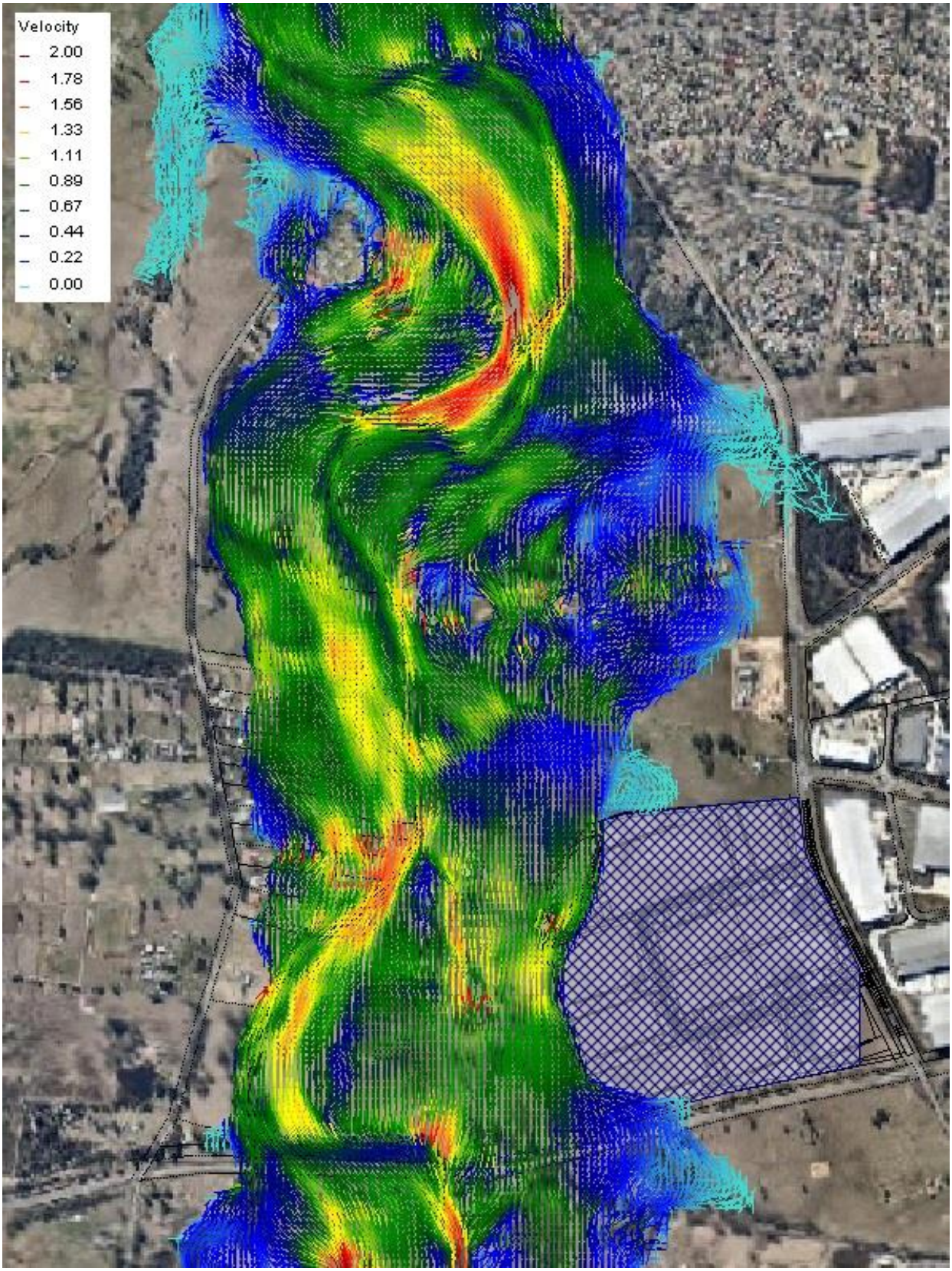

Figure C9 – 0.5% AEP Flood Velocity

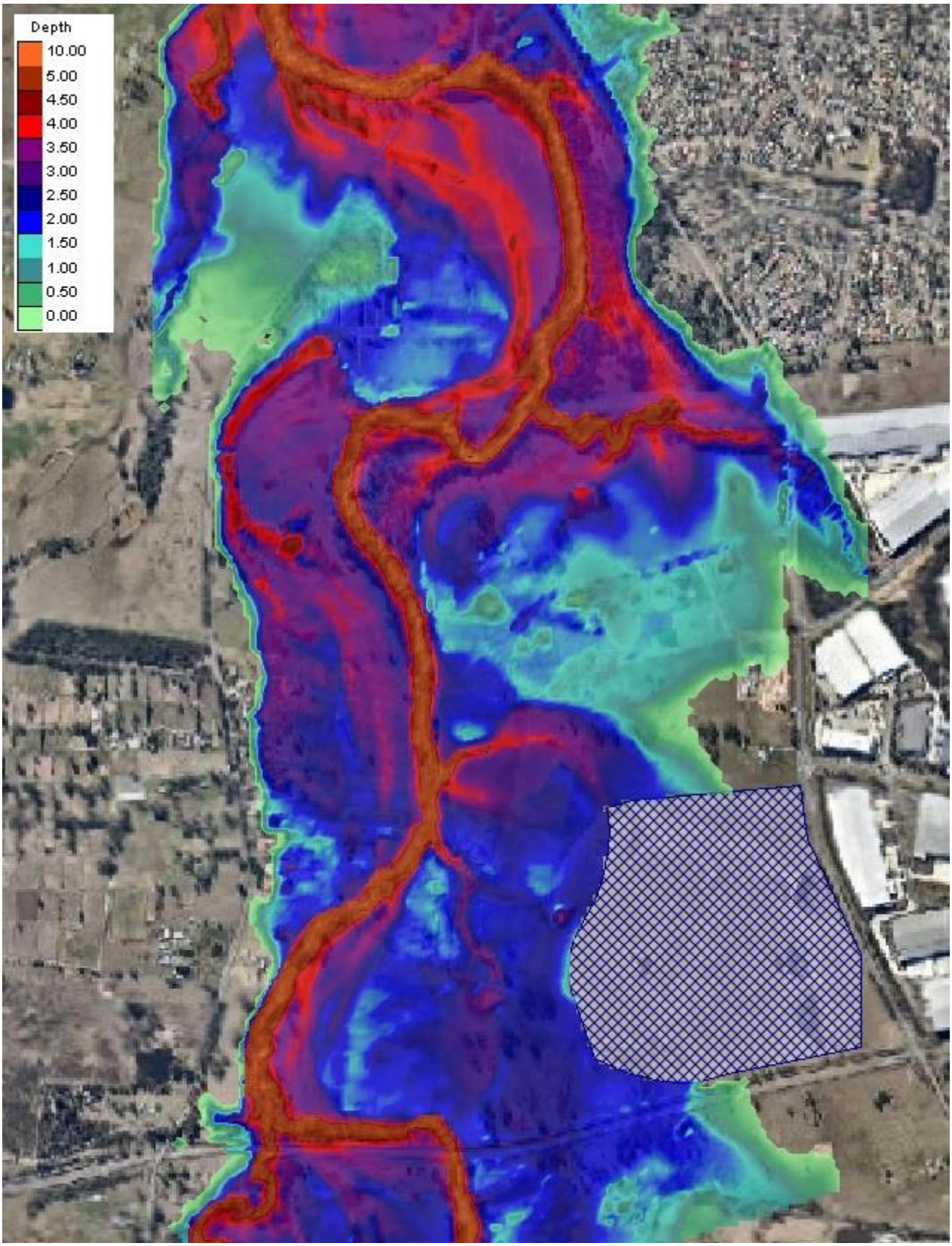

Figure C10 – PMF Flood Depth

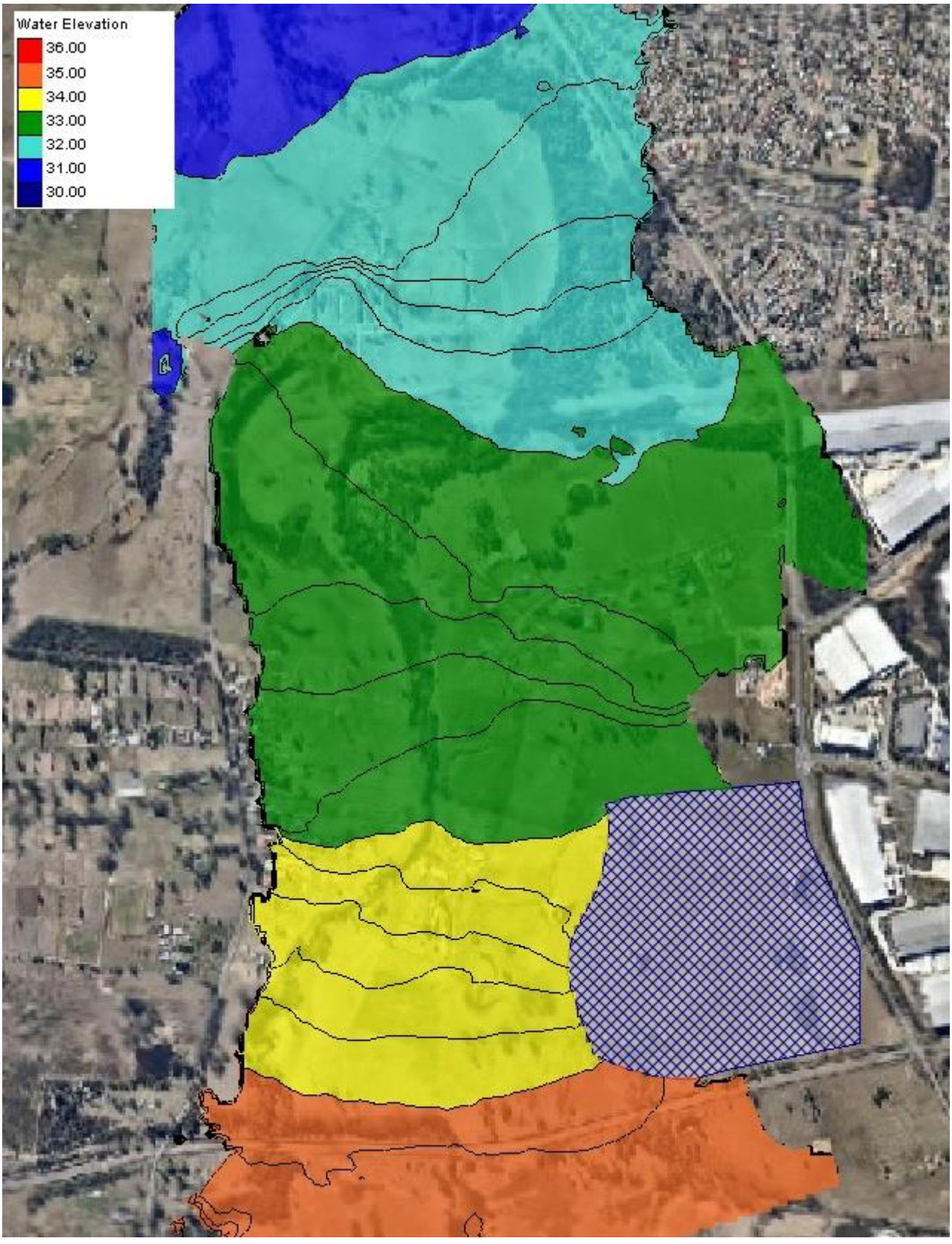

Figure C11 – PMF Flood Levels

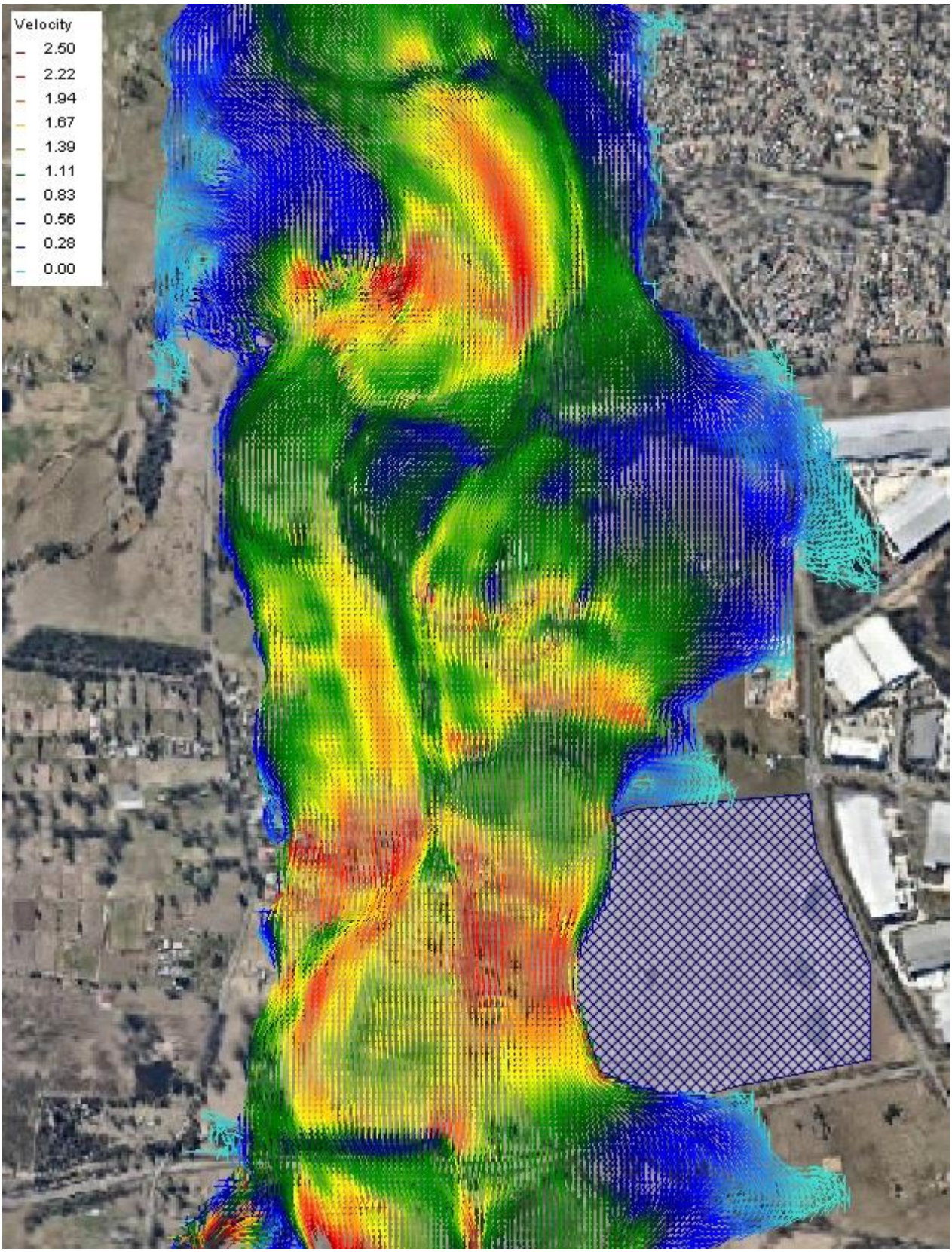

Figure C12 – PMF Flood Velocity

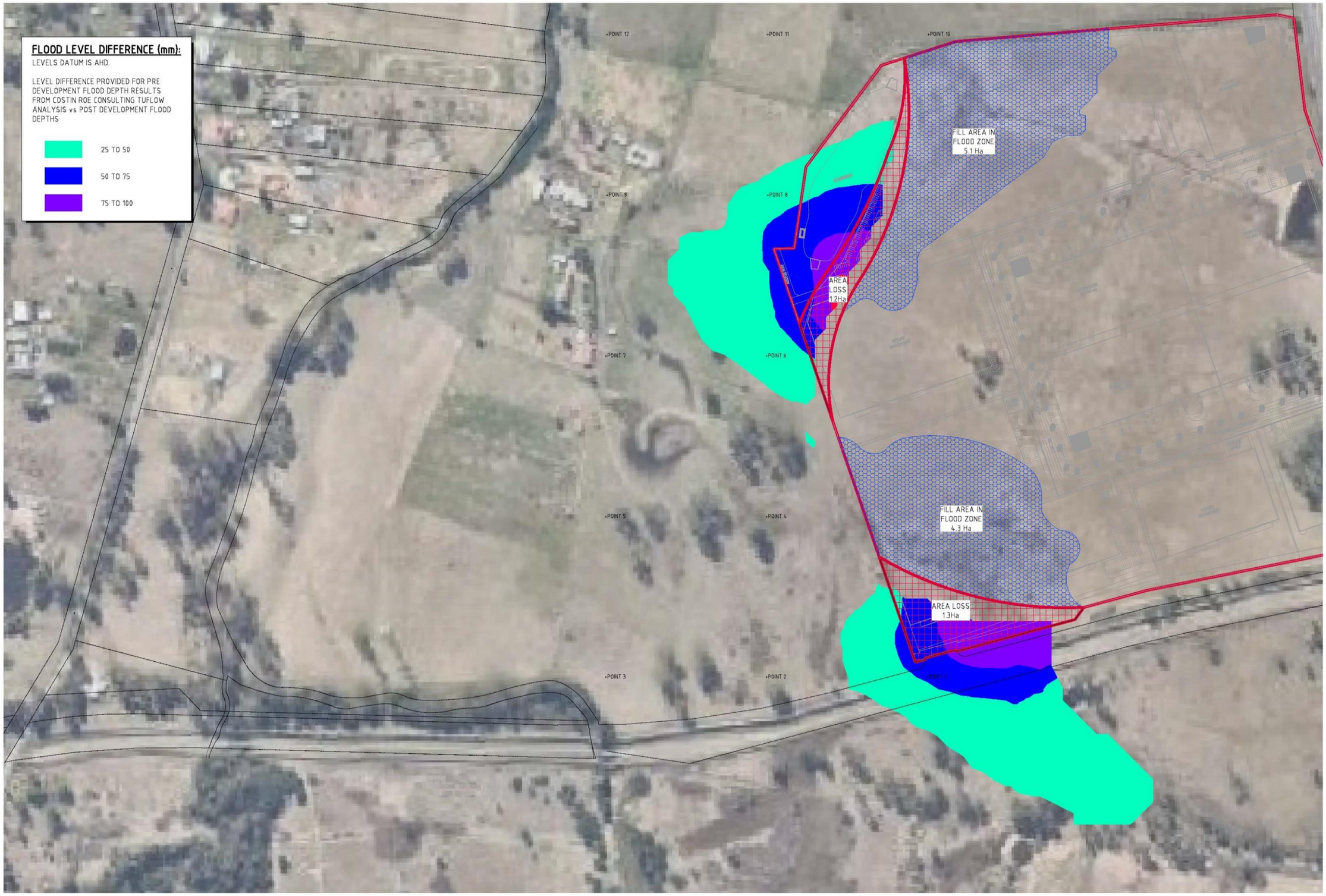

Figure C13 – 1% AEP Flood Level Afflux

APPENDIX D

SCENARIO D TUFLOW RESULTS

(Figures represent predicted values at the peak of each event)

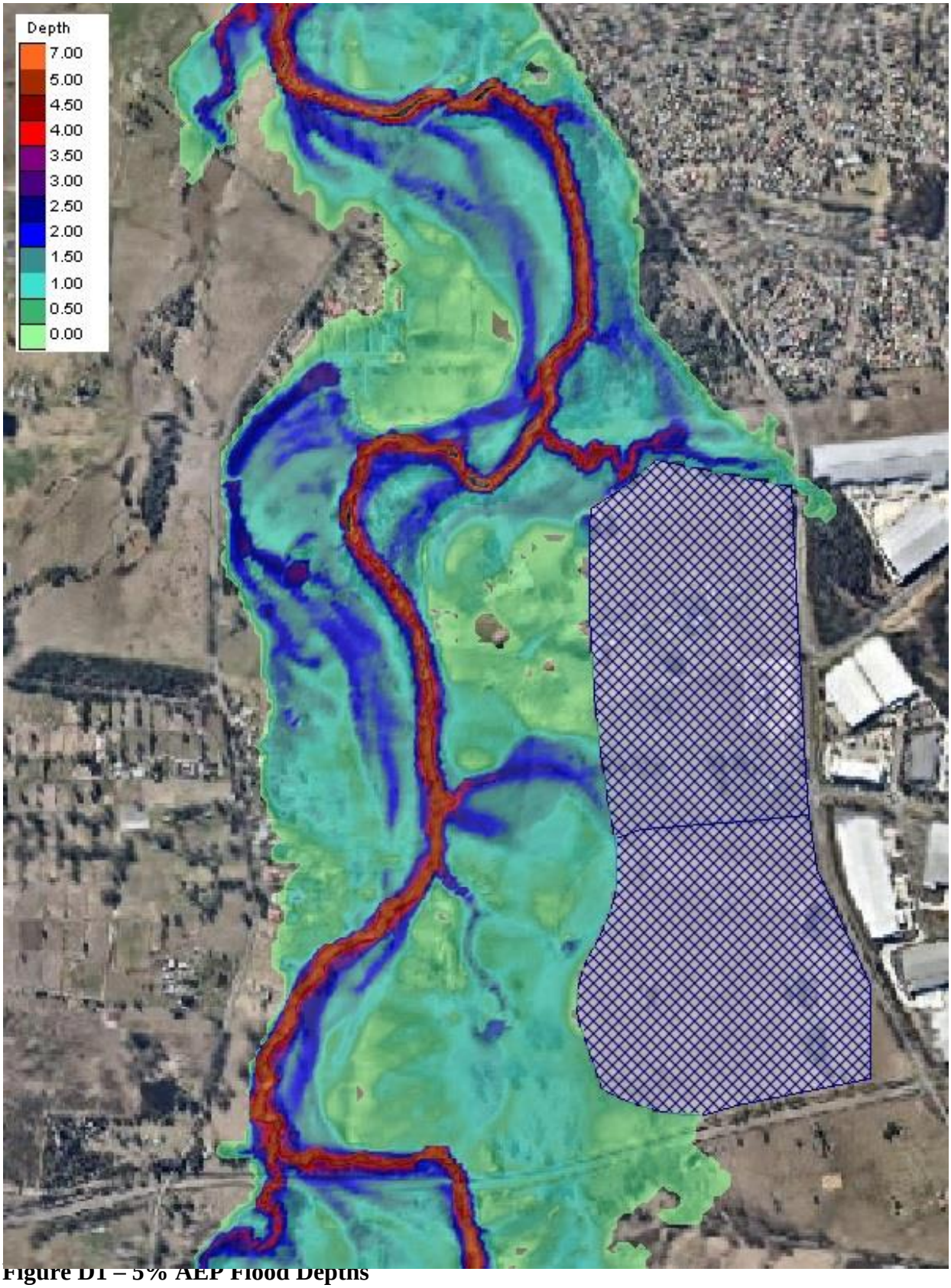

Figure D1 – 5% AEP Flood Depths

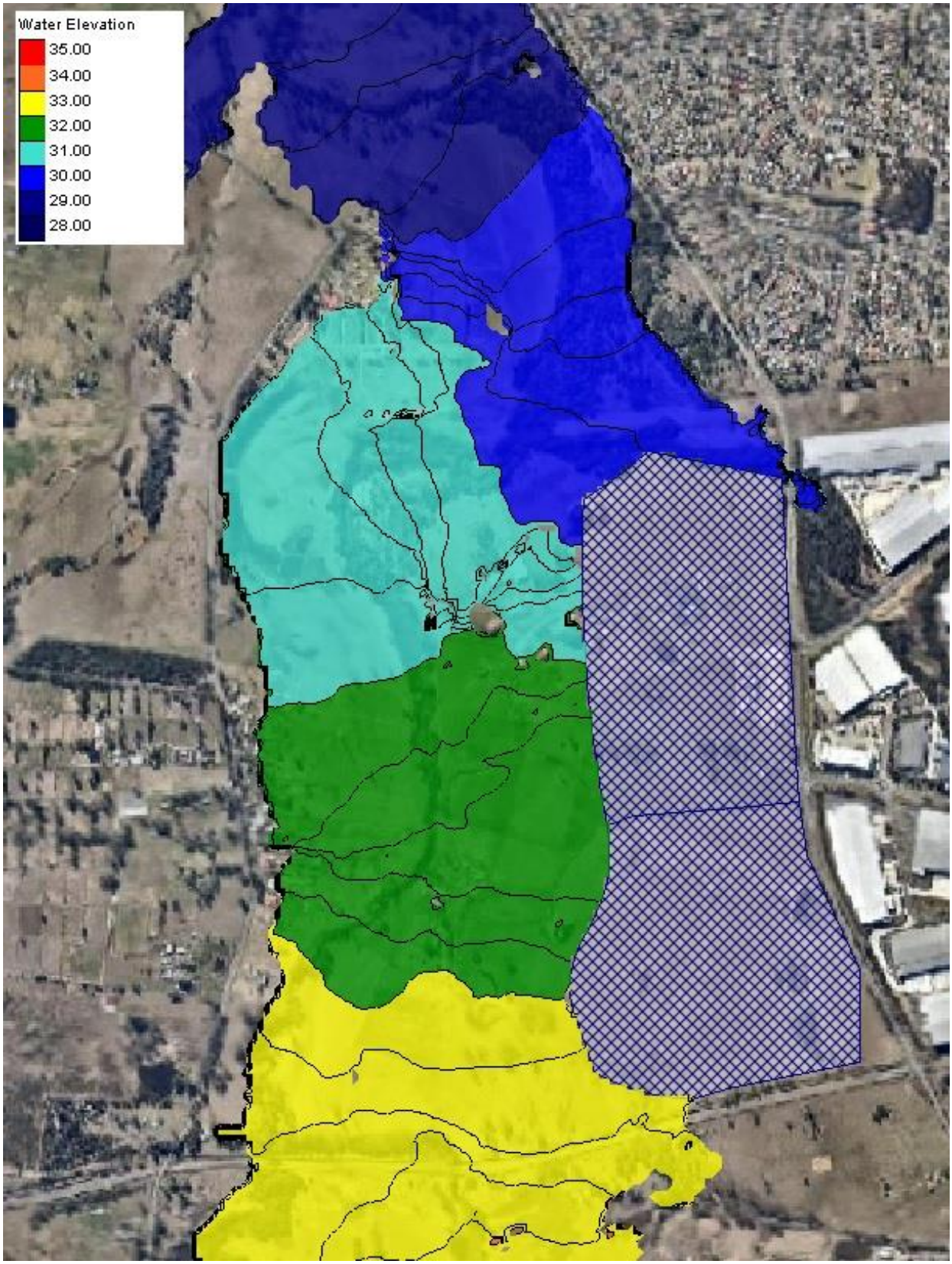

Figure D2 – 5% AEP Flood Levels

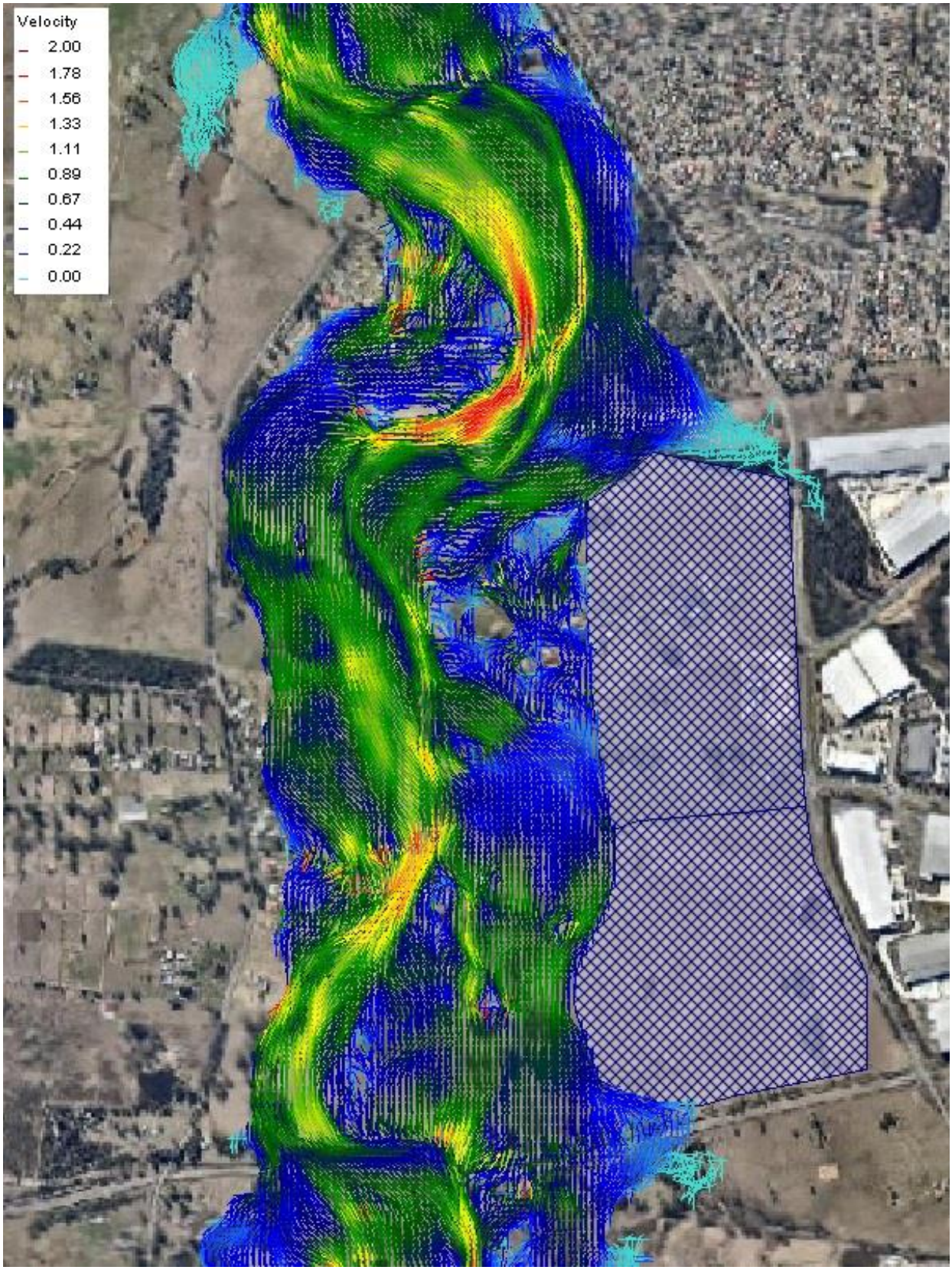

Figure D3 – 5% AEP Flood Velocity

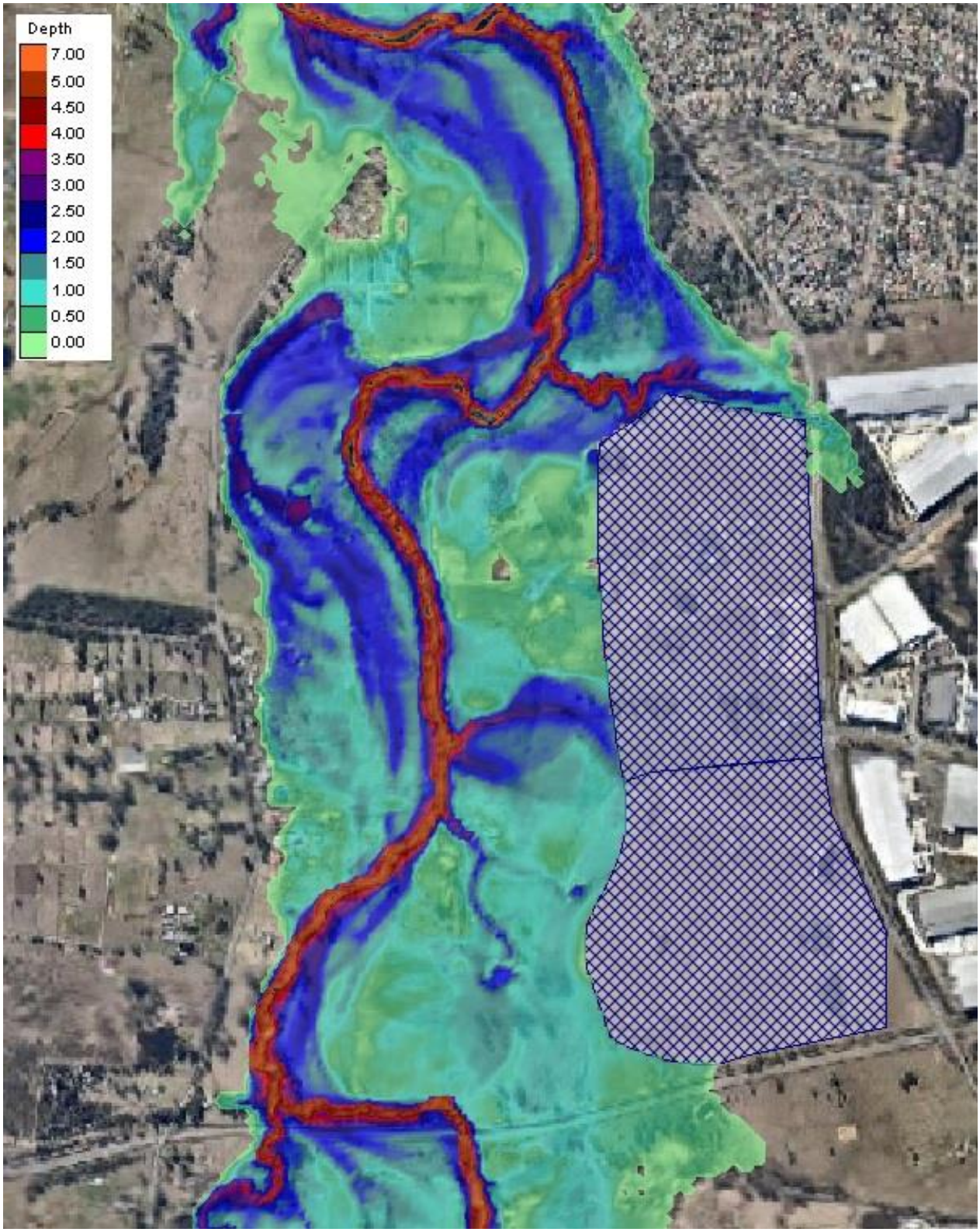

Figure D4 – 1% AEP Flood Depth

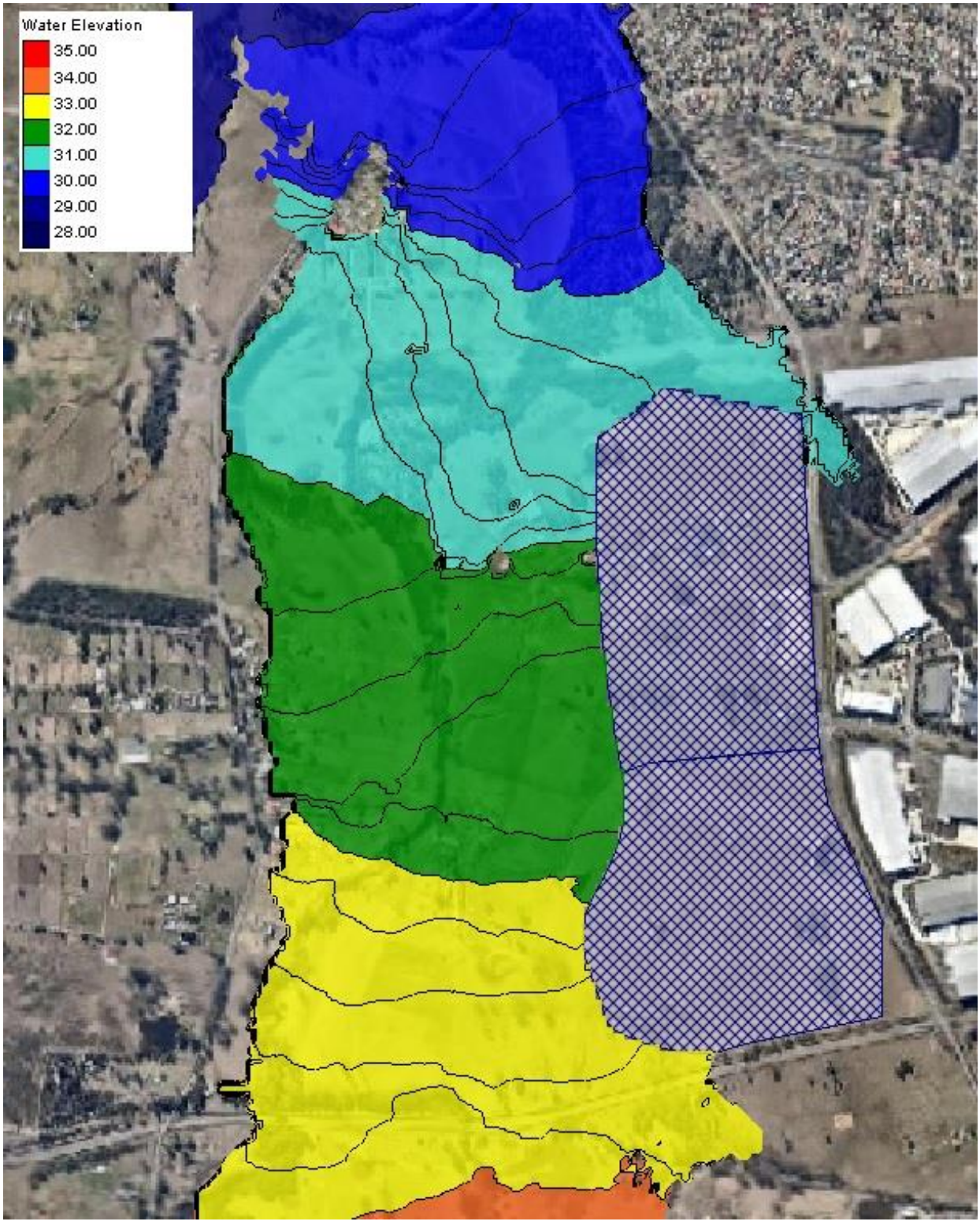

Figure D5 – 1% AEP Flood Levels

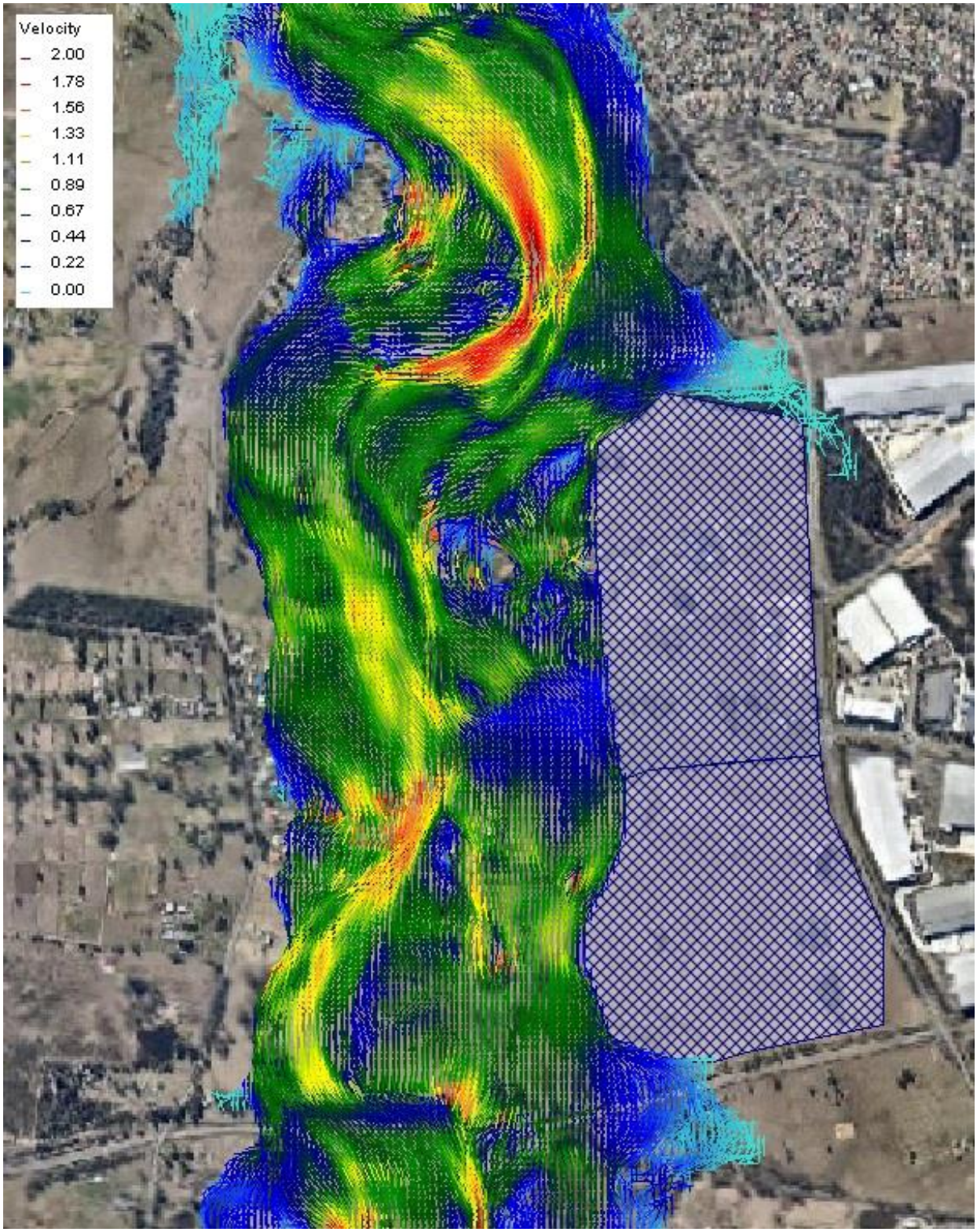

Figure D6 – 1% AEP Flood Velocity

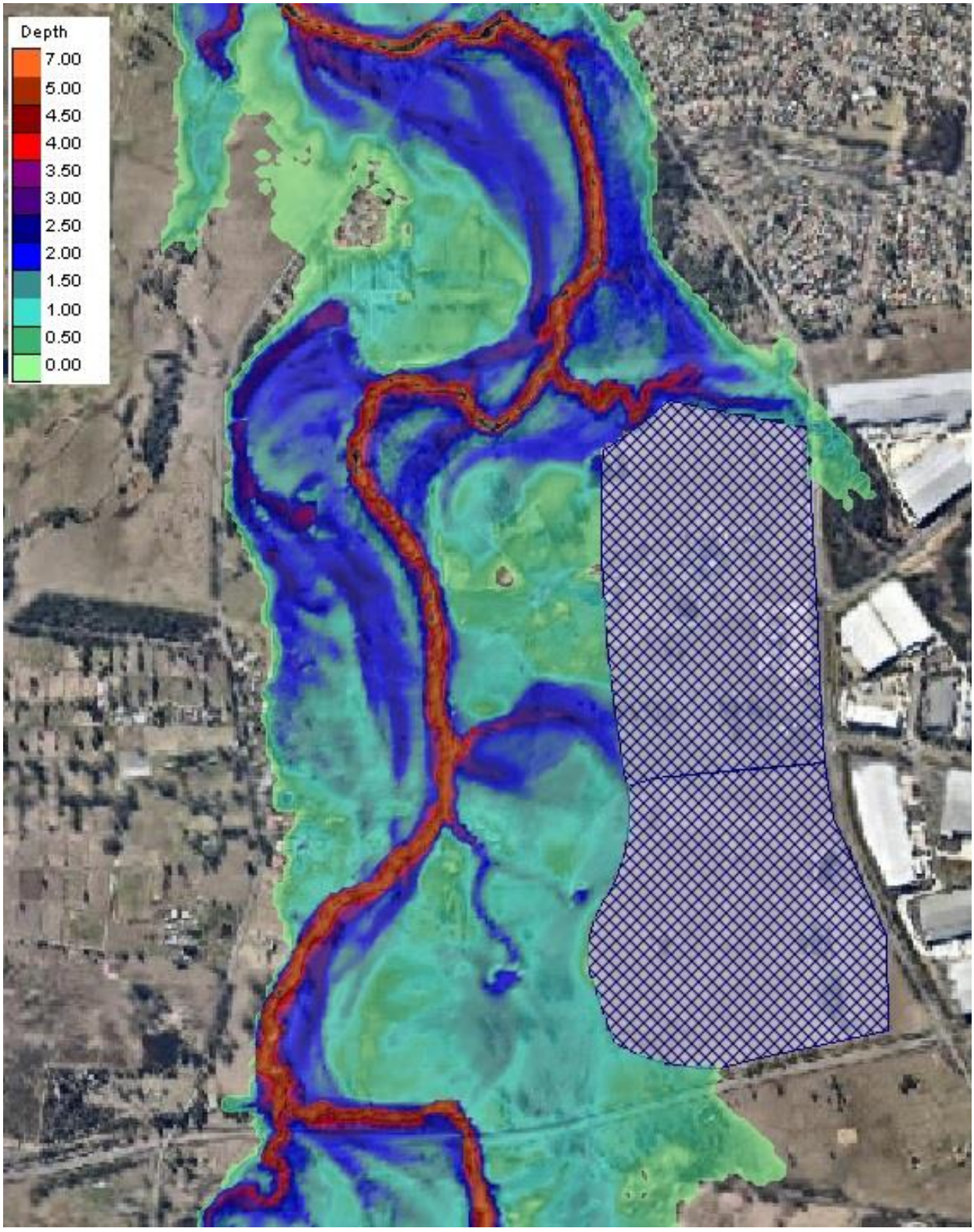

Figure D7 – 0.5% AEP Flood Depth

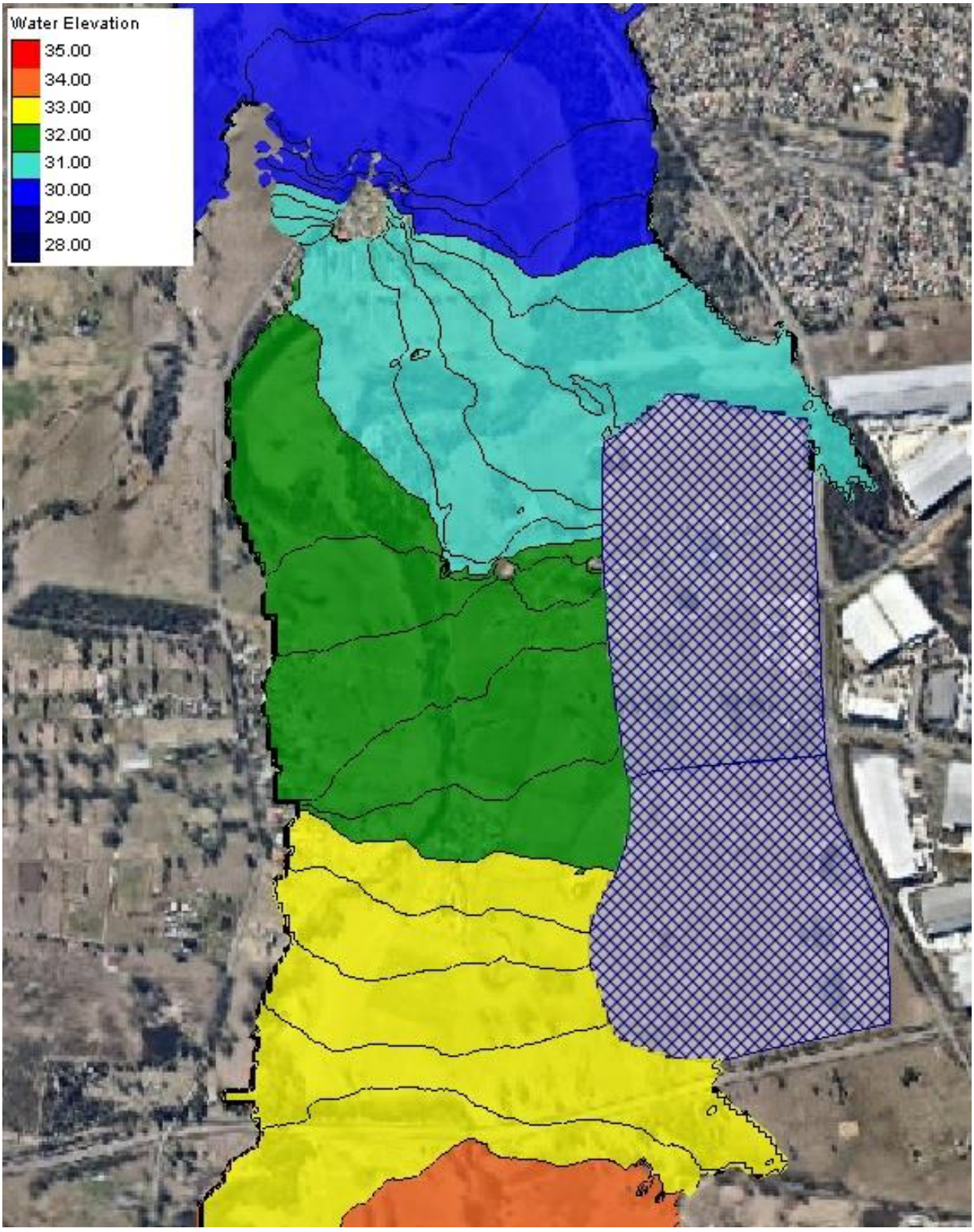

Figure D8 – 0.5% AEP Flood Levels

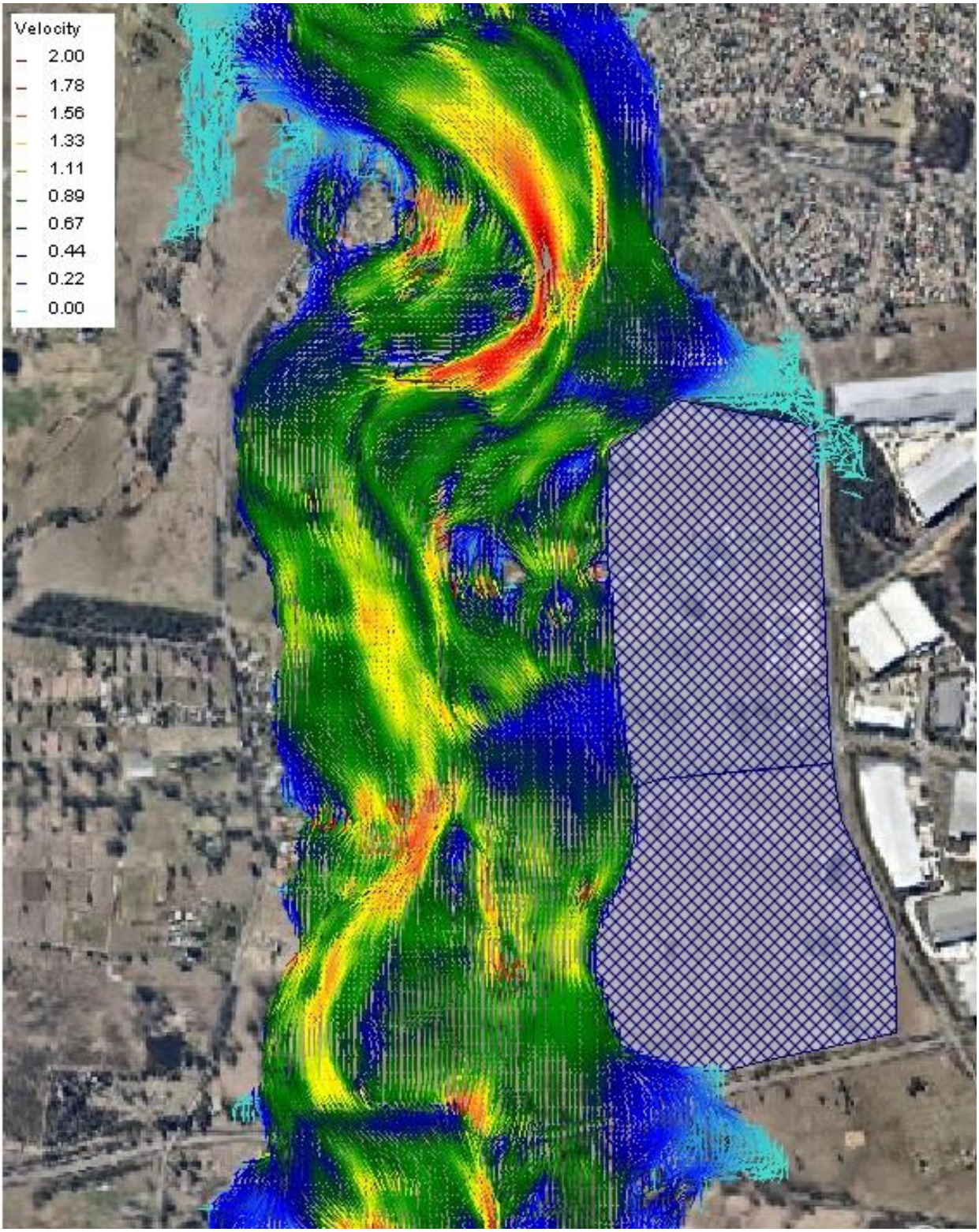

Figure D9 – 0.5% AEP Flood Velocity

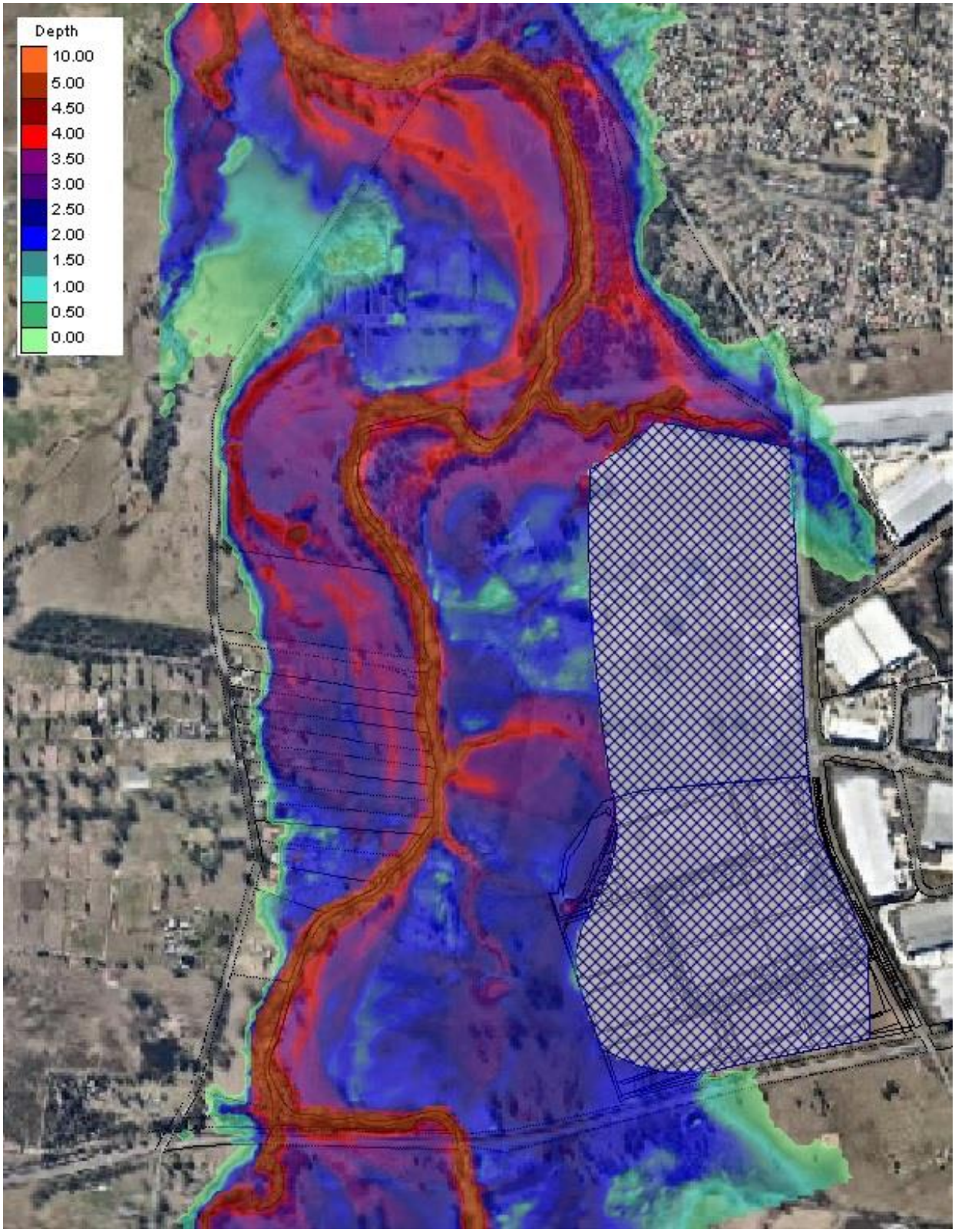

Figure D10 – PMF Flood Depth

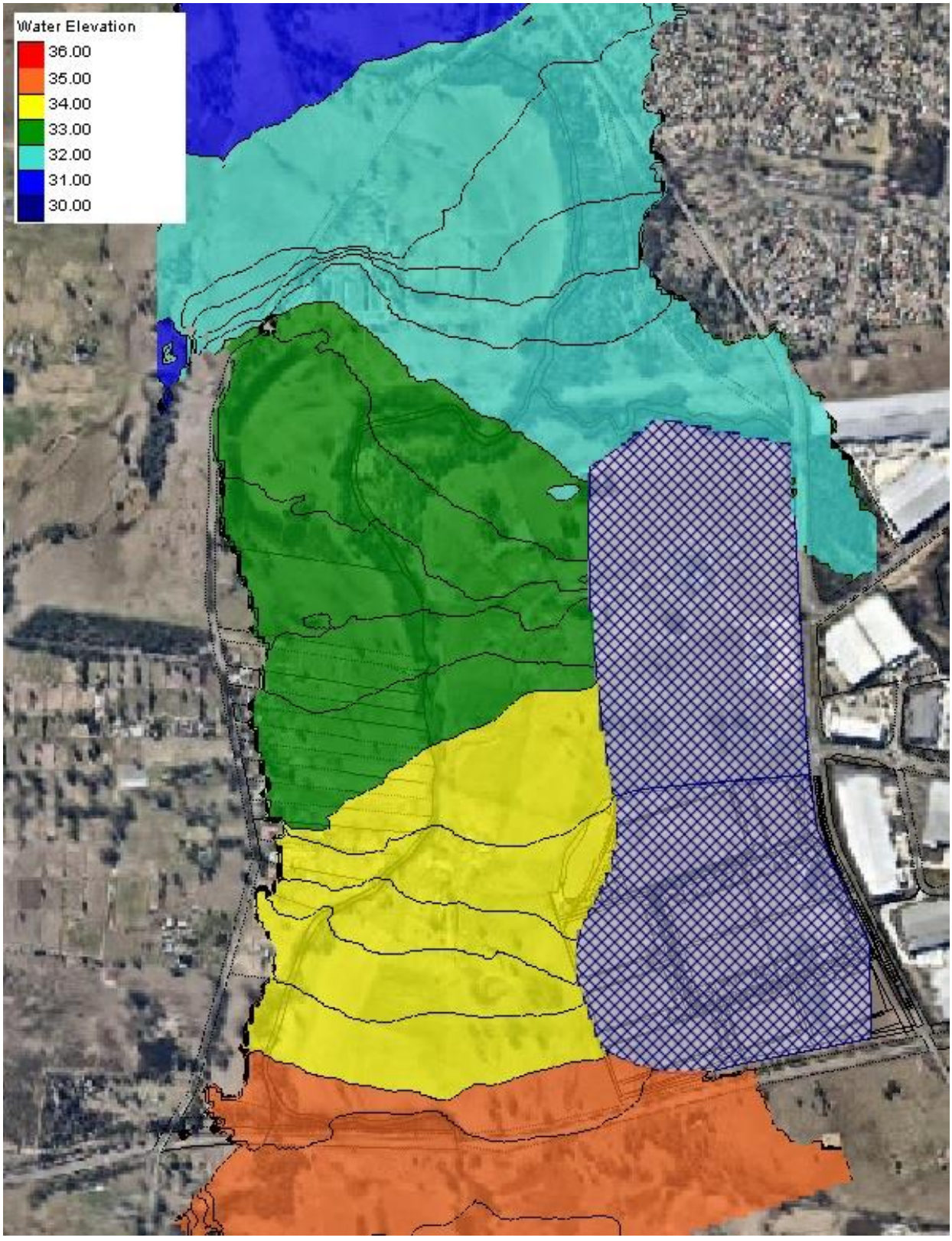

Figure D11 – PMF Flood Levels

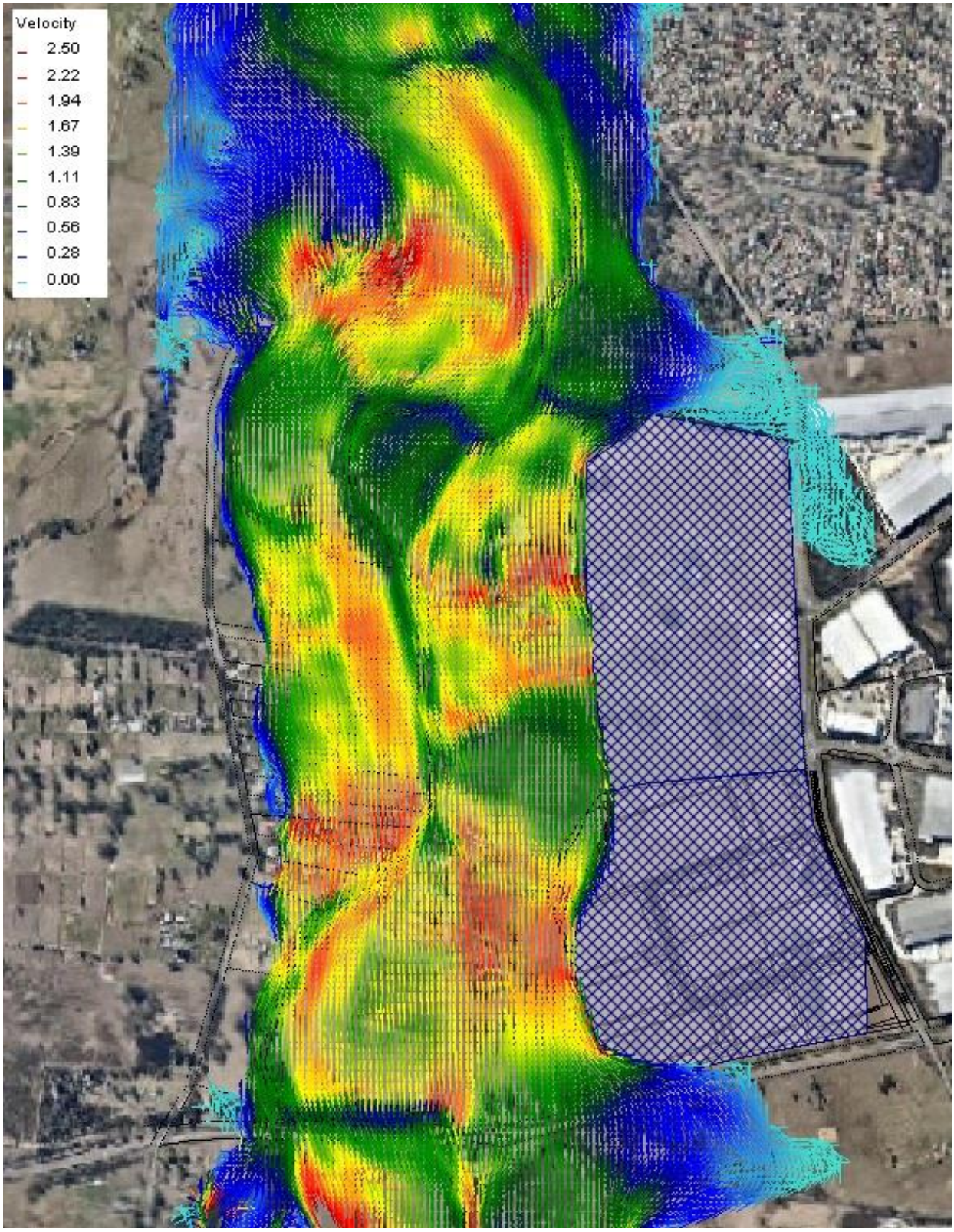

Figure D12 – PMF Flood Velocity

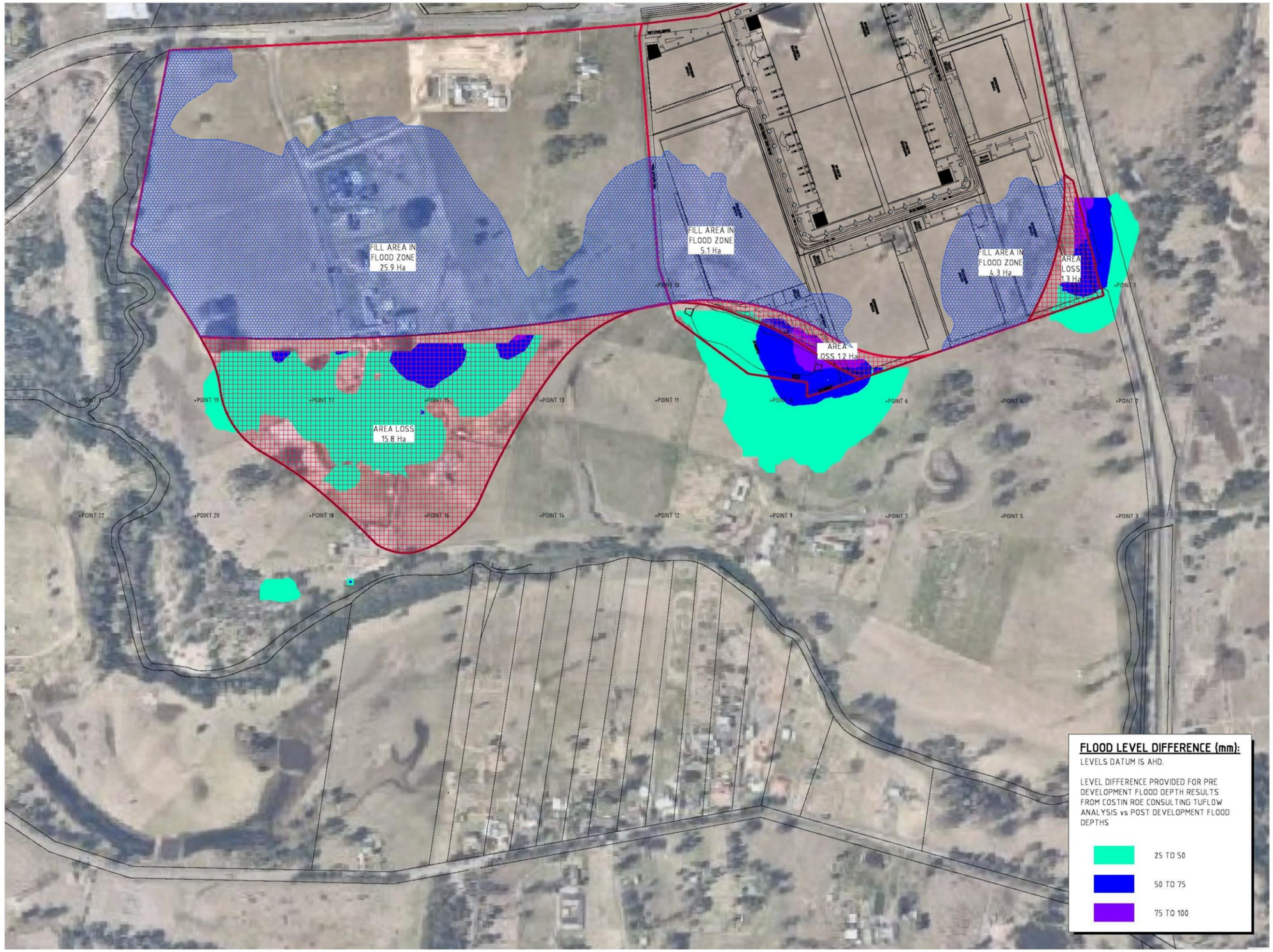

Figure D13 – 1% AEP Flood Level Afflux

APPENDIX E

VELOCITY AND FLOW COMPARISON

(Flows provided are based on a 1m flow width)

(Refer Figures C13 and D13 for point locations)

		Pre Dev 1% AEP			
Point	Ground RL (m)	Flood Level (m) AHD	Flood Depth (m)	Velocity (m/s)	Flow (m3/s)
1	33.09	33.61	0.52	0.34	0.18
2	32.40	33.60	1.20	0.71	0.85
3	32.79	33.66	0.87	1.36	1.18
4	32.27	33.45	1.18	0.81	0.96
5	32.13	33.42	1.29	0.83	1.07
6	31.95	33.12	1.17	1.21	1.42
7	32.64	33.19	0.55	1.16	0.64
8	32.29	32.75	0.46	0.75	0.35
9	32.01	32.81	0.80	1.17	0.94
10	31.52	32.69	1.17	0.40	0.47
11	31.45	32.67	1.22	0.46	0.56
12	30.37	32.65	2.28	0.63	1.44
13	30.73	32.66	1.93	0.44	0.85
14	31.52	32.45	0.93	0.48	0.45
15	32.20	32.26	0.06	1.14	0.07
16	31.83	32.31	0.48	0.54	0.26
17	31.17	31.65	0.48	0.71	0.34
18	30.71	31.57	0.86	0.36	0.31
19	29.24	31.30	2.06	1.04	2.14
20	30.06	31.44	1.38	0.54	0.75
21	25.75	31.21	5.46	1.04	5.68
22	28.79	31.35	2.56	1.54	3.94

Post Dev Scenario C 1% AEP (The Site)						
Flood Level (m) AHD	Flood Depth (m)	Change Depth (mm)	Velocity (m/s)	Change Velocity (%)	Flow (m3/s)	Change Flow (%)
33.64	0.55	30.00	0.31	-8.82	0.17	-3.56
33.61	1.21	10.00	0.67	-5.63	0.81	-4.85
33.67	0.88	10.00	1.36	0.00	1.20	1.15
33.44	1.17	-10.00	0.85	4.94	0.99	4.05
33.43	1.30	10.00	0.84	1.20	1.09	1.99
33.14	1.19	20.00	1.18	-2.72	1.40	-1.06
33.21	0.57	20.00	1.15	-0.86	0.66	2.74
32.81	0.52	60.00	0.78	4.00	0.41	17.57
32.84	0.83	30.00	1.21	3.42	1.00	7.30
32.67	1.15	-20.00	0.03	-92.50	0.03	-92.63
32.68	1.23	10.00	0.50	8.70	0.62	9.59
32.66	2.29	10.00	0.59	-6.35	1.35	-5.94
32.66	1.93	0.00	0.38	-13.64	0.73	-13.64
32.45	0.93	0.00	0.46	-4.17	0.43	-4.17
32.26	0.06	0.00	1.15	0.88	0.07	0.88
32.31	0.48	0.00	0.54	0.00	0.26	0.00
31.65	0.48	0.00	0.71	0.00	0.34	0.00
31.58	0.87	10.00	0.36	0.00	0.31	1.16
31.31	2.07	10.00	1.04	0.00	2.15	0.49
31.45	1.39	10.00	0.54	0.00	0.75	0.72
31.22	5.47	10.00	1.04	0.00	5.69	0.18
31.36	2.57	10.00	1.54	0.00	3.96	0.39

		Post Dev Scenario D 1% AEP (The Site & Future Industrial)						
Point	Ground RL (m)	Flood Level (m) AHD	Flood Depth (m)	Change Depth (mm)	Velocity (m/s)	Change Velocity (%)	Flow (m3/s) Approx	Change Flow (%)
1	33.09	33.63	0.54	20.00	0.27	-20.59	0.15	-17.53
2	32.40	33.61	1.21	10.00	0.67	-5.63	0.81	-4.85
3	32.79	33.66	0.87	0.00	1.41	3.68	1.23	3.68
4	32.27	33.44	1.17	-10.00	0.85	4.94	0.99	4.05
5	32.13	33.42	1.29	0.00	0.83	0.00	1.07	0.00
6	31.95	33.14	1.19	20.00	1.17	-3.54	1.39	-1.90
7	32.64	33.20	0.56	10.00	1.14	-1.72	0.64	0.06
8	32.29	32.82	0.53	70.00	0.76	1.33	0.40	16.75
9	32.01	32.84	0.83	30.00	1.18	0.85	0.98	4.64
10	31.52					NA	0.00	NA
11	31.45	32.69	1.24	20.00	0.49	6.52	0.61	8.27
12	30.37	32.67	2.30	20.00	0.58	-7.94	1.33	-7.13
13	30.73	32.67	1.94	10.00	0.40	-9.09	0.78	-8.62
14	31.52	32.46	0.94	10.00	0.48	0.00	0.45	1.08
15	32.20	32.28	0.08	20.00	1.04	-8.77	0.08	21.64
16	31.83	32.32	0.49	10.00	0.55	1.85	0.27	3.97
17	31.17	31.68	0.51	30.00	0.75	5.63	0.38	12.24
18	30.71	31.59	0.88	20.00	0.35	-2.78	0.31	-0.52
19	29.24	31.32	2.08	20.00	1.02	-1.92	2.12	-0.97
20	30.06	31.46	1.40	20.00	0.55	1.85	0.77	3.33
21	25.75	31.22	5.47	10.00	1.07	2.88	5.85	3.07
22	28.79	31.36	2.57	10.00	1.56	1.30	4.01	1.69