Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

OVERLAND FLOW REPORT

SSD 9522

MAMRE ROAD & SOUTHERN LINK RD ORCHARD HILLS NSW

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***Rev*: G**

CO13362.00-06g.rpt:mw

DOCUMENT VERIFICATION

Project Title	Mamre Road & Southern Link Road
Document Title	Overland Flow Report
Project No.	13362.00
Description	Overland flow assessment for new industrial estate.
Client Contact	Mr Paul Solomon, Frasers Property Mr Stephen O'Connor, Altis

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Prepared by	Mitchell Cross	
Reviewed by	Mark Wilson	
Issued by	Mitchell Cross	
File Name	13362.00.00-06g.rpt.docx	

Document History

Date	**Revision**	**Issued to**	**No. Copies**
7 Dec 2018	C	Mr Paul Solomon, Frasers Property Mr Stephen O'Connor, Altis	PDF
30 Jan. 2019	D	Mr Paul Solomon, Frasers Property Mr Stephen O'Connor, Altis	PDF
6 Mar. 2019	E	Mr Paul Solomon, Frasers Property Mr Stephen O'Connor, Altis	PDF
13 May. 2019	F	Mr Paul Solomon, Frasers Property Mr Stephen O'Connor, Altis	PDF
16 May. 2019	G	Mr Paul Solomon, Frasers Property Mr Stephen O'Connor, Altis	PDF

EXECUTIVE SUMMARY

An overland flow and flood assessment has been completed by Costin Roe Consulting as part of a State Significant Development Application SSD 9522 for an industrial estate development area at Orchard Hills, NSW.

The assessment of the proposed development which is located on the eastern bank of South Creek, has been completed using the Penrith Council preferred two-dimensional TUFLOW computer modelling engine to assess the pre and post development overland flow conditions for a range of storms. Further, the model has been established based on verification through councils adopted *Updated South Creek Flood Study, Worley Parsons, 30 January 2015*. An electronic copy of this model was obtained from Council for use and validation of our study. Council has also made available a digital version of the model results including GIS output of the DTM used in their modelling, flood surface results, flood depth results, hydrology and model build information.

The assessment has been completed for a range of probabilistic flood events and has compared the predevelopment flood conditions to the post development. Scenario testing has been completed within the bounds and requirements of the specific criteria set out in *Penrith City Council DCP Part C3 Water Management, NSW Floodplain Development Management Manual 2005,* and discussions with Penrith City Council and NSW DPE.

The Council DCP Part C3 criteria adopted in the assessment to confirm that the developed conditions do not result in affectation of upstream, downstream or adjacent properties are listed as follows:

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 Floodway Corridor areas; and
x) The filling does not occur within the drip line of existing trees.

As part of discussions with Council and the NSW DPE, *Item i)* above has been revised to ensure that no effect to upstream or downstream properties were to occur. The maximum offsite water level change confirmed for the assessment was to be 0.010-0.020m or less. On-site changes would need to be within the 0.1m as stipulated in the Council DCP.

Further to *Item (v)*, it was agreed, that any filling within the flood fringe would require any lost storage to be offset as part of the works (i.e. provide compensatory flood storage which matches displaced zones).

Various other technical modelling requirements, as agreed with Penrith Council and their peer reviewers Advisian throughout the approval stages of the adjacent First Estate development, have also been included in the modelling. Although Advisian

have not reviewed this exact model, the modelling parameters as defined through the adjacent First Estate development have been adopted in this extended model and development assessment. These parameters include modelling extent (upstream and downstream boundary locations and levels), flow hydrographs, surface roughness and land use types, inclusion of hydraulic restrictions and the methodology for data extraction and presentation.

We confirm that the provided report, modelling and modelling outputs address all of the criteria items as listed above, as included in **Section 9**. Additionally, the outcomes of the modelling also confirm flood displacement from the recently constructed Twin Creeks Residential development can also be accommodated with the proposed Mamre South Industrial development, and the outcomes of the as approved First Estate are maintained.

Further comments on other key considerations relating to the development and the regional context are also noted as follows:

- The modelling confirms the outcomes of the flood assessments completed and approved for the First Estate under SSD7173 are generally maintained. A minor difference of between 0.010-0.020m only is noted around the southern extent of the now constructed First Estate. It is important to point out that this increase is located within the high hazard flood classification zone and hence will not effect the development potential of this area. Refer **Figure 8.2** & drawing **Co13362.00-F03** in **Appendix C**;
- In relation to the potential of cumulative impact as other sites within the catchment are developed to the same or similar degree to the proposal the following is noted. The development proposal does not provide for any incremental increase in peak flood levels off-site and relatively minor changes (less than 0.1m) on site. If other future developments provide for similar relative impacts and management measures (including flood storage compensation) as required of Penrith DCP, the overall cumulative impact within the South Creek corridor would be effectively managed. Accordingly, the development would be considered to not be contributing to a future cumulative impact;
- There is sufficient capacity and time for either safe egress of occupants offsite or to an on-site refuge during a major flood event. The developed landform levels over the site are proposed at greater than 500mm above the 1% AEP storm event which allows several hours of flood warning response time. Also, at least 80% of the developed site will be above the PMF flood event. It is further noted that the pads within the PMF zone will experience maximum flood depths of only 0.5m and velocities in the range of 0.5-1.0m/s (locally up to 2m/s at the development edge) during the PMF flood event. Finally, given there is less than 0.5 kM from the PMF affected zone to the PMF free area of the site, occupants could move to flood free land in only minutes. Finally, based on the modelled rate of rise, during the PMF event it will take approximately 1hour from the time of first inundation to the peak. The velocities of flow as noted will be in the 0.5-1m/s range hence for the majority of the time during the rise to peak, DV values will be less than 0.4 (normally considered safe for pedestrian egress) and a maximum of 0.6. Noted that even if occupants did not heed any warnings and were on site in a PMF event, they would be able to move from an area of flood effected land to non-flood affected in less than minutes in a safe manner.

A framework for flood evacuation has been included in the submitted report (refer **Section 10**) which can be used to formulate more detailed flood response plans for specific stages of the site, or individual developments in the estate;

- The modelling confirms any effect to flood waters associated with the development are confined locally to the development area, hence there is no effect on the proposed Badgerys Creek Airport in relation to the development which is more than 5km upstream of the development, with no effect to surrounding landowners; and
- Further to the above, there is also no effect on the Nepean River in relation to the development which is more than 20kM downstream of the development.

The criteria adopted in the design and outcomes achieved in this report have been presented to and discussed with Penrith City Council in a meeting at Council's chambers held on 20 November 2018 with Costin Roe Consulting, EG and Frasers Property Australia.

The assessment has shown that minor filling in the flood fringe and flood storage areas, coupled with proposed flood compensation measures results in negligible effect on upstream downstream or adjoining properties, within the criteria as set out and agreed with the respective stakeholders and in accordance with acceptable industry flood engineering practice.

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1. INTRODUCTION

Costin Roe Consulting Pty Ltd has been commissioned by Frasers Property Australia and Altis Property Partners to undertake an overland flow assessment to accompany a planning application submission to rezone the existing rural use land to IN1 General Industrial, and also for the assessment to accompany a State Significant Development Application (SSDA) submission.

The western portions of the Study Area have 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. The Council report will be referred to as the *South Creek Study* from hereon.

Consultation with Penrith City Council on this and other developments in the area has been undertaken to confirm the flood planning requirements for the rezoning and development potential of the land. The scope and primary objectives of the overland flow assessment are as follows:

- Determine the design flows generated by the contributing external catchments for a range of storms (5%, 1%, 0.5% AEP storms). Hydrology and flows would be consistent with the flows as defined in the *South Creek Study*;
- Assess the pre-development overland flow path through the development site for the listed range of storms including the 1% AEP event;
- Assess the post-development overland flow path through the development site for the range of storms events so that potential impacts on and from 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; and
- 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 was to be undertaken in two stages, broadly speaking, as follows:

Stage 1 – Model Build and Validation

- Build of a 2D hydrodynamic flood model of South Creek in the vicinity of the proposed development area for the existing/ pre-developed 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%, 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 pre-developed modelling will be based on the surface used in the *South Creek Study*;
- Reporting and modelling of the pre-developed scenario to be utilised in the post developed Scenario Testing described below.

Stage 2 – Scenario Testing

- Scenario testing of post construction configurations utilising the model build as defined in the pre-developed Stage 1 report and incorporating developed conditions including the subject property, recent construction on First Estate and proposed Mandalong Precinct, and also recent residential construction in the Twin Creeks Estate on the western side of South Creek;
- Scenario testing will be undertaken for the range of AEP events defined in pre-developed assessment;
- Scenario testing is to include differences in flood levels, velocity and general hydraulics;
- The scenario testing will be undertaken for the development of *The Site* (118 Ha); and

- Confirmation that the requirements and criteria set by Penrith City Council in their DCP Part C3 Development in Flood Affected Areas has been met.

This report has been produced to present the Stage 1 and Stage 2 components of the modelling and assessment. The report provides a summary of the modelling methodology, model parameters and model results for the existing and post development conditions. The Stage 1 model is compiled to enable scenario testing to confirm the effect of development on the land within the study area. The Stage 1 TUFLOW model has not been produced to replicate the *South Creek Study* RMA model but has been completed and validated to be suitable for use in scenario testing of the effect of development on flooding.

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, and as part of a State Significant Development Application.

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.

Revision C of this report includes additional information to address key queries as included a *Request for Additional Information* from the NSW DPE in their letter dated 21 November 2018 and associated *Appendix 1 – Adequacy Review*. A detailed response letter (Ref: Co13362.09.ltr, dated 6 December 2018) has been prepared by Costin Roe Consulting in addition to the updated information contained in this report.

2. DEVELOPMENT SITE

2.1. Site Description

The Site is approximately 118 Ha and is located on the western side of Mamre Road, and to the north and south of Bakers Lane in the suburb of Orchard Hills as shown in **Figure 2.1**.

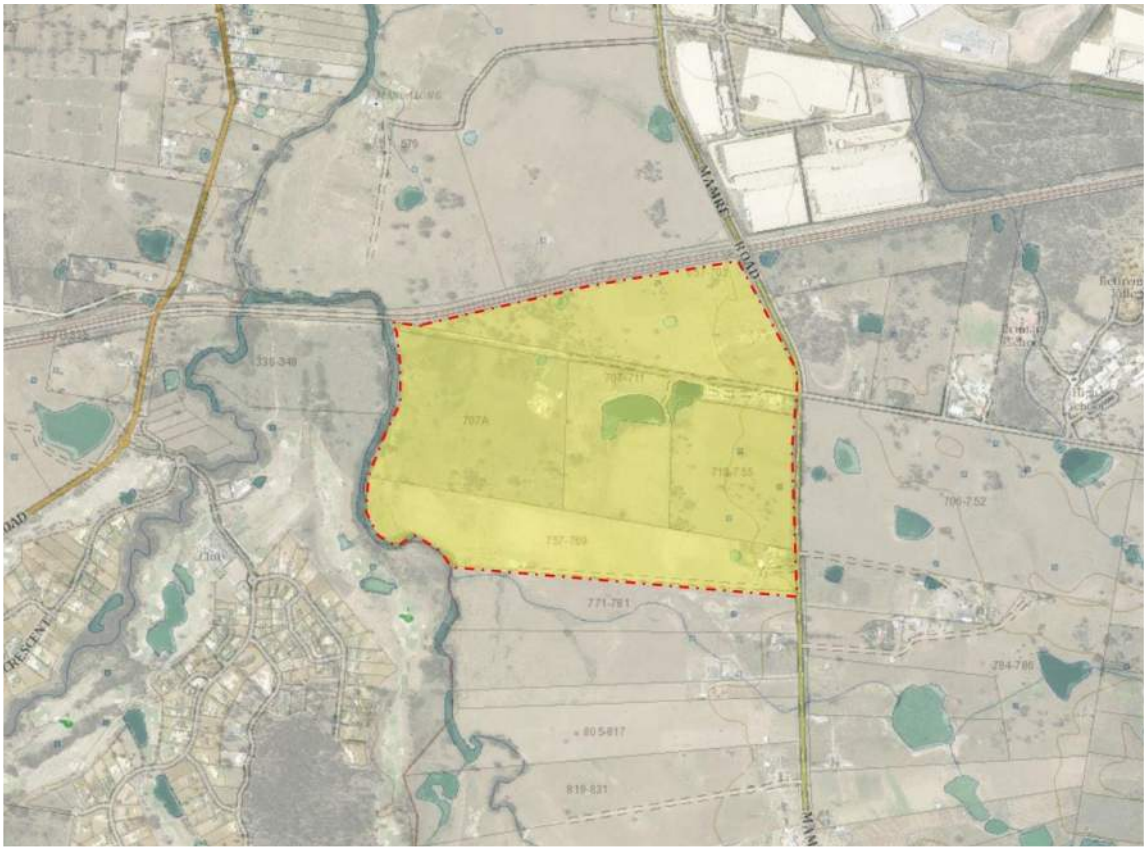


Figure 2.1 Locality Plan

The land comprises a combined area of approximately 118 Ha. The current land-use is predominately rural and rural-residential.

The highest elevation on the land is RL 45m AHD at the intersection of Bakers Lane and Mamre Road. The lowest levels range between RL 30m to RL 34.5m along the western boundary of the site adjacent to South Creek in the South Creek Flood plain.

Grades over the land vary from 0.5% to 2.5% with the grades becoming flatter as you move to the west, away from Mamre Road and toward the South Creek floodplain. South Creek is located on the western boundary of the site.

A major WaterNSW Supply Pipeline is located on northern property boundary of *The Site* area and the Altis First Estate industrial subdivision is located immediately to the north of the Sydney Water pipe.

2.2. Proposed Development

The proposed development is for an industrial estate, earthworks and infrastructure for future industrial development. An indicative lot layout is shown in **Figure 2.2**. Infrastructure works will include bulk earthworks, provision of services, road & intersection construction, and stormwater management.

The preliminary masterplan layout provided by Frasers Property shows development lots will vary between 1 Ha and 3 Ha in size. Siting of the development lots will be sympathetic to the topography of the land, access and flood planning requirements. The sites adjacent to South Creek will need to allow for the minimum 500mm freeboard to the 1% AEP flood level of South Creek.

Access to all lots would be made via the new Southern Link Road, Bakers Lane and via a new estate access road from Mamre Road. The new access road and associated intersection will be constructed to Penrith City Council requirements and ownership transferred to Penrith City Council.

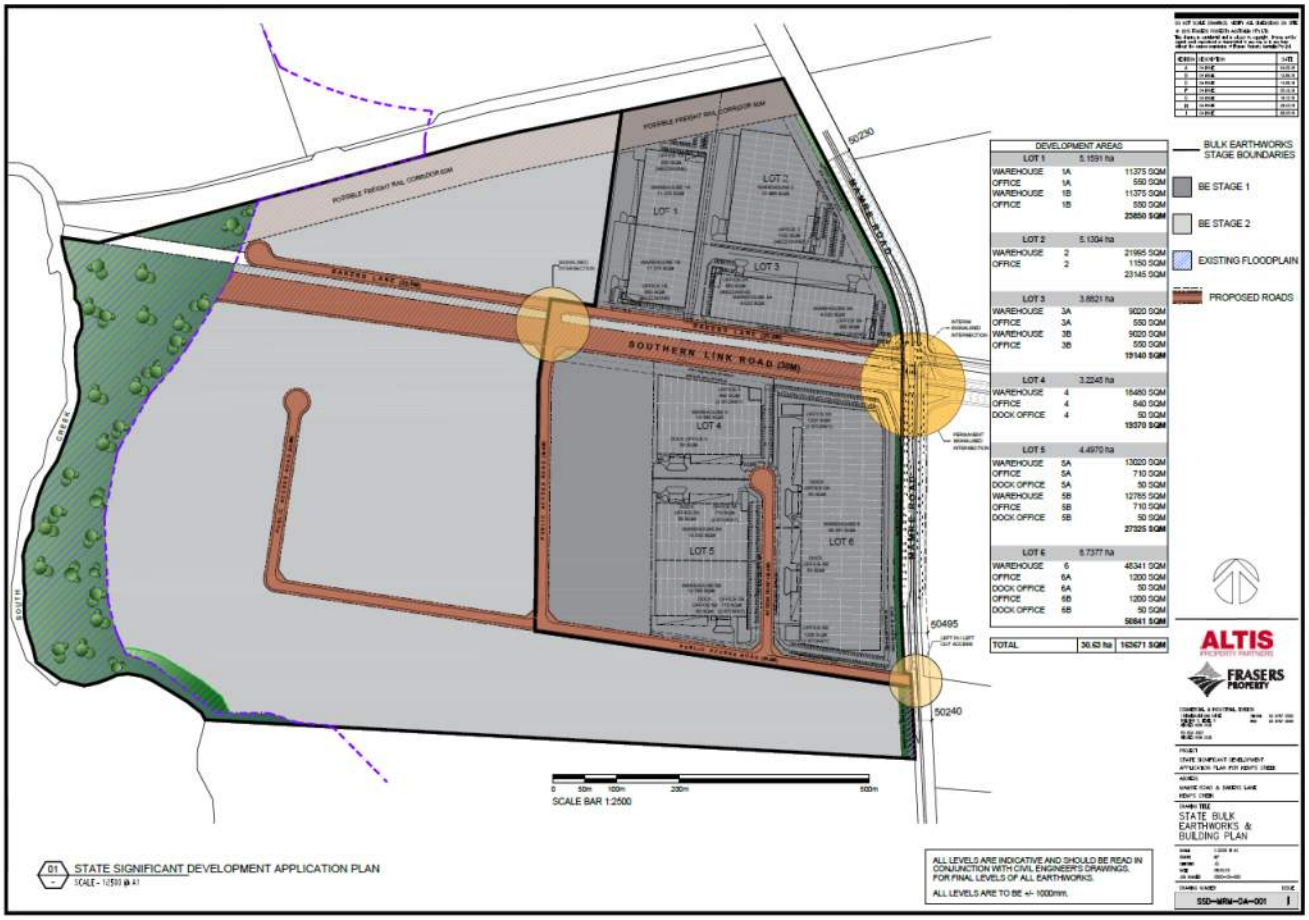


Figure 2.2. Indicative Lot Layout

3. STUDY METHODOLOGY & PLANNING OBJECTIVES

3.1. Study Methodology

The objectives of the Flood Study are to:

- Identify relevant flood-related data by searching all relevant data sources;
- Determine the likely extent and nature of flooding and identify potential hydraulic controls by carrying out detailed site visits of the study area;
- Define existing catchment condition flood behaviours for mainstream flooding in the catchment with due consideration to upstream and downstream controls on the South Creek channel;
- Define design flood levels, velocities and flow distributions for the catchment.
- Define the extent of flooding for the 1% and 5% AEP floods and PMF for the catchment;
- Define differences in flood regime as it relates to the proposed development and upstream and downstream properties;
- Define Flood Planning Levels for the flood-affected areas; and
- Confirm flood planning requires for the development.

A numerical modelling tool was developed:

- A hydraulic model 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.

Section 4 of the report discusses the content and source of relevant data which has been utilised in the study. This section describes relevant flood studies and available historical information and also provides details of the survey used to establish the DTM used in the analysis.

Section 5 discusses the catchment characteristics the hydrological information used in the study.

Section 6 discusses the development of the hydraulic model including establishment of the DTM, boundary conditions, validation, sensitivity analysis and subsequent use for design rainfall events and development scenarios.

Section 7 provides the results of the design flood estimation for the catchment for the pre-developed conditions and **Section 8** for the post-developed conditions.

Section 9 provides a summary and validation of the post development scenario in and around the specific requirements of Penrith City Council DCP Part C3. The specific DCP Criteria are listed in **Section 3.3** of this report.

Section 10 discusses flood safety and evacuation whilst **Section 11** provides concluding remarks to the overall study.

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

3.2. Floodplain Management Considerations

3.2.1. Flood Planning Level

The introduction of a Flood Planning Level (FPL) is an important flood risk management measure. FPLs are derived from a combination of a designated flood event, which can either be a historic flood or a design flood of a certain recurrence interval, plus a nominated freeboard depth.

The NSW Floodplain Development Manual, 2005 recommends that the FPL generally be based on the 100-year ARI event. It suggests that, whilst this event can be varied, it should only be done in exceptional circumstances. It is considered appropriate to adopt the 100-year ARI event for the proposed industrial development.

The freeboard component of an FPL is the difference between the flood level that the level is based upon and the FPL itself. Freeboard is designed to provide reasonable certainty that the reduced risk exposure provided by the chosen FPL is warranted, taking into account factors such as:

- Uncertainties in the estimate of flood levels;
- Differences in water levels across the floodplain;
- Wave action resulting from wind and vehicular/marine traffic during the flood event;
- Changes in rainfall patterns due to climate change;
- The cumulative effect of subsequent infill development on existing zoned land.

The Floodplain Development Manual recommends a freeboard of 0.5m for most new industrial developments and it is considered appropriate that this recommended freeboard be for adopted for the proposed development.

3.2.2. Hydraulic and Hazard Categorisation

Floodwaters can vary significantly, both in time and place across the floodplain. They can flow fast and deep at some locations and slow and shallow at other locations. This can result in large variations to the personal danger and physical property damage resulting from the flood.

The Floodplain Development Manual recognises three hydraulic categories of flood prone land, these being floodway, flood storage and flood fringe. These are then further separated into two hazard categories, high hazard and low hazard.

Floodways

Floodways are those areas where a significant volume of water flows during floods and are often aligned with natural channels. They are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, which could adversely affect other areas. They can also be areas with deeper and higher velocity flow.

Flood Storage

Flood storage areas are the parts of the floodplain that provide temporary storage for floodwaters during the passage of a flood. If a reduction in the flood storage area is experienced due to the filling of land or construction of a levee bank, it can result in adverse effects on the flood levels and peak flow rates in other areas.

Flood Fringe

Flood fringe areas are the remaining area of land affected by flooding. The development of flood fringe land does not generally have any major impact on the pattern of flood flows and/or levels.

The preparation of a flood study is almost always required in the determination of hydraulic categories. This is so that peak depths, velocities and the extent of flooding can be determined across the catchment.

Hazard Categories

Flood hazard categories are broken down into high and low hazard for each hydraulic category. High hazard areas are defined as those where there is a possible danger to personal safety and the potential for significant structural damage. Able-bodied adults would have difficulty in wading to safety. With low hazard areas, should it be necessary, a truck could evacuate people and their possessions, and able-bodied adults would have little difficulty in wading to safety.

3.2.3. Flood Damages

Damage caused by floods is generally categorised as either tangible or intangible. Tangible damages are financial in nature and can be readily measured in monetary terms. They include direct damages such as damage or loss caused by floodwaters wetting goods and property, and indirect damages such as lost wages incurred during cleanup periods after the flood event. Intangible damage includes emotional stress and even mental and physical illness caused by the flood. It is difficult, if not impossible to quantify intangible damages in financial terms.

From a flood planning perspective, it is important to consider the following direct damage categories:

- Contents Damage – refers to damage to the contents of buildings, including carpets and furniture etc.;
- Structural Damage – refers to damage to the structural fabric of buildings, such as foundations, walls floors, windows, and built-in fittings; and
- External Damage – includes damage to all items external to buildings, including cars, landscaping etc.

As there is no way to prevent a flood from occurring, and it is unrealistic to exclude all development within flood-prone areas, the intent of establishing a FPL is to minimise the risk of direct damage when a flood occurs. By minimising the direct damage, there is a carry-on effect, whereby other associated indirect tangible damages and intangible damages are also minimised.

3.2.4. Emergency Response Planning

Flood planning refers to the preparation of a formal community-based plan of action to deal with the threat, onset and aftermath of flooding. It involves planning for an event equal to, or greater than the event used to derive the FPL.

The plan of action should include an on-site response plan that addresses what measures should be undertaken once the threat of a flood is determined to be imminent. A flood

evacuation strategy should also be included so that all persons within the precinct are familiar with the processes required if a flood occurs.

3.3. Penrith Council DCP Requirements

The pre and post developed models were used for scenario testing relating to the proposed development over the industrial zoned lands.

The scenario testing has been completed within the bounds and requirements of the specific criteria set out in Penrith City Council *DCP Part C3 Water Management* and discussions with Penrith City Council.

The DCP criteria are listed as follows:

xi) Flood levels are not increased by more than 0.1m by the proposed filling;
xii) Downstream velocities are not increased by more than 10% by the proposed filling;
xiii) Proposed filling does not redistribute flows by more than 15%;
xiv) The potential for cumulative effects of possible filling proposals in that area is minimal;
xv) There are alternative opportunities for flood storage
xvi) The development potential of surrounding properties is not adversely affected by the filling proposal;
xvii) The flood liability of buildings on surrounding properties is not increased;
xviii) No local drainage flow/runoff problems are created by the filling;
xix) The filling does not occur within Floodway Corridor areas; and
xx) The filling does not occur within the drip line of existing trees.

Section 9 provides a summary and validation of the post development scenario in and around the specific requirements listed above.

4. REVIEW OF AVAILABLE DATA

Data has been obtained from a number of sources and includes information required for input to the numerical models, together with information required for validation of model results and the adequate representation and presentation of those results.

4.1. Survey/ DTM

A digital terrain model (DTM) is required to define the physical attributes of the floodplain topography including the creek cross sections and the associated floodplain levels within the model.

The DTM adopted for the assessment is based on the DTM as used in the *South Creek* Study, as provided by Penrith City Council to Costin Roe Consulting in 2016. We understand the DTM was compiled from LiDAR survey from 2014.

4.2. South Creek Flood Study

The *Updated South Creek Flood Study, Worley Parsons, 30 January 2015*, was obtained from Council for use in the study. Council has also made available a digital version of the model results including GIS output of the DTM used in their modelling, flood surface results, flood depth results, hydrology and model build information. This report as noted in Section 1.1 is referenced in this report as *The South Creek Study*.

The *South Creek Study* is a regional study commissioned by Penrith Council in-conjunction with Blacktown and Fairfield Councils. The study includes South Creek and associated tributaries, defining flood planning levels and hydraulic hazard zones along the creek and creek floodplain areas.

The *South Creek Study* includes hydrology and modelling of the 5% AEP event to the 0.5% AEP event and also the PMF event. The study shows the subject site approximately midway along the South Creek tributary and is affected by flooding during the 1% AEP event and also the 5% AEP event. The overbank flooding from South Creek extends partially within the property, comprising low hazard zones and a small area of high hazard.

The flood depths and flood surface levels predicted in the South Creek Study are nominated (Section 5.7: *Estimated RMA-2 Model Accuracy*) as being accurate to +/-200mm.

The *South Creek Study* has been used in the validation process for the TUFLOW modelling completed by Costin Roe Consulting. This validation process is discussed in more detail in following sections.

5. CATCHMENT INVESTIGATION & HYDROLOGY

5.1. Contributing Catchment Definition

The property is located approximately midway along the South Creek immediately downstream of the confluence of South Creek with Cosgrove Creek.

The contributing upstream catchment associated with South Creek is approximately 22,000 Ha (220km^2) with a mainstream length of 25 kM. The catchment generally comprises rural land which is interspersed with residential and industrial areas.

The smaller catchment associated with Cosgrove Creek is approximately 10% of the size of the larger South Creek catchment. The Cosgrove Creek catchment has an area of 2,150 Ha and a mainstream length of 9 kM. This catchment is also primarily rural residential land comprising large tracts of pervious areas.

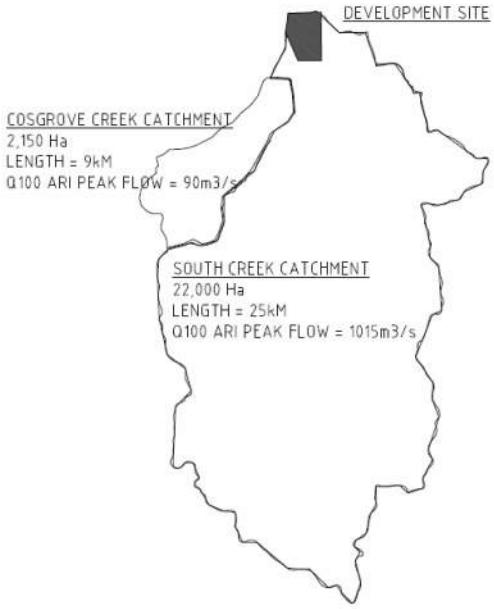


Figure 5.1. Contributing Catchments (Source: South Creek Study)

5.2. Hydrological Assessment of Existing Catchment

It was necessary to first assess the peak stormwater flow and flow hydrograph generated within the catchment, prior to estimating the levels required to traverse the subject site.

The hydrology for the TUFLOW modelling was based on the contributing catchments and peak flows described in the *South Creek Study*. Table H1 defines the 1% AEP flow of 1015m^3/s upstream of the Sydney Water Supply Pipelines, a location which coincides with the location of the study area. Table H7 defines the Cosgroves Creek 1% AEP peak flow at 90m^3/s.

In order to undertake the TUFLOW modelling, the flood hydrograph for the different flood events were required to be confirmed. Utilising the peak flows and timing included in *The South Creek Study*, a basic two node rafts model was setup to establish the hydrographs for use in the TUFLOW model, these were further refined using the recommendations and peak flow values provided by Advisian during works associated with the First Estate development to the north on the opposite side of the Sydney Catchment Authority pipeline. Rainfall intensities

and temporal patterns were derived from the Bureau of Meteorology online IFD tool and Australian Rainfall and Runoff (1987).

The assessment resulted in the following flood hydrographs of the 1% AEP and 5% AEP, **Figures 5.2** and **Figures 5.3**, for Cosgroves Creek and South Creek being defined and used in the TUFLOW modelling. The combined peak flows are consistent with those approved under the overland flow study for the First Estate completed by Costin Roe Consulting. Hydrographs relating to the 5% AEP, 0.5% AEP and PMF storms are included in **Appendix E**.

Flow boundary locations were limited to the South Creek and Cosgrove Creeks channels. This is consistent with the *South Creek Study* which does not include any other flow entry points within the *Study Area*. We note that there are two flow entry points within the study extent from industrial areas to the east of Mamre Road which were not included to maintain consistency with the South Creek Study. The flows from these comparatively small catchments are a minor component of the overall hydrology of South Creek and inclusion is not expected to affect the flood results to any discernible degree.

We confirm the peak flow of 1015m^3/s for the 1% AEP and 720m^3/s for the 5% AEP storm are consistent with the *South Creek Study* and the peak flows for both storms occurs at 22 hours.

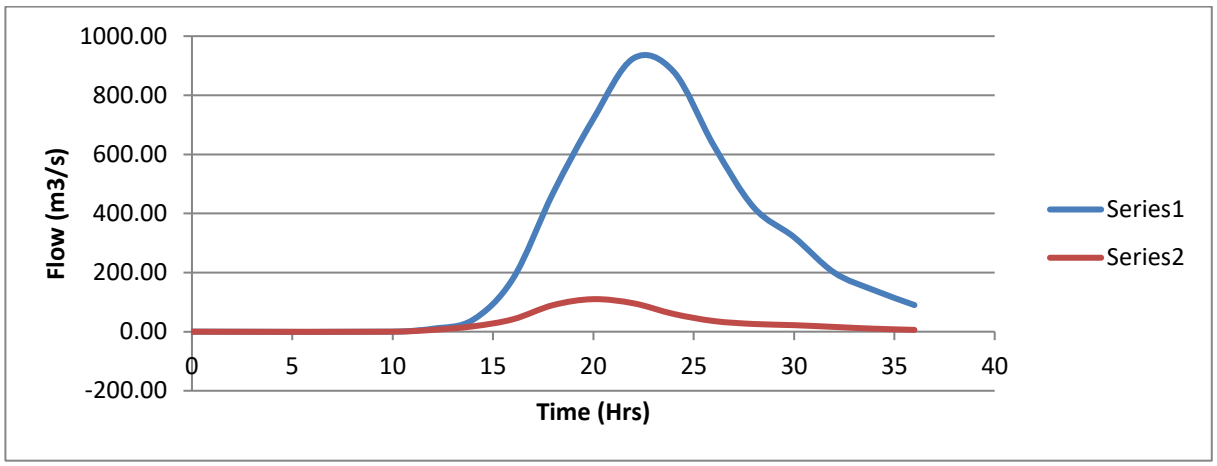


Figure 5.2 South Creek (Series 1) and Cosgroves Creek (Series 2) 1% AEP Hydrographs

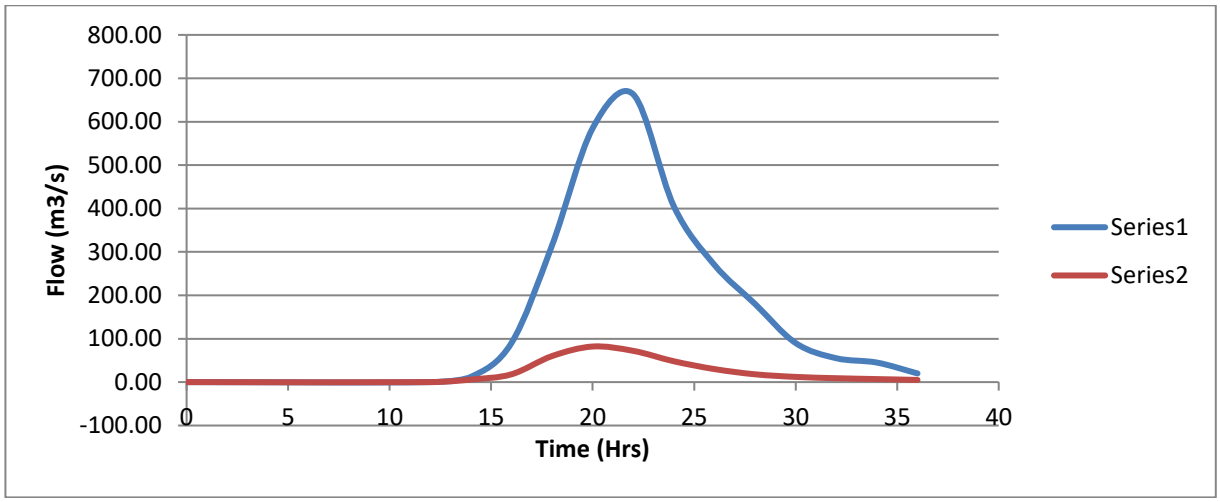


Figure 5.3 South Creek (Series 1) and Cosgroves Creek (Series 2) 5% AEP Hydrographs

6. HYDRODYNAMIC MODEL DEVELOPMENT

6.1. Extent and Topography

Hydraulic modelling for this study was undertaken using the TUFLOW engine via the XPStorm-2D Software Platform. The modelled system is based on a 2D approach for the existing cases. The DTM was developed based on LiDAR data as used in the *South Creek Study* as discussed in **Section 4** of this report.

The water levels and flows are resolved on a rectangular grid covering the area of interest. The TUFLOW model was set up with a 7m grid cell size, which is an appropriately small cell size to define overland flow behaviour, and more importantly, the difference in the behaviour between two modelled scenarios, through the area of interest.

The model extent is shown in **Figure 6.1**. Modelling has been completed along South Creek, beginning approximately 1000m upstream of *The Site* and extending approximately 1100m to the north of the Mandalong Close Rural Residential Area approximately at the Luddenham Road crossing of South Creek.

The model extent has been chosen to encompass the study area, including the 118 Ha Industrial Site and extended recent development area of Altis First Estate and Mandalong Close precinct.

6.2. Boundary Conditions

Inflow Boundaries

Design inflow hydrographs of upstream boundaries of Cosgrove Creek and South Creek have been included in the locations noted in **Figure 6.1**. These are located approximately 1100m upstream of the property boundary and inflows were based on hydrology as discussed in **Section 5** of this report.

The inflow boundaries have been positioned at distances of greater than 2.5 times the flow width from the subject property to ensure that any potential instabilities in the model that may be present at the inflow boundary entry point are resolved in the model prior to the study area. This is consistent with previously approved flooding applications and considered sufficient to produce accurate results for the effect of the development in relation to flooding of South Creek.

Downstream Water Level Boundaries

The model extent has been continued for a distance of approximately 2000m downstream of from the First Estate Precinct to a point downstream of where Luddenham Road crosses South Creek. The downstream water level boundary has been modelled using the boundary control levels provided by Worley Parsons. The modelled downstream boundary levels are provided in the **Table 6.1**.

AEP (%)	Downstream Boundary Level (m)
5	29.2
1	29.75
0.5	30.0
PMF	31.8

Table 6.1. Downstream Boundary Water Surface Levels

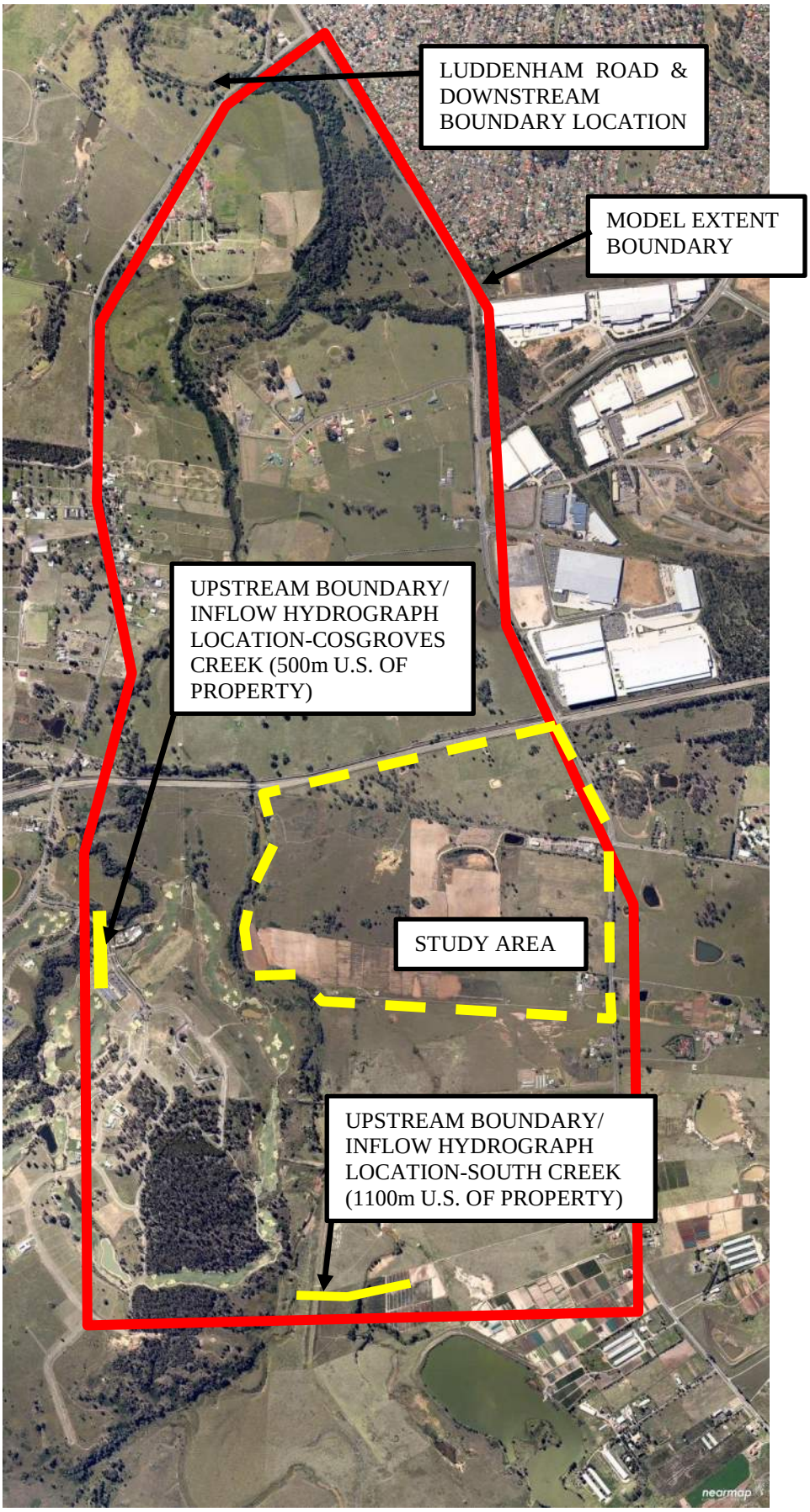


Figure 6.1. Model Extent and Model Boundary Location

6.3. Channel and Floodplain Roughness

Roughness values adopted in the model are contained in **Table 6.2** below. These are generally consistent with those included in the *Table 17* of the *South Creek Study*, except where adjusted to ensure validation of model results and achieving consistency with the results of the *South Creek Study*.

Table 6.2. Adopted TUFLOW Element Roughness Values

Model Element	Description	Roughness Parameter Value (South Creek Study)	Roughness Parameter Value (TUFLOW Study)
1	Moderately vegetated creek channel	0.10	**0.10**
2	Heavily vegetated creek channel	0.12	**0.12**
3	Grassed floodplain and sparse trees	0.05	**0.05**
4	Floodplain with moderate coverage of trees	0.08	**0.08**
5	Floodplain with dense trees	0.12	**0.12**
6	Urban Floodplain	0.04	**0.04**
7	Industrial Development	0.09	**0.09**
8	Roadways	0.015	**0.015**
9	Sydney Water Pipeline	NA	**0.08**

A figurative representation of where the above roughness values have been applied can be found in **Appendix F**.

6.4. Representation of Buildings and Hydraulic Structures

Structures modelled are consistent with those included in the *South Creek Study*.

Buildings within the extent of flooding are small, isolated residential dwellings. These dwellings provide a small footprint when compared to the overall flood plain and are were not included in the model as obstructions.

The *South Creek Study* did not include the bridge structure associated with crossing at Luddenham Road and we also negate this in our model. The Sydney Water Pipeline to the north of *The Site* has been modelled as a hydraulic constraint via adopting a high Manning's roughness value consistent with that of a floodplain with moderate tree coverage. No other major hydraulic structures are present within the limits of the modelling and no other structures have been included.

6.5. Model Validation

Model validation has been completed by comparing results of the TUFLOW modelling against the results contained in the *South Creek Study* and adjusting as required to achieve good agreement between the two models. The process for the validation was as follows:

- Establish hydrology, peak flows and hydrograph for modelled events;
- Establish TUFLOW Model using defined parameters;
- Compare results of TUFLOW modelling with South Creek Study including flood depths, flood levels (taking into account the use of consistent DTM's), flood extents and hydraulics. The comparison is made at the peak of the predicted parameters;
- Adjust roughness factors to align TUFLOW flood depths and to within 0.1m of *South Creek Study* Results.

Hydrology and peak flows were established as described in **Section 5** of this report. The hydrological information used in the TUFLOW model is consistent with those of the South Creek Study.

A number of trial models and iterations of the TUFLOW model were performed. Adjustment of roughness parameters were used to align the flood levels with those compiled in the South Creek Study.

The comparison of the flood level results shows good alignment of those produced in the TUFLOW model when compared with those of the South Creek Study. Flood water levels were seen to have a difference less than 0.1m and generally in the order of 0.03-0.05m through the overbank/ floodplain areas. The predicted flood extent is consistent between the two models for the different flood events modelled.

Given the differences in modelling techniques, parameters, predicted model accuracy (+/-0.2m) and model components these differences are considered acceptable for the base model and for continuation of post-developed scenario modelling.

Comparison of flood results at five key locations can also be observed in **Table 7.1**. Flood depths differences at these key locations can all be seen to be less than 0.05m and within the predicted RMA flood accuracy of 0.2m.

7. PRE-DEVELOPED FLOOD MODELLING RESULTS

The predicted peak flood levels, depth and velocities were extracted from the hydrodynamic modelling and were used to generate water surface profiles, depth profiles and velocity profiles for each of the design events.

The water surface profile for the 1% AEP event has been presented below in **Figure 7.1**. Reference to **Appendix A** 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 7.1**) are also presented in **Table 7.1**.

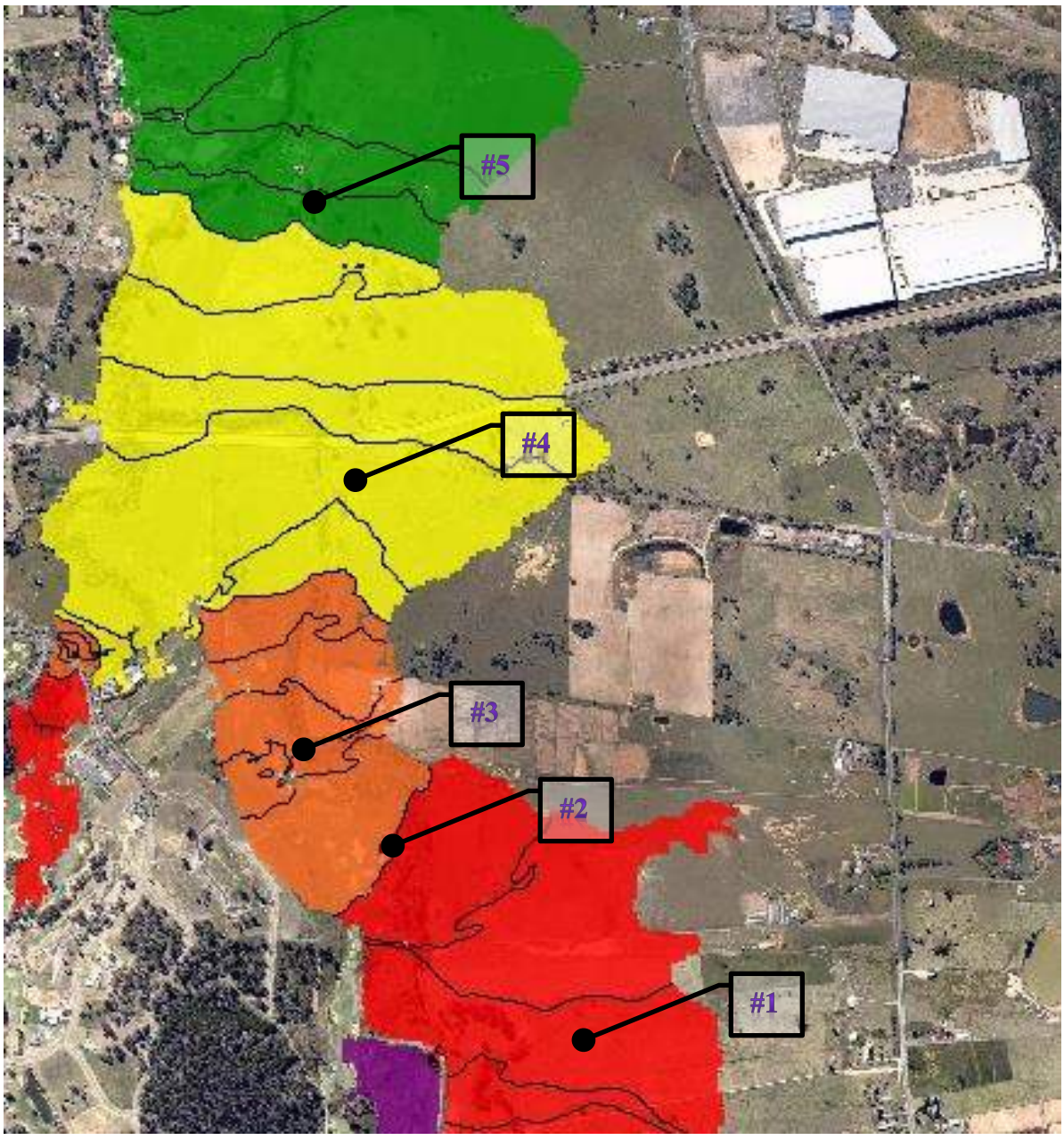


Figure 7.1. Predicted 1% AEP Peak Flood Level Profile

No.	TUFLOW			South Creek Study		
	Ground Level (m)	Flood Depth (m)	Flood Level (m)	Ground Level (m)	Flood Depth (m)	Flood Level (m)
1	32.93	2.63	35.56	32.93	2.64	35.57
2	31.65	3.33	34.98	31.65	3.32	34.97
3	33.11	1.49	34.60	33.11	1.52	34.63
4	32.47	1.25	33.72	32.47	1.29	33.76
5	30.79	2.08	32.87	30.79	2.13	32.92

Table 7.1. Predicted 1% AEP Peak Flood Parameters at Key Locations

Table 7.1 shows the predicted flood depths and levels in five key locations through the study area. The flood depths compare well with differences of 0.05m or less at the five locations.

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 1.0-1.5m. This area has been categorised by Penrith Council in the *South Creek Study* as being flood storage zone.

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

8. POST-DEVELOPMENT SCENARIO RESULTS

8.1. Options Assessment and Development

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

Scenario modelling for the filling of land was undertaken. The extent of development has been modelled to a point where the objectives nominated in **Section 3** of this report have been achieved, in addition to reviewing and including options for flood storage compensation within floodplain through undeveloped and higher hazard areas of the site. The main method for the initial assessments 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 measure of difference between the development scenarios and benchmark for development potential. The remaining flooding objectives as listed in **Section 3.3** and **Section 9** of this report for filling within flood zone were then assessed and confirmed for the development scenario. If any of the 10 criteria were not met, the model was then adjusted to ensure all the requirements of council's development control plan were met.

8.2. Development Scenario

The Development Scenario is based on filling to a point which meets the requirements of the *Penrith Council Development Control Plan Part C3*. Filling of the site has been modelled as a digital terrain model within *The Site* development footprint where the development levels and design layout are now known. Recent development within The First Estate to the north of the subject land, future Mandalong Precinct and recent residential development in Twin Rivers Estate on the western side of the South Creek have also been included in the post-development conditions. This ensures that *DCP Criteria 4* and *6* which relate to cumulative effects of development and development potential of other properties are not affected by the development do not occur. In addition an area of flood storage compensation has been included through the south-western portion of the site, further reducing flood afflux in particular around residential properties in the Twin Creeks Estate.

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 change in flood surface levels and flow regime are confined locally adjacent to the proposed areas of filling. The change to flood surfaces levels occur over eastern bank of South Creek channel and are generally contained in this area, however are generally less than 60mm. A decrease in flood levels is shown to the south of the proposed development and west of the South Creek channel, with significant upstream water level reductions;
- 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 15.12Ha of flood affected land is able to be filled and developed over the proposed site.

Figure 8.1 shows the 1% AEP flood levels and **Figure 8.2** shows 1% AEP flood surface afflux results. Further results and output can be found in report **Appendix B**. Further discussion on validation of the development scenario is included in **Section 9** of the report.

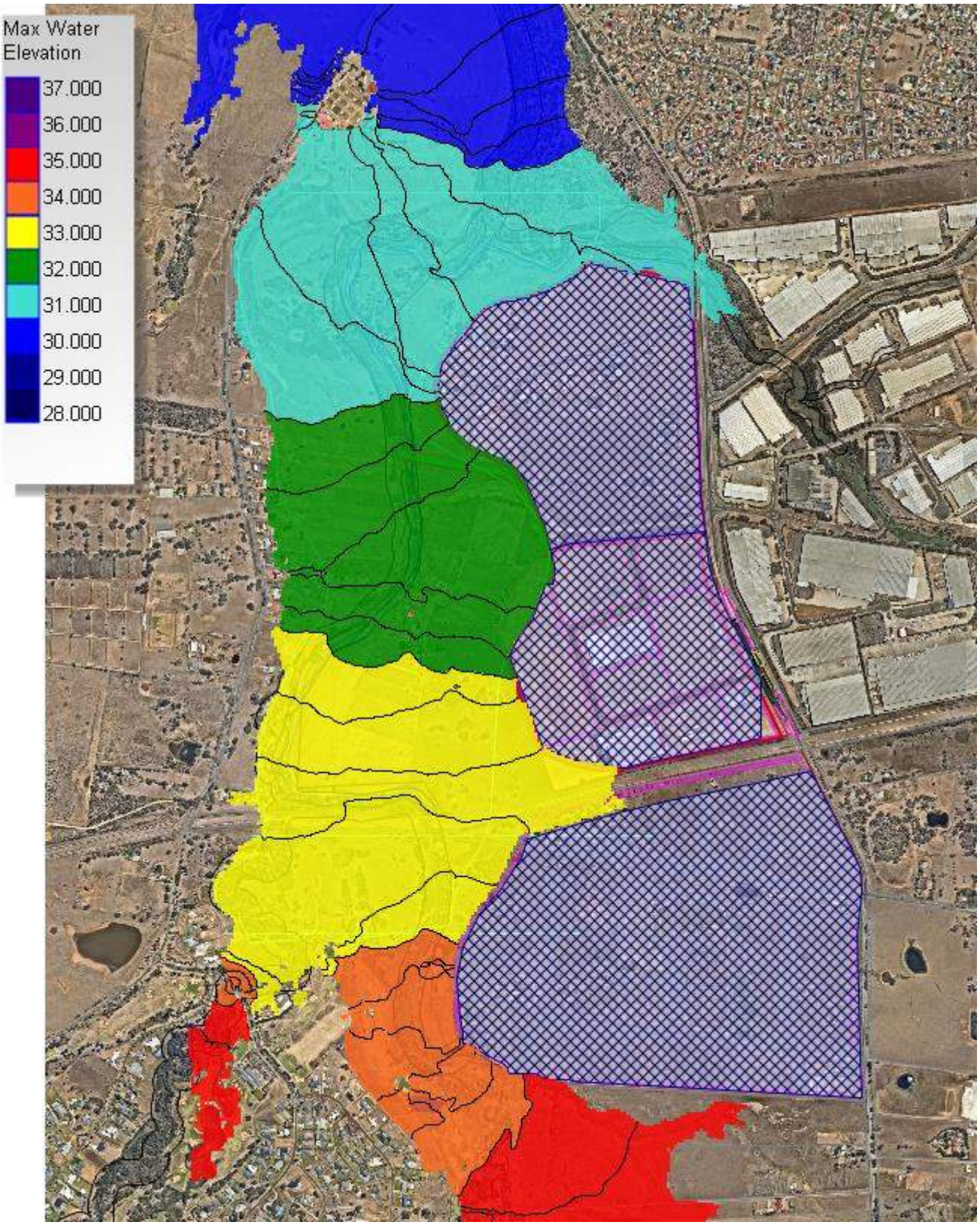


Figure 8.1. Post Development Scenario - 1% AEP Flood Surface Levels

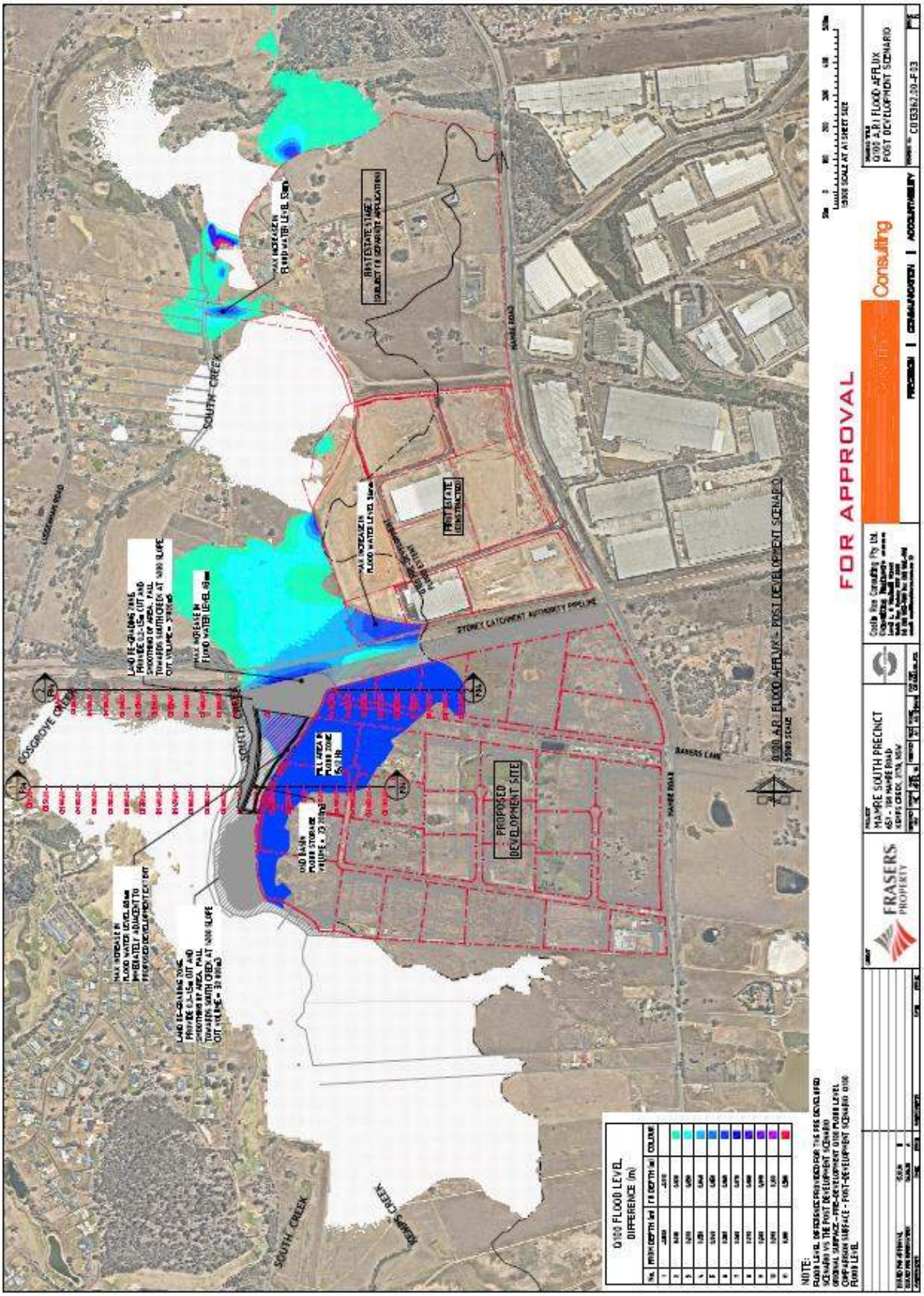


Figure 8.2. Post Development Scenario – 1% AEP Flood Surface Level Afflux

9. CONFIRMATION OF PROPOSED DEVELOPMENT & POLICY CRITERIA

The Post-Development Scenario has been assessed as meeting the requirements of *Penrith Council Development Control Plan Part C3* for filling within flood affected land. **Table 9.1** and **9.2** 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 10**.

With reference to **Section 7 & 8** and modelling results contained in **Appendices A** and **B** we provide confirmation in **Table 9.1** that the criteria set out in the *Penrith Council Development Control Plan C3* (and listed in **Section 3.3**) for filling within flood affected land.

Criteria	**Post Development Scenario Confirmation**
Criteria 1 Flood levels are not increased by more than 0.1m by the proposed filling. <u>*Post Note:*</u> *As part of discussions with Council and the NSW DPE, Item i) above has been revised to ensure that no effect to upstream or downstream properties were to occur. The maximum offsite water level change confirmed for the assessment was to be 10-20mm or less. On-site changes would need to be within the 100mm as stipulated in Council DCP.*	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, within the extents of the site boundaries. Offsite reductions present show an improvement in flood levels upstream (south) of the development and It is noted flood afflux downstream (north) of the development site and west of First Estate are consistent with previously approved and now constructed development, noting a minor 10mm difference to the previously approved afflux levels. Further, that afflux shown adjacent and to the west of Mandalong Close, are associated with a planned rezoning currently being assessed by the Department and Penrith City Council. The afflux shown in these areas is not affected by or impacted on by the proposed Altis/Frasers development, nor is the Altis/Frasers development impacted by the potential rezoning adjacent to Mandalong Close.
Criteria 2 Downstream velocities are not increased by more than 10% by the proposed filling	We confirm that the proposed filling does not increase velocities downstream of the filling areas by more than 10%. The afflux mapping contained in **Appendix B** shows there is a minor change in velocity adjacent to the proposed filling area of 0.06-0.07m/s, and a maximum increase of 7.8%. We have also shown the velocity affluxes adjacent to the *First Estate Stage 1 & 2* (which are subject to a separate application). Velocity afflux results adjacent to First Estate are consistent to those presented in the *Stage 2 (Revised) Overland Flow Report* by Costin Roe

Criteria	Post Development Scenario Confirmation
	Consulting. This confirms that the proposed filling works associated with the Mamre South Precinct are localized and do not result in a cumulative effect on flooding nor do they increase the flood affectation downstream of the subject study area. We also confirm there are no changes to the development potential of adjacent or downstream properties, those which are located within the Floodway Corridor and those external to the flood extent. Refer to pre and post development velocity comparisons included in **Appendix B**.
Criteria 3 Proposed filling does not redistribute flows by more than 15%	We confirm that the proposed filling does not redistribute flows by more than 15%. Pre and post development flow comparisons sections for South Creek have been prepared and are included in **Appendix B**. Flow rates for the total flood extents have been separated to show the flows distributed between the mainstream channel, the eastern overbank flood (right bank) and the western overbank flood (left bank) areas. The post development differences can be seen to be generally at or below 10%, with a maximum of 15% being seen within the eastern (right) overbank area of the creek. Further noting the maximum 15% change in the eastern bank, equates to less than 3% of the total flow in South Creek. Further noted that the cross sectional distribution methodology included in this assessment is consistent with the approved methodologies with Council included in previous overland flow assessments associated with the adjoining SSD 7173 application.
Criteria 4 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. The afflux output shows an increase of up to 30-40mm across the flood plain, through areas of high hydraulic hazard grading to zero increase to the north and south of the maximum afflux. This area is also seen to be majority high hazard/ floodway where development is not permitted. The majority of afflux adjacent to the proposed

Criteria	Post Development Scenario Confirmation
	development shows a decrease in water surface levels as a result of flood compensation provided as part of the development. To the north, that is downstream of the development area, the effects due to development grade out to zero through a defined extent. Further, the proposed development provides compensatory flood storage of 87,800m^3, noting that the displaced storage volume is 75,000m^3. Hence the affect due to development is confined to a specific area, and not cumulative to upstream areas. We confirm that cumulative effects of filling are not applicable to the proposed filling and development.
Criteria 5 There are alternative opportunities for flood storage. <u>*Post Note:*</u> *Further to Item (v), it was agreed, that any filling within the flood fringe would require any lost storage to be offset as part of the works (i.e. provide compensatory flood storage which matches displaced zones).*	The flooding in South Creek comprises mainstream flooding with overbank topping and flow within the flood plain on the eastern and western sides of the creek. Compensatory flood storage is provided along the south-west corner and north-west corner of the proposed development, with additional volume available within the remaining flood plain. The proposed development provides compensatory flood storage in the nominated areas discussed above, and shown on drawing **Co13362.00-F03** in **Appendix A**, of 87,800m^3. The displaced volume is 75,000m^3. Hence additional flood storage has been provided to that displaced through the development. The estate stormwater management basin proposed as part of the development has been included within the model and provides some flood storage, located at the north-western extent of the site. The basin has been modelled at 80% full during the flood event. It is noted that peak flow of the local storm event does not align with the peak flow for the regional flood event and hence it is unlikely the basin will be at full capacity during the regional flood. Further noting that any maintenance, although not related to flood affectation or assessment will be undertaken by the proponent as discussed with Penrith City Council.
Criteria 6 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. It is noted that several properties on the western side of

Criteria	Post Development Scenario Confirmation
	South Creek are adjacent to an area which experiences a reduction of flood afflux, and the increase in afflux is restricted to an area adjacent to the development. Based on this surrounding properties will not be adversely affected by the filling proposal. In relation to the development potential to these properties on the western side of South Creek, the high hydraulic/ floodway zone extends through the majority of the flood affected land on the western side of South Creek. Areas of high hydraulic hazard, as confirmed by Penrith Council, are restricted from filling or development, hence development potential through the majority of the land to west of South Creek is limited in scope. Further, developers or land owners proposing any additional development on the west of South Creek have the opportunity to also complete their own assessment and mitigation solutions to maximize their development footprint within the bounds of Councils DCP, including flood storage offsets or other solutions, through undeveloped portions of the land.
Criteria 7 The flood liability of buildings on surrounding properties is not increased	Surrounding building and properties are not affected by flooding changes due to the proposed filling and no reduction in flood immunity has been shown in the analysis. A reduction in flood levels has been shown adjacent to the Twin Creeks Residential Estate, hence no increase in flood liability will occur in relation these properties. Furthermore, the residential properties along Medinah Avenue to the west of the proposed development are generally sited between 1.0-1.5m above the predicted flood level, hence flood immunity requirements (min 0.5m) are not impacted due to the proposed development. Review of the ALS survey data shows that existing dwellings along Luddenham Road are generally sited between 2-4m above the predicted flood levels, hence flood immunity requirements (min 0.5m) are not impacted due to the proposed development. It is also noted that several farm structures are located within the flood plain and existing flood extent. Afflux in the vicinity of these structures is in the range of 0.02-0.030m. Refer drawing **Co13362.01-F03** which shows afflux values and confirms freeboard to dwellings.

Criteria	Post Development Scenario Confirmation
	It is also noted that afflux shown to the west of the First Estate (per SSD 7173) is not changed or affected by the current assessment. This area is not subject to the current assessment and approval submission, however it is noted again that the outcome of the modelling confirms this development does not associate any cumulative impacts or affect upstream downstream or adjacent properties as a result of the proposed filling works.
Criteria 8 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. All local tributaries and flow paths will either operate in a similar manner to the existing regime or form part of the overall stormwater management system for the estate.
Criteria 9 The filling does not occur within Floodway Corridor	All filling is proposed outside of Floodway Corridor as required of the DCP and council.
Criteria 10 The filling does not occur within the drip line of existing trees	Filling is proposed within rezoned rural land and existing trees outside of the proposed rezoning areas are not affected by proposed filling activities. It is expected that trees within rezoned land will be affected by future industrial development, consistent with the nature of the future development and zoning of the land. Specialist studies will form part of future development approvals over the land. This is also noted to be consistent with the approval of the Stage 1 report and supported by Council.

Table 9.1. Stage 2 (Revised) Scenario- Confirmation of DCP Part C3 Criteria

Further comments on other key considerations relating to the development and the regional context are also noted as follows:

- The modelling confirms the outcomes of the flood assessments completed and approved for the First Estate under SSD7173 are generally maintained. A minor difference of between 0.010-0.020m only is noted around the southern extent of the now constructed First Estate;
- In relation to the potential of cumulative impact as other sites within the catchment are developed to the same or similar degree to the proposal the following is noted. The development proposal does not provide for any incremental increase in peak flood levels off-site and relatively minor changes on site. If other future developments provide for similar relative impacts and management measures (including flood storage compensation) as required of Penrith DCP, the overall cumulative impact within the South Creek corridor would be

effectively managed. Accordingly, the development would be considered to not be contributing to a future cumulative impact;

- There is sufficient capacity and time for either safe egress of occupants offsite or to an on-site refuge during a major flood event. The levels over the site are proposed at greater than 0.5m above the 1% AEP storm event which allows several hours of flood warning response time. Also, at least 50% of the developed site will be above the PMF flood event. Given there is less than 1kM from the flood affected zone to a PMF free area of the site, occupants could move to flood free land in only minutes.
  A framework for flood evacuation has been included in the submitted report (refer **Section 10**) which can be used to formulate more detailed flood response plans for specific stages of the site, or individual developments in the estate;
- There is negligible effect on the proposed Badgerys Creek Airport in relation to the development which is more than 5km upstream of the development; and
- There is negligible effect on the Nepean River in relation to the development which is more than 20kM downstream of the development.

10. FLOOD SAFETY AND EVACUATION

10.1. Introduction

This section of the report presents the relevant information in relation to egress and evacuation during the approach of a significant flood event. The information in this report can be used as a framework for the overall precinct and for future more detailed emergency response plans for individual facilities.

This framework has been completed with consideration to the State Emergency and Rescue Management Act 1989 (NSW), the State Emergency Service Act 1989 (NSW), and the Penrith City Council Local Flood Plan 2012 (refer **Appendix D**) which includes the South Creek Catchment.

Based on typical light industrial population rates of 1 employee per 200m^2 GFA, it is expected that approximately 2500 people will occupy the 118 Ha precinct following completion of the development. These people would be distributed proportionately between approximately 20-25+ facilities depending on lot/ development layouts and will require safe passage during possible flood events.

10.2. Flood Extent and Timing

The flood levels and extent during various storm events are included in earlier sections of this report, and the PMF event for the Developed Scenario is shown below in **Figure 10.1.**

Figure 8.1 shows that at least 80% of the developed site will be above the PMF flood event. It is further noted that the pads within the PMF zone will experience maximum flood depths of only 0.5m-1.0m and velocities in the range of 0.5-1.0m/s (locally up to 2m/s at the development edge) during the PMF flood event. Additional, given there is less than 0.5 kM from the PMF affected zone to the PMF free area of the site, occupants could move to flood free land in only minutes.

Finally, based on the modelled rate of rise, during the PMF event it will take approximately 1hour from the time of first inundation to the peak. The velocities of flow as noted will be in the 0.5-1m/s range hence for the majority of the time during the rise to peak, DV values will be less than 0.4 (normally considered safe for pedestrian egress) and a maximum of 0.6. Noted that even if occupants did not heed any warnings and were on site in a PMF event, they would be able to move from an area of flood effected land to non-flood affected in less than minutes in a safe manner.

We also include **Table 10.1** which shows the proposed pad level, PMF flood level and maximum flow depths during the PMF event. Further information on the PMF event can be found in drawing **Co13362.00-F14** in **Appendix C**.

Lot Number & Level	Lot Level RL (m)	PFM Flood Level (m)	Maximum Flood Depth (m)
Lot 18	40.00	37.30	0
Lot 17	39.90	37.25	0
Lot 16	38.50	37.25	0
Lot 15	37.80	37.25	0
Lot 29	37.30	37.20	0
Lot 28	36.70	37.10	0.4
Lot 27	35.90	36.90	1.0
Lot 6	41.50	37.30	0
Lot 4	41.00	37.25	0
Lot 5	40.50	37.27	0
Lot 9	38.50	37.25	0
Lot 8	39.20	37.25	0
Lot 7	39.70	37.25	0
Lot 14	37.90	37.20	0
Lot 13	39.20	37.20	0
Lot 12	39.70	37.20	0
Lot 26	36.20	36.30	0.1
Lot 24	36.20	36.22	0.02
Lot 22	37.00	36.00	0
Lot 25	35.50	36.15	0.65
Lot 23	35.50	36.05	0.55
Lot 21	36.00	36.00	0
Lot 3	39.50	36.50	0
Lot 2	39.50	36.40	0
Lot 1	38.70	36.00	0
Lot 11	37.70	35.90	0
Lot 10	36.80	35.10	0
Lot 20	35.80	35.10	0
Lot 19	35.00	35.00	0

Table 10.1. PMF Level and Flow Depth

As discussed in earlier sections of the report, the main flood peak in South Creek will occur 20-24 hours after the flood producing storm begins. It is noted that flooding of the South Creek Flood plain could occur in a timeframe less than 20-24 hours and discussion with Advisian (formerly Worley Parsons) suggest that flooding would occur 4 hours following peak intensity rainfall and that an effective warning time of 4 hours could be considered for the precinct also considering the flood wave take approximately 1 hour to travel between Elizabeth Drive and the Warragamba Pipeline (at the north of the Study Area) and 3.5 hours from the Bringelly Road Crossing, being the upper extent of the South Creek study area. Further discussion on effective warning measures and triggers are included in following sections.

It should be noted that local inundation of Mamre Road will occur from local tributaries and industrial catchments on the east of Mamre Road to the north of Mandalong Close via Blind Kemps Creek in addition to backing up of floodwater associated with South Creek.

Local inundation could also occur at a low point and existing culvert on Mamre Road adjacent to the south-east of the Study Area. The extent of this is expected to be minor and short lived in nature associated with local flood events only. It is noted the upstream catchment has a limited upstream catchment of 32 Ha and is largely undeveloped or rural– this route is generally not recommended unless in early stages of a flood event and the preferred route through Erskine Park Drive be used for egress during flood events.

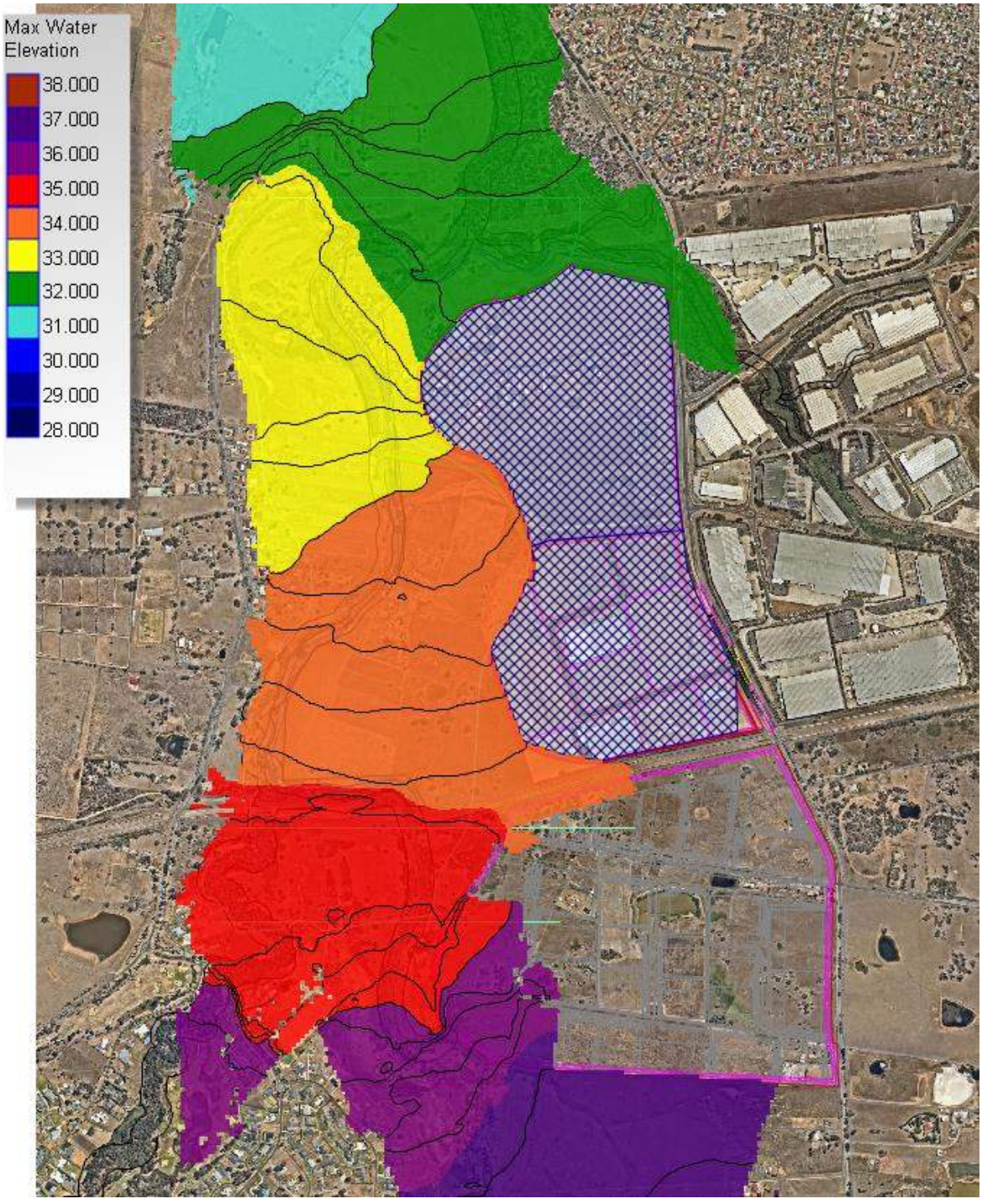


Figure 10.1. Post Development Scenario - PMF Flood Level and Extent

10.3. **Preparedness**

Development of Warning Systems

Each facility should have a facility specific plan which sets out flood warden, evacuation zones and responsible persons. As noted the advice in this report can be used as a framework for these site specific plans, in conjunction with Penrith Council and SES sub plans as required.

The NSW SES Penrith Local Controller is responsible for monitoring the flood risk over the area and for issuing flood warnings to the community. Any person or group occupying the precinct at the time of flood danger should adhere to any warnings issued. The warning message will normally be issued via SMS (phone text) by the SES, and flood alerts would also be provided by the BOM prior to SES flood warning. During periods of heavy or forecast heavy rainfall it is important that one or some of the occupants of a facility should be able to receive such messages. The occupants must then immediately follow the flood evacuation plan in this report or the instructions of the SES controller in the area.

As described in **Section 10.4** below, the SES Warning System is based on predicted rainfall and gauges on the Hawkesbury River at Windsor and at the Nepean River. These rivers do not directly influence flood levels within South Creek directly adjacent to the precinct and supplementary information specific to the site should be used for individual flood management plans. The BOM/ SES system will provide good initial guidance, however in addition to the SES flood warning system, it is recommended that monitoring of real time gauges within South Creek, and potentially an in-house or precinct wide warning system also be employed to supplement the BOM gauges. Such a warning system could consist of a series of flood depth markers or responders placed on the west of the precinct within the South Creek flood plain. A suitable response/ trigger methodology has been outlined in **Section 10.4** which can be utilised to inform users of the site to prepare their own site-specific flood management response plans.

Flood warning and emergency response for the development site will be based on the flood behaviour within South Creek. Whilst it is understood there is no formal flood warning system on South Creek, there are existing water level and rainfall gauges relevant to the catchment. These gauges include:

- Water level – South Creek at the Great Western Highway Stn 567071
- Water level – South Creek at Mulgoa Road (Elizabeth Drive) Stn 567070
- Rainfall – Bringelly (Maryland) BoM Stn 67015
- Rainfall – Rossmore (South Creek) BoM Stn 67061
- Rainfall – Badgerys Creek BoM Stn 67108
- Rainfall – Erskine Park Reservoir (Maryland) BoM Stn 67066

Real-time data (updated at 15-minute intervals) for these sites can be accessed through the BoM website via the following hyperlink:

http://www.bom.gov.au/nsw/flood/greatersydney.shtml .

Preparation Steps

It is the responsibility of the occupants of the each facility to understand the risks and dangers of flooding across the precinct, and the need to evacuate in such an event.

It is recommended that the users of the each facility are registered to able to receive flood warning messages via SMS from the NSW SES.

Lastly, the evacuation framework, including the evacuation route, contained in this report must be understood and adapted to each specific facility. It is recommended that a copy or copies of this route and plan are kept at several locations on site such as the maintenance manager, and office administrator. A thorough understanding of *Councils Local Flood Plan* as included in **Appendix D** of this report should also be made.

It is noted that significant lead warning time would not be required to enable effective flood response plans to be initiated for this site. The freeboard set at 0.5m above the 1% AEP means that all sites are at a level higher than the 0.5% AEP flood level. Also, significant portions of the estate are above the PMF level and are not flood affected, meaning that safe refuge in major flood events is available. Further, given the travel distances from the western fringe of the site, to the eastern flood free portions are less than 1000m, vehicular and pedestrian evacuation to flood free land above the PMF level may be completed in less than 5minutes. It is noted that sufficient warning times are recommended in the Flood Response section of the report, however even if these were to be shortened to less than an hour this would still result in ample time for safe evacuation to be made.

10.4. Flood Response

The following sub-sections of the report provide information on flood rate of rise, timing and potential flood triggers that could be utilised by future facility owners which are below the PMF flood level to be able to prepare their own flood response plans.

The rate of rise can be reviewed directly via the BOM river gauges in South Creek as listed in Section 10.3 (noting these levels do not correspond to AHD), and a site-specific gauge is recommended for the site. One such system is the *Dipstick automatic flood warning system* by Tuftec.

Response Triggers

1. **Trigger 1 - *A flood alert/watch/advice is issued by the BOM.***

   The BOM alert will be issued if flood producing rain is predicted. This provides an early warning that flooding may occur, however is not confirmation that flooding will occur. If this alert is issued then the Flood Warden should be on alert for further BOM, SES or site-specific Triggers.

2. **Trigger 2 – *General flood alert issued by the BOM.***

   A generalised flood warning would be issued when flooding is expected to occur in a given area. These would generally be provided by the BOM with three hours warning time is expected from issue of warning to peak flood level as per the "Service Level Specification for Flood Forecasting and Warning Services for New South Wales – Version 2.0" (Bureau of Meteorology, 2013).

   It is noted that Trigger 3 may occur prior to Trigger 2 and the Flood Warden is required to consider this eventuality.

3. **Trigger 3 - *Site flood level gauge achieves flood level in South Creek of RL 32m.***

   This would allow for 2hr to evacuation level (ie Q100+0.5m) in a PMF event, or 5-6hours in a 0.5% AEP (1 in 200yr ARI).

   Flood Warden at this point should put building occupants on alert to evacuate or move to on-site refuge with follow up in 1hr or Trigger 4 being met. Flood warden to contact SES for additional updates and confirmation of road closures.

4. **Trigger 4 – *Site flood level gauge achieves flood level in South Creek of RL 33.8m.***

   This trigger would allow for a 1hr period prior to the evacuation level being reached (i.e. the 1% AEP+0.5m) in a PMF event, or 2hours in a 0.5% AEP (1 in 200yr Ari).

   Flood warden should advise evacuation within 30min is required, otherwise immediate evacuation could occur or remain on site for future movement to on-site refuge. Any evacuation route or timing should be completed in consultation with SES to confirm road closures.

5. **Trigger 5 – *Site flood level gauge achieves flood level in South Creek of RL 34.2m (ie Q100+0.5m), or rate of rise between Trigger 2 to 4 is less than 2 hours.***

   Flood warden should advise occupants or remaining occupants to move to on-site flood refuge zone. No further vehicular evacuation would be recommended.

Once the South Creek flood height reaches the nominated flood level then warnings will be distributed to all occupiers of the facilities at the time of the warning.

Table 10.1 provides information relating to differing AEP storm events, SES warnings and the status of the vehicular evacuation route. It is noted that there is no direct correlation data published between AEP events and the SES flood warning levels within the Penrith City Council.

Design Flood (AEP)	Flood Warning (BOM/SES)	Predicted Flood Level at Site^ (m)	Status of Evacuation Route
-	Minor	-	Not Impacted
-	Moderate/ Level 1	-	Not Impacted
-	Major/ Level 2	-	Potentially Impacted
20%	-	-	Not Impacted
10%	-	-	Not Impacted
5%	-	33.4	Not Impacted
2%	-	-	Not Impacted
1%	-	33.7	Not Impacted
0.5%	-	33.8	Impacted^^
PMF	-	35.2	Cut

Table 10.1. Flood Route Evacuation Status

^: AEP Level taken at upstream end of precinct adjacent to Sydney Water Pipeline to nearest 0.1m

^^: Note route impacted in short duration local storm of 2hr duration however not impacted during long duration 36Hr event.

Response Strategies

Following the appropriate warning message or response trigger, response operations should commence. The response requirement for each site would be highly dependent on the specific user and potential of damage from flooding. Normally the response would begin with necessary property protection for each facility. Typical measures could include sandbagging, moving any furniture, machinery or stock that may be affected by flood waters of level greater than flood planning levels. As noted, all developed land has been sited at the 1% AEP flood level plus 0.5m freeboard or higher, so the probability of occurrence is low and individual plans should be made for each facility to ensure the response measures meet the requirements o that facility.

Occupants are to be mobilised with the level of importance and urgency corresponding to the flood risk. High flood risk areas (i.e. those on northern and western side of precinct) must be evacuated before medium risk (i.e. those in central portions of the precinct), and finally low risk (i.e. those on the south-east of the precinct) areas, in line with the Triggers listed earlier in this section of the report.

The preferred evacuation route from the precinct is to be made north-east of the site as shown in **Figure 10.2**. The modelling of Blind Kemp Creek within the First Estate Stage 2 (Revised) report by Costin Roe Consulting shows that overtopping of Erskine Park Drive will not occur when South Creek is in flood for flood events less than the 0.5% AEP event. The route is expected to be cut in events between the 0.5% AEP and PMF event and evacuation during these events would be cautioned, subject to SES road closures and authority warnings. On site shelter could be considered for PMF events in areas known to be free of flooding during the PMF including the Eastern and south-eastern portions of the precinct if the preferred evacuation route is cut or SES warnings recommend on-site shelter be undertaken. It is noted that Erskine Park Road is more susceptible overtopping during local storms of short duration, than when larger flood front passes through South Creek, hence the evacuation route has a lower probability of occurrence to be cut when South Creek is in flood

Other potential evacuation routes, such as south along Mamre Road, to Elizabeth Drive or Bakers Lane, or north along Mamre Road past its intersection with Erskine Park Road, would also be expected to be inundated and potentially hazardous during PMF and smaller AEP events. These routes are not recommended to be utilised during major storm events.

The final route to an Emergency Refuge Centre, or movement to an on-site refuge (adjacent to Mamre Road and above the PMF flood line) would need to be assessed in more detail as part of a site-specific plan as it is understood portions of Elizabeth Drive will also be inundated during the PMF event. The recommended route to the M4 Motorway is shown below in **Figure 10.2**.

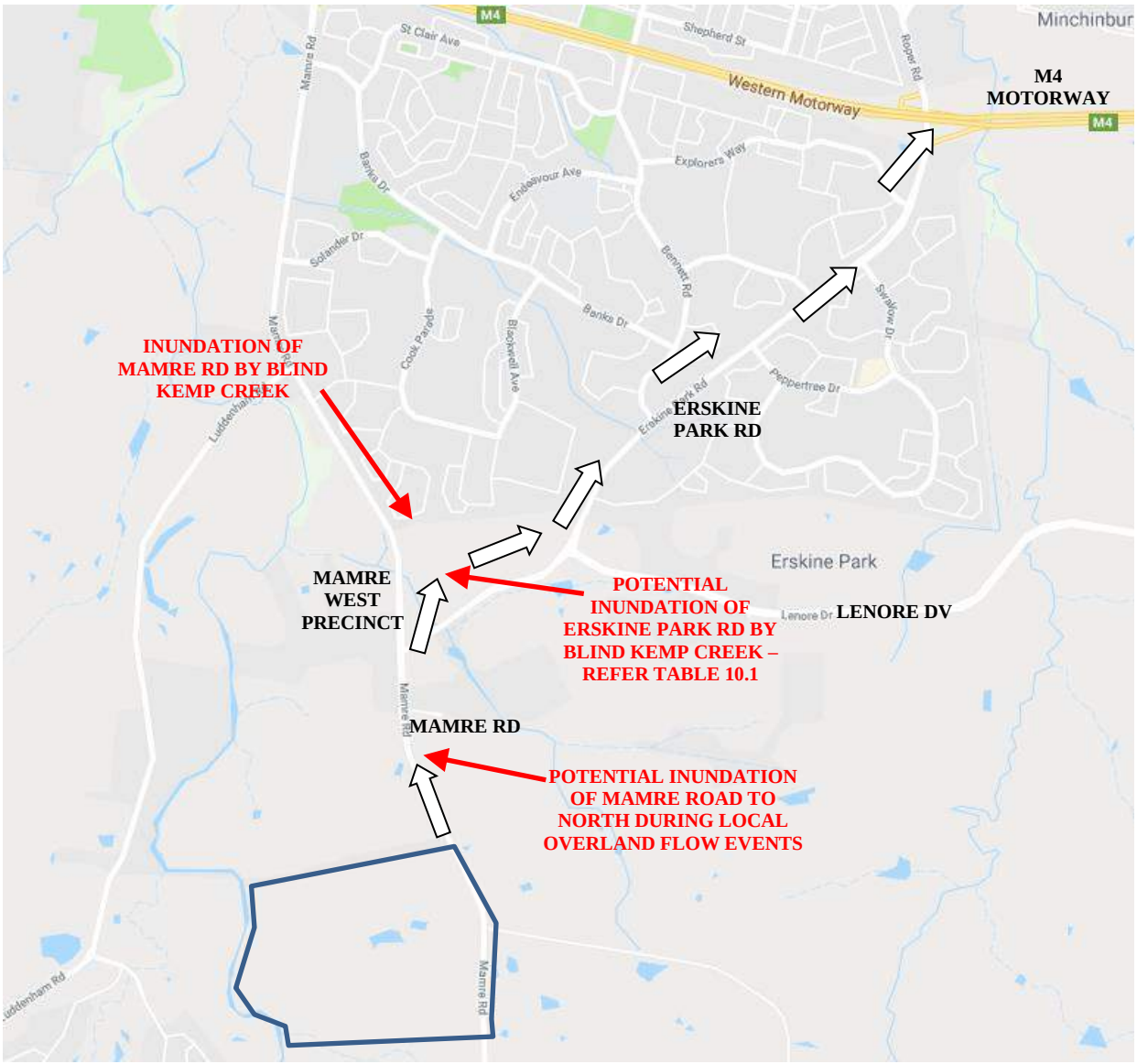


Figure 10.2. Potential Flood Evacuation Route

The transport by which the affected occupants travel along the evacuation route is private vehicle. If one does not own a private vehicle, then alternate transport for evacuation should be sought. However, in the event that flood waters have encroached the flood evacuation route, it is important that under no circumstances should flood waters be driven through, noting vehicles can be swept away by flood water at depths of only 200mm. On-site refuge is recommended in this instance and the proposed evacuation point would be at Mamre Road, adjacent to the Sydney Water Pipeline which is free from flooding and above the PMF flood event.

End of Response Operations

Once the flood levels recede below the trigger level and the danger posed by flooding has passed, the NSW SES Liverpool Local Controller will issue an "all clear" message which will be conveyed in the same format as the warning message, via SMS. Building occupiers can then return to the precinct.

11. CONCLUSION

This Overland Flow Report has been prepared in support of a development and rezoning of a parcel of land to the west of Mamre Road, Orchard Hills.

The Site has been identified by Penrith City Council as being affected by overland flows associated with South Creek. This report has been prepared in the Stage 1 modelling of the existing creek, within the zone of the development. This modelling has been undertaken to confirm the suitability of the model for future scenario 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 land area being proposed as the Subject Land for inclusion in the final structure plan for the proposed industrial estate.

A TUFLOW hydrodynamic flood model of South Creek was produced for the area surrounding the development for the purpose of future scenario testing. The current report provides a summary of the model build and results for the existing, pre-developed, condition over the land. The model has now been reviewed by Penrith City Councils consultants, Worley Parsons, prior to the Stage 2 Scenario Testing being undertaken.

The TUFLOW modelling included adjustment and validation of the pre-developed conditions using the *South Creek Study*. Results of the TUFLOW modelling show acceptable comparison with those of the *South Creek Study* with differences in flood depths of less than 100mm being achieved. Flood surface levels are also seen to be within 0.1m of those produced in the *South Creek Study* and similar hydraulic conditions were also observed. The flood surface varies in level from RL 35.20m AHD at the upstream (south) end of the development site to RL 33.60m AHD at the downstream end of the site (north/ Sydney Water Pipeline).

The post development TUFLOW modelling shows that filling within certain flood affected land can be made without impacting upstream, downstream and adjacent properties and which meets the specific criteria set out in the *Penrith City Council DCP Part C3*. These criteria include limiting depth and velocity afflux, confirming no effect on development potential to other properties or reduction in flood immunity to other properties.

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 in relation to overland flow and flooding within South Creek.

APPENDIX A

TUFLOW MODEL PRE-DEVELOPMENT RESULTS

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

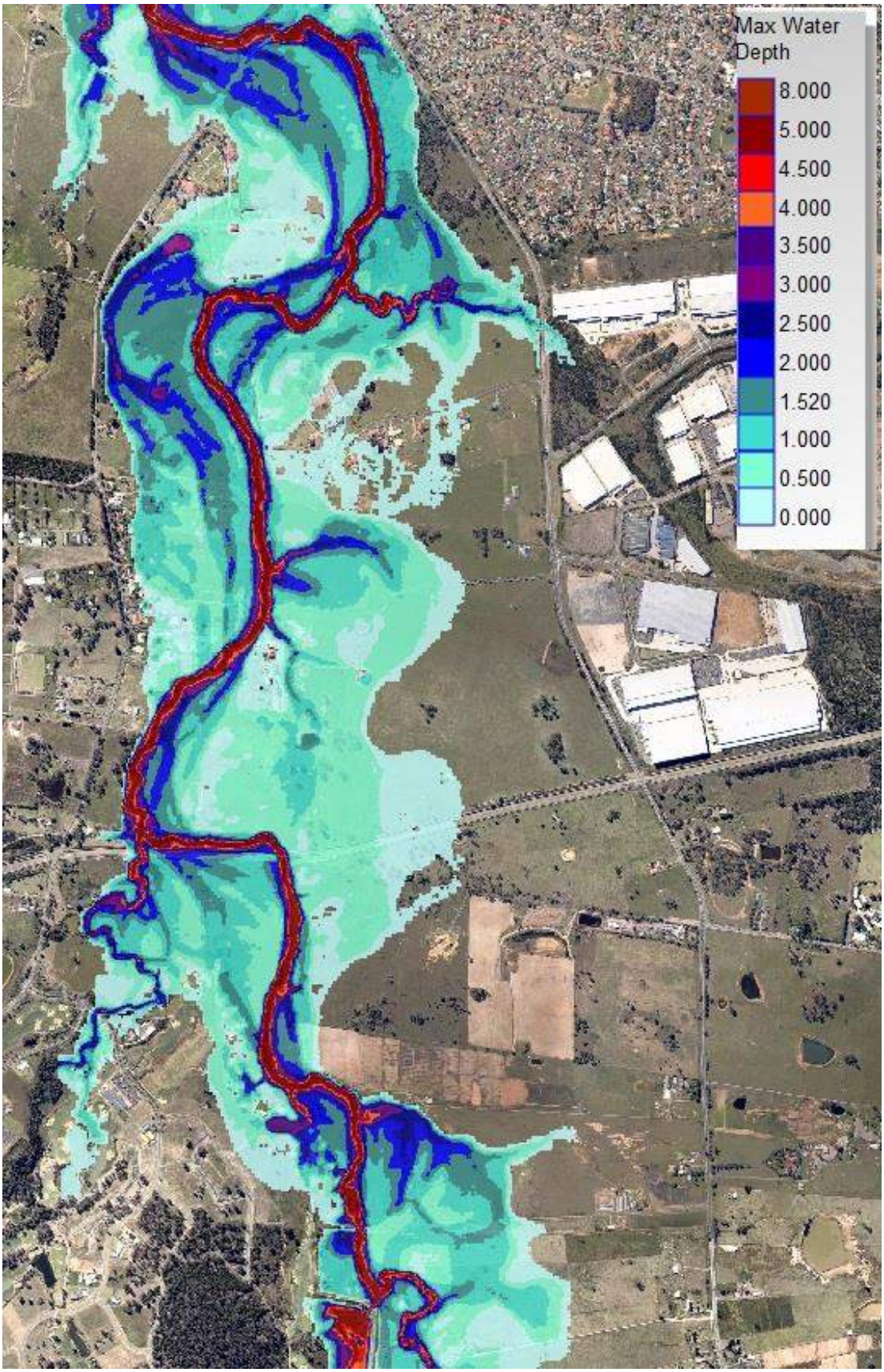


Figure A1 – 5% AEP Flood Depths (Pre-Development)

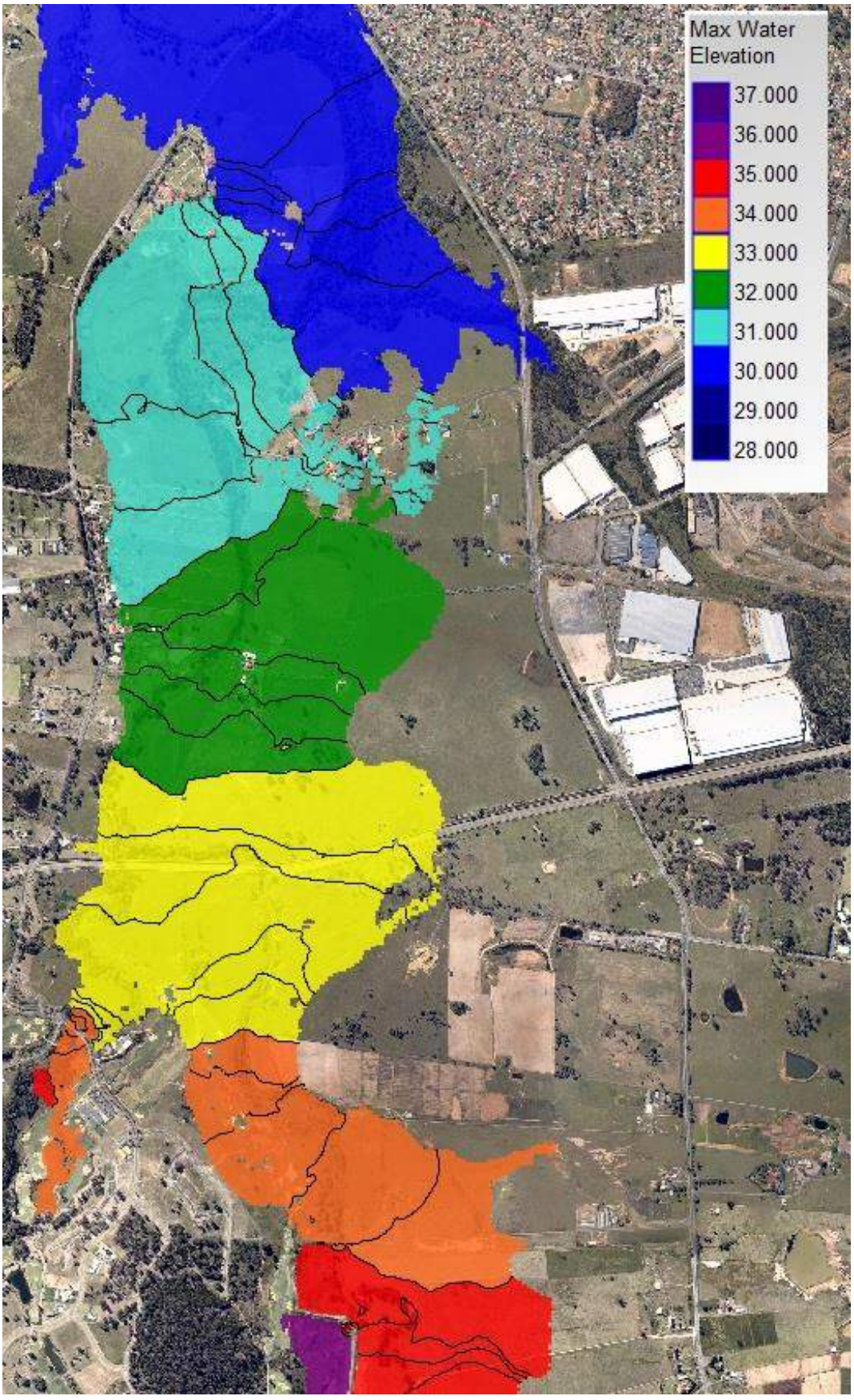


Figure A2 – 5% AEP Flood Levels (Pre-Development)

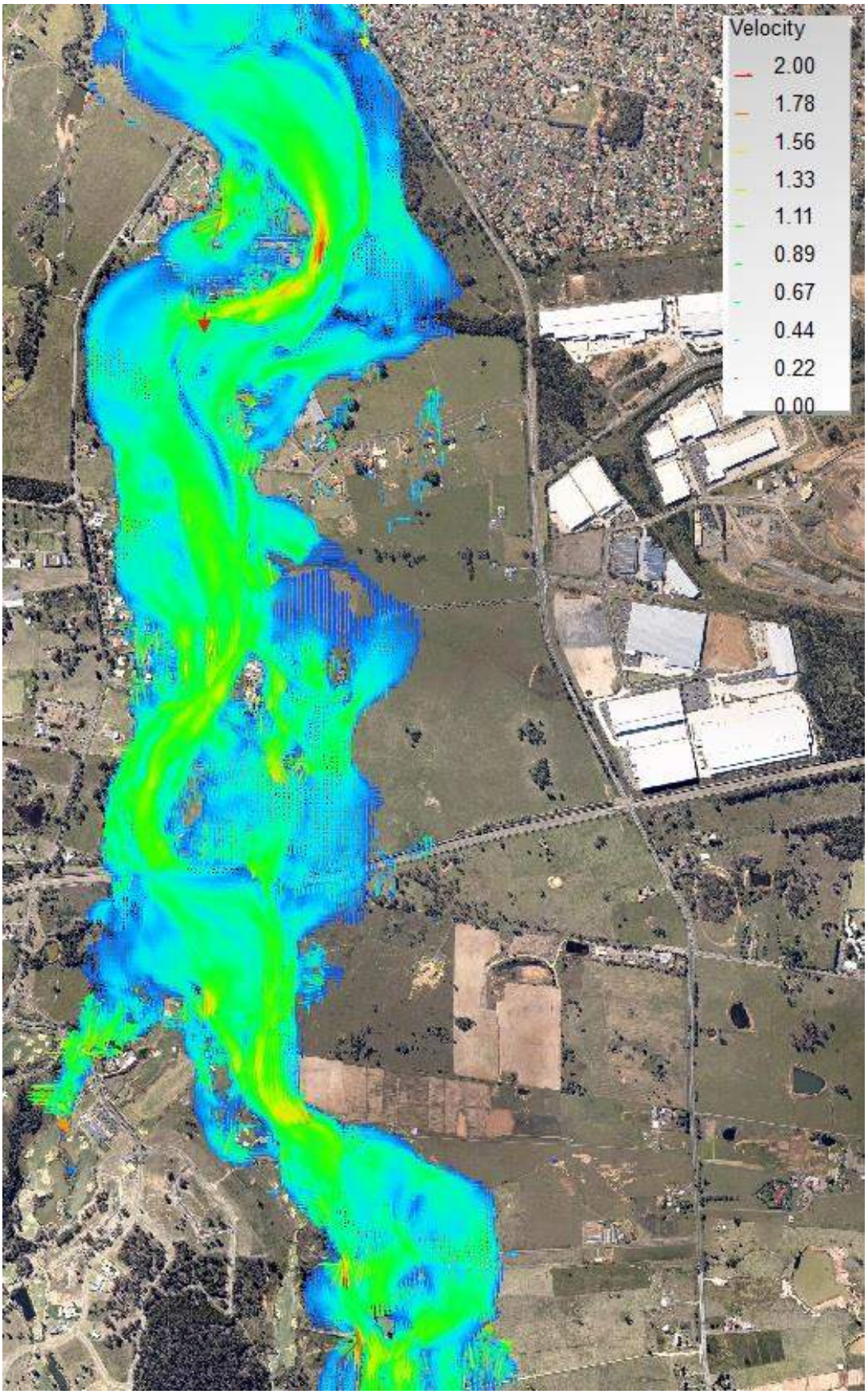


Figure A3 – 5% AEP Flood Velocity (Pre-Development)

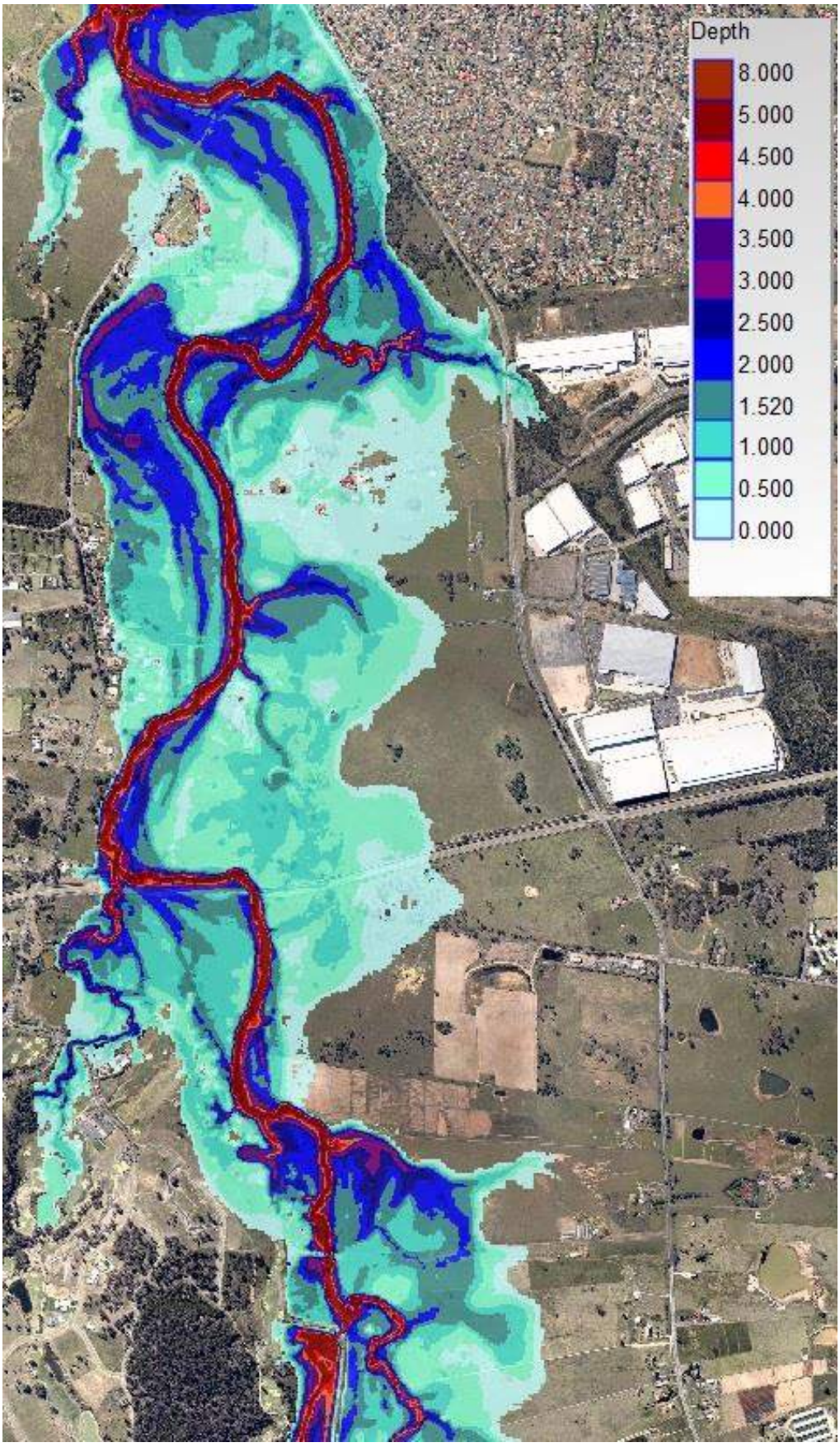


Figure A4 – 1% AEP Flood Depth (Pre-Development)

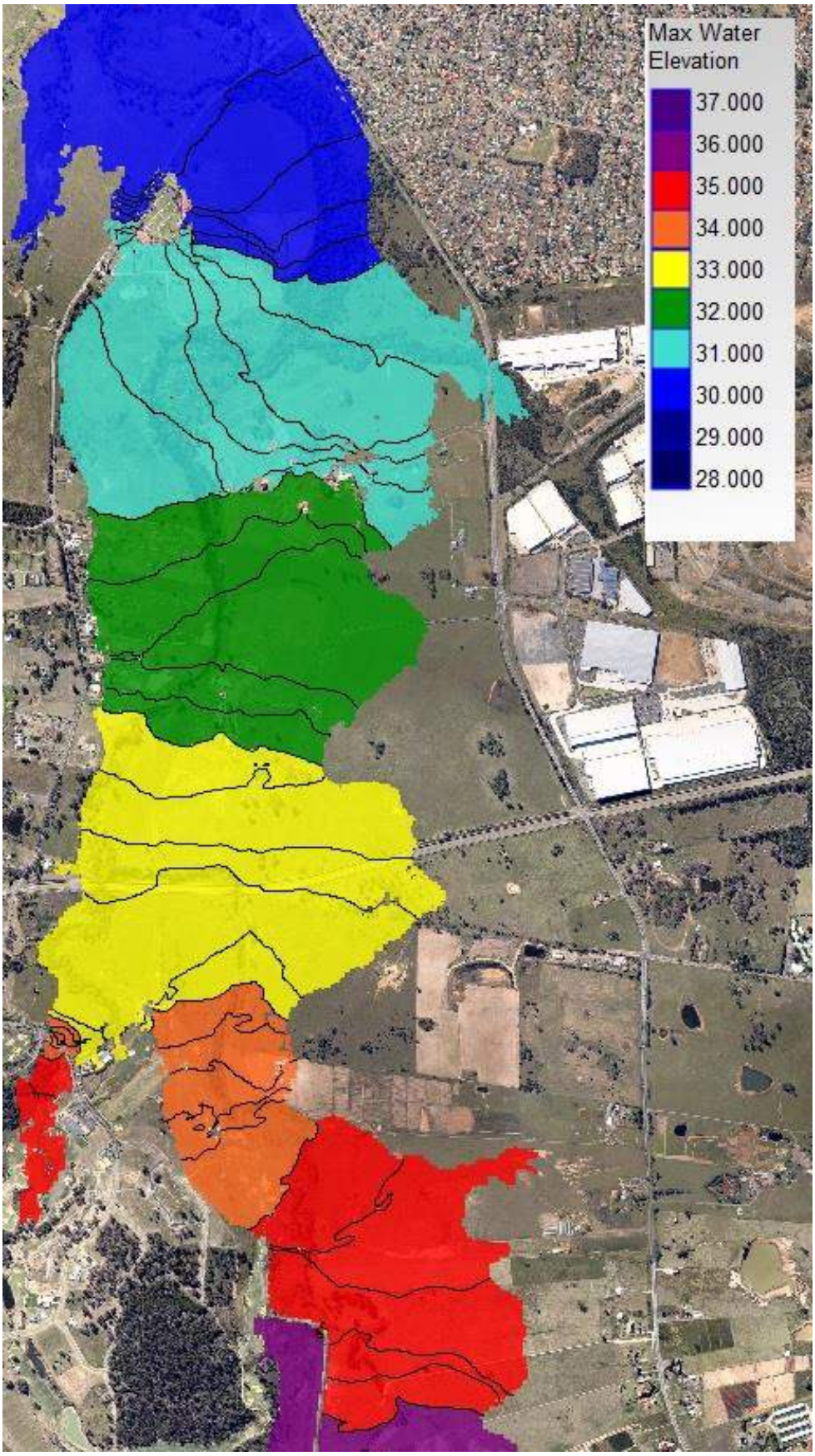


Figure A5 – 1% AEP Flood Levels (Pre-Development)

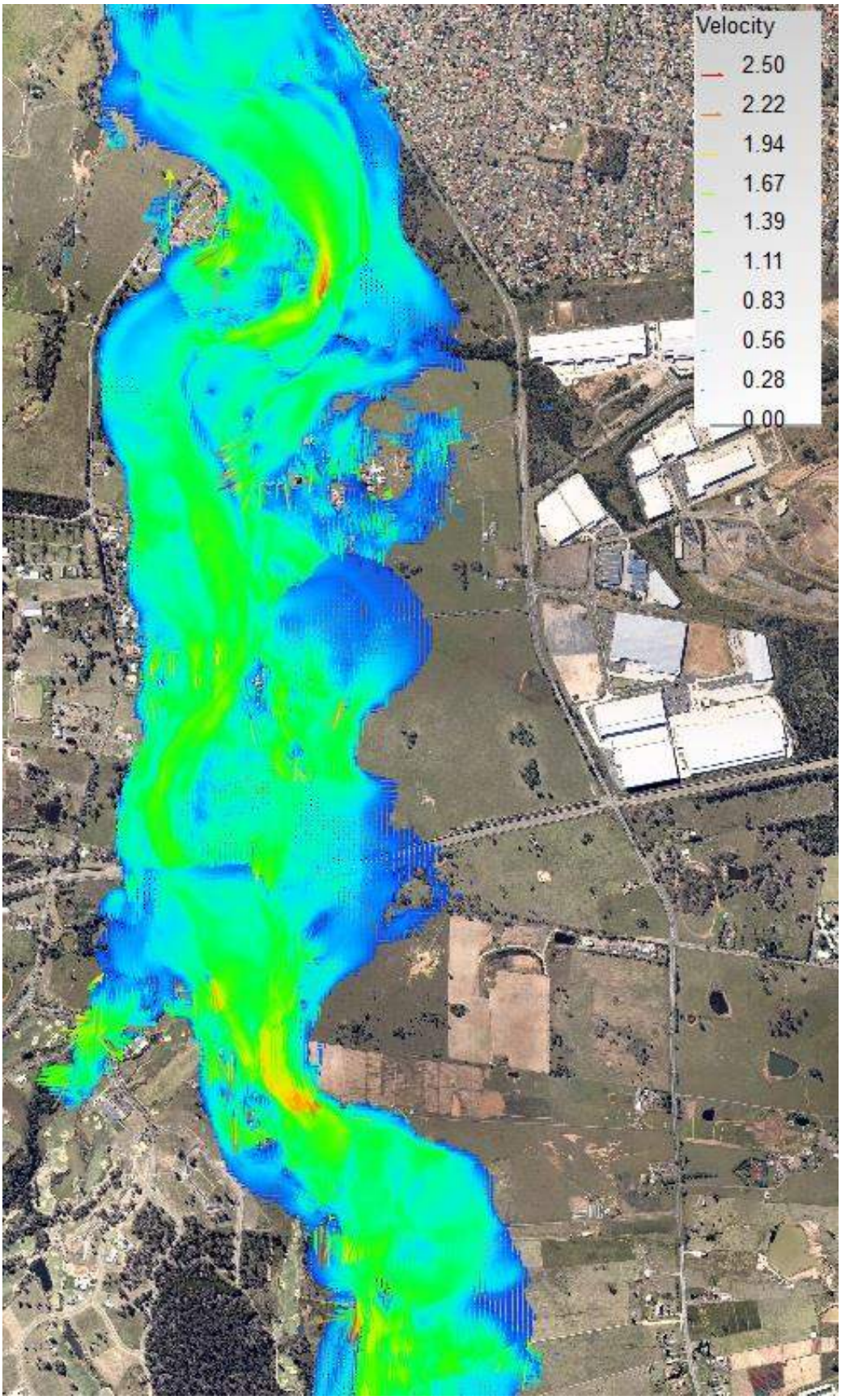


Figure A6 – 1% AEP Flood Velocity (Pre-Development)

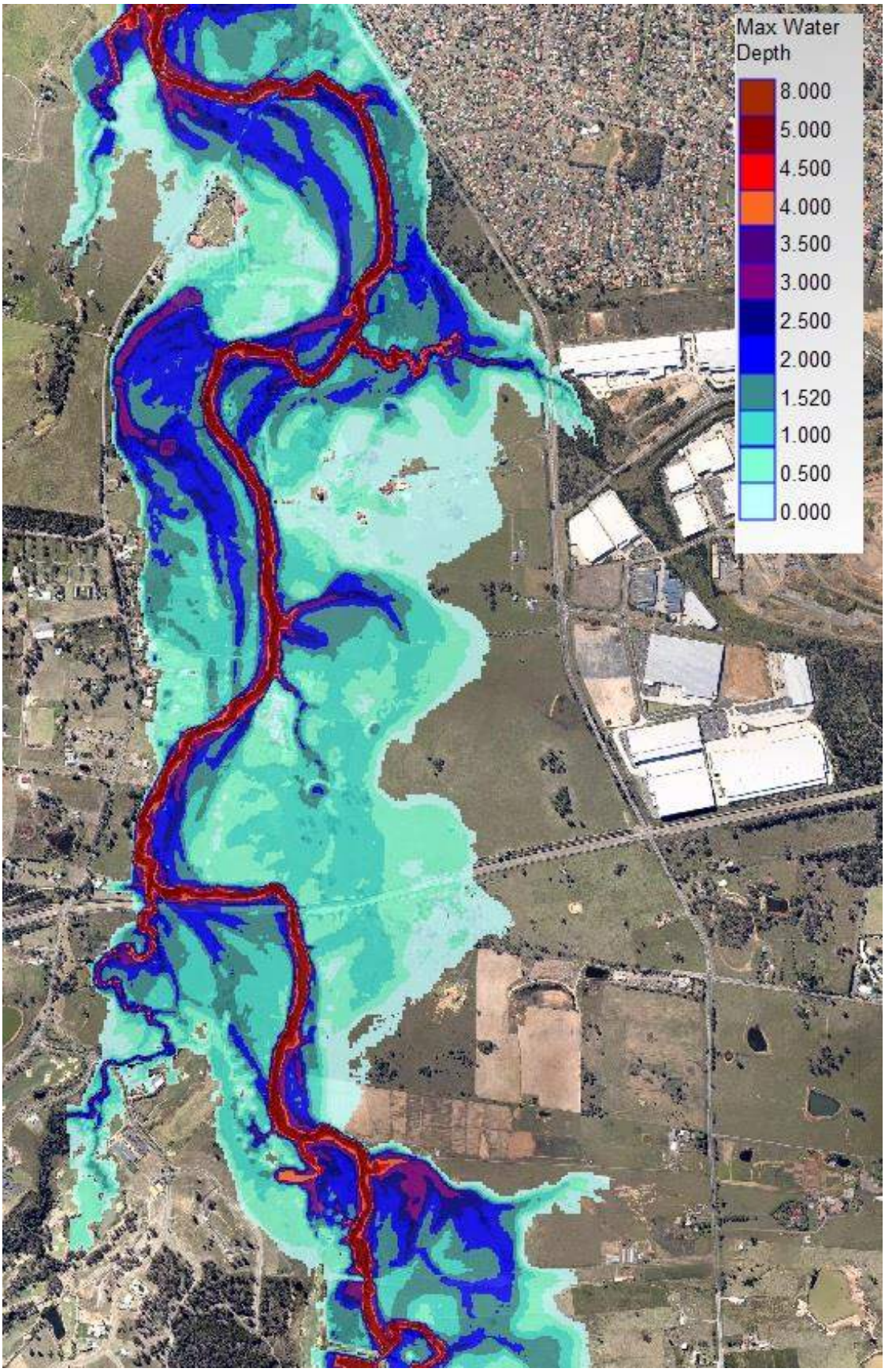


Figure A7 – 0.5% AEP Flood Depth (Pre-Development)

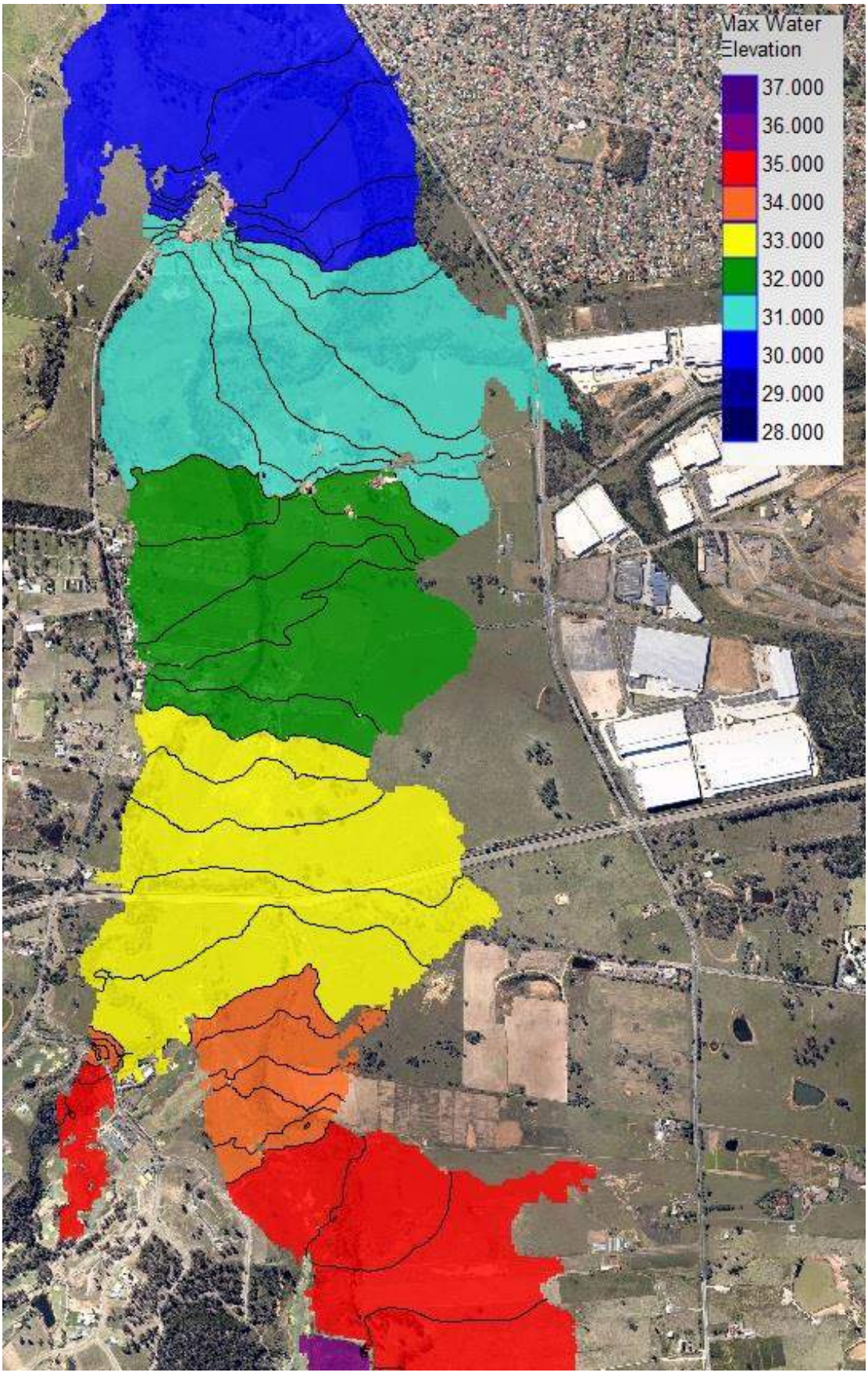


Figure A8 – 0.5% AEP Flood Levels (Pre-Development)

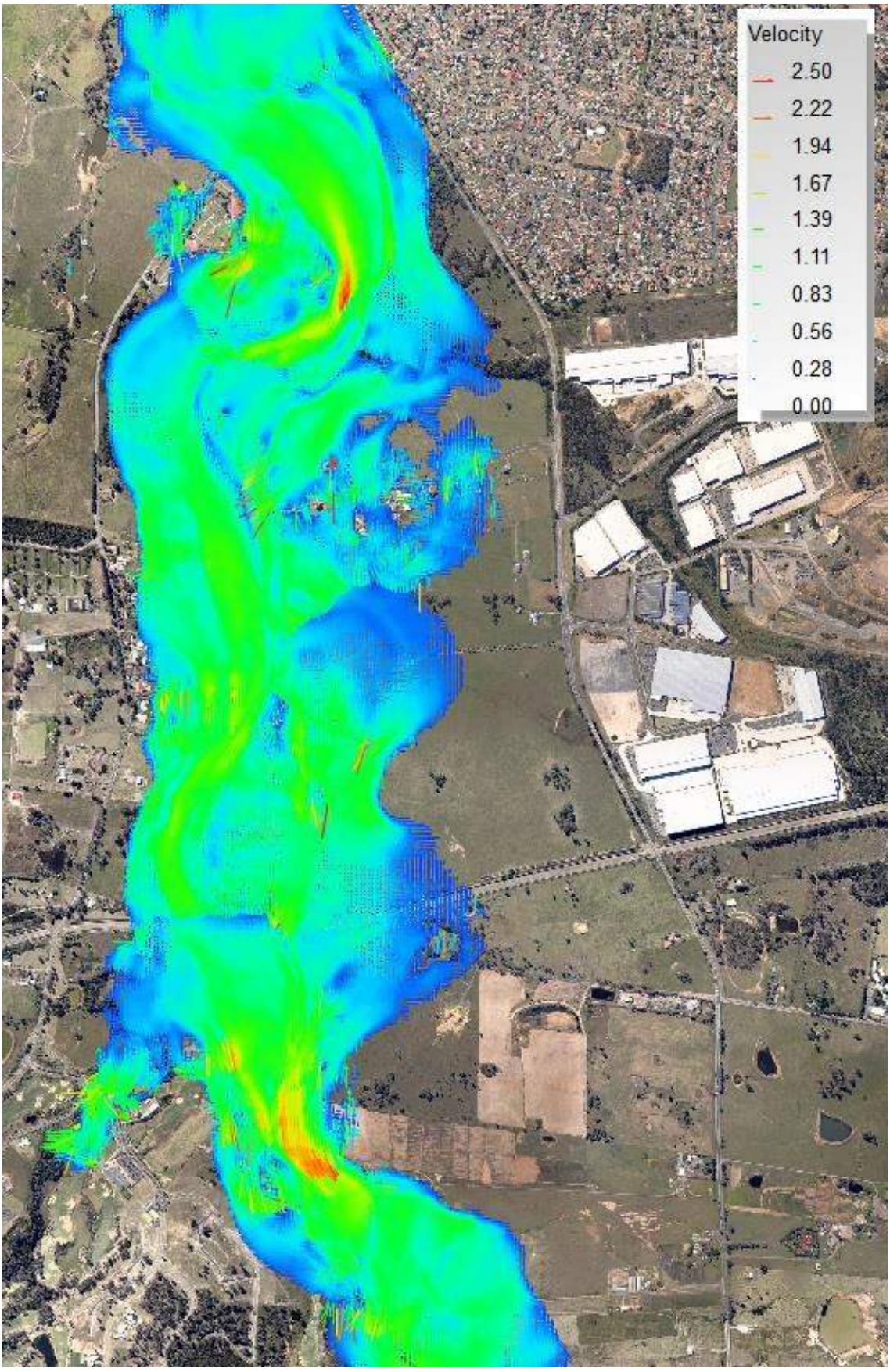


Figure A9 – 0.5% AEP Flood Velocity (Pre-Development)

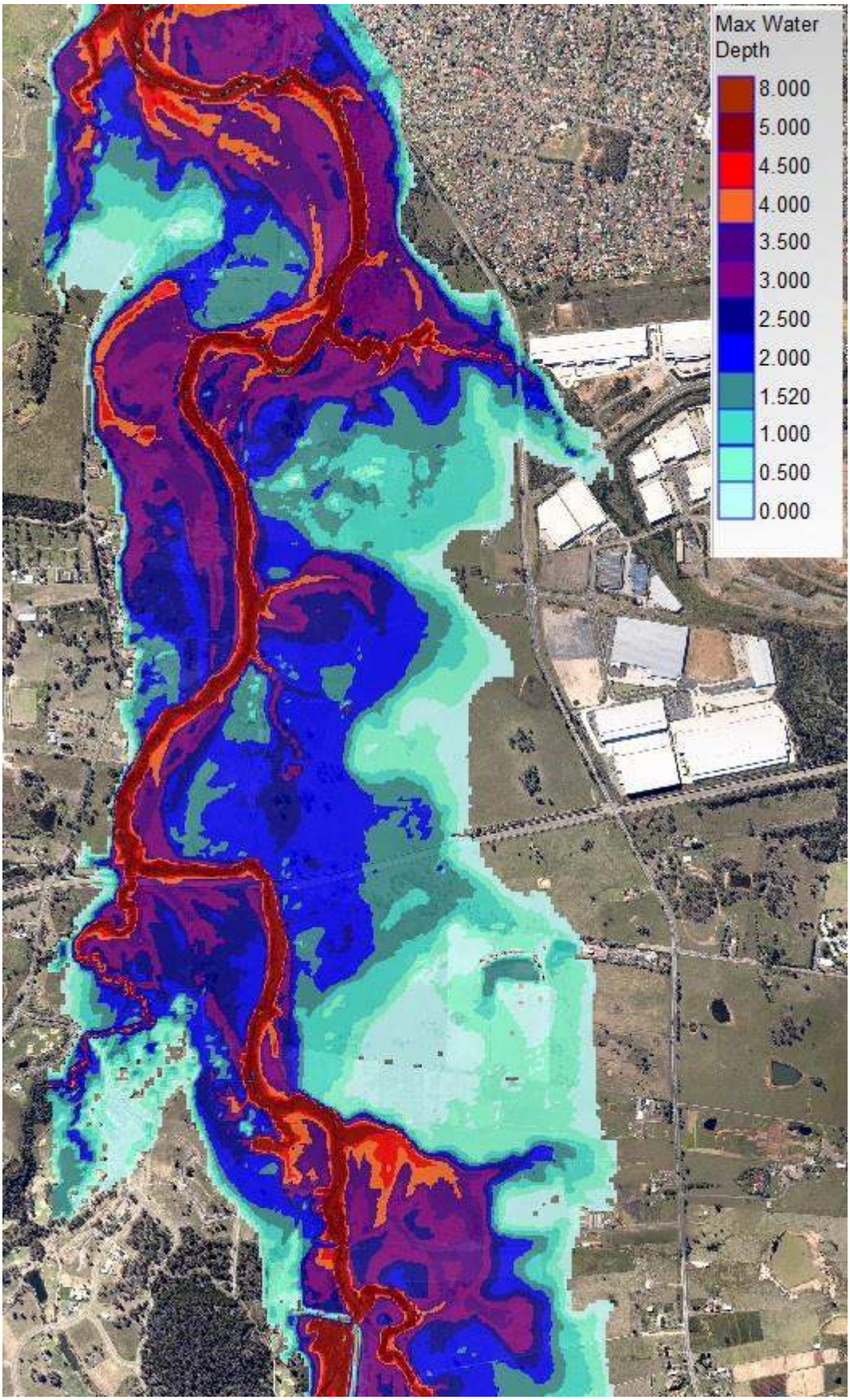


Figure A10 – PMF Flood Depth (Pre-Development)

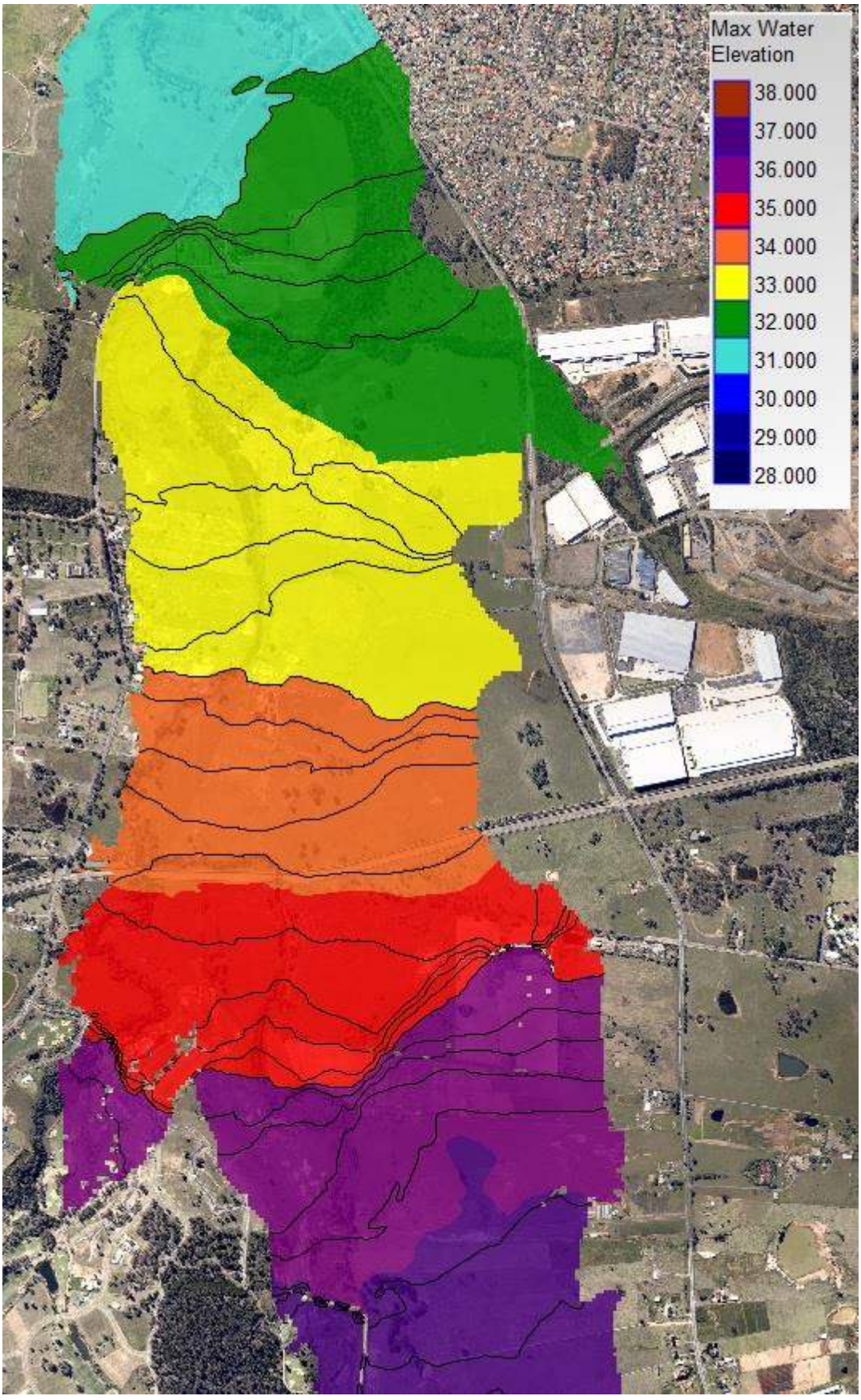


Figure A11 – PMF Flood Levels (Pre-Development)

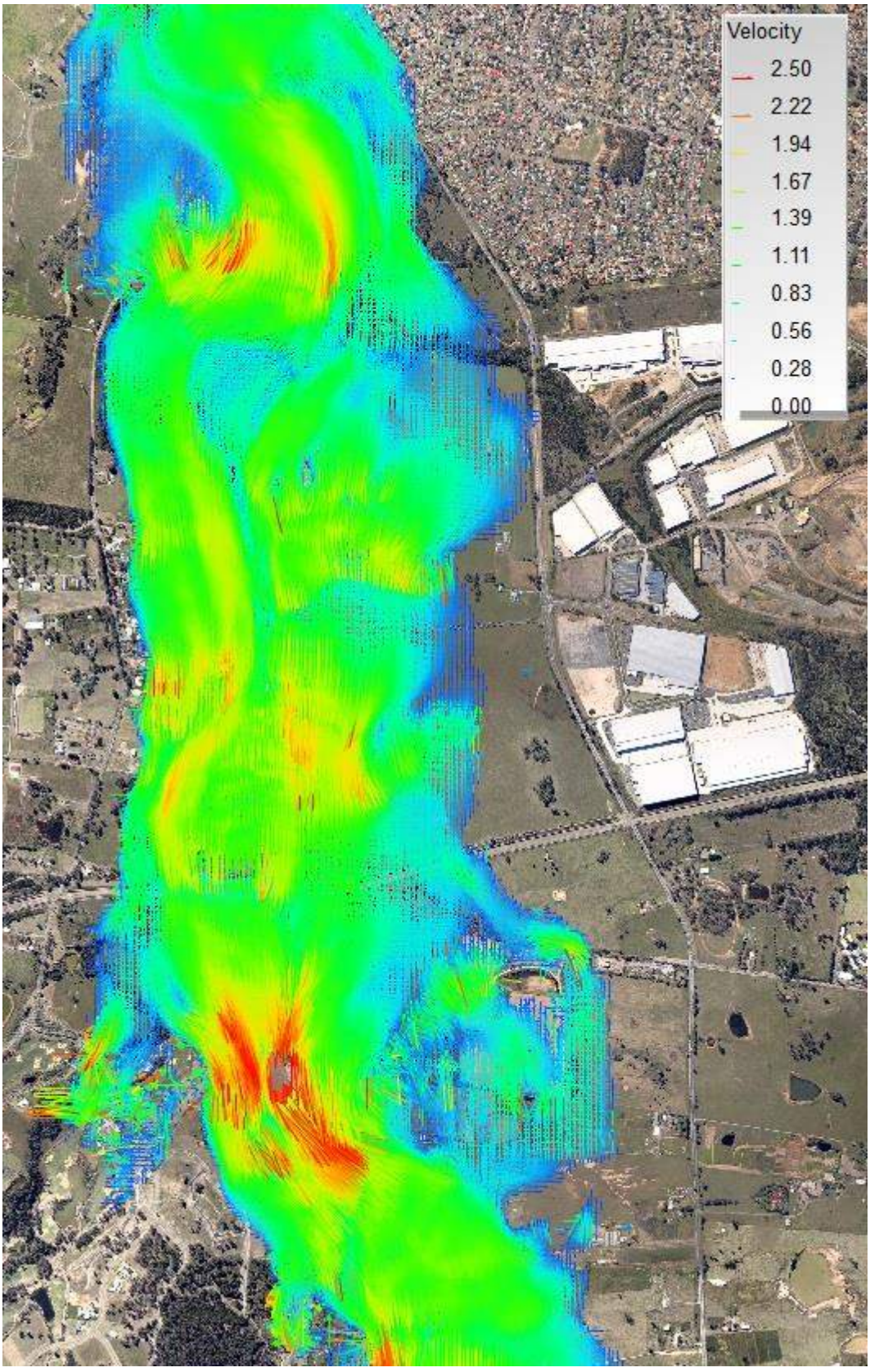


Figure A12 – PMF Flood Velocity (Pre-Development)

APPENDIX B

TUFLOW MODEL POST-DEVELOPMENT RESULTS

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

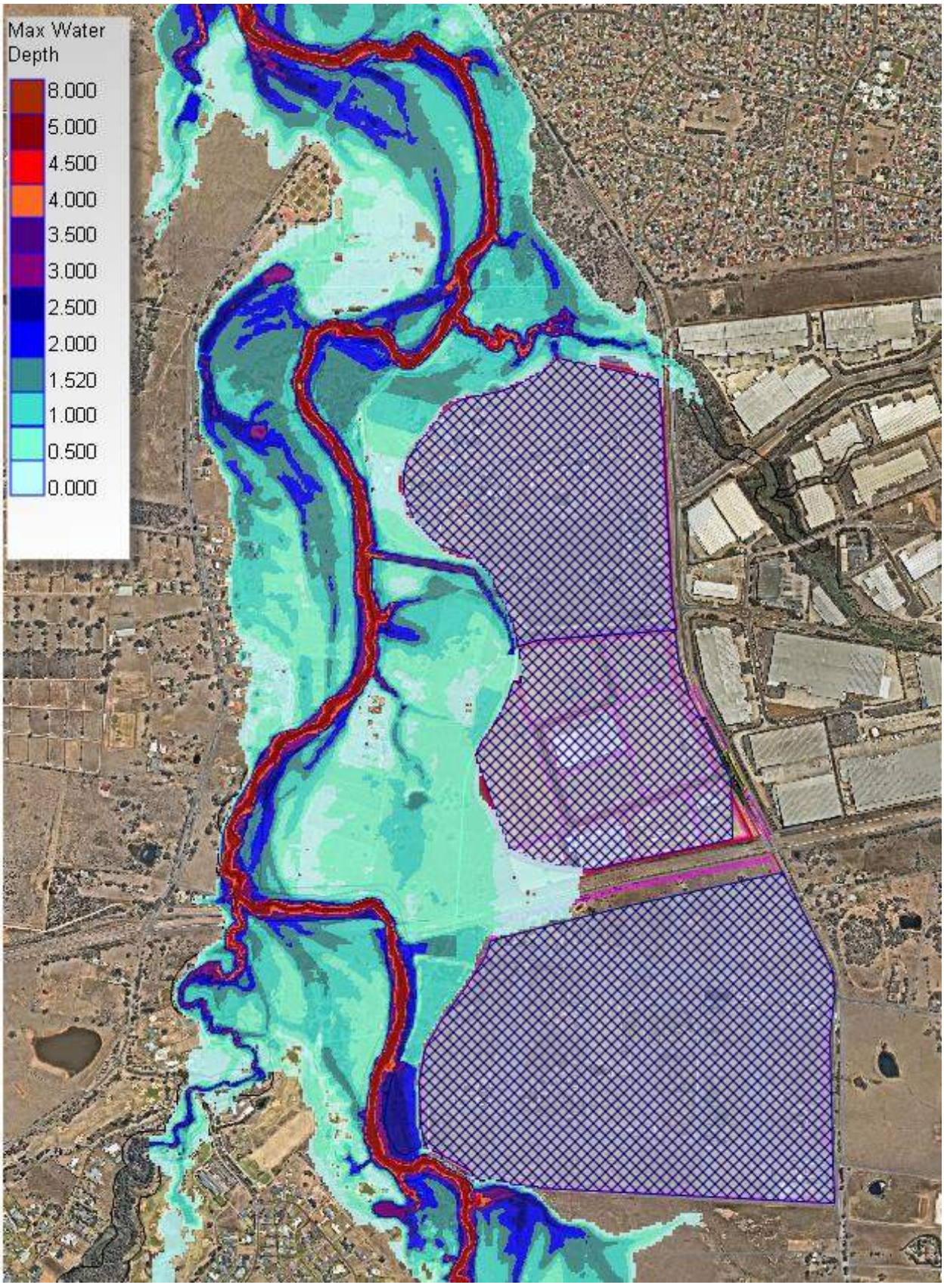


Figure B1 – 5% AEP Flood Depths (Post-Development)

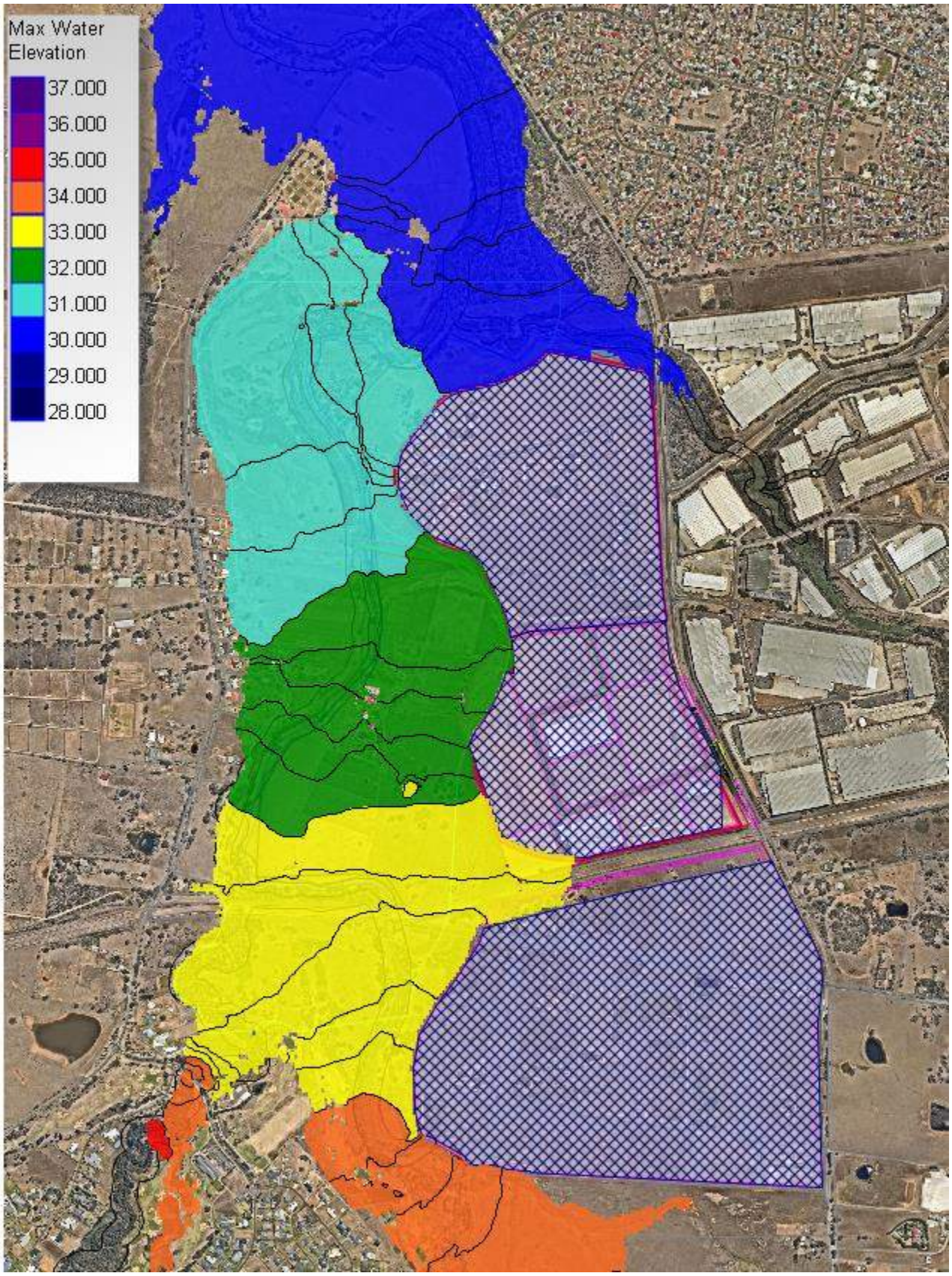


Figure B2 – 5% AEP Flood Levels (Post-Development)

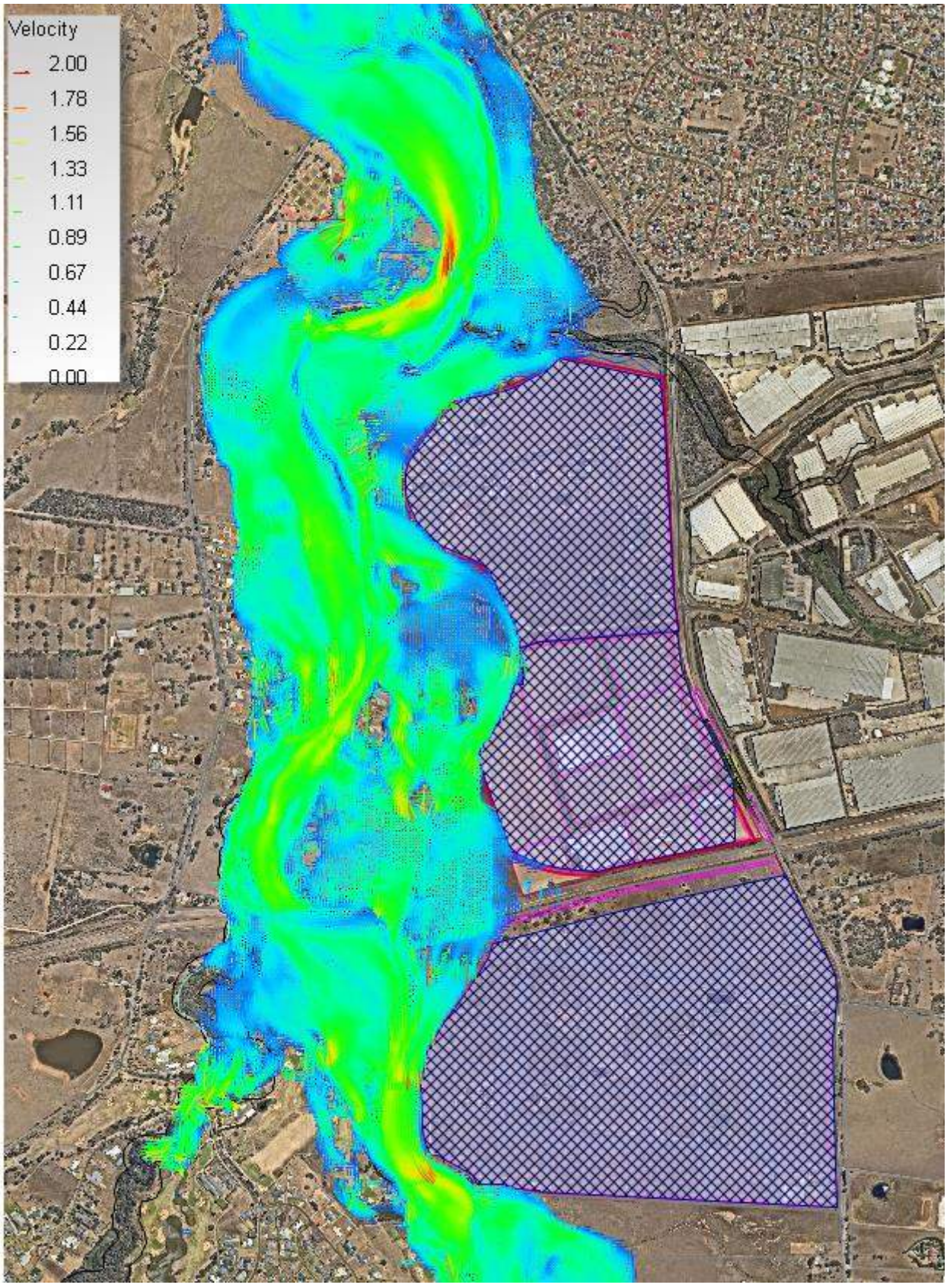


Figure B3 – 5% AEP Flood Velocity (Post-Development)

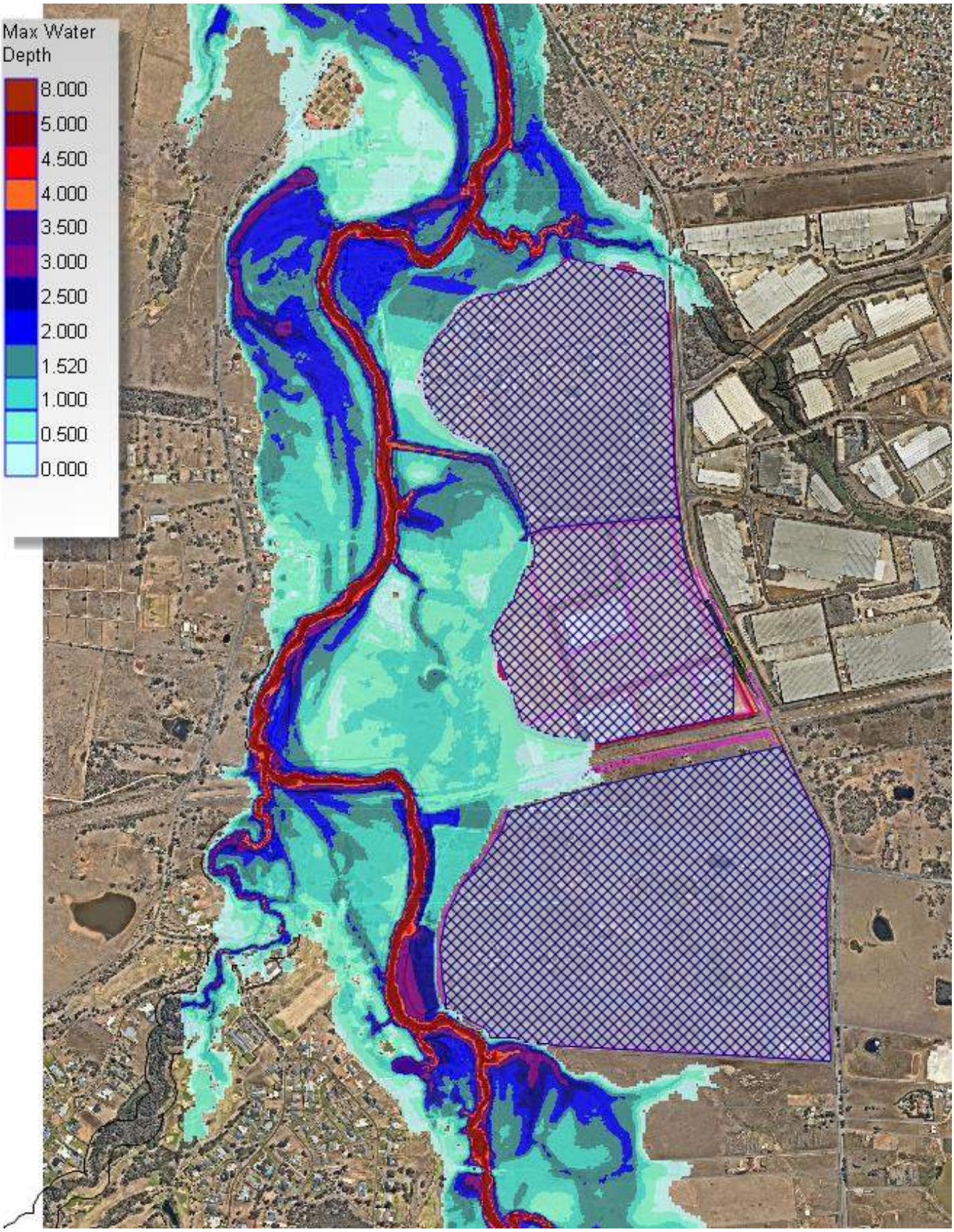


Figure B4 – 1% AEP Flood Depth (Post-Development)

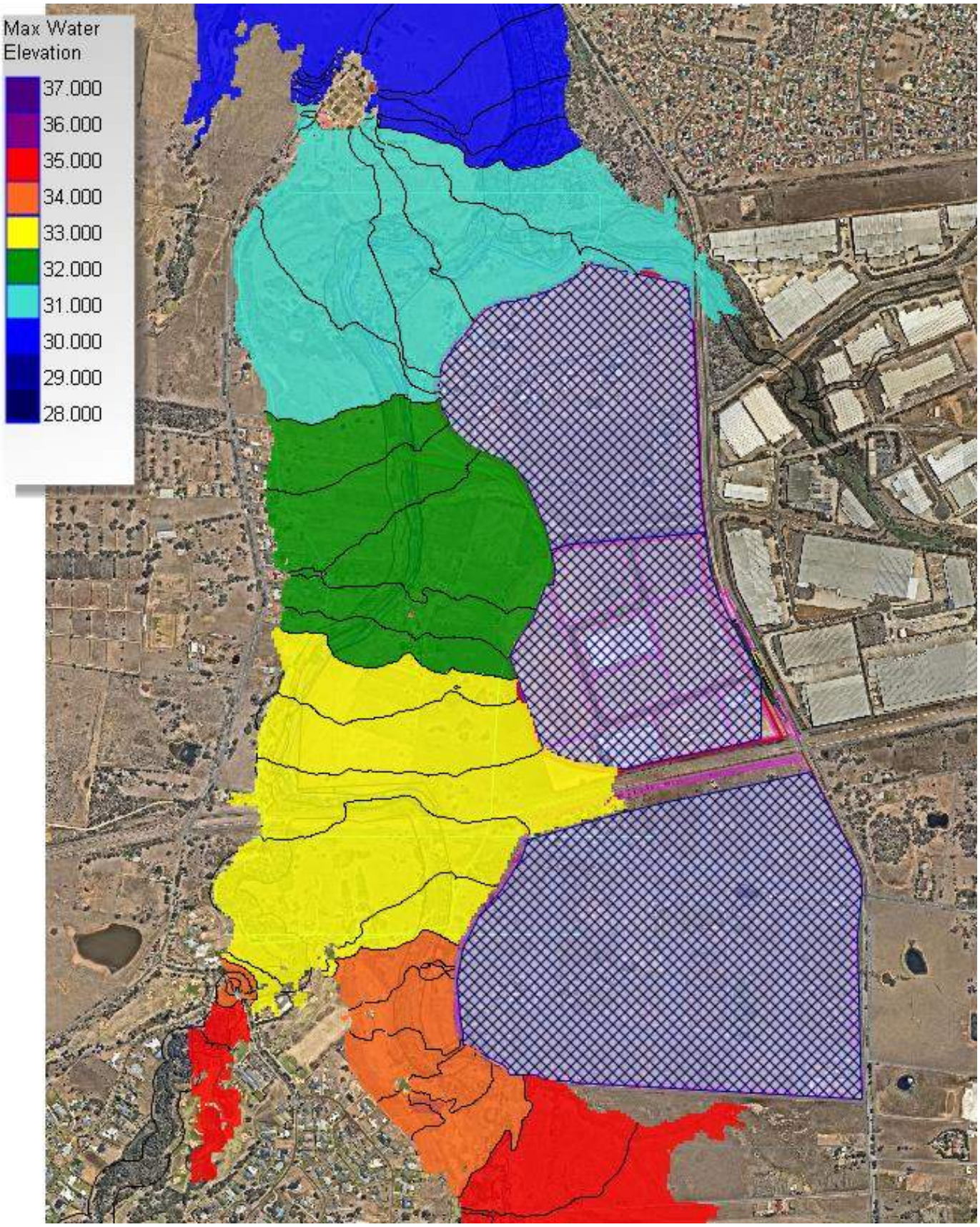


Figure B5 – 1% AEP Flood Levels (Post-Development)

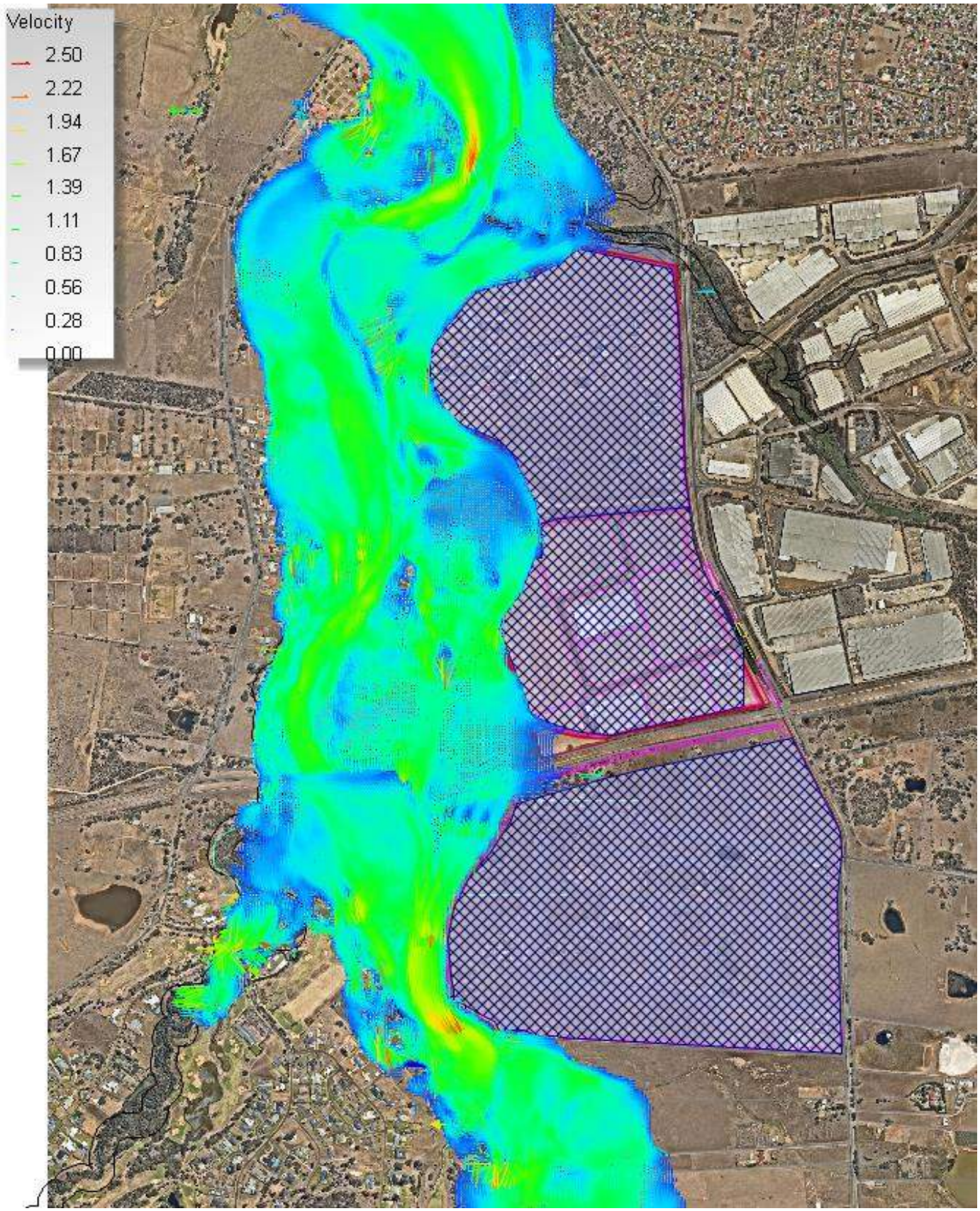


Figure B6 – 1% AEP Flood Velocity (Post-Development)

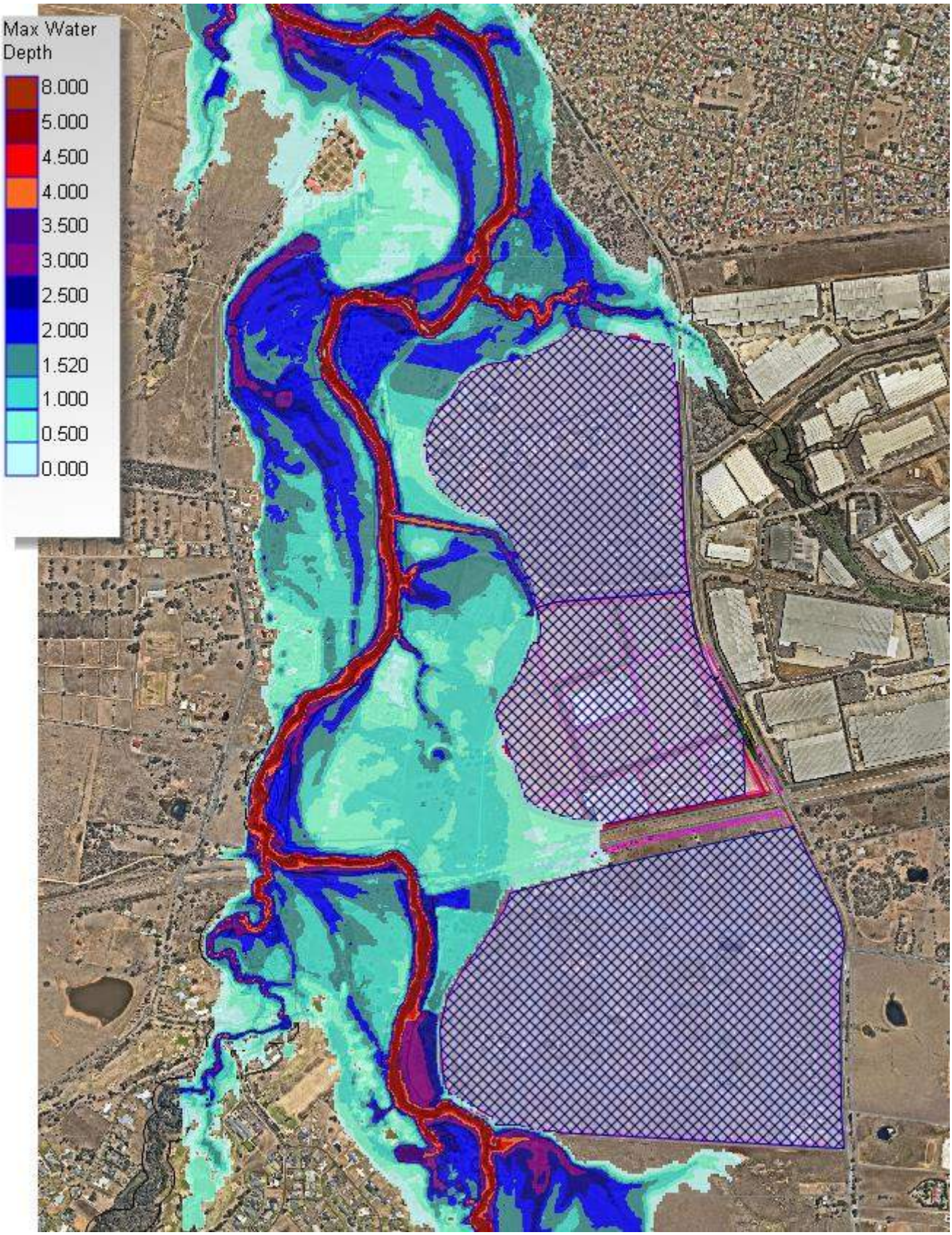


Figure B7 – 0.5% AEP Flood Depth (Post-Development)

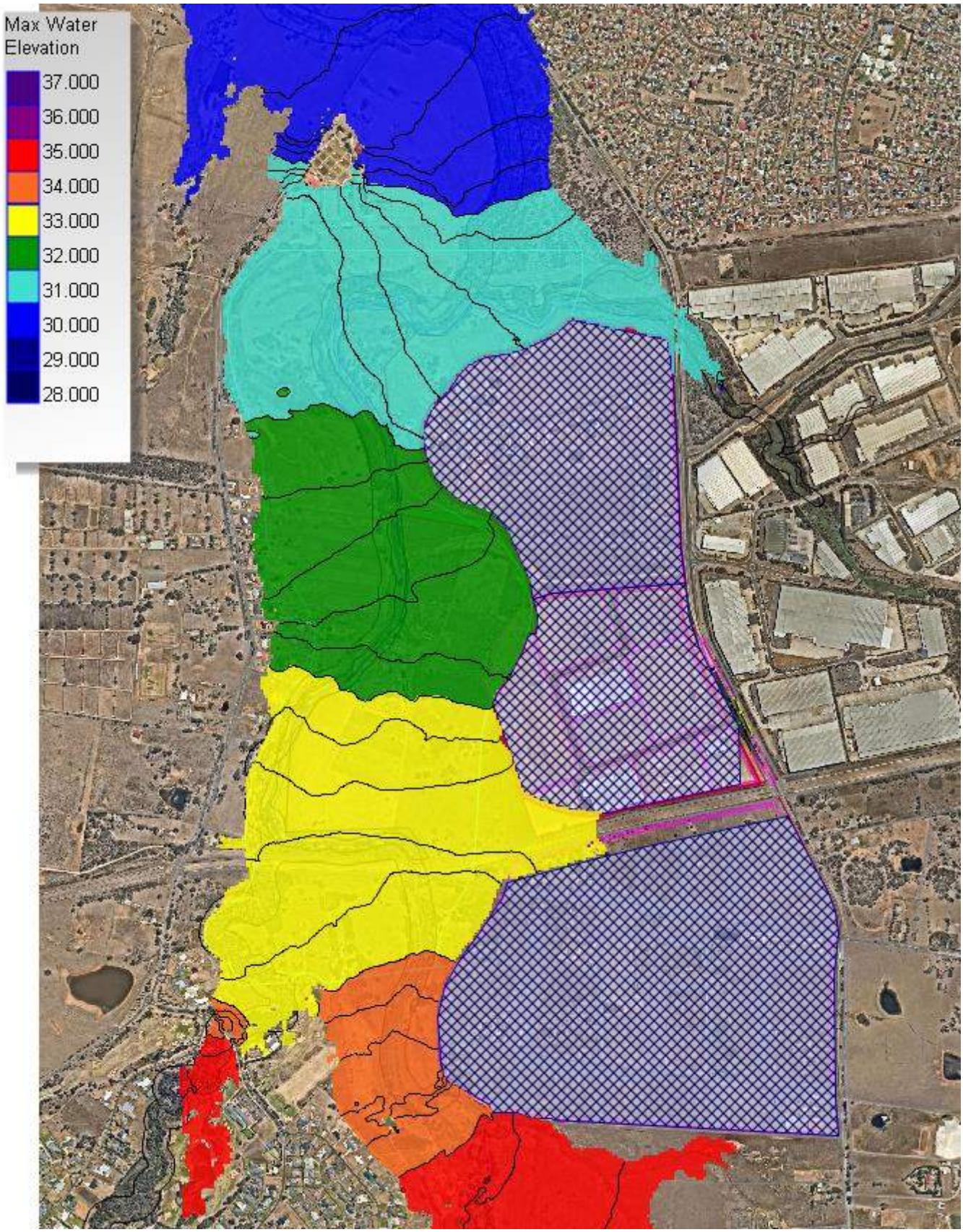


Figure B8 – 0.5% AEP Flood Levels (Post-Development)

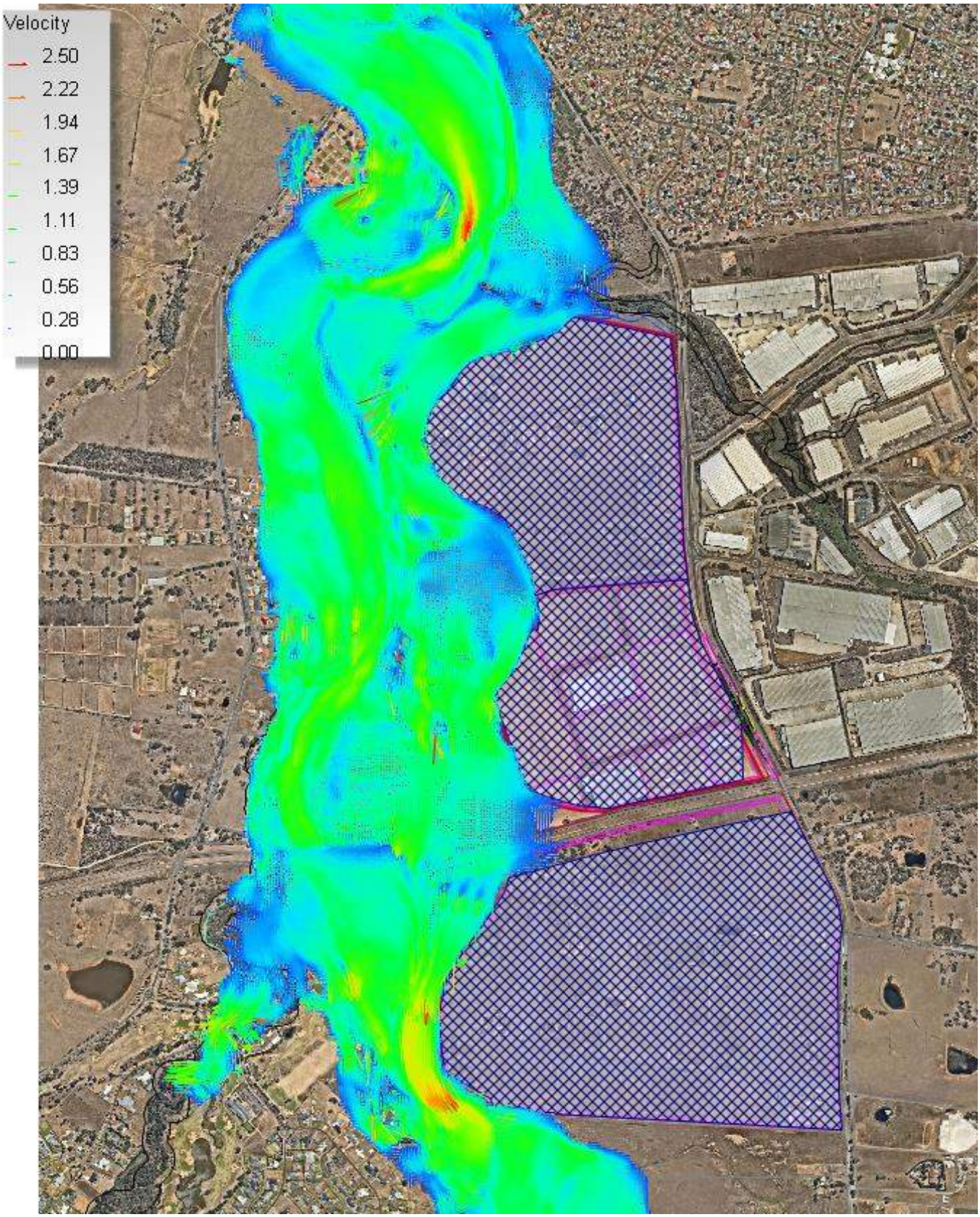


Figure B9 – 0.5% AEP Flood Velocity (Post-Development)

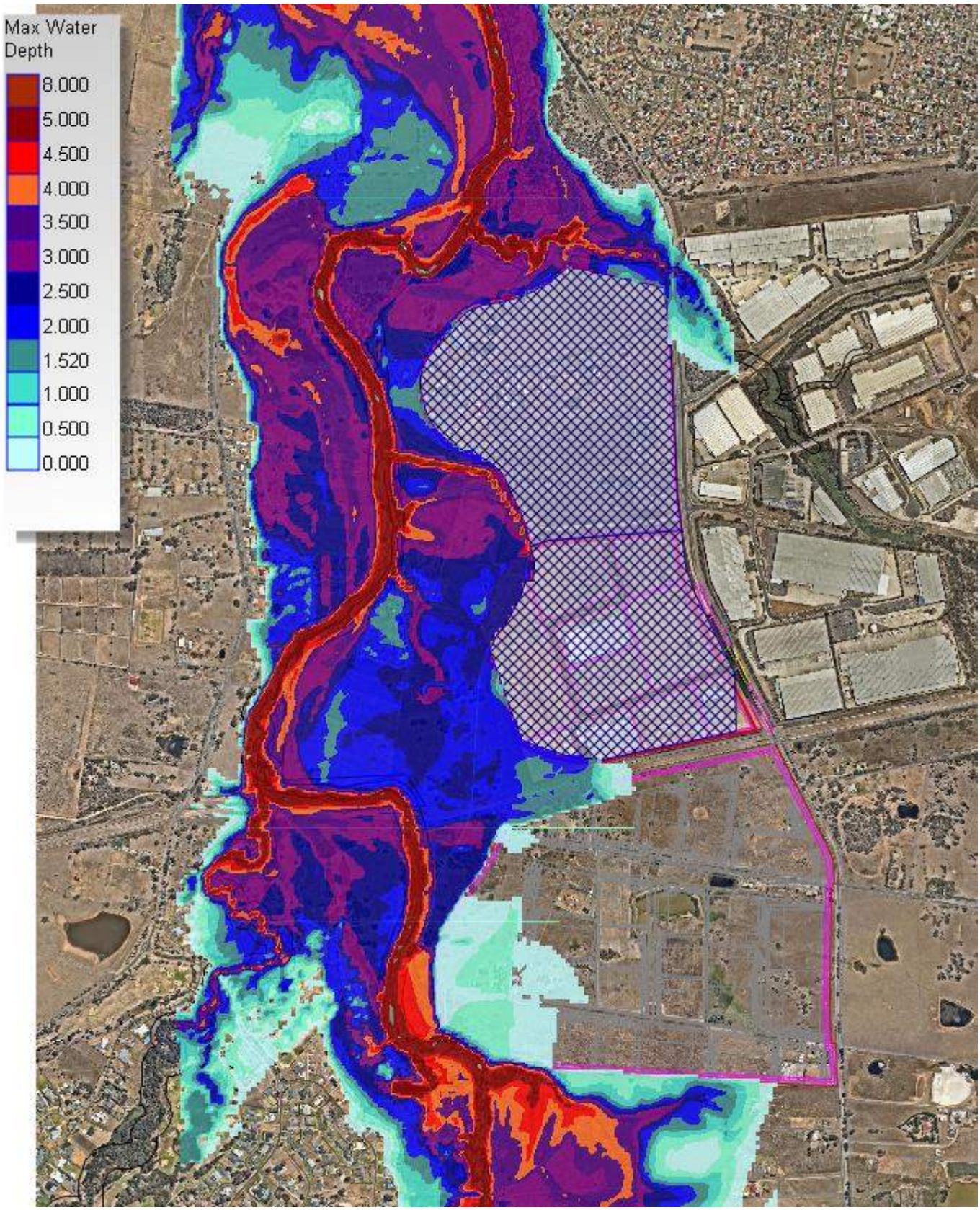


Figure B10 – PMF Flood Depth (Post-Development)

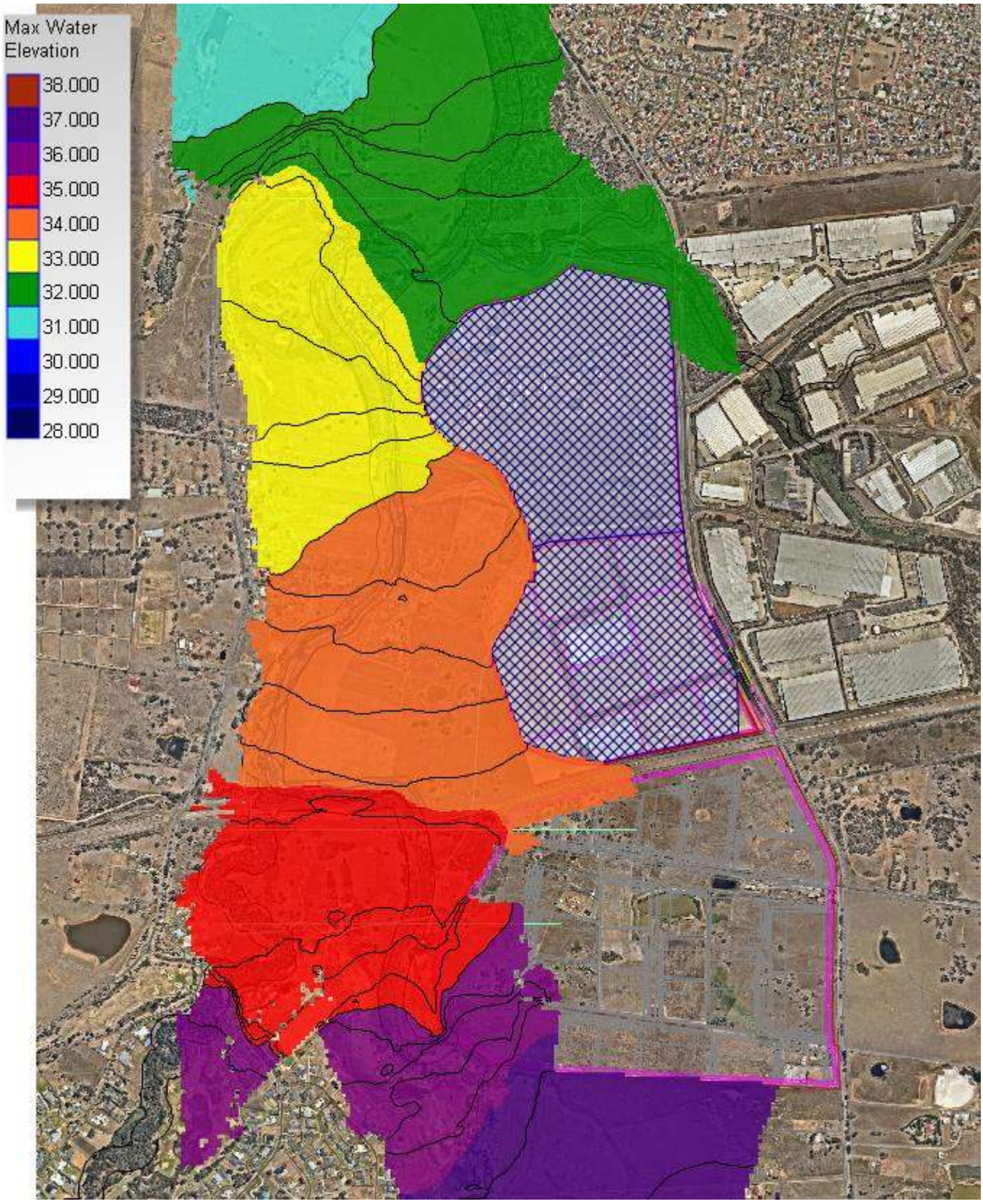


Figure B11 – PMF Flood Levels (Post-Development)

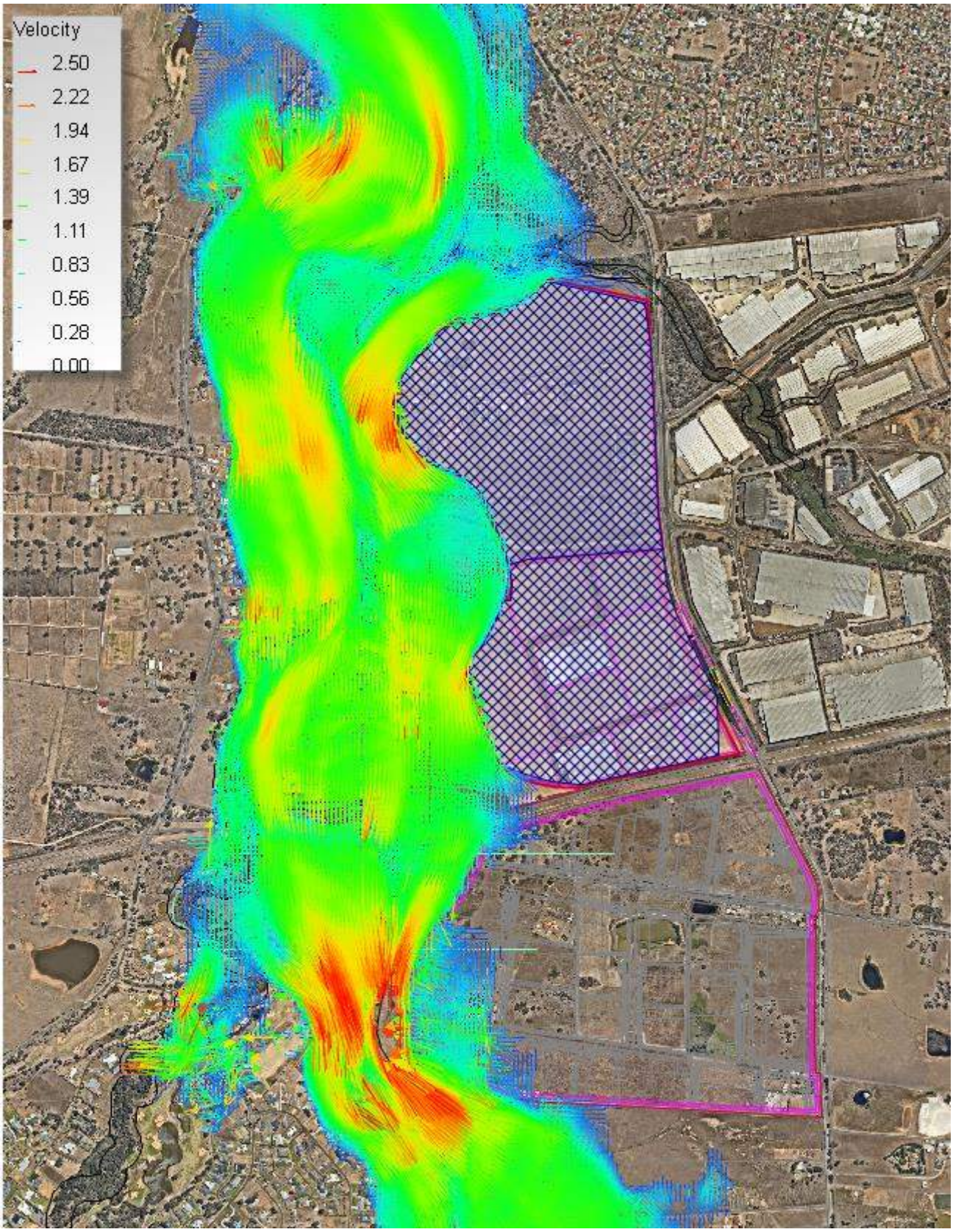
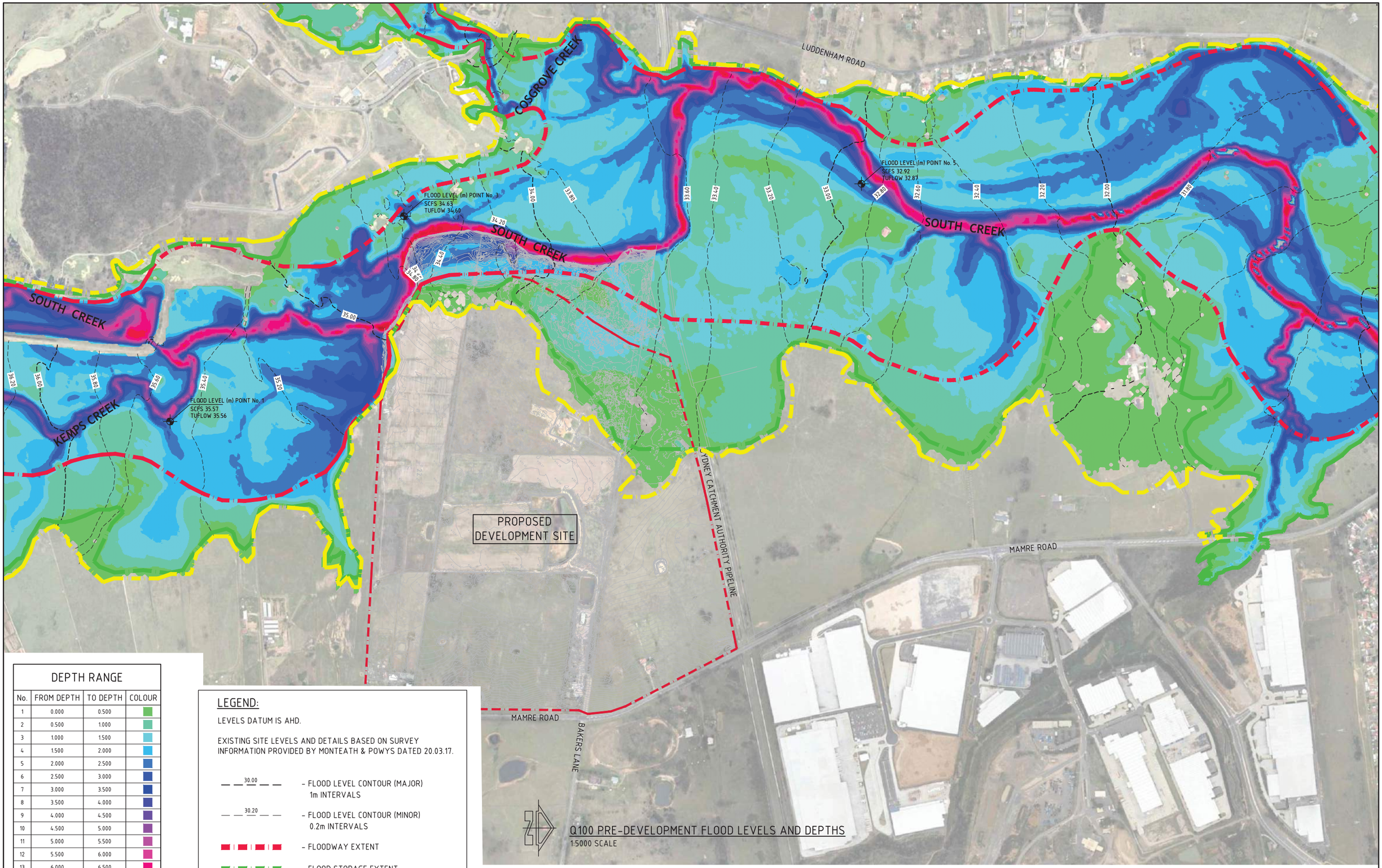


Figure B12 – PMF Flood Velocity (Post-Development)

APPENDIX C

DEPTH & VELOCITY AFFLUX MAPS AND FLOW DISTIBUTION SECTIONS



DEPTH RANGE

No.	FROM DEPTH	TO DEPTH	COLOUR
1	0.000	0.500	
2	0.500	1.000	
3	1.000	1.500	
4	1.500	2.000	
5	2.000	2.500	
6	2.500	3.000	
7	3.000	3.500	
8	3.500	4.000	
9	4.000	4.500	
10	4.500	5.000	
11	5.000	5.500	
12	5.500	6.000	
13	6.000	6.500	
14	6.500	7.000	
15	7.000	7.500	
16	7.500	8.000	

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY MONTEATH & POWYS DATED 20.03.17.

- 30.00 – FLOOD LEVEL CONTOUR (MAJOR) 1m INTERVALS
- 30.20 – FLOOD LEVEL CONTOUR (MINOR) 0.2m INTERVALS
- FLOODWAY EXTENT
- FLOOD STORAGE EXTENT
- FLOOD FRINGE EXTENT

Q100 PRE-DEVELOPMENT FLOOD LEVELS AND DEPTHS

1:5000 SCALE

50m 0 100 200 300 400 500m

1:5000 SCALE AT A1 SHEET SIZE

FOR APPROVAL

AMENDMENTS	DATE	ISSUE
ISSUED FOR APPROVAL	06.12.18	C
ISSUED FOR APPROVAL	15.10.18	B
ISSUED FOR INFORMATION	06.06.18	A

AMENDMENTS DATE ISSUE

CLIENT: FRASERS PROPERTY

PROJECT: MAMRE SOUTH PRECINCT
657 - 708 MAMRE ROAD
KEMPS CREEK, 2178, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	APRIL '18		A1	AS SHOWN	C013362.00-F01

Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 696 448
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7699 Fax: (02) 9241-3731
email: mail@costinroe.au ©

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE: Q100 PRE-DEVELOPMENT FLOOD LEVELS AND DEPTHS

DRAWING No C013362.00-F01 ISSUE C

LAND RE-GRADING ZONE.
PROVIDE 0.2-1.5m CUT AND SMOOTHING OF AREA. FALL TOWARDS SOUTH CREEK AT 1:200 SLOPE
CUT VOLUME = 32 800m3

LAND RE-GRADING ZONE.
PROVIDE 0.2-1.5m CUT AND SMOOTHING OF AREA. FALL TOWARDS SOUTH CREEK AT 1:200 SLOPE
CUT VOLUME = 31 800m3

FLOOD STORAGE VOLUME LOST FROM DEVELOPMENT = 71000m^3

Q100 PRE-DEVELOPMENT FLOOD EXTENT

PROPOSED DEVELOPMENT SITE

FIRST ESTATE (CONSTRUCTED)

FIRST ESTATE STAGE 2 (SUBJECT TO SEPARATE APPLICATION)

SYDNEY CATCHMENT AUTHORITY PIPELINE

COSGROVE CREEK

SOUTH CREEK

KEMPS CREEK

LUDDENHAM ROAD

MAMRE ROAD

BAKERS LANE

Q100 FLOOD DEPTH (m)

No.	FROM DEPTH (m)	TO DEPTH (m)	COLOUR
1	0.000	0.500	
2	0.500	1.000	
3	1.000	1.500	
4	1.500	2.000	
5	2.000	2.500	
6	2.500	3.000	
7	3.000	3.500	
8	3.500	4.000	
9	4.000	4.500	
10	4.500	5.000	
11	5.000	5.500	
12	5.500	6.000	
13	6.000	6.500	
14	6.500	7.000	
15	7.000	7.500	
16	7.500	8.000	

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY MONTEATH & POWYS DATED 20.03.17.

30.00 - FLOOD LEVEL CONTOUR (MAJOR) 1m INTERVALS

30.20 - FLOOD LEVEL CONTOUR (MINOR) 0.2m INTERVALS

- FLOODWAY EXTENT

- FLOOD STORAGE EXTENT

- FLOOD FRINGE EXTENT

Q100 POST-DEVELOPMENT FLOOD LEVELS AND DEPTHS

1:5000 SCALE

50m 0 100 200 300 400 500m

1:5000 SCALE AT A1 SHEET SIZE

FOR APPROVAL

AMENDMENTS	DATE	ISSUE
ISSUED FOR APPROVAL	07.12.18	C
ISSUED FOR APPROVAL	15.10.18	B
ISSUED FOR INFORMATION	06.06.18	A

AMENDMENTS DATE ISSUE

CLIENT: FRASERS PROPERTY

PROJECT: MAMRE SOUTH PRECINCT
657 - 708 MAMRE ROAD
KEMPS CREEK, 2178, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	APRIL '18		A1	AS SHOWN	C013362.00-F02

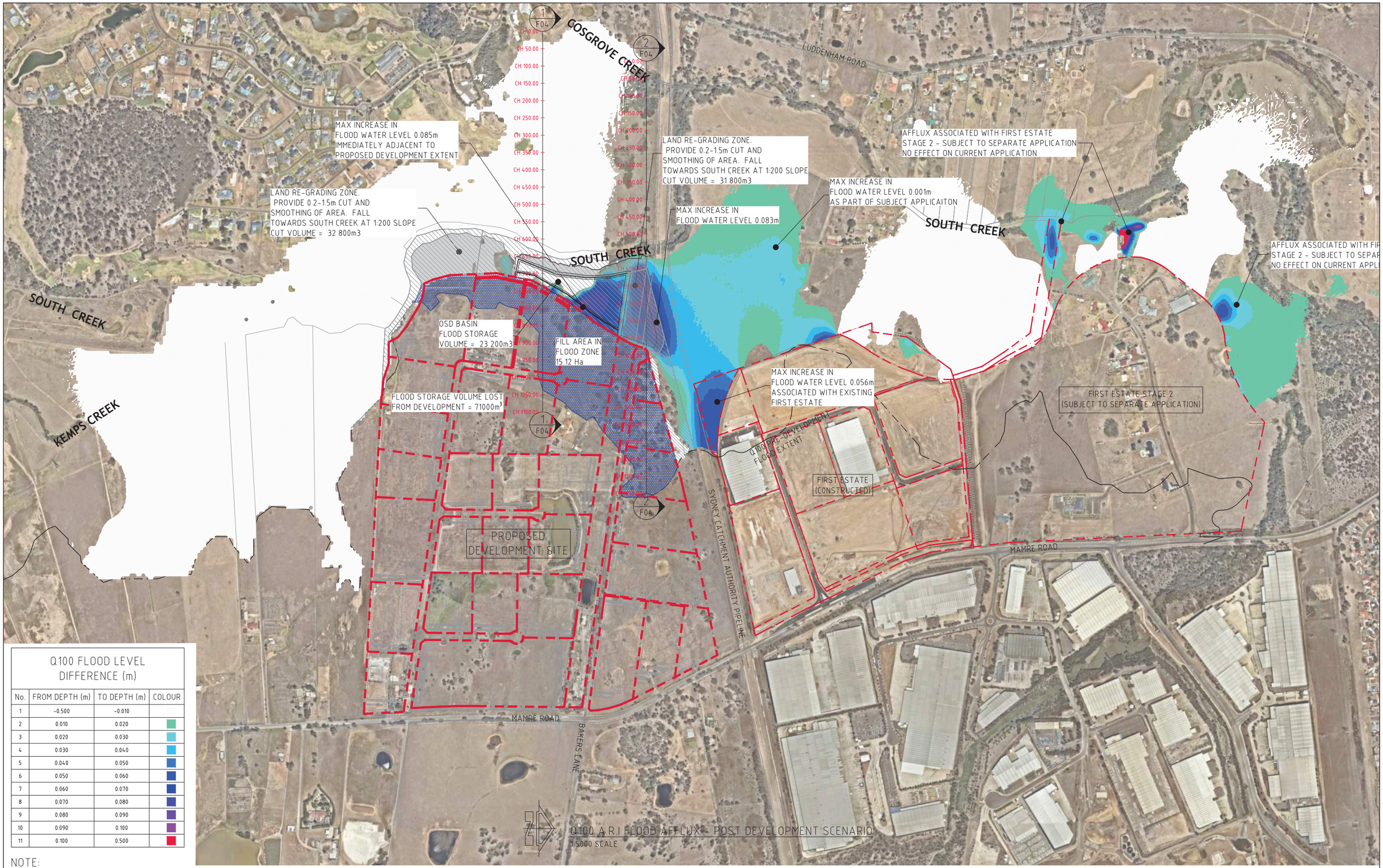
Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 696 448
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7699 Fax: (02) 9241-3731
email: mail@costinroe.au ©

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE: Q100 POST-DEVELOPMENT FLOOD LEVELS AND DEPTHS

DRAWING No C013362.00-F02 ISSUE C



Q100 A.R.I FLOOD AFFLUX - POST DEVELOPMENT SCENARIO
1:5000 SCALE

Q100 FLOOD LEVEL DIFFERENCE (m)			
No.	FROM DEPTH (m)	TO DEPTH (m)	COLOUR
1	-0.500	-0.010	
2	0.010	0.020	
3	0.020	0.030	
4	0.030	0.040	
5	0.040	0.050	
6	0.050	0.060	
7	0.060	0.070	
8	0.070	0.080	
9	0.080	0.090	
10	0.090	0.100	
11	0.100	0.500	

NOTE:
FLOOD LEVEL DIFFERENCE PROVIDED FOR THE PRE DEVELOPED SCENARIO VS THE POST DEVELOPMENT SCENARIO
ORIGINAL SURFACE - PRE-DEVELOPMENT Q100 FLOOD LEVEL
COMPARISON SURFACE - POST-DEVELOPMENT SCENARIO Q100 FLOOD LEVEL

50m 0 100 200 300 400 500m
1:5000 SCALE AT A1 SHEET SIZE

FOR APPROVAL

AMENDMENTS	DATE	ISSUE
ISSUED FOR APPROVAL	07.12.18	C
ISSUED FOR APPROVAL	15.10.18	B
ISSUED FOR INFORMATION	06.06.18	A

AMENDMENTS DATE ISSUE

CLIENT: FRASERS PROPERTY

PROJECT: MAMRE SOUTH PRECINCT
657 - 708 MAMRE ROAD
KEMPS CREEK, 2178, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	APRIL '18		A1	AS SHOWN	C013362.00-F03

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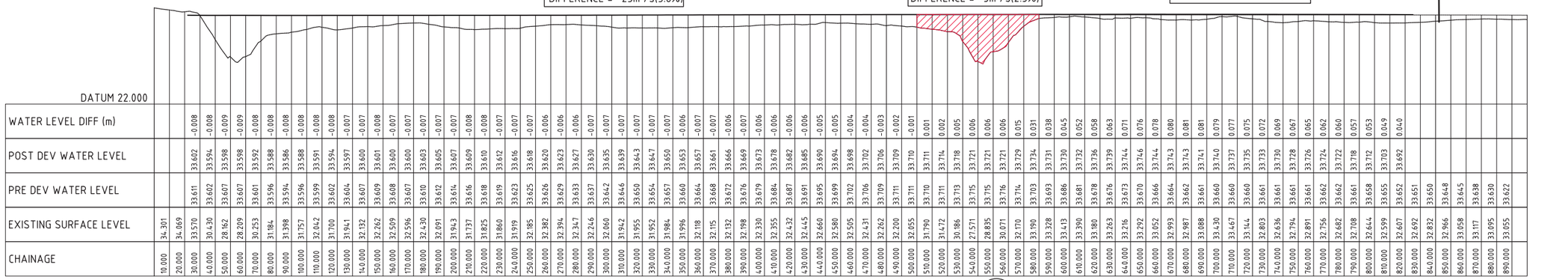
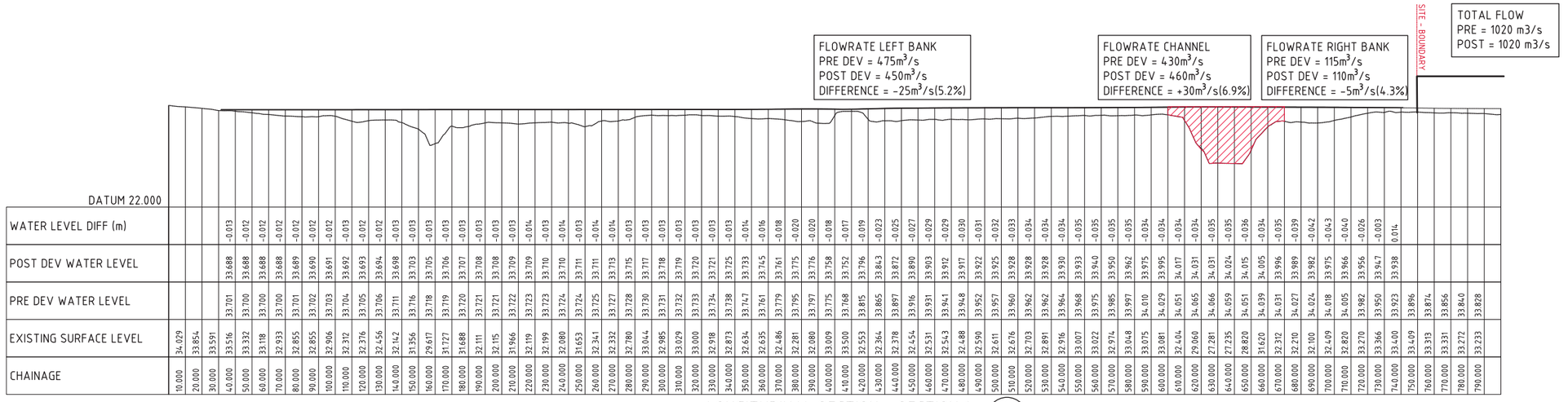
DRAWING TITLE: Q100 A.R.I FLOOD AFFLUX POST DEVELOPMENT SCENARIO

DRAWING No C013362.00-F03 ISSUE C



CHAINAGE	EXISTING SURFACE LEVEL	PRE DEV WATER LEVEL	POST DEV WATER LEVEL	WATER LEVEL DIFF (m)
10.000	34.301			
20.000	34.069			
30.000	33.570	33.611	33.602	-0.008
40.000	30.430	33.602	33.594	-0.008
50.000	28.162	33.607	33.598	-0.009
60.000	28.209	33.607	33.598	-0.009
70.000	30.253	33.601	33.592	-0.008
80.000	31.184	33.596	33.588	-0.008
90.000	31.398	33.594	33.586	-0.008
100.000	31.757	33.596	33.588	-0.008
110.000	32.042	33.599	33.591	-0.008
120.000	31.700	33.602	33.594	-0.008
130.000	31.941	33.604	33.597	-0.007
140.000	32.132	33.607	33.600	-0.007
150.000	32.262	33.609	33.601	-0.008
160.000	32.509	33.608	33.600	-0.007
170.000	32.596	33.607	33.600	-0.007
180.000	32.430	33.610	33.603	-0.007
190.000	32.091	33.612	33.605	-0.007
200.000	31.943	33.614	33.607	-0.007
210.000	31.737	33.616	33.609	-0.008
220.000	31.825	33.618	33.610	-0.008
230.000	31.860	33.619	33.612	-0.007
240.000	31.919	33.623	33.616	-0.007
250.000	32.185	33.625	33.618	-0.007
260.000	32.382	33.626	33.620	-0.006
270.000	32.394	33.629	33.623	-0.006
280.000	32.347	33.633	33.627	-0.006
290.000	32.246	33.637	33.630	-0.007
300.000	32.060	33.642	33.635	-0.007
310.000	31.942	33.646	33.639	-0.007
320.000	31.955	33.650	33.643	-0.007
330.000	31.952	33.654	33.647	-0.007
340.000	31.984	33.657	33.650	-0.007
350.000	31.996	33.660	33.653	-0.006
360.000	32.118	33.664	33.657	-0.007
370.000	32.115	33.668	33.661	-0.007
380.000	32.132	33.672	33.666	-0.006
390.000	32.198	33.676	33.669	-0.007
400.000	32.330	33.679	33.673	-0.006
410.000	32.355	33.684	33.678	-0.006
420.000	32.432	33.687	33.682	-0.006
430.000	32.445	33.691	33.685	-0.006
440.000	32.660	33.695	33.690	-0.005
450.000	32.580	33.699	33.694	-0.005
460.000	32.505	33.702	33.698	-0.004
470.000	32.431	33.706	33.702	-0.004
480.000	32.262	33.709	33.706	-0.003
490.000	32.200	33.711	33.709	-0.002
500.000	32.055	33.711	33.710	-0.001
510.000	31.790	33.710	33.711	0.001
520.000	31.472	33.711	33.714	0.002
530.000	30.186	33.713	33.718	0.005
540.000	27.571	33.715	33.721	0.006
550.000	28.835	33.715	33.721	0.006
560.000	30.071	33.716	33.721	0.006
570.000	32.170	33.714	33.729	0.015
580.000	33.190	33.703	33.734	0.031
590.000	33.328	33.693	33.731	0.038
600.000	33.413	33.686	33.730	0.045
610.000	33.390	33.681	33.732	0.052
620.000	33.180	33.678	33.736	0.058
630.000	33.263	33.676	33.739	0.063
640.000	33.216	33.673	33.744	0.071
650.000	33.292	33.670	33.746	0.076
660.000	33.052	33.666	33.744	0.078
670.000	32.993	33.664	33.743	0.080
680.000	32.987	33.662	33.743	0.081
690.000	33.088	33.661	33.741	0.081
700.000	33.430	33.660	33.740	0.079
710.000	33.467	33.660	33.737	0.077
720.000	33.144	33.660	33.735	0.075
730.000	32.803	33.661	33.733	0.072
740.000	32.636	33.661	33.730	0.069
750.000	32.794	33.661	33.728	0.067
760.000	32.891	33.661	33.726	0.065
770.000	32.756	33.662	33.724	0.062
780.000	32.682	33.662	33.722	0.060
790.000	32.708	33.661	33.718	0.057
800.000	32.644	33.658	33.712	0.053
810.000	32.599	33.655	33.703	0.049
820.000	32.607	33.652	33.692	0.040
830.000	32.692	33.651		
840.000	32.832	33.650		
850.000	32.966	33.648		
860.000	33.058	33.645		
870.000	33.117	33.638		
880.000	33.095	33.630		
890.000	33.055	33.622		

LONGITUDINAL SECTION – SECTION 2 (2 / F03)
HORIZONAL SCALE 1:1500
VERTICAL SCALE 1:300



CHAINAGE	EXISTING SURFACE LEVEL	PRE DEV WATER LEVEL	POST DEV WATER LEVEL	WATER LEVEL DIFF (m)
10.000	34.029			
20.000	33.854			
30.000	33.591	33.701	33.688	-0.013
40.000	33.516	33.700	33.688	-0.012
50.000	33.332	33.700	33.688	-0.012
60.000	33.118	33.700	33.688	-0.012
70.000	32.933	33.701	33.689	-0.012
80.000	32.855	33.702	33.690	-0.012
90.000	32.855	33.703	33.691	-0.012
100.000	32.906	33.704	33.692	-0.012
110.000	32.312	33.705	33.693	-0.013
120.000	32.376	33.706	33.694	-0.012
130.000	32.456	33.711	33.698	-0.013
140.000	32.142	33.716	33.703	-0.013
150.000	31.356	33.718	33.705	-0.013
160.000	29.617	33.719	33.706	-0.013
170.000	31.727	33.720	33.707	-0.013
180.000	31.688	33.721	33.708	-0.013
190.000	32.111	33.721	33.708	-0.013
200.000	32.115	33.721	33.708	-0.013
210.000	31.966	33.722	33.709	-0.013
220.000	32.119	33.723	33.709	-0.014
230.000	32.199	33.723	33.710	-0.013
240.000	32.080	33.724	33.710	-0.014
250.000	31.653	33.724	33.711	-0.013
260.000	32.341	33.725	33.711	-0.014
270.000	32.332	33.727	33.713	-0.014
280.000	32.780	33.728	33.715	-0.013
290.000	33.044	33.730	33.717	-0.013
300.000	32.985	33.731	33.718	-0.013
310.000	33.029	33.732	33.719	-0.013
320.000	33.000	33.733	33.720	-0.013
330.000	32.918	33.734	33.721	-0.013
340.000	32.813	33.738	33.725	-0.013
350.000	32.634	33.747	33.733	-0.014
360.000	32.635	33.761	33.745	-0.016
370.000	32.486	33.779	33.761	-0.018
380.000	32.281	33.795	33.775	-0.020
390.000	32.080	33.797	33.776	-0.020
400.000	33.009	33.775	33.758	-0.018
410.000	33.500	33.768	33.752	-0.017
420.000	32.553	33.815	33.796	-0.019
430.000	32.364	33.865	33.843	-0.023
440.000	32.318	33.897	33.872	-0.025
450.000	32.454	33.916	33.890	-0.027
460.000	32.531	33.931	33.903	-0.029
470.000	32.543	33.941	33.912	-0.029
480.000	32.488	33.948	33.917	-0.030
490.000	32.590	33.952	33.922	-0.031
500.000	32.611	33.957	33.925	-0.032
510.000	32.676	33.960	33.928	-0.033
520.000	32.703	33.962	33.928	-0.034
530.000	32.891	33.962	33.928	-0.034
540.000	32.916	33.964	33.930	-0.034
550.000	33.007	33.968	33.933	-0.035
560.000	33.022	33.975	33.940	-0.035
570.000	32.974	33.985	33.950	-0.035
580.000	33.048	33.997	33.962	-0.035
590.000	33.075	34.010	33.975	-0.034
600.000	33.081	34.029	33.995	-0.034
610.000	32.404	34.051	34.017	-0.034
620.000	29.060	34.065	34.031	-0.034
630.000	27.281	34.066	34.031	-0.035
640.000	27.235	34.059	34.024	-0.035
650.000	28.820	34.051	34.015	-0.036
660.000	31.620	34.039	34.005	-0.034
670.000	32.312	34.031	33.996	-0.035
680.000	32.210	34.027	33.989	-0.039
690.000	32.100	34.024	33.982	-0.042
700.000	32.439	34.018	33.975	-0.043
710.000	32.820	34.005	33.966	-0.040
720.000	33.270	33.982	33.956	-0.026
730.000	33.366	33.950	33.947	-0.003
740.000	33.400	33.923	33.938	0.014
750.000	33.409	33.896		
760.000	33.313	33.874		
770.000	33.331	33.856		
780.000	33.272	33.840		
790.000	33.233	33.828		

LONGITUDINAL SECTION – SECTION 1 (1 / F03)
HORIZONAL SCALE 1:1500
VERTICAL SCALE 1:300

FOR APPROVAL

3m 0 5 10 15 20 25 30m
1:300 SCALE AT A1 SHEET SIZE

15m 0 15 30 45 60 75 90 105 120 135 150m
1:1500 SCALE AT A1 SHEET SIZE

AMENDMENTS	DATE	ISSUE
ISSUED FOR APPROVAL	06.12.18	C
ISSUED FOR APPROVAL	15.10.18	B
ISSUED FOR INFORMATION	06.06.18	A

AMENDMENTS DATE ISSUE

CLIENT: FRASERS PROPERTY

PROJECT: MAMRE SOUTH PRECINCT
657 - 708 MAMRE ROAD
KEMPS CREEK, 2178, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	APRIL '18		A1	AS SHOWN	C013362.00-F04

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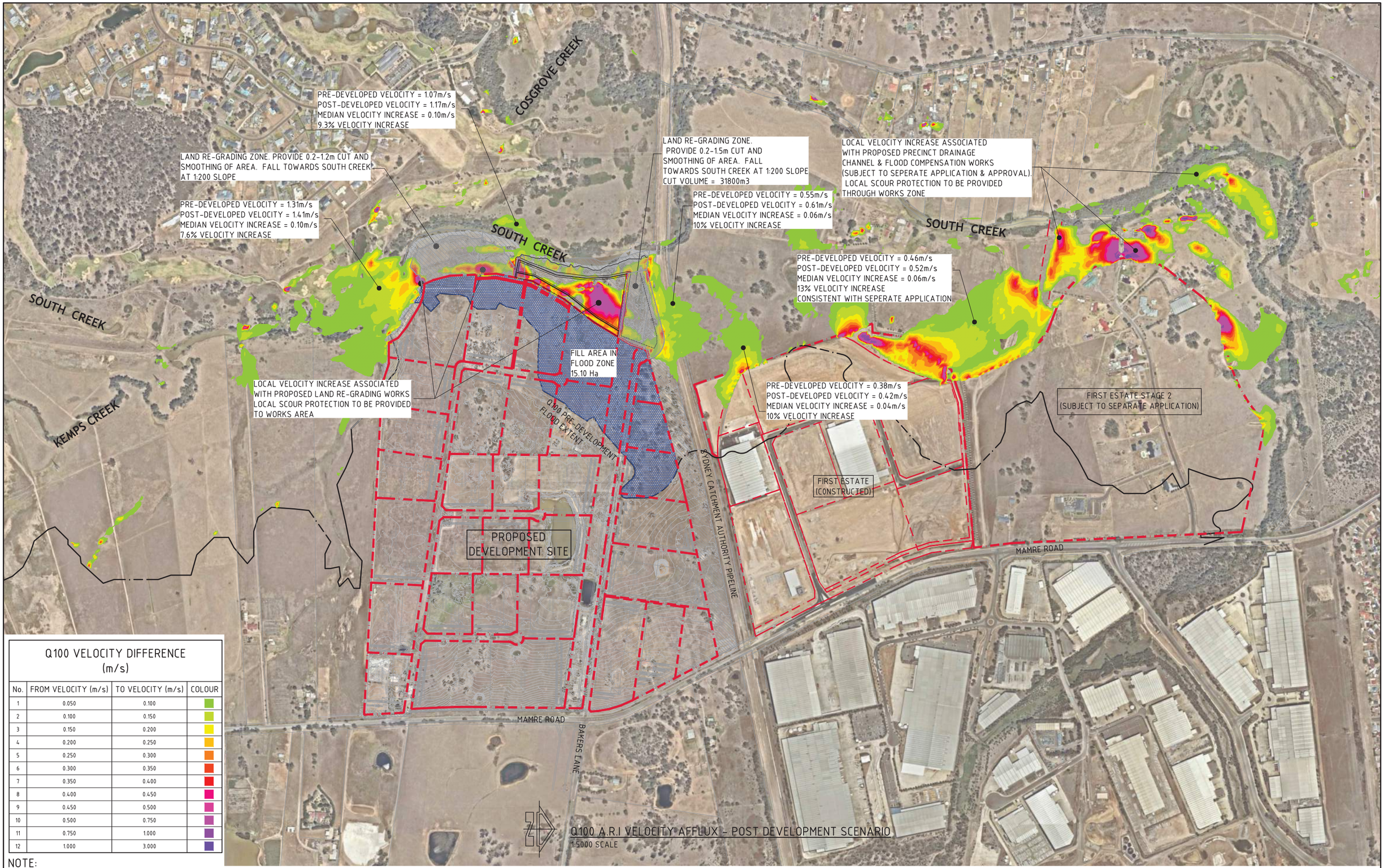
DRAWING TITLE: Q100 FLOW DISTRIBUTION SECTIONS POST DEVELOPMENT SCENARIO

DRAWING No: C013362.00-F04 ISSUE: C



Q100 VELOCITY DIFFERENCE (m/s)			
No.	FROM VELOCITY (m/s)	TO VELOCITY (m/s)	COLOUR
1	0.050	0.100	
2	0.100	0.150	
3	0.150	0.200	
4	0.200	0.250	
5	0.250	0.300	
6	0.300	0.350	
7	0.350	0.400	
8	0.400	0.450	
9	0.450	0.500	
10	0.500	0.750	
11	0.750	1.000	
12	1.000	3.000	

NOTE:
VELOCITY DIFFERENCE PROVIDED FOR THE PRE DEVELOPED SCENARIO VS THE POST DEVELOPMENT SCENARIO
ORIGINAL SURFACE - PRE-DEVELOPMENT Q100 VELOCITY
COMPARISON SURFACE - POST-DEVELOPMENT SCENARIO Q100 VELOCITY

Q100 A.R.I VELOCITY AFFLUX - POST DEVELOPMENT SCENARIO
1:5000 SCALE

50m 0 100 200 300 400 500m
1:5000 SCALE AT A1 SHEET SIZE

FOR APPROVAL

AMENDMENTS	DATE	ISSUE
ISSUED FOR APPROVAL	06.12.18	C
ISSUED FOR APPROVAL	15.10.18	B
ISSUED FOR INFORMATION	06.06.18	A

AMENDMENTS DATE ISSUE

CLIENT: FRASERS PROPERTY

PROJECT: MAMRE SOUTH PRECINCT
657 - 708 MAMRE ROAD
KEMPS CREEK, 2178, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	APRIL '18		A1	AS SHOWN	C013362.00-F05

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DRAWING TITLE: Q100 A.R.I VELOCITY AFFLUX POST DEVELOPMENT SCENARIO

DRAWING No: C013362.00-F05 ISSUE: C

COSGROVE CREEK
LUDDENHAM ROAD
SOUTH CREEK
SOUTH CREEK
SOUTH CREEK
KEMPS CREEK
PROPOSED DEVELOPMENT SITE
SYDNEY CATCHMENT AUTHORITY PIPELINE
FIRST ESTATE (CONSTRUCTED)
FIRST ESTATE STAGE 2 (SUBJECT TO SEPARATE APPLICATION)
MAMRE ROAD
MAMRE ROAD
BAKERS LANE
N

PMF FLOOD DEPTH (m)			
No.	FROM DEPTH (m)	TO DEPTH (m)	COLOUR
1	0.000	0.500	
2	0.500	1.000	
3	1.000	1.500	
4	1.500	2.000	
5	2.000	2.500	
6	2.500	3.000	
7	3.000	3.500	
8	3.500	4.000	
9	4.000	4.500	
10	4.500	5.000	
11	5.000	5.500	
12	5.500	6.000	
13	6.000	6.500	
14	6.500	7.000	
15	7.000	7.500	
16	7.500	8.000	

LEGEND:

LEVELS DATUM IS AHD.

EXISTING SITE LEVELS AND DETAILS BASED ON SURVEY INFORMATION PROVIDED BY MONTEATH & POWYS DATED 20.03.17.

30.00 - FLOOD LEVEL CONTOUR (MAJOR) 1m INTERVALS

30.20 - FLOOD LEVEL CONTOUR (MINOR) 0.2m INTERVALS

PMF POST-DEVELOPMENT FLOOD LEVELS AND DEPTHS

1:5000 SCALE

50m 0 100 200 300 400 500m

1:5000 SCALE AT A1 SHEET SIZE

FOR APPROVAL

ISSUED FOR INFORMATION	06.12.18	A
AMENDMENTS	DATE	ISSUE

AMENDMENTS	DATE	ISSUE

CLIENT: FRASERS PROPERTY

PROJECT: MAMRE SOUTH PRECINCT
657 - 708 MAMRE ROAD
KEMPS CREEK, 2178, NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
MW	MC	APRIL '18		A1	AS SHOWN	C013362.00-F14

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DRAWING TITLE: PMF POST-DEVELOPMENT FLOOD LEVELS AND DEPTHS

DRAWING No: C013362.00-F14 ISSUE: A

APPENDIX D

Penrith City Council Local Flood Plan

2012

PENRITH CITY

LOCAL FLOOD PLAN

A SUB-PLAN OF

PENRITH LOCAL DISASTER PLAN (DISPLAN)

Chair, Local Emergency Management Committee

SES Local Controller

April 2012 Edition

To be reviewed no later than April 2017

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Penrith, Local Emergency Management Committee Members....4
Penrith, Local Emergency Management Officer....1
Penrith, Local Emergency Operations Centre....1
Penrith, Mayor....1
Penrith, General Manager....1
Penrith, Technical Services Department....1
Fire & Rescue NSW, Windsor....1
Rural Fire Service, Penrith....1
Ambulance Service of NSW, Windsor....1
Marine Rescue NSW....1
Endeavour Energy....1
Telstra....1
Office of Environment and Heritage....1
Department of Primary Industries....1
Department of Community Services....1
Roads and Marine Services....1
Hospitals....1
Schools.... 1 each
Council Libraries.... 1 each
Caravan Parks.... 1 each
Spare....1

AMENDMENT LIST

Proposals for amendments to this plan should be forwarded to:

The Local Controller
State Emergency Service Penrith Unit
Gipps Street
Claremont Meadows

Amendments promulgated in the amendment list below have been entered in this plan.

Amendment List Number	Date	Amendment Entered By	Date

LIST OF ABBREVIATIONS

The following abbreviations have been used in this plan:

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AIIMS	Australasian Inter-service Incident Management System
ARI	Average Recurrence Interval (Years)
ALERT	Automated Local Evaluation in Real Time
AWRC	Australian Water Resources Council
Bureau	Australian Government Bureau of Meteorology
DCF	Dam Crest Flood
DECCW	Department of Environment, Climate Change and Water
DSC	Dams Safety Committee
DISPLAN	Disaster Plan
DSEP	Dam Safety Emergency Plan
DVR	Disaster Victim Registration
NOW	NSW Office of Water
GIS	Geographic Information System
GRN	Government Radio Network
IFF	Imminent Failure Flood
LEMO	Local Emergency Management Officer
LEOCON	Local Emergency Operations Controller
OAP	Operational Action Plan
PMF	Probable Maximum Flood
PMR	Private Mobile Radio
PMP	Probable Maximum Precipitation
RMS	Roads and Marine Services
SEOCON	State Emergency Operations Controller
SERCON	State Emergency Recovery Controller
SES	NSW State Emergency Service
SEWS	Standard Emergency Warning Signal
TMC	Transport Management Centre
VRA	Volunteer Rescue Association
WICEN	Wireless Institute Civil Emergency Network

GLOSSARY

Annual Exceedance Probability (AEP). The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. For example, if a peak flood level (height) has an AEP of 5%, there is a 5% chance (that is, a one-in-20 chance) of such a level or higher occurring in any one year (see also Average Recurrence Interval).

Assistance Animal. A guide dog, a hearing assistance dog or any other animal trained to assist a person to alleviate the effect of a disability (Refer to Section 9 of the Disability Discrimination Act 1992).

Australian Height Datum (AHD). A common national surface level datum approximately corresponding to mean sea level.

Average Recurrence Interval (ARI). The long-term average number of years between the occurrence of a flood as big as, or larger than, the selected event. For example, floods reaching a height as great as, or greater than, the 20 year ARI flood event will occur on average once every 20 years.

Catchment (river basin). The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
Coastal Erosion. The loss of land along the shoreline predominantly by the offshore movement of sand during storms.

Dambreak Study. A Dambreak Study is undertaken to determine the likely downstream inundation areas in case of a dam failure. Modelling is undertaken for a range of dam breach possibilities and design floods. The dambreak study includes information such as the extent of flooding, flood travel times and flood water velocities. The study can assist dam owners, regulators, and emergency agencies in the preparations of evacuation plans, dam break and other flood warning systems, and hazard classification of affected areas.

Dam Failure. The uncontrolled release of a water storage. The failure may consist of the collapse of the dam or some part of it, or excessive seepage or discharges. The most likely causes of dam failure are:

- **Flood Induced Dam Failure:** Dam failure caused by flood, either due to overtopping erosion or by subsequent structural failure.
- **Sunny Day Dam Failure:** Dam Failure as a result of factors other than flood i.e. other than flood flow into the reservoir. Causes of "Sunny Day" dam failure can include internal erosion, landslide, piping, earthquake or sabotage.

Dam Safety Emergency Plan (DSEP). A DSEP outlines the required actions of owners and their personnel at dams in response to a range of possible emergency situations. The NSW Dam Safety Committee requires a quality controlled DSEP, with associated dambreak warning procedures to be prepared for prescribed dams where persons may be at risk downstream, if the dam failed.

Design flood (or flood standard). A flood of specified magnitude that is adopted for

planning purposes. Selections should be based on an understanding of flood behaviour and the associated flood risk, and take account of social, economic and environmental considerations. There may be several design floods for an individual area.

DisPlan (Disaster Plan). The object of a Displan is to ensure the coordinated response by all agencies having responsibilities and functions in emergencies.

Emergency Alert. A national telephony alerting based system available for use by emergency service agencies to send SMS and voice messages to landlines and/or mobile telephones (by billing address) in times of emergency.

Essential services. Those services, often provided by local government authorities, that are considered essential to the life of organised communities. Such services include power, lighting, water, gas, sewerage and sanitation clearance.

Evacuation. The temporary movement (relocation) of people from a dangerous or potentially dangerous place to a safe location, and their eventual return. It is a safety strategy which uses distance to separate people from the danger created by the hazard.

Evacuation Order. Notification to the community, authorised by the SES, when the intent of an Operations Controller is to instruct a community to immediately evacuate in response to an imminent threat.

Evacuation Warning. Notification to the community, authorised by the SES, when the intent of an Operations Controller is to warn a community of the need to prepare for a possible evacuation.

Flash flooding. Flooding which is sudden and often unexpected because it is caused by sudden local or nearby heavy rainfall. It is sometimes defined as flooding which occurs within six hours of the rain that causes it.

Flood. Relatively high water level which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences, including Tsunami.

Flood classifications. Locally defined flood levels used in flood warnings to give an indication of the severity of flooding (minor, moderate or major) expected. These levels are used by the State Emergency Service and the Australian Government Bureau of Meteorology in flood bulletins and flood warnings.

Flood intelligence. The product of collecting, collating, analysing and interpreting flood-related data to produce meaningful information (intelligence) to allow for the timely preparation, planning and warning for and response to a flood.

Flood fringe. The remaining area of flood prone land after floodway and flood storage have been defined.

Flood liable land (also referred to as flood prone land). Land susceptible to flooding by the Probable Maximum Flood. (PMF) event. This term also describes the maximum extent of

a floodplain which is an area of a river valley, adjacent to the river channel, which is subject to inundation in floods up to this event.

Flood of record. Maximum observed historical flood.

Floodplain Management Plan. A plan developed in accordance with the principles and guidelines in the New South Wales Floodplain Development Manual. Such a plan usually includes both written and diagrammatic information describing how particular areas of flood prone land can be used and managed to achieve defined objectives.

Flood Plan. A response strategy plan that deals specifically with flooding and is a sub-plan of a Disaster Plan. Flood plans describe agreed roles, responsibilities, functions, strategies and management arrangements for the conduct of flood operations and for preparing for them. A flood plan contains information and arrangements for all floods whereas an OAP is for a specific flood/event.

Flood Rescue: the rescue or retrieval of persons trapped by floodwaters.

Flood storage areas: Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation.

Floodway. An area where a significant volume of water flows during floods. Such areas are often aligned with obvious naturally-defined channels and are areas that, if partially blocked, would cause a significant redistribution of flood flow which may in turn adversely affect other areas. They are often, but not necessarily, the areas of deeper flow or the areas where higher velocities occur.

Flood Watch. A Flood Watch is a notification of the potential for a flood to occur as a result of a developing weather situation and consists of short generalised statements about the developing weather including forecast rainfall totals, description of catchment conditions and indicates streams at risk. The Bureau will also attempt to estimate the magnitude of likely flooding in terms of the adopted flood classifications. Flood Watches are normally issued 24 to 36 hours in advance of likely flooding. Flood watches are issued on a catchment wide basis.

Flood Warning. A Flood Warning is a gauge specific forecast of actual or imminent flooding. Flood Warnings specify the river valley, the locations expected to be flooded, the likely severity of flooding and when it will occur.

Functional Area. Means a category of services involved in the preparations for an emergency, including the following:

- Agriculture and Animal Services;
- Communication Services;
- Energy and Utility Services;
- Engineering Services;

- Environmental Services;
- Health Services;
- Public Information Services;
- Transport Services; and
- Welfare Services.

Geographic Information System (GIS). A computerised database for the capture, storage, analysis and display of locationally defined information. Commonly, a GIS portrays a portion of the earth's surface in the form of a map on which this information is overlaid.

Inundation. See definition for Flood.

Indirect Effect. Indirect effects are generally a consequence of infrastructure damage or interruption of services and can affect communities distant from the actual flood footprint i.e. floodplain. Indirect effects can also refer to indirect losses due to disruption of economic activity, both in areas which are inundated or isolated. Indirect effects are one of the three primary sources of risk in the context of flooding (the other two are inundation and isolation).

Isolation. Properties and/or communities where flooding cuts access to essential services or means of supply. Isolation is one of the three primary sources of risk in the context of flooding (the other two are inundation and indirect effects).

Local overland flooding. Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.

Major flooding. Flooding which causes inundation of extensive rural areas, with properties, villages and towns isolated and/or appreciable urban areas flooded.

Minor flooding. Flooding which causes inconvenience such as closing of minor roads and the submergence of low-level bridges. The lower limit of this class of flooding, on the reference gauge, is the initial flood level at which landholders and/or townspeople begin to be affected in a significant manner that necessitates the issuing of a public flood warning by the Australian Government Bureau of Meteorology.

Moderate flooding. Flooding which inundates low-lying areas, requiring removal of stock and/or evacuation of some houses. Main traffic routes may be covered.
Operational Action Plan (OAP). An action plan for managing a specific flood event. Information from the Local Flood Plan is used to develop the OAP.

Peak height. The highest level reached, at a nominated gauging station, during a particular flood event.

Prescribed Dam. "Prescribed" dams are those listed in Schedule 1 of the Dams Safety Act 1978. The NSW Dam Safety Committee will prescribe those dams with the potential for a failure which could have a significant adverse effect on community interests.

Probable Maximum Flood (PMF). The largest flood that could conceivably be expected to occur at a particular location, usually estimated from probable maximum precipitation. The

PMF defines the maximum extent of flood prone land, that is, the floodplain. It is difficult to define a meaningful Annual Exceedance Probability for the PMF, but it is commonly assumed to be of the order of 104 to 107 (once in 10,000 to 10,000,000 years).

Runoff. The amount of rainfall which ends up as streamflow, also known as 'rainfall excess' since it is the amount remaining after accounting for other processes such as evaporation and infiltration.

Standing Operating Procedure (SOP).

Stage height. A level reached, at a nominated gauging station, during the development of a particular flood event.

Stream gauging station. A place on a river or stream at which the stage height is routinely measured, either daily or continuously, and where the discharge is measured from time to time so as to develop a relationship between stage and discharge or rating curve.

Part 1 - Introduction

1.1 Purpose

1.1.1 This plan covers the preparedness measures, the conduct of response operations and the co-ordination of immediate recovery measures for all levels of flooding on the Nepean River within the boundaries of the Penrith City.

1.1.2 The extent and complexity of operations required to deal with a severe to extreme flood in the Hawkesbury Nepean Valley, dictate the need for a set of management arrangements for operational control different to those used for less severe levels of flooding in the valley. For the purpose of planning, a flood in the Hawkesbury-Nepean Valley can be classified as either a Level 1 flood or a Level 2 flood according to the degree of severity.

1.1.3 A Level **1 flood** is defined as one in which the water level of the Hawkesbury-Nepean River is not expected to exceed 15.0 metres on the Windsor Bridge gauge. For such a flood the operation is within the scope of normal arrangements detailed in the respective SES Region and Local Flood Plans and the respective District and Local DISPLAN's.

1.1.4 A **Level 2 flood** is defined as one in which the water level of the Hawkesbury-Nepean River is expected to exceed 15.0 metres on the Windsor Bridge gauge. In such a flood the operation will be beyond the scope of the respective SES Region and Local Flood Plans and the respective District and Local DISPLAN's. In this case the provisions of the Hawkesbury Nepean Flood Emergency Plan will apply.

1.2 Authority

1.2.1 This plan is issued under the authority of the State Emergency and Rescue Management Act 1989 and the State Emergency Service Act 1989. It has been accepted by the SES Sydney Western Region Controller and the Penrith Local Emergency Management Committee.

1.2.2 This plan is also regarded to be a sub-plan of the SES Sydney Western Region Flood Plan.

1.2.3 The plan is also to be regarded as a sub-plan of the Hawkesbury Nepean Flood Emergency State Plan.

1.3 Area Covered by the Plan

1.3.1 The area covered by the plan is the Penrith local government area.

1.3.2 Penrith City covers an area of 407 square kilometres and has a population of 184,611 (as of 2009). The City has a mixture of residential, commercial, industrial,

rural and environmentally protected areas.

1.3.3 The council area and its principal rivers and creeks are shown in Map 1.

1.3.4 The council area is in the SES Sydney Western Region and for emergency management purposes is part of the Sydney West Emergency Management District.

1.4 Description of Flooding and its Effects

1.4.1 The nature of flooding in the Penrith Council area is described in Annex A.

1.4.2 The effects of flooding on the community are detailed in Annex B.

1.5 Responsibilities

1.5.1 The general responsibilities of emergency service organisations and supporting services (functional areas) are listed in the Local Disaster Plans (DISPLAN). Some specific responsibilities are expanded upon in the following paragraphs. The extent of their implementation will depend on the severity of flooding.

1.5.2 **SES Penrith City Local Controller** The SES Local Controller is responsible for dealing with floods as detailed in the State Flood Plan, and will:

Preparedness

a. Maintain a Local Headquarters in accordance with the SES Controllers' Handbook and the SES Operations Manual.

b. Ensure that SES members are trained to undertake operations in accordance with current policy as laid down in the SES Controllers' Handbook and the SES Operations Manual.

c. Develop and operate a flood intelligence system.

d. Coordinate the development and operation of a warning service for the community.

e. Participate in floodplain risk management initiatives organised by the Hills Shire Council.

f. Coordinate a public education program.

g. Identify and monitor people and/or communities at risk of flooding and tsunami.

h. Ensure that the currency of this plan is maintained.

Response

i. Control flood operations. This includes:

   i. Directing the activities of the SES units operating within the council area.
   ii. Coordinating the activities of supporting agencies and organisations and ensuring that liaison is established with them.

j. Provide an information service in relation to:

- Flood heights and flood behaviour.
- Coastal erosion / inundation.
- Road conditions and closures.
- Advice on methods of limiting property damage.
- Confirmation of evacuation warnings.

k. Direct the conduct of flood rescue operations.

l. Direct the evacuation of people and/or communities.

m. Provide immediate welfare support for evacuated people.

n. Coordinate the provision of emergency food and medical supplies to isolated people and/or communities.

o. Coordinate operations to protect property, for example by:

- Arranging resources for sandbagging operations.
- Lifting or moving household furniture.
- Lifting or moving commercial stock and equipment.
- Moving farm animals.

p. Arrange for support (for example, accommodation and meals) for emergency service organisation members and volunteers assisting them.

q. If SES resources are available, assist with emergency fodder supply operations conducted by Department of Primary Industries.

r. If SES resources are available, assist the NSW Police Force, RTA and Council with road closure and traffic control operations.

s. Exercise financial delegations relating to the use of emergency orders as laid down in the SES Controllers' Handbook.

t. Coordinate the collection of flood intelligence.

u. Submit Situation Reports to the SES Sydney Western Region Headquarters and agencies assisting within the council area. These will contain information on:

- Road conditions and closures.
- Current flood behaviour.
- Current operational activities.
- Likely future flood behaviour.
- Likely future operational activities.
- Probable resource needs.

v. Keep the Local Emergency Operations Controller advised of the flood situation and the operational response.

w. Issue the 'All Clear' when flood operations have been completed.

x. Ensure that appropriate Debriefs/After Action Reviews are held after floods.

Recovery

y. Assist in the establishment and deliberations of the Recovery Coordinating Committee.

1.5.3 SES Penrith Unit Members

a. Carry out flood and tsunami response tasks. These may include:

- The management of the SES Hills Local Headquarters Operations Centres.
- Gathering flood and coastal erosion/inundation intelligence.
- Flood rescue.
- Evacuation.
- Providing immediate welfare for evacuated people.
- Delivery of warnings and information.
- Resupply.
- Levee monitoring.
- Sandbagging.
- Lifting and/or moving household furniture and commercial stock.
- Moving farm animals.
- Assisting in repairing or improving levees.
- Assisting with road closure and traffic control operations.
- Assisting with emergency fodder supply operations.

b. Assist with preparedness activities.

c. Undertake training in flood operations and coastal erosion/inundation.

1.5.4 Ambulance Service of NSW

a. Assist with the evacuation of elderly and/or infirm people.

1.5.5 Animal & Agricultural Services Coordinator

a. Coordinate the supply and delivery of emergency fodder.

b. Provide advice on dealing with dead and injured farm animals.

c. Provide financial, welfare and damage assessment assistance to flood affected farm people.

d. Coordinate the operation of animal shelter compound, facilitate for the domestic pets and companion animals of evacuees.

1.5.6 Australian Government Bureau of Meteorology (BoM)

a. Provide Flood Watches for the Hawkesbury River

b. Provide Flood Warnings, incorporating height-time predictions, for:

- Wallacia.
- Penrith (Victoria Bridge).

c. Provide Severe Weather Warnings and/or Severe Thunderstorm Warnings when flash flooding is likely to occur.

1.5.7 Australian Rail Track Corporation

a. Close and re-open railway lines as necessary and advise the SES Penrith Local Controller.

b. Arrange trains for evacuations and/or commuting purposes.

1.5.8 Caravan Park Proprietors

a. Prepare a Flood Management Plan for the Caravan Park.

b. Ensure that owners and occupiers of caravans are aware that the caravan park is flood liable and what they must do to facilitate evacuation and van relocation when flooding occurs.

c. Ensure that occupiers are informed of flood warnings and flood watches.

d. Coordinate the evacuation of people and the relocation of moveable vans when floods are rising and their return when flood waters have subsided.

e. Inform the SES of the progress of evacuation and/or van relocation operations and of any need for assistance in the conduct of these tasks.

1.5.9 Childcare Centres and Preschools

a. Childcare centres in flood affected areas to be contacted by the SES in the event of possible flooding.

b. When notified the child care centres should:

- Liaise with the SES and arrange for the early release of children whose travel arrangements are likely to be disrupted by flooding and/or road closures.
- Assist with coordinating the evacuation of preschools and childcare centres.

1.5.10 Communications Services Coordinator

a. Assist the SES to identify infrastructure at risk of flooding for incorporation into planning and intelligence.

b. Provide additional telecommunications support for the SES Local Headquarters as required.

c. Maintain telephone services.

d. Repair and restore telephone facilities damaged by flooding.

1.5.11 Department of Corrective Services

a. Coordinate the evacuation of correctional facilities threatened by flooding in the Penrith LGA.

1.5.12 Endeavour Energy

a. Provide advice to the SES Local Controller of any need to disconnect power supplies or of any timetable for reconnection.

b. Clear or make safe any hazard caused by power lines or electrical reticulation equipment.

c. Assess the necessity for and implement the disconnection of customers' electrical installations where these may present a hazard.

d. Advise the public with regard to electrical hazards during flooding and to the availability or otherwise of the electricity supply.

e. Inspect, test and reconnect customers' electrical installations as conditions allow.

f. Assist the SES to identify infrastructure at risk of flooding for incorporation into planning and intelligence.

1.5.13 Jemena (Gas)

a. Maintenance and repair of facilities.

1.5.14 Fire & Rescue NSW

a. Assist with the delivery of evacuation warnings.

b. Assist with the conduct of evacuations.

c. Provide equipment for pumping flood water out of buildings and from low-lying areas.

d. Assist with cleanup operations, including the hosing out of flood affected properties.

1.5.15 NSW Police

a. Assist with the delivery of evacuation warnings.

b. Assist with the conduct of evacuation operations.

c. Conduct road and traffic control operations in conjunction with council and/or the Roads and Traffic Authority (RTA).

d. Ensure evacuees at evacuation centres in the council area are registered.

e. Secure evacuated areas.

1.5.16 Office of Environment and Heritage

a. Provide specialist advice to the SES regarding flooding.

1.5.17 Penrith Local Emergency Operations Controller

a. Monitor flood operations.

b. Coordinate support to the SES Local Controller if requested to do so.

1.5.18 Penrith Local Emergency Management Officer

a. Provide executive support to the LEOCON in accordance with the Penrith Local Disaster Plan.

b. At the request of the SES Local Controller, advise appropriate agencies and officers of the activation of this plan.

1.5.19 Penrith City Council

Preparedness

a. Establish and maintain floodplain risk management committee and ensure that key agencies are represented.

b. Provide flood studies and floodplain risk management studies to the SES.

c. Maintain Dam Safety Emergency Plans and provide copies to the SES.

d. Provide information on the consequences of dam failure to the SES for incorporation into planning and flood intelligence.

e. Contribute to the development and implementation of a public education program on flooding within the council area.

f. Maintain a plant and equipment resource list for the council area.

Response

g. At the request of the SES Local Controller, deploy personnel and resources for flood-related activities and assist with warning of residents of evacuations.

h. Close and re-open council roads (specify other roads nominated by agreement with the RTA) and advise the SES Local Controller, the Police and people who telephone the council for road information.

i. Assist with the removal of caravans from caravan parks.

j. Provide back-up radio communications.

k. Provide vehicles capable of passing through shallow floodwaters.

l. In the event of evacuations, set up and operate animal shelter compound facilities for the domestic pets and companion animals of evacuees.

Recovery

m. Provide for the management of health hazards associated with flooding. This includes removing debris and waste.

n. Ensure premises are fit and safe for reoccupation and assess any need for demolition.

o. Arrange for storage of evacuees' furniture as required.

1.5.20 Penrith VRA

a. Assist the SES with evacuation operations.

1.5.21 Roads and Marine Services (RMS)

a. Close and reopen RMS roads affected by flood waters and advise the SES Hills Local Controller.

1.5.22 Rural Fire Service (RFS), Cumberland District

a. Provide personnel in rural areas and villages to:

- Inform the SES Local Controller about flood conditions and response needs in the RFS District, and
- Disseminate flood information.

b. Provide vehicles capable of passing through shallow floodwaters.

c. Assist with the delivery of evacuation warnings.

d. Assist with the conduct of evacuations.

e. Provide equipment and operators for pumping flood water out of buildings and from low-lying areas.

f. Assist with the removal of caravans.

g. Provide back-up radio communications.

h. Assist with cleanup operations, including the hosing of flood affected properties.

i. Provide equipment, communications and trained personnel for air base/support operations.

j. Assist with monitoring roads closed by flooding and rates of rise in back creeks.

1.5.23 School Administration Offices including Catholic Education Office, Department of Education & Training and Private Schools

a. Liaise with the SES and arrange for the early release of students whose travel arrangements are likely to be disrupted by flooding and/or road closures.

b. Pass information to school bus drivers/companies and/or other school principals on expected or actual impacts of flooding.

c. Assist with coordinating the evacuation of the schools.

1.5.24 Transport Services Coordinator

a. Arrange transport facilities for evacuations and/or commuting purposes.

b. On request provide a liaison officer to the SES Penrith Local Controller or SES Sydney Western Region Headquarters as required.

c. On request attend/contribute to the post event AAR/debrief.

1.5.25 Welfare Services Coordinator

a. Manage evacuation centres designated in this plan.

b. Provide clothing, accommodation, food and welfare services for flood affected people, including stranded travellers.

Part 2 - Preparedness

2.1 Maintenance of this Plan

2.1.1 The SES Local Controller will maintain the currency of this plan by:

a. Ensuring that all agencies, organisations and officers mentioned in it are aware of their roles and responsibilities.

b. Conducting exercises to test arrangements.

c. Reviewing the contents of the plan:

- After each flood operation.
- When significant changes in land use or community characteristics occur.
- When new information from flood studies becomes available.
- When flood control or mitigation works are implemented are altered.
- When there are changes, which alter agreed plan arrangements.

2.1.2 In any event, the plan is to be reviewed no less frequently than every five years.

2.2 Floodplain Management

2.2.1 The SES Local Controller will ensure that the SES:

a. Participates in floodplain management committee activities.

b. Consults with the flood prone community about the nature of the flood problem and its management.

c. Informs the SES Sydney Western Region Headquarters of involvement in floodplain management activities.

2.3 Development of Flood Intelligence

2.3.1 Flood intelligence describes flood behaviour and its effects on the community.

2.3.2 The SES will develop and maintain a flood intelligence system.

2.4 Development of Warning Systems

2.4.1 The SES will maintain a flood warning system for areas affected by flooding. This requires:

a. An identification of the potential clients of flood warning information at different levels of flooding.

b. Available information about the estimated impacts of flooding at different heights.

c. Identification of required actions and the amounts of time needed to carry them out.

d. Appropriate means of disseminating warnings to different clients and at different flood levels.

2.5 Public Education

2.5.1 The SES Penrith Local Controller with the assistance of the Penrith City Council, the SES Sydney Western Region Headquarters and SES State Headquarters, is responsible for ensuring that the residents of the council area are aware of the flood threat in their vicinity and how to protect themselves from it.

2.5.2 Specific strategies to be employed include:

a. Dissemination of emergency kits, flood-related brochures, booklets and locally tailored flood action guides in flood liable areas.

b. Talks (including public meetings and FloodSafe Community Information Nights) and visual displays (including photographs and video) oriented to community organisations and schools.

c. Publicity given to this plan and to flood-orientated SES activities through local media outlets, including articles in local newspapers about the flood threat and appropriate responses.

2.6 Training

2.6.1 Throughout this document there are references to functions that must be carried out by the members of the SES Penrith City Unit. The SES Local Controller is responsible for ensuring that the members are:

a. Familiar with the contents of this plan.

b. Training in the skills necessary to carry out the tasks allocated to the SES.

2.7 Resources

2.7.1 The SES Local Controller is responsible for maintaining the condition and state of readiness of:

a. SES equipment.

b. The SES Local Headquarters.

Part 3 - Response

Control

3.1 Control Arrangements

3.1.1 The SES is the legislated combat agency for floods and is responsible for the control of flood operations. This includes the co-ordination of other agencies and organisations for flood management tasks.

3.1.2 Flood operations can occur on one or more of the following river/creek systems at the same or different times:

a. Nepean River

b. Rickabys Creek

c. South Creek

d. Ropes Creek

3.1.3 A **Level 1 flood operation** will be dealt with using those arrangements detailed in the SES Sydney Western Region Flood Plan and this Local Flood Plan.

3.1.4 A **Level 2 flood operation** will be dealt with using the arrangements described in Hawkesbury-Nepean Flood Emergency Sub Plan augmented by those Level 2 flood arrangements described within the SES Sydney Western Region Flood Plan and this Local Flood Plan.

3.1.5 The decision to commence a Level 2 flood operation is driven primarily by the potential need to completely evacuate whole communities before mainstream flooding cuts evacuation routes. A Level 2 operation may also be required to manage a large-scale resupply operation to affected areas.

3.1.6 The Local DISPLAN will operate to provide support as requested by the SES Local Controller.

3.2 Start of Response Operations

3.2.1 This plan is always active to ensure that preparedness actions detailed in this plan are completed.

3.2.2 Response operations will begin:

a. On receipt of the first of a Bureau of Meteorology Flood Watch, Preliminary Flood Warning or Flood Warning for the Nepean River.

b. On receipt of a Flood Warning for the Hawkesbury River at Windsor which

indicates backup flooding on Rickabys Creek, South Creek and Ropes Creek.

c. When other evidence leads to an expectation of flooding on the South Creek system.

d. When other evidence leads to an expectation of flooding within the Penrith local government area.

3.2.3 Contact with the BOM to discuss the development of flood warnings will normally be through the SES Sydney Western Region Headquarters.

3.2.4 The following persons and organisations will be advised of the start of response operations by the SES Local Controller regardless of the location and severity of the flooding anticipated:

a. SES Sydney Western Region Headquarters

b. Penrith Local Emergency Operations Controller

c. Penrith Local Emergency Management Officer

d. Penrith City Council (via the LEMO)

3.2.5 Other agencies listed in this plan will be advised by the LEMO on the request of the SES Hawkesbury Local Controller as appropriate to the location and nature of the threat.

3.3 Designation of Start Time

3.3.1 In Level 2 flood operations on the Nepean River the SES Sydney Western Region Controller will designate the "Start Time" to help Controllers at all levels calculate the timings that apply to their areas of responsibility. This will be done with the assistance of the Bureau of Meteorology, normally based on a Flood Warning. The "Start Time" will be based on the time the Hawkesbury River reached, or is expected to reach, 6 metres on the Windsor flood gauge.

3.4 Response Strategies

3.4.1 The key strategy for flood operations is:

a. **Provision of warnings, information and advice to communities**

Inform the community regarding the potential impacts of a flood and what actions to undertake in preparation for flooding.

Provide timely and accurate information to the community.

3.4.2 The response strategies for flood operations include:

a. **Property protection**

Protect the property of residents and businesses at risk of flood damage.

Assistance with property protection by way of sandbagging and the lifting or transporting of furniture, personal effects, commercial stock and caravans;

Assistance with the protection of essential infrastructure.

b. Evacuation

The pre-emptive movement of people away from areas that will be affected by flooding.

c. Rescue

Rescue of people from floods.

d. Resupply

Minimise disruption upon the community by resupplying towns and villages which have become isolated as a consequence of flooding.

Ensure supplies are maintained to property owners by coordinating the resupply of properties which have become isolated as a consequence of flooding.

The provision of fodder to farm animals.

3.4.3 In Level 1 flood operations the SES Local Controller will select the appropriate response strategy to deal with the expected impact of the flood in each sector. The impact may vary from sector to sector so a number of different strategies may have to be selected and implemented across the whole operational area.

3.4.4 In Level 2 flood operations the SES Sydney Western Region Controller will select the appropriate response strategy to deal with the expected impact of the flood in each sector. The impact may vary from sector to sector so a number of different strategies may to be selected and implemented across the whole operational area. The available strategies for each sector are explained in detail in Part 6 of the Hawkesbury Nepean Flood Emergency Sub Plan.

3.4.5 Supporting strategies include:

a. Protect the community from incidents involving fire and hazardous materials.

b. Maintain the welfare of communities and individuals affected by the impact of a flood.

c. Minimise disruption to the community by ensuring supply of essential energy and utility services.

d. Ensure coordinated health services are available to and accessible by the flood affected communities.

e. Maintain the welfare of animals affected by the impact of a flood.

3.4.6 The execution of these supporting strategies is detailed in the Emergency Services and Functional Area sections below.

3.5 Operations Centres

3.5.1 The SES Operations Centre is located at:

SES Penrith City Local Headquarters
Gipps Street
Claremont Meadows

3.5.2 Supporting Emergency Operations Centres (EOC's) are located as follows:

a. Penrith City Local Emergency Operations Centre – Administration Office, Local Area Command, Penrith Police Station, 317 High Street Penrith.

b. Penrith District Rural Fire Service Control Centre – 99 Cox Avenue, Kingswood.

3.6 Operational Management

3.6.1 Flood operations in the Penrith LGA will be controlled on a Sector basis. The Sectors are listed below and a description and map is included at Map 2:

a. Wallacia Sector
b. Penrith South Sector
c. Penrith Sector
d. Penrith North Sector
e. Emu Plains Sector
f. Londonderry Sector
g. South Creek A Sector

3.6.2 In Level 1 flood operations evacuations from all Sectors will initially be controlled direct from the SES Penrith City Local Headquarters.

3.6.3 In Level 1 flood operations the SES Local Controller may activate the following Sector Control Centres to coordinate possible evacuations from low lying areas and to provide a local information service and point of contact to the population in the

relevant Sector:

a. Wallacia

b. Penrith South

3.6.4 As flood operations progress the following Divisions will be established:

Division	Sectors	Comments
Nepean River Division	Wallacia Sector Penrith South Sector Penrith Sector Penrith North Sector Emu Plains Sector	Flooding in these sectors is due to flooding on the Nepean River.
South Creek Division	Londonderry Sector South Creek A Sector	Flooding in these sectors is due to backup flooding from the Hawkesbury River along Rickabys Creek, South Creek and Ropes Creek
Nepean Flood Rescue Division		This Division controls local and out of area flood rescue resources. The area of operations covered by this Division will expand into the areas inundated in the other Divisions.

3.6.5 In Level 2 flood operations the SES Local Controller will activate one or more of the following Sector Control Centres to control evacuations:

Division	Sector	Localities	Sector Control Centre
Nepean River Division	Wallacia	Wallacia	RFS Shed Pub Retirement Village
	Penrith South	Mulgoa Regentville Glenmore Park	Regentville Community Hall Jeanette Street Regentville
	Penrith	Jamisontown Penrith	SES Penrith Local HQ
	Penrith North	North Penrith Penrith Lakes (Castlreagh) Cranebrook	Community Centre Hosking Street Cranebrook

Division	Sector	Localities	Sector Control Centre
South Creek Division	Londonderry	Upper Castlereagh Agnes Banks (south) Londonderry Berkshire Park Llandilo	Test Safe Australia Londonderry Road Londonderry (to be confirmed)
	South Creek A	Colyton Dunheved Erskine Park Oxley Park St Marys St Clair Werrington	SES Penrith Local HQ

3.7 Liaison

3.7.1 At the request of the SES Penrith Local Controller, each agency with responsibilities identified in this plan will provide liaison (including a liaison officer where necessary) to the SES Penrith Operations Centre.

3.7.2 The following agencies are to provide a liaison officer initially to the SES Penrith City Local Headquarters.

a. NSW Police Force.

b. Rural Fire Service.

c. Fire & Rescue NSW.

3.7.3 Other agencies with responsibilities identified in this plan are to maintain regular contact with the SES Hawkesbury Local Headquarters or provide liaison officers as required by the SES Local Controller.

3.7.4 Liaison officers are to:

a. Have the authority to deploy the resources of their parent organisations at the request of the SES Penrith Local Controller,

b. Advise the SES Penrith Local Controller on resource availability for their service, and

c. Be able to provide communications to their own organisations.

3.8 All Clear

3.8.1 When the immediate danger to life and property has passed the SES Sydney Western Region Controller or the SES Local Controller will issue an 'all clear' message signifying that response operations have been completed. The message will be distributed through the same media outlets as earlier evacuation messages. The

relevant Controller will also advise details of recovery coordination arrangements, arrangements made for clean up operations prior to evacuees being allowed to return to their homes, and stand-down instructions for agencies not required for recovery operations.

3.8.2 A template guide to the content of an all clear message is contained in Annex E – Template Evacuation Warning, Evacuation Order and All Clear.

Planning

3.9 Collating Situational Information

Strategy

3.9.1 The SES maintains and records situational awareness of current impacts and response activities.

Actions

3.9.2 The SES Penrith Local Headquarters collates information on the current situation in the Penrith LGA and incorporates in Situation Reports.

3.9.3 The SES Sydney Western Region Headquarters collates Region-wide information for inclusion in Region SES Situation Reports.

3.9.4 Sources of flood intelligence during flood operations include:

a. **Agency Situation Reports.** Agencies and functional areas provide regular situation reports (SITREPs) to the SES.

b. **Active Reconnaissance.** The SES Local Operations Controller is responsible for coordinating the reconnaissance of impact areas, recording and communicating observations. Reconnaissance can be performed on the ground and using remote sensing (more commonly aerial).

c. The **Bureau of Meteorology's Flood Warning** Centre provides river height and rainfall information, data can is available on the website http://www.bom.gov.au/hydro/flood/nsw/

d. The Department of Services, Technology and Administration's, **Manly Hydraulics Laboratory** automated river watch system funded by the Department of Environment, Climate Change and Water. This system provides river height and rainfall readings for a number of gauges as indicated in Annex C. Recent data from this system is available on the Manly Hydraulic Laboratory website: http://www.mhl.nsw.gov.au. A history of area floods is also available upon request via the website.

e. **NSW Office of Water.** This office advises flow rates and rates of rise for the Hawkesbury-Nepean. Daily river reports containing information on gauge heights and river flows are available from the website: http://waterinfo.nsw.gov.au/

f. **SES Sydney Western Region Headquarters.** The Region Headquarters provides information on flooding and its consequences, including those in nearby council areas (this information is documented in Bulletins and Situation Reports).

g. **Community Members.** SES gauge readers, RFS personnel and other members of the community provide information on flooding.

3.9.5 During flood operations sources of information on roads closed by flooding include:

a. Penrith City Council

b. Penrith Police

c. Penrith Rural Fire Service

d. VKG Penrith

e. SES Sydney Western Region Headquarters

3.9.6 Situational information relating to consequences of flooding and/or coastal erosion should be used to verify and validate SES Flood Intelligence records.

3.10 Providing Flood Information

Strategy

3.10.1 The SES Penrith Local Headquarters provides advice to the SES Sydney Western Region Headquarters on current and expected impacts of flooding in the Penrith LGA.

Action

3.10.2 The SES Penrith Local Controller will ensure that the SES Sydney Western Region Controller is regularly briefed on the progress of operations.

3.10.3 SES Penrith Local Headquarters operations staff will be briefed regularly so that they can provide information in response to inquiries received in person or by other means such as phone or fax.

3.10.4 **BOM Flood Warnings** The SES Sydney Western Region Headquarters will send a copy of BOM Flood Warnings to the SES Penrith Unit. On receipt the SES Local Controller will provide the SES Sydney Western Region Headquarters with information on the estimated impacts of flooding at the predicted heights for inclusion in SES Region Flood Bulletins.

3.10.5 **SES Region Flood Bulletins** The SES Sydney Western Region Headquarters will regularly issue SES Region Flood Bulletins (using information from BOM Flood Warnings and SES Local Flood Advices) to SES units, media outlets and agencies on behalf of all SES units in the Region.

3.10.6 **SES Low Pump Warnings** As required, the SES Local Controller will issue Low

Level Pump Warnings for the Hawkesbury River through the Lowland Farmers Warden System. They will also be provided to local radio stations for broadcast.

3.10.7 **SES Local Flood Advices** The SES Local Controller may issue Local Flood Advices for locations not covered by the BOM Flood Warnings. They may be provided verbally in response to phone inquiries but will normally be incorporated into SES Region Flood Bulletins. They will be distributed to:

a. SES Sydney Western Region Headquarters

b. Sector Command Centres (where established)

c. Local radio stations

d. Penrith City Council

e. Penrith Police Local Area Command

f. Penrith Rural Fire Service

g. Specified individuals and local agencies

3.10.8 The SES Penrith City Local Headquarters will operate a "phone-in" information service for the community in relation to:

a. river heights,

b. flood behaviour,

c. road conditions,

d. closures of local and main roads and advice,

e. advice on safety matters and means of protecting property.

3.10.9 In Level 1 flood operations the SES Local Controller may request the SES Sydney Western Region Controller to provide an overflow "phone-in" information service at SES Sydney Western Region HQ for the community in relation to:

a. river heights,

b. flood behaviour,

c. road conditions,

d. closures of local and main roads and advice,

e. advice on safety matters and means of protecting property.

3.10.10 In Level 2 flood operations the Joint Media Information Centre (established under the Hawkesbury Nepean Flood Emergency Sub Plan) will coordinate the provision of all information to the media relating to the flood event.

3.10.11 The Public Information and Inquiry Centre (operated by the Police Service) will answer calls from the public regarding registered evacuees.

3.10.12 The TMC Traffic Information Line will provide advice to callers on the status of roads.

3.10.13 Collation and dissemination of road information is actioned as follows:

a. The SES Local Controller provides road status reports for main roads in the council area to the SES Sydney Western Region Headquarters Road Information Cell and to the Penrith Police Force Local Area Command Headquarters.

b. The Road Information Cell obtains information from the NSW Police Force, Council and the RMS.

c. The SES Sydney Western Region Headquarters distributes information on main roads to SES units, media outlets and agencies as part of SES Flood Bulletins.

d. The Road Information Cell also provides a "phone-in" service to the public.

Operations

3.11 Communications Systems

3.11.1 The primary means of office-to-office communications is by telephone, email and facsimile.

3.11.2 The primary means of communication to and between deployed SES resources is by the Government Radio Network (GRN).

3.11.3 Backup communications will be provided in two ways:

a. The SES has installed a Private Mobile Radio (PMR) network, consisting of 5 repeaters, for the Hawkesbury Nepean to operate if the GRN fails.

b. To cater for the possible failure of the telephone or mobile telephone network (primarily within the flooded area) sufficient ground station independent satellite telephones are maintained by the SES to provide essential links between Sector Command Centres and the SES Hawkesbury Local Headquarters.

3.11.4 All liaison officers will provide their own communication links back to their parent agencies.

3.11.5 All other agencies will provide communications as necessary to their deployed field teams.

3.12 Road Control

3.12.1 A number of roads within the council area are affected by flooding. Details are provided in Annex B.

3.12.2 The council closes and re-opens its own roads.

3.12.3 The RMS closes and re-opens State roads.

3.12.4 The NSW Police Service has the authority to close and re-open roads but will normally only do so (if the council or the RMS has not already acted) if public safety requires such action or to secure, control and keep clear evacuation routes.

3.12.5 When resources permit, the SES assists Council or the Police by erecting road closure signs and barriers.

3.12.6 Police, RMS or Council officers closing or re-opening roads or bridges affected by flooding are to advise the SES Penrith Local Headquarters, which will then provide a road information service to local emergency services, the public and the Sydney Western SES Region Headquarters. All such information will also be passed to the Police, RMS and the Council.

3.13 Traffic Control

3.13.1 In the event of major flooding, the SES Penrith Local Controller may direct the imposition of traffic control measures. The entry into flood affected areas will be controlled in accordance with the provisions of the State Emergency Service Act, 1989 (Part 5, Sections 19, 20, 21 and 22) and the State Emergency Rescue Management Act, 1989 (Part 4, Sections 60KA, 60L and 61).

3.13.2 The following regional road evacuation routes are used for the indicated Sectors in the Hawkesbury LGA and pass through the Penrith LGA:

a. Llandilo Road Route (used for evacuation from Bligh Park and Windsor Downs Sectors).

b. Londonderry Road Route (used for evacuation from the Richmond Sector).

c. Castlereagh Road Route (used for evacuation from the Richmond Sector).

d. Northern Road Route (used for evacuation from the Windsor Sector).

3.13.3 The Londonderry Road, Llandilo Road and Castlereagh Road Routes merge on to the Northern Road Route, which continues along Parker Street to the Great Western Highway and M4 Motorway to evacuation centres in the Blacktown local government area.

3.13.4 During Level 2 flood operations the road evacuation route for the Emu Plains Sector will be managed under arrangements detailed in the Hawkesbury-Nepean Flood Emergency Sub Plan.

3.14 Aircraft Management

3.14.1 Aircraft can be used for a variety of purposes during flood operations including evacuation, rescue, resupply, reconnaissance and emergency travel.

3.14.2 Air support operations will be conducted under the control of the SES Region Headquarters, which may allocate aircraft to units if applicable. The SES Local Controller may task aircraft allocated by the Region Headquarters for flood operations within the Council area.

3.14.3 **Airport.** There are no aerodromes in the Penrith Local Government Area.

3.15 Assistance for Animals

3.15.1 Matters relating to the welfare of livestock, companion animals and wildlife are to be referred to Agriculture and Animal Services.

3.15.2 Requests for emergency supply and/or delivery of fodder to stranded livestock, or for livestock rescue, are to be referred to Agriculture and Animal Services.

3.15.3 Requests for animal rescue should be referred to the SES.

3.16 Stranded Travellers

3.16.1 Flood waters can strand travellers. Travellers seeking assistance will be referred to the Welfare Services Functional Area liaison officer for the arrangement of temporary accommodation.

3.17 Affected Communities

3.17.1 Annex F deals with the arrangements relating to the evacuation of residents and the removal of caravans.

Wallacia Sector

3.17.2 The relevant flood gauge for the Sector is the Wallacia flood gauge.

3.17.3 Lower levels of flooding may require evacuations within the Wallacia area. For higher level flooding the residents of the Wallacia/Mulgoa Road area may have to be completely evacuated during Level 2 evacuations.

3.17.4 This area can become a high flood island in Level 2 flood operations.

Penrith South Sector

3.17.5 The relevant flood gauge for the Sector is Victoria Bridge flood gauge.

3.17.6 The flood area type for this Sector is Area accessible by road.

3.17.7 Depending on expected inundation levels, a large number of persons may have to be progressively evacuated from the Regentville, Mulgoa and Glenmore Park areas during Level 2 flood evacuations.

Penrith Sector

3.17.8 The relevant flood gauge for the Sector is Victoria Bridge flood gauge.

3.17.9 The flood area type for this Sector is Area accessible by road.

3.17.10 Depending on expected inundation levels, up to a maximum of 14,500 persons may have to be progressively evacuated from the Penrith, Jamisontown, Peach Tree Creek areas during Level 2 flood evacuations.

Penrith North Sector

3.17.11 The flood area type for this Sector is Area accessible by road.

3.17.12 The relevant flood gauge for the Sector is the Victoria Bridge flood gauge.

3.17.13 Depending on expected inundation levels, up to a maximum of (TBA) persons may have to be progressively evacuated from the North Penrith, Penrith Lakes, Penrith Lakeside and Cranebrook areas during Level 2 flood evacuations.

Emu Plains Sector

3.17.14 The relevant flood gauge for the Sector is Victoria Bridge flood gauge.

3.17.15 A low flood island develops in this Sector in floods greater than 1 in 100 AEP. Most of the Area accessible by road. There is a small landlocked area that develops in Emu Heights in the larger floods.

3.17.16 Level 2 flood evacuations will be conducted under arrangements detailed in the separate Emu Plains Sector Annex to the Blue Mountains Local Flood Plan.

Londonderry Sector

3.17.17 Flooding in the Londonderry Sector is mainly due to backup flooding along Rickabys Creek and South Creek.

3.17.18 The relevant flood gauge is the Windsor Bridge flood gauge.

3.17.19 The flood area type for this Sector is Area accessible overland.

3.17.20 As the flood nears PMF levels then floodwaters from the Agnes Banks and Richmond Sectors merge into the floodwaters from Rickabys Creek in the suburb of Londonderry.

3.17.21 The population of Londonderry may have to be completely evacuated during Level 2 flood operations.

South Creek A Sector

3.17.22 Flooding in the South Creek A Sector is mainly due to flooding on South Creek or from backup flooding from the Hawkesbury River along Rickabys Creek and South Creek.

3.17.23 The flood area type for this Sector is Area accessible by road.

3.17.24 The relevant flood gauge is the Windsor Bridge flood gauge.

3.17.25 Because of local flooding initially and back up flooding in South Creek and Ropes Creek for higher level floods, up to 7,000 persons may have to be progressively evacuated from the St Marys and Werrington areas to evacuation centres during Level 2 flood evacuations.

3.18 Managing Property Protection Operations

Strategy

3.18.1 Protect the property of residents and businesses at risk of flood damage.

Actions

3.18.2 The SES is the responsible agency for the coordination of operations to protect property.

3.18.3 Property may be protected by:

a. Lifting or moving of household furniture.

b. Lifting or moving commercial stock and equipment.

c. Sandbagging to minimise entry of water into buildings.

3.18.4 The SES Penrith Local Headquarters maintains a small stock of sandbags, and back-up supplies are available through the SES Sydney Western Region Headquarters. A motorised sandbag-filling machine is available through the SES Sydney Western Region Headquarters. The Penrith City Council also has stocks of sand and bags and can provide supplies of filled bags on request. Alternatively, local concrete trucks may be used.

3.18.5 Property protection options are however, very limited in the Penrith Local Government Area due to the large number of properties that can be affected and the depth of floodwaters arising from severe flooding on the Nepean River and backup flooding on South Creek from the Hawkesbury River.

3.19 Managing Flood Rescue Operations

Strategy

3.19.1 Rescue of people from floods.

Actions

3.19.2 The SES Local Controller controls flood rescues in the Local Government Area.

3.19.3 The SES may request other agencies to undertake flood rescues on behalf of the SES. Assisting agencies must supply information regarding rescues performed to the SES.

3.19.4 Flood rescues may be carried out using high-clearance vehicles, flood rescue boats and (under some circumstances) helicopters.

3.19.5 Additional flood rescue boats and crews can be requested through the SES Sydney Western Region Headquarters. These resources must be utilised in conjunction with appropriate local resources.

3.20 Managing Evacuation Operations

Strategy

3.20.1 Evacuations will take place when there is a risk to public safety. Circumstances may include:

a. Evacuation of people when their homes or businesses are likely to flood.

b. Evacuation of people who are unsuited to living in isolated circumstances, due to flood water closing access.

c. Evacuation of people where essential energy and utility services have failed or where buildings have been made uninhabitable.

Actions

3.20.2 The evacuation operation will have the following stages:

a. Decision to Evacuate

b. Mobilisation

c. Evacuation Warning/Order Delivery

d. Withdrawal

e. Shelter

f. Return

3.20.3 Evacuations will be controlled using the Sectors described in paragraph 3.6.1.

3.20.4 The SES will advise the community of the requirements to evacuate. The SES will issue an Evacuation Warning when the intent of an SES Operations Controller is to warn the community of the need to prepare for a possible evacuation. The SES will issue an Evacuation Order when the intent of the SES Operations Controller is to instruct a community to immediately evacuate in response to an imminent threat.

3.20.5 Evacuations will be conducted in two levels:

a. **Level 1:** Evacuations of areas inundated or at threat of isolation by floods less than about the 15.0 metre level at the Windsor Bridge. The SES Local Controller controls these evacuations.

b. **Level 2:** Evacuations of areas threatened by floods of higher levels. It is expected that if such evacuations are required, the Hawkesbury Nepean Flood Emergency Sub Plan will be activated and evacuations throughout the valley will be co-ordinated centrally from the SES Sydney Western Region Headquarters.

3.20.6 The most effective means of evacuation is via road using private cars and buses. However, the other means of evacuation may also be used as backups.

3.20.7 If there is sufficient time between the activation of this plan and the evacuation of communities, the SES Sydney Western Region Controller will discuss the temporary closure of appropriate schools with the Regional Director, Western Sydney Region, Department of School Education and Training (Kingswood). This will enable pupils to stay at home or be returned home so they can be evacuated (if required) with their families.

3.20.8 The Department of School Education and Training will coordinate the evacuation of schools (High School, Primary School, Child Care facilities) if not already closed.

3.20.9 The Health Services Functions Area will coordinate the evacuation of hospitals, health centres, and aged care facilities (including nursing homes).

3.20.10 The Dept of Corrective Services and NSW Police Service will coordinate the evacuation of correctional facilities.

3.20.11 The SES Local Controller is to provide the following reports to the SES Sydney Western Region Headquarters:

a. Advice of commencement of the evacuation of each Sector;
b. Half-hourly progress reports (by Sectors) during evacuations;
c. Advice of completion of the evacuation of each Sector.

General Evacuation Arrangements

3.20.12 The evacuation operation will have the following stages:

a. Mobilisation

b. Evacuation Order Delivery

c. Withdrawal

d. Shelter

e. Return

Mobilisation

3.20.13 The SES Local Controller will mobilise the following to provide personnel for doorknock teams for designated Sectors:

a. SES Penrith Unit members,

b. RFS Cumberland District members via the RFS Fire Control Officer,

c. Local Police Force officers.

3.20.14 The SES Sydney Western Region Controller will mobilise any additional personnel required to assist with doorknock teams using:

a. SES members from the SES Sydney Western Region and surrounding SES Regions.

b. NSWFB personnel arranged via the NSWFB Liaison Officer located at SES Sydney Western Region Headquarters.

c. RFS personnel arranged via the RFS Liaison Officer located at SES Sydney Western Region Headquarters.

3.20.15 The SES Local Controller will request the Penrith City LEMO to provide Council personnel to assist with traffic coordination within Sectors.

3.20.16 The SES Local Controller will arrange liaison officers for Sector Command Centres.

3.20.17 The SES Sydney Western Region Controller will mobilise the required number of buses for Sectors via the Transport Services Functional Area Coordination Centre. Sector Commanders may request the SES Local Controller to provide additional buses.

Evacuation Order

3.20.18 A template guide to the content of evacuation warning messages is provided at Annex E.

3.20.19 In Level 1 flood operations the SES Local Controller will prepare Evacuation Warnings and Evacuation Orders and distribute them via local flood warning systems and to the SES Sydney Western Region Controller.

3.20.20 In level 2 flood operations Evacuation Orders will be issued under the direction of the SES Sydney Western Region Controller. These will be distributed to:

a. The SES State Operations Centre.

b. The SES Penrith Local Controller.

c. Metropolitan media outlets via the Joint Media Information Centre.

d. Affected communities via dial-out warning systems where installed or applicable.

3.20.21 In Level 2 flood operations the SES Local Controller will distribute Evacuation Warnings to:

a. Sector Command Centres (where established).

b. Penrith Local Emergency Operations Centre.

c. Penrith City Council.

d. Penrith Police Local Area Command.

e. Penrith Rural Fire Service Control Centre.

f. Local SES Wardens.

g. Other local agencies and specified individuals.

3.20.22 The Standard Emergency Warning Signal (SEWS) may be used to precede all Evacuation Warnings broadcast on Hawkesbury Radio.

3.20.23 The SES Sydney Western Region Controller will distribute Evacuation Warnings and Orders to metropolitan media outlets.

3.20.24 Sector Command Centres, where established, will distribute Evacuation Orders via Emergency Service personnel in doorknock teams to areas under threat of inundation.

3.20.25 Doorknock teams will work at the direction of:

a. The Sector Commander if a Sector Command Centre is established.

b. The relevant Division Commander where a Sector Command Centre has not been established.

3.20.26 Field teams conducting doorknocks will record and report back the following information to their Sector Commander:

a. Addresses and locations of houses doorknocked and/or evacuated.

b. The number of occupants.

c. Details of support required (such as transport, medical evacuation, assistance to

secure house and/or property and raise or move belongings).

d. Details of residents who refuse to comply with the Evacuation Order.

3.20.27 **Refusal to evacuate**. Field teams cannot afford to waste time dealing with people who are reluctant or refuse to comply with any Evacuation Order. These cases are to be referred to the NSW Police Liaison Officer who will arrange for Police to ensure their evacuation.

Withdrawal

3.20.28 In each Sector, evacuations will generally be done in stages starting from the lowest areas and progressively from higher areas.

3.20.29 Sector Commanders will direct evacuees who require accommodation or welfare assistance to designated evacuation centres. Evacuees who have their own accommodation arrangements will not be directed to Evacuation Centres. It is not possible to determine in advance how many will fall into this category.

3.20.30 The SES Local Controller, through Sector Commanders, will manage the evacuation of people within each Sector up to the point where people enter the Sector's designated regional road evacuation route.

3.20.31 Evacuees will:

a. Move under local traffic arrangements from the relevant Sectors to the route Entry Point as detailed in the evacuation Annexes;

b. Move under traffic management arrangements to the route Exit Points;

c. Continue along the suburban road network to allocated Evacuation Centres.

3.20.32 In the flood island Sectors evacuees will be directed onto regional evacuation routes established under arrangement in the Hawkesbury Nepean Flood Emergency Sub Plan.

3.20.33 **Management of Pets and Companion Animals of Evacuees**: Assistance for animals (guide dogs, hearing assistance animals, etc) will remain in the care of their owners throughout the evacuation. This includes transport and access into evacuation centres etc. Due to safety restrictions, it may not be possible to allow companion animals to accompany their owners when being transported via aircraft or flood rescue boats. DPI will make separate arrangements for the evacuation and care of companion animals.

3.20.34 **Transport and storage**: Transport and storage of furniture from flood threatened properties will be arranged as time and resources permit.

3.20.35 **Security**: The NSW Police Force will provide security for evacuated areas.

Shelter

3.20.36 **Evacuation centres/areas**. The usual purpose of evacuation centres is to meet the immediate needs of victims, not to provide them with accommodation. Evacuees will be advised to go to or be taken to the nearest accessible evacuation centre, which may initially be established at the direction of the SES Hawkesbury Local Controller, but managed as soon as possible by DoCS.

3.20.37 **Registration**: The NSW Police Force will ensure that all evacuees are registered on arrival at the designated evacuation centres.

3.20.38 **Animal shelter compounds**: Animal shelter compounds will be set up for the domestic pets and companion animals of evacuees if required. Facilities will be managed by DPI.

Return

3.20.39 Once it is considered safe to do so, the SES Local Controller will authorise the return of evacuees to their normal or alternative place of residence. This decision will be made in consultation with the following:

a. Health Service Functional Area Coordinator (public health),
b. Engineering Services Functional Area Co-coordinator (electrical safety of buildings),
c. Transport Services Functional Areas Coordinator (status of roads).

3.20.40 The return will be controlled by the SES Local Controller and may be conducted, at their request, by DoCS.

3.20.41 In Level 2 flood operations the return will be coordinated by the SES Sydney Western Region Controller.

3.21 Managing Resupply Operations

Resupply of Isolated Towns and Villages

Strategy

3.21.1 Minimise disruption upon the community by resupplying towns and villages which have become isolated as a consequence of flooding.

Actions

3.21.2 The SES is responsible for the coordination of the resupply of isolated communities.

3.21.3 If flood predictions indicate that areas are likely to become isolated, the SES Local Operations Controller should advise retailers that they should stock up.

3.21.4 When isolation occurs, retailers will be expected to place orders with suppliers where they have a line of credit and to instruct those suppliers to package their goods and deliver them to loading points designated by the SES.

3.21.5 The SES is prepared to deliver mail to isolated communities but may not be able to do so according to normal Australia Post timetables.

3.21.6 The SES will assist hospitals with resupply of linen and other consumables where able.

Resupply of Isolated Properties

Strategy

3.21.7 Ensure supplies are maintained to property owners by coordinating the resupply of properties which have become isolated as a consequence of flooding.

Actions

3.21.8 The resupply of isolated properties is a common requirement during floods and coordination can be difficult because requests can emanate from a variety of sources. Isolated properties may call their suppliers direct, place their orders through their own social networks or contact the SES.

3.21.9 The principles to be applied when planning for the resupply of isolated properties are:

a. The SES will coordinate resupply and establish a schedule.

b. Some isolated households will not have the ability to purchase essential grocery items due to financial hardship. If an isolated household seeks resupply from the SES and claims to be, or is considered to be, in dire circumstances, he/she is to be referred to Welfare Services for assessment of eligibility. Where financial eligibility criteria are met, Welfare Services will assist with the purchase of essential grocery items. Welfare Services will deliver the essential grocery items to the SES designated loading point for transport.

c. Local suppliers will liaise with the SES regarding delivery of resupply items to the designated loading point.

d. Local suppliers are responsible for packaging resupply items for delivery.

3.21.10 A flowchart illustrating the Resupply process is shown in Annex G. Please note that the flowchart outlines the resupply process but does not encompass all potential situations and/or outcomes.

Logistics

Strategy

3.21.11 Maintain resources to ensure operational effectiveness.

Actions

3.21.12 If local SES and other local resources are insufficient or likely to be exhausted, additional SES resources (people and equipment) within the relevant SES Region may be deployed by the SES Region Headquarters. If further SES resources are required from other Regions, they will be deployed by the SES State Headquarters.

3.21.13 The SES may request support directly from a supporting agency whilst keeping the appropriate Emergency Operations Controller informed or request the relevant Emergency Operations Controller to coordinate support to it.

3.21.14 As far as possible, supporting agencies are to provide their own logistic support in consultation with SES where appropriate.

Emergency Services

Strategy

3.21.15 Protect the community from incidents involving fire and hazardous materials.

Actions

3.21.16 Fire & Rescue NSW respond to fire and land based HAZMAT incidents in the flood affected areas as detailed in the NSW HAZMAT Plan.

3.21.17 The Rural Fire Service will respond to fire in rural fire districts within flood affected areas.

3.21.18 NSW Ambulance will provide:

a. Pre-hospital care

b. Ambulance service management of multiple evacuation sites where ambulance assistance in facilities / patient evacuations is necessary

c. Aero-medical evacuation.

3.21.19 In Sectors that will be completely evacuated the emergency services will need to coordinate their operations with the SES Sydney Western Region Headquarters, via their Liaison Officers, so that their personnel and assets can be safely evacuated from the area before evacuation routes are cut.

3.21.20 The SES Local Controller will ensure that the providers of essential services (electricity, water, sewerage, medical and public health) are kept advised of the flood situation. Essential service providers must keep the SES Local Controller abreast of their status and ongoing ability to provide their services.

3.21.21 The Functional Areas identified in NSW DISPLAN will provide support to the SES in the conduct of flood operations. The Functional Areas will liaise with the SES Local Controller as per the Local DISPLAN. However, in Level 2 flood operations the provisions of the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.22 Agriculture and Animal Services

Strategy

3.22.1 Maintain the welfare of animals affected by the impact of a flood.

Actions

3.22.2 Matters relating to the welfare of livestock, pets, companion animals and wildlife (including feeding and rescue) are to be referred to the Agriculture and Animal Services Functional Area.

3.22.3 Requests for emergency supply and/or delivery of fodder to stranded livestock, or for livestock rescue, are to be passed to the Agriculture and Animal Services Functional Area.

3.22.4 During Level 2 flood operations the provisions to Agriculture and Animal services in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.23 Communications Services

3.23.1 The Communications Services Functional Area will coordinate the restoration of telecommunications.

3.23.2 During Level 2 flood operations the provisions to Communications Services in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.24 Energy and Utilities

Strategy

3.24.1 Minimise disruption to the community by ensuring supply of essential energy and utility services.

Actions

3.24.2 The Energy and Utilities Functional Area will minimise disruption to the community

by ensuring supply of essential energy and utility services.

3.24.3 During Level 2 flood operations the provisions to Energy and Utilities in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.25 Engineering Services

3.25.1 The Engineering Services Functional Area will coordinate the restoration of critical public buildings for example hospitals.

3.25.2 During Level 2 flood operations the provisions to Engineering Services in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.26 Health Services

Strategy

3.26.1 Ensure coordinated health services are available to and accessible by the flood affected communities.

Actions

3.26.2 The Health Services Functional Areas will:

a. Treat sick and injured people, including the provision of pre-hospital care and transport by Ambulance Service of NSW.

b. Provide and coordinate immediate mental health support to persons both directly and indirectly affected.

c. Assess public health risks and provide advice to emergency services and communities.

d. Provide environmental health advice.

3.26.3 All matters relating to the primary production, manufacturing, processing and handling of all food from "paddock/ocean" to retail, inclusive of all restaurants, food services and catering businesses should be referred to the NSW Food Authority through the Agriculture and Animal Services Functional Area.

3.26.4 During Level 2 flood operations the provisions relating to Health Services in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.27 Transport Services

3.27.1 During Level 2 flood operations the provisions relating to Transport Services in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

3.28 Welfare Services

Strategy

3.28.1 Maintain the welfare of communities and individuals affected by the impact of a flood.

Actions

3.28.2 The Welfare Services Functional Area will manage evacuation centres for affected residents and travellers.

3.28.3 The Welfare Services Functional Area is to activate the Welfare Services Functional Area Supporting Plan if required to coordinate disaster welfare services to communities affected.

3.28.4 SES will provide immediate welfare for evacuees where required but will hand the responsibility over to the Welfare Services Functional Area as soon as possible. In these cases the SES will brief the Welfare Services Functional Area at the earliest opportunity regarding the assistance provided.

3.28.5 Details of all residents assisted must be available to the Welfare Services Functional Area as early as possible so that they can conduct follow-up visits.

3.28.6 During Level 2 flood operations the provisions relating to Welfare Services in the Hawkesbury Nepean Flood Emergency Sub Plan will apply.

Part 4 - Recovery

4.1 Recovery Coordination at the Local Level

4.1.1 In Level 1 flood operations the SES Local Controller will ensure that planning for long-term recovery operations begins at the earliest opportunity, initially through briefing the Local Emergency Management Committee (LEMC). As soon as possible the LEMC will meet to discuss recovery implications including the need for a Local Recovery Committee. The LEMC will consider any impact assessment in determining the need for recovery arrangements. This is conveyed in the first instance to the State Emergency Operations Controller (SEOCON) for confirmation with the State Emergency Recovery Controller (SERCON).

4.1.2 Once the need for recovery has been identified, the SERCON, in consultation with the SEOCON, may recommend the appointment of a Local Recovery Coordinator and nominate an appropriate candidate to the Minister for Emergency Services.

4.1.3 The SERCON may send a representative to the LEMC and subsequent recovery meetings to provide expert recovery advice and guidance.

4.1.4 The SES Local Controller and Local Emergency Operations Controller (LEOCON) attend recovery meetings to provide an overview of the emergency response operation.

4.1.5 The SES Region Operations Controller, the District Emergency Management Officer (DEMO) and appropriate District Functional Area Coordinators will be invited to the initial local meeting and to subsequent meetings as required.

4.1.6 The recovery committee will:

a. Develop and maintain a Recovery Action Plan with an agreed exit strategy

b. Monitor and coordinate the activities of agencies with responsibility for the delivery of services during recovery.

c. Ensure that relevant stakeholders, especially the communities affected, are involved in the development and implementation of recovery objectives and strategies and are informed of progress made.

d. Provide the SERCON with an end of recovery report.

e. Ensure the recovery is in line with the National Principles of Disaster Recovery and the NSW tenets.

4.2 Recovery Coordination at the District and State Level

4.2.1 In the event that an emergency affects several local areas, a District Emergency Management Committee (DEMC) will meet to discuss recovery implications including the need for a District Recovery Committee. This is conveyed in the first instance to the SEOCON for confirmation with the SERCON.

4.2.2 In the event of an emergency which affects multiple districts, or is of state or national consequence, or where complex, long term recovery and reconstruction is required, it may be necessary to establish a State Recovery Committee and the appointment of a State Recovery Coordinator.

4.2.3 For Level 2 flood operations recovery operations will be coordinated as per the recovery arrangements in Part 8 of the Hawkesbury Nepean Flood Emergency Sub Plan.

4.3 Arrangements for Debriefs / After Action Reviews

4.3.1 As soon as possible after flooding has abated, the SES Local Controller will advise participating organizations of details of response operation after action review arrangements.

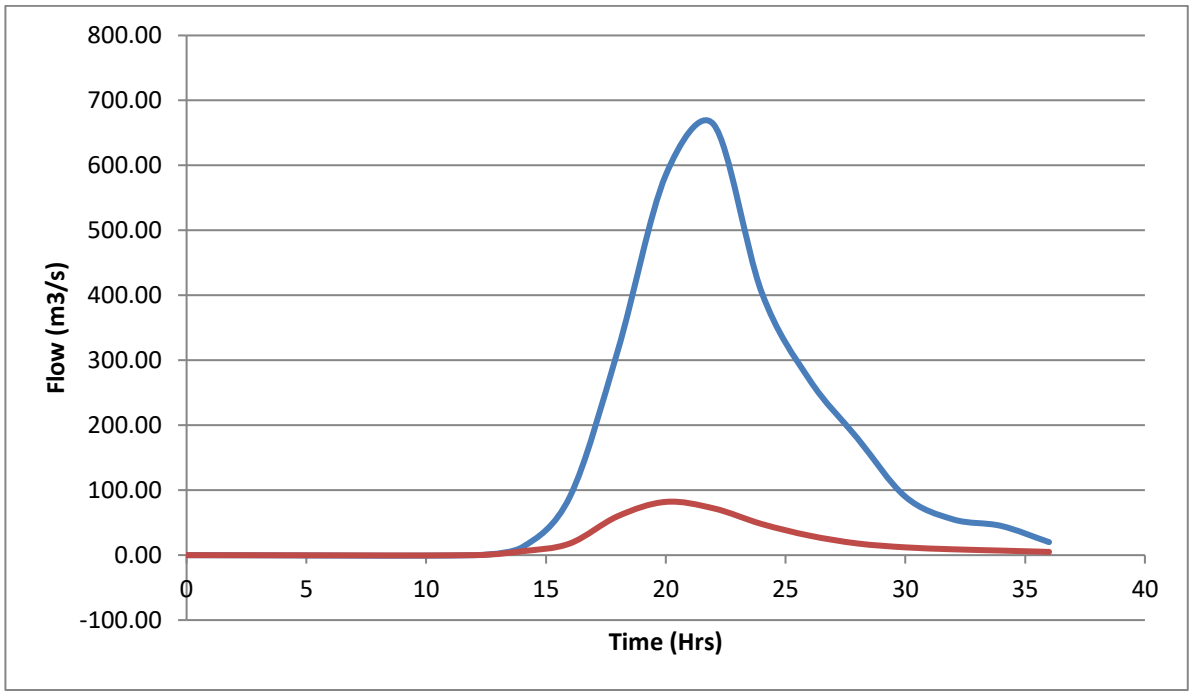
4.3.2 The SES Local Controller will ensure that adequate arrangements are in place to record details of the after action review and each item requiring further action is delegated to an organisation or individual to implement.

4.3.3 The SES Local Controller will pass the results of the debrief to the SES Sydney Western Region Controller.

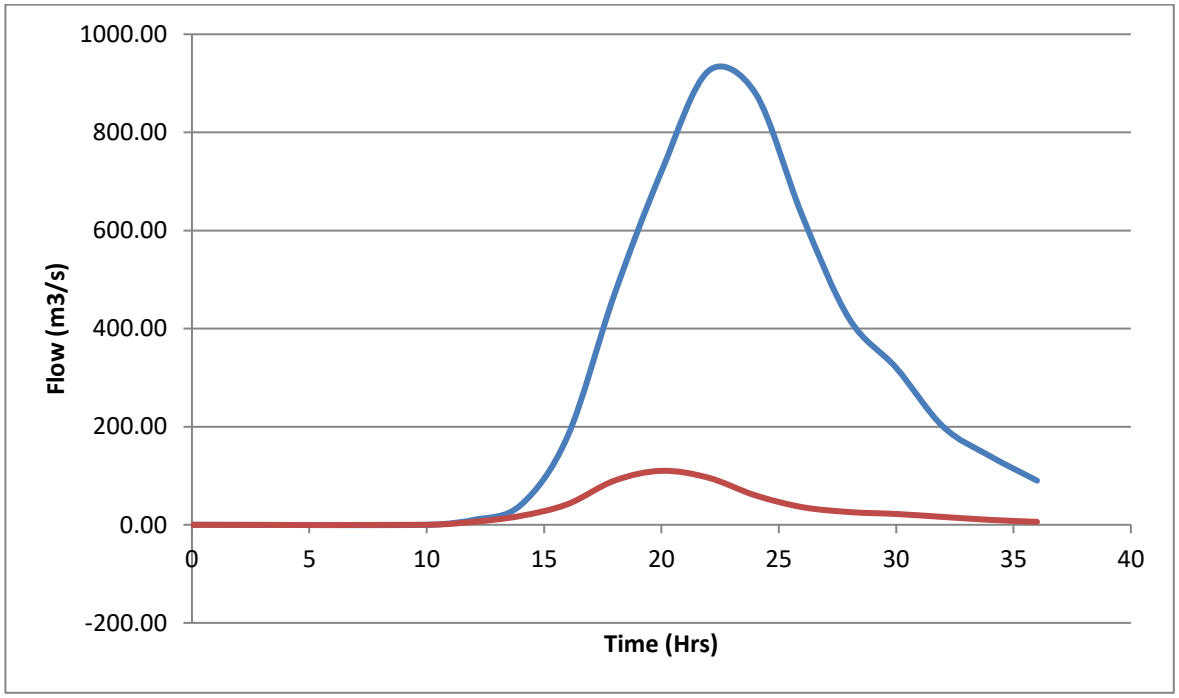
4.3.4 Follow-up to ensure the satisfactory completion of these actions will be undertaken by the Penrith Local Emergency Management Committee.

APPENDIX E

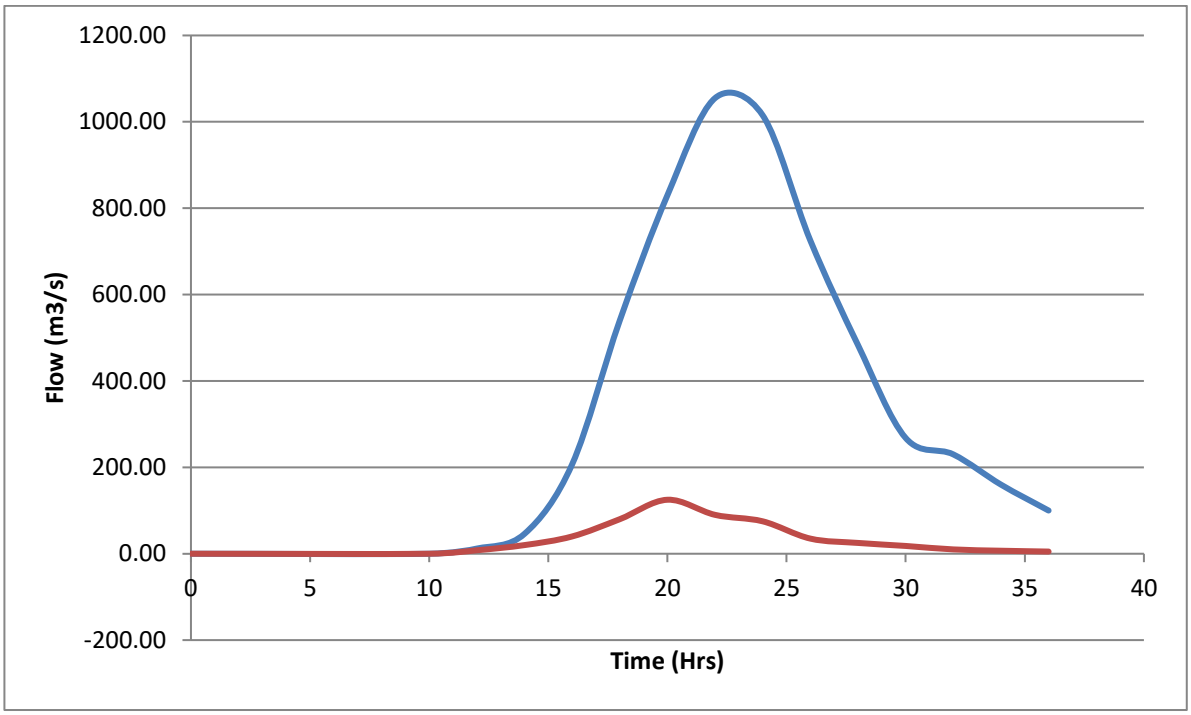
INFLOW HYDROGRAPHS



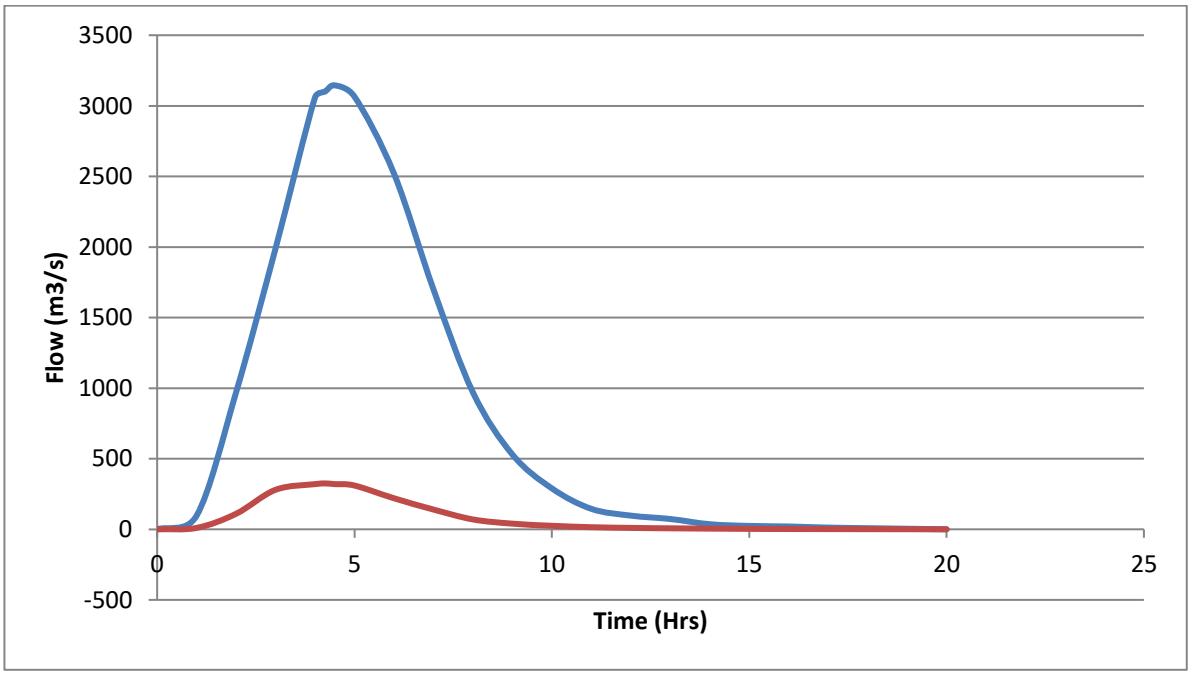
South Creek and Cosgrove Creek 5% AEP Hydrographs



South Creek and Cosgrove Creek 1% AEP Hydrographs



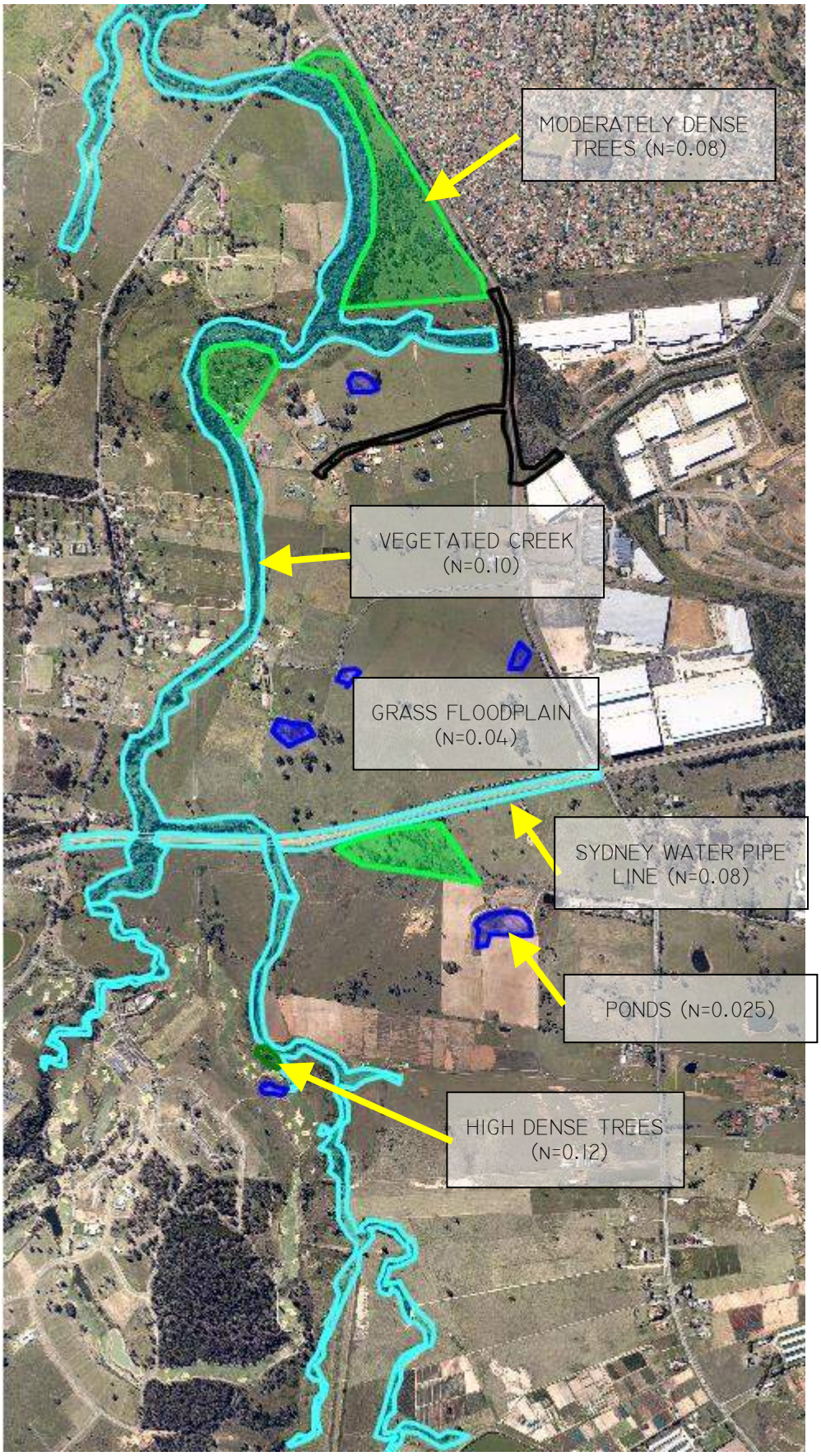
South Creek and Cosgrove Creek 0.5% AEP Hydrographs



South Creek and Cosgrove Creek PMF Hydrographs

APPENDIX F

MANNINGS ROUGHNESS SURFACE AREAS


MODERATELY DENSE TREES (N=0.08)
VEGETATED CREEK (N=0.10)
GRASS FLOODPLAIN (N=0.04)
SYDNEY WATER PIPE LINE (N=0.08)
PONDS (N=0.025)
HIGH DENSE TREES (N=0.12)