Appendix D

DRAFT

STORMWATER SYSTEM MAINTENANCE SCHEDULE

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
SWALES/ LANDSCAPED AREAS			
Check density of vegetation and ensure minimum height of 150mm is maintained. Check for any evidence of weed infestation	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Inspect swale for excessive litter and sediment build up	Six monthly	Maintenance Contractor	Remove sediment and litter and dispose in accordance with local authorities' requirements.
Check for any evidence of channelisation and erosion	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed swale profile is maintained
Weed Infestation	Three Monthly	Maintenance Contractor	Remove any weed infestation ensuring all root ball of weed is removed. Replace with vegetation where required.
Inspect swale surface for erosion	Six Monthly	Maintenance Contractor	Replace top soil in eroded area and cover and secure with biodegradable fabric. Cut hole in fabric and revegetate.
INLET & JUNCTION PITS			
Inside of pits	Six Monthly	Maintenance Contractor	Remove grate and inspect internal walls and base, repair where required. Remove any collected sediment, debris, litter.
Outside of pits	Four Monthly/ After Major Storm	Maintenance Contractor	Clean grate of collected sediment, debris, litter and vegetation.
PROPRIETARY TREATMENT DEVICES (OceanSave GPT)			
Refer to Manufacturers Operation and Maintenance Manuel	Annually	Maintenance Contractor	Refer to Manufacturers Operation and Maintenance Manuel

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
BIORETENTION BASIN			
Check all items nominated for SWALES/ LANDSCAPED AREAS above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above	Refer to SWALES/ LANDSCAPED AREAS section above
Check for sediment accumulation at inflow points	Six monthly/ After Major Storm	Maintenance Contractor	Remove sediment and dispose in accordance with local authorities' requirements.
Check for erosion at inlet or other key structures.	Six monthly/ After Major Storm	Maintenance Contractor	Reinstate eroded areas so that original, designed profile is maintained
Check for evidence of dumping (litter, building waste or other).	Six monthly	Maintenance Contractor	Remove waste and litter and dispose in accordance with local authorities' requirements.
Check condition of vegetation is satisfactory (density, weeds, watering, replating, mowing/ slashing etc)	Six monthly	Maintenance Contractor	Replant and/or fertilise, weed and water in accordance with landscape consultant specifications
Check for evidence of prolonged ponding, surface clogging or clogging of drainage structures	Six monthly/ After Major Storm 5-10 years	Maintenance Contractor	Remove sediment and dispose in accordance with local authorities' requirements. Replace filter media & planting – refer to appropriately qualified engineer or stormwater specialist
Check stormwater pipes and pits	Six monthly/ After Major Storm	Maintenance Contractor	Refer to INLET/ JUNCTION PIT section.
FUTURE RAINWATER TANK			
Check for any clogging and blockage of the first flush device	Monthly	Maintenance Contractor	First flush device to be cleaned out

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Check for any clogging and blockage of the tank inlet - leaf/litter screen	Six monthly	Maintenance Contractor	Leaves and debris to be removed from the inlet leaf/litter screen
Check the level of sediment within the tank	Every two years	Maintenance Contractor	Sediment and debris to be removed from rainwater tank floor if sediment level is greater than the maximum allowable depth as specified by the hydraulic consultant
STORMWATER SYSTEM			
General Inspection of complete stormwater drainage system	Bi-annually	Maintenance Contractor	Inspect all drainage structures noting any dilapidation in structures and carry out required repairs.
OSD SYSTEM			
Inspect and remove any blockage from orifice	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen to inspect orifice.
Inspect trash screen and clean	Six Monthly	Maintenance Contractor/ Owner	Remove grate and screen if required to clean it.
Inspect flap valve and remove any blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate. Ensure flap valve moves freely and remove any blockages or debris.
Inspect pit sump for damage or blockage.	Six Monthly	Maintenance Contractor/ Owner	Remove grate & screen. Remove sediment/ sludge build up and check orifice and flap valve are clear.
Inspect storage areas and remove debris/ mulch/ litter etc likely to block screens/ grates.	Six Monthly	Maintenance Contractor/ Owner	Remove debris and floatable materials.
Check attachment of orifice plate and screen to wall of pit	Annually	Maintenance Contractor	Remove grate and screen. Ensure plate or screen mounted securely, tighten fixings if required. Seal gaps if required.

MAINTENANCE ACTION	FREQUENCY	RESPONSIBILITY	PROCEDURE
Check orifice diameter is correct and retains sharp edge.	Five yearly	Maintenance Contractor	Compare diameter to design (see Work-as-Executed) and ensure edge is not pitted or damaged.
Check screen for corrosion	Annually	Maintenance Contractor	Remove grate and screen and examine for rust or corrosion, especially at corners or welds.
Inspect overflow weir and remove any blockage	Six monthly	Maintenance Contractor/ Owner	Ensure weir is free of blockage.
Inspect walls for cracks or spalling	Annually	Maintenance Contractor	Remove grate to inspect internal walls, repair as necessary.
Check step irons	Annually	Maintenance Contractor	Ensure fixings are secure and irons are free from corrosion.

Appendix E

FLOOD ASSESSMENT

E.1 INTRODUCTION

E.1.1 Introduction

This Appendix to Section 8 is provided to confirm technical parameters adopted in the *Overland Flow Assessment* for the proposed industrial estate development. The *Study Area* has been identified by Penrith City Council, as being affected by overland flow from an external catchment on the north-east of the property.

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%, 0.2% AEP & PMF); Hydrology would be based on RAFTS modelling.
- Assess the pre-development overland flow path through the development site for the listed range of storms including 1% AEP storm event;
- Assess the post-development levels on the effect of overland flow through the development site for the listed range of storms including 1% AEP storm event so that potential impacts on the development can be assessed and mitigated;
- Confirm that there is adverse impact to upstream, downstream and adjacent properties as a result of the development; and
- Confirm flood planning levels applicable to the development.

Appendix E provides technical detail to the summary and conclusions discussed in the **Section 8** of this report.

E.1.2 Survey/ DTM

Survey is required to define the physical attributes of the floodplain topography including the channel cross sections and the associated floodplain levels.

The pre-development scenario survey has been compiled based on a detail site survey for areas within the site, and for areas external to the site where detail survey is not available, digital terrain information has been obtained through government sources in the form of ALS survey. The on-ground survey information was completed in and around the study area to properly define the existing overland flow path cross section and features.

For assessment of the post-development scenario, the proposed development levels and drainage system (where appropriate) were then added to the pre-developed survey surface to create a post developed surface to use in the TUFLOW model and scenario modelling. This DTM was imported to the TUFLOW model to simulate land filling and proposed compensation areas in and around the flood affected land.

The surveys and design surfaces were used as the basis for the digital terrain model (DTM) used in the hydraulic modelling of the pre and post development scenario respectively.

E.1.3 Previous Studies

Penrith Council has undertaken a flood study of the nearby South Creek - *Updated South Creek Flood Study, Worley Parsons, 30 January 2015*. The site is noted to be east of South Creek however clear of the South Creek Floodplain, hence does not form part of Councils South Creek Flood Study. The site is noted to be a contributing catchment of South Creek.

Penrith Council has also undertaken a regional assessment of local tributaries Penrith Overland Flow Flow "*Overview Study – Flood Analysis for Central Urban (Zone 1), Northern Rural (Zone 2), Southern Rural (Zone 3)*" – Cardno 2006. The site is located within the Southern Rural (Zone 3) and an excerpt of the flood model output is shown in **Figure E1.1**. The area shown on the southern portion of the site as being flood affected in the PMF event is noted to comprise a farm dam only which is fully within the proposed development extent and as such has not been included in the current overland flow assessment.

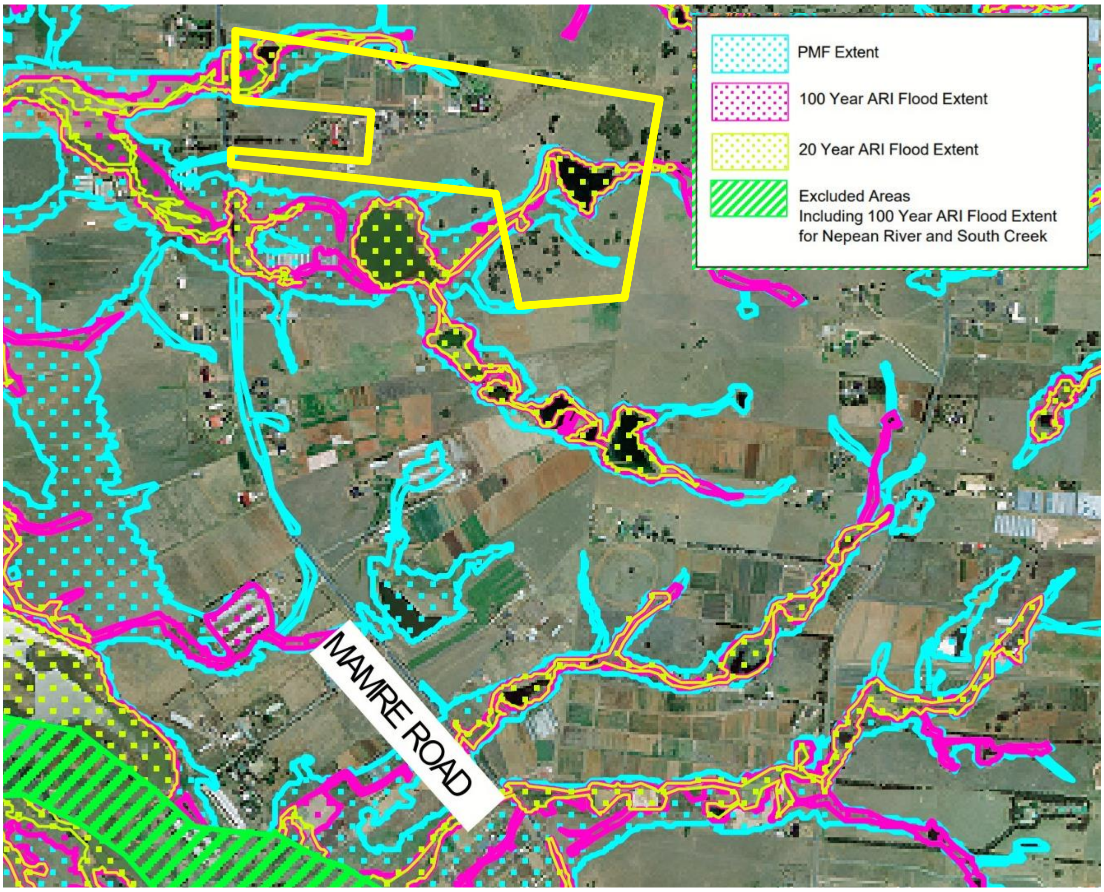

Figure E1.1. Excerpt of Figure 6.1k of Cardno 2006 Study

E.2 CATCHMENT INVESTIGATION & HYDROLOGY

E.2.1 Contributing Catchment Definition

The contributing catchment comprises rural land use with approximately >90% pervious surfaces. The area has recently been rezoned by DPIE as part of the Mamre Road Precinct of the Badgerys Creek Airport Aerotropolis.

Future developments will need to match pre-development flows through detention. As such our assessment has been based on modelling the existing rural pervious land use.

For the pre-development condition, the catchment has been divided into 7 contributing sub-catchments that drain through the site. Cat 1 & 7 enter the site along the western boundary and have a total area of approximately 29.45Ha, whilst catchment Cat 3, with an area of 33.24Ha enters the site along the northern boundary. Cat 2, 4, 5 & 6 enter along the south & south-east of the site, including areas within the proposed development site, with an area of 96.66Ha. These catchments are shown below in **Figure E2.1**.

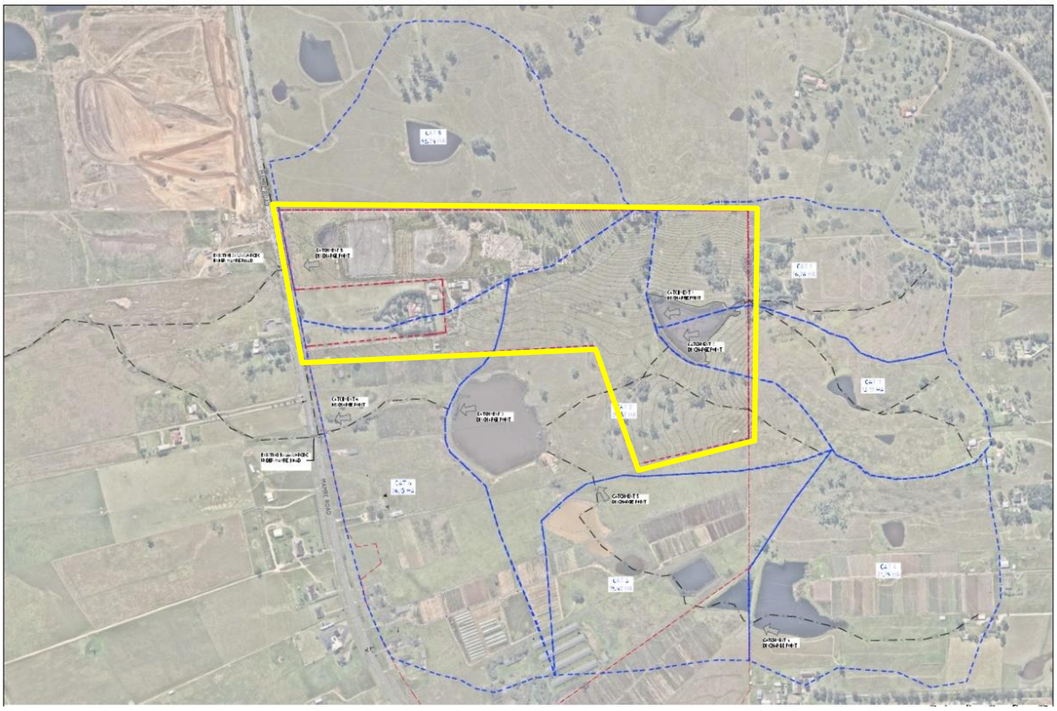

Figure E2.1. Pre-Development Contributing Catchment.

For the post development condition, the catchment has been divided into 16 contributing sub-catchments which comprise of 6 sub-catchments external to the development site (undeveloped) and 12 sub-catchments internal to the development site, including 4 sub-catchments as part of the Mirvac development (by others). The total catchment area in the post development condition is equal to the total catchment area in the pre-development condition. These catchments are shown below in **Figure E2.2**.

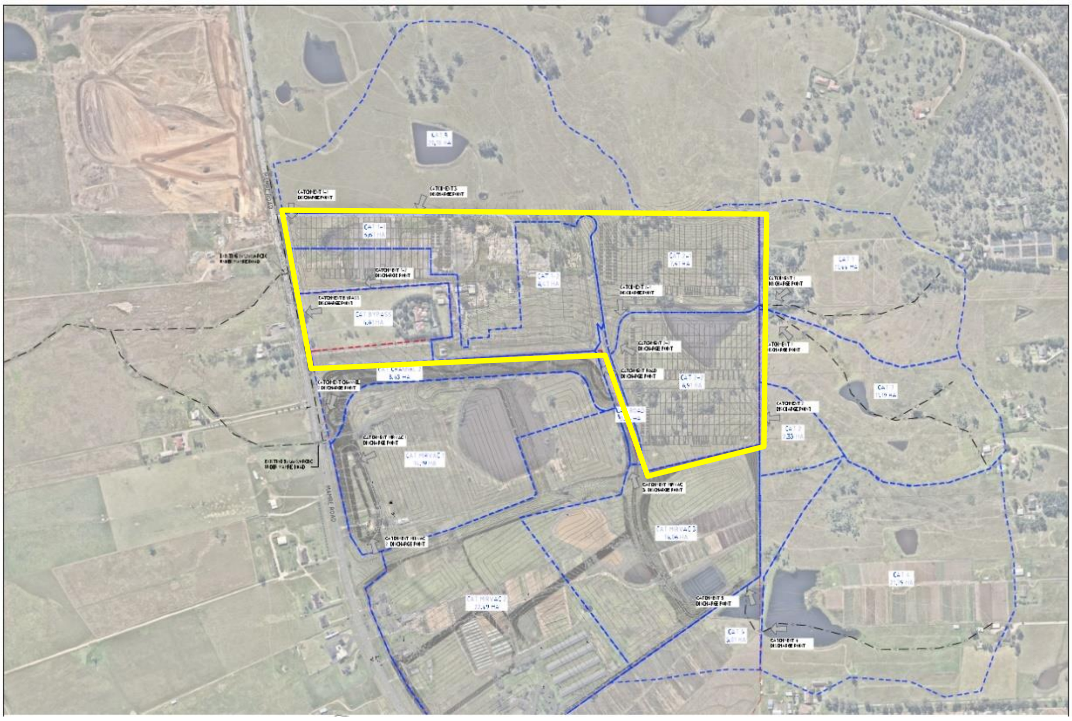

Figure E2.2. Post Development Contributing Catchment.

E.2.2 Hydrological Assessment of Existing Catchment

Flood hydrographs were assessed using a RAFTS model based on the contributing catchment. The inflow hydrograph for catchments in the pre & post development conditions were extrapolated from the RAFTS model for the 5%, 1%, 0.5%, 0.2% AEP & PMF events as shown in **Figure E2.3 to Figure E2.97.** Rainfall intensities and temporal patterns were derived from the Bureau of Meteorology online IFD tool and Australian Rainfall and Runoff. It was determined that the critical storm duration which produces peak flows for the contributing catchments is the 45 minute storm event. This is consistent with the critical duration storm used in the Penrith Overland Flow Study by Cardno (2006).

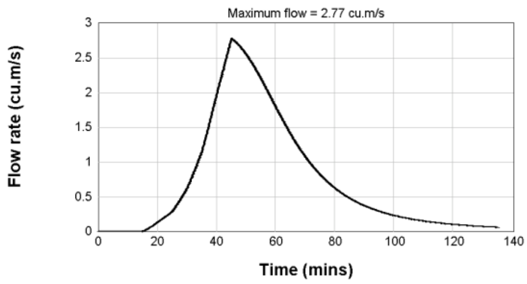

Figure E2.3: Pre-Development 5% AEP Inflow Hydrograph - Catchment 1

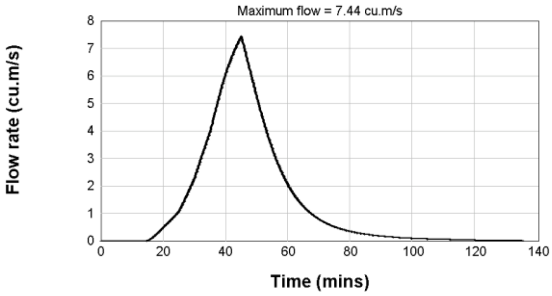

Figure E2.4: Pre-Development 5% AEP Inflow Hydrograph - Catchment 2

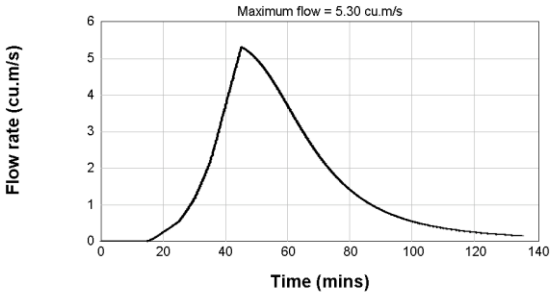

Figure E2.5: Pre-Development 5% AEP Inflow Hydrograph - Catchment 3

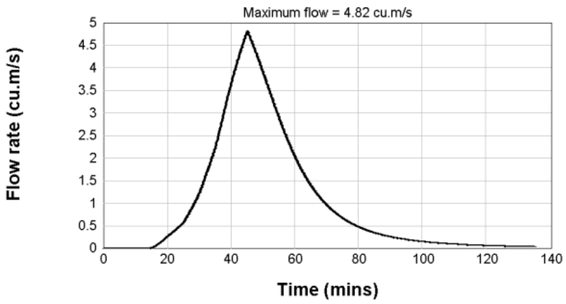

Figure E2.6: Pre-Development 5% AEP Inflow Hydrograph - Catchment 4

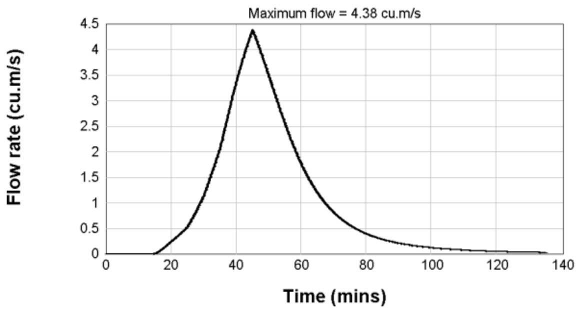

Figure E2.7: Pre-Development 5% AEP Inflow Hydrograph - Catchment 5

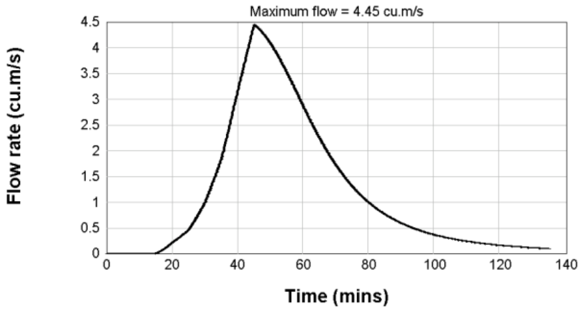

Figure E2.8: Pre-Development 5% AEP Inflow Hydrograph - Catchment 6

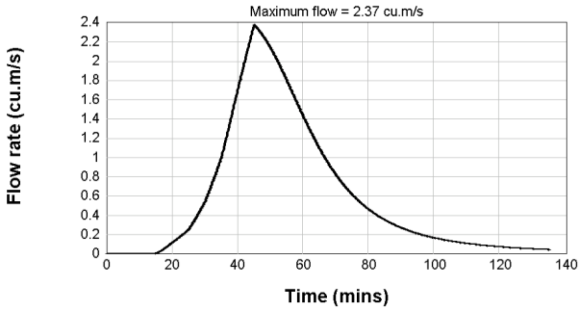

Figure E2.9: Pre-Development 5% AEP Inflow Hydrograph - Catchment 7

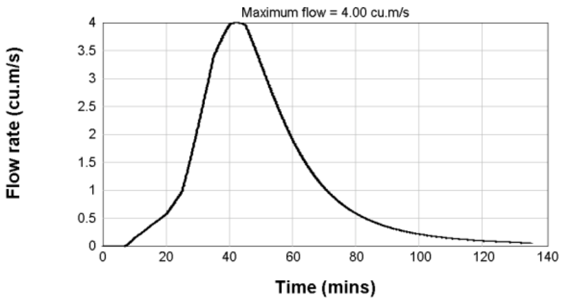

Figure E2.10: Pre-Development 1% AEP Inflow Hydrograph - Catchment 1

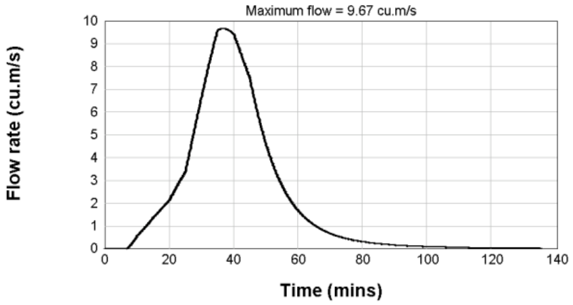

Figure E2.11: Pre-Development 1% AEP Inflow Hydrograph - Catchment 2

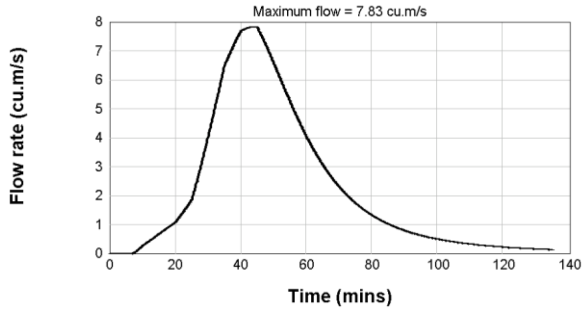

Figure E2.12: Pre-Development 1% AEP Inflow Hydrograph - Catchment 3

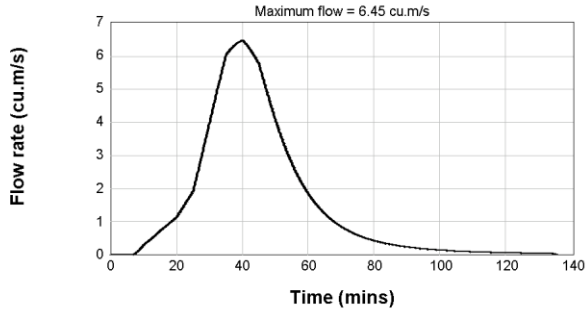

Figure E2.13: Pre-Development 1% AEP Inflow Hydrograph - Catchment 4

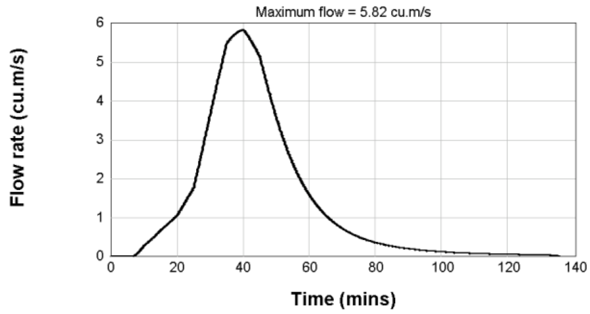

Figure E2.14: Pre-Development 1% AEP Inflow Hydrograph - Catchment 5

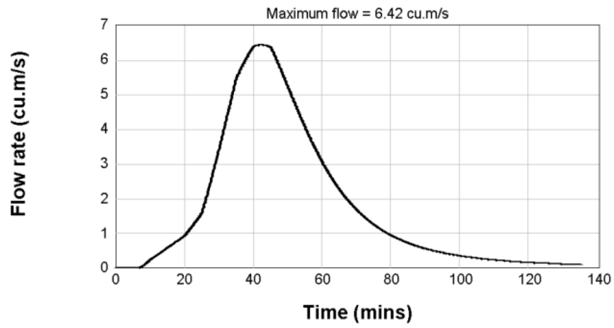

Figure E2.15: Pre-Development 1% AEP Inflow Hydrograph - Catchment 6

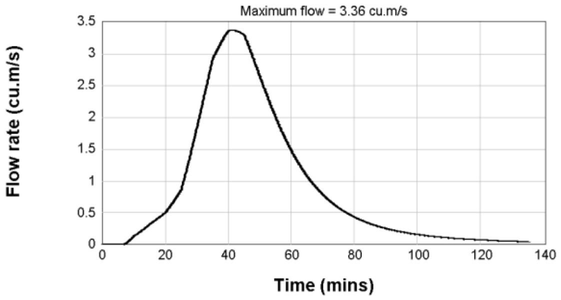

Figure E2.16: Pre-Development 1% AEP Inflow Hydrograph - Catchment 7

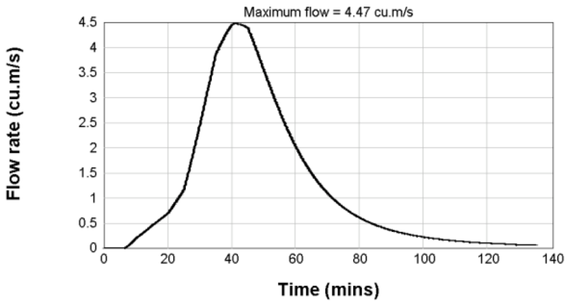

Figure E2.17: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 1

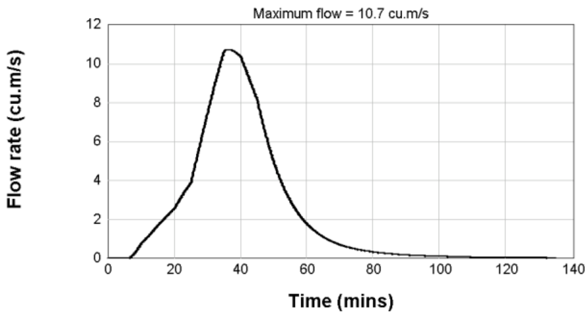

Figure E2.18: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 2

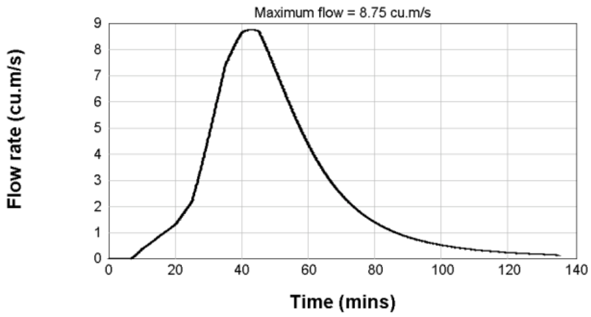

Figure E2.19: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 3

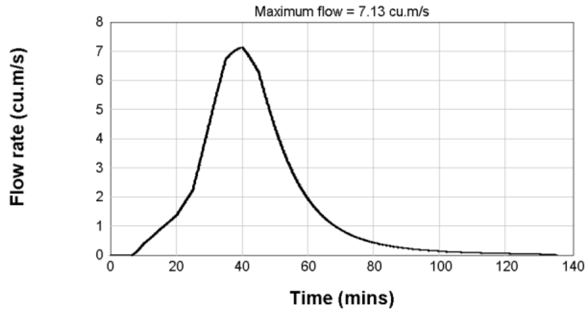

Figure E2.20: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 4

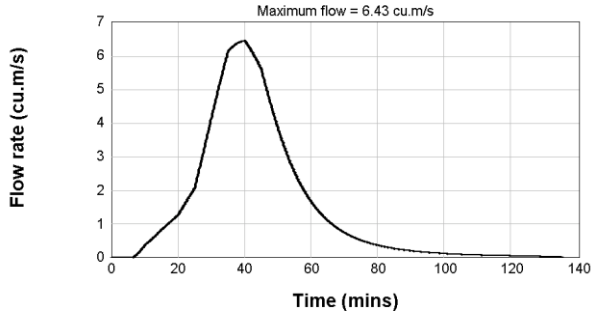

Figure E2.21: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 5

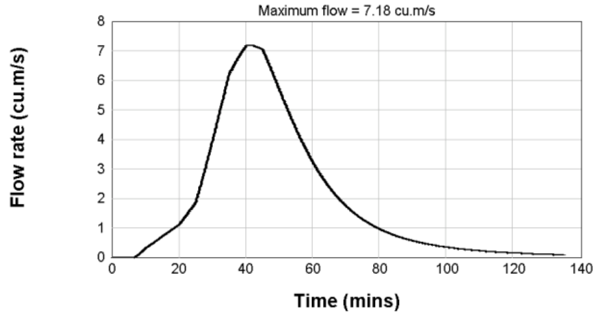

Figure E2.22: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 6

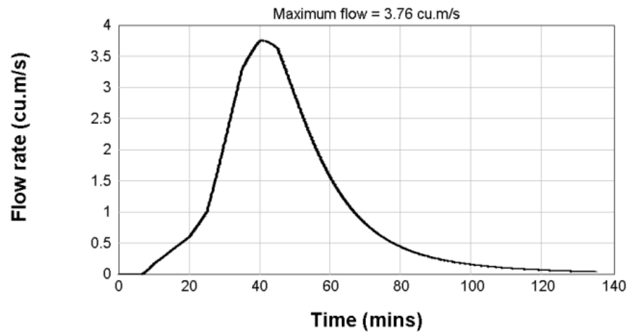

Figure E2.23: Pre-Development 0.5% AEP Inflow Hydrograph - Catchment 7

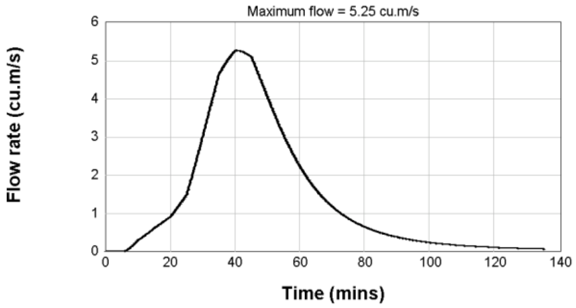

Figure E2.24: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 1

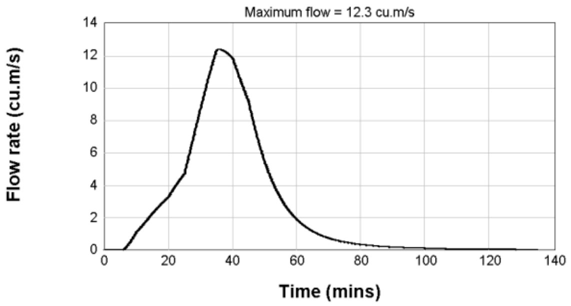

Figure E2.25: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 2

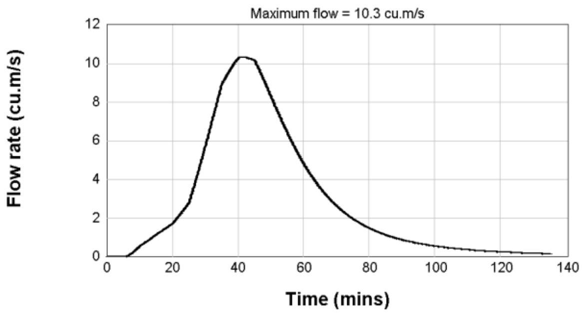

Figure E2.26: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 3

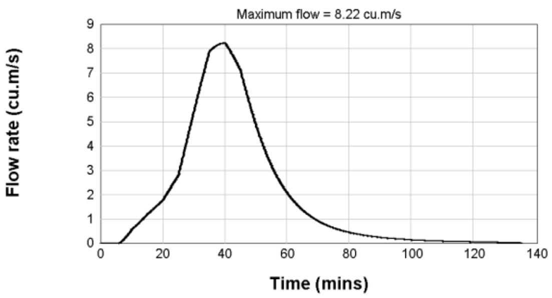

Figure E2.27: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 4

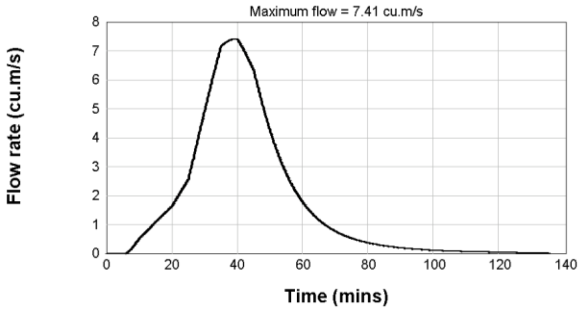

Figure E2.28: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 5

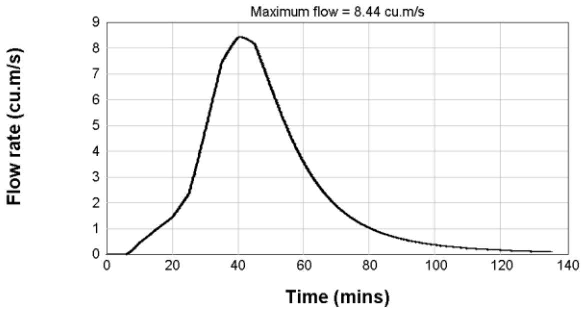

Figure E2.29: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 6

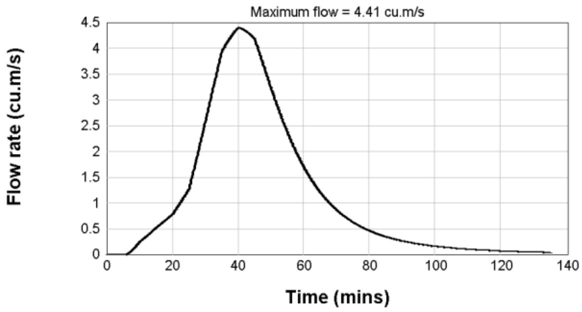

Figure E2.30: Pre-Development 0.2% AEP Inflow Hydrograph - Catchment 7

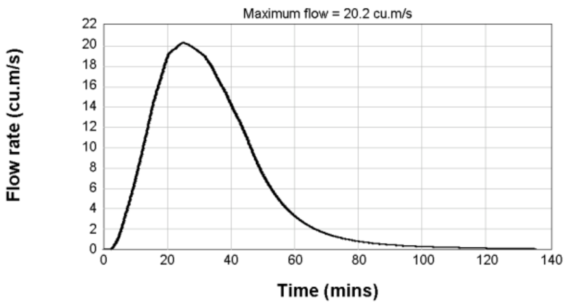

Figure E2.31: Pre-Development PMF Inflow Hydrograph - Catchment 1

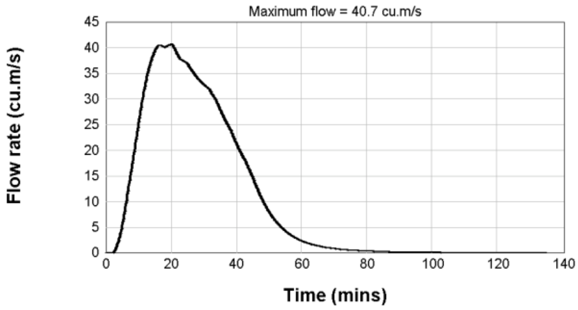

Figure E2.32: Pre-Development PMF Inflow Hydrograph - Catchment 2

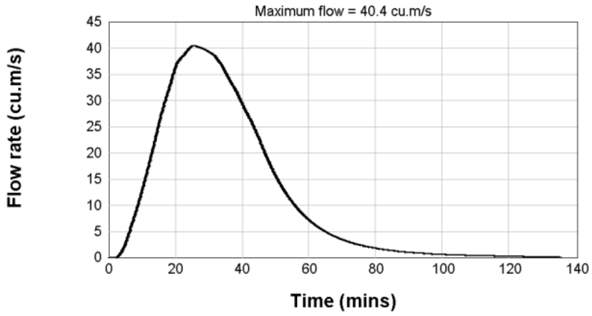

Figure E2.33: Pre-Development PMF Inflow Hydrograph - Catchment 3

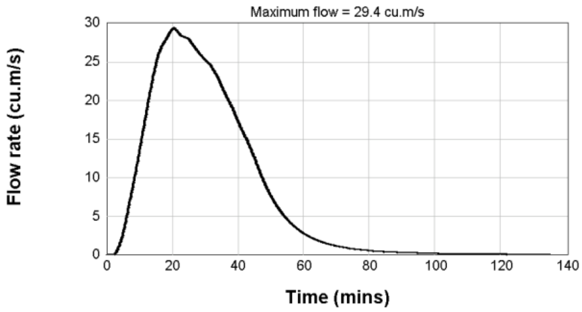

Figure E2.34: Pre-Development PMF Inflow Hydrograph - Catchment 4

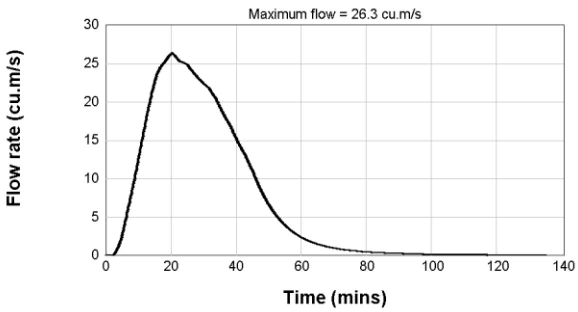

Figure E2.35: Pre-Development PMF Inflow Hydrograph - Catchment 5

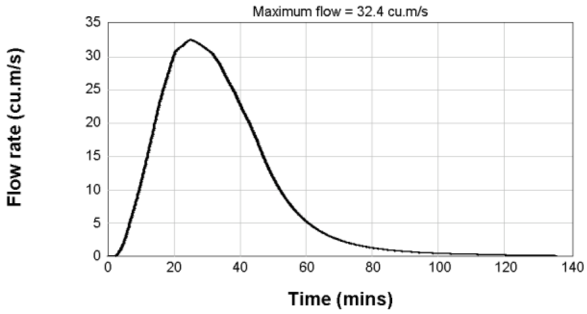

Figure E2.36: Pre-Development PMF Inflow Hydrograph - Catchment 6

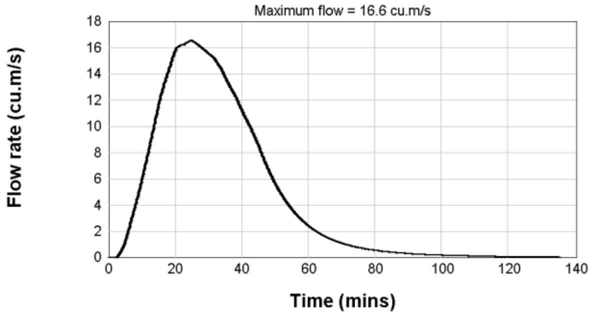

Figure E2.37: Pre-Development PMF Inflow Hydrograph - Catchment 7

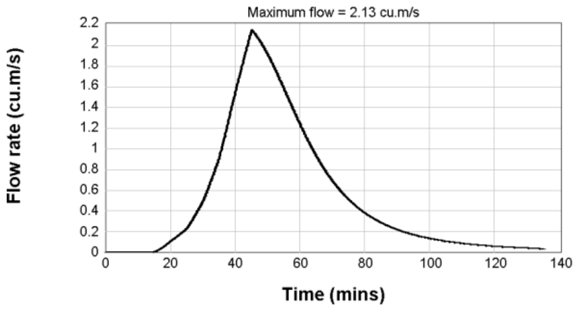

Figure E2.38: Post Development 5% AEP Inflow Hydrograph - Catchment 1

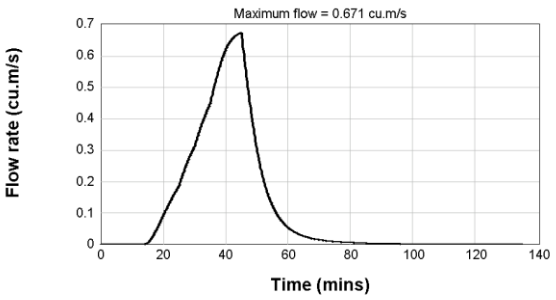

Figure E2.39: Post Development 5% AEP Inflow Hydrograph - Catchment 2

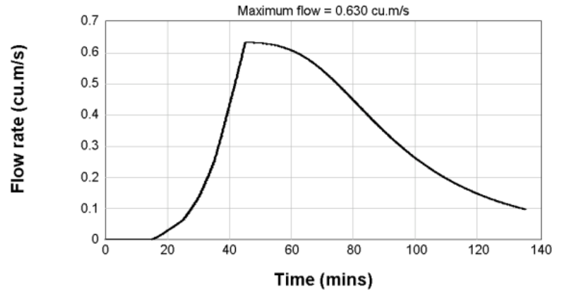

Figure E2.40: Post Development 5% AEP Inflow Hydrograph - Catchment 2-1

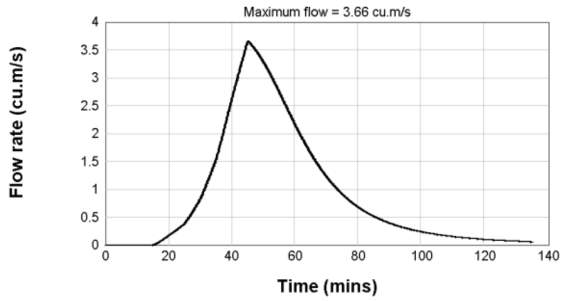

Figure E2.41: Post Development 5% AEP Inflow Hydrograph - Catchment 3

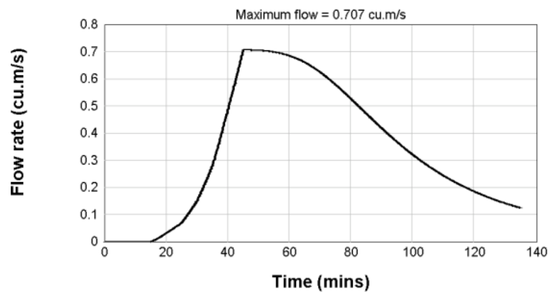

Figure E2.42: Post Development 5% AEP Inflow Hydrograph - Catchment 2-2

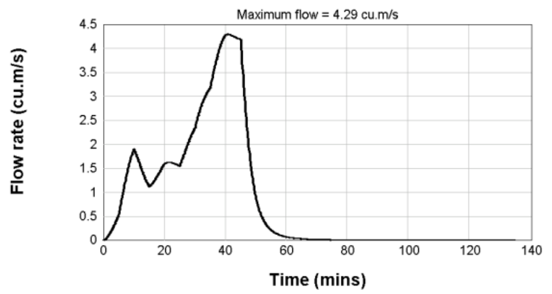

Figure E2.43: Post Development 5% AEP Inflow Hydrograph - Catchment Mirvac 1

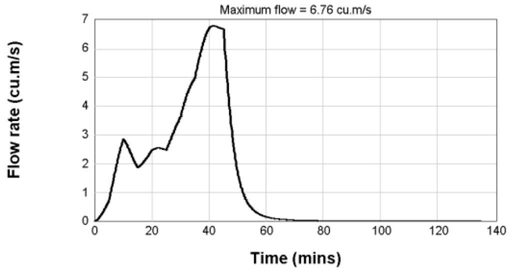

Figure E2.44: Post Development 5% AEP Inflow Hydrograph - Catchment Mirvac 2

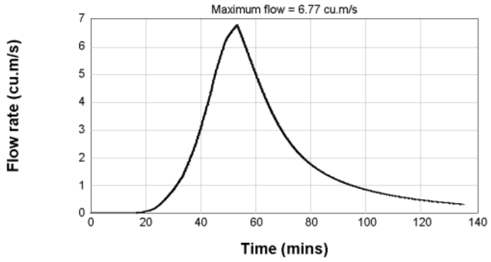

Figure E2.45: Post Development 5% AEP Inflow Hydrograph - Catchment Mirvac 3

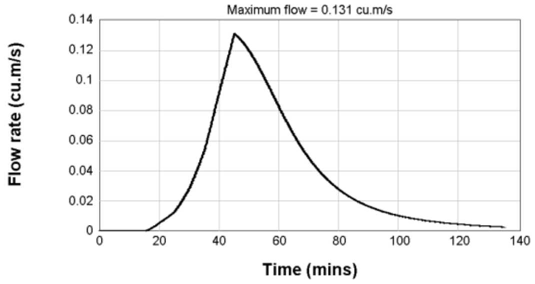

Figure E2.46: Post Development 5% AEP Inflow Hydrograph - Catchment Road

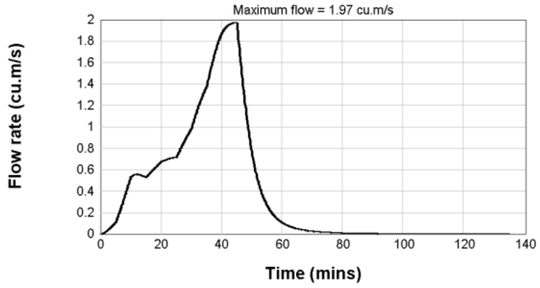

Figure E2.47: Post Development 5% AEP Inflow Hydrograph - Catchment 1-1

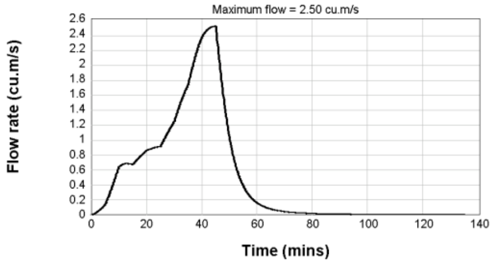

Figure E2.48: Post Development 5% AEP Inflow Hydrograph - Catchment 1-2

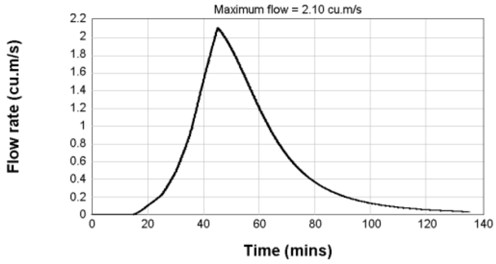

Figure E2.49: Post Development 5% AEP Inflow Hydrograph - Catchment 7

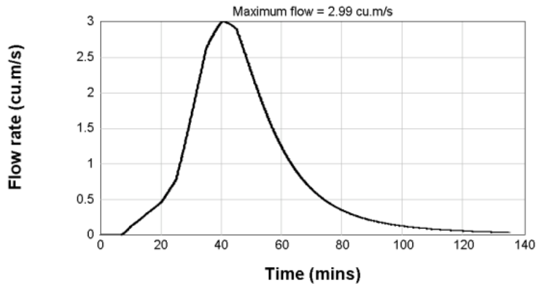

Figure E2.50: Post Development 1% AEP Inflow Hydrograph - Catchment 1

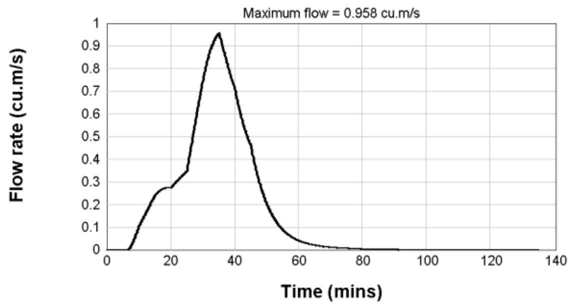

Figure E2.51 Post Development 1% AEP Inflow Hydrograph - Catchment 2

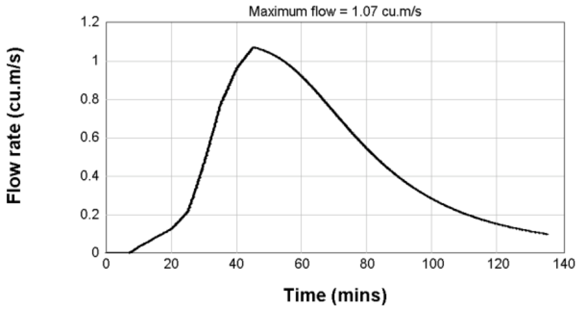

Figure E2.52: Post Development 1% AEP Inflow Hydrograph - Catchment 2-1

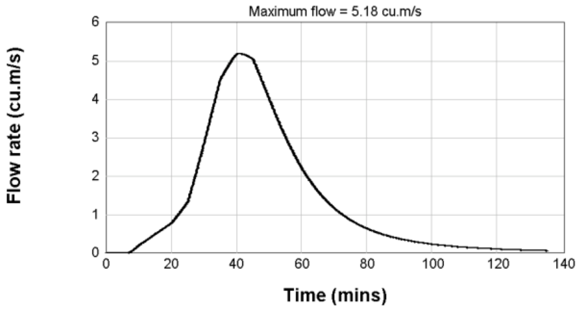

Figure E2.53: Post Development 1% AEP Inflow Hydrograph - Catchment 3

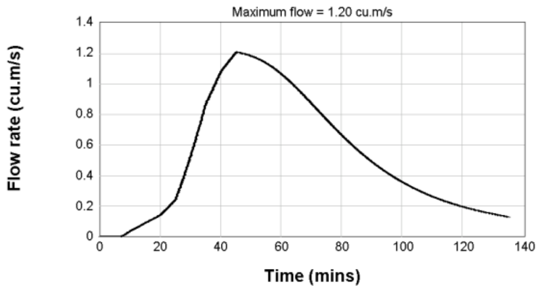

Figure E2.54: Post Development 1% AEP Inflow Hydrograph - Catchment 2-2

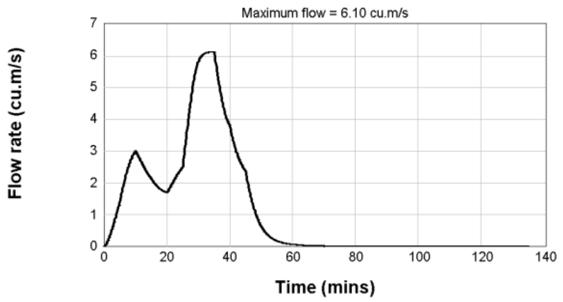

Figure E2.55: Post Development 1% AEP Inflow Hydrograph - Catchment Mirvac 1

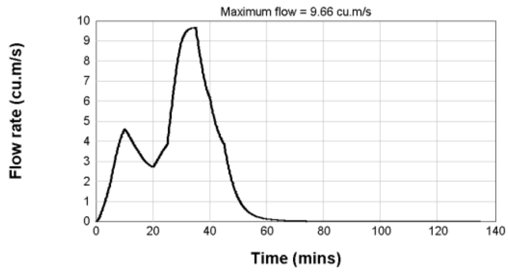

Figure E2.56Post Development 1% AEP Inflow Hydrograph - Catchment Mirvac 2

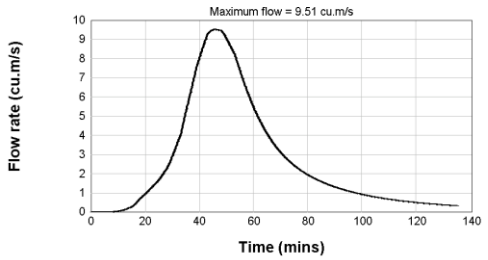

Figure E2.57: Post Development 1% AEP Inflow Hydrograph - Catchment Mirvac 3

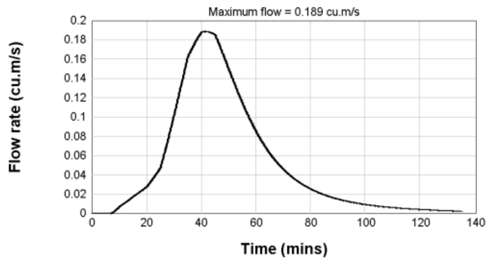

Figure E2.58: Post Development 1% AEP Inflow Hydrograph - Catchment Road

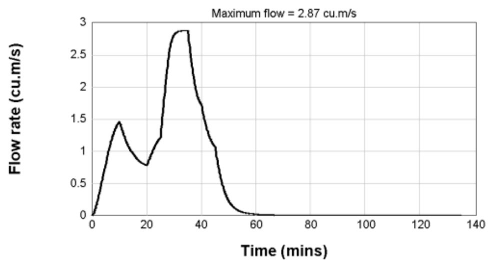

Figure E2.59: Post Development 1% AEP Inflow Hydrograph - Catchment 1-1

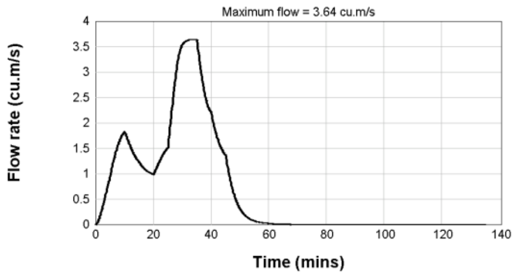

Figure E2.60: Post Development 1% AEP Inflow Hydrograph - Catchment 1-2

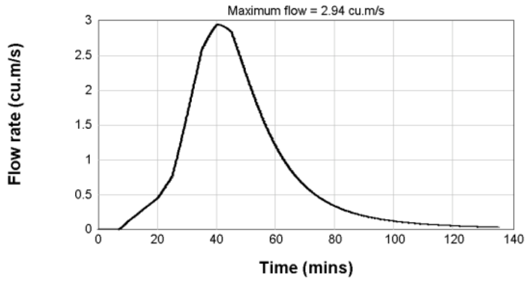

Figure E2.61: Post Development 1% AEP Inflow Hydrograph - Catchment 7

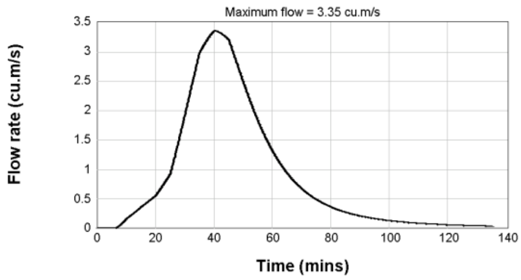

Figure E2.62: Post Development 0.5% AEP Inflow Hydrograph - Catchment 1

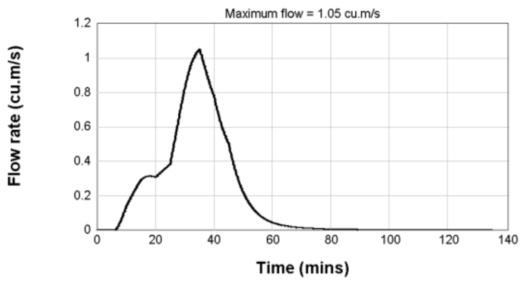

Figure E2.63: Post Development 0.5% AEP Inflow Hydrograph - Catchment 2

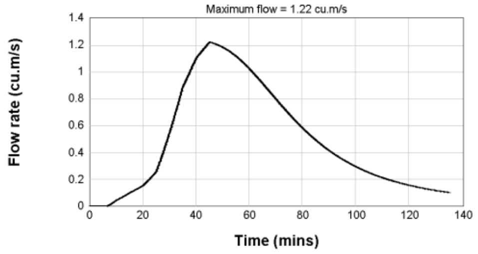

Figure E2.64: Post Development 0.5% AEP Inflow Hydrograph - Catchment 2-1

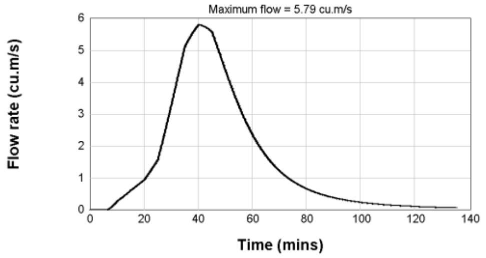

Figure E2.65: Post Development 0.5% AEP Inflow Hydrograph - Catchment 3

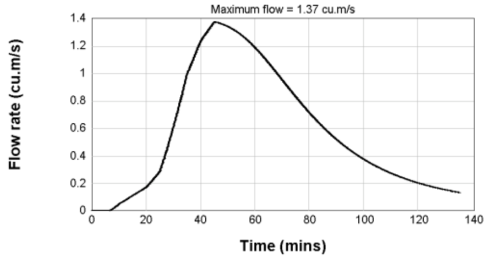

Figure E2.66: Post Development 0.5% AEP Inflow Hydrograph - Catchment 2-2

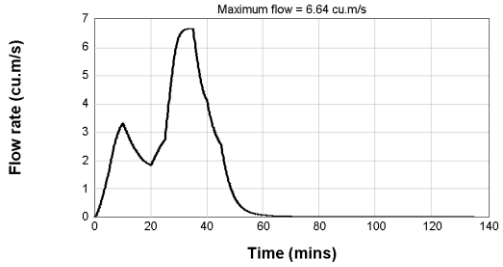

Figure E2.67: Post Development 0.5% AEP Inflow Hydrograph - Catchment Mirvac 1

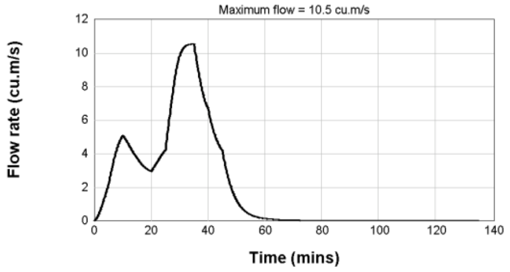

Figure E2.68: Post Development 0.5% AEP Inflow Hydrograph - Catchment Mirvac 2

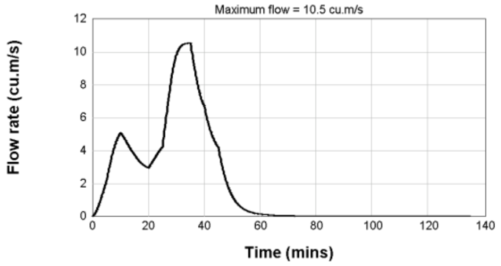

Figure E2.69: Post Development 0.5% AEP Inflow Hydrograph - Catchment Mirvac 3

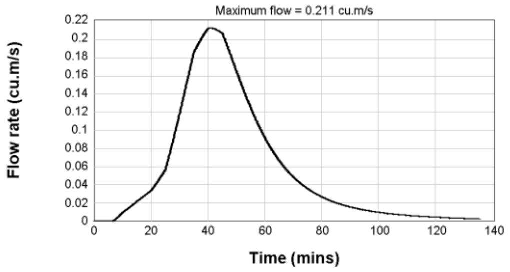

Figure E2.70: Post Development 0.5% AEP Inflow Hydrograph - Catchment Road

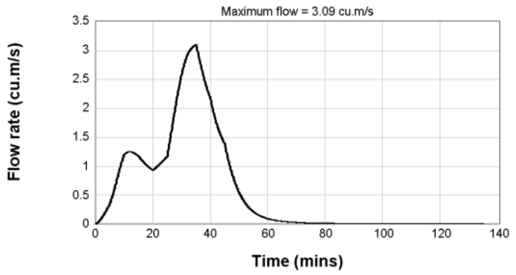

Figure E2.71: Post Development 0.5% AEP Inflow Hydrograph - Catchment 1-1

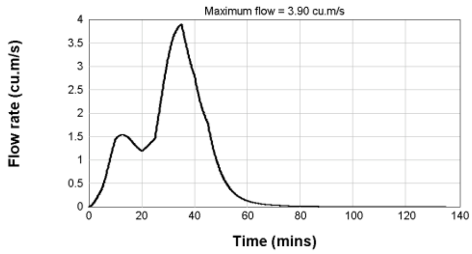

Figure E2.72: Post Development 0.5% AEP Inflow Hydrograph - Catchment 1-2

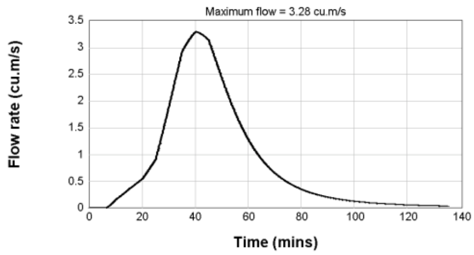

Figure E2.73: Post Development 0.5% AEP Inflow Hydrograph - Catchment 7

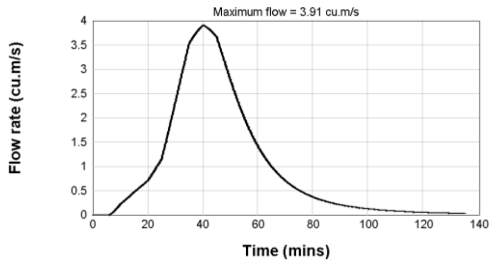

Figure E2.74: Post Development 0.2% AEP Inflow Hydrograph - Catchment 1

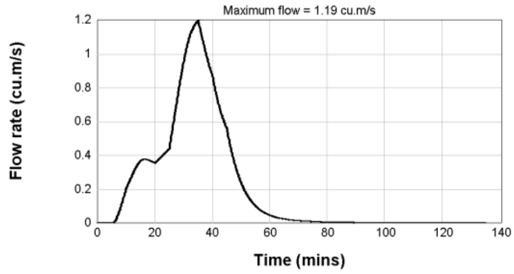

Figure E2.75: Post Development 0.2% AEP Inflow Hydrograph - Catchment 2

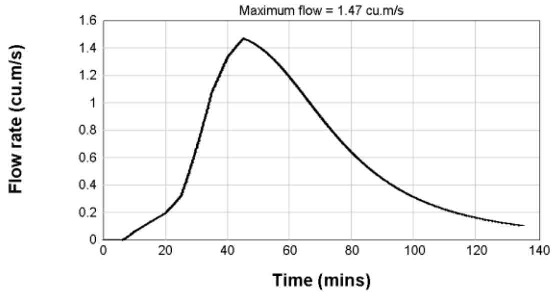

Figure E2.76: Post Development 0.2% AEP Inflow Hydrograph - Catchment 2-1

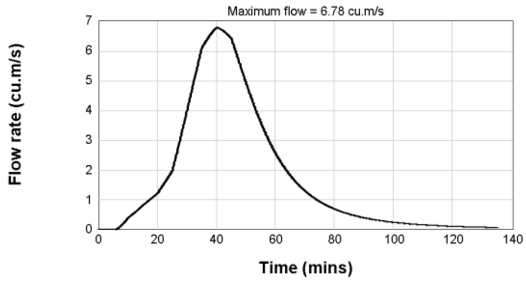

Figure E2.77: Post Development 0.2% AEP Inflow Hydrograph - Catchment 3

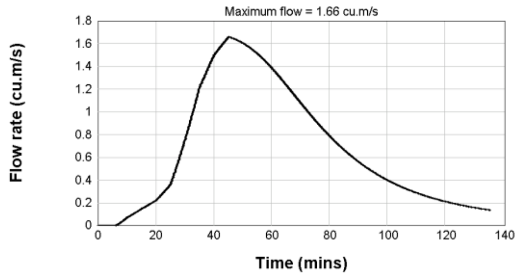

Figure E2.78: Post Development 0.2% AEP Inflow Hydrograph - Catchment 2-2

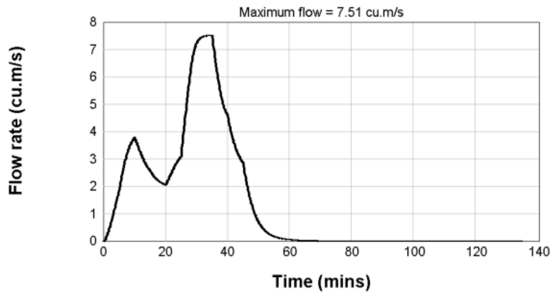

Figure E2.79: Post Development 0.2% AEP Inflow Hydrograph - Catchment Mirvac 1

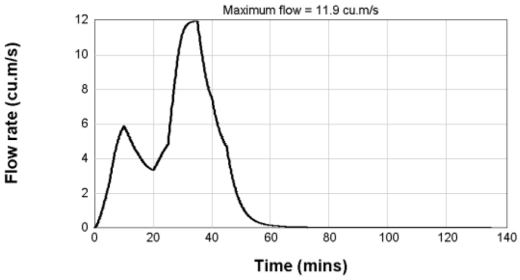

Figure E2.80: Post Development 0.2% AEP Inflow Hydrograph - Catchment Mirvac 2

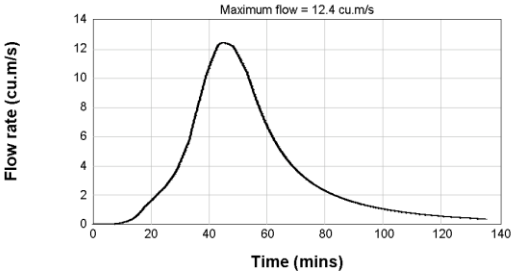

Figure E2.81: Post Development 0.2% AEP Inflow Hydrograph - Catchment Mirvac 3

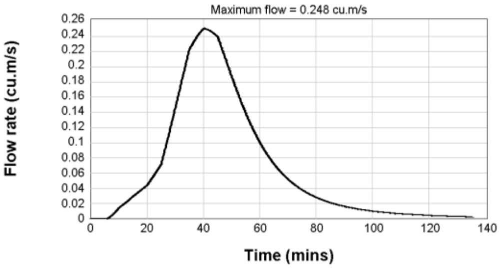

Figure E2.82: Post Development 0.2% AEP Inflow Hydrograph - Catchment Road

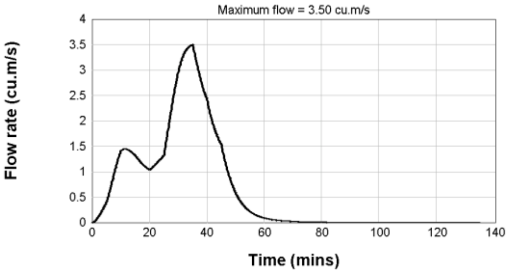

Figure E2.83: Post Development 0.2% AEP Inflow Hydrograph - Catchment 1-1

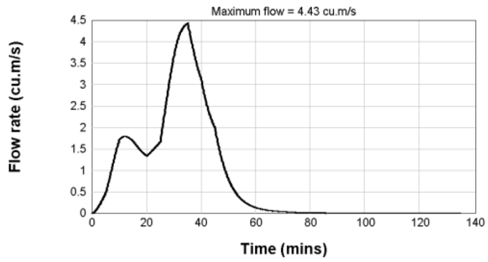

Figure E2.84: Post Development 0.2% AEP Inflow Hydrograph - Catchment 1-2

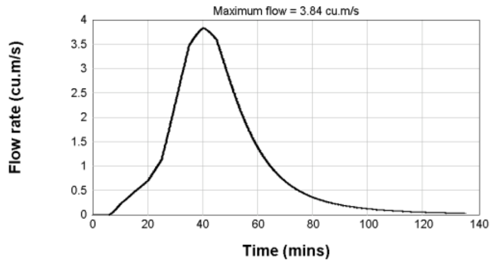

Figure E2.85: Post Development 0.2% AEP Inflow Hydrograph - Catchment 7

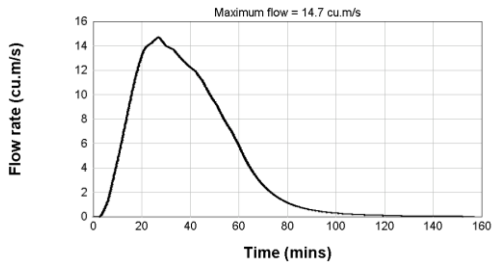

Figure E2.86: Post Development PMF Inflow Hydrograph - Catchment 1

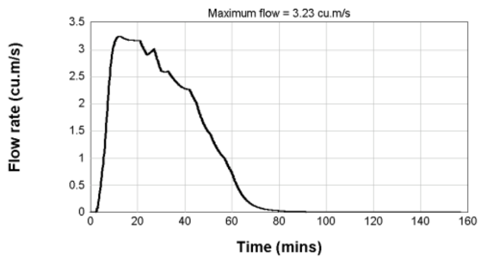

Figure E2.87: Post Development PMF Inflow Hydrograph - Catchment 2

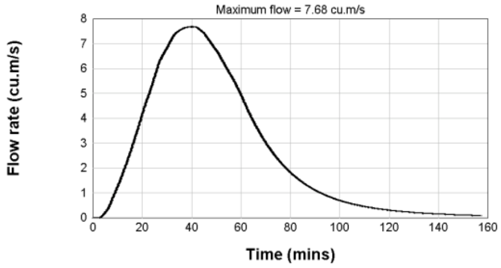

Figure E2.88: Post Development PMF Inflow Hydrograph - Catchment 2-1

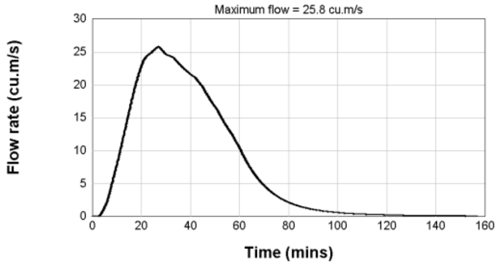

Figure E2.89: Post Development PMF Inflow Hydrograph - Catchment 3

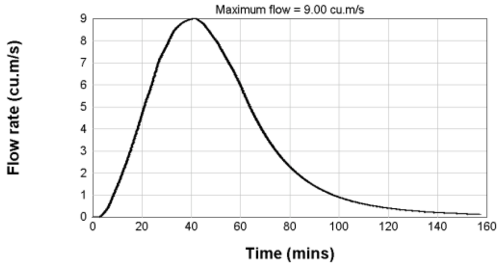

Figure E2.90: Post Development PMF Inflow Hydrograph - Catchment 2-2

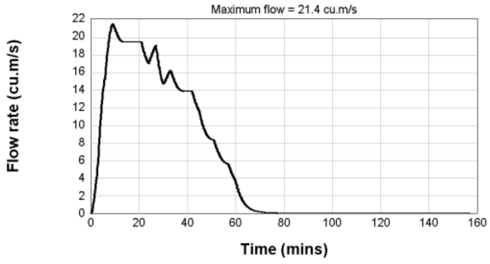

Figure E2.91: Post Development 5% AEP Inflow Hydrograph - Catchment Mirvac 1

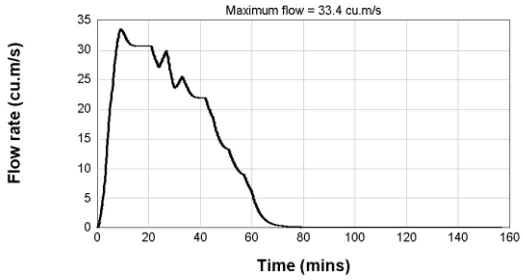

Figure E2.92: Post Development PMF Inflow Hydrograph - Catchment Mirvac 2

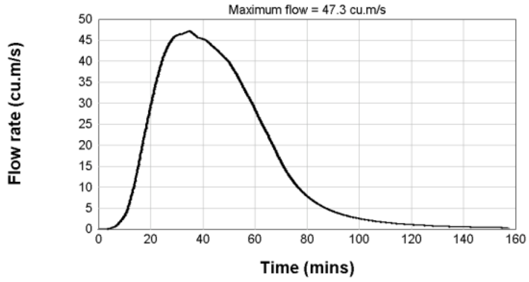

Figure E2.93: Post Development PMF Inflow Hydrograph - Catchment Mirvac 3

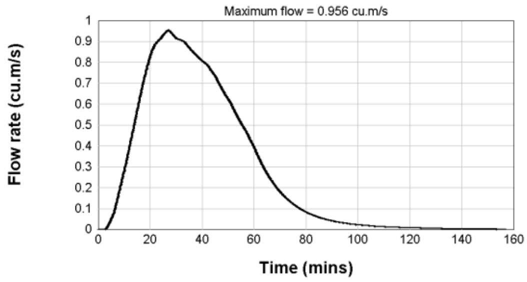

Figure E2.94: Post Development PMF Inflow Hydrograph - Catchment Road

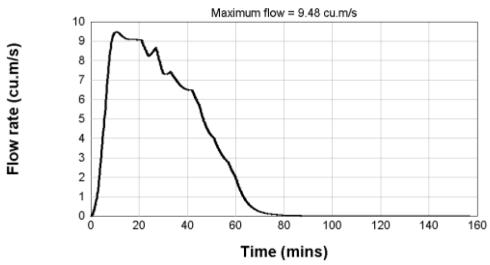

Figure E2.95: Post Development PMF Inflow Hydrograph - Catchment 1-1

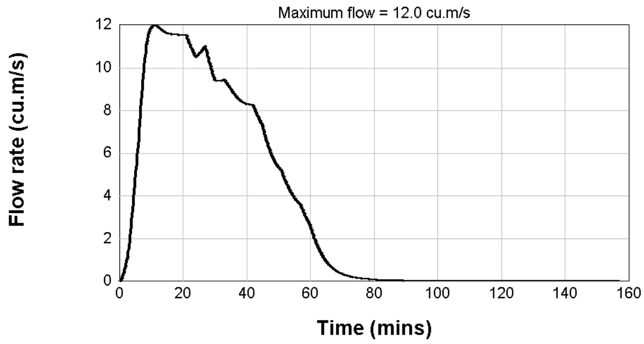

Figure E2.96: Post Development PMF Inflow Hydrograph - Catchment 1-2

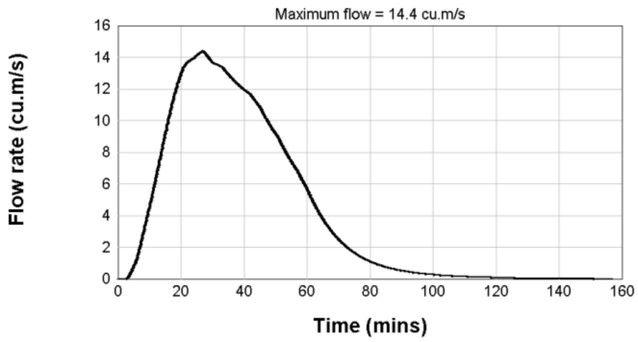

Figure E2.97: Post Development PMF Inflow Hydrograph - Catchment 7

E.3 HYDRODYNAMIC MODEL DEVELOPMENT

E 3.1 Extent and Topography

The model extent is shown in **Figure E3.1** of this appendix. The model begins approximately 450m upstream of the development and extending approximately 200m downstream of the development.

E.3.2 Boundary Conditions

Inflow Boundaries

Design inflow hydrographs for the model have been included at the location approximately 450m upstream of the existing upstream farm dam. Flows are based on hydrology as discussed in **Section E.2.2** of this Appendix.

The upstream boundary was located sufficiently upstream of the development to ensure the extent of predicted impacts from the development would be covered and any modelling iterations would be resolved clear of the development affectation zone.

Downstream Water Level Boundaries

The downstream water levels have been based on normal outlflow and design gradient of 1%

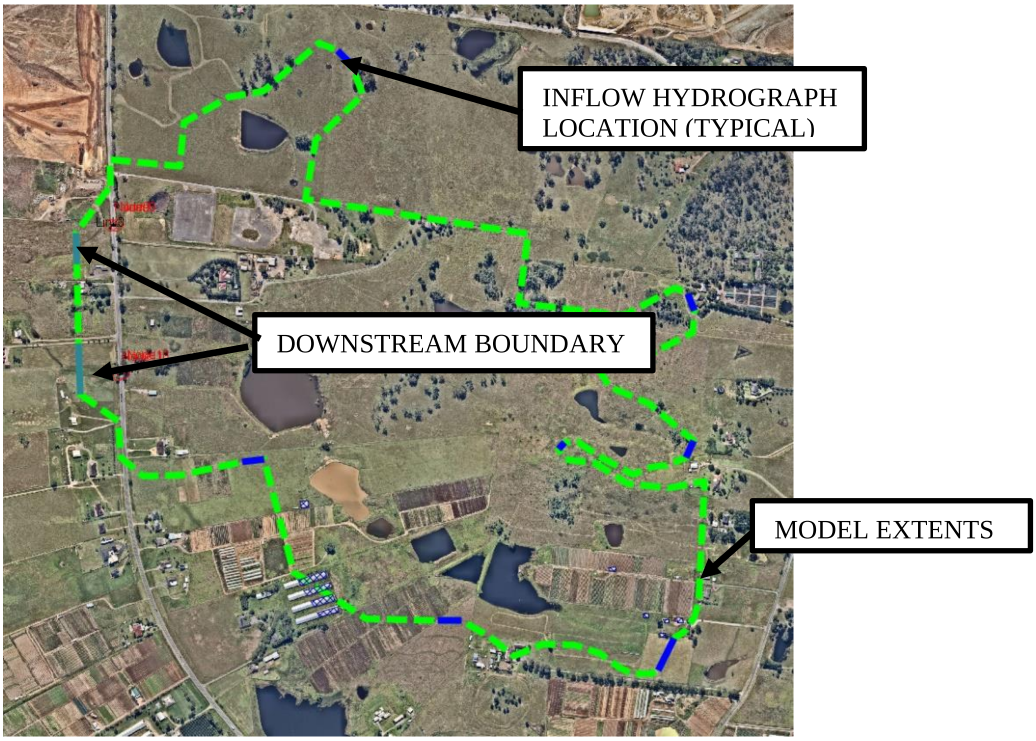

Figure E3.1: Model Extent and Model Boundary Locations

E.3.3 Channel and Floodplain Roughness

Roughness values adopted in the model are contained in **Table E2** below. These are generally consistent with previous studies completed within the Penrith Council area and have been adopted in this overland flow study.

Table E2. Adopted TUFLOW Element Roughness Values

Model Element	Description	Roughness Parameter Value
1	Trees / Vegetation	0.08
2	Grassed (Default)	0.04
3	Ponds	0.025
4	Roads	0.025
5	Hardstand	0.012
6	Buildings	(blockout)

A figurative representation of where the above roughness values have been applied can be found in **Figures E3.2 & E3.3.**

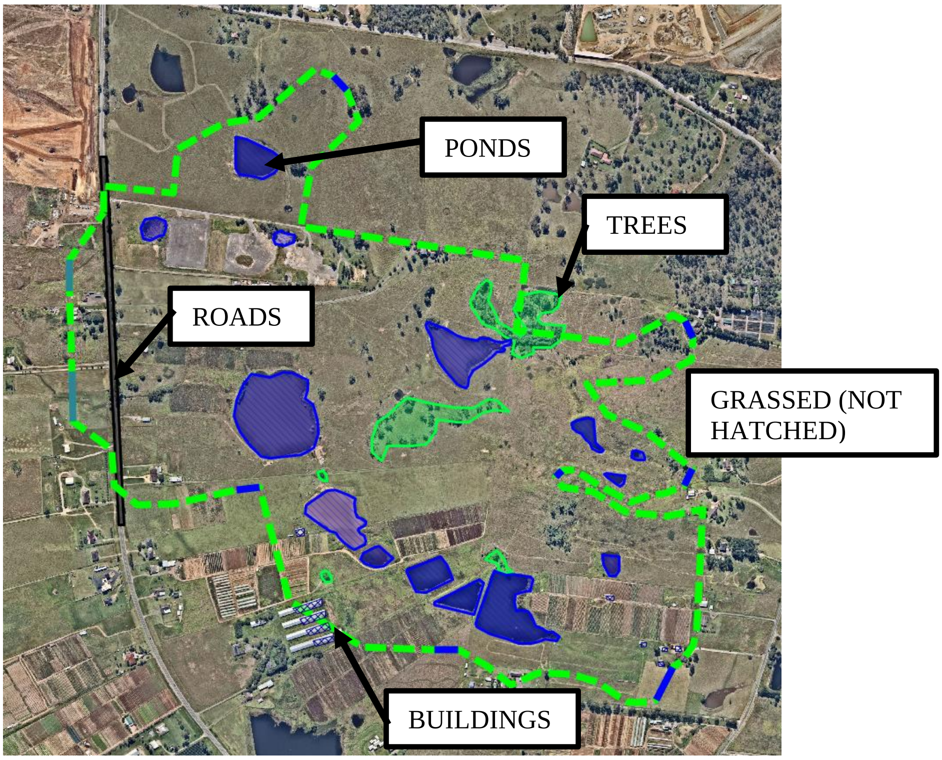

Figure E3.2: Manning's Roughness Surface Areas (Pre-Development)

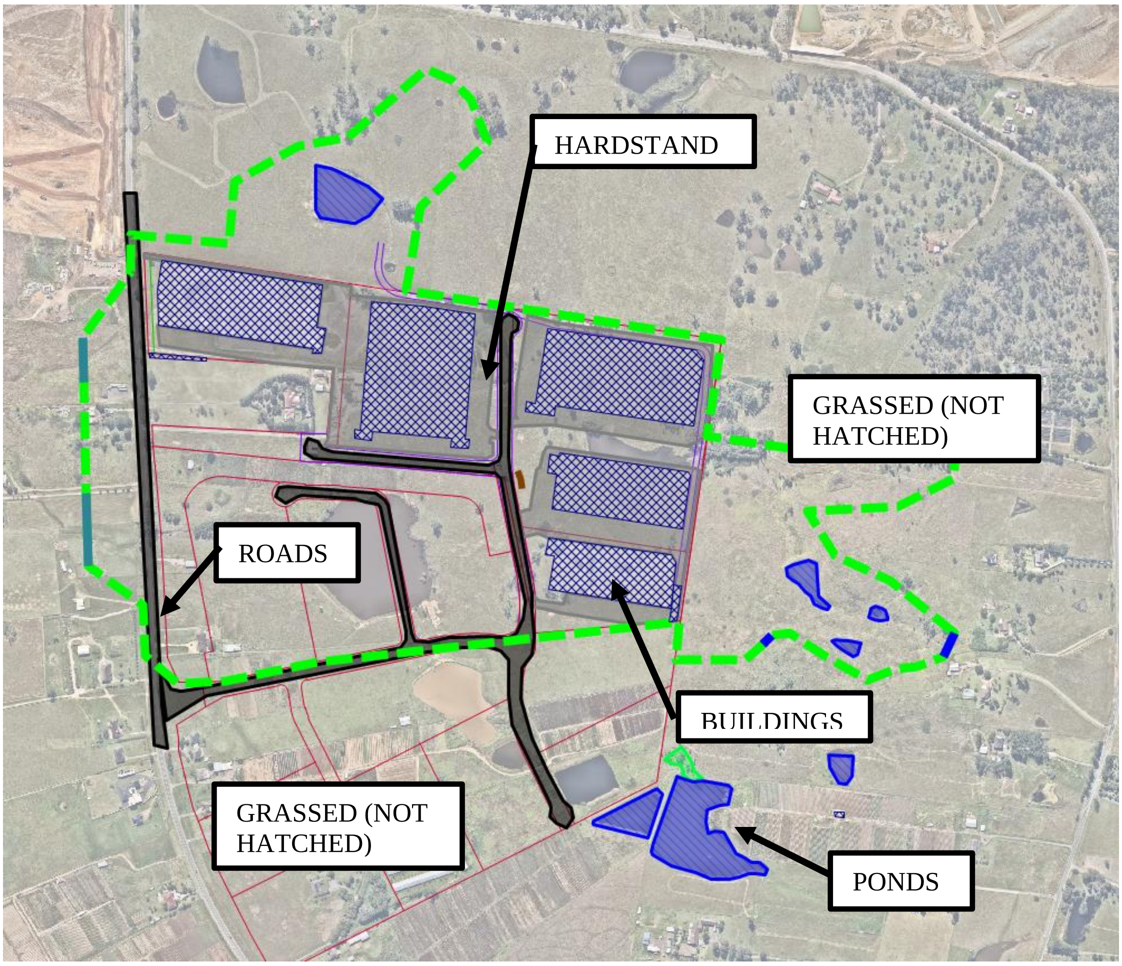

Figure E3.3: Manning's Roughness Surface Areas (Post-Development)

E.3.4 Model Validation

Model validation has been completed by comparing results of the TUFLOW modelling against the results contained in the Penrith Council study from 2006. Model parameters were adjusted as required to achieve acceptable agreement between the two model output. 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 the Penrtith Council Figures including flood depths, flood levels, flood extents and hydraulics. The comparison is made at the peak of the predicted parameters;
- Adjust roughness factors to align TUFLOW flood extent to align with the Penrith Council Results.

Hydrology and peak flows were established as described in **Section E.2.2** of this report.

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 council figures.

The comparison of the flood level results shows good alignment of those produced in the TUFLOW model when compared with those of the council figures. The predicted flood extent is consistent between the two models for the flood event 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.

E.3.5 Proposed Overland Flow Management Strategy

Flows from within the development sites have been only considered in the sizing of the stormwater system and erosion control for the development sites. The proposed buildings will be set at the 1% AEP level plus 0.5m freeboard per council policy.

Penrith City Council require that flows from the upstream catchment to be conveyed through the site. Council also requires proof that the proposed development does not increase the flood risk to the surrounding properties. Further, the TUFLOW modelling and assessment confirms there is negligible impact on upstream, downstream and/ or adjoining sites as a result of the proposed developments.

E.4 MODEL OUTPUT

Model output for pre and post development conditions for the Catchment flooding events on site as discussed in earlier sections have been included in the following Figures.

We note figures represent predicted values at the peak of each event. The figures represent predicted values at the peak of the 1% AEP. Further figures for the 5%, 0.5% and 0.2% AEP and PMF event can be found in **Appendix E2** of this report.

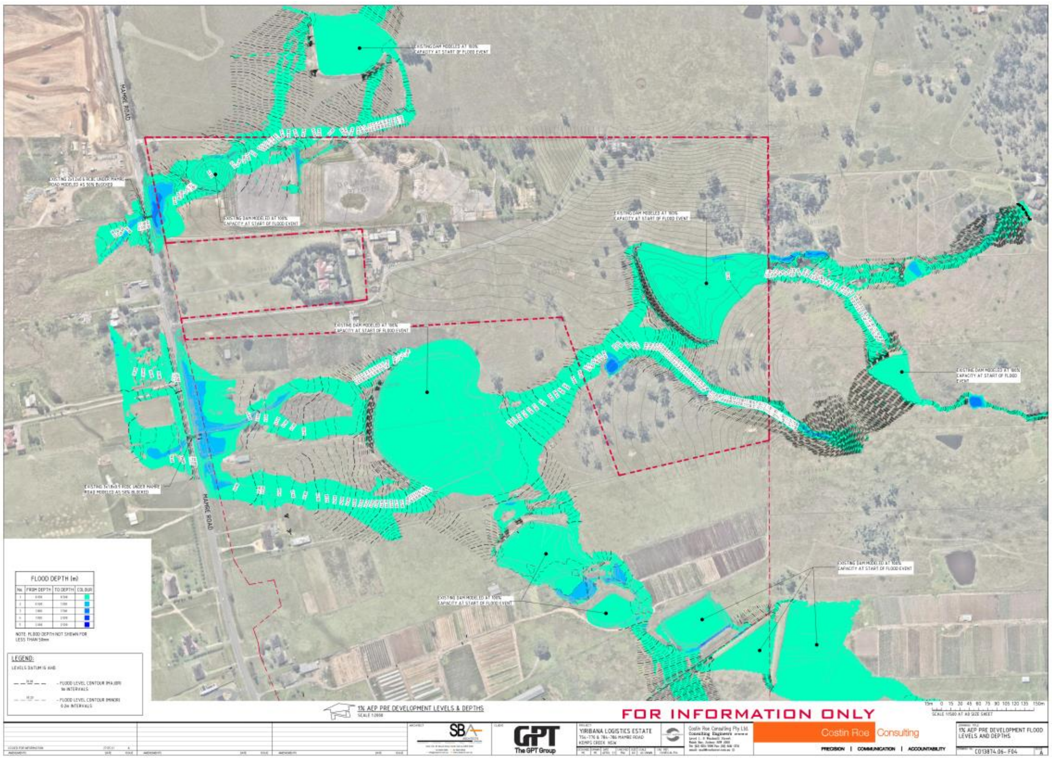

Figure E4.1: 1% AEP Flood Depths – Pre-Development

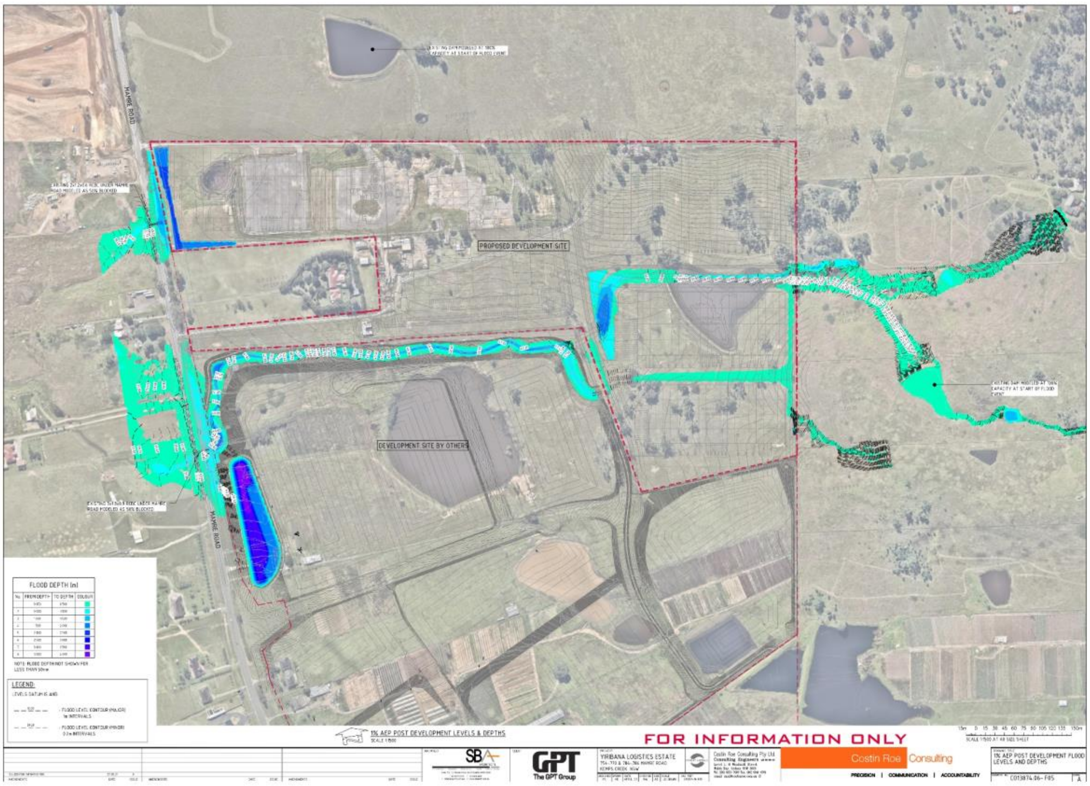

Figure E4.2: 1% AEP Flood Depths – Post Development

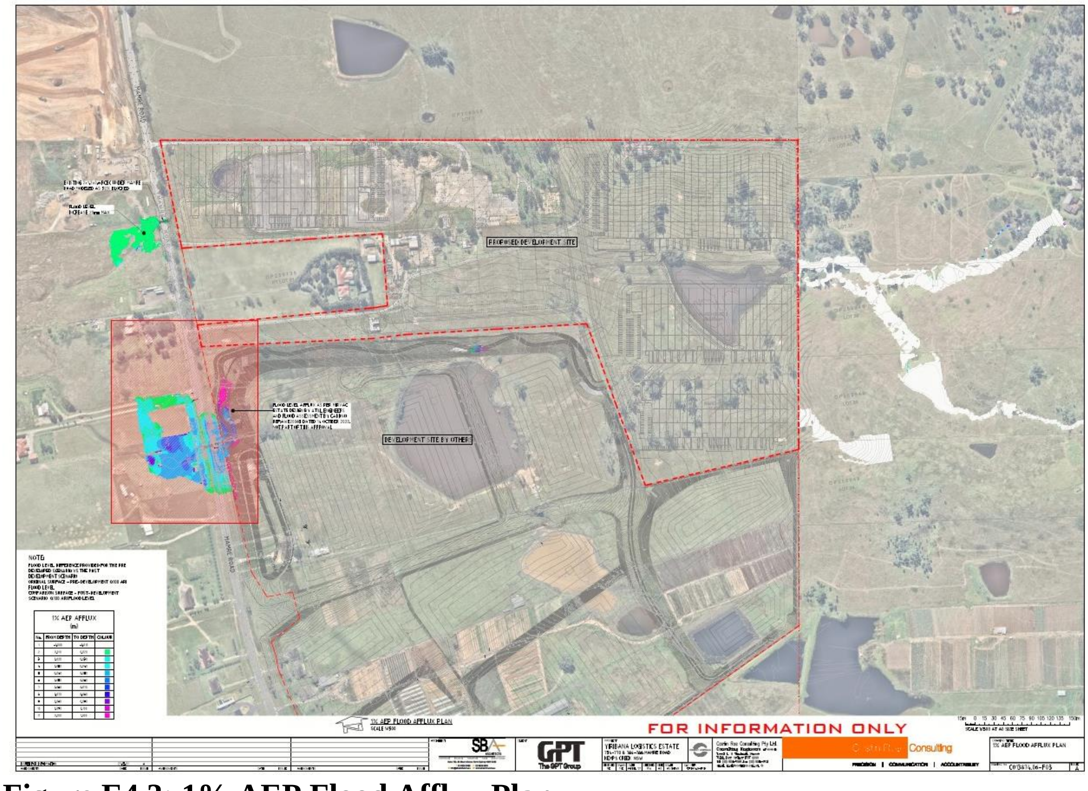

Figure E4.3: 1% AEP Flood Afflux Plan

E.5 FLOOD ASSESSMENT DISCUSSION

This Appendix to the *Civil Engineering Report* for Lots 59 & 60 DP259135 Mamre Road, Kemps Creek, NSW, has been prepared to assess the effect of flooding on the proposed development, and also to confirm no affectation on upstream downstream or adjoining properties. Further the assessment was also completed to ensure that sufficient flood conveyance are available, post development, during the 5%, 1%. 0.5%, 0.2% AEP and PMF flood event.

A TUFLOW hydrodynamic flood model has been completed and the pre and post development flood events assessed for the 5%, 1%. 0.5%, 0.2% AEP and PMF rainfall event..

This Appendix confirms the technical input and detailed output completed as part of the assessment. **Appendix E** is to be read in conjunction with **Section 8** of this report.