

Our reference: 20-306

27 July 2021

Penrith City Council
PO Box 60
Penrith NSW 2751
C/O – Colliers International

Attn: Stephen Masters

Dear Stephen,

RE: NEW PRIMARY SCHOOL IN MULGOA RISE – OVERLAND FLOW FLOODING SUMMARY

Introduction

A new primary school is proposed at Mulgoa Rise / Glenmore Park (hereon referred to as 'The Site'). The Site is currently undeveloped. The proposed works includes a facility which can accommodate in the order of 1000 students. However, the proposed development involves the construction and operation of a new public primary school that will initially accommodate 414 students.

The Site is bounded to the north by Deerubbin Drive, to the south by Forestwood Drive, to the west by Darug Avenue and to the east by the existing Mulgoa Rise Sports Fields and on-grade carpark. The site is located within a parent subdivision, consisting of predominately low-density residential dwellings. The subject site is shown in Figure 1 below.

Woolacotts Consulting Engineers (hereon referred to as 'Woolacotts') were engaged to undertake the civil design for the proposed new primary school.



Figure 1 New Primary School in Mulgoa Rise Site – Aerial Image. Source: Sixmaps (2021)

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Flooding Background

Initial investigations undertaken by Woolacotts indicated that The Site is potentially affected by local overland flow flooding. As result, Woolacotts carried out preliminary one-dimensional flood analysis. The results of this analysis indicated that Forestwood Drive, Darug Avenue and Deerubbin Drive all had insufficient channel capacity to fully contain the 1% Annual Exceedance Probability (AEP) flood event leading to overland flow flooding travelling through The Site and adjacent properties. However, due to the size of the catchment and complexity of the road network, two-dimensional flood modelling was required to accurately depict the capacity of the existing roadways.

Woolacotts liaised with Penrith City Council (hereon referred to as 'Council') on the 30th March 2021, who advised that Council did not have two-dimensional flood model of the area. Refer Attachment 1 email correspondence. As such, Woolacotts engaged GRC Hydro to undertake two-dimensional overland flow flood modelling of The Site and surrounding area using TUFLOW analysis software. TUFLOW analysis software is widely used and is considered best practice under the NSW Floodplain Risk Management Program.

Results of Flood Analysis

The results of the two-dimensional flood modelling indicated that Forestwood Drive, Darug Avenue and Deerubbin Drive had insufficient channel capacity to fully contain the 1% AEP flood event leading to overland flow flooding travelling through The Site and adjacent properties. Refer Figure 2 below for the 1% AEP flood extents and Attachment 2 for the Flood Impact Assessment prepared by Woolacotts.

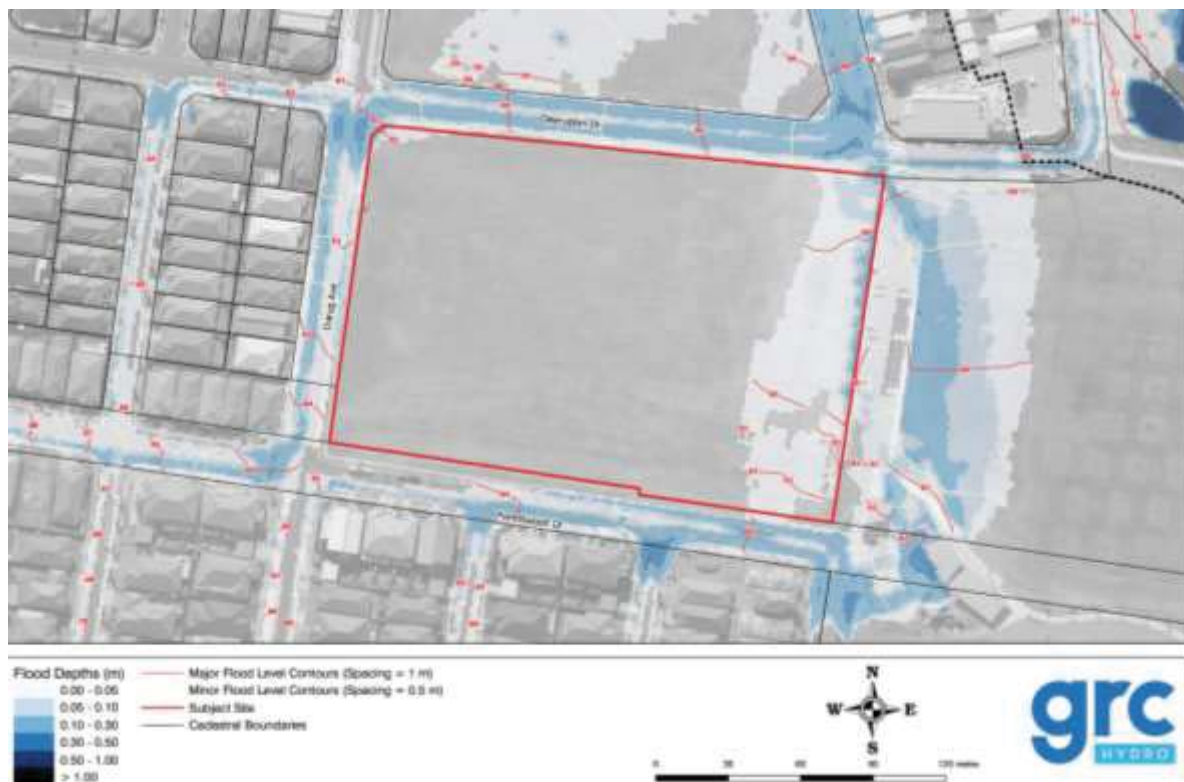


Figure 2 1% AEP Flood Extents

Pedestrian Crossings on Surrounding Roads

The proposed development will include pedestrian crossings on Darug Avenue, Deerubbin Drive and Forestwood Drive. Refer Figure 3 below for the location of the pedestrian crossings.



Figure 3 Pedestrian Crossing Locations

It was originally proposed to provide raised pedestrian crossing thresholds in Deerubbin Drive, Darug Avenue and Forestwood Drive. The Pre-Lodgement Advice (dated 25th March 2021) for the new primary school in Mulgoa Rise states “The design of the raised pedestrian crossing thresholds in Deerubbin Drive and in Darug Avenue shall not have any adverse impact upon the street drainage system nor any overland flow paths that may be conveyed within the street system.” Refer Attachment 3 for the Pre-Lodgement Advice.

For the 1% AEP flood event, the provision of raised pedestrian crossing thresholds in Deerubbin Drive, Darug Avenue and Forestwood Drive will reduce the channel capacity of the roadway to convey the overland flow from the major storm event. As indicated in Figure 2, all three roadways currently have insufficient channel capacity to fully contain the 1% AEP flood event. Therefore, reducing the roadway’s channel capacity through the provision of raised pedestrian crossing thresholds will result in additional depth of flooding entering The Site and neighbouring properties and will impact the required building FFLs.

As a result, alternate details for the pedestrian crossings in Deerubbin Drive, Darug Avenue and Forestwood Drive are to be adopted that satisfy the required traffic engineering aspects but do not impact the risk of overland flow flooding on adjacent properties during the 1% AEP flood event.

Please request any further information you may require.

Yours faithfully,

Woolacotts Consulting Engineers

A handwritten signature in black ink, appearing to read 'A Phillips', with a stylized, flowing script.

Alexander Phillips

BE MIEAust CPEng

NER Civil – Membership No. 4192513

Attachment 1 – Email Correspondence with Council

Attachment 2 – Flood Impact Assessment

Attachment 3 - Pre-Lodgement Advice

Alexander Phillips

From: Alexander Phillips
Sent: Wednesday, 31 March 2021 10:35 AM
To: Stephen Masters
Cc: Maughan-Wright, Anthony; Tom Hemmett; Anthony Mayo; Mitton, Jock
Subject: RE: Mulgoa Rise Public School - Local Overland Flows and Water Quality Requirements

Good morning Stephen,

Thank you for your time on the phone yesterday. As per our discussion, please see below:

1. Currently there is no two-dimensional flood model for the subdivision area. However you have drainage, catchment and Work-As-Executed plans that you will be providing to us for our review.
2. Considering the parent subdivision works, water quality modelling (using the program MUSIC) is not required for the site. However, we will provide site specific WSUD measures including rainwater reuse, litter baskets in grated inlet pits, small grassed swales and grassed buffer strips.

Regards,

Alexander Phillips | Associate Structural & Civil Engineer

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From: Alexander Phillips
Sent: Tuesday, 30 March 2021 10:29 AM
To: Stephen Masters <stephen.masters@penrith.city>
Cc: Maughan-Wright, Anthony <Anthony.MaughanWright@colliers.com>; Tom Hemmett <HemmettT@richardcrookes.com.au>; Anthony Mayo <mayoa@richardcrookes.com.au>; Mitton, Jock <Jock.Mitton@colliers.com>
Subject: Mulgoa Rise Public School - Local Overland Flows and Water Quality Requirements

Good morning Stephen,

I tired calling earlier to discuss two items raised in the Mulgoa Rise Public School Pre-DA meeting, specifically overland flow flooding and water quality requirements

1. **Overland flow flooding** – A large external catchment is directed towards the site as per the attached “External Catchment Area”. Our preliminary one-dimensional analysis indicated that both Forestwood Drive and Darug Avenue had insufficient channel capacity to fully contain the 1% AEP flood event leading to overland flow flooding travelling through the site. However, due to the size of the catchment and complexity of the road network, two dimensional flood modelling is required to accurately depict the capacity of the existing roadways. Do you have a two dimensional flood model for this area which shows that the 1% AEP flood event is fully conveyed within the road system and that the site is not affected by local overland flow flooding? And if so, could you please provide us with a copy of this model.
2. **Water Quality Requirements** – The Pre-DA meeting minutes indicate that water quality and water quantity have been provided as part of the parent subdivision works. However, it is also stated that a WSUD strategy is required for the site to address water conservation, quality and quantity. Could further guidance be

provided on the WSUD requirements for the site considering the water quality / quantity parent subdivision works.

If you require any further clarification on the above, please give me a call.

Regards,

Alexander Phillips | Associate Structural & Civil Engineer

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School Infrastructure NSW

New Primary School in Mulgoa Rise

Flood Impact Assessment

20-306 / 6 May 2021 / Revision A

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Document control

Rev	Date	Revision details	Approved	Verified	Prepared
A	06.05.21	SSDA Submission	KEC	JC	AP

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1.0 Introduction

The proposed primary school at Mulgoa Rise / Glenmore Park is a new school on a brownfield site, the site is a former quarry that has been filled to the current surface levels.

The master plan prepared for the school, contemplates a facility which can accommodate in the order of 1000 students. However, the proposed development involves the construction and operation of a new public primary school that will initially accommodate 414 students. Refer Figure 1 below for the proposed site plan.



Figure 1 Site Plan

The purpose of this report is to detail the following:

- Flood risk on-site taking into account the effects of climate change, sea level rise and an increase in rainfall intensity.
- Assess the impacts of the development, including any changes to flood risk onsite or off-site, and propose design solutions to mitigate flood risk where required.
- Two-dimensional flood modelling

2.0 Existing Conditions

The proposed primary school site ("The Site") is a brownfield site. The subject site is bounded to the north by Deerubbin Drive, to the south by Forestwood Drive, to the west by Darug Avenue and to the east by the existing Mulgoa Rise Sports Fields and on-grade carpark. The site is located within a parent subdivision, consisting of predominately low-density residential dwellings. The subject site is shown in Figure 2 below:



Figure 2 New Primary School in Mulgoa Rise Site – Aerial Image. Source: Sixmaps (2021)

The total existing site area is approximately 3 hectares based on the surveyed site boundaries. The site grades gently from a high point in the south-west corner, to a low point in the north east corner. An existing grassed batter (approximately 1V:10H) is located along the southern site boundary. Remaining gradients within the site, from the toe of the batter to the north west corner of the site, varies between 1% to 4%.

3.0 Proposed Development

The master plan prepared for the school, contemplates a facility which can accommodate in the order of 1000 students. However, the proposed development involves the construction and operation of a new public primary school that will initially accommodate 414 students.

The proposed development will facilitate a Core 21 school with 18 learning spaces, plus 2 support classes. The development will also include a school hall, library, staff facilities, and administrative areas built to Core 35, allowing capacity for future expansion. Sporting areas and playing fields will also form part of the development.

The current proposal includes the following buildings:

Building A	Administration and Library
Buildings B2 & B3	Classroom buildings
Building C	Hall and ancillary facilities

4.0 Flood Behaviour

4.1 Flood Investigation

Preliminary investigations have indicated that The Site is potentially affected by two sources of flooding: riverine flooding from the Nepean River (including its tributaries) and local overland flow flooding.

Riverine flooding occurs when heavy rainfall causes the water levels in a river to rise and escape the main channel. Local overland flow flooding is run-off that travels over the land during heavy rainfall events, affected by urban features such as stormwater infrastructure, roads, fences, walls and other structures.

4.2 Riverine Flooding

Correspondence with Penrith City Council has revealed that The Site is not flood affected by riverine flooding by the 1% Annual Exceedance Probability (AEP) design storm event. Refer to Appendix B – Council Flood Advice for further information.

4.3 Overland Flow Flooding

Preliminary site investigations indicated that a large external catchment area was directed towards The Site. Due to the sizeable frontage of The Site, in combination with the limited channel capacity of the surrounding roadways, the investigations indicated that there was potential for overland flow flooding to be directed through The Site.

Based on the above investigations, Woolacotts engaged GRC Hydro to undertake two-dimensional overland flow flood modelling of the proposed development using TufLOW analysis software. A summary of the results of this modelling is provided below:

- The TufLOW modelling has shown that The Site is subjected to overland flow flooding during the 1% Annual Exceedance Probability (AEP) storm event and Probable Maximum Flood (PMF) event. Refer Figures 3 and 4 below.
- During the 1% AEP storm event, overland flow flooding occurs in the north-western corner and eastern portion of The Site. This flooding is shallow (less than 300mm) and has a hazard classification of H1, which is the lowest level of hazard and is generally safe for people, vehicles, and buildings.
- The 1% AEP rainfall intensity was increased by 10% (in accordance with ARR2019) to account for climate change. Refer to Section 3.2 in Appendix A for further clarification. This resulted in an increase of peak water levels by 0.1 m. Based on this assessment it is concluded that the climate change scenario does not have any significant effect on flood risk at the site.
- The 1% AEP flood level impact that compared the changes in flood levels between existing and the proposed conditions is shown in Figure 5 below.

- With reference to Figure 5, the impacted areas from the proposed development include the north-western corner and the south-eastern corner of The Site. The impacts are summarised below:
 - The proposed works adjacent the north-west corner of The Site, result in less than 0.1m increase in the flood level at the Deerubbin Drive / Darug Avenue intersection. However, this increase in flood depth does not impact private property or increase the flood risk
 - The proposed car park in the south-east corner results in a localised increase in flood level. The depth of flooding at the carpark, shown on Figure 5 is relative to the existing ground level. The proposed car park level is approximately 0.3 m above existing level, which has been included in the flood modelling resulting in a net flood level at the carpark of < 0.05 m. The raised carpark level also slightly redistributes the overland flow path. This results in a newly flooded area. Because the flood levels are very shallow (<0.05 m) and located away from any buildings, there is no increase in flood risk.
- Overall, the proposed development will have no significant adverse impacts on the existing 1% AEP flood behaviour, which consists of shallow overland flow paths of H1 hazard

Refer to Appendix A for the *Overland Flow Flood Study* by GRC Hydro dated 29th April 2021 for further information on overland flow flooding.

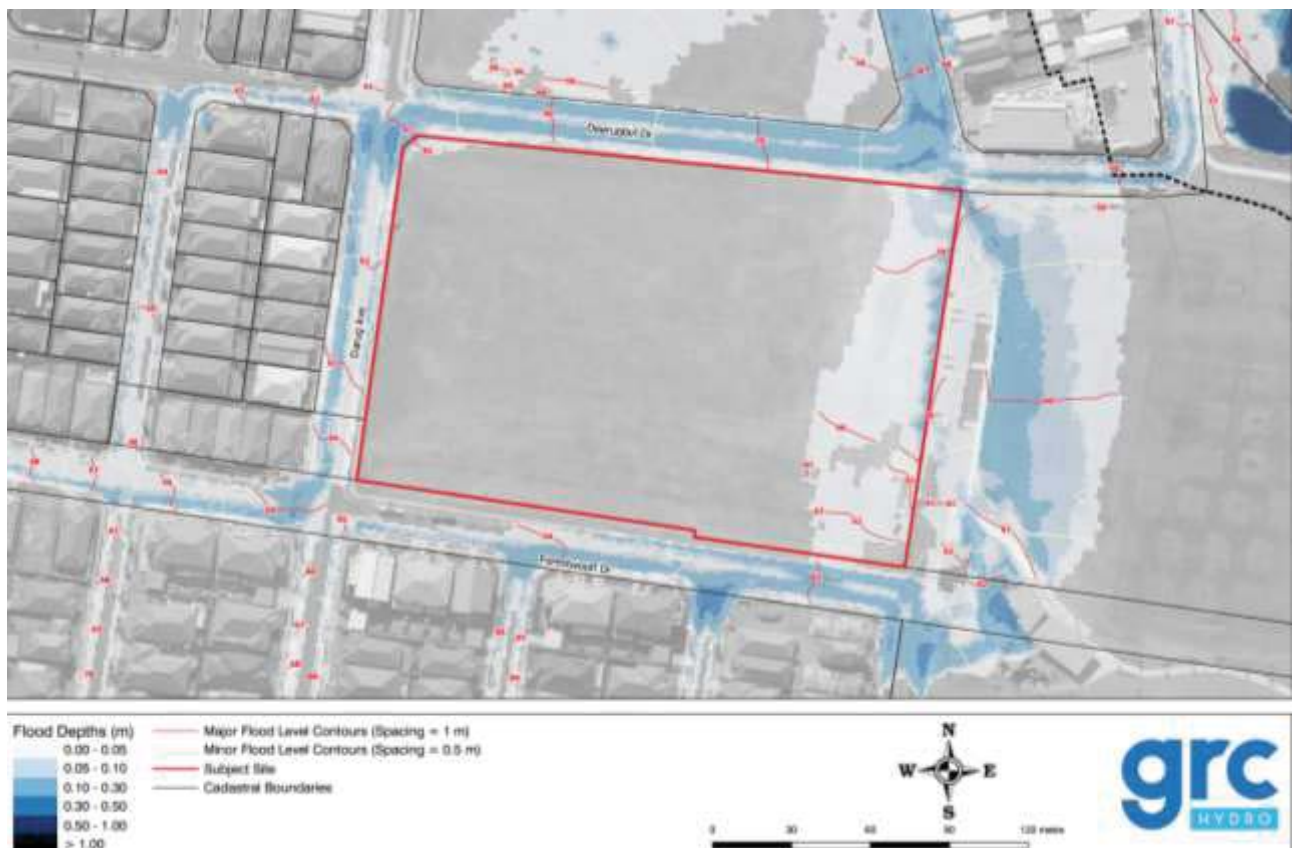


Figure 3 – 1% Pre-developed flood mapping (extract from *Overland Flow Flood Study*)

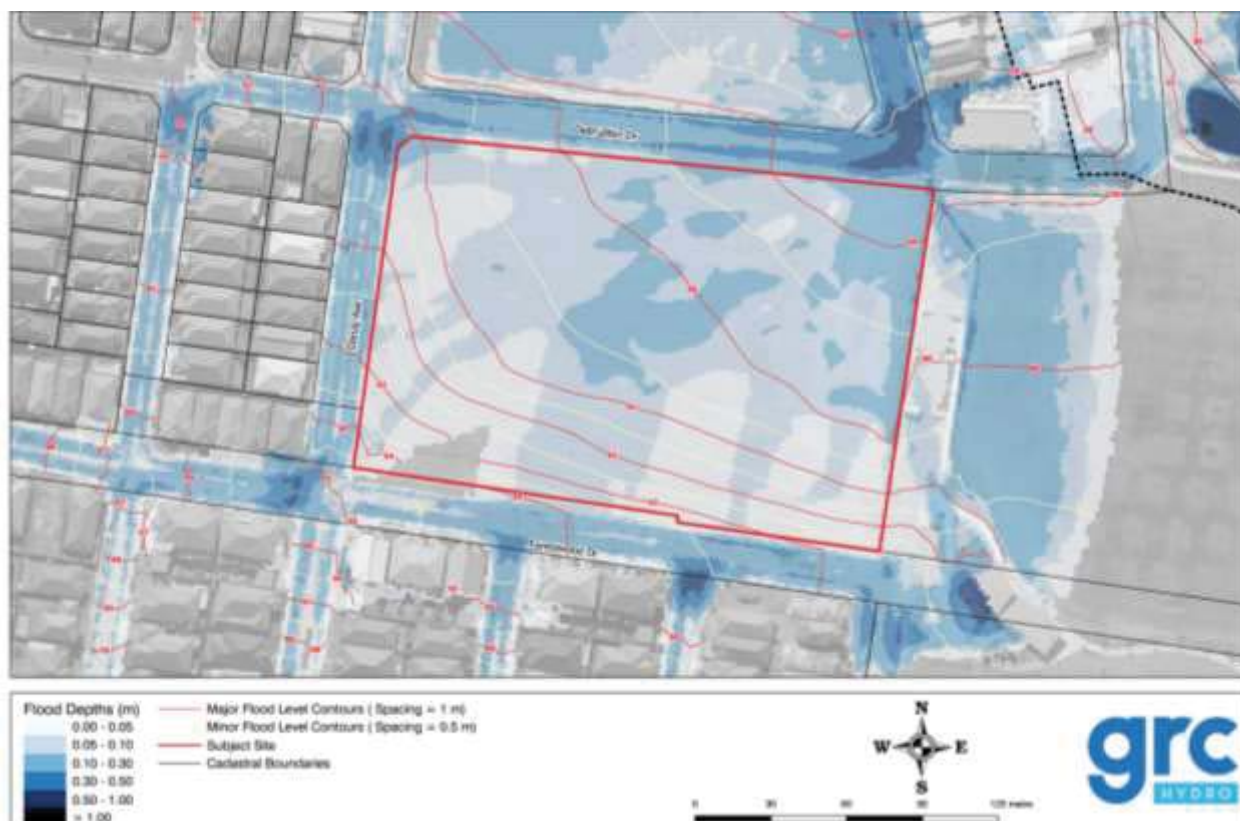


Figure 4 – PMF Pre-developed flood mapping (extract from *Overland Flow Flood Study*)

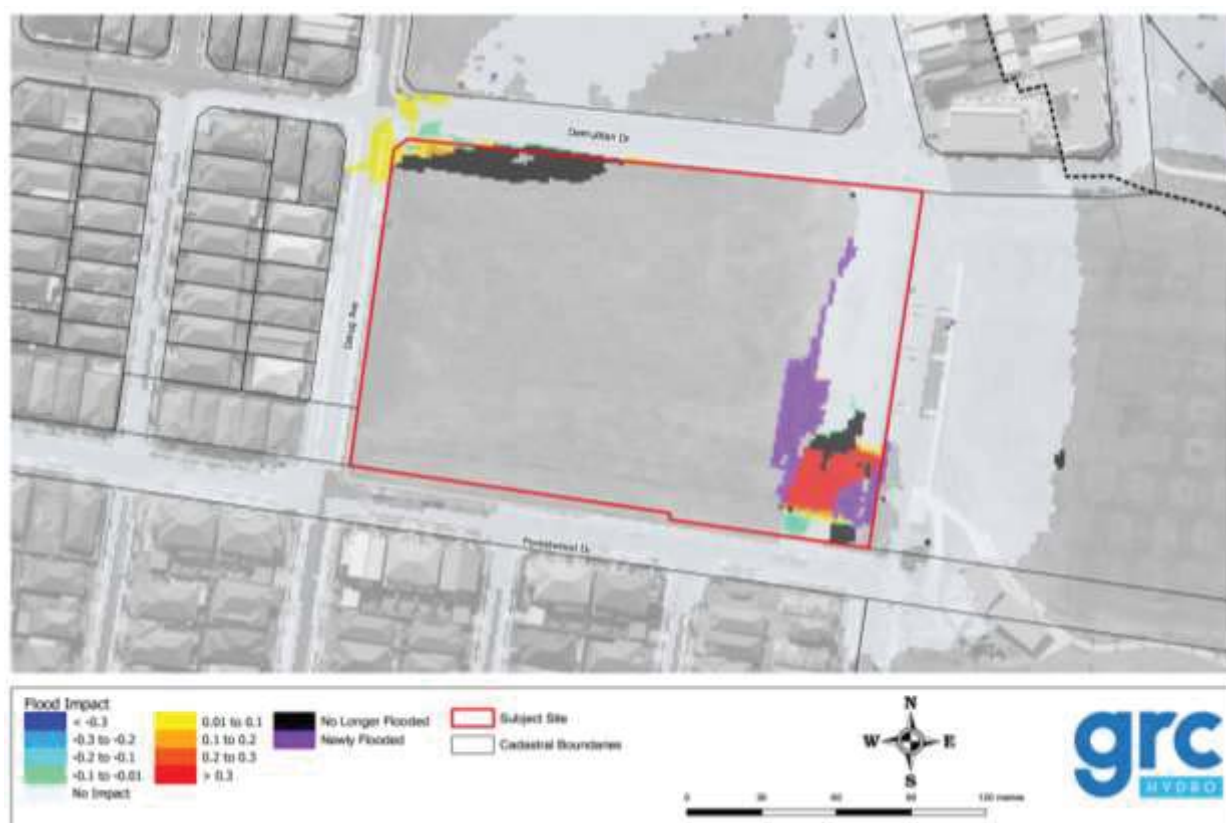


Figure 5 – 1% Post-developed flood mapping (extract from *Overland Flow Flood Study*)

5.0 Flood management and impacts

5.1 Minimum Floor Levels

According to Council requirements, the Finished Floor Levels (FFL) must be located 500mm above the 1% AEP flood level.

The overland flow flooding along Darug Avenue and Deerubbin Drive governs the FFL of Buildings (1% AEP flood level plus 500mm freeboard).

For Deerubbin Drive, the flood contours (along the northern site boundary) vary from 61.0m to 59.5m AHD. This results in a minimum FFL of 61.5m AHD for Building A, 60.9m AHD for Buildings B2 and B3, and 60.10m AHD for Building C. This is summarised in Table 1 below.

Table 1 - Minimum Floor Level Information			
Building	A	B2 and B3	C
Design flood level (1% AEP)	61.0m AHD*	60.4m AHD	59.6m AHD
Freeboard	0.5m	0.5m	0.5m
Flood Planning Level (FPL)	61.5m AHD (1% AEP + 0.5m Freeboard)	60.9m AHD (1% AEP + 0.5m Freeboard)	60.1m AHD (1% AEP + 0.5m Freeboard)
PMF Level	61.09m AHD	60.6m AHD	60.1m AHD

*Note: The 1% AEP Design Flood Level for Building A shown in Table 1 above, is along Deerubbin Drive. For Darug Avenue, the flood contours (along the western site boundary) vary from 64.5m to 61.0m AHD. To maintain an FFL of 61.5m AHD for Building A, a diversion wall is required along the northern half of the western boundary, along with a diversion embankment south of Building. Refer to the *Civil Engineering Schematic Design Report* by Woolacotts, Revision A, dated 5th May 2021 for further information.

5.2 Proposed raised thresholds / blisters

The proposed development will include a pedestrian crossings on Darug Avenue, Deerubbin Drive and Forestwood Drive adjacent the north-western corner of The Site.

The provision of raised thresholds / blisters along Darug Avenue, Deerubbin Drive and Forestwood Drive will result in additional depth of flooding entering The Site and neighbouring properties and will impact the required building FFLs.

Refer to the *Civil Engineering Schematic Design Report* by Woolacotts, Revision A, dated 5th May 2021 for further information.

5.3 Flood Response

The two main responses to a flood emergency include evacuation or Shelter in Place. Evacuation involves moving to an area that is outside the reach of floodwaters, while Shelter in Place refers to staying within the building until floodwaters have receded and it is safe to leave.

The appropriate flood response is typically provided in a Flood Emergency Response Plan. A Flood Emergency Response Plan will be undertaken by the project team prior to the completion of construction.

Appendix A

Overland Flow Flood Study

MULGOA RISE PUBLIC SCHOOL OVERLAND FLOW FLOOD STUDY





Mulgoa Rise Public School Overland Flow Flood Study

Project Number: 210009
Client: Woolacotts Consulting Engineers
Client Contact: Justin Chirillo
Report Author: Felix Taaffe and Christine Chang
Date: 29 April 2021
Verified By: Stephen Gray

Date	Version	Description
23 April 2021	1	Draft
29 April 2021	2	Final

Filepath: j:\210009\Admin\210009_Mulgoa_Rise_Public_School_Flood_Study_v01.docx

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Figure 2: Hydraulic Model Inputs

Figure 3: Flood Depths and Levels – 1% AEP

Figure 4: Flood Velocity – 1% AEP

Figure 5: Flood Hazard – 1% AEP

Figure 6: Flood Depths and Levels – PMF

Figure 7: Flood Velocity – PMF

Figure 8: Flood Hazard – PMF

Figure 9: Flood Depths and Levels (Proposed Case) – 1% AEP

Figure 10: Flood Impact- 1% AEP

EXECUTIVE SUMMARY

An overland flow flood study has been undertaken for the proposed Mulgoa Rise Public School. Small sections of the subject site are subject to shallow overland flow flooding, which passes through the north-west corner and east portion of the site.

The site's upstream catchment consists of residential blocks to the south. A hydraulic model has been developed based on TUFLOW software as well as a DRAINS hydrologic model. Flood characteristics for 1% AEP and PMF events have been assessed, as well as a climate change scenario. Peak flood depths, levels and velocities and hazard has been mapped for the site. In most flood events, the large majority of overland flow is contained in the kerb-gutter system and poses minimal risk to the site. 1% AEP flooding has H1 hazard and is not sensitive to increased rainfall intensity due to climate change. In the PMF there is shallow sheet flow across the site, also of H1 hazard.

The proposed development will raise and re-grade a portion of the site and place a car park near the site's south-east corner. The development will not significantly impact on existing flooding, with only a localised increase in two areas that does not correspond to any increase in flood risk. Based on this assessment the development is considered suitable for the site and in accordance with the SEARs requirements.

1. INTRODUCTION

This report has been prepared by GRC Hydro Pty Ltd on behalf of Woolacotts Consulting Engineers. Development of a grassed area in a new residential area of Mulgoa is proposed. The development is for the construction of Mulgoa Rise Public School and will include school buildings in the north-west corner of the site, a large open space and a car park in the south-east corner. This report assesses flooding at the site in accordance with the Secretary's Environmental Assessment Requirements (SEARs). The subject site can be affected by both riverine flooding from the Nepean River and local overland flow flooding. The current assessment only addresses overland flow flooding.

2. PROPOSED DEVELOPMENT

2.1 Site Description

The subject site is located in Mulgoa, NSW around 6 km south of Penrith. The subject site is approximately 2.9 ha and is bounded by Deerubbin Drive to the north, Forestwood Drive to the south, and Darug Avenue to the west. A carpark and grassed area is located to the east and a second grassed area is located to the north. The site is located within an area of medium density residential development.

The site slopes down from south west to east north, with an elevation range of around 64.2 mAHD at the corner of Darug Avenue and Forestwood Drive, to 58.5 mAHD at east end of Deerubbin Drive.

The site's upstream catchment has been determined as part of a hydrologic assessment and is shown on Figure 1, which shows the study area and digital elevation model (DEM). The catchment area is approximately 29 ha.

2.2 Proposed Development

The proposed school includes construction of school buildings, carparks and assembly areas, sport courts, and landscaped areas. Buildings will be located in the north-west portion of the site. The proposed development includes raising and re-grading parts of the existing site. The proposed ground surface has been provided for the purpose of this flooding assessment.

2.3 SEARs SSDA Requirements

This flood study addresses the relevant Standard Secretary's Environmental Assessment Requirements (SEARs) for the proposed development, which include the assessment of hydrologic flows, potential flooding impacts and flood hazard considerations. Peak flood level, depth, extent and flood hazard have been produced for the 1% AEP and PMF events. The current study is for the purpose of addressing SEARs requirements pertaining to overland flow only.

3. FLOODING ASSESSMENT

3.1 Model Setup

The site was previously excluded from overland flow modelling undertaken by Penrith City Council's Overland Flow Flood Overview Study (Cardno, 2006) where it was identified as being within the 1% AEP Nepean River and South Creek flood extent. However, as per the current study's brief, correspondence with Penrith City Council has revealed that the site is not flood affected by riverine flooding by the 1% AEP design storm event. A hydrologic model (DRAINS) and hydraulic model (TUFLOW) have been established by the current study to assess overland flow flooding. This software is widely used and is considered best practice under the NSW Floodplain Risk Management Program.

3.1.1 Hydrologic Model

The hydrologic model (DRAINS) consists of 38 subcatchments, delineated based on LiDAR data. The subject site including the topography are shown in Figure 1 while the subcatchments are shown in Image 1 below. The imperviousness percentage of each subcatchment was estimated from aerial imagery. The DRAINS model was then run for the 1% AEP and Probable Maximum Flood (PMF) using the ARR2019, including rainfall losses.



Image 1: DRAINS subcatchments

Critical Duration Analysis

The critical storm duration for flooding at the site was determined to be 20 minutes. As per ARR2019, ten temporal patterns per storm duration were run to determine the median and mean flow value for each duration. The results are shown in Image 2 below, which shows the critical duration (20 minutes) and temporal pattern (no. 4).

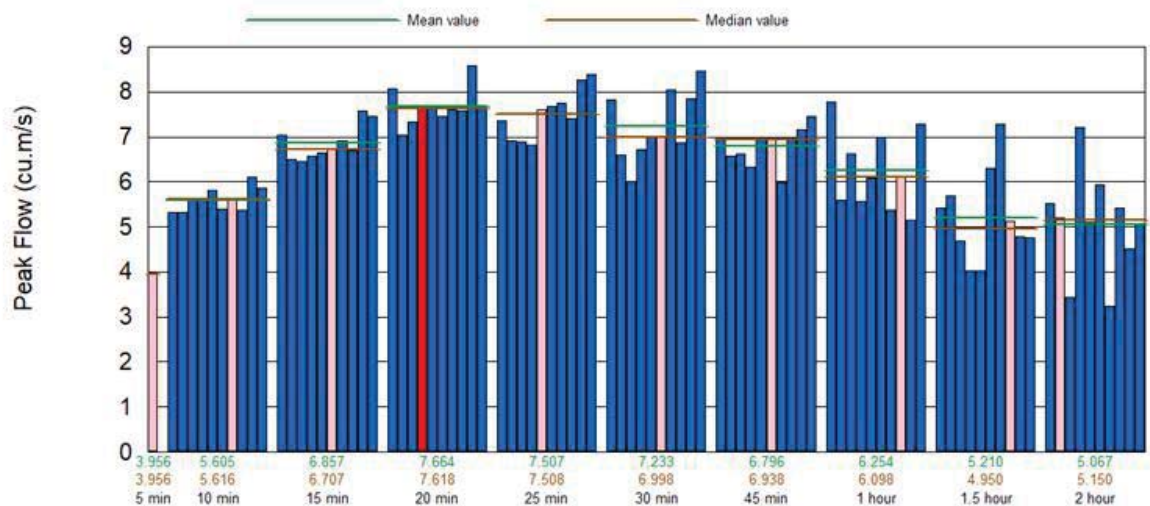


Image 2: Critical Duration Analysis Results

3.1.2 Hydraulic Model

The hydraulic model was based on TUFLOW software. The model extent and input layers are shown on Figure 2. The model input data and parameters are as follows:

- Topographic data: LiDAR data has been supplied by the Department of Education and also compared to data downloaded from the NSW LPI website (date: 2019). LiDAR was then used to develop a 1 m x 1 m DEM.
- Hydraulic roughness (Manning's 'n') based on surface types, including:
 - o Grassed areas: 0.04
 - o Roads and urban areas: 0.025
- Model inflows: Inflows hydrographs from DRAINS were applied on the downstream corner of each urban block
- Downstream boundary: fixed tailwater downstream boundary approximately 200 m downstream of the site
- Buildings have been modelled as impermeable obstructions.
- Kerb and gutter system and road crests were included as breaklines in the model, based on LiDAR data and the estimated gutter depth.

Model Validation

In the absence of calibration data for the site's catchment, the hydraulic model results were validated based on a review of the unit flow rate for the 1% AEP event. The unit flow rate is calculated as the 1% AEP peak flow, divided by the catchment size, to give a flow rate per hectare. GRC Hydro have

estimated unit flow rates for many catchments across Sydney and find that values are consistently in the 0.1-0.4 m³/s per hectare range, for overland flow catchments.

The model results gave a peak 1% AEP flow of 6.75 m³/s from a 29 ha catchment, or a unit flow rate of 0.23 m³/s per hectare. This values fall within the expected range and give a strong indication that the hydrologic and hydraulic model results are accurate and reliable.

3.2 Existing Flood Behaviour

Hydraulic model results are presented in the following section, which include the assessment of hydrologic flows, potential flooding impacts and flood hazard considerations. Peak flood level, depth, extent and flood hazard have been produced for the 1% AEP and PMF events.

These are presented in Figure 3 to Figure 8, as follows:

- Figure 3: Existing Flood Depths and Levels- 1% AEP;
- Figure 4: Existing Flood Velocity- 1% AEP;
- Figure 5: Existing Flood Hazard- 1% AEP;
- Figure 6: Existing Flood Depths and Levels- PMF;
- Figure 7: Existing Flood Velocity- PMF;
- Figure 8: Existing Flood Hazard- PMF;

Flood hazard mapping has been developed through application of ARR2019 and Australian Emergency Management Institute (AEMI) flood hazard guidelines. The guidelines consider the threat to people, vehicles and buildings based on flood depth and velocity at a specific location. The AEMI flood hazard mapping can be used to assess the flood hazard for site occupants and proposed site usage, as well as for the community surrounding the site. The hazard categories are shown in Chart 1 below.

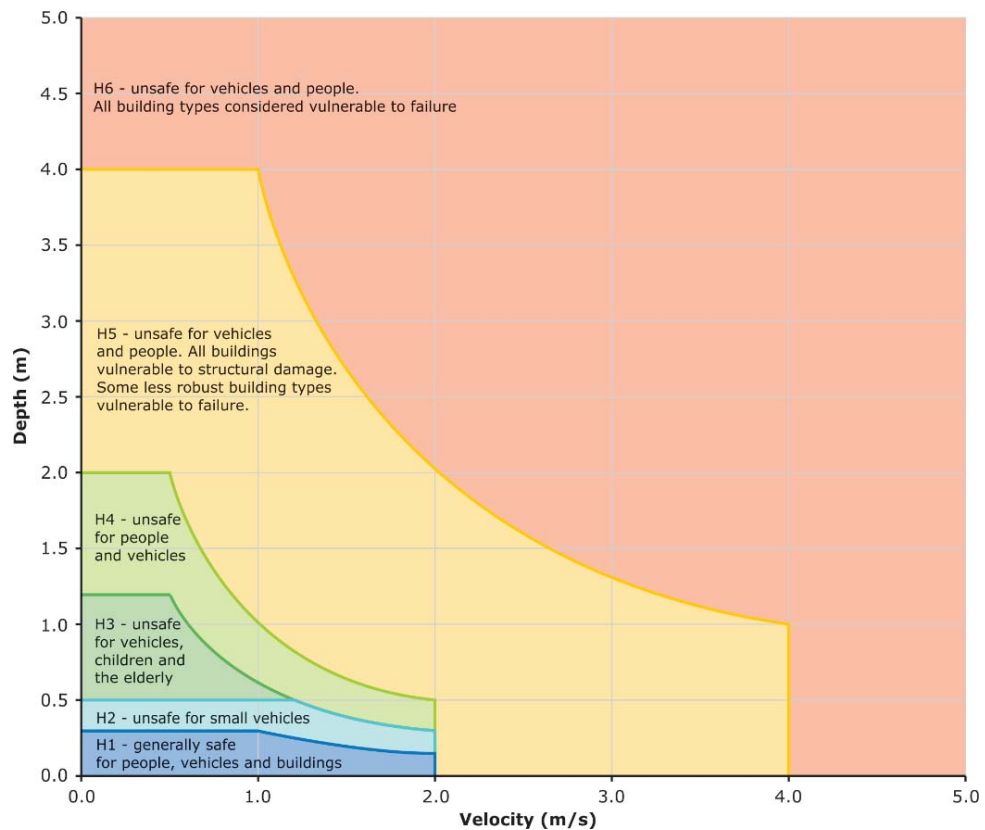


Chart 1: Flood Hazard Curves (Australian Emergency Management Handbook 7)

The results show there are two shallow overland flowpaths that affect the subject site in the 1% AEP event. These are:

1. Overland flow that arrives at the corner of Darug Avenue and Forestwood Drive then continues north down Darug Avenue. The flow is largely contained in the roadway with depths of less than 0.1 m across most of the road, and flow of 0.1-0.3 m in the gutter. After it turns east onto Deerubbin Drive there is a depth of less than 0.1 m that extends onto the corner of the subject site.
2. Overland flow that arrives at Forestwood Drive south of the site flows east and is mostly contained in the kerb-gutter system, preventing flow onto the site, until a shallow flow of less than 0.1 m spills onto the south-east corner of the site and flows north.

The large majority of the site is not flood-affected by overland flow flooding in a 1% AEP event. There is a corresponding low level of hazard with only H1 hazard on the site in the 1% AEP event.

In the PMF the entire site is flood-affected with broad sheet flow of around 0.1 m depth (some areas are slightly deeper at 0.1-0.3 m). The PMF hazard is H1 across the site.

Climate Change Assessment

The 1% AEP rainfall intensity was increased by 10% to account for potential increases in rainfall intensity associated with climate change. The procedures outlined in Book 1, Chapter 6 of ARR2019 were applied with the following parameters/assumptions; East Coast South Cluster, medium consequence risk rating, RCP4.5, 2090 planning horizon.

The augmented inflows to the hydraulic model (TUFLOW) translate to a general increase of peak water levels by 0.01 m or less. Based on this assessment it is concluded that the small size of the site's catchment means the climate change scenario does not have any significant effect on flood risk at the site.

3.3 Assessment of Proposed Development

The proposed development is located in an area that is largely unaffected in most flood events but experiences shallow overland flooding on the east boundary and the north-west corner. To assess the suitability of the development with regard to overland flow, the proposed design was schematised in the hydraulic model as a 'proposed' case. This was then used to assess flood risk to the site itself, and secondly, impact on the existing flood behaviour established in the previous section.

The model 'proposed' case was based on the design drawings and 3D TIN provided by Woolacotts and shown in Image 3. The proposed case in the hydraulic model consisted of incorporation of the proposed landform into the TUFLOW model grid. No stormwater drainage for overland flow is proposed as part of the development.

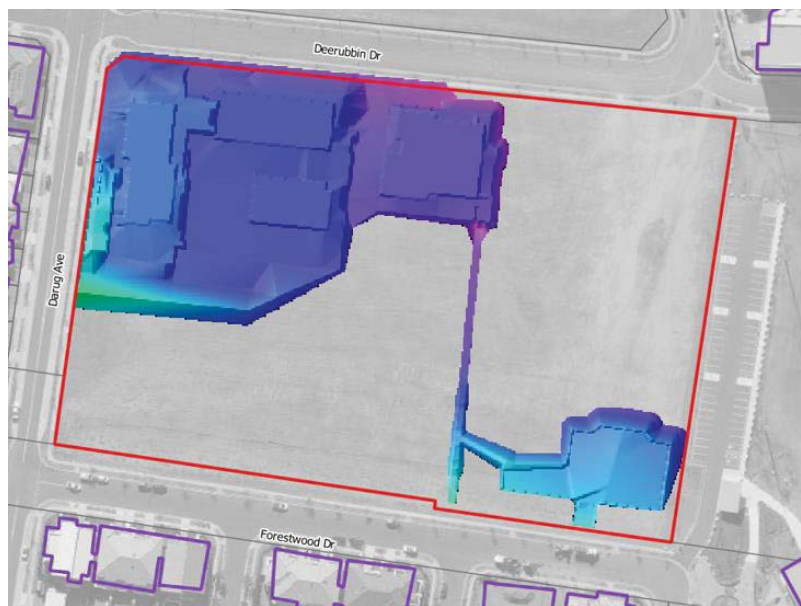


Image 3: Overview of modified area of the site

The 1% AEP flood level impact that compared the changes in flood levels between existing and proposed conditions. Figure 9 shows the 1% AEP depth and level under the proposed case while Figure 10 shows the flood impact. As can be seen on the impact figure, the following impacts occur as a result of the development:

- The raised area near the north-west corner results in marginally higher flooding at the intersection of Deerubbin Drive and Darug Avenue. The impact is less than 0.1 m and there is no impact on private property. There is no increase in flood risk associated with the slight increase in peak level.

- The raised area for the car park in the south-east corner results in a localised increase in flood level. The car park itself raises the flood level (i.e. the flood depths are not higher) by 0.3 m and slightly redistributes the overland flow path. This results in a newly flooded area. Given it is very shallow (<0.05 m) and located away from any buildings, there is no increase in flood risk.

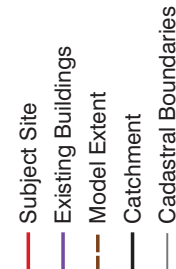
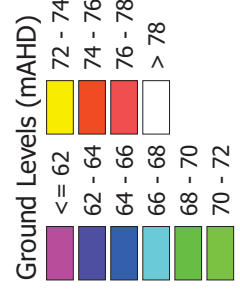
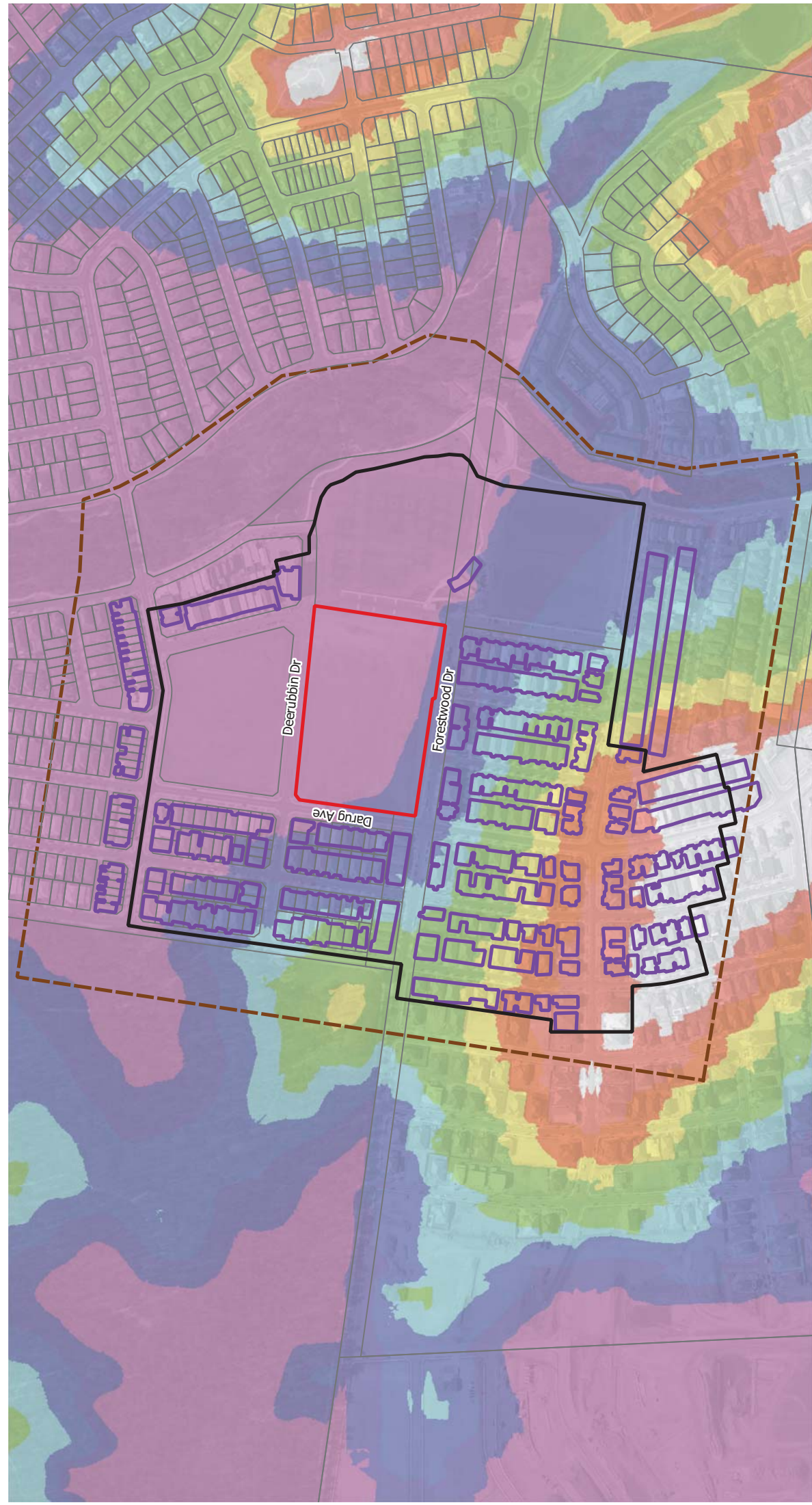
Overall, the proposed development will have no significant adverse impacts on the existing 1% AEP flood behaviour, which consists of shallow overland flowpaths of H1 hazard.

4. CONCLUSIONS

An overland flow flood study has been undertaken for the proposed Mulgoa Rise Public School. Small sections of the subject site are subject to shallow overland flow flooding, which passes through the north-west corner and east portion of the site.

The site's upstream catchment consists of residential blocks to the south. A hydraulic model has been developed based on TUFLOW software as well as a DRAINS hydrologic model. Flood characteristics for 1% AEP and PMF events have been assessed, as well as a climate change scenario. Peak flood depths, levels and velocities and hazard has been mapped for the site. In most flood events, the large majority of overland flow is contained in the kerb-gutter system and poses minimal risk to the site. 1% AEP flooding has H1 hazard and is not sensitive to increased rainfall intensity due to climate change. In the PMF there is shallow sheet flow across the site, also of H1 hazard.

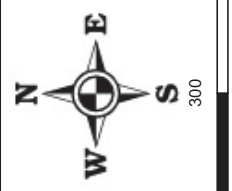
The proposed development will raise and re-grade a portion of the site and place a car park near the site's south-east corner. The development will not significantly impact on existing flooding, with only a localised increase in two areas that does not correspond to any increase in flood risk. Based on this assessment the development is considered suitable for the site and in accordance with the SEARs requirements.



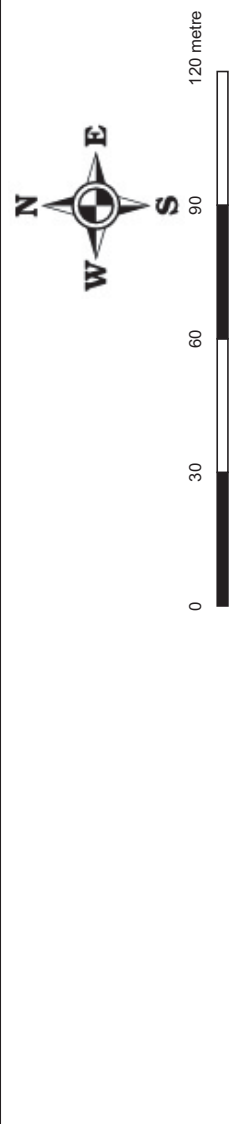
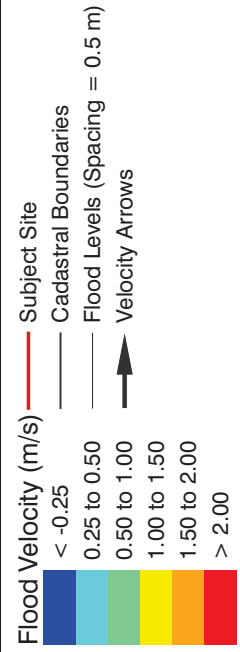
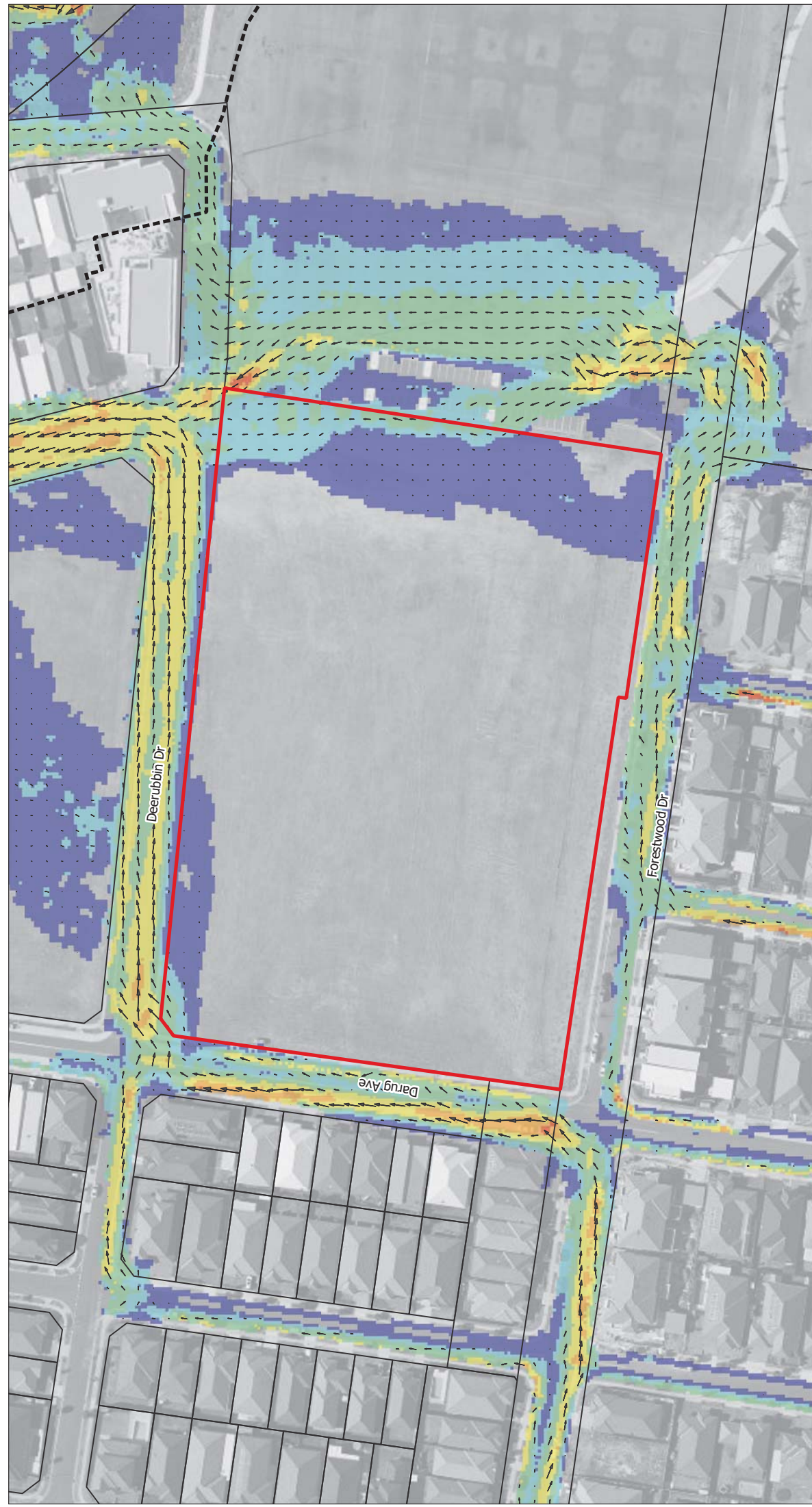
TITLE: Study Area and DEM	PROJECT: Mulgoa Rise Public School	PROJECT No. 210009	DATE: 04-2021	SCALE: 1:4000	FIGURE No. 01
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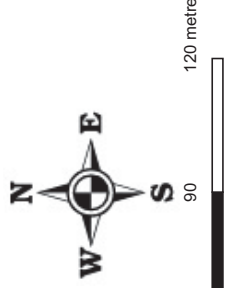
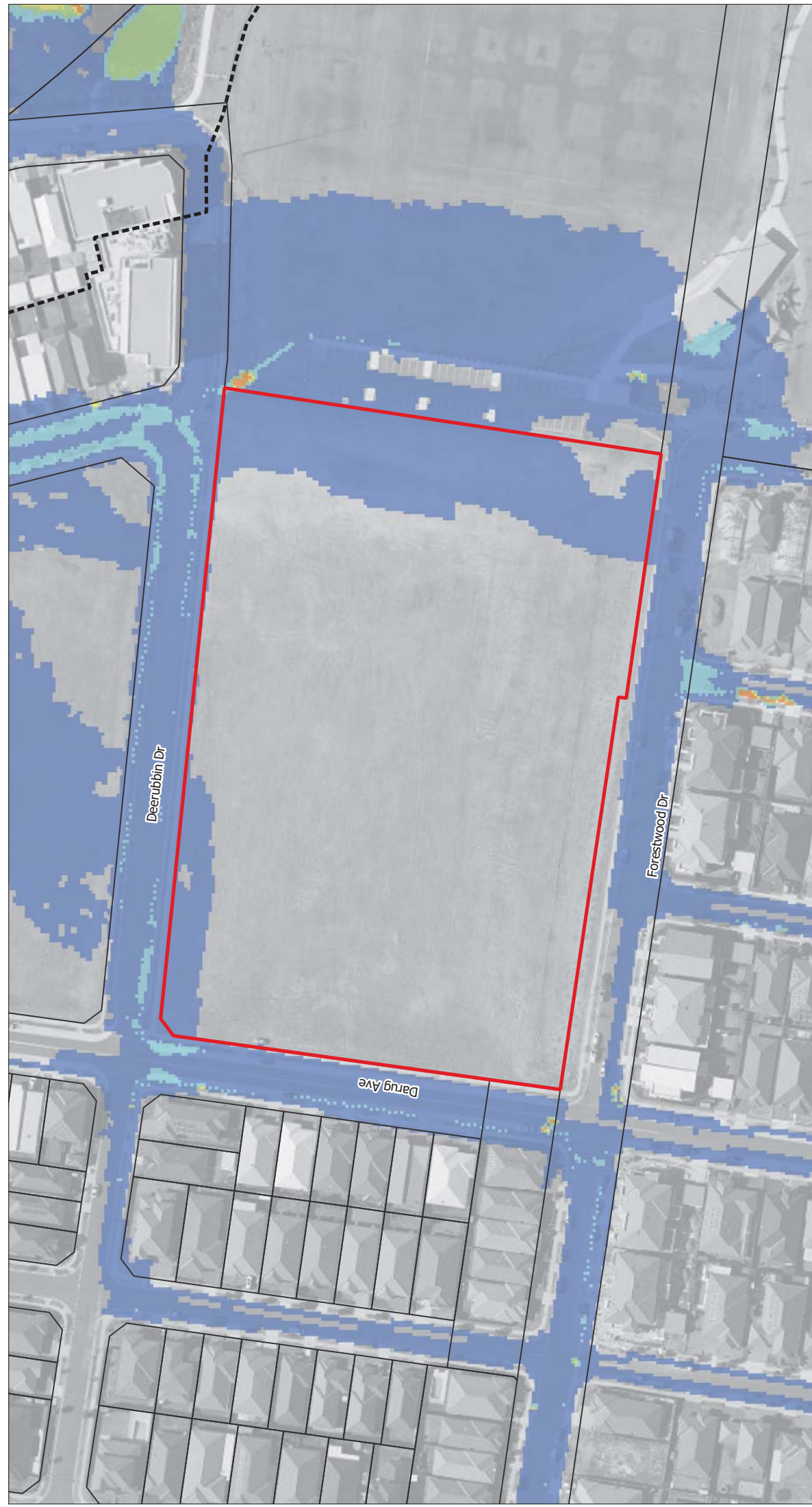
- | | |
|---|--|
|  Inflow Locations |  Catchment |
|  Rural (Mannings Value = 0.04) |  Cadastral Boundaries |
|  Existing Buildings |  Downstream Boundary |
|  Proposed New Structures |  Road Crests |
|  Subject Site |  Road kerbs |
|  Model Extent | |



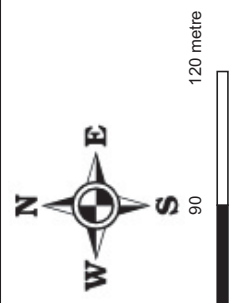
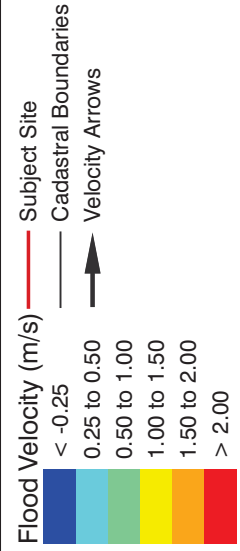
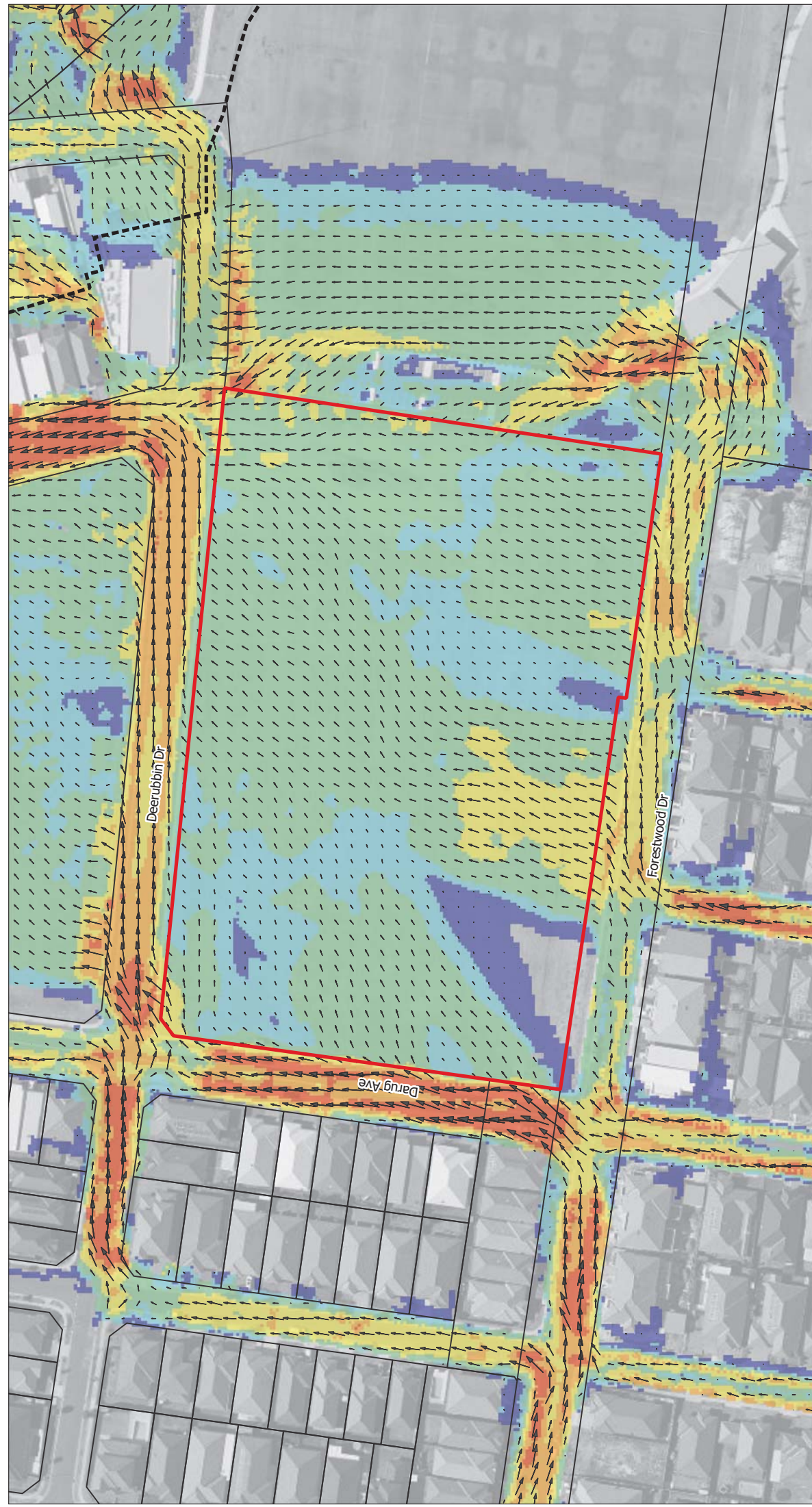
TITLE: Hydraulic Model Inputs- Existing Conditions	PROJECT: Mulgoa Rise Public School Flood Study	PROJECT No. 210009	DATE: 04-2021	SCALE: 1:4000	FIGURE No. 02
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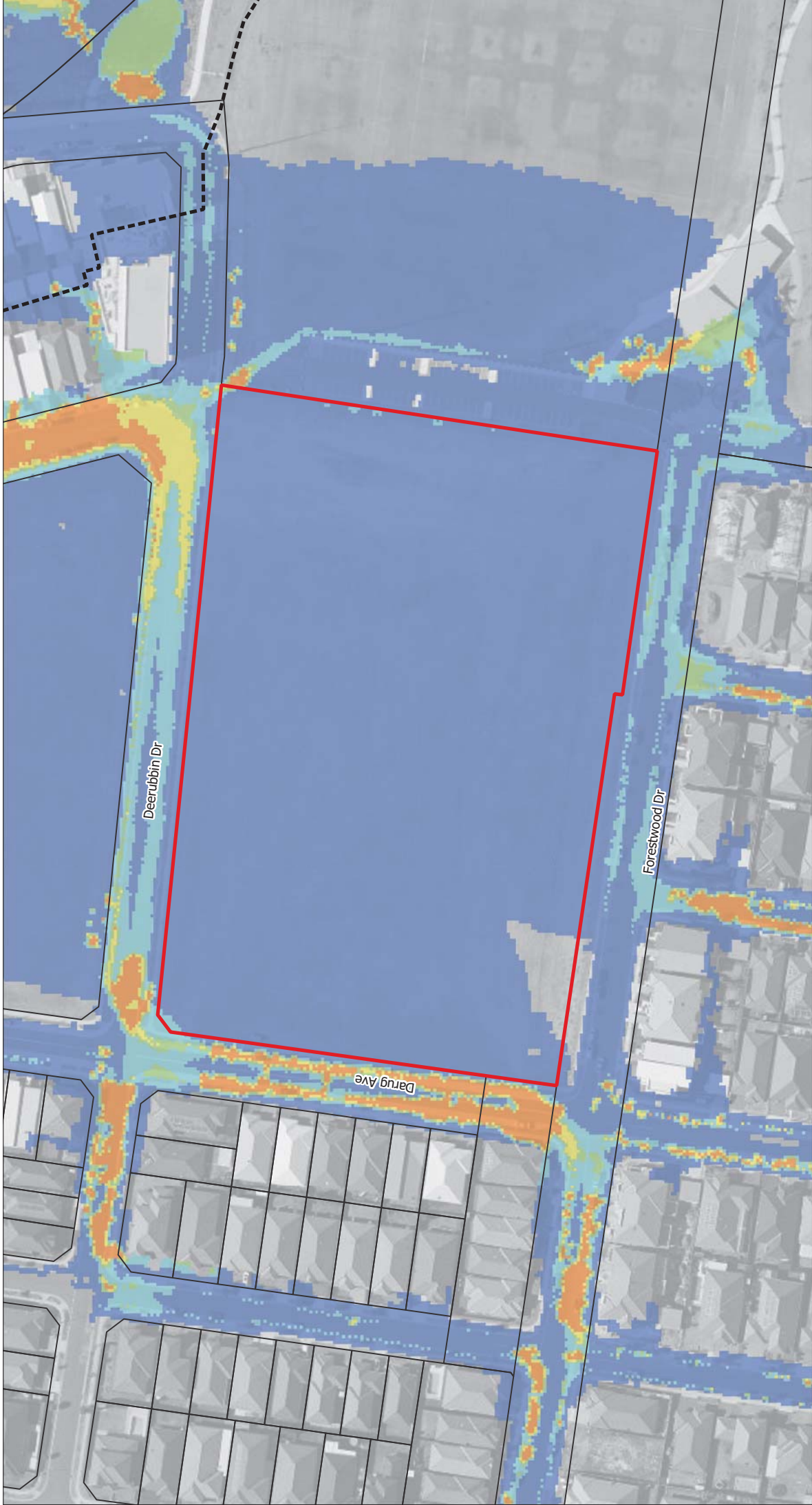
TITLE: Existing Flood Velocity - 1% AEP	PROJECT: Mulgoa Rise Public School Flood Study	PROJECT No. 210010	DATE: 04-2021	SCALE: 1:1200	FIGURE No. 04
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TITLE: Existing Flood Hazard - 1% AEP	PROJECT: Mulgoa Rise Public School Flood Study	PROJECT No. 210010	DATE: 04-2021	SCALE: 1:1200	FIGURE No. 05
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TITLE: Existing Flood Velocity - PMF	PROJECT: Mulgoa Rise Public School Flood Study	PROJECT No. 210010	DATE: 04-2021	SCALE: 1:1200	FIGURE No. 07
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Flood Hazard (ZAEM1)

H1

H2

H3

H4

H5

H6

Subject Site

Cadastral Boundaries

N

W

E

S

0

30

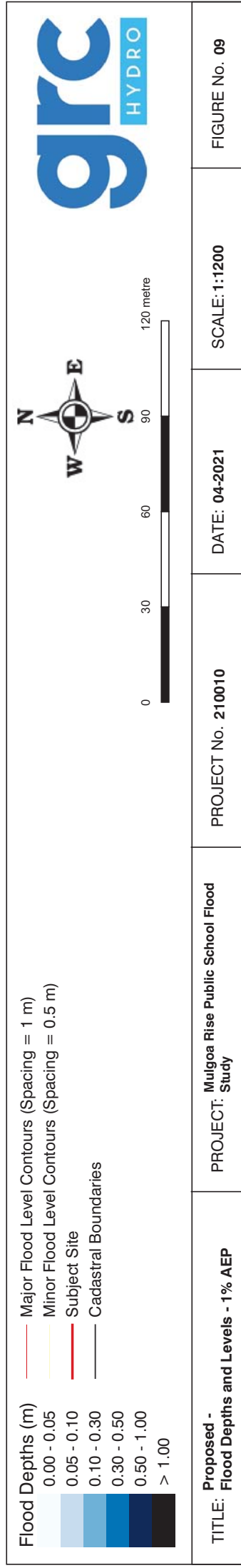
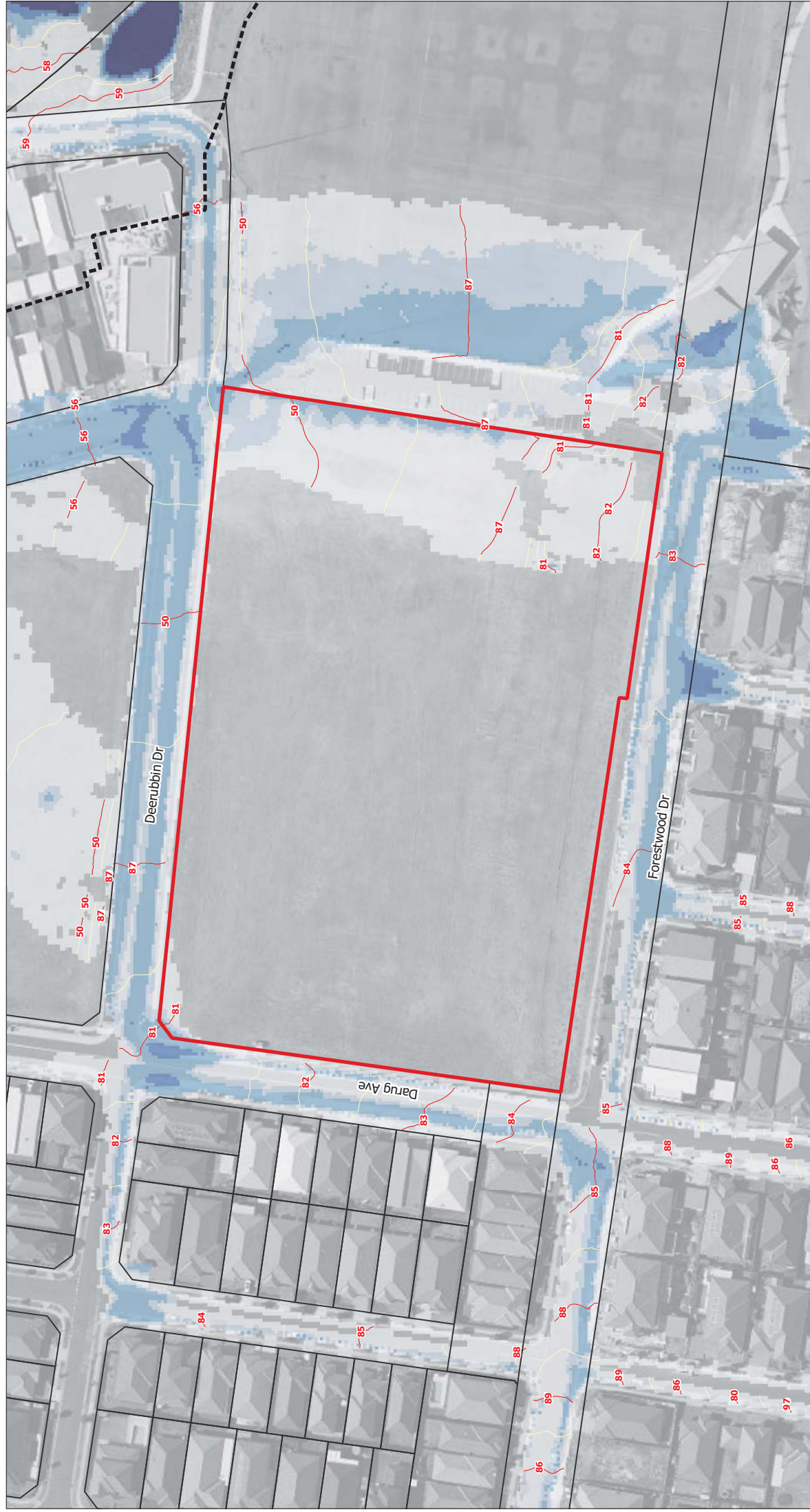
60

90

120 metre



TITLE: Existing Flood Hazard - PMF	PROJECT: Mulgoa Rise Public School Flood Study	PROJECT No. 210010	DATE: 04-2021	SCALE: 1:1208	FIGURE No. 08
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Appendix B

Council Flood Advice

Alexander Phillips

From: Caleb O'Reilly <Caleb.O'Reilly@penrith.city>
Sent: Thursday, 21 January 2021 12:11 PM
To: Alexander Phillips
Cc: Justin Chirillo
Subject: Engineering Advice - 1-23 Forestwood Drive, Glenmore Park (Lot 1663 DP 1166869) - Flood Advice
Attachments: Penrith_Overland_Flow_Overview_Study Exclusion.pdf

Hi Alex,

As discussed over the phone, 1-23 Forestwood Drive, Glenmore Park (Lot 1663 DP 1166869) is not currently identified as flood effected by the 1% AEP design storm event. This information is based on data available to Council on the date of this email and may change in the future if new information becomes available.

If you have any further questions feel free to contact me.

Kind Regards,

Caleb O'Reilly
Trainee Engineer

E Caleb.O'Reilly@penrith.city
T +61 2 4732 7928 | F | M
PO Box 60, PENRITH NSW 2751
www.visitpenrith.com.au
www.penrithcity.nsw.gov.au



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From: Alexander Phillips <aphillips@woolacotts.com.au>
Sent: Thursday, 21 January 2021 9:40 AM
To: Caleb O'Reilly <Caleb.O'Reilly@penrith.city>
Cc: Justin Chirillo <JChirillo@woolacotts.com.au>
Subject: 1-23 Forestwood Dr, Glenmore Park - Flood Query

EXTERNAL EMAIL: This email was received from outside the organisation. Use caution when clicking any links or opening attachments.

Hi Caleb,

I am currently working on the civil concept design for a Department of Education development at 1-23 Forestwood Drive, Glenmore Park and had a question regarding flooding.

Woolacotts have been unable to locate a Flood Study which includes The Site area. Has a separate flood study been prepared for the southern end of Glenmore Park where The Site is located?

The Site area is currently excluded from the Penrith Overland Flow Study by Cardno (2006), as seen in the attached extract. Additionally, further investigation has shown that The Site area has also not been covered by the following flood studies:

- Nepean River Flood Study – Final Report by Advisian, dated November 2018
- South Creek Floodplain Risk Management Study by Advisian, dated August 2019 (Exhibition Draft)
- Peach Tree and Lower Surveyors Creek Flood Study - Final Report by Catchment Simulation Solutions, dated April 2019
 - Although the Site area is included in the catchment map

Please advise if you have any additional information that may assist, thanks.

Regards,

Alexander Phillips | Associate Structural & Civil Engineer

WOOLACOTTS CONSULTING ENGINEERS

T +61 2 8203 1519 | M

www.woolacotts.com.au

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Our Ref: PL21/0017
Contact: Gavin Cherry
Telephone: (02) 4732 8125

25 March 2021

RPS Group
Level 9 , No. 17 York Street
SYDNEY NSW 2000

Attention: Anthony Maughan-Wright

Dear Mr Maughan-Wright,

Pre-lodgement Advice
Proposed Development: State Significant Development - Mulgoa Rise
Public School
Lot 1663 DP 1166869 , Address 60-78 Deerubbin Drive GLENMORE
PARK NSW 2745

Thank you for engaging with Council on 25 March 2021 to outline a proposed state significant development proposal for the above matter. The meeting was useful for Council in gaining an understanding of your proposal and allows for Council to advise on key consideration and submission documentation that should inform and accompany the proposed state significant development application.

The proposal is considered to provide positive educational opportunities for the local community and the design rationale and positioning of the development form on the site is generally supported.

These notes outline key matters for consideration in the finalisation of the design package and should inform the preparation of application documentation for lodgement with the Department.

If we can help you any further regarding the attached advice, please feel free to contact me on (02) 4732 8125.

Yours sincerely

Gavin Cherry
Development Assessment Coordinator

Penrith City Council
PO Box 60, Penrith
NSW 2751 Australia
T 4732 7777
F 4732 7958
penrithcity.nsw.gov.au

PRE-LODGE MENT ADVICE

Proposal State Significant Development - Mulgoa Rise Public School

Address Lot 1663 DP 1166869

60-78 Deerubbin Drive GLENMORE PARK NSW 2745

Attendees:

Proponent

Matthew Metlege- Schools Infrastructure NSW

Jack Bruderlin - Schools Infrastructure NSW

Anthony Maughan-Wright – Colliers

Jock Mitton - Colliers

Shaun Smith - RPS

Carmit HarnikSaar - NBRS

Parisa Ettehad - NBRS

Kasia Balsam - PTS

Andrew Morse – PTC

Penrith City Council

Gavin Cherry– Development Assessment Coordinator

Abby Younan – Planning Administration Officer

Joshua Romeo – Senior Waste Planning Officer

Craig Squires – Building Certification and Fire Safety Coordinator

Stephen Masters – Senior Development Engineer

Daniel Davidson – Senior Traffic Engineer

Michael Middleton – Team Leader Environmental Health

Matters Identified for Address in the Preparation of the SSD Application

INITIAL STEPS

- As outlined within the body of these notes, there was a suggestion during the meeting that the indicated extent of overland flow and flooding affectation may not be as significant as diagrammatically reflected within the concept plans prepared. This is a critical aspect to investigate and clarify with Council's Development Engineers, as the outcome of these discussions may alter spatial restrictions on the site as well as flood planning level requirements which in turn affects finished floor levels. It is strongly encouraged that engagement directly with Council's Development Engineers

be pursued in the first instance, to verify if the current spatial arrangement or level differences across the site can or should be refined.

- Following clarification on overland and flooding, address of the traffic and parking matters is suggested. The concept plans require realignment of kerb lines for accessible drop off / pick up as well as pedestrian crossings, line marking and sign posting. It is recommended that in principle support for the road works and parking arrangements be discussed and secured with Council's Traffic Engineers and Development Engineers in the progression of the SSD documentation, so as to ensure that no complications will arise during later stages of the development including Section 138 Roads Act applications and engagement with the Local Traffic Committee.
- Following clarification on overland and flooding, an opportunity review developed landscape plans would be appreciated as the setback zones to the public road network and the resulting streetscape outcomes will be a key consideration for Council when the SSD application is lodged. This includes planting densities and pot sizes, selected species, fencing, lighting and any irrigation measures proposed.
- The outcome of the State Governments Design Review Panel process should be outlined to Council to confirm if there are any implications to the design or arrangement of the built form that has broader implications on other considerations applicable to the development.

ENGINEERING MATTERS:

General Considerations

- Council's engineering requirements for development, including policies and specifications listed herein, can be located on Council's website at the following link:
<https://www.penrithcity.nsw.gov.au/Building-and-Development/Development-Applications/Engineering-requirements-for-developments/>
- All engineering works must be designed and constructed in accordance with Council's *Design Guidelines for Engineering Works for Subdivisions and Developments* and Council's *Engineering Construction Specification for Civil Works*.

Stormwater Management

- Stormwater drainage for the site must be in accordance with the following:
 - o Council's Development Control Plan,
 - o *Stormwater Drainage Specification for Building Developments* policy, and
 - o *Water Sensitive Urban Design Policy and Technical Guidelines*.
- A stormwater concept plan, accompanied by a supporting report and calculations, should be submitted with the application to the Department.

- Stormwater from the site is to be discharged into the drainage system within Deerubbin Drive along the northern boundary of the site. During construction of the subdivision, stub pipe connections were constructed to inside the property boundary to allow for future connection of stormwater. Please refer to an extract of the approved Construction Certificate plans (Ref: CCX11/0033) at the end of these notes, depicting the design catchment along with an extract of the Works as Executed plans showing the available connections at pits 1/8A, 1/9A, 1/10A & 1/11A.
- Water quality and water quantity treatment systems have been previously provided as part of the parent subdivision works. Pending capacity of the existing street drainage systems, On-site Stormwater Detention (OSD) is not required for the site
- A water sensitive urban design strategy prepared by a suitably qualified person is to be provided for the site. The strategy shall address water conservation, water quality, water quantity, and operation and maintenance. The strategy should demonstrate compliance with Council's Water Sensitive Urban Design Policy and Technical Guideline and include any Music Modelling (SQZ files).
- A sediment and erosion control plan shall be submitted with the application. Adequate sediment and erosion control measures shall be provided to prevent sediment loads entering the bio-retention basins within the Glenmore Park Riparian Corridor which are already online.

Local Overland Flows

- It is noted that submitted plans show the lot is impacted by local overland flow flooding requiring provision of 0.5m freeboard to floor levels of buildings. Council's records indicate that the lot is not impacted by any local overland flows and is not coded as being affected by local overland flow flooding. Generally, when a residential subdivision is approved, local overland flows from the catchment are designed to be conveyed within the road system in a safe and acceptable manor and not through private lots unless an easement for drainage is provided to allow for the passage of overland flows through such lots.

It is suggested that the Hydraulic Engineer make contact with Council to ensure all available information from adjoining subdivisions was utilised when undertaking the flood study. Council will be able to provide scanned PDF plans of the adjoining subdivisions including drainage catchment plans and hydraulic calculations. Please contact the following representative from Council's Engineering Services Department to obtain any additional information:

Stephen Masters
Senior Engineer Major Developments
M 0423781518
E stephen.masters@penrith.city

Roadworks

- Any works within the road reserve will require a separate Section 138 Roads Act approval from Penrith City Council as the Roads Authority under the Roads Act. A Section 138 Roads Act application shall be made to Penrith City Council for the raised pedestrian thresholds, modifications to any kerb & gutter or stormwater pits, vehicular crossings, and lead in public utility services. Any application for a Roads Act approval shall include detailed engineering plans that address the following requirements:
 - o The design of the raised pedestrian crossing thresholds in Deerubbin Drive and in Darug Avenue shall not have any adverse impact upon the street drainage system nor any overland flow paths that may be conveyed within the street system.
 - o The raised pedestrian crossing threshold in Darug Avenue shall not conflict with the existing kerb inlet pits and lintels, nor have any adverse impact upon inlet capacity.
 - o It is noted that the development proposes to widen the existing car parking bays along the frontage of Darug Avenue to accommodate an on-street accessible parking pick-up / drop off bay. It is Council's preference that any accessible parking drop off areas be provided on-site. If the accessible parking bays are to be provided on the street, then the bays shall comply with AS2890.6, requiring widening of the existing parking bay by approximately 0.7m resulting in the loss of street trees. It is Council's preference that the verge area be widened by 0.7m so as street trees can be incorporated into the street scape. Having compensatory plantings within the school grounds, that will be located behind a large palisade fence, will detract from the streetscape.
 - o Any kerb extension / blister treatment / raised threshold treatment in Darug Avenue shall include vehicular turn paths for all turning movements for a 12.5m Heavy Rigid Vehicle at the intersection with Deerubbin Drive.
 - o Details of any pedestrian fencing are to be included.
 - o The proposed bus bay may impede pedestrian sight lines at the raised pedestrian crossing threshold when a bus is stationary in the bus bay. Pedestrian and vehicular sight distances at the raised crossing are to be assessed and shall include assessment of a bus parked within the bus bay.
 - o Details of the existing bus stop and boarding point are to be included. If the bus boarding point is to be relocated, the applicant shall contact Busways to seek approval.

- o Details of regulatory 'No Stopping' zones for the raised pedestrian crossing threshold are to be included.
- o Any signage and line marking within the public road will require approval from Council's Local Traffic Committee.
- o Any driveways / vehicular crossings shall be located a minimum of 1m from any lintel of a kerb inlet pit and a minimum of 1m from any public utility service lids/covers.
- o Bus shelters shall be provided at the existing bus stops on Darug Avenue south of Deerubbin Drive as part of the development.

Street Lighting

- Any raised pedestrian threshold and associated marked crossings are to be lit in accordance with Australian Standards.

Earthworks

- No retaining walls or filling is permitted for this development which will impede, divert or concentrate stormwater runoff passing through the site.

TRAFFIC MANAGEMENT AND PARKING:

- A Signage and Line marking Plan is required to be included with SSD materials submitted and would likely include Bus Zone signage, No Parking signage (for kiss & ride), any unrestricted parking fronting site (rationale, if none, to be included in traffic report).
- The approved location of the Derrubbin Drive crossing as approved within Development Consent No. DA19/0348 should be verified and reflected within the plans as progressed. Information relating to this DA is available on the State Governments Sydney Western City Planning Panel website or Council's DA Tracker. Refer to Condition 79 within the SWCPP Assessment Report

<https://www.planningportal.nsw.gov.au/planning-panel/mixed-use-development-5>

The design of this crossing should be a raised threshold (wombat) crossing as depicted in plans presented during the meeting.

- Regarding the Darug Ave proposed pedestrian crossing point, Council recommends that the proponent undertake community consultation.
- The proposal must also ensure that proposed kerbside blister islands do not unduly impact the effective operation of existing kerb inlet pits.

- Pedestrian fencing adjacent to crossings (to corral peds to crossing point) would be appropriate and should be included on plans.
- During the meeting it was suggested that a reliance on Council's car parking may be investigated however as outlined during the meeting, it was considered from a planning and traffic perspective that any development (even a school) should provide sufficient onsite parking to cater for staffing needs without reliance on an adjacent car park which is provided for the community in support of recreational use of adjacent lands. This suggestion would also likely exacerbate on-street congestion resulting in greater competition for available on-street car parking spaces.
- Council requests a detailed Traffic Report be provided for assessment purposes, even though Council is not the determining authority, as it will assist Council in planning appropriate signage and ancillary works (particularly for adjacent sites) and provides further opportunity for feedback on the SSD. The report should include (but not be limited to) the following:
 - o Detail modal share/split and rationale.
 - o Include expected traffic generation (numbers of staff and parents) – percentage of car park coverage for staff accessing the site.
 - o Address parking (onsite and offsite), demonstrating staff car parking requirements and how this is met onsite.
 - o Detail proposed drop off pick up arrangement (signage, timing, etc). Will it operate both morning and afternoon and/or are there alternative arrangements that could work such as allowing longer term parking of an afternoon?
 - o Detail proposed pedestrian connections.
 - o Access points/gates (including gate to sporting field, how will this operate).
 - o Include resident consultation results re: proposed Darug Avenue ped crossing in Traffic Report (we can then take it to LTC).
 - o Accessible drop off to comply with clearances/shared zone requirements AS2890.6. and kerb ramp placements for wheelchairs. Must be demonstrated.
 - o Waste vehicle swept paths to/from the site, as well as internal manoeuvring swept paths.

ENVIRONMENTAL MANAGEMENT:

- The Environmental Impact Statement must address all applicable environmental considerations relating to the site and the proposed use. This includes an Acoustic Assessment noting the provision of outdoor play areas and any plant associated with the school operations.

- The application should be accompanied by a contamination assessment statement that addresses SEPP 55 considerations and ensures that the site is suitable or can be made suitable for the proposed use. It must be noted that via the overlay of SREP 20 and SEPP 55 clause provisions, requires that any remediation proposed on the site would require development consent and the submission of a remedial action plan in support of the application.

PLANNING & LANDSCAPING

- The spatial arrangement of the built form is generally supported due to the presentation and activation of Deerubbin Drive and its interface with the approved mixed development to the north. The architectural building form and COLA features provide a deference in height and articulation which is supported noting that the landscape design will be critical in the ultimate streetscape outcomes achieved. It requested that Council's Landscape Architect be afforded an opportunity to review draft Landscape Plans prior to SSD Application lodgement.
- The proposed finished floor and ground levels and resulting ramping at the intersection of Deerubbin Drive & Darug Avenue will require sufficient planting density and maturity to ameliorate the presentation of any walls or elevated walkways as viewed from this critical intersection.
- The provision of sufficient on-site parking is considered a critical element to be addressed in this application. While that parking may be limited to staff only, this is considered necessary without sole reliance on Council's adjacent car park. Further, the separation distance of parking from the Stage 1 building works is of concern given the distance is approximately 150m and would be 200m if the adjacent car park was utilised. Considerations of safety, security and lighting would be critical, not to mention accessibility and accessible staff parking provision. Any investigations for access and use of the adjacent Council car park would require engagement with Council's Property Team and may necessitate a lease agreement or similar arrangement. Please liaise with Jarrod Murphy (Council's Program Manager - Business Development and Acquisitions) on (02) 4732 8082 if you wish to pursue these discussions.

- The Penrith LEP 2010 provides a maximum building height of 15m and it should be demonstrated that the proposal complies with this requirement. The proposal should also address the relevant provisions within the Penrith Development Control, Plan 2014 – Part E7 – Glenmore Park (Part B) Stage 2

WASTE MANAGEMENT:

- **Service Classification:** The following controls relate to developments outlined within Part D – Land Use Controls of the Penrith Development Control Plan 2014.
- **Integrated On-site Waste Collection:** Waste collection vehicles proposed to service commercial and industrial developments are to be designed in accordance with the vehicle specifications outlined in section 3.5 of the '*Industrial, commercial and mixed-use waste management guideline*' document.

On-site Collection (section 2.2.1)

The vehicle must be able to safely and efficiently access the site and the nominated collection point to perform on-site waste collection. There must be sufficient manoeuvring area on-site to allow the collection vehicle to enter and exit the site in a forward direction and service the development efficiently with little or no need to reverse.

Architectural Plans (section 2.2.2)

Scaled architectural plans are required to support the development application which demonstrate the site's entry point, vehicle's route of travel and manoeuvring comply with a standard waste collection vehicle (section 3.5).

Swept Path Models (section 2.2.3)

Swept path models to be provided illustrating how a standard waste collection vehicle (section 3.5) will enter, service and exit the site. A 0.5m unobstructed clearance is required from all obstructions for the vehicle's ingress and egress manoeuvres. The model to provide on-street parking on both sides of the road adjacent to the development to demonstrate unobstructed access during a 'business as usual' configuration.

Service Clearances (section 2.2.4)

For rear loaded vehicles an additional 2m unobstructed loading zone is required behind the vehicle for the loading of 660L and 1,100L bins. Additionally, a 0.5m side clearance is required on either side of the vehicle for driver movements and accessibility.

Plan of Operations (2.2.6)

All development applications to be submitted with accompanying 'Plan of Operations', outlining proposed; Bin Infrastructure Sizes, Collection Frequency, Waste Collection Vehicle Dimensions, Hours of Collection and Access to Waste Collection Room.

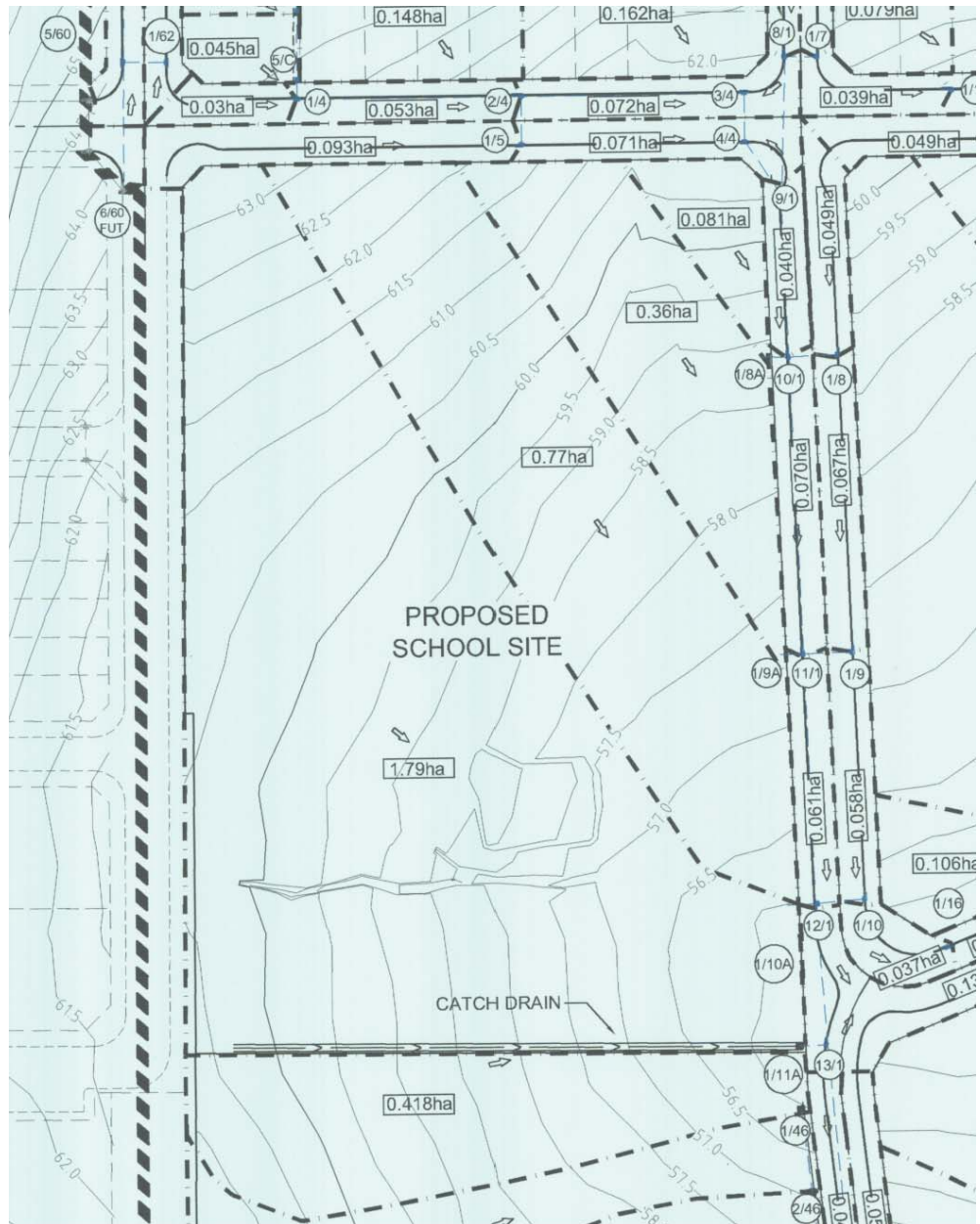
- **Waste Collection Infrastructure:** Waste collection infrastructure to be provided in accordance with section 3.1 of the '*Industrial, commercial and mixed-use waste management guideline*' document.
- **Waste Generation Rates:** Proposed generates rates for respective developments are required to be provided to permit waste collection in accordance with section 3.3 of the '*Industrial, commercial and mixed-use waste management guideline*' document.
- **Waste Collection Rooms**
All developments are required to provide a waste collection room integrated wholly within the developments built form to permit a safe and efficient waste collection service. The room to incorporate the following into its design in accordance with section 3.4 of the '*Industrial, commercial and mixed-use waste management guideline*' document.
- **Waste Infrastructure Guidelines**
For further specific waste operational and infrastructure information refer to the '*Industrial, commercial and mixed-use waste management guideline*' document attached:
<https://www.penrithcity.nsw.gov.au/Building-and-Development/Development-Applications/Forms/>

Key Land Based Considerations

Bushfire Prone Land will likely require lodgement of a Bushfire Assessment Report.

Flood Affected Land will require floor levels to Australian Height Datum (AHD).

Impacts to native vegetation (including grassland) will require an assessment under the NSW Biodiversity Offset Scheme and may require a Biodiversity Assessment Report or a Test of Significance.



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