ACE Civil Stormwater Services Pty Ltd

Flood Impact Assessment

Proposed Residential Development
2 Mandala Parade, Castle Hill

Prepared For
The Hills Shire Council

Client
Deicorp PTY LTD

Project No.
ACE200124

Issue B July 2021

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Disclaimer

The advice and information contained within this report relies on the quality of the records and other data provided by the Client and obtained from Council along with the time and budgetary constraints imposed.

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1 INTRODUCTION

Deicorp Project Showground Pty Ltd commissioned Australian Consulting Engineers (ACE) to undertake a flood assessment for the proposed development of 2 Mandala Parade in the Doran Drive Precinct, Castle Hill (the site). Landcom and Sydney Metro has appointed Deicorp as the developer of the site.

The proposed development is a 20-storey mixed-use development, comprising 440 residential units, retail, commercial and community spaces, including a public plaza. The proposal is a State Significant Development and the Department of Planning Industry and Environment (DPIE) has issued Secretary's Environmental Assessment Requirements (SEARs) for the preparation of Environmental Impact Statement (EIS) for the proposal.

This report will:

1. Establish the existing flooding characteristics due to the overland flow from the upstream catchment.
2. Determine the impacts of the proposed development on flooding.
3. Define the flood risk for the proposal in accordance with the SEARs.
4. Demonstrate that the proposed development meets SEARs related to flood hazard.

2 SITE DETAILS

2.1 Location

The proposed development site is located within The Hills Shire Council Local Government Area and is identified as 2 Mandala Street, Castle Hill, Lot 55 DP 1253217 with a total site area of approximately 0.7969 hectares. The site is located in the Doran Avenue Precinct and is adjacent to the recently constructed Showground Station on Metro North West line.

The site is bounded by Andalusian Way to the east, Doran Drive to the west, De Clambe Drive to the north and Mandala Parade to the south.

Figure 2.1 shows the site's location highlighted in yellow.

Figure 2.1– Site Location

2.2 Proposed Development

The proposed development is a 20-storey mixed-use development, comprising 440 residential units, retail, commercial and community spaces, including a public plaza. Vehicular access to the site is from De Clambe Drive with pedestrian access primarily from Doran Drive and Mandala Parade.

A perspective view of the proposed development is shown in **Figure 2.2**

Figure 2.2 – Proposed Development

Refer to **Appendix A** for the preliminary development plans for the site.

2.3 Topography, Landuse and Drainage

The site is located within the Showground Development Precinct and is adjacent to the recently developed Showground Station as part of the North West Metro. The catchment for the site extends from De Clambe Drive near Showground Road in the north to Doran Avenue intersection with De Clambe Drive. The old Hills Shire Council Chambers (now demolished) to the north-east

is also a part of the catchment. A large catchment from the old showgrounds contributes flow at the intersection of Doran Avenue and De Clambe Drive and can potentially impact the flood behaviour for the site. **Figure 2.3** shows the catchment layout. The catchment area is approximately 4.5 ha.

The site has steep slope and drops approximately 9m from 98m AHD at Andalusian Way to approximately 89m AHD at Doran Avenue. Further west, the ground drops steeply by approximately 5m, where a car park has recently been constructed for the commuters using the Showground Station. The entrance to the station is at approximately 89.8m AHD.

The street drainage is provided along all the roads surrounding the site. The minor flows would be carried by the pit and pipe system whereas the major flows are likely along the roads. The street drainage discharges to an open channel along De Clambe Road, west of Doran Avenue intersection. The open channel carries flow to a flood retarding basin, which in turn discharges to the Cattai Creek.

A large catchment from the old showgrounds also contributes to the flow at this location. **Figure 2.3** shows this catchment, which is approximately 3.75 ha.

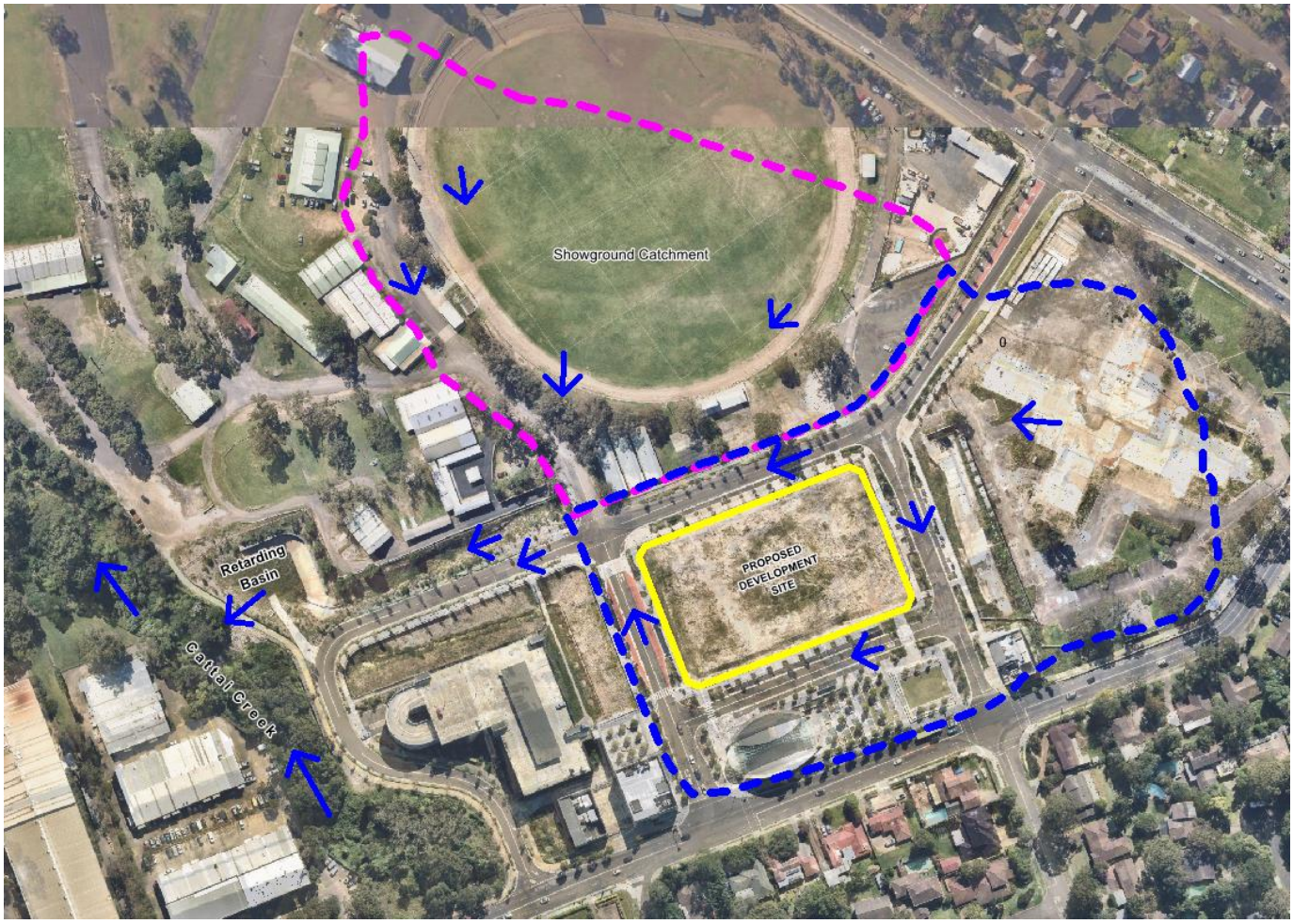

Figure 2.3 - Catchment Map

3 FLOOD MODEL DEVELOPMENT

Two separate models were developed for flood modelling. A hydrological model using the DRAINS modelling software was developed to estimate runoff from the contributing catchments and a fully dynamic 1D/2D hydraulic model using the TUFLOW modelling software was developed for establishing the flood behaviour, including flood level, velocity, hazard and other data. The catchment hydrographs derived from the DRAINS model were used as an input to the TUFLOW model. The model set-up details are provided in the following sections.

3.1 DRAINS Model Set-up

The data presented in the Stormwater Management Report (Aurecon) was used to develop the DRAINS model for the study area. The survey data for the site and the surrounding areas was used to refine the model. Two models were developed: one for the existing conditions on site, and the other representing the proposed development.

The IL/CL (Initial Loss/Continuing Loss) hydrological model was used for runoff estimation. The following rainfall losses were used in the IL/CL model

Impervious area Initial Loss	1 mm
Impervious area Continuing Loss	0 mm
Pervious area Initial Loss	5 mm
Pervious area Continuing Loss	2 mm

Details of the data used for setting up the DRAINS model are provided in Appendix B.

The AR&R 2019 was used for estimation of the design flood hydrographs. A summary of data downloaded from the AR&R data hub is provided in Appendix C. This data was imported into the DRAINS model and model runs carried out for various design flood events. For each design event, several durations were modelled and as per the AR&R 2019 procedures, each duration was represented by ten different temporal patterns.

Since the catchment for study area is small, only shorter duration storms of 5 min, 10 min, 20 min, 25 min, 30 min, 45 min, 60 min, 90 min and 120m durations were used for the purpose of design flood modelling. Review of the DRAINS modelling results indicated that the storm durations from 5 min to 30 min were critical for the study area. Accordingly, these durations were used to undertake the hydraulic modelling as described in the following section.

For the Probable Maximum Flood (PMF) modelling, 15 min duration was found to be critical.

3.2 TUFLOW Model Set-up

The TUFLOW model was set-up to define the existing flood behaviour and assess the impact of the proposed development. The model extents were established such that the impact of the proposed development is captured within the model domain and to have a downstream boundary far enough to prevent any influence on the flood behaviour in the study area. **Figure 3.1** shows the model extent.

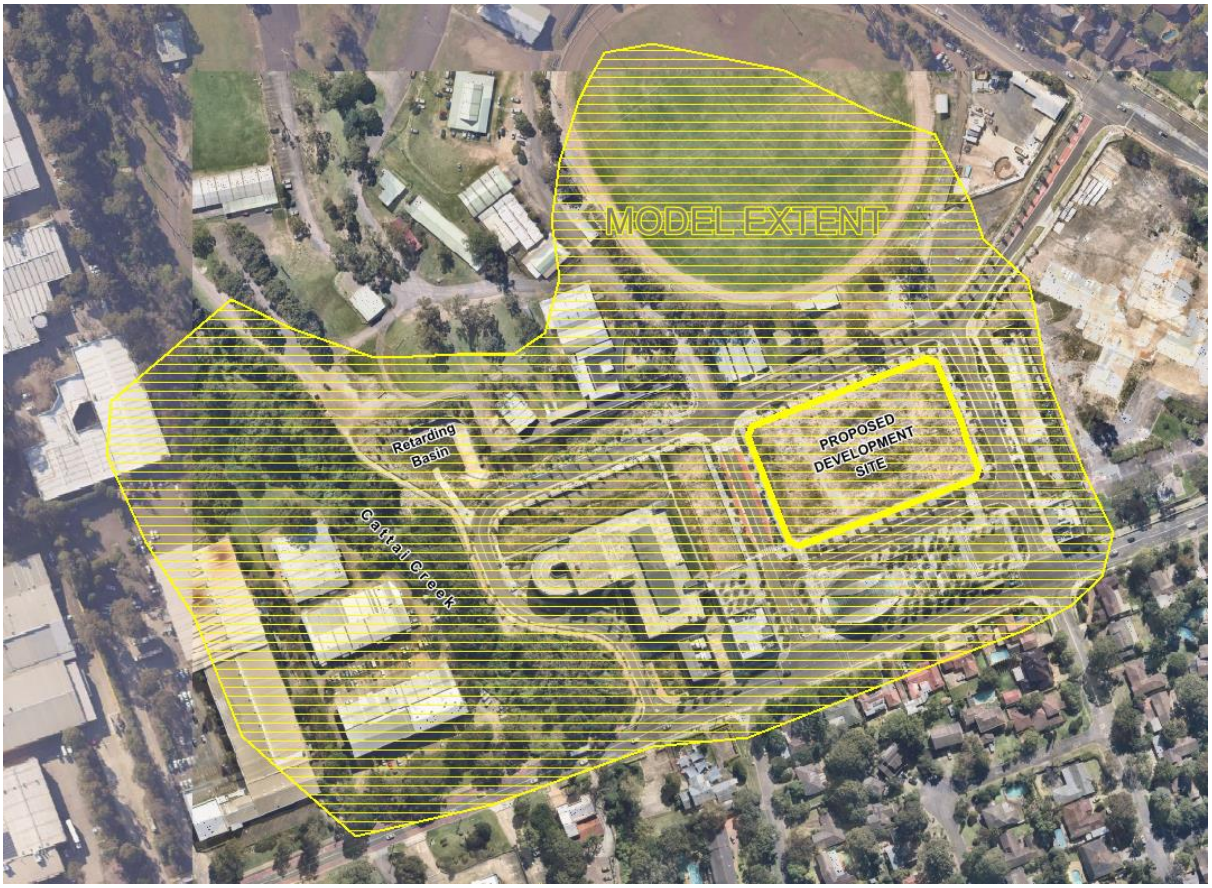

Figure 3.1 – TUFLWO Model Extent

3.2.1 *Terrain Data*

The terrain data for the modelled area was sourced from the NSW Department of Land and Property Information, Spatial Data Services, through the http://elevation.fsdf.org.au/ website. This data is based on the LiDAR (Light Detection and Ranging) survey undertaken in June 2020 and has a vertical accuracy of 0.3m (95% confidence interval) and a horizontal accuracy of 0.8m (95% confidence interval).

The site survey, which has a higher vertical accuracy was superimposed on the above terrain data and incorporated in the TUFLOW model. A high definition 2D grid was developed for the model with a grid size of 0.5m. Figure xx shows the model grid.

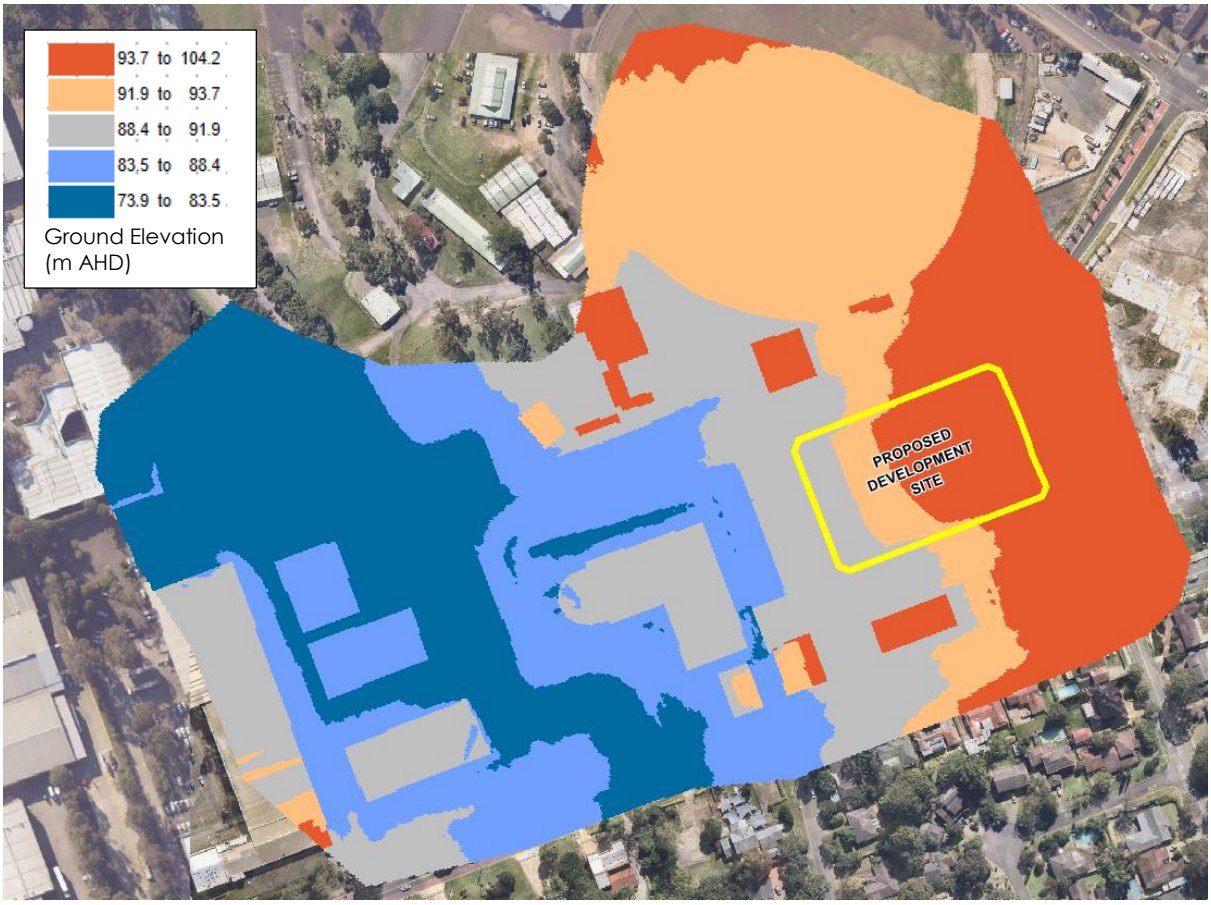

Figure 3.2 – TUFLOW Model Grid

3.2.2 *Model Roughness*

The following surface roughness was used for various land uses in the model:

- Roads – 0.015
- Grass/Paddock – 0.03
- Open Channel – 0.06
- Cattai Creek – 0.1

A high roughness value was adopted for Cattai Creek due to dense overgrown vegetation within the creek.

3.2.3 *Buildings*

The buildings were modelled by raising the terrain of the building footprint so that the floodwaters could not enter the building area. The overland flow would go around the buildings to the downstream areas.

The proposed development was also modelled in a similar manner i.e. as a blockage to flow.

Figure 3.3 – Buildings Blocked in the Model

3.2.4 *1D Model Set-up*

The street drainage in the modelled area was included as the 1D component in the TUFLOW model. The pit and pipe data were sourced from the site survey. The drainage data outside the surveyed extents but within the modelled extent was obtained during a site visit.

The roughness for the drainage pipes was assumed to be 0.015 (Mannings n). The pit inlet stage-discharge data was derived from the DRAINS model.

The open channel along De Clambe Road was included in the 2D component of the model since the fine model grid (0.5m) is sufficient to represent the channel cross-section.

3.2.5 *Model Boundaries*

The inflow boundaries of the model were derived from the DRAINS model. The catchment runoff estimated in the DRAINS model was applied as an inflow boundary at each pit in the modelled area. The runoff from the old Council Chambers was applied as a line boundary near the intersection of De Clambe Road and the Andalusian Way.

The inflow from the Showgrounds catchment was applied at the pit in a sag near the De Clambe Road and Doran Avenue.

The downstream boundary was applied at Cattai Creek based on a depth-discharge relationship derived from the creek slope in the TUFLOW model.

The model boundaries are shown in **Figure 3.4.**

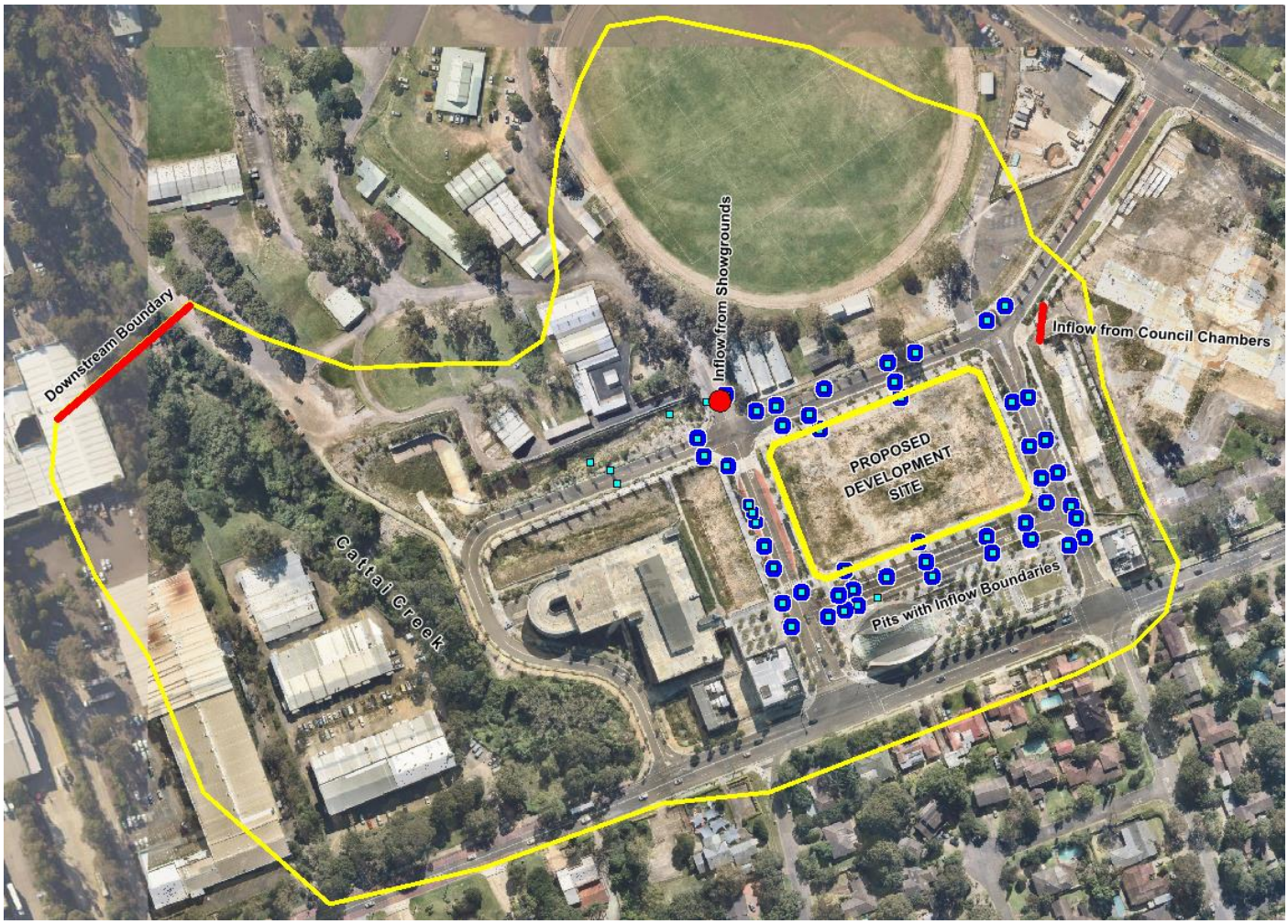

Figure 3.4 – Model Boundaries

3.3 Proposed Development Model

The proposed development was incorporated in the model as a single building spread over the entire site, assuming blockage to flow through the entire site.

A few of the model boundaries were also modified to represent the outflow from the proposed OSD in the south-western corner of the site. The OSD outlet pipe flow was used as a boundary for the pit connected to the OSD. Overflow from the OSD was assumed to be distributed along the width of the entire site facing Doran Avenue.

4 DESIGN FLOOD MODELLING

The DRAINS model was run for the 5% AEP and 1% AEP events for various durations ranging from 5 minutes to 2 hours. Review of model results indicated that durations from 5 minute to 30 minute are likely to be critical for the hydraulic modelling and hence inflow hydrographs were generated for these durations only.

Following the AR&R 2019 procedures ten inflow hydrographs were developed for each duration based on ten different temporal patterns. These hydrographs were incorporated in the hydraulic model and model runs were undertaken for all the durations of a given design flood event.

For PMF modelling, the 15 minute and the 30 minute durations were selected for modelling purposes. The temporal patterns along with the intensity data was incorporated in the DARISN model and inflow hydrographs generated for the hydraulic model.

4.1 Model Results

Model results were processed and peak flood level, depth, velocity and hazard grids were developed for each design flood event.

The ten grids of peak values for each duration were first processed and a median value was derived. This value represents the design flood for that duration. The median value grids from each duration were then processed to derive the maximum value, which represents the peak flood data for that design flood event.

The peak PMF values were simply the maximum of the 15 minute and the 30 minute durations.

4.2 Existing Flood Conditions

The peak flood level, depth, velocity and hazard for the 5% AEP are presented in **Figure 4.2** to **Figure 4.5** and for 1% in **Figure 4.6** to **Figure 4.9**.

The peak PMF values are presented in Figure 4.10 to Figure 4.13.

Flood Hazard has been mapped in accordance with the requirements of Appendix L of the NSW Floodplain Development Manual. The graphical representation of hazard categorisation is shown in **Figure 4.1.**

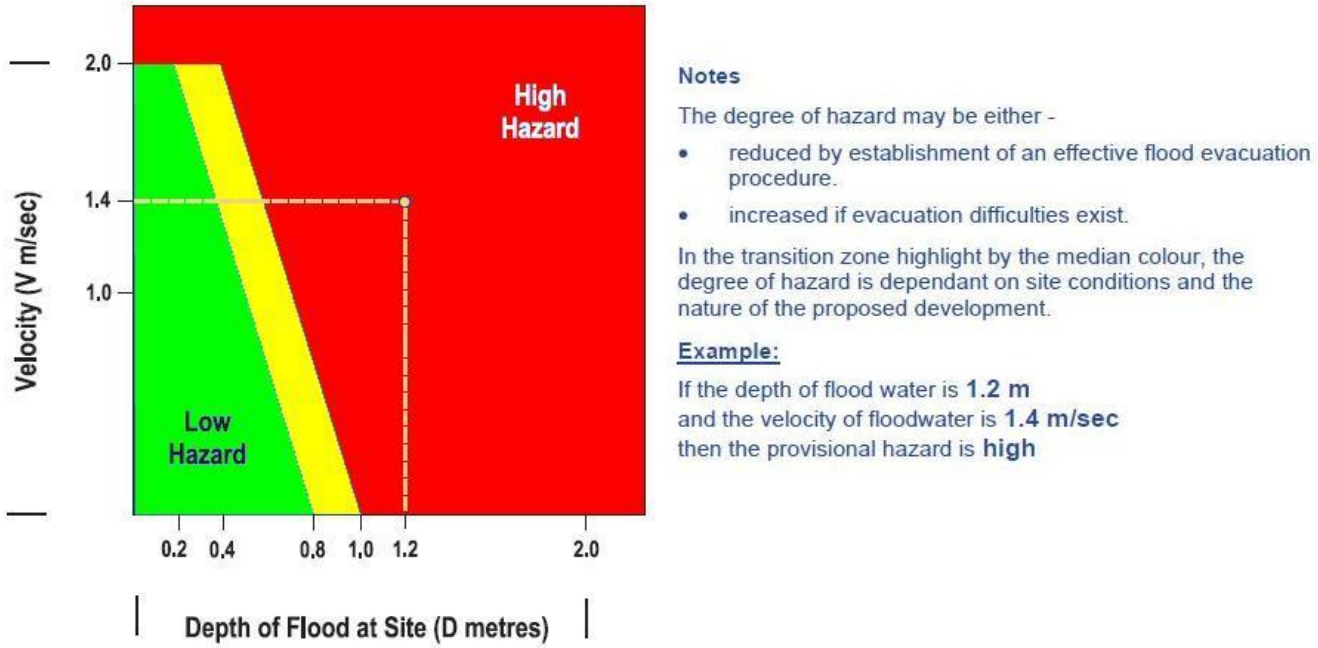

Figure 4.1 – Provisional Hydraulic Hazard Categories (Figure L2 from NSW Floodplain development manual (2005))

The above hazard categorisation is a standard output from the TUFLOW model.

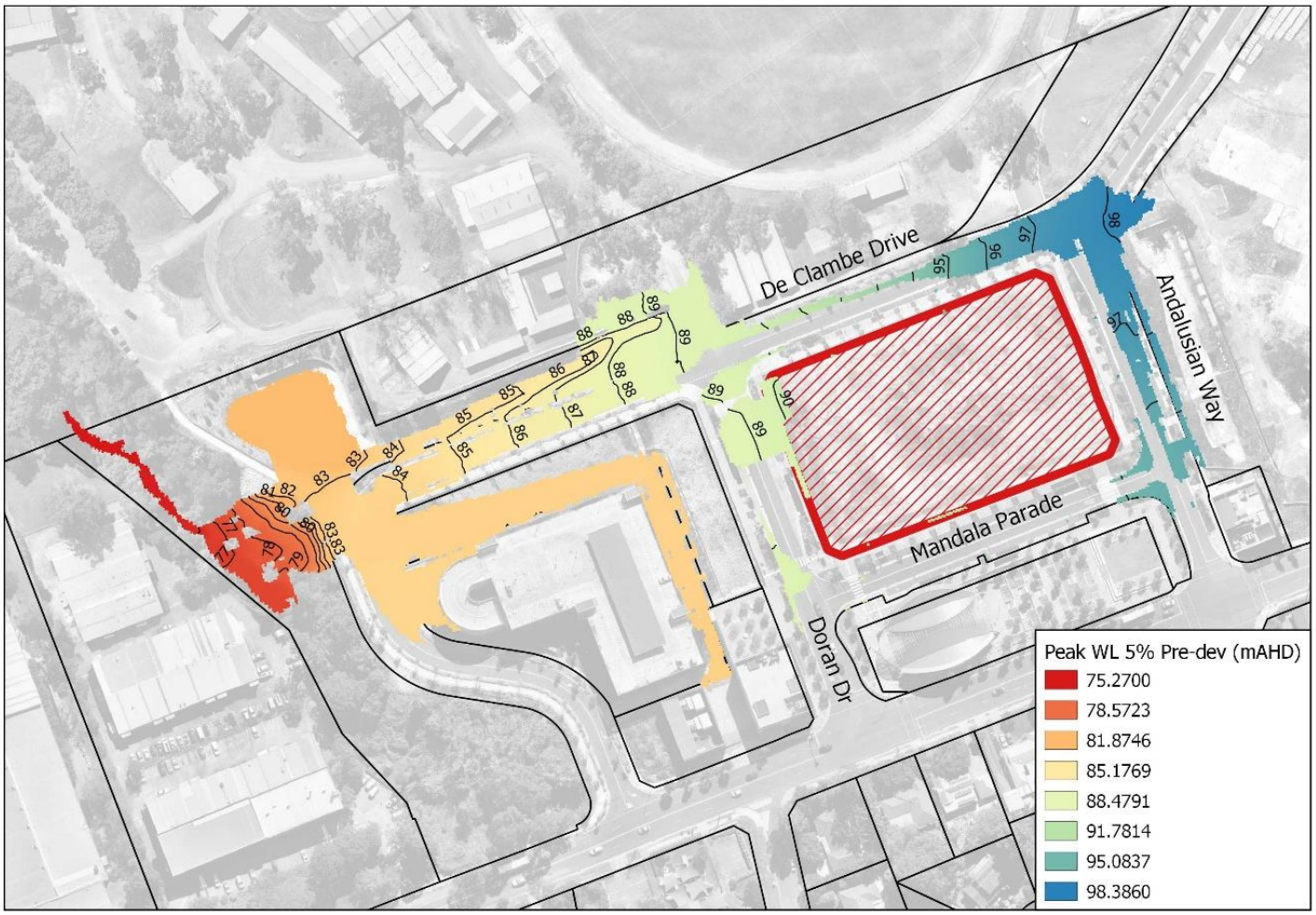

Figure 4.2 – Existing Scenario 5% AEP Flood Level

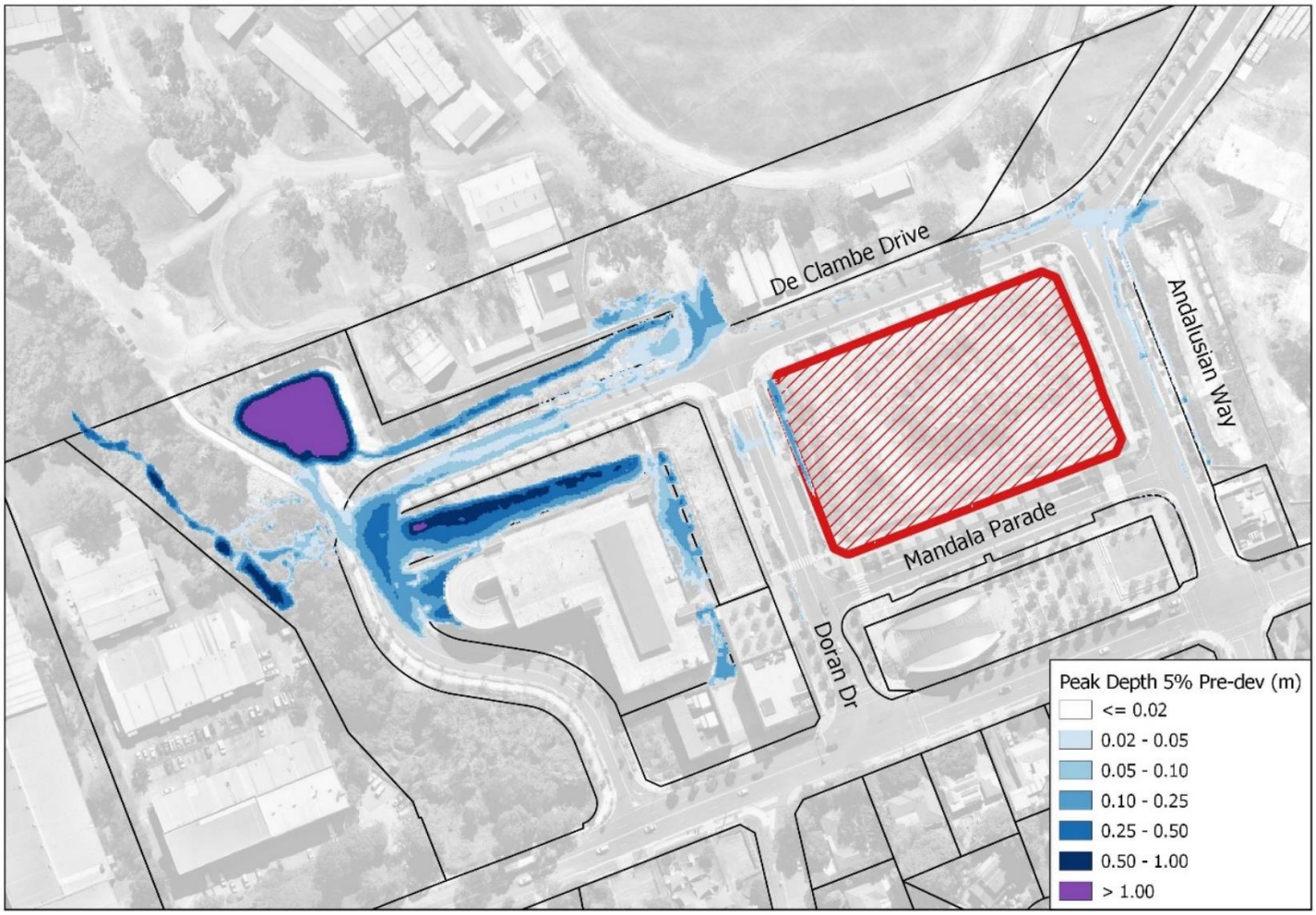

Figure 4.3 – Existing Scenario 5% AEP Flood Depth

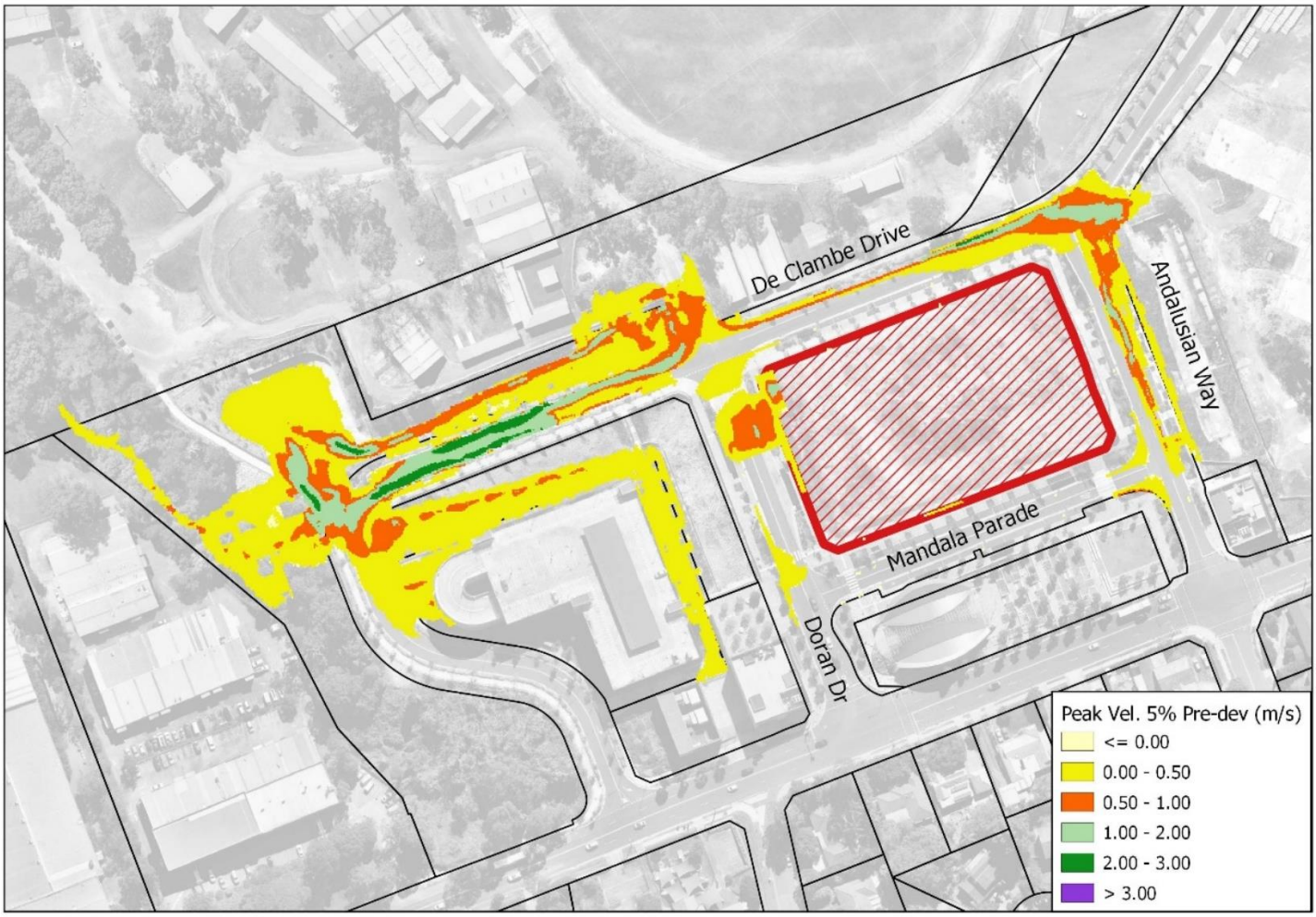

Figure 4.4 – Existing Scenario 5% AEP Flood Velocity

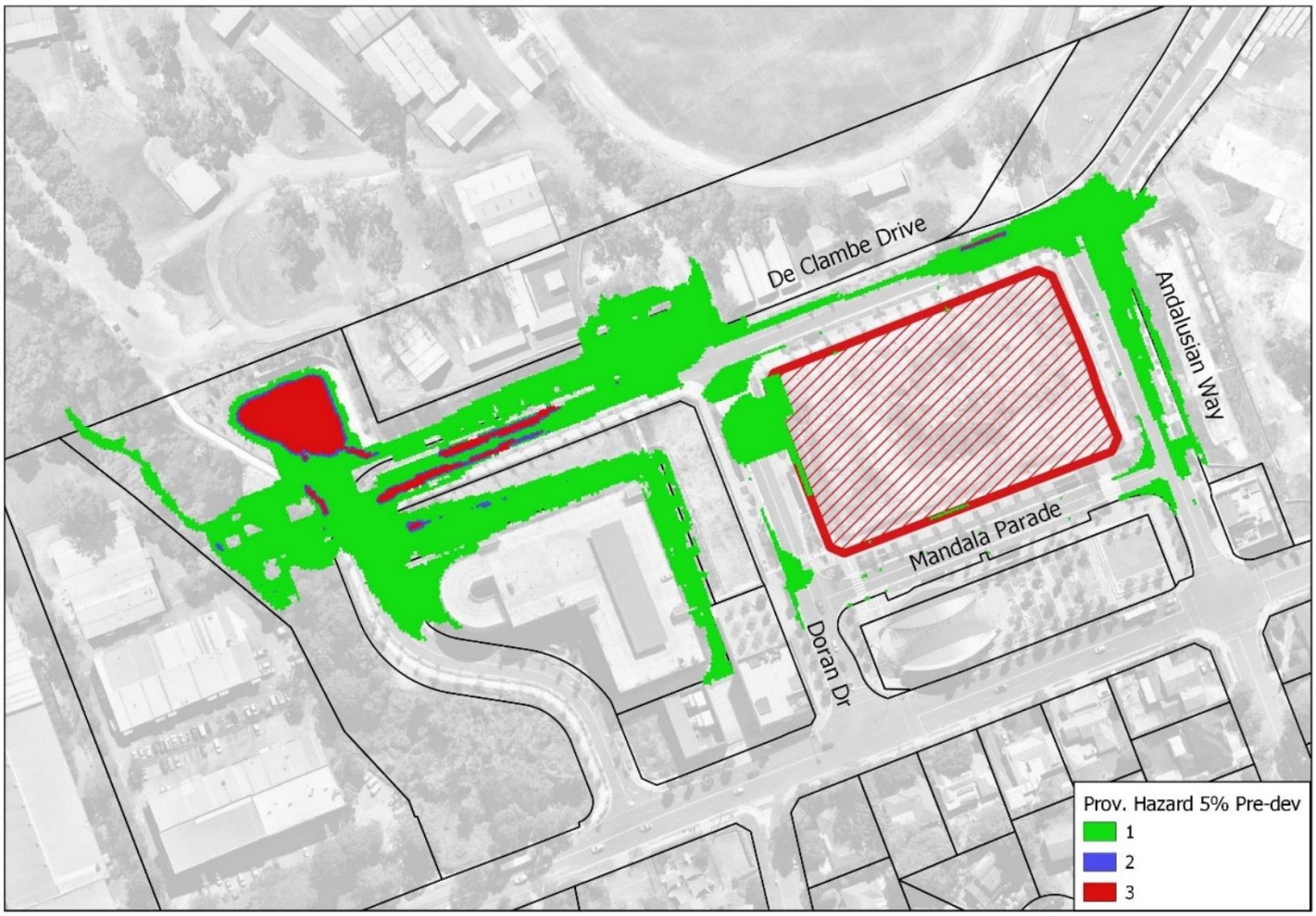

Figure 4.5 – Existing Scenario 5% AEP Flood Hazard

(1 = Low 2 = Medium 3 = High)

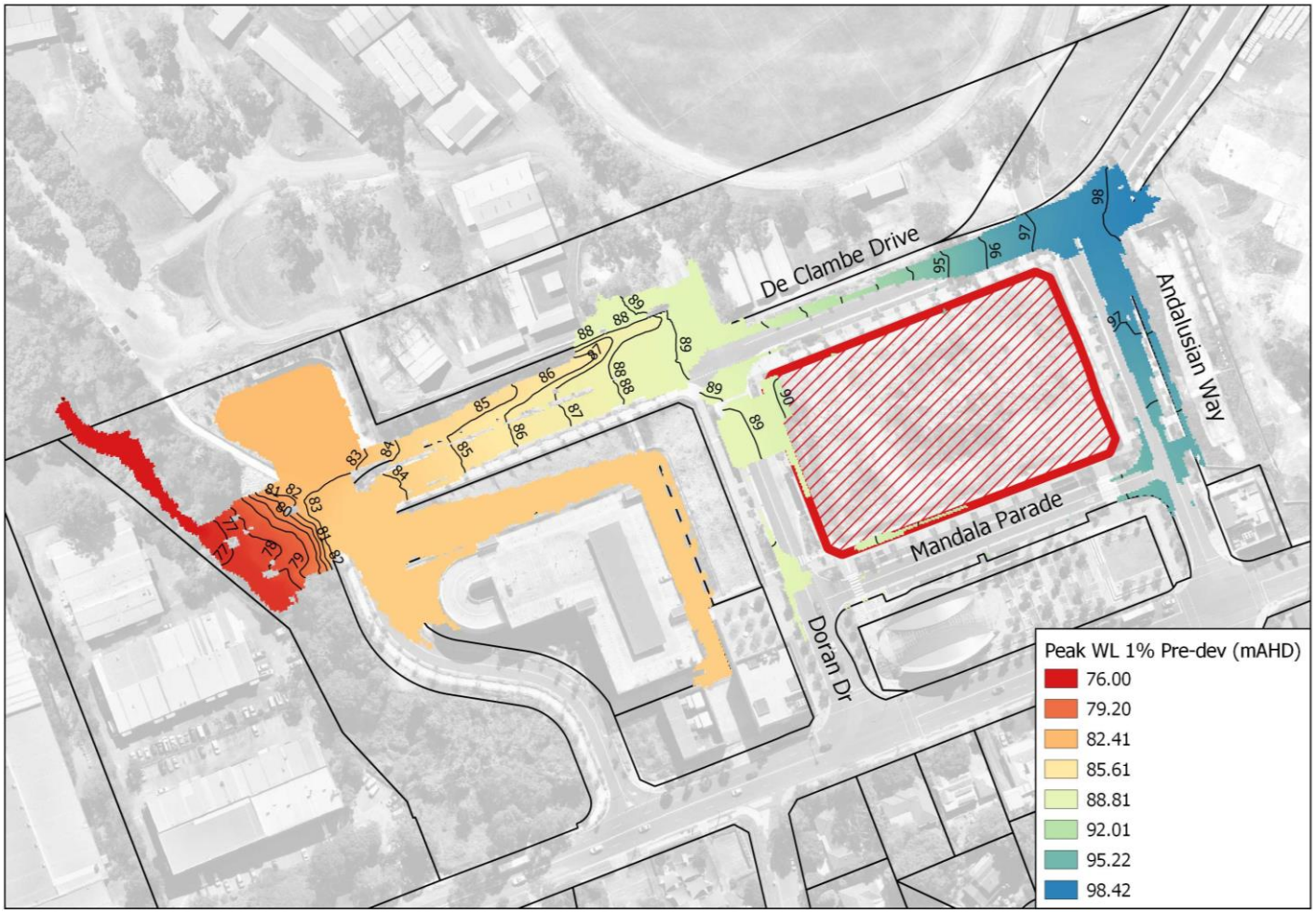

Figure 4.6 – Existing Scenario 1% AEP Flood Level

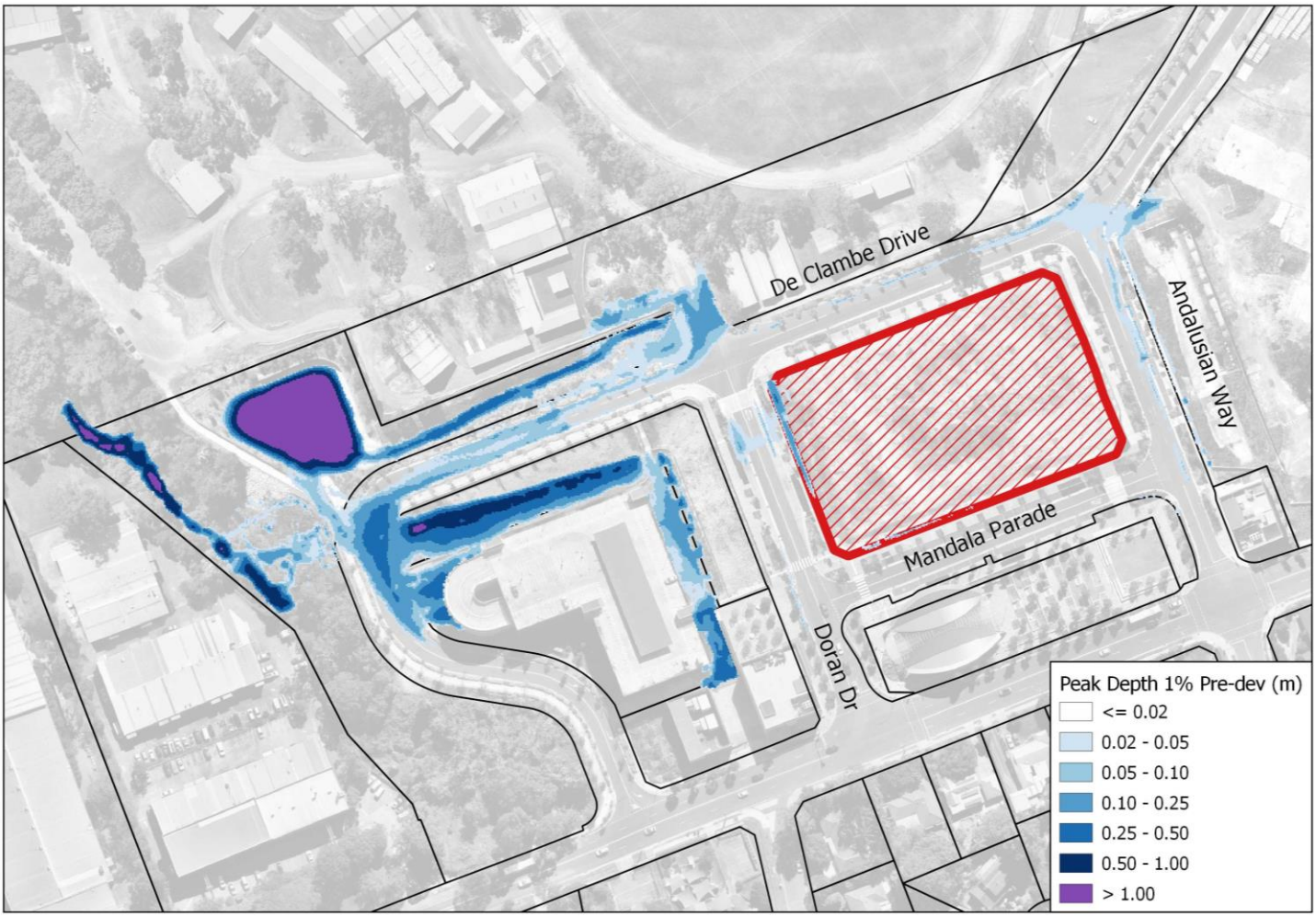

Figure 4.7 – Existing Scenario 1% AEP Flood Depth

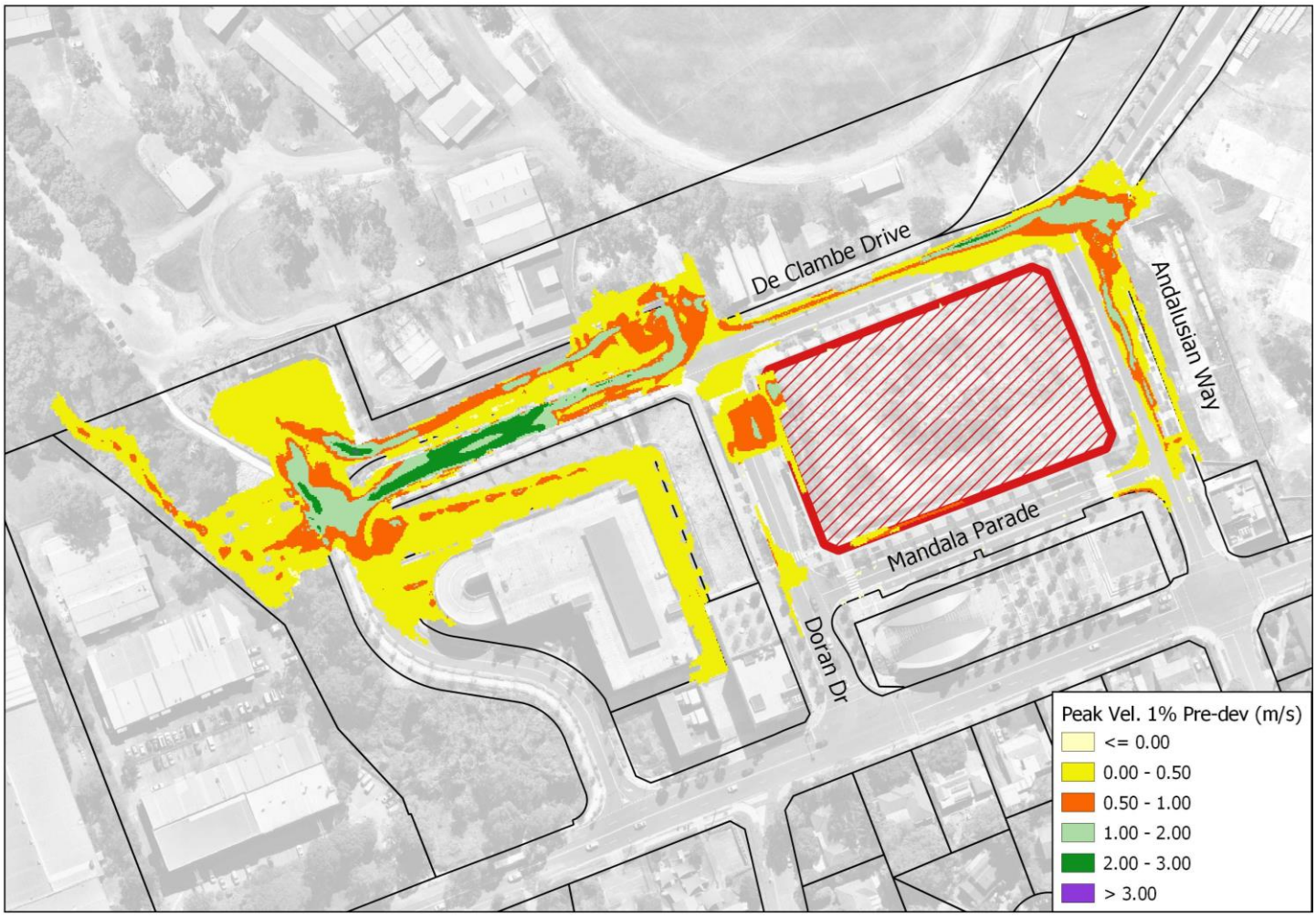

Figure 4.8 – Existing Scenario 1% AEP Flood Velocity

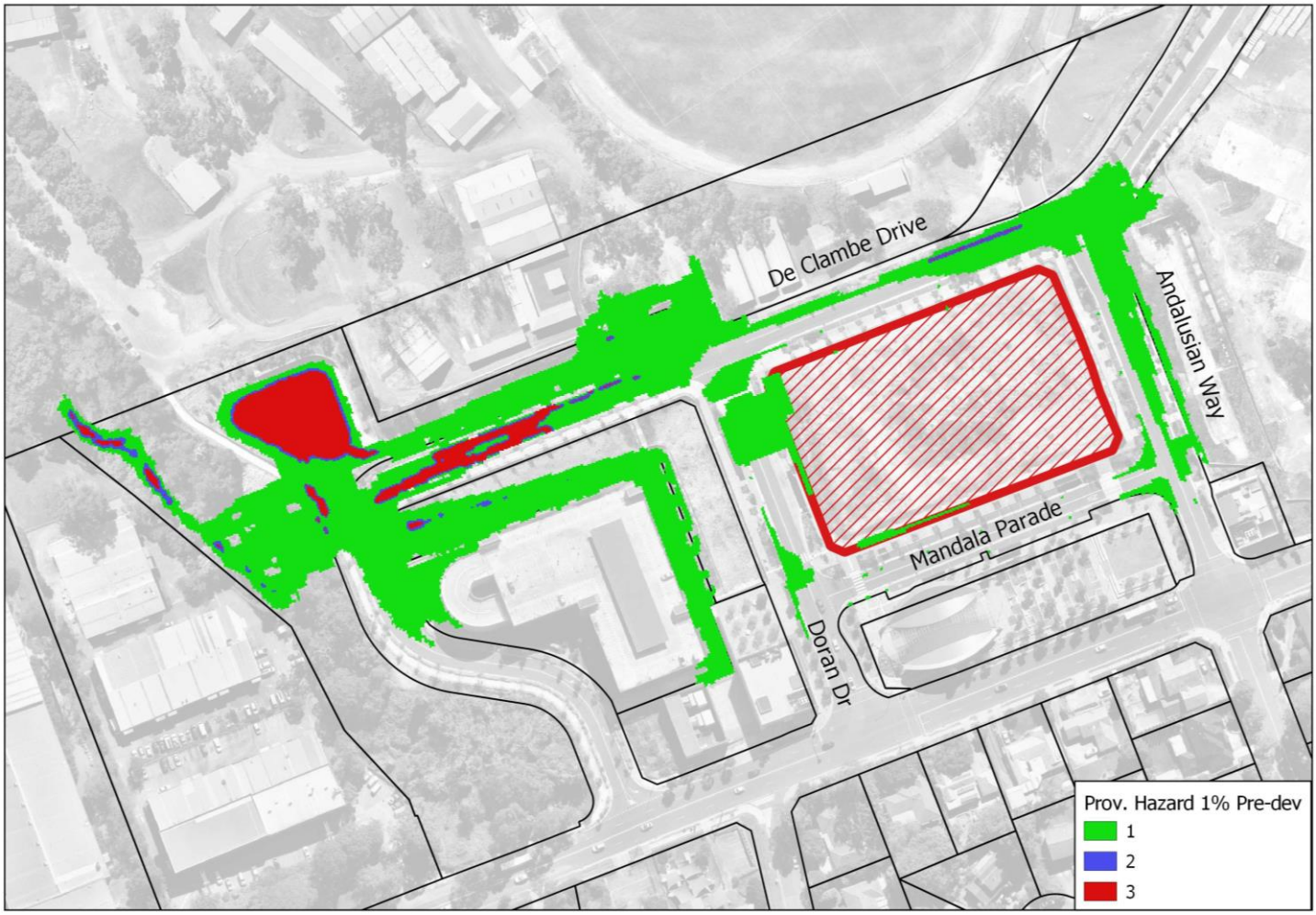

Figure 4.9 – Existing Scenario 1% AEP Flood Hazard Mapping

(1 = Low 2 = Medium 3 = High)

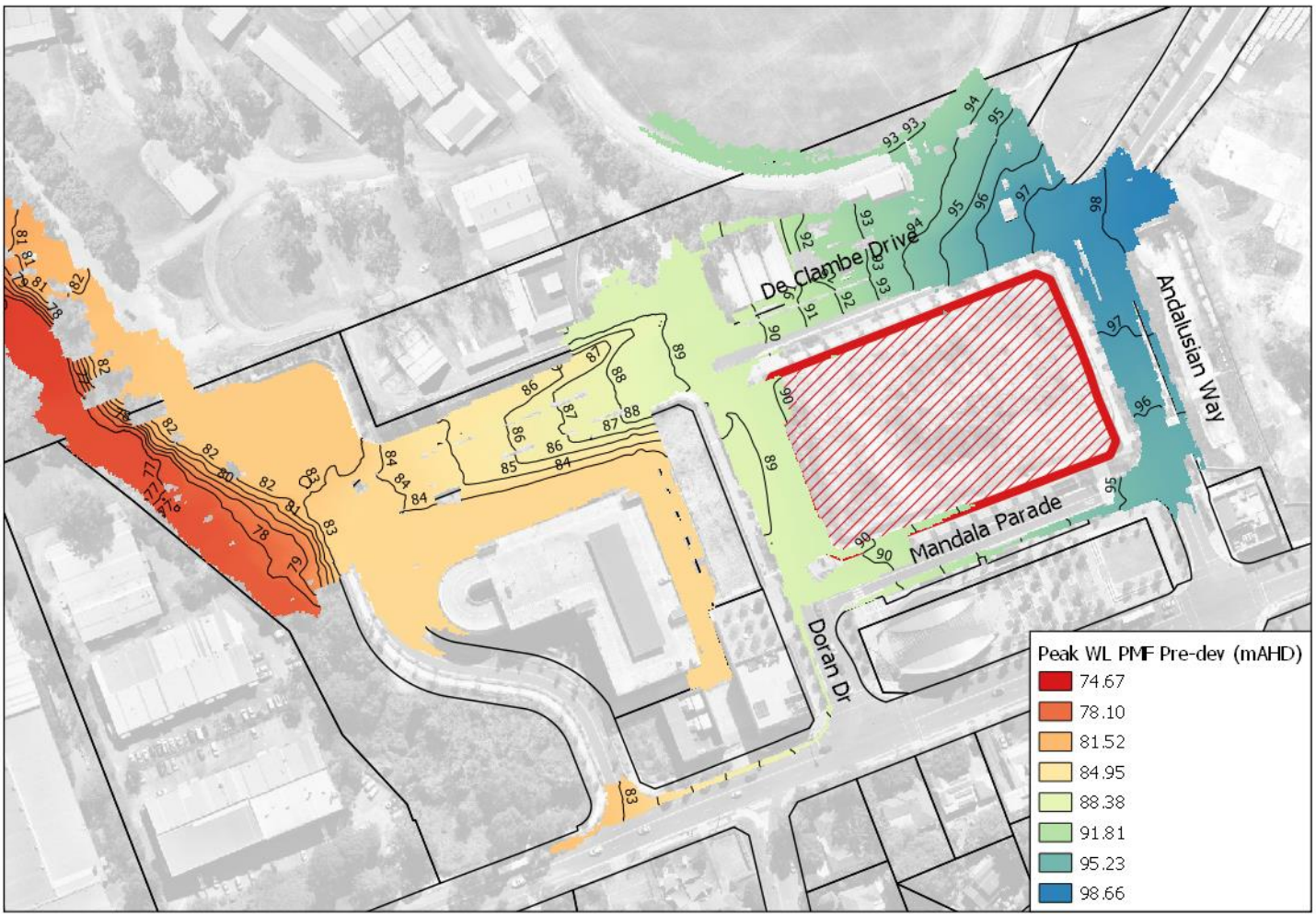

Figure 4.10 – Existing Scenario PMF Flood Level

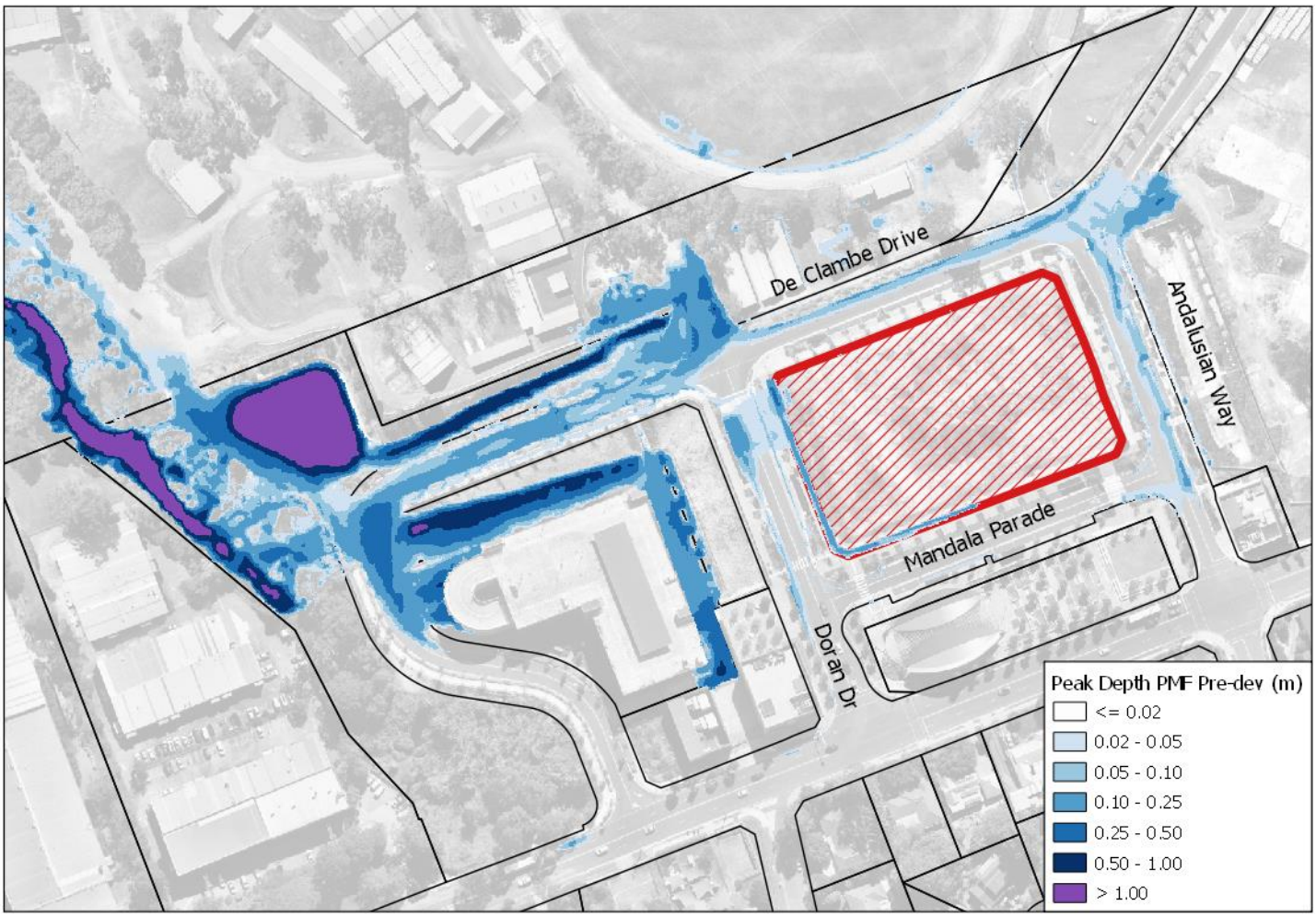

Figure 4.11 – Existing Scenario PMF Flood Depth

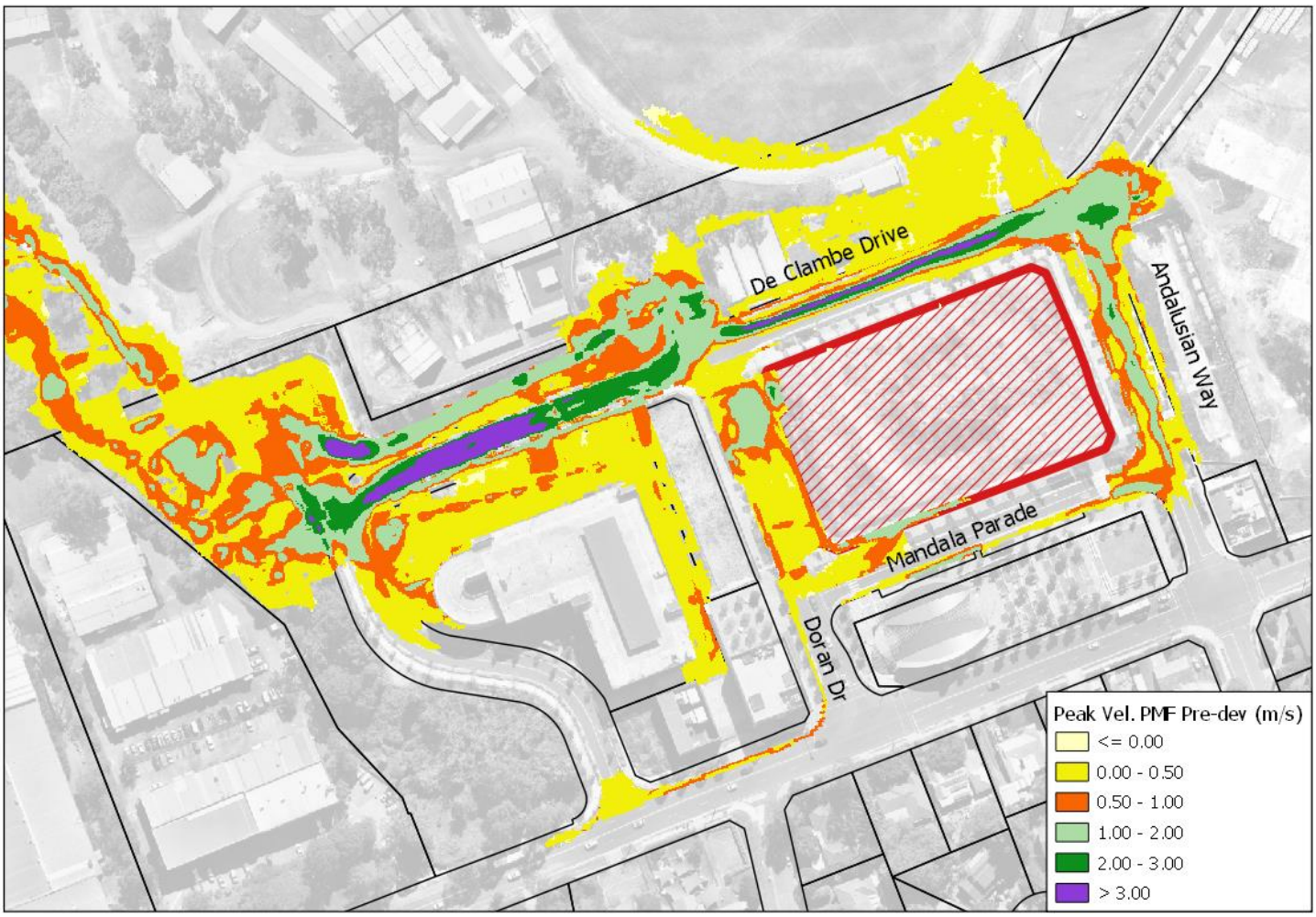

Figure 4.12 – Existing Scenario PMF Flood Velocity

Figure 4.13 – Existing Scenario PMF Flood Hazard
(1 = Low 2 = Medium 3 = High)

4.2.1 *Floodprone Land*

As per the Floodplain Development Manual, the floodprone land in a floodplain is the flood affected area defined by the PMF. The PMF flood extent shown in Figure 4.10 defines the floodprone land for the site and the surrounding areas.

4.2.2 *Flood Planning Area*

The Flood Planning Area (FPA) for the site was defined by adding a free-board of 0.5m to the 1% AEP flood level model results. Figure xx shows the FPA for the site and its surrounding area.

Figure 4.14 – Flood Planning Area

4.2.3 *Discussion*

The results of the flood modelling for the existing scenario indicate that flooding at the site results from overland flow from the upstream catchment in the immediate vicinity of the proposed development. Since the upstream catchment is small, the overland flooding is not significant.

Further downstream, the flow from the Showgrounds combines with the flow from the site catchment resulting in significant flooding along De Clambe Drive, west of Doran Avenue. The existing scenario flooding can be summarised as:

- The flooding is contained in the road reserve up to the 1% AEP event
- The sag at the Doran Avenue (near the bus stop) is flooded to a significant depth
- The peak flood velocity varies from 0.5-1.0 m/s along the surrounding roads of the site

- The provisional flood hazard is low on the surrounding roads of the site, except for a small area on De Clambe Drive, adjacent to the north-western part of the site.

In a PMF event, all the surrounding roads are flooded to varying depth ranging from 0.1-0.25m along De Clambe Drive Andalusian Way and Doran Avenue. The flooding is generally contained within the road reserve. The provisional flood hazard is High along De Clambe Drive and at the sag on Doran Drive. The velocity along De Clambe Drive can be greater than 3 m/s, along Andalusian Way from 1-2 m/s and at Doran Avenue near the sag from 1-2 m/s.

4.3 Proposed Development Condition

The proposed development models (DRAINS and TUFLOW) were run for the design flood events and model results processed as described above.

The peak flood level, depth, velocity and hazard for the 5% AEP are presented in **Figure 4.15** to **Figure 4.18** and for 1% in **Figure 4.19** to **Figure 4.22**.

The peak PMF values are presented in **Figure 4.23** to **Figure 4.26**.

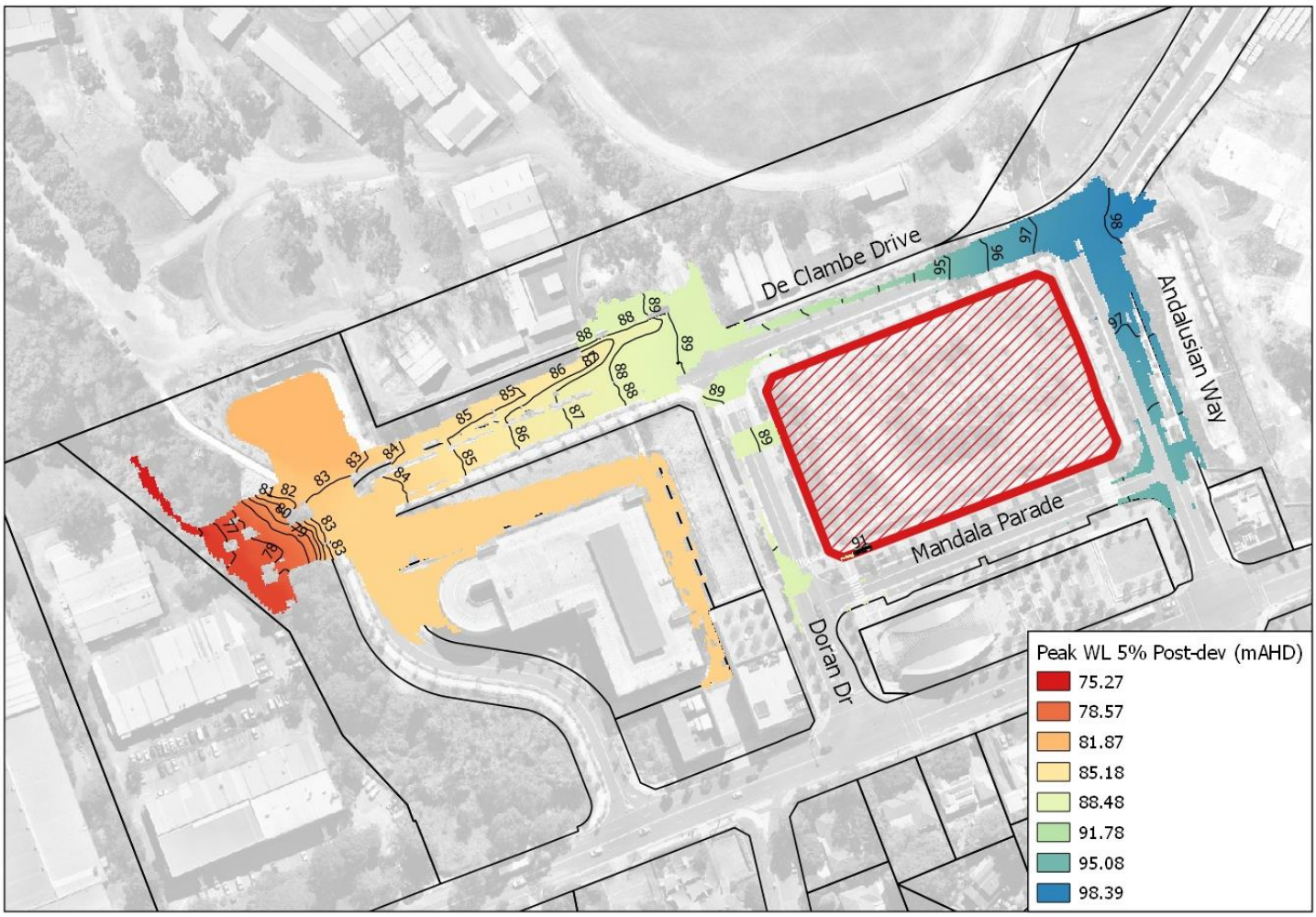

Figure 4.15 – Developed Scenario 5% AEP Flood Extent

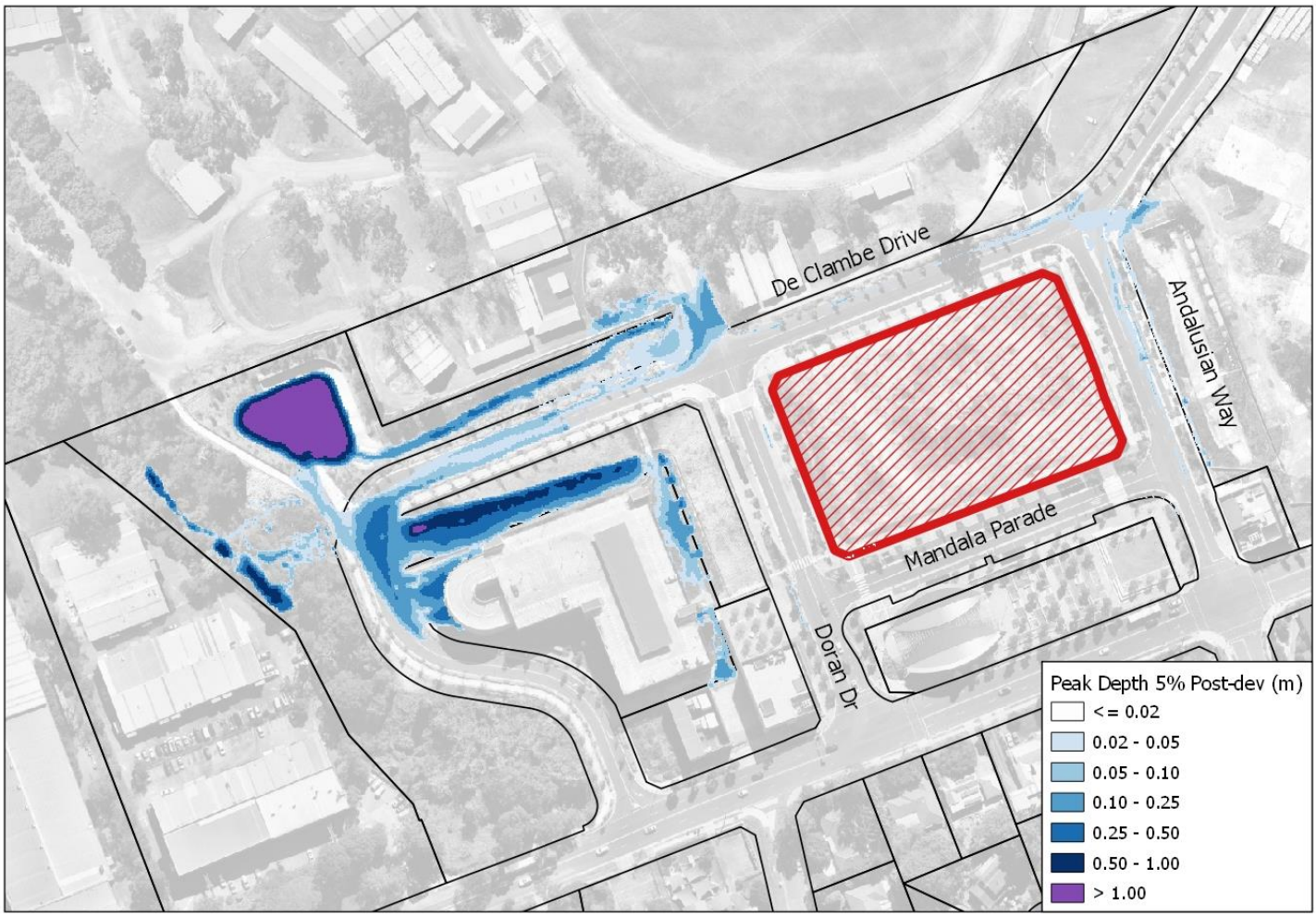

Figure 4.16 – Developed Scenario 5% AEP Flood Depth

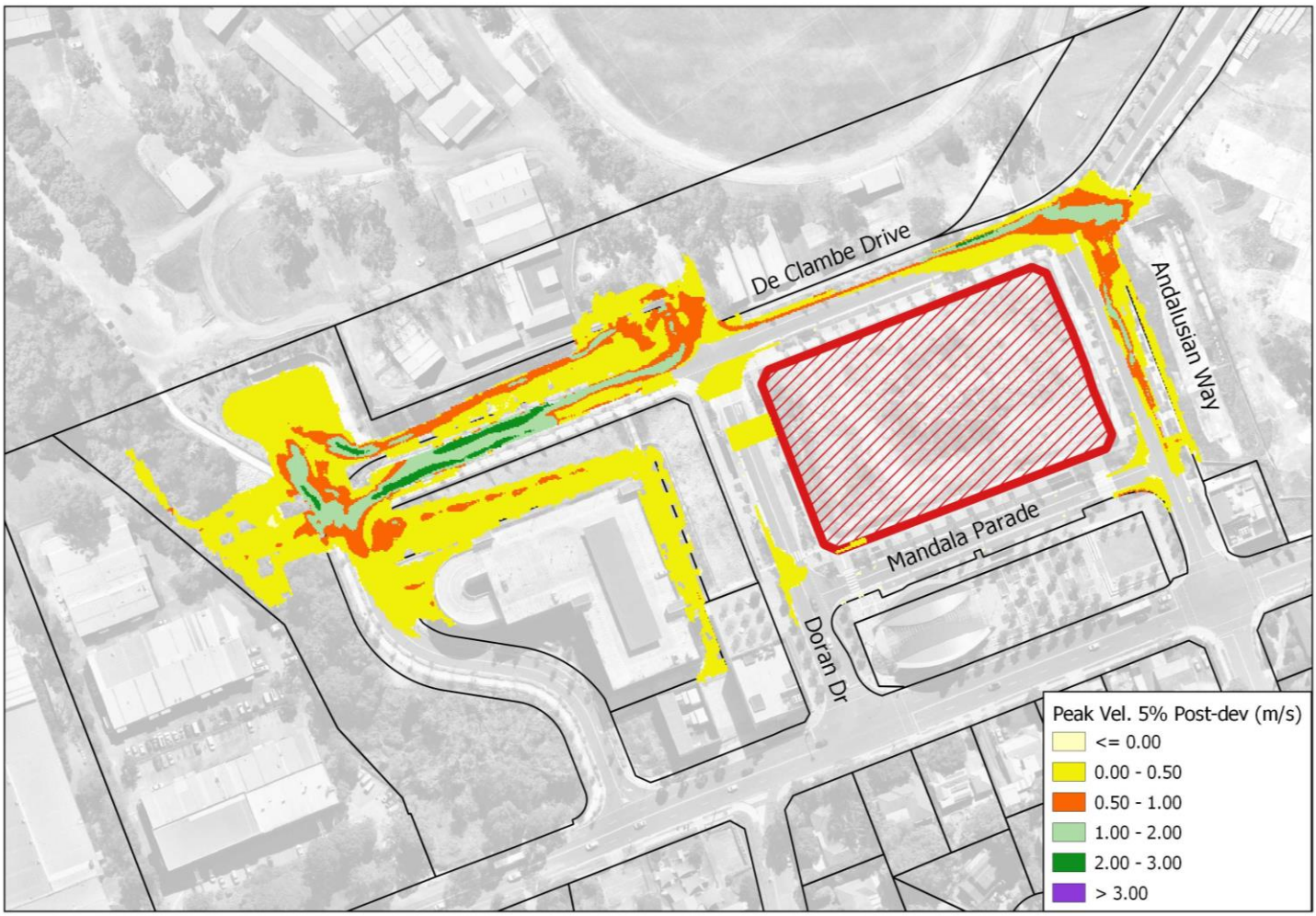

Figure 4.17 – Developed Scenario 5% AEP Flood Velocity

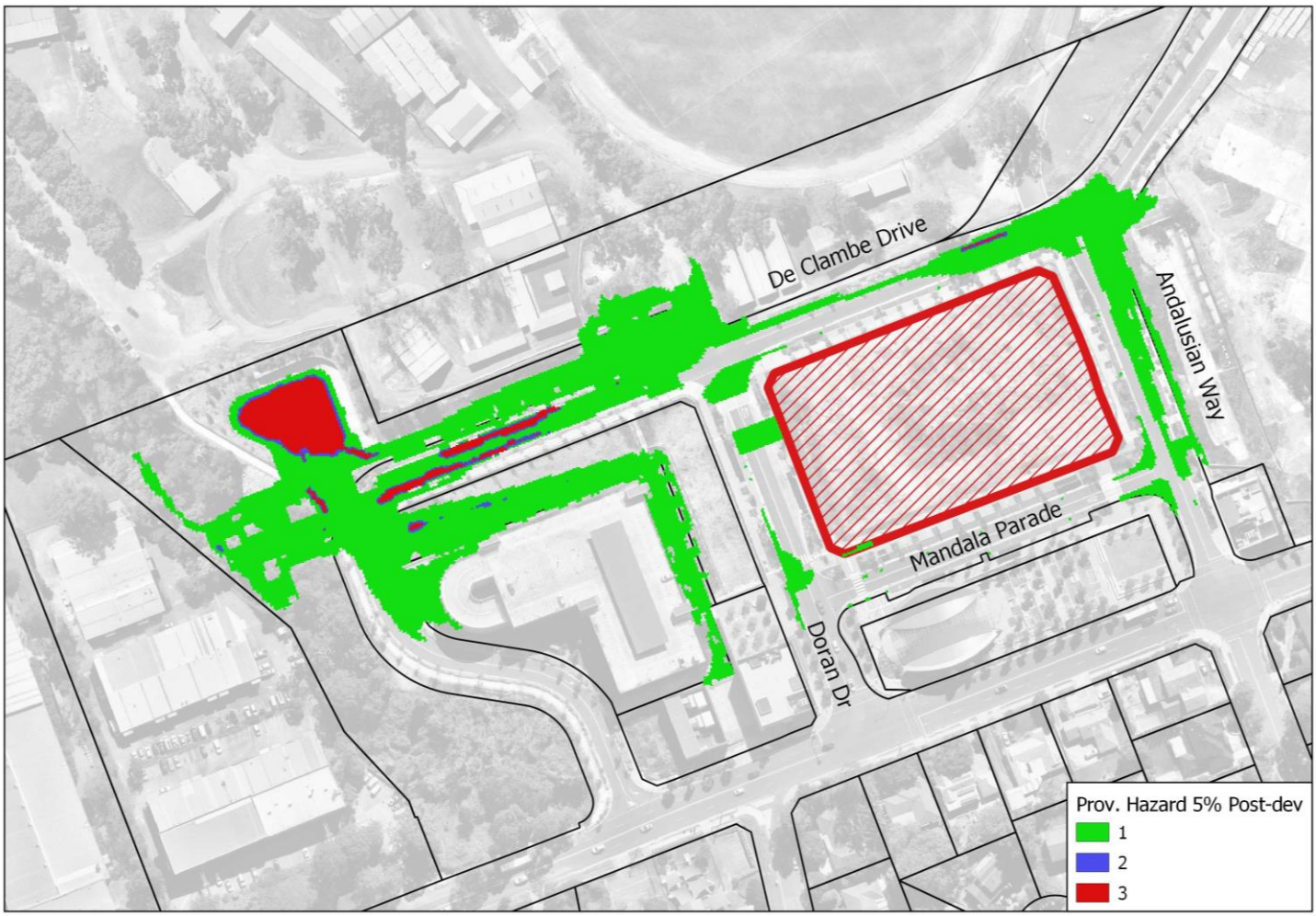

Figure 4.18 – Developed Scenario 5% AEP Flood Hazard

(1 = Low 2 = Medium 3 = High)

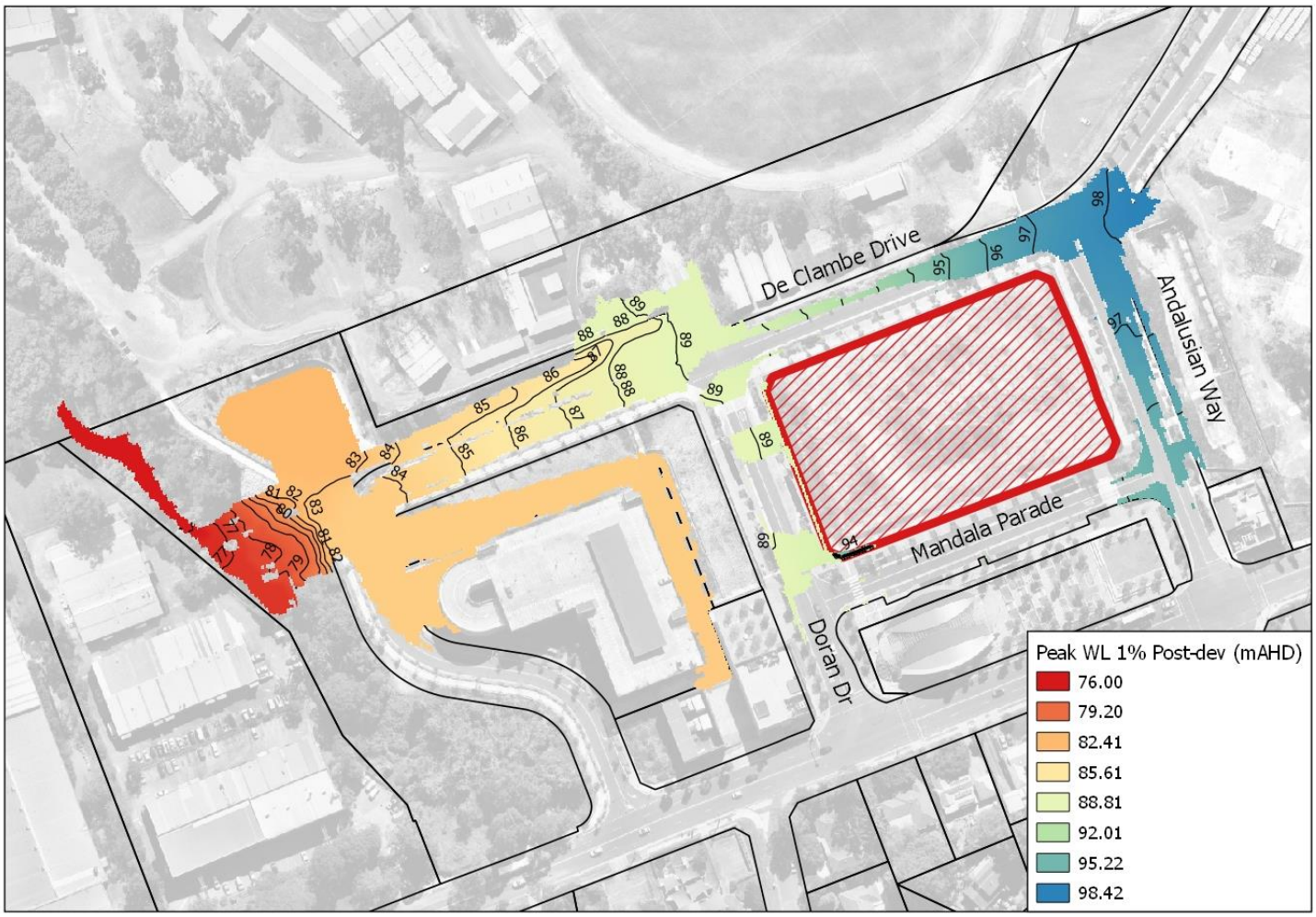

Figure 4.19 – Developed Scenario 1% AEP Flood Extent

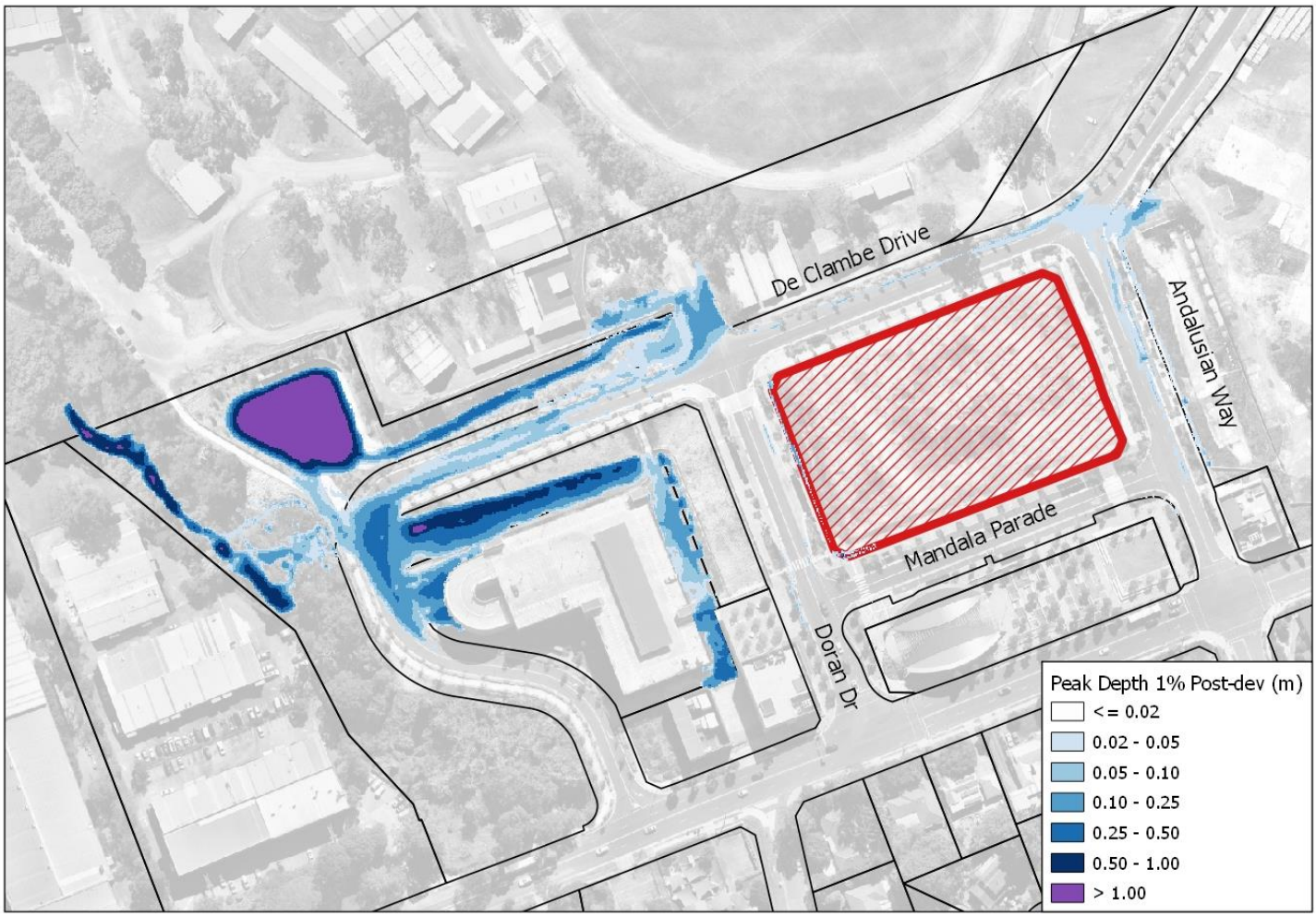

Figure 4.20 – Developed Scenario 1% AEP Flood Depth

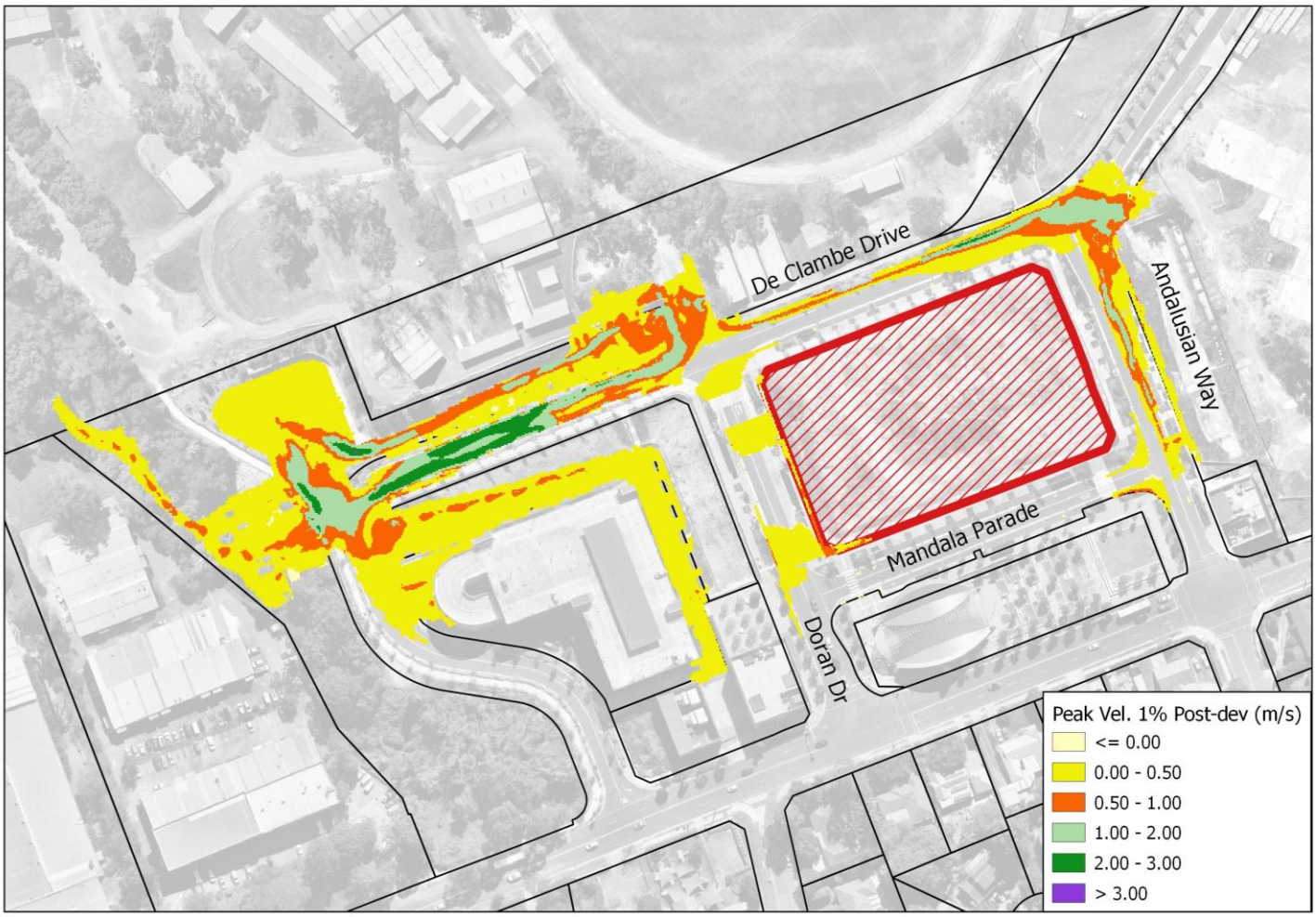

Figure 4.21 – Developed Scenario 1% AEP Flood Velocity

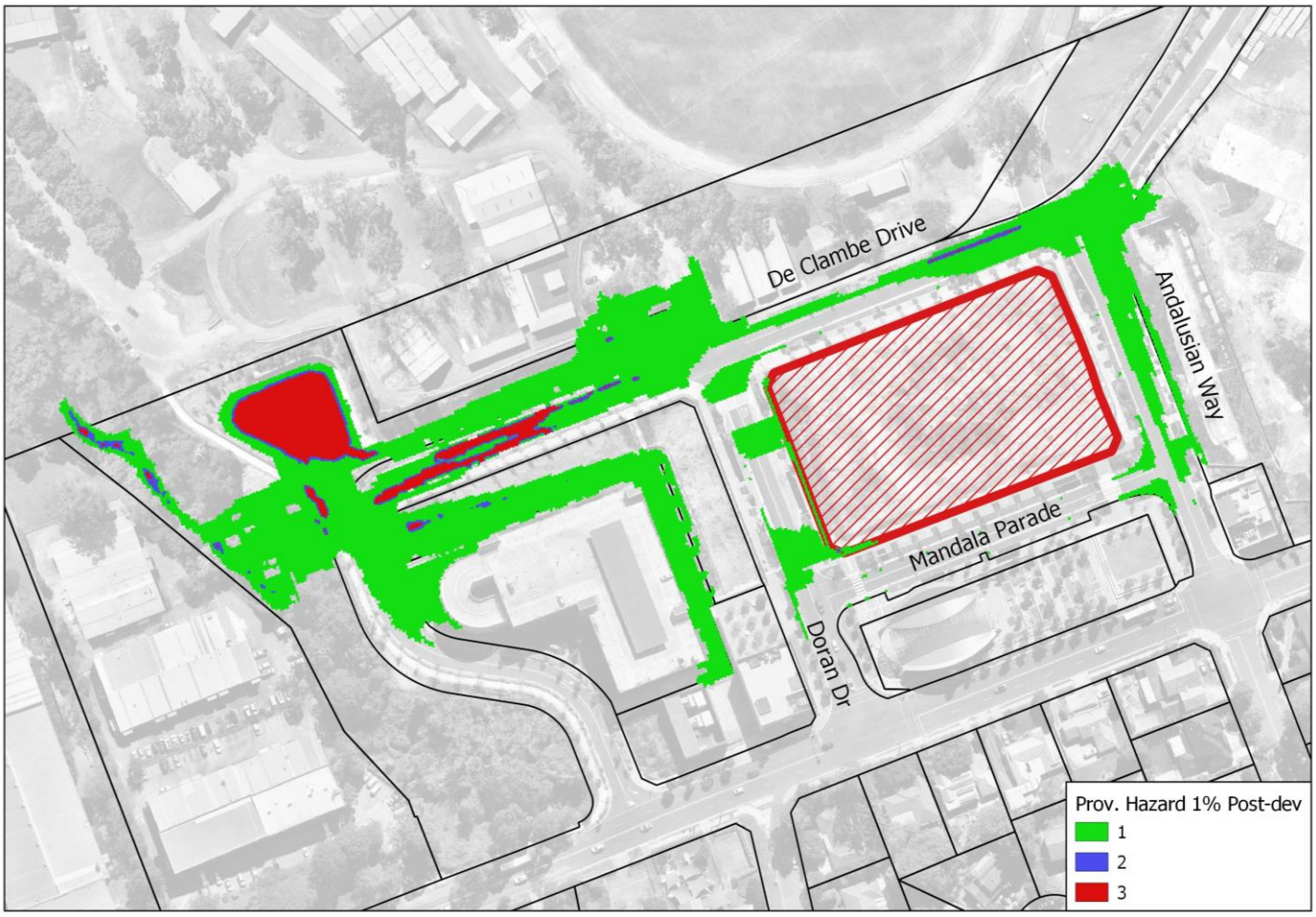

Figure 4.22 – Developed Scenario 1% AEP Flood Hazard

(1 = Low 2 = Medium 3 = High)

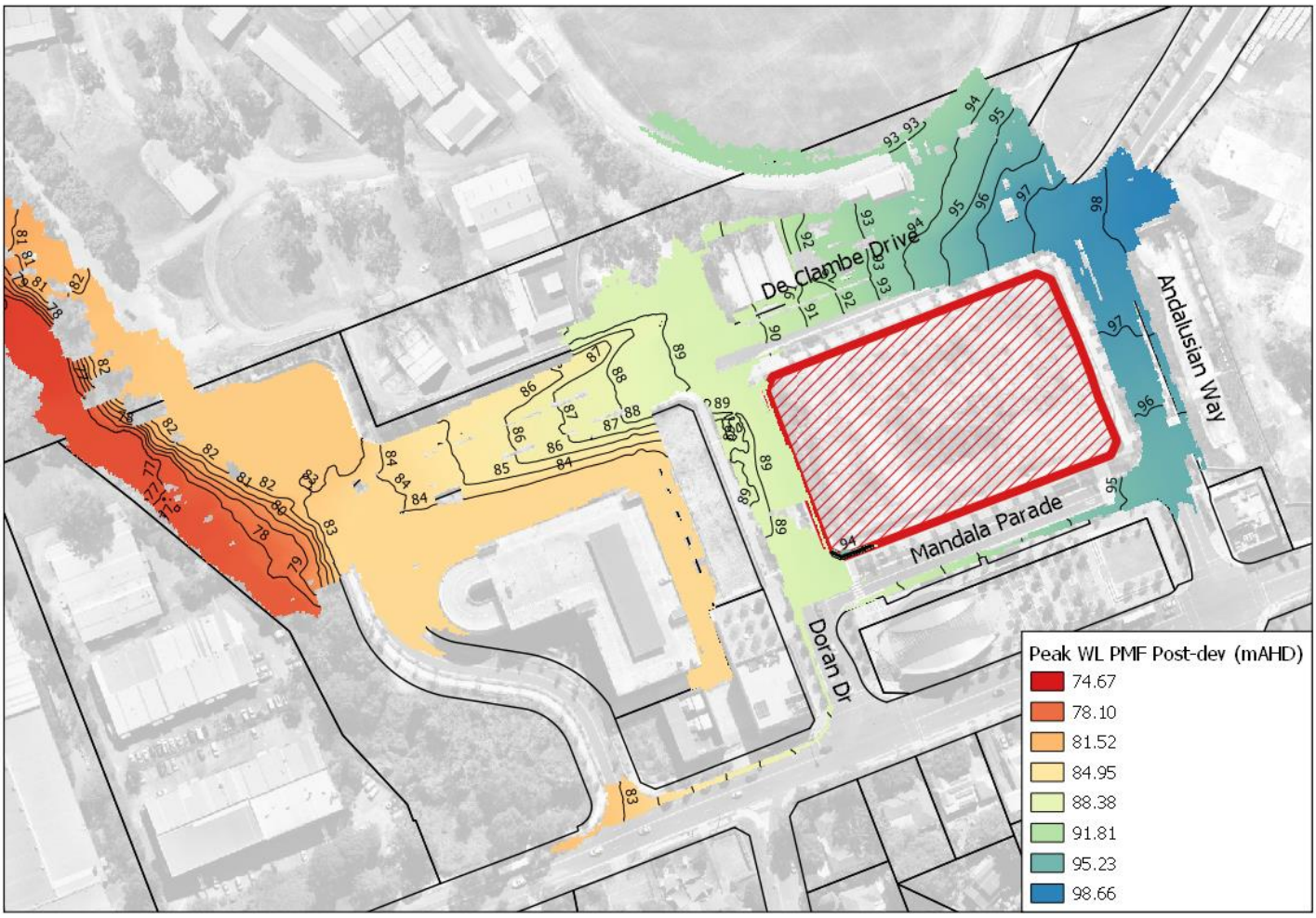

Figure 4.23 – Developed Scenario PMF Flood Level

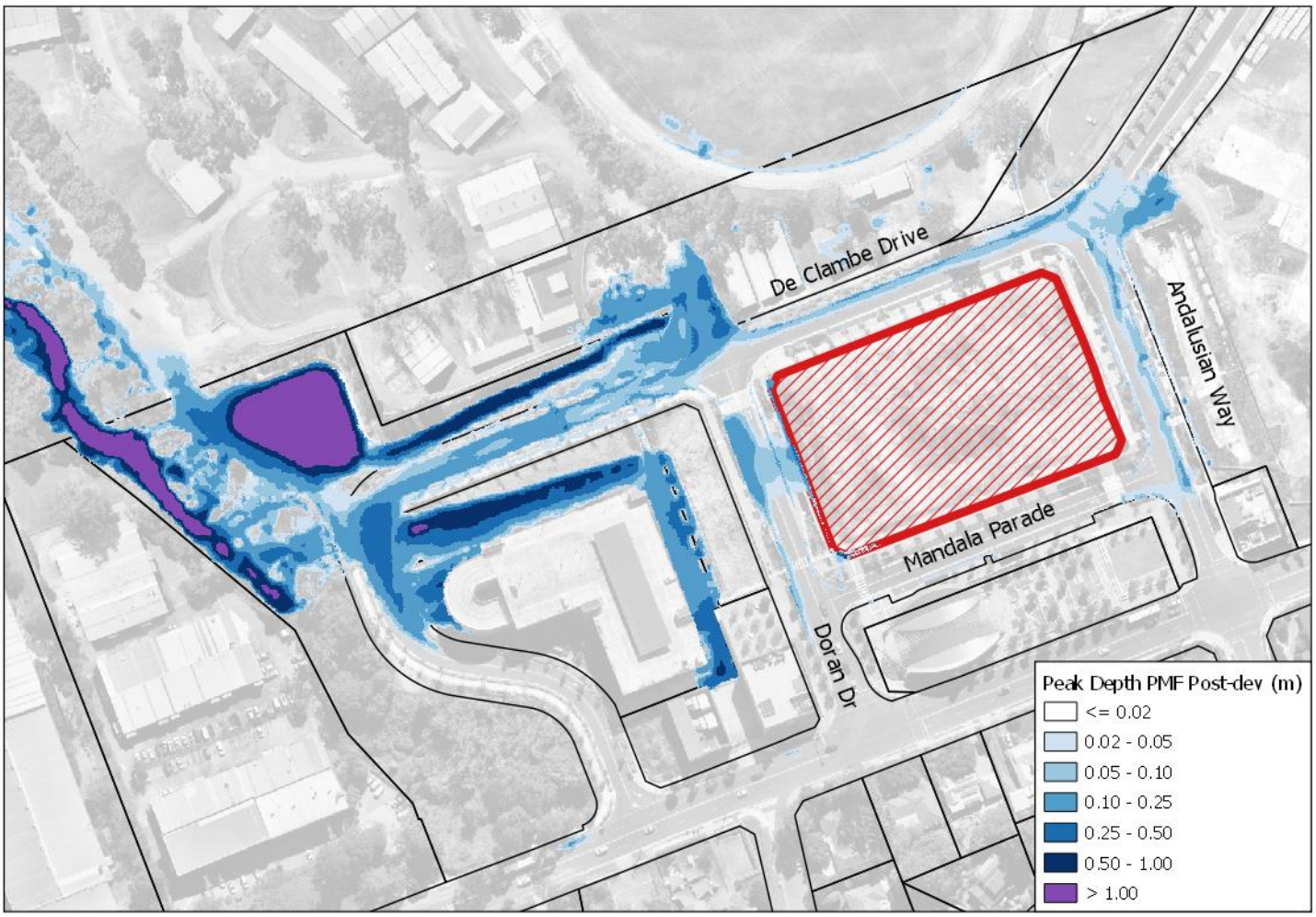

Figure 4.24 – Developed Scenario PMF Flood Depth

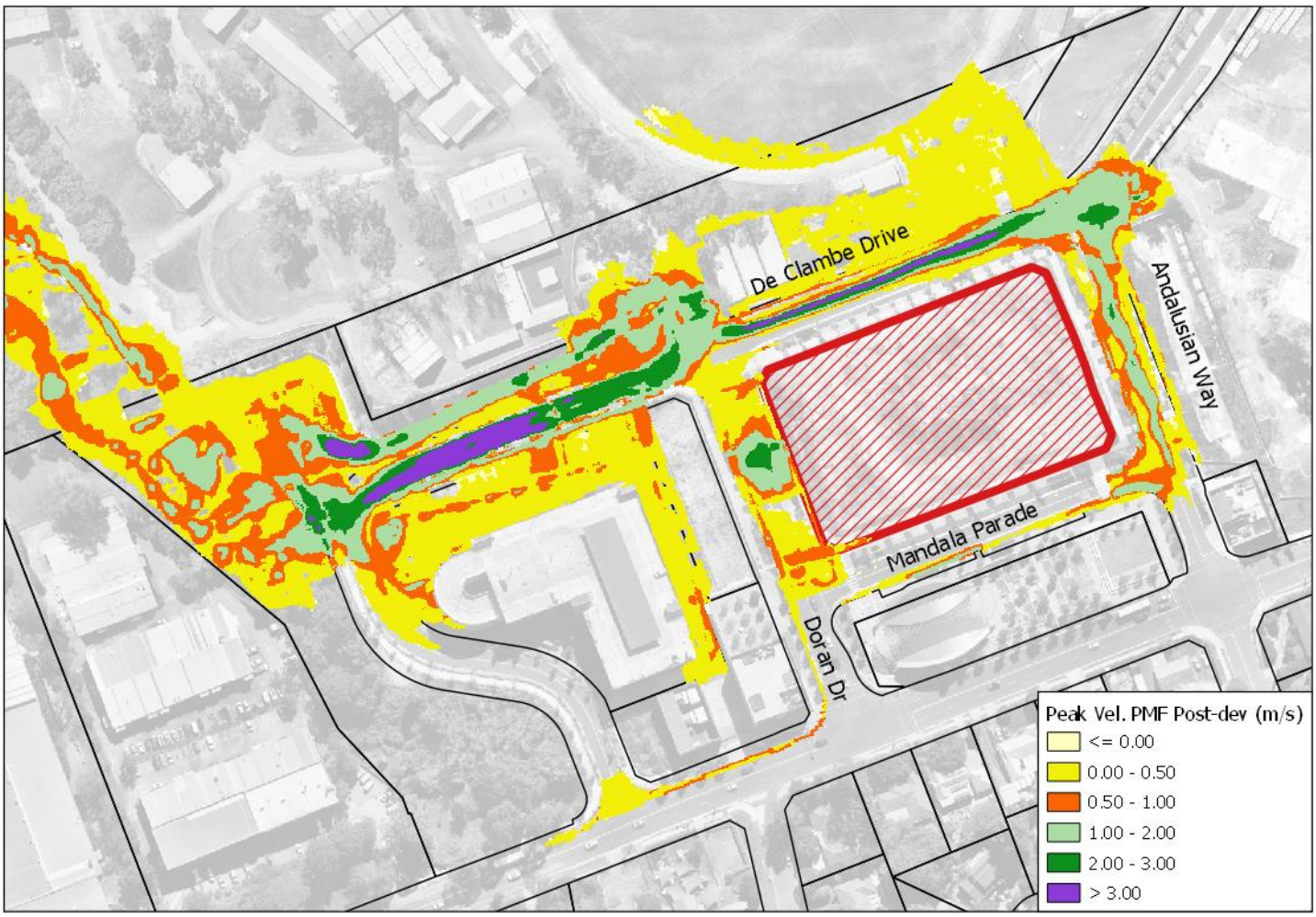

Figure 4.25 – Developed Scenario PMF Flood Velocity

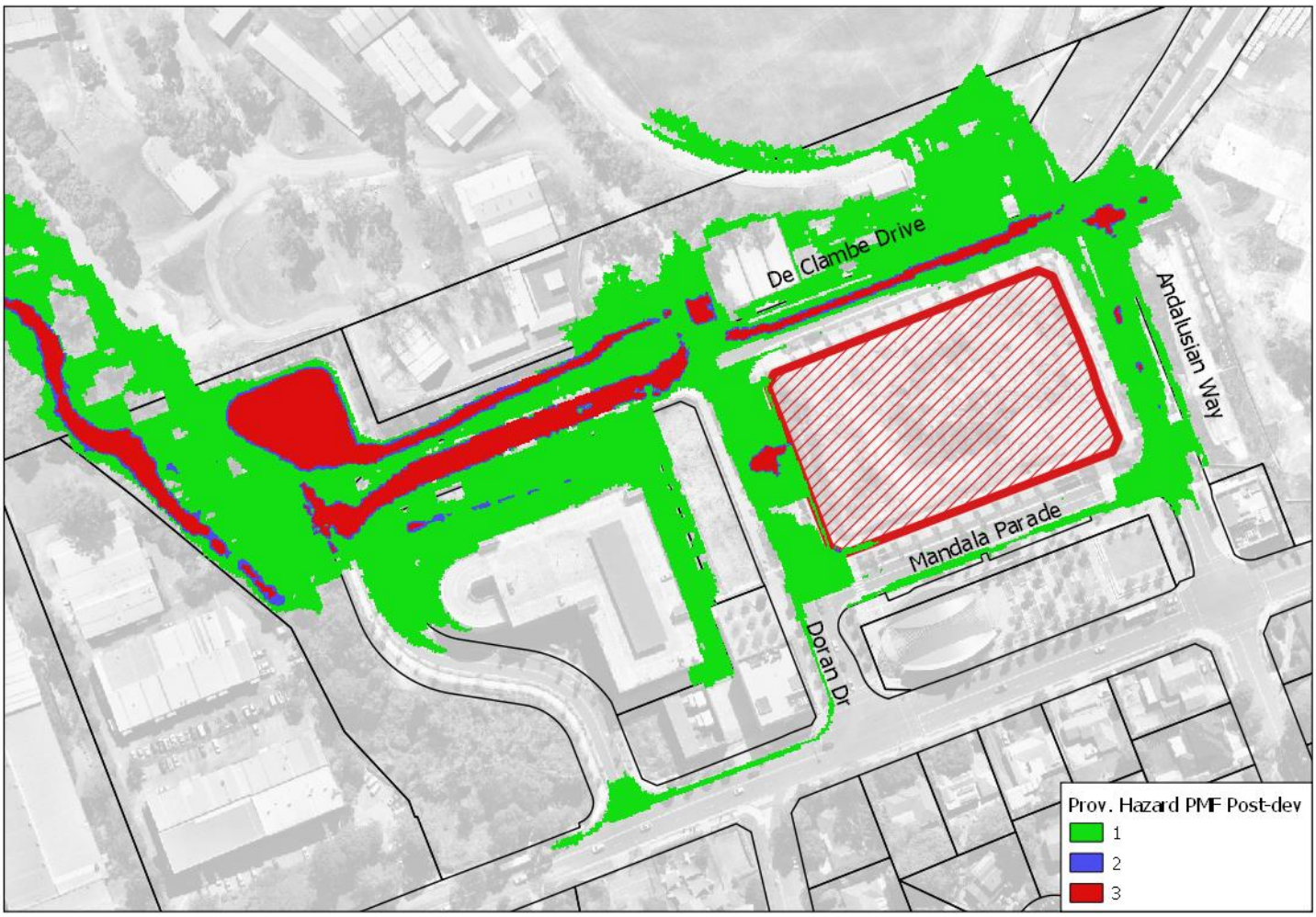

Figure 4.26 – Developed Scenario PMF Flood Hazard

(1 = Low 2 = Medium 3 = High)

4.3.1 *Discussion*

The proposed development was modelled as a blockage to overland flow. The flood behaviour is similar to the existing scenario for the roads surrounding the site since there is no overland flow path through the site for the upstream catchment.

The development has an OSD, which is proposed to reduce the runoff from the developed site to the pre-development levels up to the 1% AEP event. However, for larger flood events. the overflow from the OSD will initiate near Mandala Parade and result in some minor flooding at that location.

The flood behaviour for the developed scenario can be summarised as:

- The flood behaviour is similar to the existing conditions

- There is minor overflow from the OSD in the 1% AEP event resulting in overland flow near the intersection of Doran Drive and Mandala Parade
- The provisional flood hazard is low on the surrounding roads of the site

In a PMF event, the flooding is generally contained within the road reserve. However, the overflow from the building drainage and the OSD results in additional flow arriving at Doran Avenue.

4.4 Flood Impact Assessment

The flood impact of the proposed development was assessed by comparing the pre and post development flood behaviour. Difference in flood level, velocity and hazard for the pre and post development scenarios was estimated to highlight the change.

The difference maps for the peak flood level, velocity and hazard for the 5% AEP are presented in **Figure 4.27** to **Figure 4.29** and for 1% in **Figure 4.30** to **Figure 4.32**.

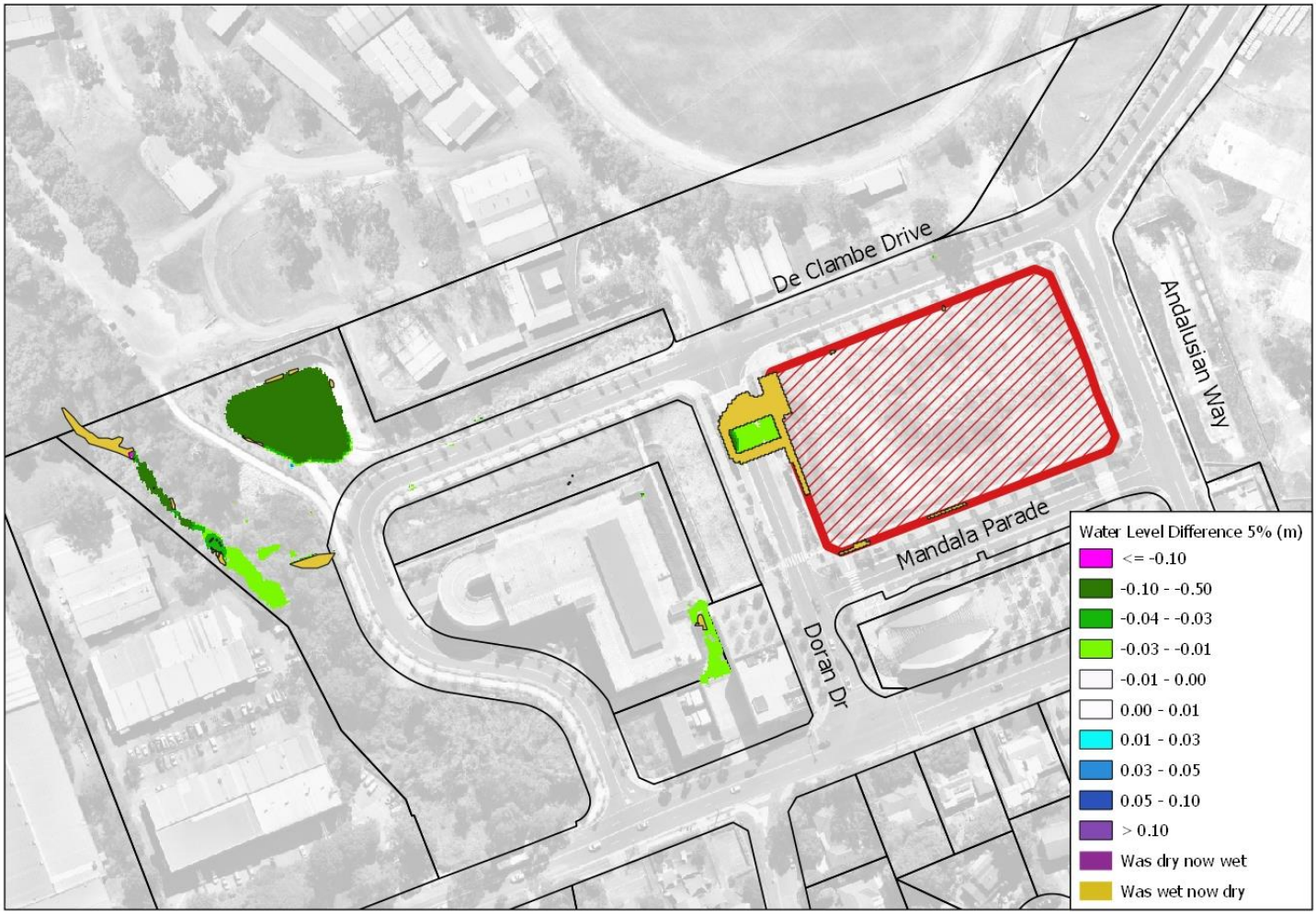

Figure 4.27 – Flood Level Difference – 5% AEP

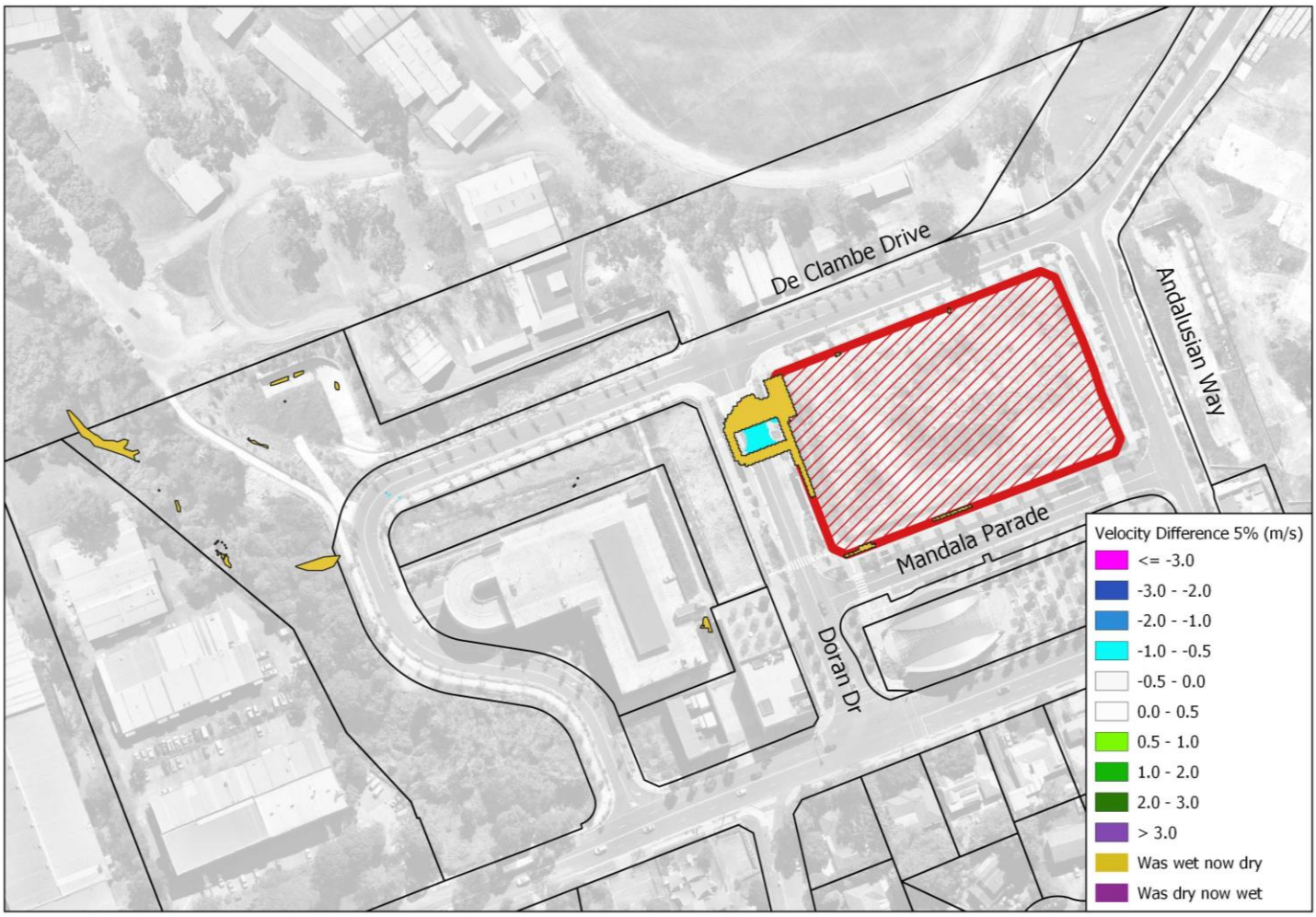

Figure 4.28 – Flood Velocity Difference – 5% AEP

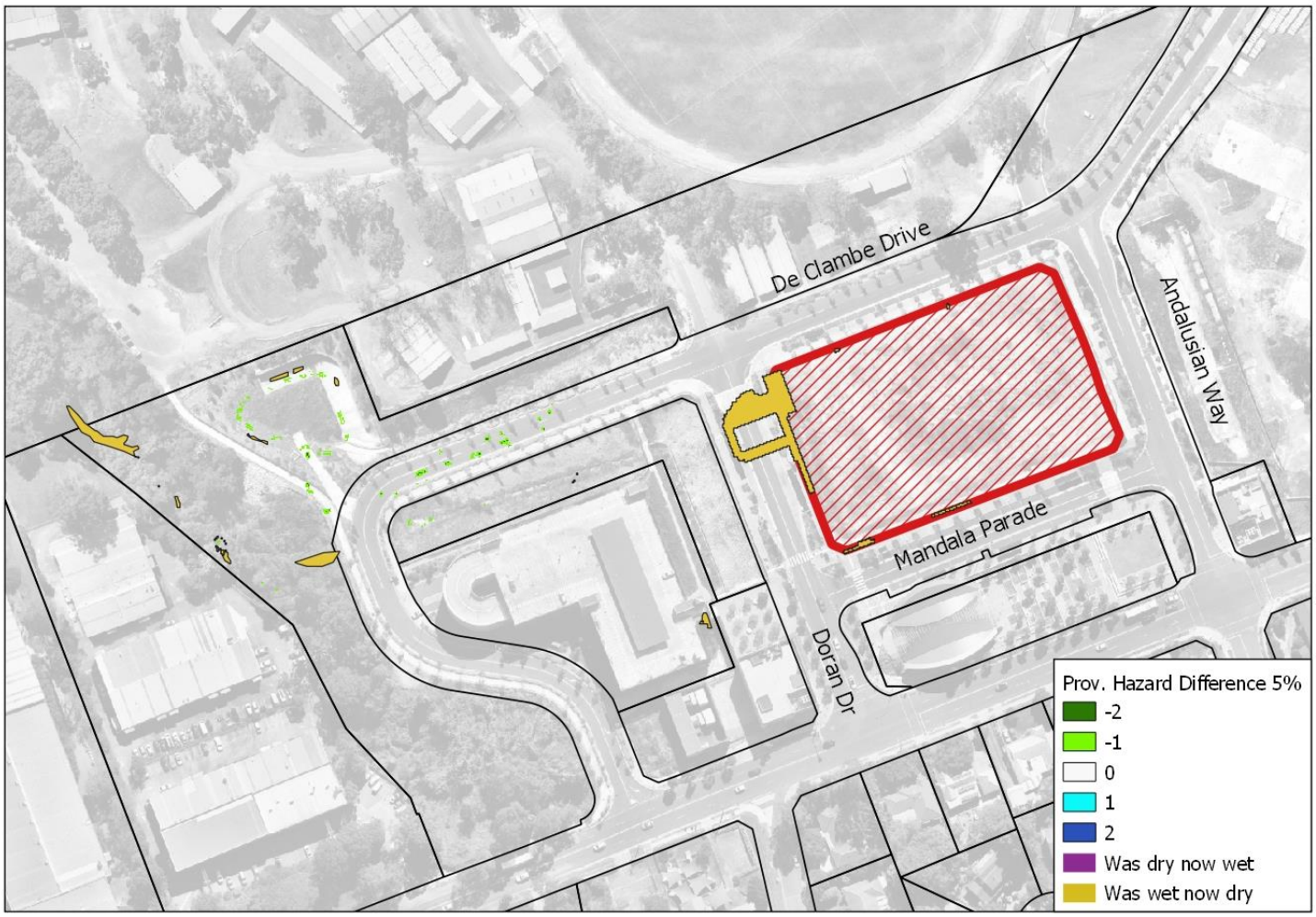

Figure 4.29 – Flood Hazard Difference – 5% AEP

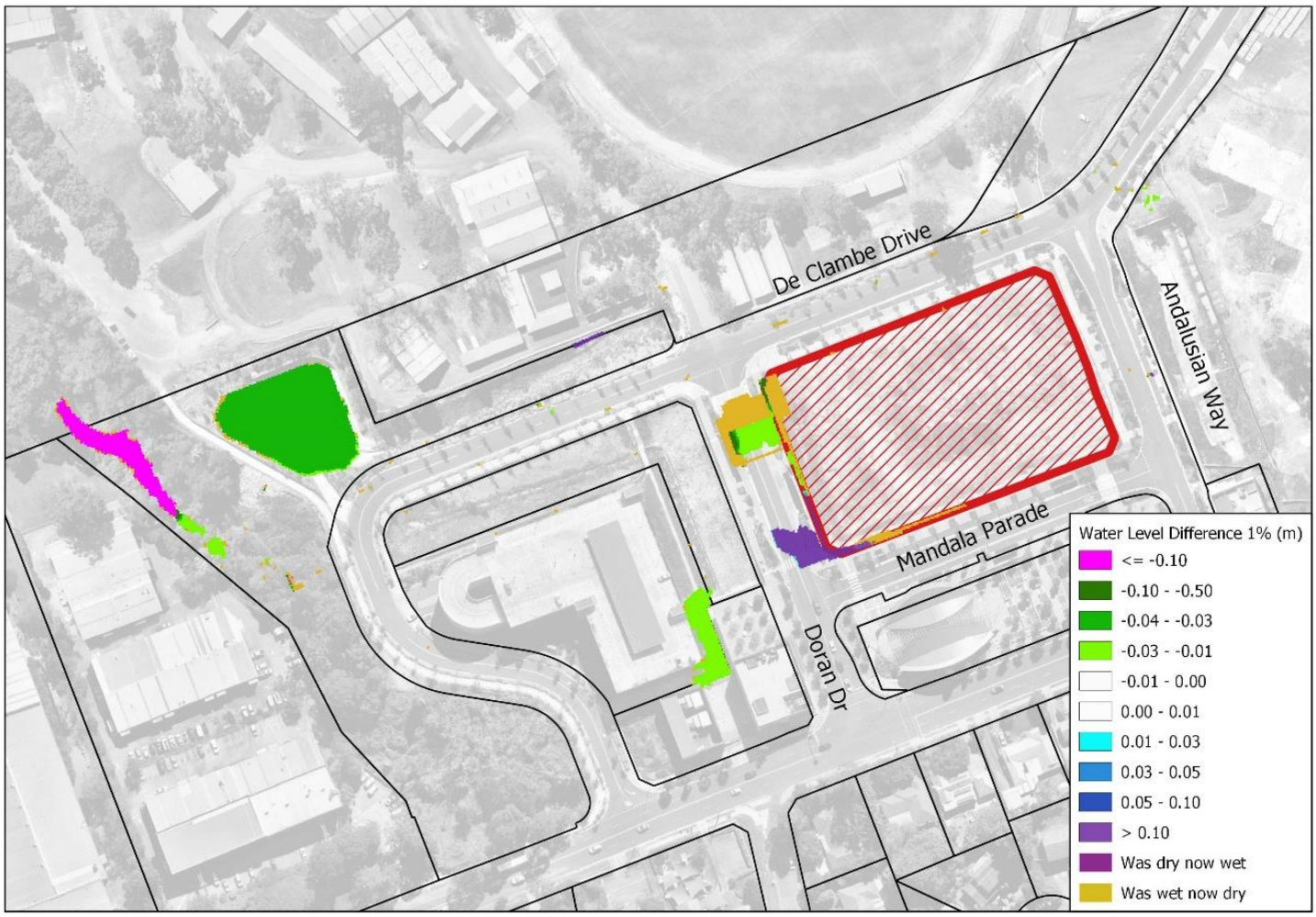

Figure 4.30 – Flood Level Difference – 1% AEP

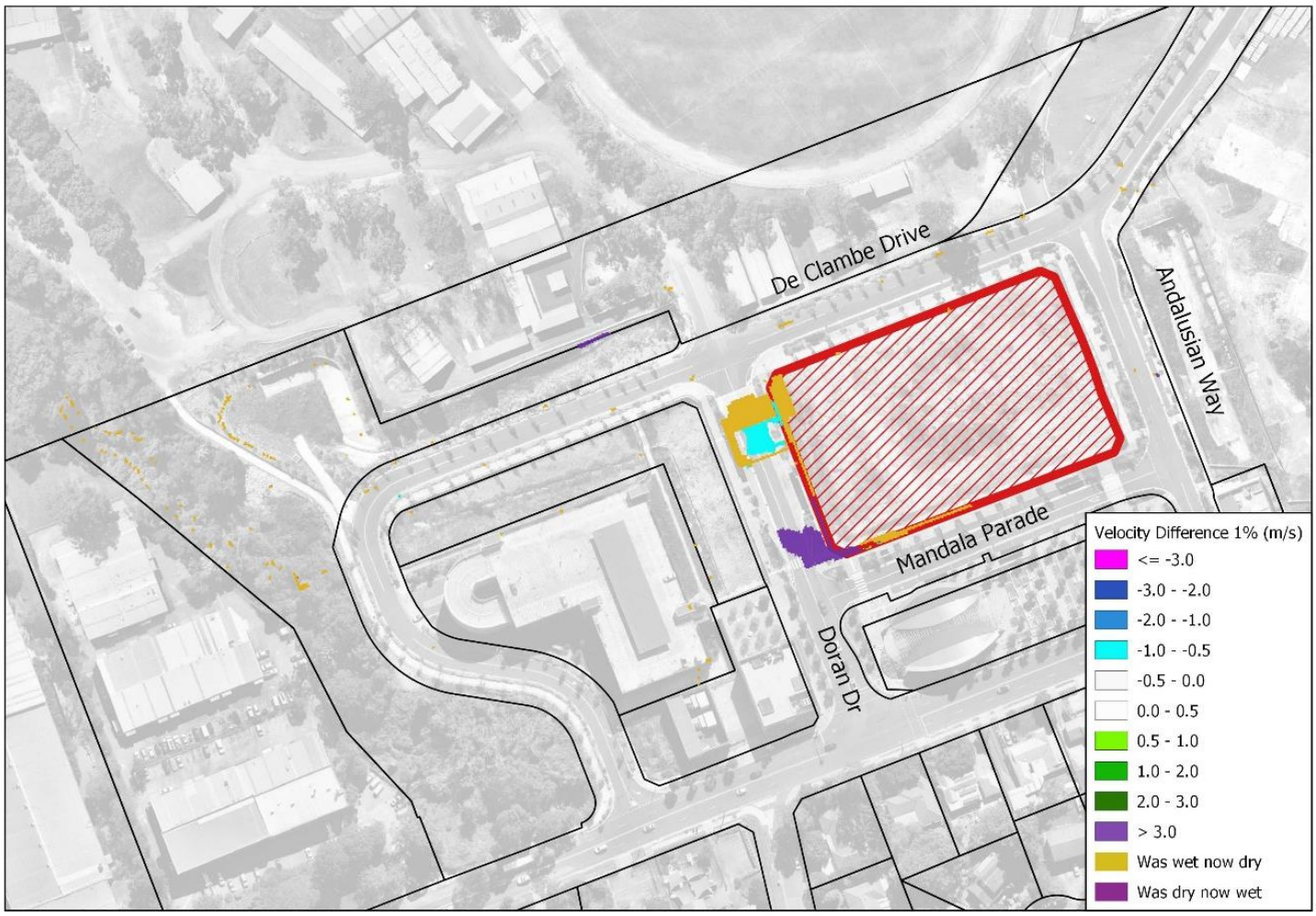

Figure 4.31 – Flood Velocity Difference – 1% AEP

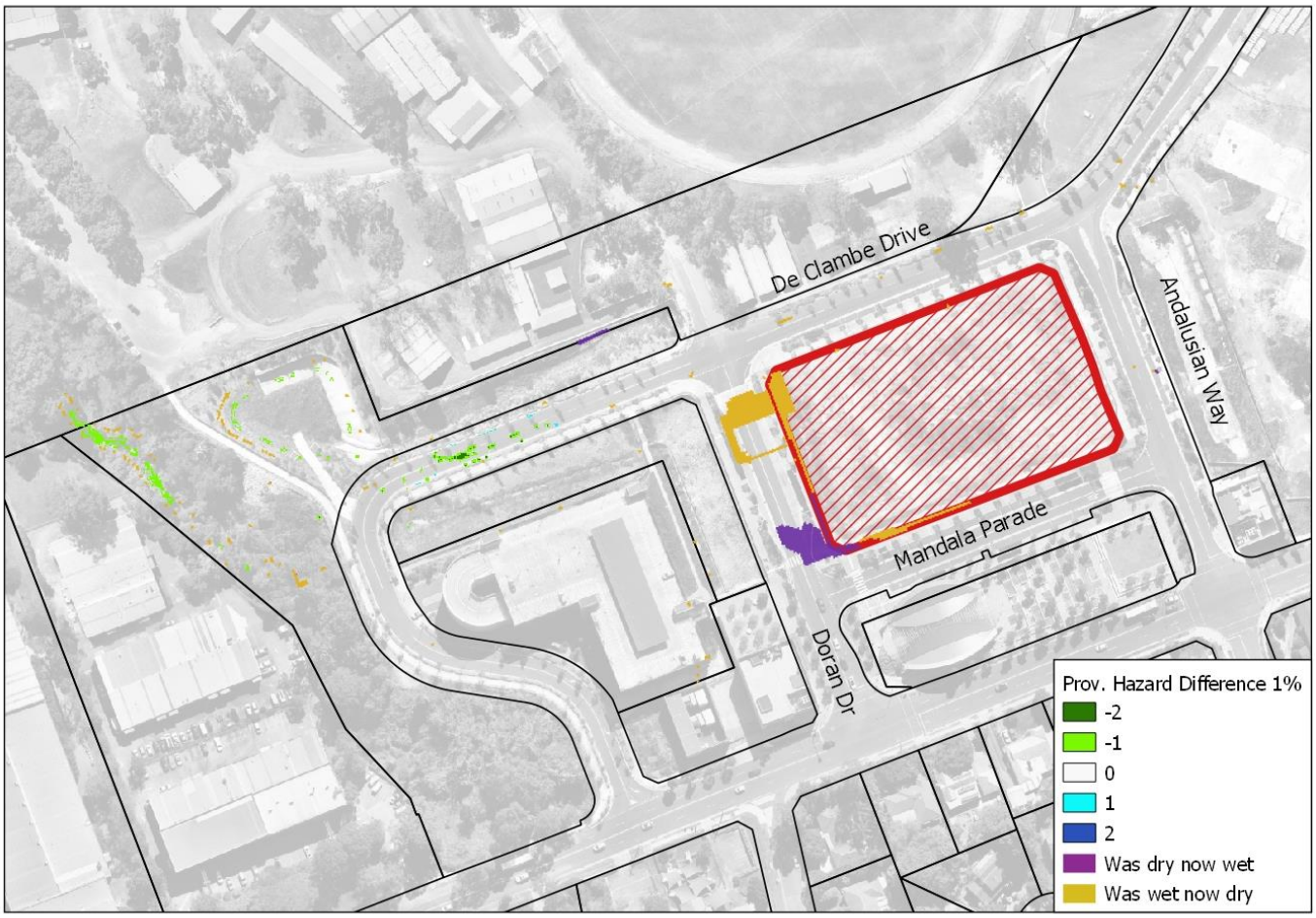

Figure 4.32 – Flood Hazard Difference – 1% AEP

4.4.1 *Discussion*

Comparison of pre and post development flood behaviour shows no significant impact in the 5% AEP and the 1% AEP flood events. This is primarily due to the flooding being contained within the road reserve.

With the proposed development the runoff from the site would be directed to an OSD and only a small part of the site would directly contribute runoff to Doran Avenue. However, under existing conditions, a significant part of the site contributes flow to Doran Avenue sag near the bus stop. The flooding of Doran Avenue at the sag would therefore reduce with the proposed development.

The proposed OSD for the development, near the intersection of Doran Avenue and Mandala Parade, is shown to overflow during the 1% AEP flood. However, the overflow depth is not significant and the provisional flood hazard remains Low.

Further downstream, within the flood detention basin and the Cattai Creek there is reduction in flood levels and hence no adverse impact.

5 CLIMATE CHANGE ASSESSMENT

The future climate is likely to produce more intense rainfall and consequent flooding. As suggested by the SEARs, the impact of climate change was assessed by undertaking flood modelling for the 0.5% AEP and 0.2% AEP flood events (20 minute duration), both events representing higher intensity flooding for two periods in the future.

The modelling was undertaken for the developed scenario to determine the impact of the development in a future climate. **Figure 5.1**to **Figure 5.4** show the flood level, depth, velocity and hazard for 0.5% AEP event and **Figure 5.5** to **Figure 5.8** show the same for the 0.2% AEP event.

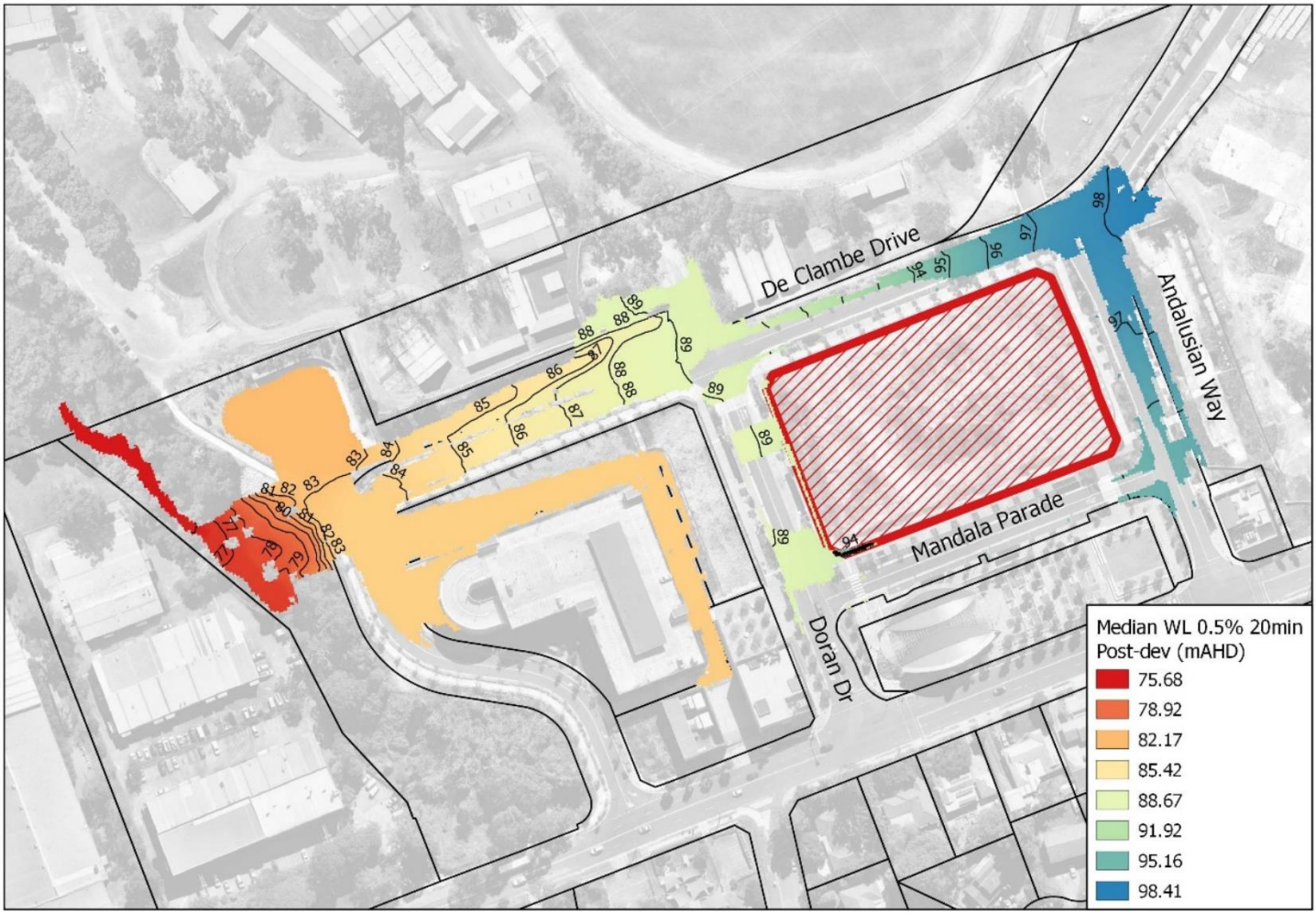

Figure 5.1 – Developed Scenario 0.5% AEP Flood Level

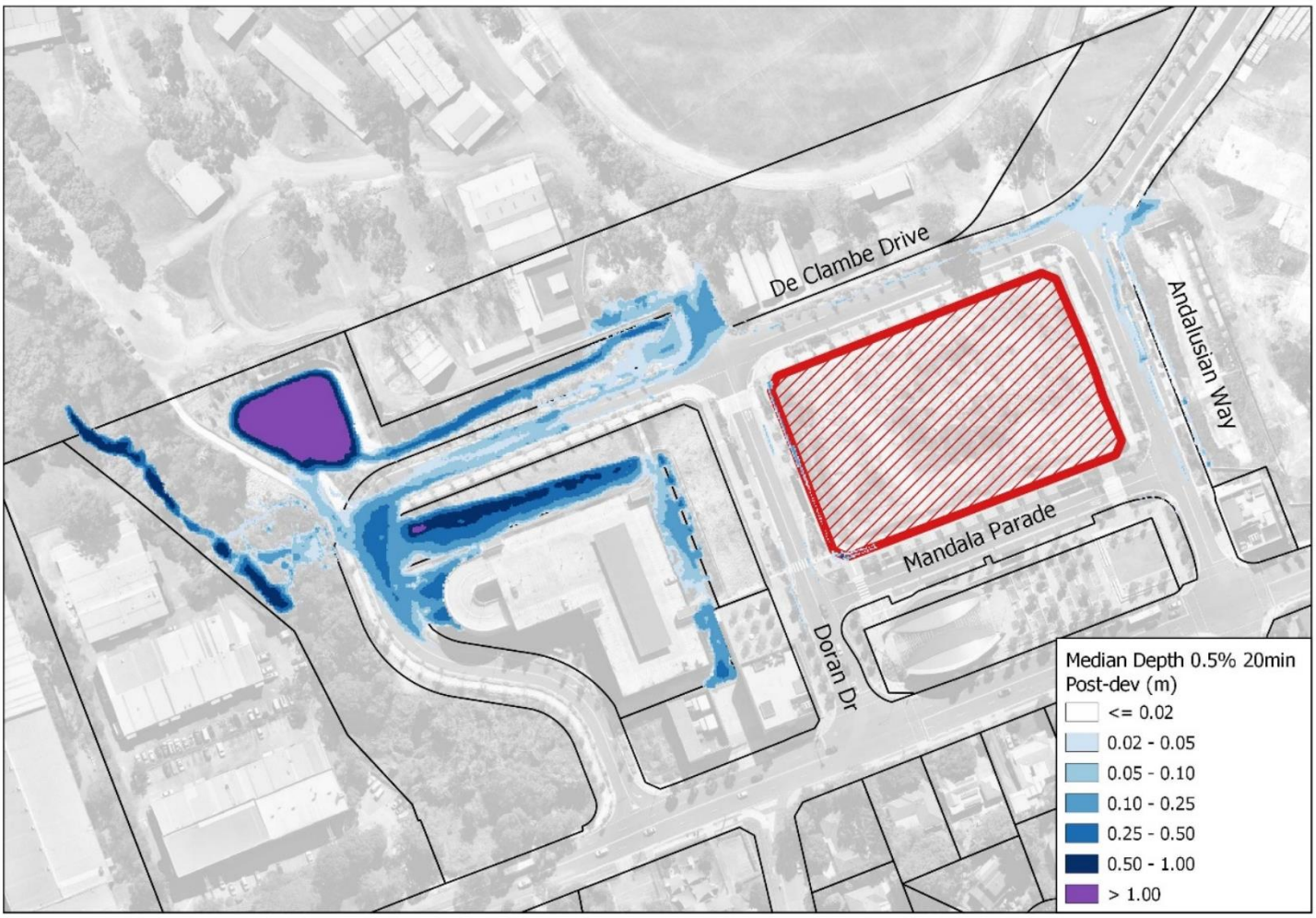

Figure 5.2 – Developed Scenario 0.5% AEP Flood Depth

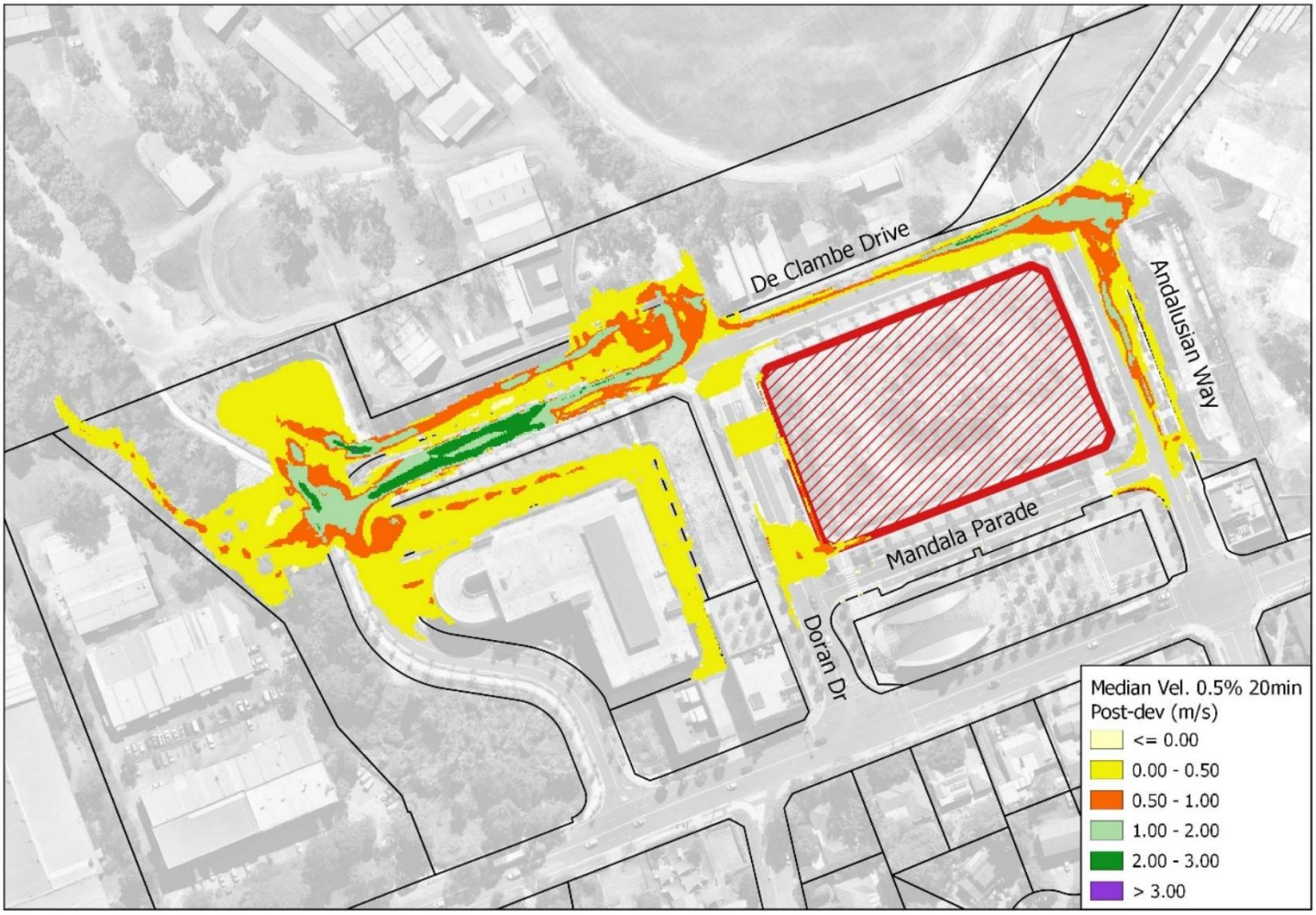

Figure 5.3 – Developed Scenario 0.5% AEP Flood Velocity

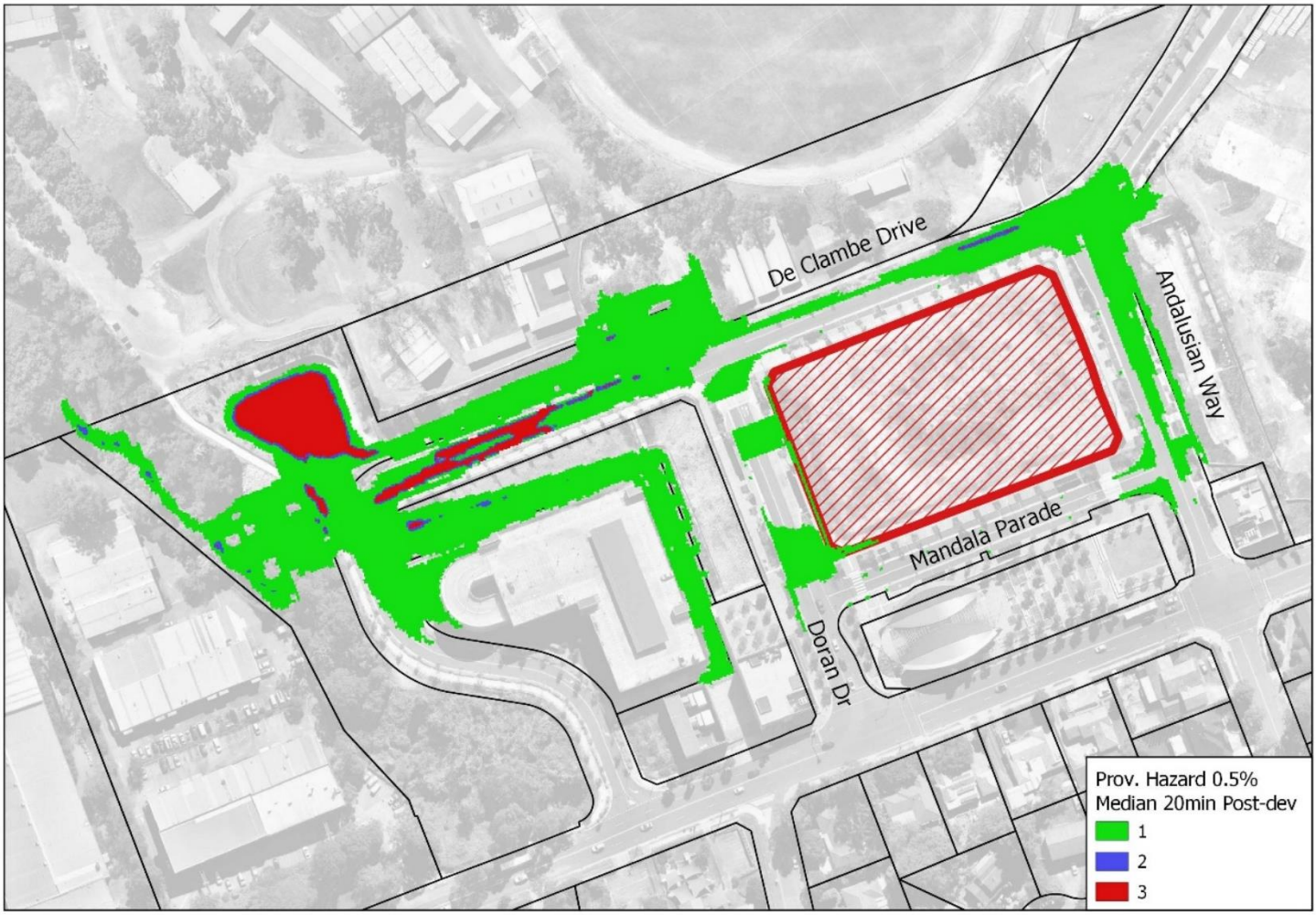

Figure 5.4 – Developed Scenario 0.5% AEP Flood Hazard

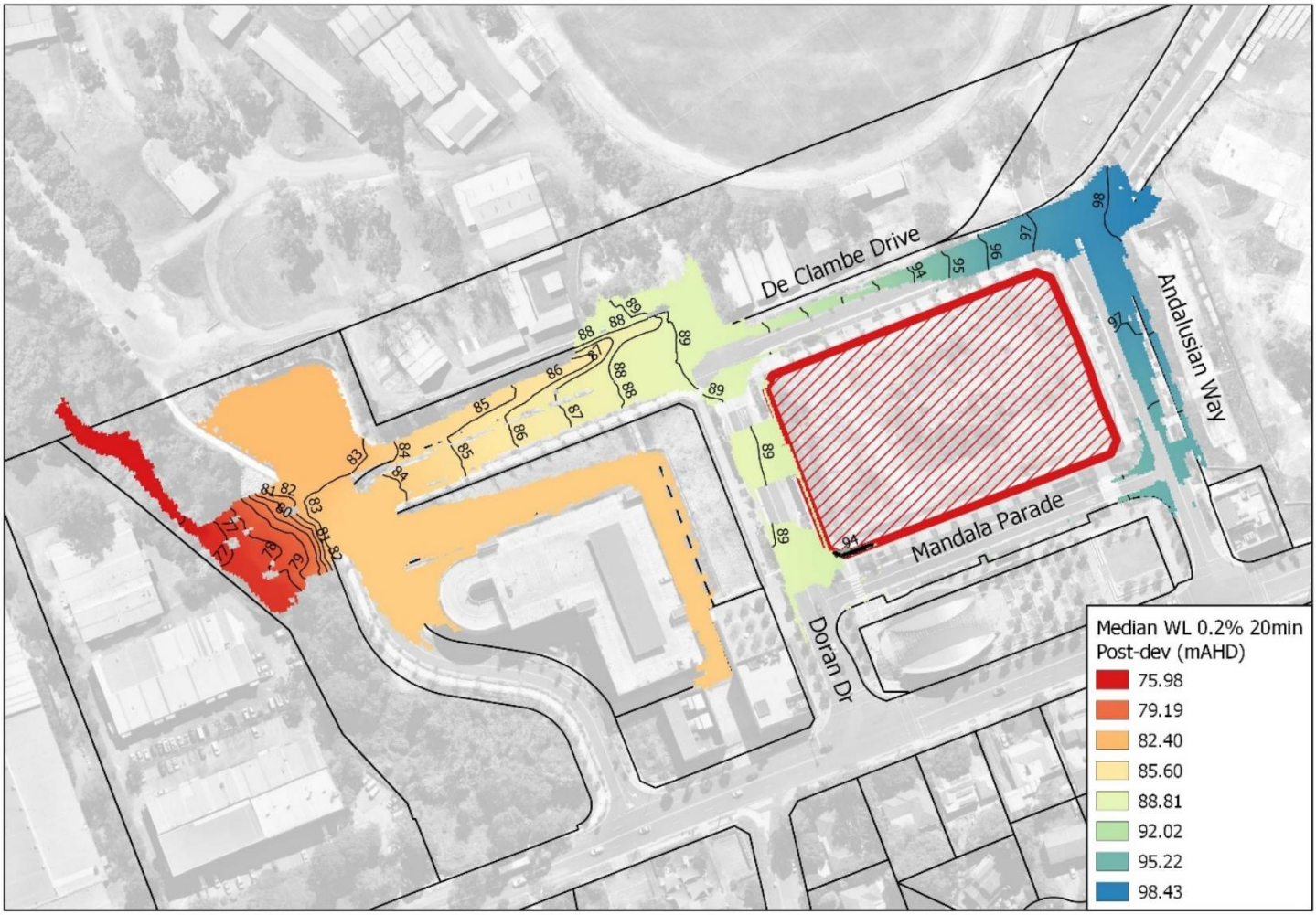

Figure 5.5 – Developed Scenario 0.2% AEP Flood Level

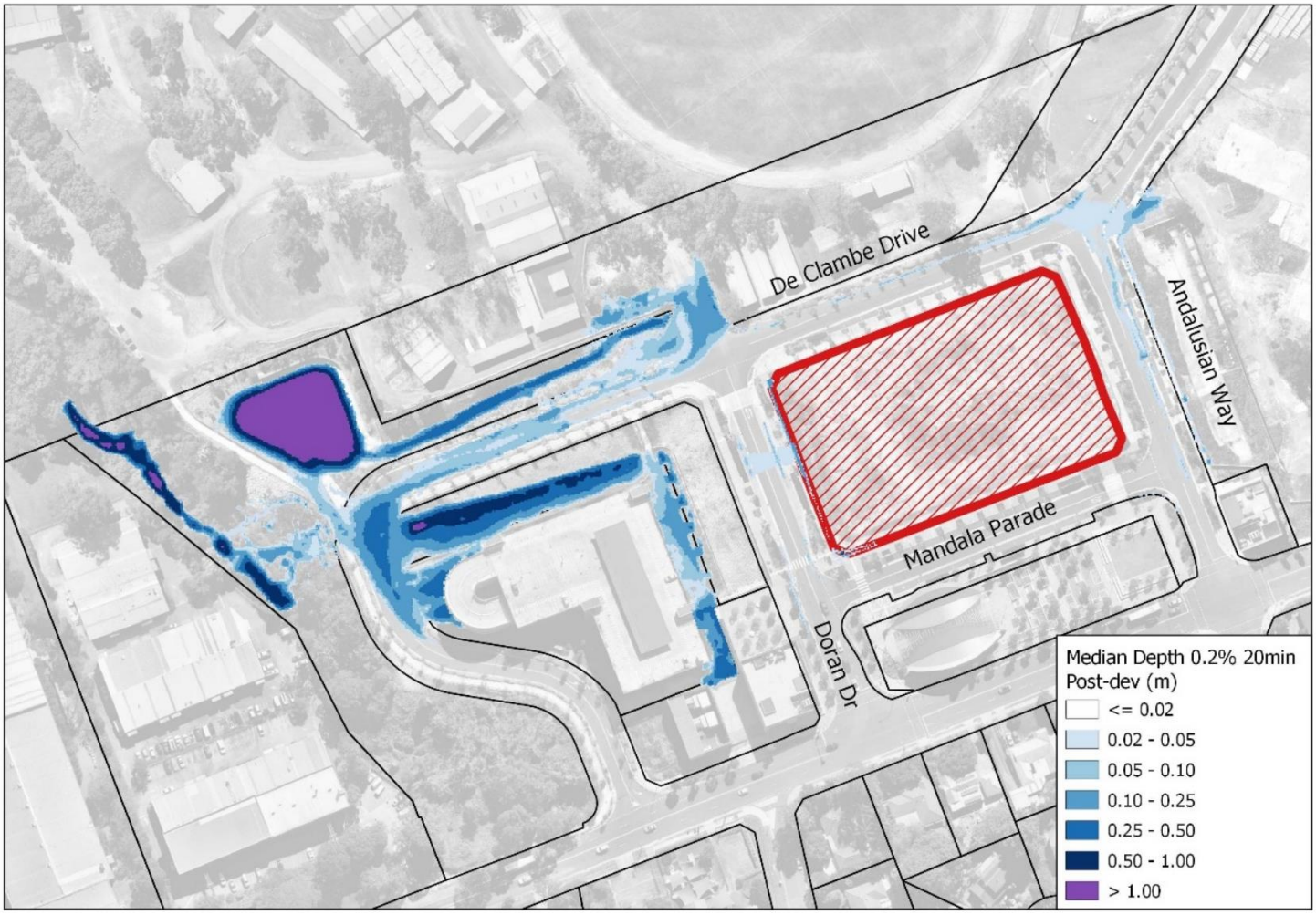

Figure 5.6 – Developed Scenario 0.2% AEP Flood Depth

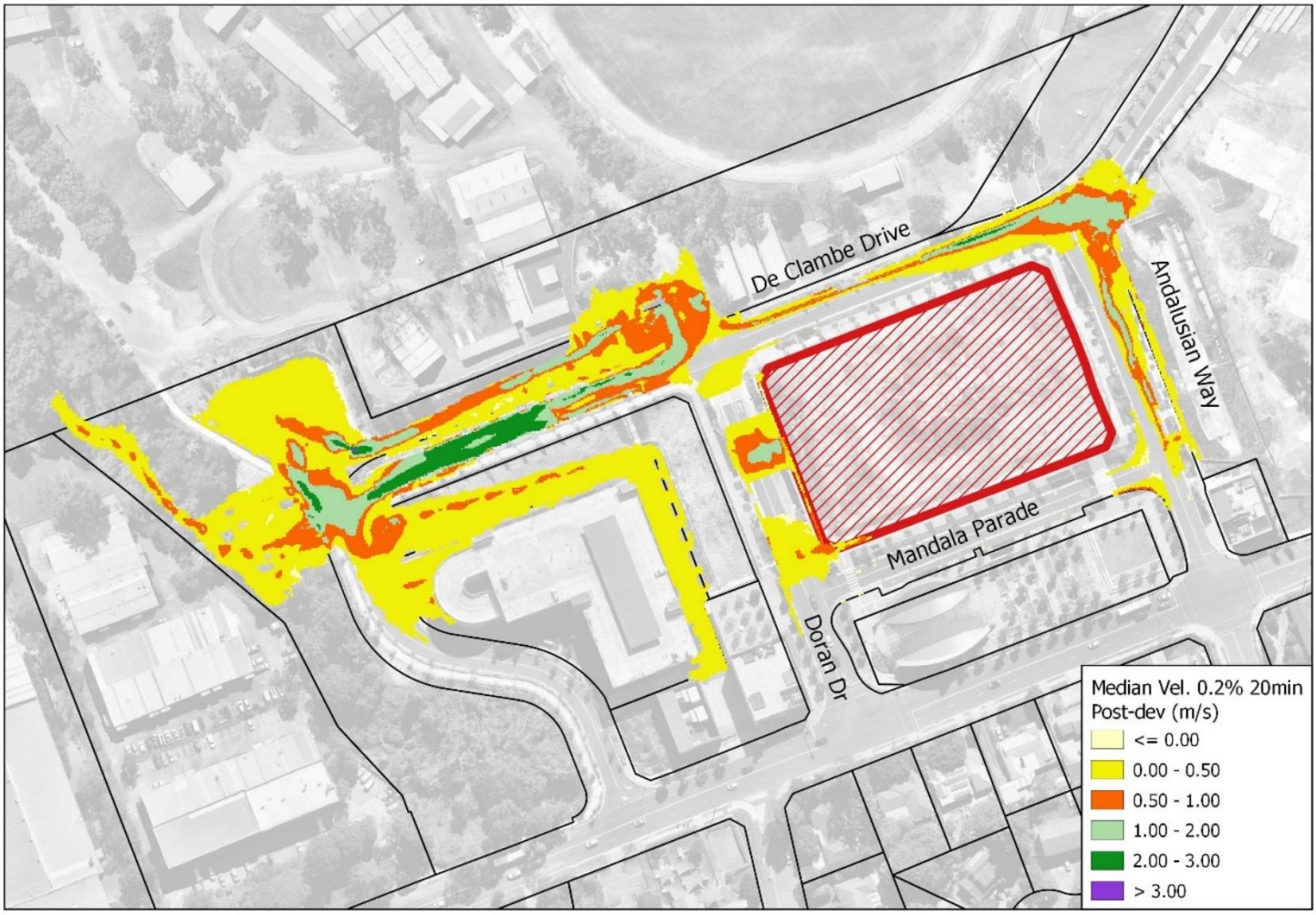

Figure 5.7 – Developed Scenario 0.2% AEP Flood Velocity

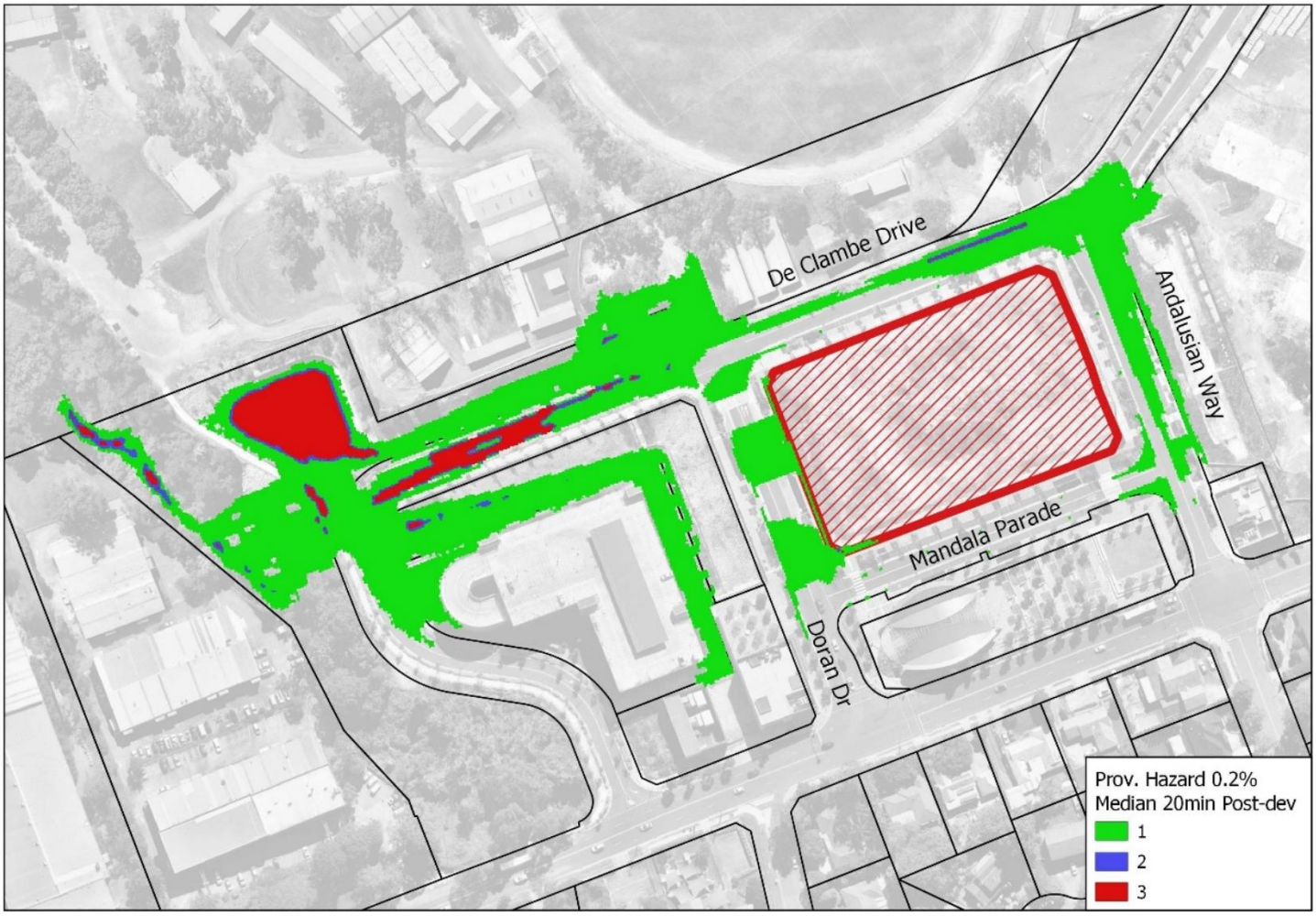

Figure 5.8 – Developed Scenario 0.5% AEP Flood Hazard

5.1 Future Climate Flood Behaviour

The incremental change in the flood behaviour for the development was assessed by preparing difference maps of 0.5% and 0.2% AEP events with the 1% AEP event for the developed scenario. Figure 5.9 to Figure 5.11 shows the change in flood behaviour for the 0.5% AEP event and Figure 5.12 to Figure 5.14 for the 0.2% AEP event.

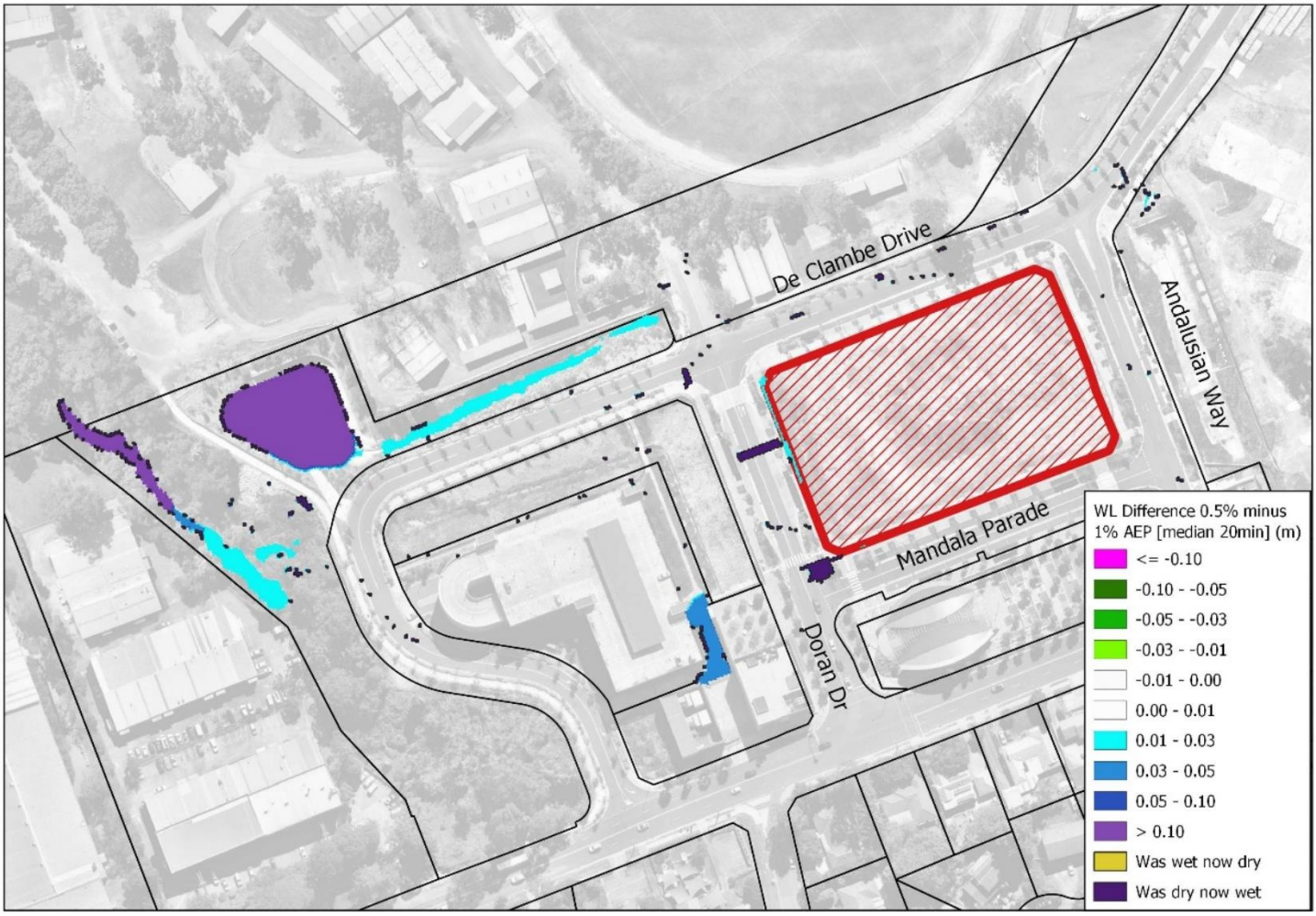

Figure 5.9 – Flood Level Difference – 0.5% AEP

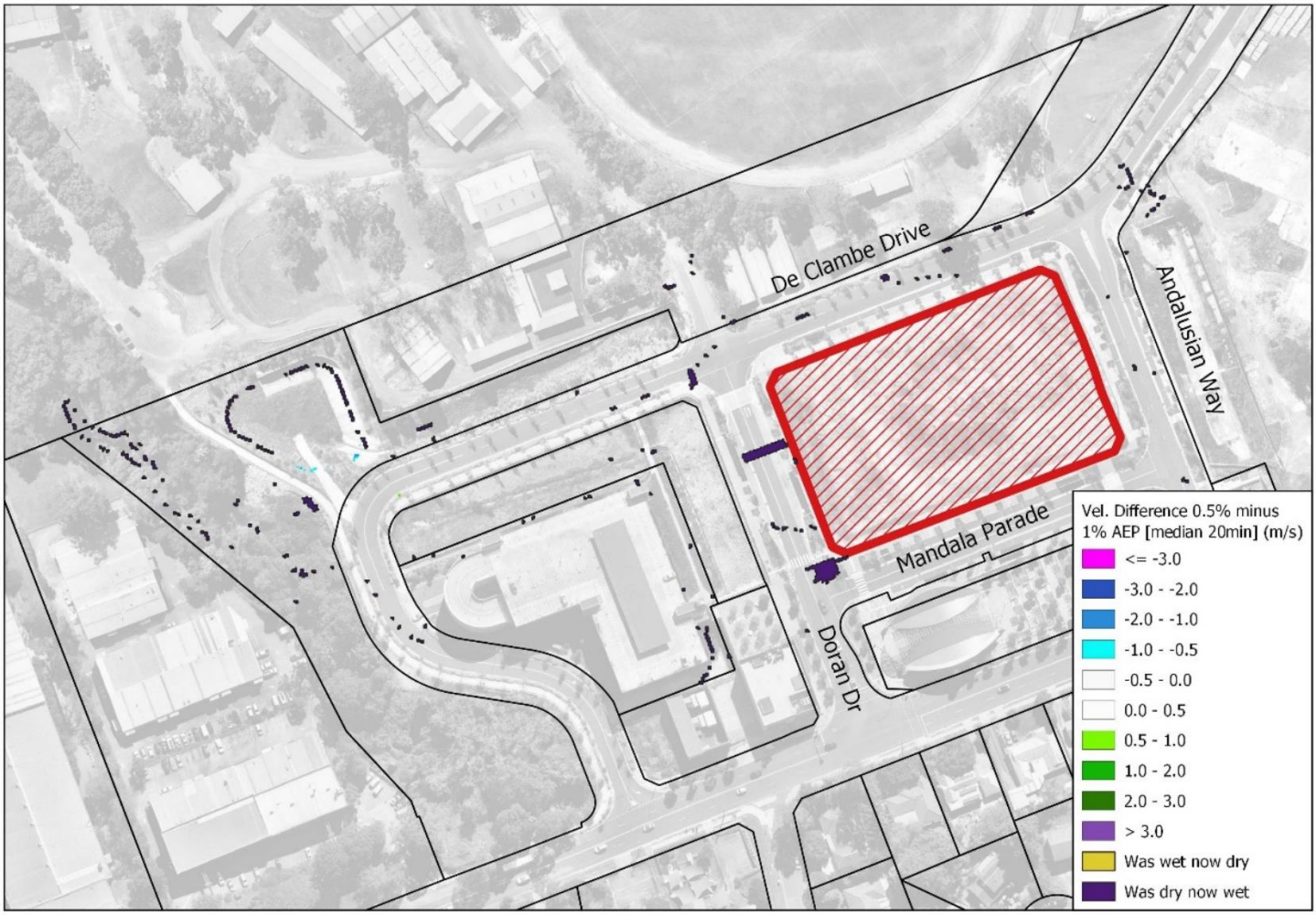

Figure 5.10 – Flood Velocity Difference – 0.5% AEP

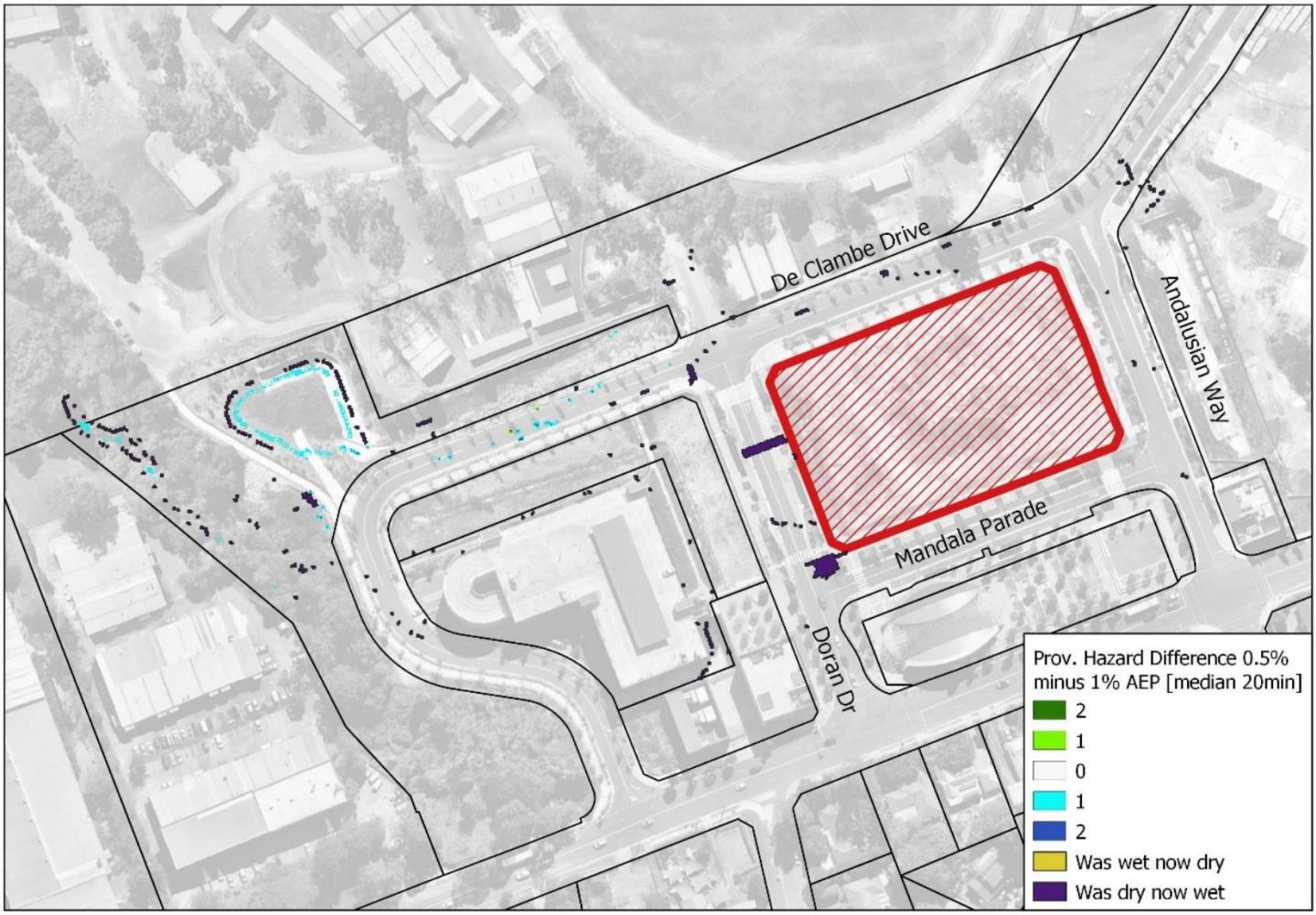

Figure 5.11 – Flood Hazard Difference – 0.5% AEP

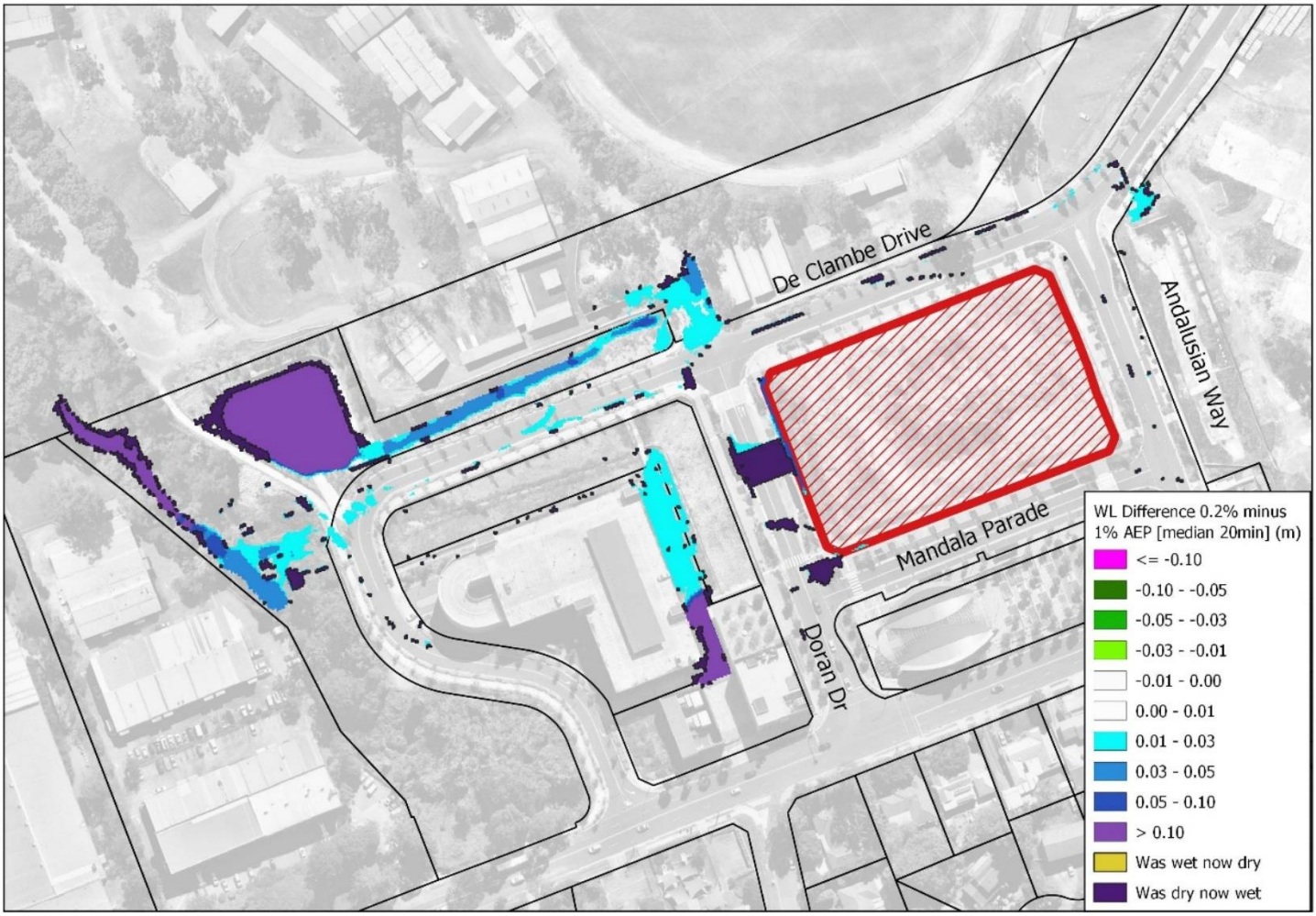

Figure 5.12 – Flood Level Difference – 0.2% AEP

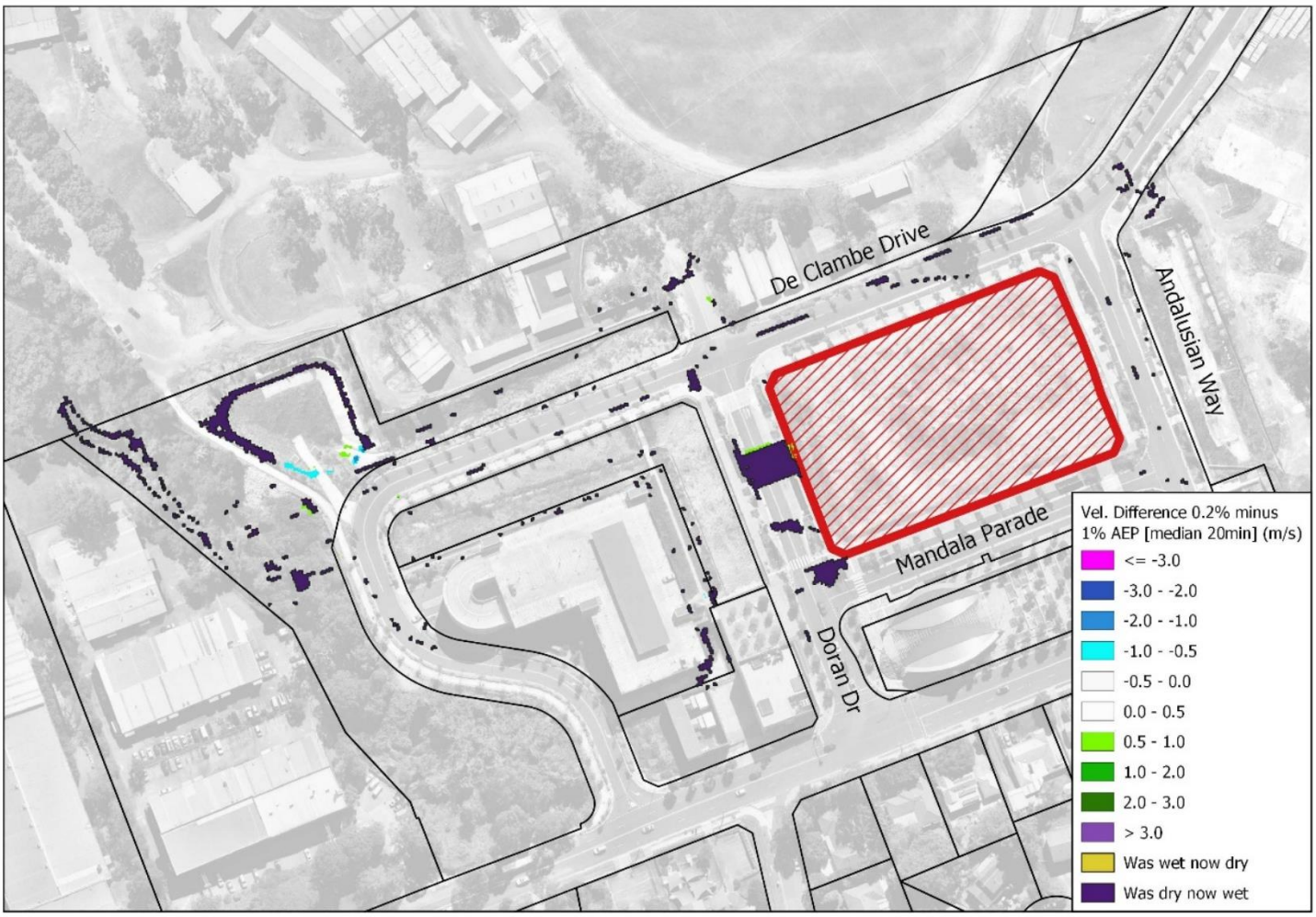

Figure 5.13 – Flood Velocity Difference – 0.2% AEP

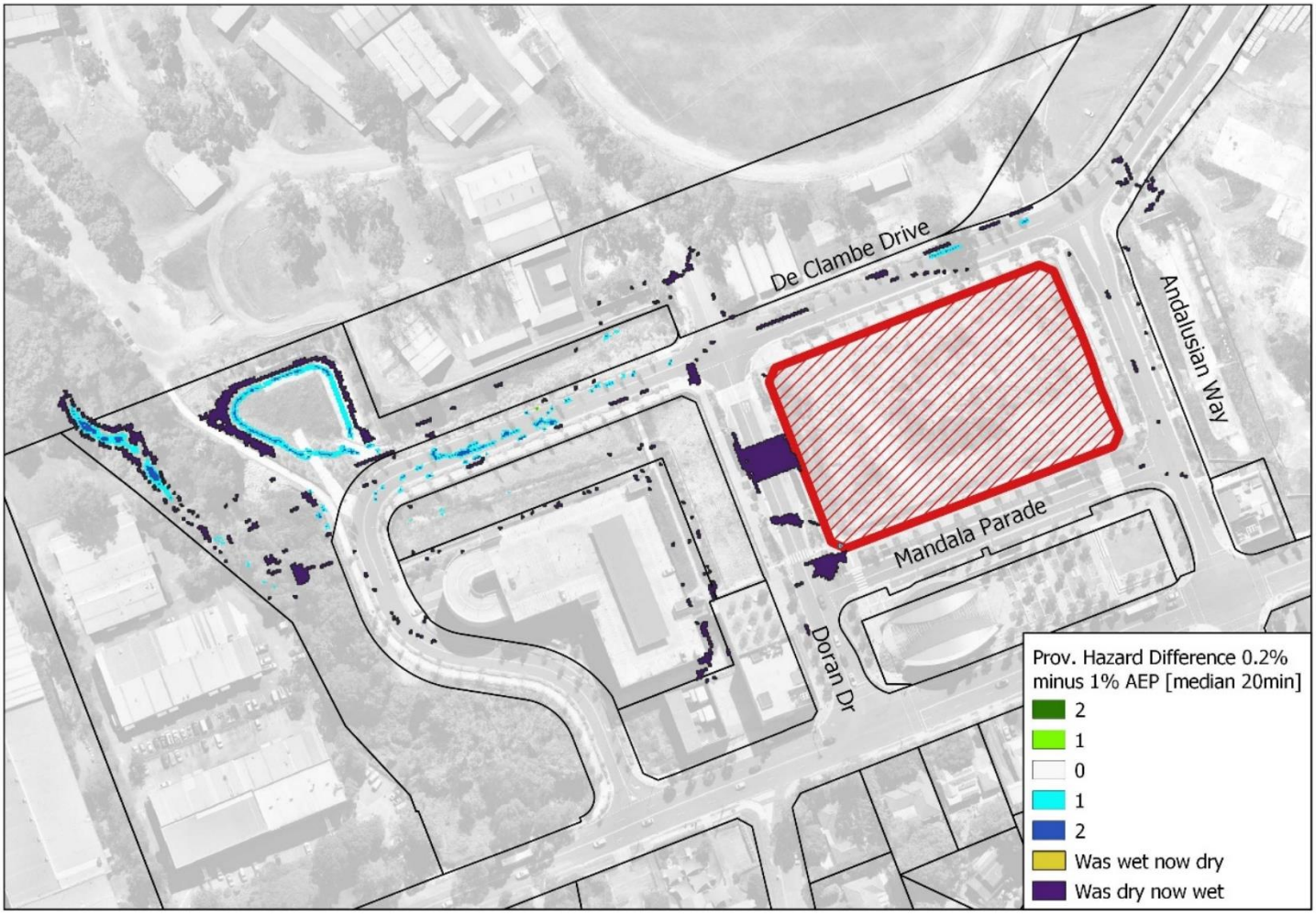

Figure 5.14 – Flood Hazard Difference – 0.2% AEP

5.1.1 *Discussion*

The 0.5% AEP and the 0.2% AEP model runs were undertaken as proxies for the two future climate scenarios. Comparison with the current climate flood behaviour for the development indicates that flooding is not likely to worsen significantly in the future. However, some areas which are currently dry would be flooded in the future. However, the depth of the flooding is not significant.

The provisional flood hazard is also not likely to change with the future climate.

6 FLOOD EMERGENCY MANAGEMENT

Flood emergency planning and implementing appropriate measures during a flood event is an effective way of managing the flood risk. In general, flood evacuation is necessary during a flood emergency and is a preferred method of managing the emergency. A flood warning system plays a critical role in undertaking an effective evacuation.

The feasibility of evacuation from a flood prone area is generally established through analysis of several factors which account for the delay between receiving an evacuation warning by the residents and acting upon it, time taken by occupants to prepare for evacuation, time for vehicular evacuation to pass the point of danger and likely traffic delays along the evacuation route.

Based on the above, several hours of warning and preparation time is required for an effective and orderly evacuation of a flood affected area.

The flood assessment undertaken in this study suggests that the flood arrival times are very short and with steep rate of rise of floodwaters (flash flooding, evacuation of residents would not be feasible. In a major flood event, the residents of the study area are likely to stay indoor until the floodwaters have receded. This approach of avoiding flood risk, generally known as shelter-in-place, is likely to be a suitable approach for the proposed development. This approach carries much lower risk than attempting to evacuate during or at the onset of flooding. In addition, the scale of the development suggests that evacuation of a large number of residents may not be feasible.

The shelter-in-pace strategy also carries some risks. Some of the measures that can be taken for minimising this risk include:

- ensuring that the development is structurally sound to withstand the impact of a PMF event
- provision of space for residents of the ground floor on a second storey in the building for evacuation above the flood level
- providing updates to the residents about the ongoing flooding
- emergency help line to assist the residents with querries, including basic medical advice
- ensuring basic amenities during the emergency, such as lighting arrangement.

6.1 Evacuation

Although the likelihood of a medical or other similar emergencies during a flood event is small, an evacuation may be necessary during the flood event.

Review of the flood modelling undertaken for this study suggests that provisional flood hazard for events up to the 0.2% AEP event would generally be low along all roads surrounding the development. Access therefore is available from all the surrounding roads. However, in a PMF, De Clambe Drive and a small area of Doran Avenue (near the bus stop) is affected by High hazard. Thus access to the development would only be available via Mandala Parade and Andalusian Way. These roads can be used as access to the building for undertaking the required evacuation.

7 CONCLUSIONS

A detailed flood assessment has been undertaken for the proposed development at 2 Mandala Parade, Castle Hill. Flood modelling was carried out to assess the impact of the proposed development. It can be concluded that

- The proposed development has insignificant impact on the surrounding properties, assets or infrastructure
- There is no active overland flow path through the site and hence the proposed development does not affect any existing flow conveyance
- Provision of OSD is likely to maintain the existing runoff regime and hence not adversely impact the beneficial inundation of the floodplain environment (Cattai Creek) due to the proposed development
- The proposal does not result in increased runoff and hence the downstream environment (Cattai Creek) is not affected due to increase in flood flow, velocity or depth
- The concept for shelter-in-place during a flood emergency is feasible for the proposed development and therefore not likely to impact the existing emergency management arrangements in the area
- The proposed development does not have any apparent social or economic cost of flooding as a consequence of flooding.

7.1 Recommendations

Several recommendations are made based on the outcomes of this flood assessment. In addition, the ***Climate Change Adaptation & Resilience*** report prepared by SLR (SLR Ref: 610.30132-R01 Version No: -v1.0, dated: June, 2021) has been reviewed and its recommendations considered in making the following recommendations to manage the flood risk on the site:

- The Flood Planning Level (FPL) for the proposed development should be derived from the 1% AEP flood level for the future climate (0.2% AEP event) by adding a 0.5m free board. The FPL can potentially vary along the gradient of the site
- The building should be designed to withstand the forces associated with the PMF flood
- The building should be flood proofed using suitable flood proofing materials up to the FPL.
- The entry to any basement car park should be set at the FPL or the PMF, whichever is higher
- There should be no opening in the structure below the FPL or the PMF, whichever is higher
- All sensitive infrastructure, including the electric and gas infrastructure and appliances should be located above the FPL
- A Flood Emergency Response Plan for the development should be prepared keeping in view the limitations of evacuation from the site.
- The design of the OSD should be updated to capture the 1% AEP runoff for the future climate (0.2% AEP event)

8 REFERENCES

1. Australia Government, Bureau of Meteorology Website http://www.bom.gov.au/
2. New South Wales Government, State Emergency Management Plan – Evacuation Management Guidelines, March 2014

9 APPENDICES

Appendix A DEVELOPMENT LAYOUT PLANS

NOTES

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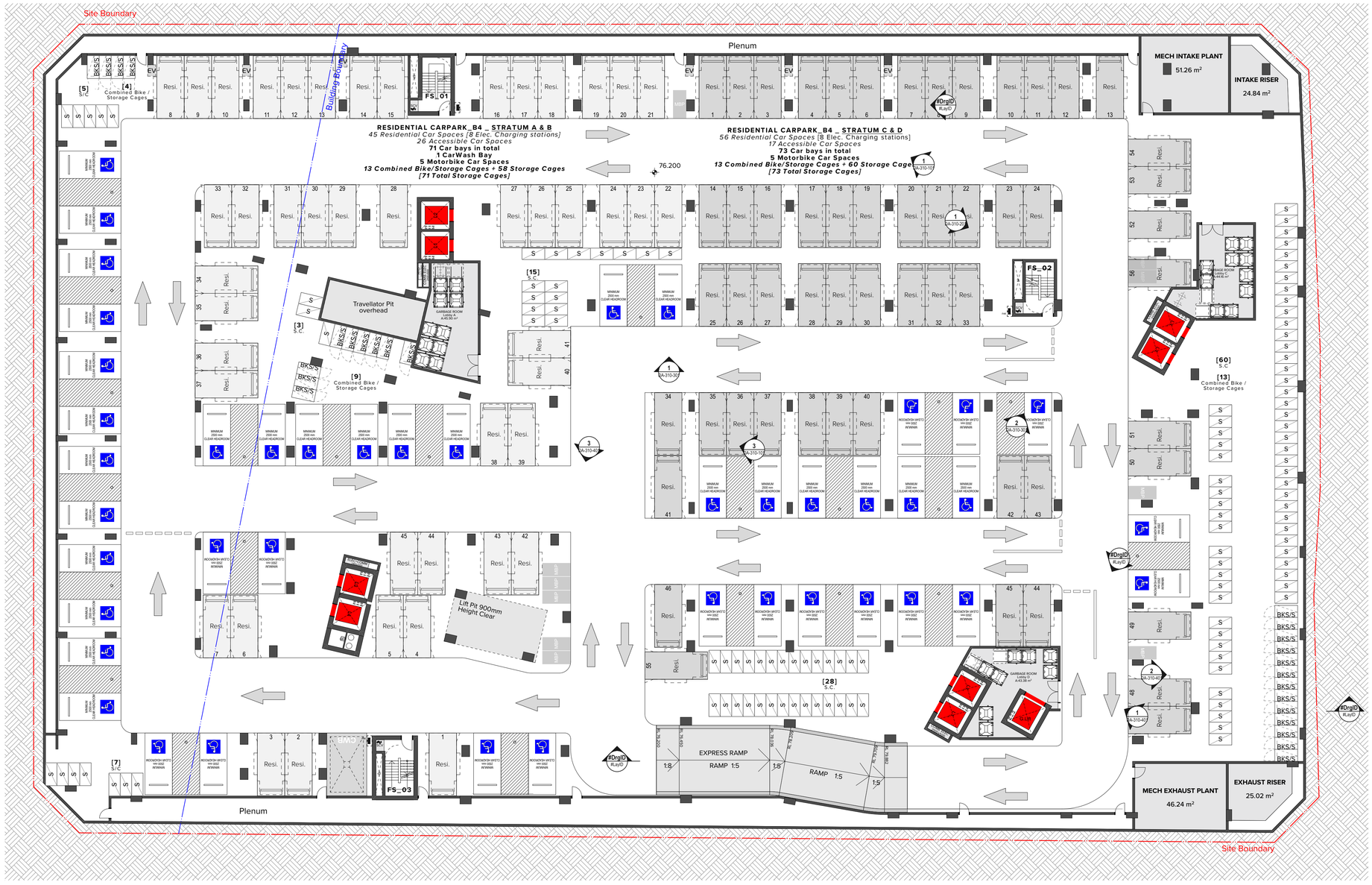

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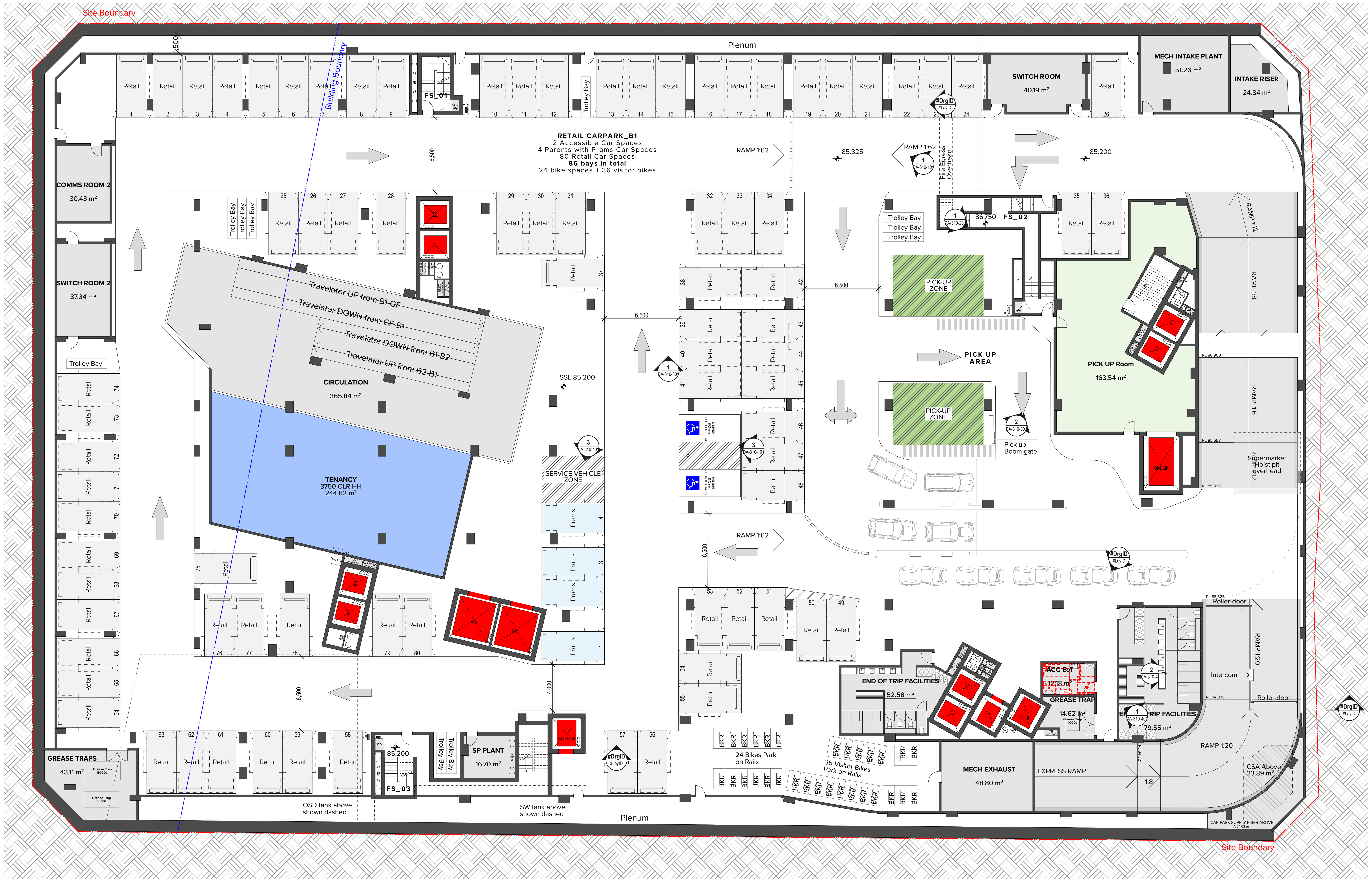

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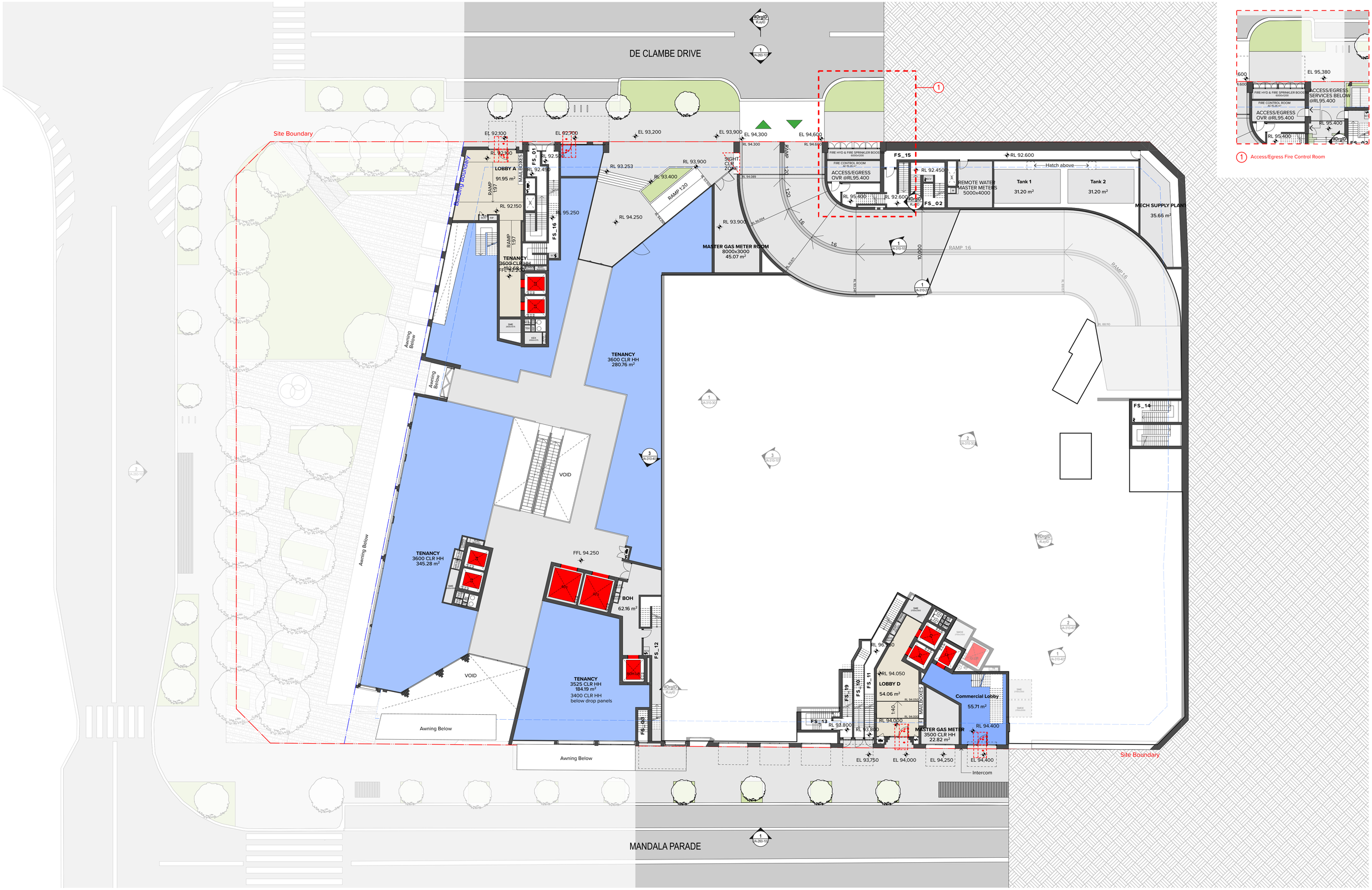

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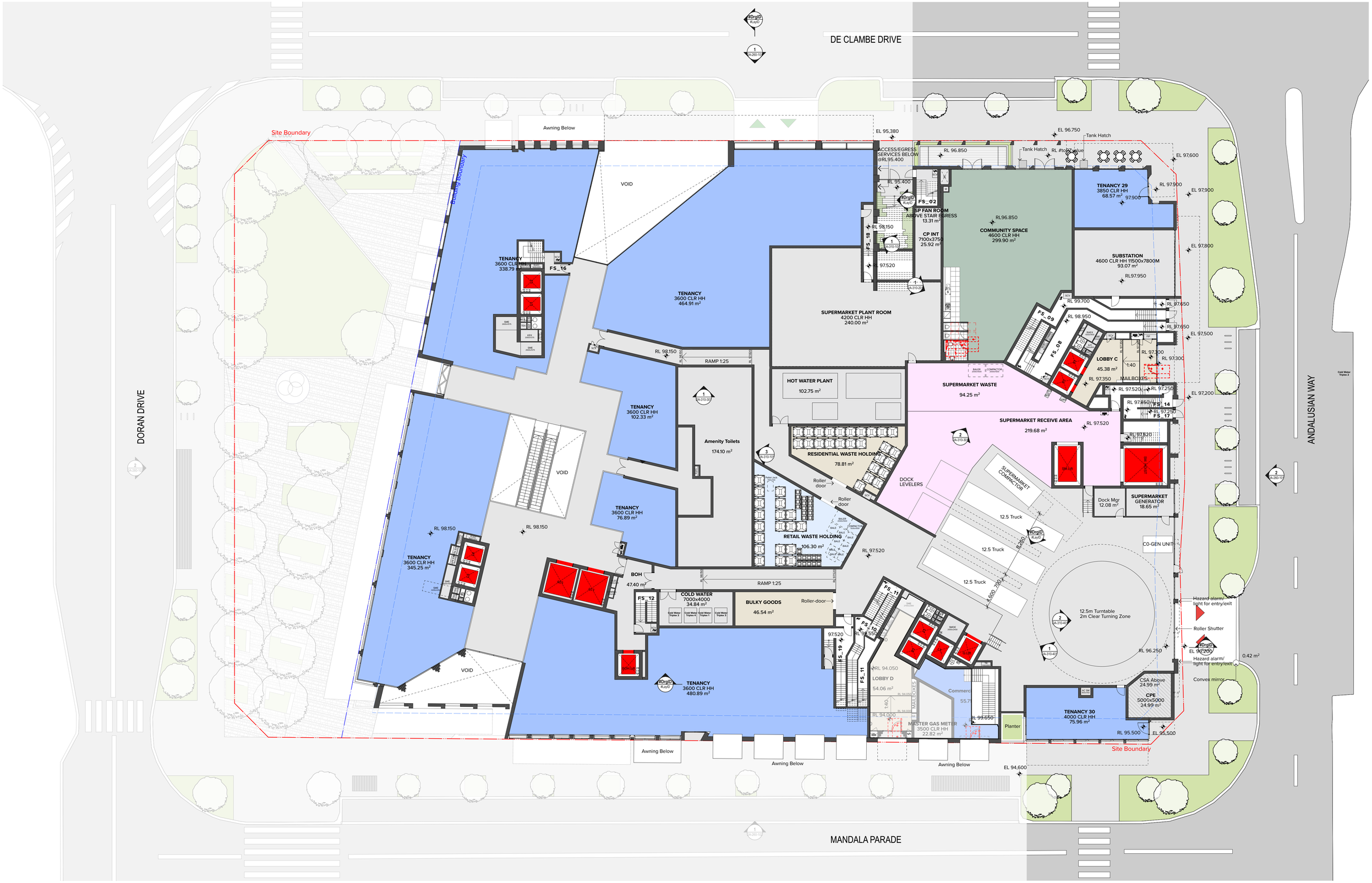

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DLCS Quality Endorsed Company ISO 9001:2015, Registration Number 20476
Nominated Architect: Nicholas Turner 6685, ABN 86 064 094 911

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01	07.06.21	JMC	Draft DA for Review
02	18.06.21	JMC	Draft DA for Review
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Project Title
Doran Drive
Doran Drive, Castle Hill Castle Hill NSW 2154 Australia

Drawing Title
GA PLANS
Level 03

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-030
Drawn by: AM, VT, JL, JE
Rev: 03
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Project Title
Doran Drive
Doran Drive, Castle Hill Castle Hill NSW 2154 Australia

Drawing Title
GA PLANS
Level 04

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-040
Drawn by: AM, VT, JL, JE
Rev: 03
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Project Title
Doran Drive
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Drawing Title
GA PLANS
Level 05

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-050
Drawn by: AM, VT, JL, JE
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Drawing Title

GA PLANS
Level 06

Scale: **1:200 @A1, 50%@A3**
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-060**
Drawn by: AM, YT, JL, JE
Rev: **03**
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Drawing Title
GA PLANS
Level 07

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-070
Drawn by: AM, YT, JL, JE
Rev: 03
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Doran Drive
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Drawing Title
GA PLANS
Level 08

Scale: 1:200 @A1, 50%@A3
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-080**
Drawn by: AM, VT, JL, JE
Rev: **03**
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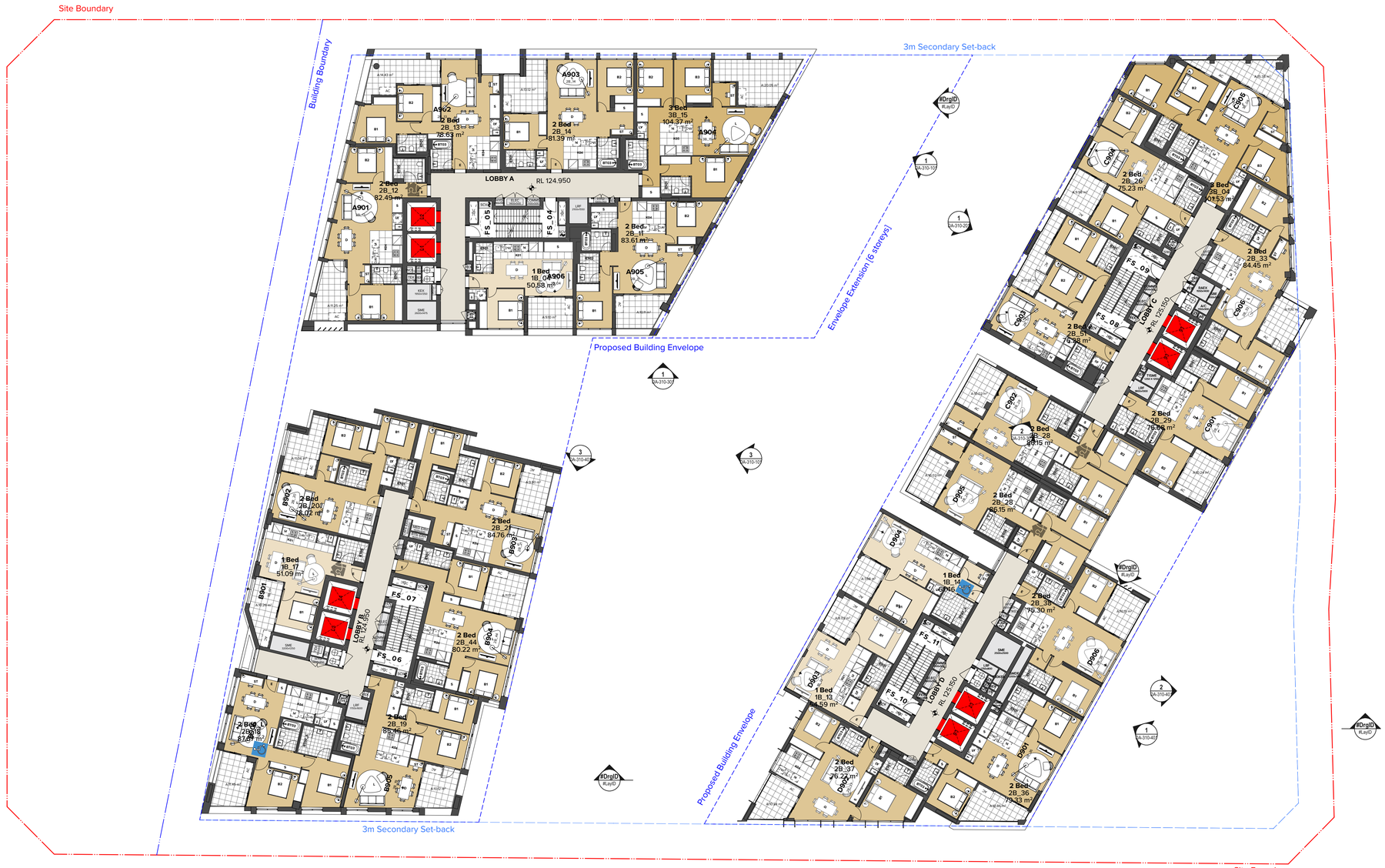

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Project Title
Doran Drive
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Drawing Title
GA PLANS
Level 09

Scale: 1:200 @A1, 50%@A3
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-090**
Drawn by: AM, VT, JL, JE
Rev: **03**
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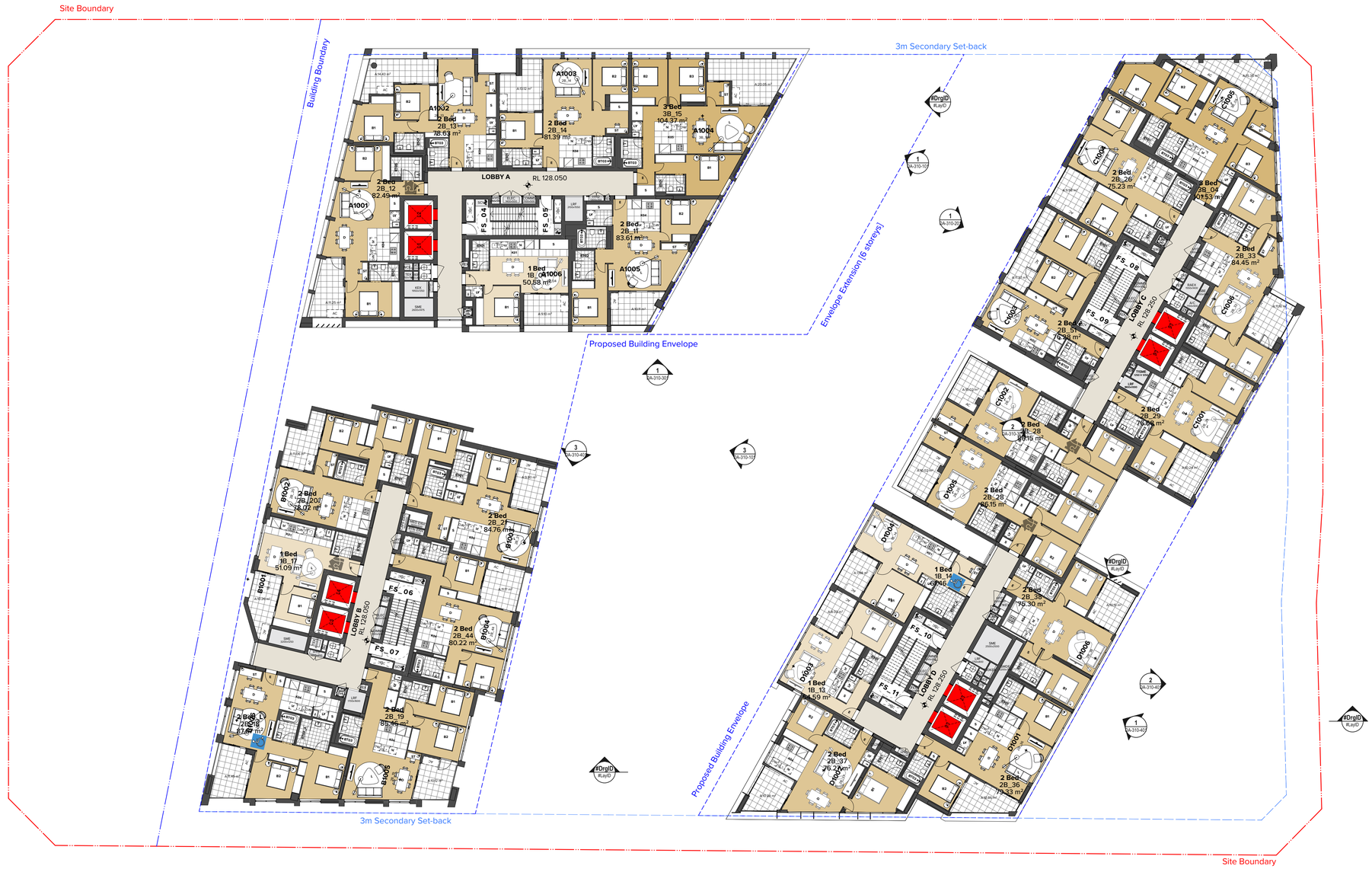

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Project Title
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Drawing Title
GA PLANS
Level 10

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-100
Drawn by: AM, VT, JL, JE
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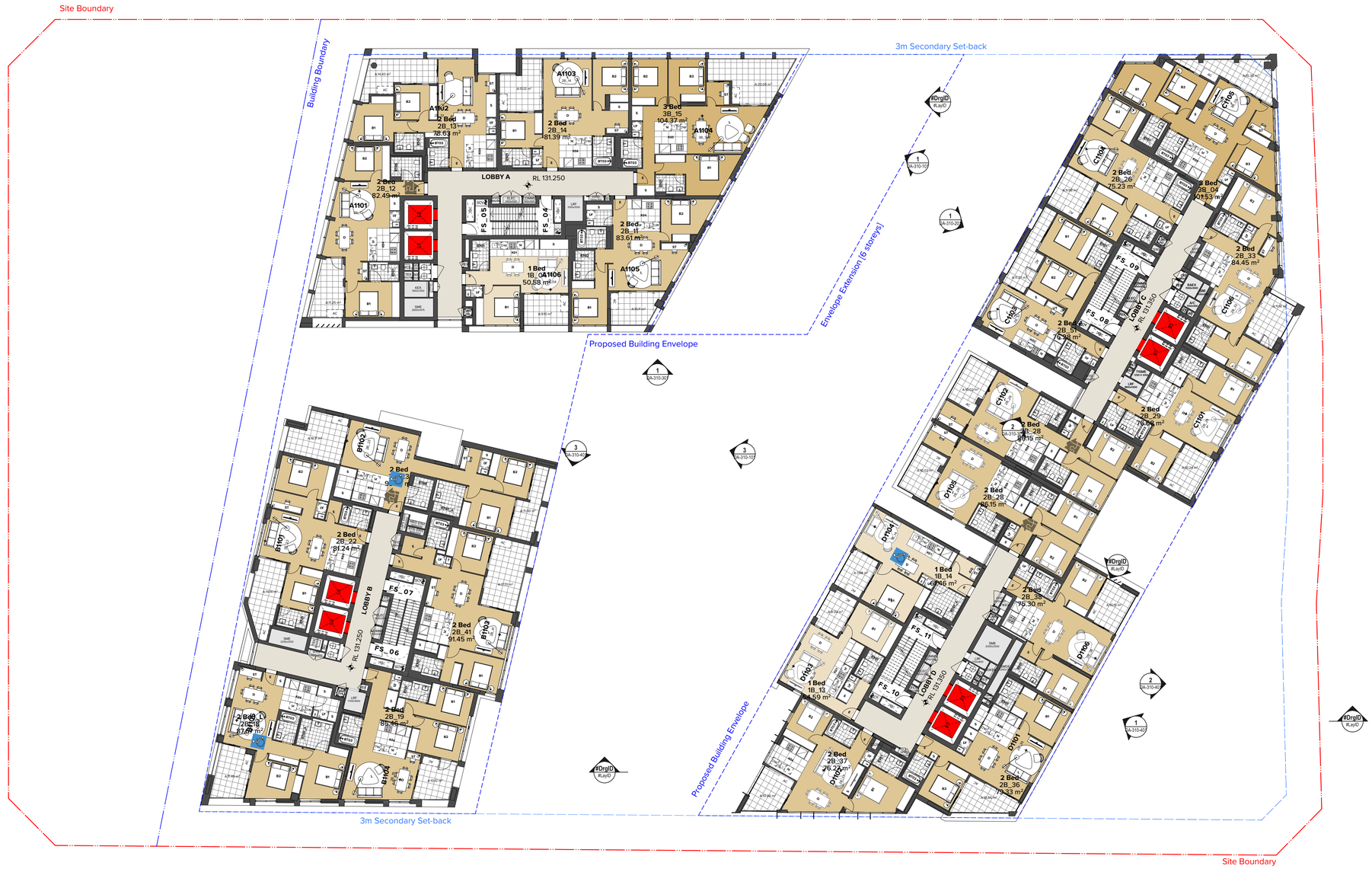

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02	18.06.21	JMC	Draft DA for Review
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Project Title
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Drawing Title
GA PLANS
Level 11

Scale **1:200 @A1, 50%@A3**
Status **Subject to Change**
Project No. **19068**
Dwg No. **DA-110-110**
Drawn by **AM, VT, JL, JE**
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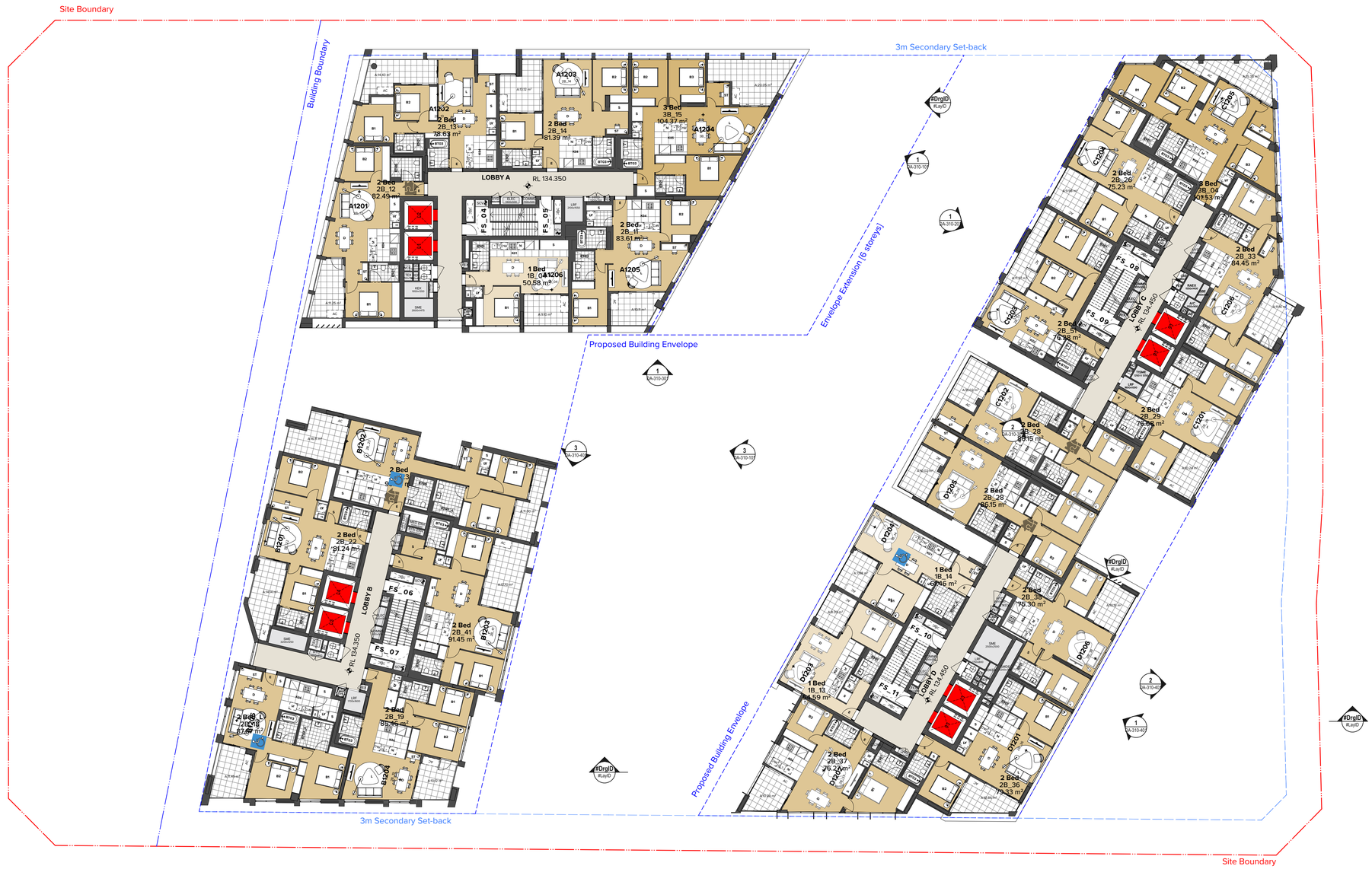

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Doran Drive
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Drawing Title
GA PLANS
Level 12

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-120
Drawn by: AM, VT, JL, JE
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Doran Drive
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Drawing Title
GA PLANS
Level 13

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-130
Drawn by: AM, VT, JL, JE
Rev: 03
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03	25.06.21	JMC	Retail Update

Project Title
Doran Drive
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Drawing Title
GA PLANS
Level 14

Scale: 1:200 @A1, 50%@A3
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-140**
Drawn by: AM, VT, JL, JE
Rev: **03**
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Project Title
Doran Drive
Doran Drive, Castle Hill Castle Hill NSW 2154 Australia

Drawing Title
GA PLANS
Level 15

Scale: 1:200 @A1, 50%@A3
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-150**
Drawn by: AM, VT, JL, JE
Rev: **03**
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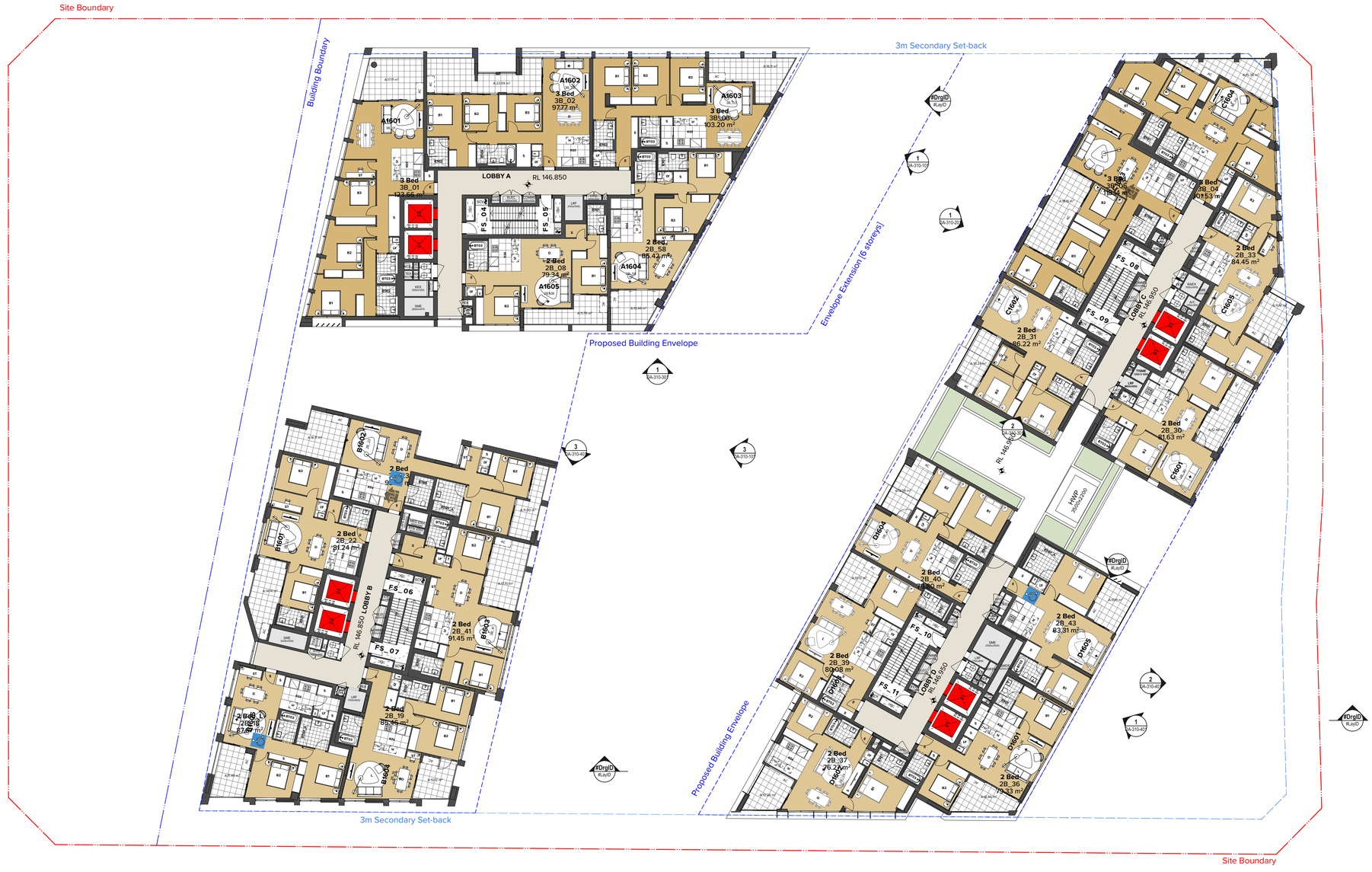

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Nominated Architect: Nicholas Turner 6685, ABN 86 064 084 911

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Project Title
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Drawing Title
GA PLANS
Level 16

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-160
Drawn by: AM, VT, JL, JR
Rev: 03
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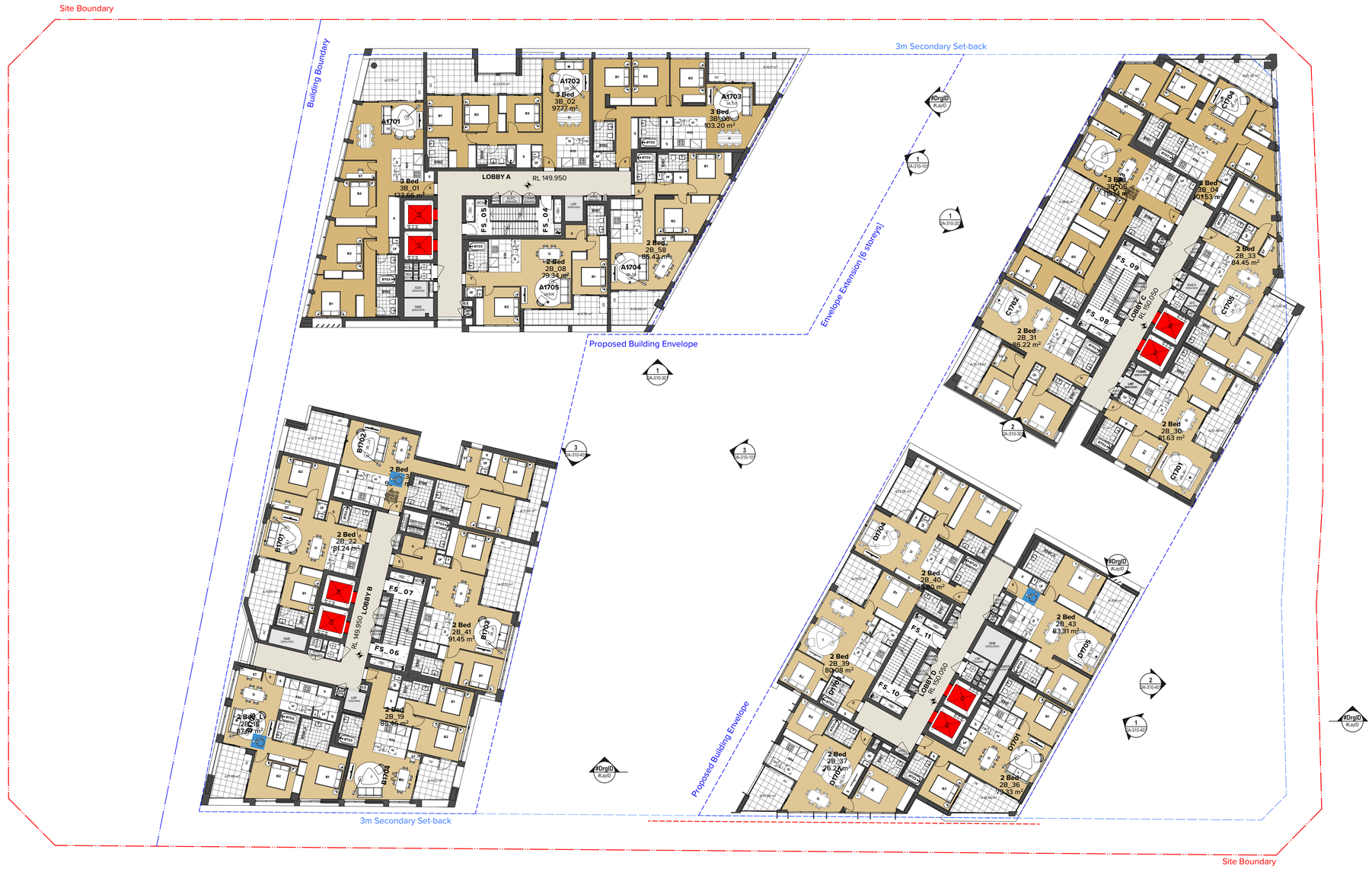

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Project Title
Doran Drive
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Drawing Title
GA PLANS
Level 17

Scale: 1:200 @A1, 50%@A3
Status: Subject to Change
Project No.: 19068
Dwg No.: DA-110-170
Drawn by: AM, VT, JL, JE
Rev: 03
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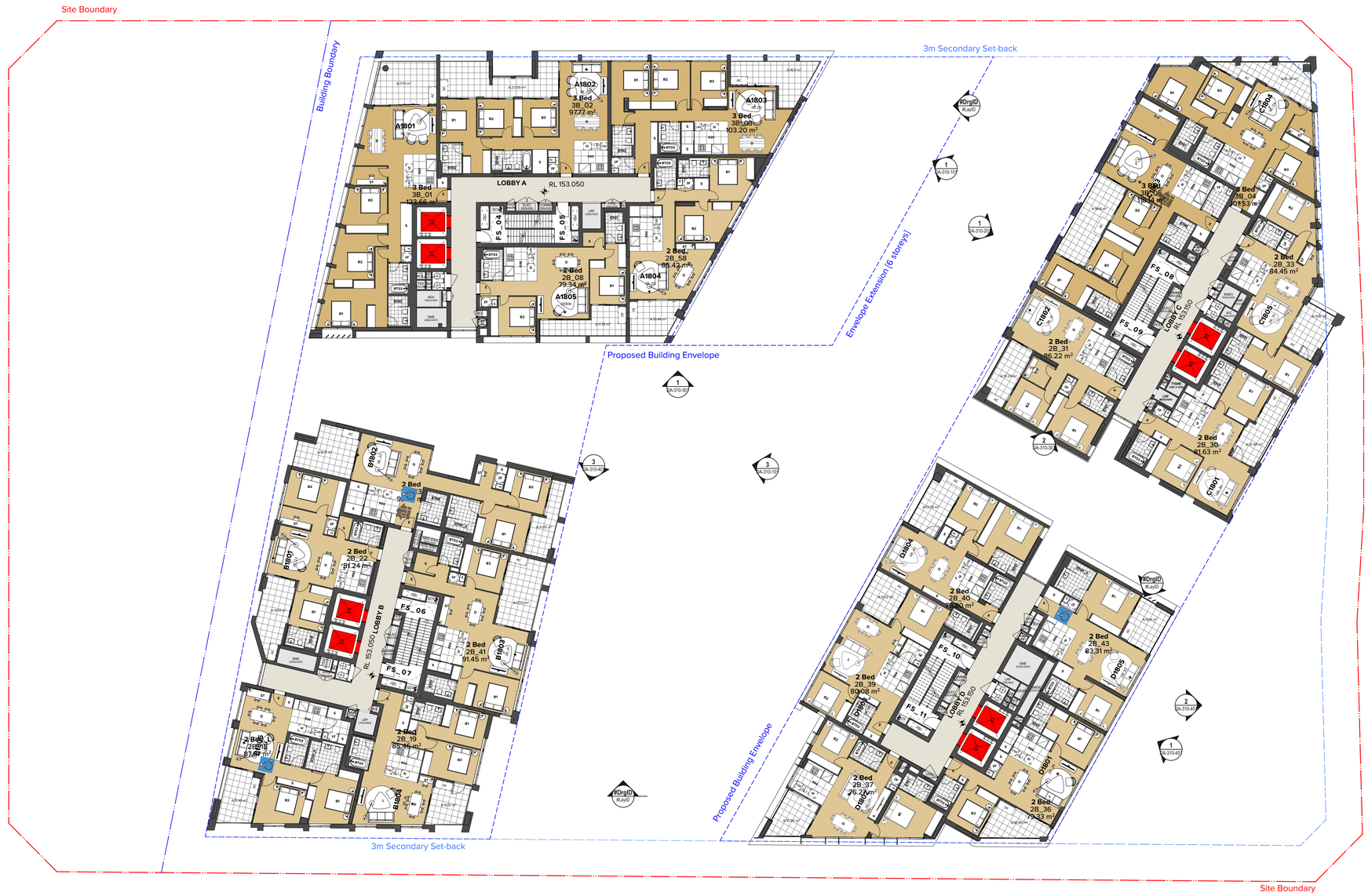

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Project Title
Doran Drive
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Drawing Title
GA PLANS
Level 18

Scale: 1:200 @A1, 50%@A3
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-180**
Drawn by: AM, VT, JL, JE
Rev: **03**
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Project Title
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Drawing Title
GA PLANS
Level 19

Scale: 1:200 @A1, 50%@A3
Status: **Subject to Change**
Project No.: **19068**
Dwg No.: **DA-110-190**
Drawn by: AM, VT, JL, JE
Rev: **03**
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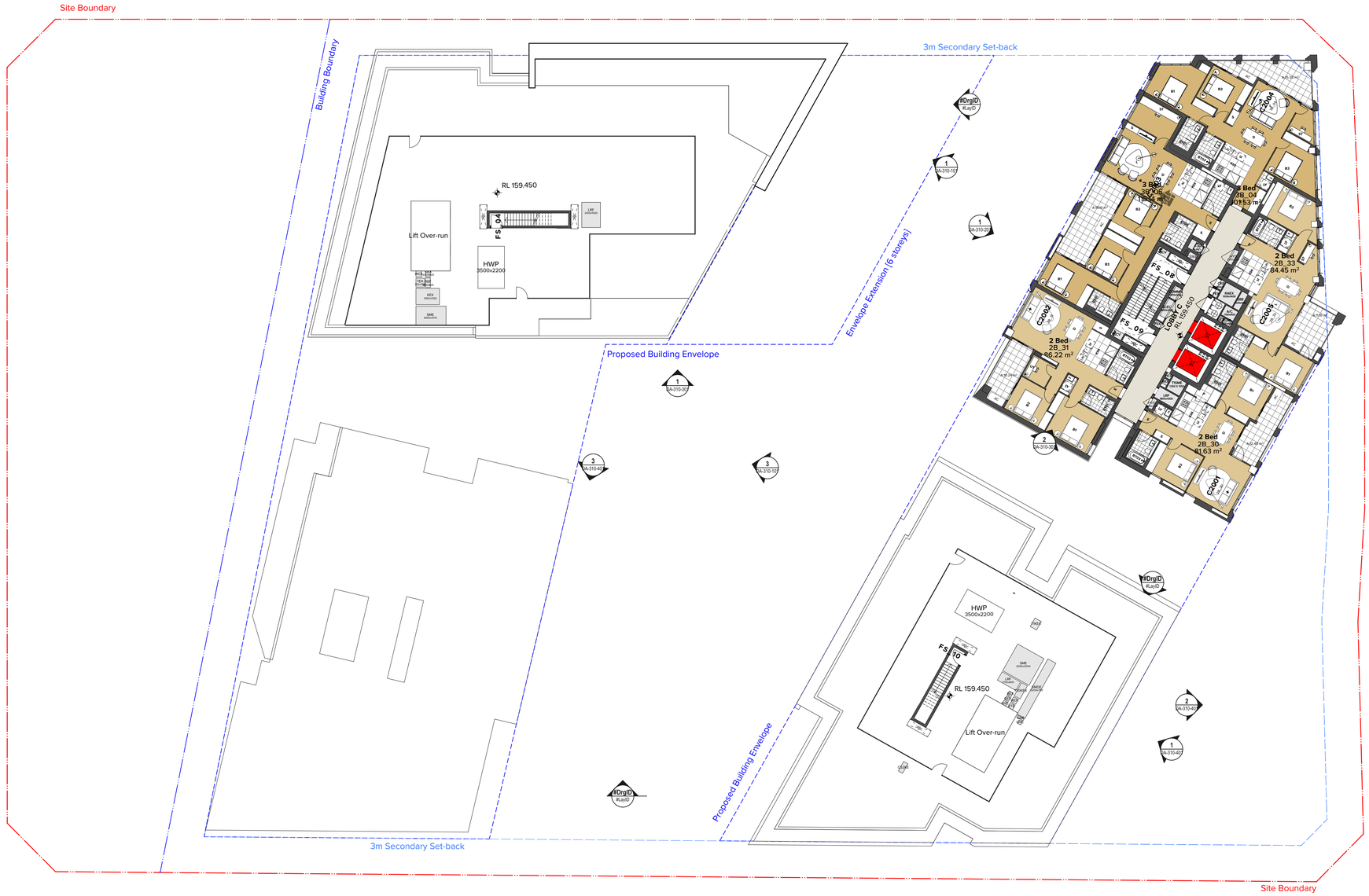

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Nominated Architect: Nicholas Turner 6905, ABN 88 094 094 911

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Project Title
Doran Drive
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Drawing Title
GA PLANS
Level 20

Scale
1:200 @A1, 50%@A3
Status
Subject to Change
Project No.
19068
Dwg No.
DA-110-200
Drawn by
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Rev
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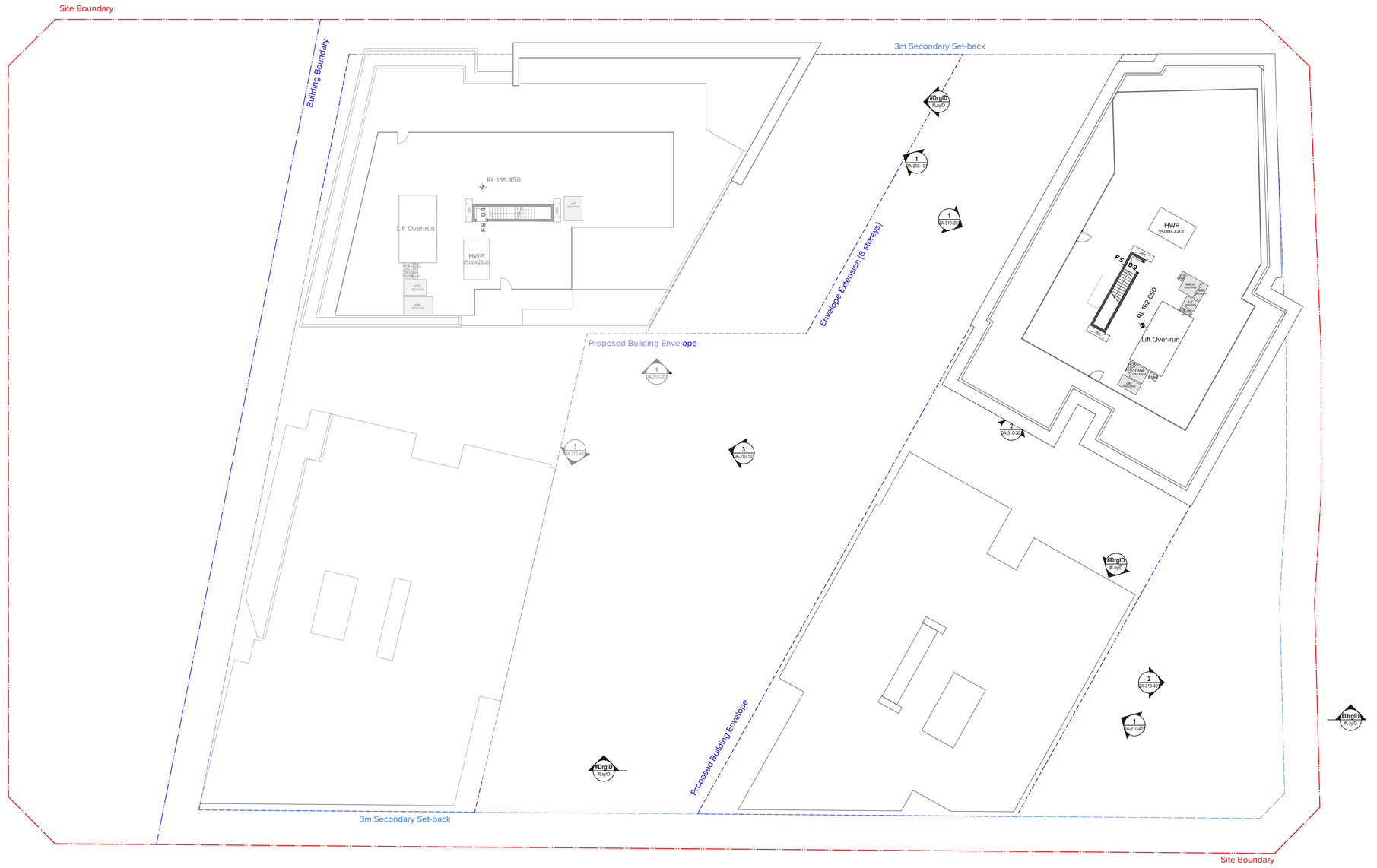

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Drawing Title
GA PLANS
Level 21

Scale
1:200 @A1, 50%@A3

Project No.
19068

Drawn by
AM, VT, JL, JE

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Status
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Dwg No.
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Appendix B DRAINS Model Data

PIT / NODE DETAILS Version 15

Name	Type	Family	Size	Ponding Volume (cu.m)	Pressure Change Coeff. Ku	Surface Elev (m)	Max Pond Depth (m)	Base Inflow (cu.m/s)	Blocking Factor	x	y	Bolt-down lid	id	Part Full Shock Loss	Inflow Hydrograph	Pit is	Internal Width (mm)	Inflow is Misaligned	Minor Safe Pond Depth (m)	Major Safe Pond Depth (m)
A01-1	OnGrade	NSW RTA S	Single SO1 Pit		5.9	97.116		0	0.1	313567.8	6266312	No	46343995	1 x Ku	No	Existing		No		
A01-2	OnGrade	NSW RTA S	Single SO1 Pit		0.5	97.101		0	0.1	313559.8	6266309	No	46343996	1 x Ku	No	Existing		Yes		
A01-3	OnGrade	NSW RTA S	Single SO1 Pit		2.1	96.393		0	0.1	313568.6	6266288	No	46343997	1 x Ku	No	Existing		No		
A01-4	OnGrade	NSW RTA S	SA2		1.2	95.841		0	0.1	313574.7	6266272	No	46343998	1 x Ku	No	Existing		No		
A01-5	OnGrade	NSW RTA S	SA1		0.9	95.446		0	0.1	313576.7	6266260	No	46343999	1 x Ku	No	Existing		No		
A01-6	OnGrade	NSW RTA S	SA2		2	94.844		0	0.1	313566.7	6266250	No	46344000	1 x Ku	No	Existing				
A01-7	OnGrade	NSW RTA S	Single SO1 Pit		0.2	93.959		0	0.1	313547.4	6266242	No	46344001	1 x Ku	No	Existing		No		
A01-8	OnGrade	NSW RTA S	Single SO1 Pit		0.8	92.095		0	0.1	313517.3	6266231	No	46344002	1 x Ku	No	Existing		No		
A01-9	OnGrade	NSW RTA S	Single SO1 Pit		0.3	90.683		0	0.1	313497.5	6266223	No	46344003	1 x Ku	No	Existing		No		
A01-10	OnGrade	NSW RTA S	Single SO1 Pit		0	89.756		0	0.1	313480.9	6266216	No	46344004	1 x Ku	No	Existing		No		
A01-11	OnGrade	NSW RTA S	SA2		1.6	89.563		0	0.1	313474.6	6266214	No	46344005	1 x Ku	No	Existing		Yes		
A01-12	OnGrade	NSW RTA S	SA1		0.8	89.282		0	0.1	313455.4	6266216	No	46344006	1 x Ku	No	Existing		No		
A01-13	OnGrade	NSW RTA S	SA2		2.6	89.047		0	0.1	313446.2	6266210	No	46344007	1 x Ku	No	Existing				
A01-14	OnGrade	NSW RTA S	Single SO1 Pit		0	88.958		0	0.1	313441.5	6266228	No	46344008	1 x Ku	No	Existing		No		
A01-15	OnGrade	NSW RTA S	Single SO1 Pit		0.3	88.863		0	0.1	313437.3	6266239	No	46344009	1 x Ku	No	Existing		No		
A01-16	OnGrade	NSW RTA S	Single SO1 Pit		0.3	88.781		0	0.1	313433	6266250	No	46344010	1 x Ku	No	Existing		No		
A01-17	OnGrade	NSW RTA S	Single SO1 Pit		0.3	88.749		0	0.1	313431.2	6266255	No	46344011	1 x Ku	No	Existing		No		
A01-18	Sag	NSW RTA S	Double SO1	0.3	0.3	88.715	0.1	0	0.2	313429.6	6266259	No	46344012	1 x Ku	No	Existing		No	0.2	0.15
A01-19	OnGrade	NSW RTA S	Single SO1 Pit		1	88.971		0	0.1	313418.6	6266278	No	46344013	1 x Ku	No	Existing		No		
A01-20	OnGrade	NSW RTA S	SA1		0.7	88.775		0	0.1	313407.2	6266283	No	46344014	1 x Ku	No	Existing		No		
A01-21	OnGrade	NSW RTA S	SA2		1	88.725		0	0.1	313404	6266291	No	46344015	1 x Ku	No	Existing		No		
A01-22	Node					88.307		0		313393	6266287		46344016		No					
A02-1	OnGrade	unlimited	unlimited		2.1	97.939		0	0.1	313564.8	6266349	No	46344017	1 x Ku	No	Existing		No		
A02-2	OnGrade	NSW RTA S	SA2		1.5	97.6		0	0.1	313556.3	6266357	No	46344018	1 x Ku	No	Existing		Yes		
A02-3	OnGrade	NSW RTA S	SA2		1.4	97.306		0	0.1	313547.7	6266350	No	46344019	1 x Ku	No	Existing		No		
A02-4	OnGrade	NSW RTA S	SA2		1.1	95.35		0	0.1	313512	6266334	No	46344020	1 x Ku	No	Existing		No		
A02-5	OnGrade	NSW RTA S	SA2		1.6	94.299		0	0.1	313498	6266328	No	46344021	1 x Ku	No	Existing		No		
A02-6	OnGrade	NSW RTA S	SA2		1	91.869		0	0.1	313466.4	6266316	No	46344022	1 x Ku	No	Existing		No		
A02-7	OnGrade	NSW RTA S	SA2		0	90.091		0	0.1	313442.7	6266307	No	46344023	1 x Ku	No	Existing		No		
A02-8	OnGrade	NSW RTA S	SA2		1.6	89.517		0	0.1	313433.2	6266305	No	46344024	1 x Ku	No	Existing		Yes		
A03-1	OnGrade	NSW RTA S	SA2		5.8	95.626		0	0.1	313589.1	6266258	No	46344025	1 x Ku	No	Existing		No		
A03-2	Sag	NSW RTA S	SA2	0.3	5.9	95.52	0.09	0	0.2	313591.6	6266252	No	46344026	1 x Ku	No	Existing		No	0.2	0.14
A03-3	OnGrade	NSW RTA S	SA2		2	95.635		0	0.1	313595.3	6266242	No	46344027	1 x Ku	No	Existing		Yes		
A03-4	OnGrade	NSW RTA S	SA2		1.1	95.589		0	0.1	313587.6	6266238	No	46344028	1 x Ku	No	Existing		No		
A03-5	OnGrade	NSW RTA S	SA2		1.7	94.82		0	0.1	313569.3	6266242	No	46344029	1 x Ku	No	Existing		No		
A04-1	OnGrade	NSW RTA S	Single SO1 Pit		5.5	90.146		0	0.1	313493	6266212	No	46344030	1 x Ku	No	Existing		No		
A04-2	OnGrade	NSW RTA S	Single SO1 Pit		5.9	89.699		0	0.1	313483.4	6266209	No	46344031	1 x Ku	No	Existing		No		
A04-3	OnGrade	NSW RTA S	SA2		0.8	89.529		0	0.1	313476.5	6266206	No	46344032	1 x Ku	No	Existing		No		
A04-4	OnGrade	NSW RTA S	SA2		1.7	89.46		0	0.1	313468.9	6266203	No	46344033	1 x Ku	No	Existing		No		
A04-5	OnGrade	NSW RTA S	SA2		1.8	89.111		0	0.1	313451	6266198	No	46344034	1 x Ku	No	Existing		Yes		
A06-1	OnGrade	NSW RTA S	Single SO1 Pit		3.3	91.98		0	0.5	313513.1	6266240	No	46344036	1 x Ku	No	Existing		No		
A07-1	OnGrade	NSW RTA S	Single SO1 Pit		5.7	92.154		0	0.1	313520.3	6266223	No	46344037	1 x Ku	No	Existing		No		
A08-1	OnGrade	NSW RTA S	Single SO1 Pit		5.9	93.964		0	0.1	313550.3	6266235	No	46344038	1 x Ku	No	Existing		No		
A09-1	OnGrade	NSW RTA S	Single SO1 Pit		5.9	91.505		0	0.5	313464.6	6266296	No	46344039	1 x Ku	No	Existing		No		
A09-2	OnGrade	NSW RTA S	Single SO1 Pit		5.9	91.338		0	0.1	313459.3	6266303	No	46344040	1 x Ku	No	Existing		No		
A09-3	OnGrade	NSW RTA S	SA2		0.5	90.324		0	0.1	313446	6266298	No	46344041	1 x Ku	No	Existing		Yes		

A10-1	OnGrade	NSW RTA S	Single SO1	Pit			3.3	94.595			0	0.5	313504.7	6266312	No	46344042	1 x Ku	No	Existing		No		
A10-2	OnGrade	NSW RTA S	Single SO1	Pit			2.7	94.573			0	0.1	313501.4	6266320	No	46344043	1 x Ku	No	Existing		No		
A011-1	OnGrade	NSW RTA S	Single SO1	Pit			5.9	96.38			0	0.1	313576.2	6266291	No	46344044	1 x Ku	No	Existing		No		
A012-1	OnGrade	NSW RTA S	Single SO1	Pit			5.9	95.823			0	0.1	313582.5	6266275	No	46344045	1 x Ku	No	Existing		No		
O A01-20	Node							88.775			0		313396.2	6266279		46344046		No					
N159188	Node										0		313589.4	6266348		46671224		No					
N185505	Node							89.5			0		313465.4	6266222		53371042		No					
Bypass	Node							89.9			0		313448.3	6266258		76451740		No					
A05-1	OnGrade	unlimited	unlimited				0.6	89.677			0	0.5	313477.1	6266226	No	46344035	1 x Ku	No	Existing		No		
P_Shgrd_O	Sag	NSW RTA S	SA3		10		1.5	88.8		0.2	0	0.2	313417.9	6266313	No	86026822	1 x Ku	No	New			0.25	0.25
P_Shgrnd_	Sag	NSW RTA S	SA2		5		1.5	88.8		0.2	0	0.2	313400.9	6266307	No	86026823	1 x Ku	No	New			0.25	0.25
Outlet_1	Node							87.09			0		313389.2	6266303		46344048		No					

DETENTION BASIN DETAILS

Name	Elev	Surf. Area	Not Used	Outlet Type	K	Dia(mm)	Centre RL	Pit Family	Pit Type	x	y	HED	Crest RL	Crest Length	id
Basin8	88.75	250		Culvert	0.5					313475.4	6266231	No			51418931
	89.75	250													
	89.751	3													
	89.9	3													

SUB-CATCHMENT DETAILS

Name	Pit or Node	Total Area (ha)	EIA %	Perv Area %	RIA %	EIA Time (min)	Perv Time (min)	RIA Time (min)	EIA Length (m)	Perv Length (m)	RIA Length (m)	EIA Slope(%) %	Perv Slope %	RIA Slope %	EIA Rough	Perv Rough	RIA Rough	Rainfall Multiplier
C A01-1	A01-1	0.0409	100	0	0	5	10	0										1
C A01-2	A01-2	0.0202	100	0	0	5	10	0										1
C A01-3	A01-3	0.028	100	0	0	5	10	0										1
C A01-4	A01-4	0.023	100	0	0	5	10	0										1
C A01-5	A01-5	0.0171	100	0	0	5	10	0										1
C A01-6	A01-6	0.0221	100	0	0	5	10	0										1
C A01-7	A01-7	0.0212	100	0	0	5	10	0										1
C A01-8	A01-8	0.0408	100	0	0	5	10	0										1
C A01-9	A01-9	0.0219	100	0	0	5	10	0										1
C A01-10	A01-10	0.0276	100	0	0	5	10	0										1
C A01-11	A01-11	0.0168	100	0	0	5	10	0										1
C A01-12	A01-12	0.0218	100	0	0	5	10	0										1
C A01-13	A01-13	0.0828	100	0	0	5	10	0										1
C A01-14	A01-14	0.043	100	0	0	5	10	0										1
C A01-15	A01-15	0.0291	100	0	0	5	10	0										1
C A01-16	A01-16	0.0323	100	0	0	5	10	0										1
C A01-17	A01-17	0.0143	100	0	0	5	10	0										1
C A01-18	A01-18	0.0156	100	0	0	5	10	0										1
C A01-19	A01-19	0.1018	100	0	0	5	10	0										1
C A01-20	A01-20	0.0165	100	0	0	5	10	0										1
C A01-21	A01-21	0.0208	100	0	0	5	10	0										1
C A02-1	A02-1	0.1062	100	0	0	5	10	0										1
C A02-3	A02-3	0.0179	100	0	0	5	10	0										1
C A02-4	A02-4	0.0609	100	0	0	5	10	0										1
C A02-5	A02-5	0.0152	100	0	0	5	10	0										1
C A02-6	A02-6	0.0421	100	0	0	5	10	0										1

C A02-7	A02-7	0.0364	100	0	0	5	10	0											1
C A02-8	A02-8	0.0168	100	0	0	5	10	0											1
C A03-1	A03-1	0.1001	100	0	0	5	10	0											1
C A03-2	A03-2	0.0648	100	0	0	5	10	0											1
C A03-3	A03-3	0.1047	100	0	0	5	10	0											1
C A03-4	A03-4	0.0286	100	0	0	5	10	0											1
C A03-5	A03-5	0.0255	100	0	0	5	10	0											1
C A04-2	A04-2	0.0854	100	0	0	5	10	0											1
C A04-3	A04-3	0.0094	100	0	0	5	10	0											1
C A04-4	A04-4	0.0668	100	0	0	5	10	0											1
C A04-5	A04-5	0.0231	100	0	0	5	10	0											1
C A07-1	A07-1	0.0951	100	0	0	5	10	0											1
C A08-1	A08-1	0.0154	100	0	0	5	10	0											1
C A09-2	A09-2	0.0348	100	0	0	5	10	0											1
C A09-3	A09-3	0.0072	100	0	0	5	10	0											1
C A10-2	A10-2	0.0329	100	0	0	5	10	0											1
C A11-1	A011-1	0.0882	100	0	0	5	10	0											1
C A12-1	A012-1	0.054	100	0	0	5	10	0											1
Cat101892	N159188	1.08	100	0	0	8.5	10	0											1
C Bypass	Bypass	0.016	100	0	0	5	5	2											1
C A05-1	Basin8	0.78	100	0	0	5	10	0											1
Cat_Shgrnc	P_Shgrd_O	3.75	15	85	0	3	10	2											1

PIPE DETAILS

Name	From	To	Length	U/S IL	D/S IL	Slope	Type	Dia	I.D.	Rough	Pipe Is	No. Pipes	Chg From	At Chg	Chg	Rl	Chg	RL	etc
			(m)	(m)	(m)	(%)		(mm)	(mm)						(m)	(m)	(m)	(m)	(m)
P A01-1	A01-1	A01-2	8.499	95.86	95.73	1.53	Concrete, u	375	375	0.3	Existing	1	A01-2	0					
P A01-2	A01-2	A01-3	23.387	95.73	94.97	3.25	Concrete, u	375	375	0.3	Existing	1	A01-3	0					
P A01-3	A01-3	A01-4	16.947	94.97	94.5	2.77	Concrete, u	375	375	0.3	Existing	1	A01-4	0					
P A01-4	A01-4	A01-5	12.197	94.5	94.06	3.61	Concrete, u	375	375	0.3	Existing	1	A01-5	0					
P A01-5	A01-5	A01-6	14.184	94.06	93.32	5.22	Concrete, u	375	375	0.3	Existing	1	A01-6	0					
P A01-6	A01-6	A01-7	20.769	93.32	92.33	4.77	Concrete, u	375	375	0.3	Existing	1	A01-7	0					
P A01-7	A01-7	A01-8	32.298	92.33	90.48	5.73	Concrete, u	375	375	0.3	Existing	1	A01-8	0					
P A01-8	A01-8	A01-9	21.169	90.48	89.15	6.28	Concrete, u	375	375	0.3	Existing	1	A01-9	0					
P A01-9	A01-9	A01-10	17.901	89.15	88.3	4.75	Concrete, u	375	375	0.3	Existing	1	A01-10	0					
P A01-10	A01-10	A01-11	6.791	88.3	88.14	2.36	Concrete, u	600	600	0.3	Existing	1	A01-11	0					
P A01-11	A01-11	A01-12	19.249	88.14	87.77	1.92	Concrete, u	600	600	0.3	Existing	1	A01-12	0					
P A01-12	A01-12	A01-13	10.699	87.77	87.48	2.71	Concrete, u	600	600	0.3	Existing	1	A01-13	0					
P A01-13	A01-13	A01-14	18.075	87.48	87.31	0.94	Concrete, u	600	600	0.3	Existing	1	A01-14	0					
P A01-14	A01-14	A01-15	11.834	87.31	87.13	1.52	Concrete, u	750	750	0.3	Existing	1	A01-15	0					
P A01-15	A01-15	A01-16	11.938	87.13	87.02	0.92	Concrete, u	750	750	0.3	Existing	1	A01-16	0					
P A01-16	A01-16	A01-17	5.116	87.02	86.94	1.56	Concrete, u	750	750	0.3	Existing	1	A01-17	0					
P A01-17	A01-17	A01-18	4.46	86.94	86.87	1.57	Concrete, u	750	750	0.3	Existing	1	A01-18	0					
P A01-18	A01-18	A01-19	22.421	86.87	86.69	0.8	Concrete, u	750	750	0.3	Existing	1	A01-19	0					
P A01-19	A01-19	A01-20	12.319	86.69	86.5	1.54	Concrete, u	750	750	0.3	Existing	1	A01-20	0					
P A01-20	A01-20	A01-21	8.889	86.5	86.39	1.24	Concrete, u	750	750	0.3	Existing	1	A01-21	0					
P A01-21	A01-21	A01-22	11.825	86.39	86	3.3	Concrete, u	750	750	0.3	Existing	1	A01-22	0					
P A02-1	A02-1	A02-2	11.477	96.464	95.95	4.48	Concrete, u	375	375	0.3	Existing	1	A02-2	0					
P A02-2	A02-2	A02-3	11.129	95.95	95.73	1.98	Concrete, u	375	375	0.3	Existing	1	A02-3	0					
P A02-3	A02-3	A02-4	39.237	95.73	93.57	5.51	Concrete, u	375	375	0.3	Existing	1	A02-4	0					

P A02-4	A02-4	A02-5	14.996	93.57	92.57	6.67	Concrete, u	375	375	0.3	Existing	1	A02-5	0
P A02-5	A02-5	A02-6	33.903	92.57	90.28	6.75	Concrete, u	375	375	0.3	Existing	1	A02-6	0
P A02-6	A02-6	A02-7	25.327	90.28	88.28	7.9	Concrete, u	375	375	0.3	Existing	1	A02-7	0
P A02-7	A02-7	A02-8	9.827	88.28	87.73	5.6	Concrete, u	600	600	0.3	Existing	1	A02-8	0
P A02-8	A02-8	A01-21	32.144	87.73	86.39	4.17	Concrete, u	600	600	0.3	Existing	1	A01-21	0
P A03-1	A03-1	A03-2	6.812	94.148	94.08	1	Concrete, u	375	375	0.3	Existing	1	A03-2	0
P A03-2	A03-2	A03-3	10.299	94.06	93.957	1	Concrete, u	375	375	0.3	Existing	1	A03-3	0
P A03-3	A03-3	A03-4	8.534	93.937	93.852	1	Concrete, u	375	375	0.3	Existing	1	A03-4	0
P A03-4	A03-4	A03-5	18.662	93.832	93.44	2.1	Concrete, u	375	375	0.3	Existing	1	A03-5	0
P A03-5	A03-5	A01-6	8.09	93.44	93.32	1.48	Concrete, u	375	375	0.3	Existing	1	A01-6	0
P A04-1	A04-1	A04-2	10.43	88.74	88.41	3.16	Concrete, u	375	375	0.3	Existing	1	A04-2	0
P A04-2	A04-2	A04-3	7.333	88.41	88.1	4.23	Concrete, u	375	375	0.3	Existing	1	A04-3	0
P A04-3	A04-3	A04-4	8.133	88.1	87.85	3.07	Concrete, u	375	375	0.3	Existing	1	A04-4	0
P A04-4	A04-4	A04-5	18.602	87.85	87.636	1.15	Concrete, u	375	375	0.3	Existing	1	A04-5	0
P A04-5	A04-5	A01-13	12.954	87.616	87.48	1.05	Concrete, u	375	375	0.3	Existing	1	A01-13	0
P A06-1	A06-1	A01-8	10.657	90.9	90.48	3.94	Concrete, u	375	375	0.3	Existing	1	A01-8	0
P A07-1	A07-1	A01-8	8.018	90.63	90.48	1.87	Concrete, u	375	375	0.3	Existing	1	A01-8	0
P A08-1	A08-1	A01-7	7.982	92.57	92.33	3.01	Concrete, u	375	375	0.3	Existing	1	A01-7	0
P A09-1	A09-1	A09-2	9.062	90.28	90.01	2.98	Concrete, u	375	375	0.3	Existing	1	A09-2	0
P A09-2	A09-2	A09-3	14.298	90.01	88.89	7.83	Concrete, u	375	375	0.3	Existing	1	A09-3	0
P A09-3	A09-3	A02-7	9.644	88.89	88.28	6.33	Concrete, u	375	375	0.3	Existing	1	A02-7	0
P A10-1	A10-1	A10-2	8.749	93.33	93.09	2.74	Concrete, u	375	375	0.3	Existing	1	A10-2	0
P A10-2	A10-2	A02-5	9.432	93.09	92.57	5.51	Concrete, u	375	375	0.3	Existing	1	A02-5	0
P A11-1	A011-1	A01-3	8.231	95.052	94.97	1	Concrete, u	375	375	0.3	Existing	1	A01-3	0
P A12-1	A012-1	A01-4	8.246	94.582	94.5	0.99	Concrete, u	375	375	0.3	Existing	1	A01-4	0
Pipe16451	Basin8	A05-1	10	88.75	88.645	1.05	Concrete, u	375	375	0.3	NewFixed	1	A05-1	0
P A05-1	A05-1	A01-10	10.768	88.64	88.3	3.16	Concrete, u	375	375	0.3	Existing	1	A01-10	0
p-Shgrnd_(	P_Shgrd_O	P_Shgrnd_	11	87.5	87.17	3	Concrete, u	600	600	0.3	NewFixed	1	P_Shgrnd_	0
p_Shgrnd_(	P_Shgrnd_	Outlet_1	5	87.17	87.1	1.4	Concrete, u	600	600	0.3	NewFixed	1	Outlet_1	0

DETAILS of SERVICES CROSSING PIPES

Pipe	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	Chg (m)	Bottom Elev (m)	Height of S (m)	etc etc

CHANNEL DETAILS

Name	From	To	Type	Length (m)	U/S IL (m)	D/S IL (m)	Slope (%)	Base Width (m)	L.B. Slope (1:?)	R.B. Slope (1:?)	Manning n	Depth (m)	Roofed

OVERFLOW ROUTE DETAILS

Name	From	To	Travel Time (min)	Spill Level (m)	Crest Length (m)	Weir Coeff. C	Cross Section	Safe Depth Major Stor (m)	Safe Depth Minor Stor (m)	Safe DxV (sq.m/sec)	Bed Slope (%)	D/S Area Contributing %	id	
F A01-1x	A01-1	A011-1	1				7.5 m road	0.3	0.15	0.4	3.21	100	46344147	22.957
F A01-2x	A01-2	A01-3	1				7.5 m road	0.3	0.15	0.4	3.03	100	46344148	23.387
F A01-3x	A01-3	A01-4	1				7.5 m road	0.3	0.15	0.4	3.26	100	46344149	16.947
F A01-4x	A01-4	A01-5	1				7.5 m road	0.3	0.15	0.4	3.15	100	46344150	12.549
F A01-5x	A01-5	A01-6	1				7.5 m road	0.3	0.15	0.4	3.96	100	46344151	15.212
F A01-6	A01-6	A01-7	1				7.5 m road	0.3	0.15	0.4	4.26	100	46344152	20.768
F A01-7	A01-7	A01-8	1				7.5 m road	0.3	0.15	0.4	5.77	100	46344153	32.298
F A01-8	A01-8	A01-9	1				7.5 m road	0.3	0.15	0.4	6.67	100	46344154	21.169

F A01-9	A01-9	A01-10	1		7.5 m road	0.3	0.15	0.4	5.18	100	46344155	17.901
F A01-10	A01-10	A01-11	1		7.5 m road	0.3	0.15	0.4	2.84	100	46344156	6.79
F A01-11	A01-11	A01-12	1		7.5 m road	0.3	0.15	0.4	1.31	100	46344157	21.494
F A01-12	A01-12	A01-14	1		4 m wide p	0.3	0.15	0.4	1.49	100	46344158	21.739
F A01-13	A01-13	A01-14	1		7.5 m road	0.3	0.15	0.4	0.49	100	46344159	18.076
F A01-14	A01-14	A01-15	1		7.5 m road	0.3	0.15	0.4	0.8	100	46344160	11.834
F A01-15	A01-15	A01-16	1		7.5 m road	0.3	0.15	0.4	0.69	100	46344161	11.938
F A01-16	A01-16	A01-17	1		7.5 m road	0.3	0.15	0.4	0.63	100	46344162	5.115
F A01-17	A01-17	A01-18	1		7.5 m road	0.3	0.15	0.4	0.76	100	46344163	4.46
F A01-18	A01-18	A01-20	1		7.5 m road	0.3	0.15	0.4	1	100	46344164	22.775
F A01-19	A01-19	A01-20	1		7.5 m road	0.3	0.15	0.4	1.48	100	46344165	13.21
F A01-20	A01-20	O A01-20	1		7.5 m road	0.3	0.15	0.4	4	100	46344166	13.6
F A01-21	A01-21	A01-22	1		7.5 m road	0.3	0.15	0.4	4	100	46344167	10
F A02-1x	A02-1	A02-3	1		Overflow a	0.05	0	0.6	3.78	100	46344168	16.75
F A02-2x	A02-2	A02-3	1		7.5 m road	0.3	0.15	0.4	2.64	100	46344169	11.128
F A02-3x	A02-3	A02-4	1		7.5 m road	0.3	0.15	0.4	4.97	100	46344170	39.322
F A02-4x	A02-4	A02-5	1		7.5 m road	0.3	0.15	0.4	7.01	100	46344171	14.996
F A02-5x	A02-5	A02-6	1		7.5 m road	0.3	0.15	0.4	7.17	100	46344172	33.903
F A01-19x	A02-6	A02-7	1		7.5 m road	0.3	0.15	0.4	7.02	100	46344173	25.327
F A01-20x	A02-7	A02-8	1		7.5 m road	0.3	0.15	0.4	5.84	100	46344174	9.821
F A01-21x	A02-8	P_Shgrd_O	1		7.5 m road	0.3	0.15	0.4	1	100	46344175	10
F A03-1	A03-1	A03-2	1		7.5 m road	0.3	0.15	0.4	0.13	100	46344176	6.811
OF169744	A03-2	A03-5	0.1		4 m wide p	0.3	0.15	0.4	3.72	100	60940239	24.1
F A03-3	A03-3	A03-2	1		7.5 m road	0.3	0.15	0.4	0.17	100	46344177	10.299
F A03-4x	A03-4	A03-5	1		7.5 m road	0.3	0.15	0.4	3.62	100	46344178	21.236
F A03-5	A03-5	A08-1	1		7.5 m road	0.3	0.15	0.4	4.19	100	46344179	20.435
F A04-1x	A04-1	A04-2	1		7.5 m road	0.3	0.15	0.4	4.29	100	46344180	10.429
F A04-2	A04-2	A04-3	1		7.5 m road	0.3	0.15	0.4	2.32	100	46344181	7.333
F A04-3	A04-3	A04-4	1		7.5 m road	0.3	0.15	0.4	0.85	100	46344182	8.132
F A04-4	A04-4	A04-5	1		4 m wide p	0.3	0.15	0.4	1.88	100	46344183	18.598
F A04-5	A04-5	A01-13	1		7.5 m road	0.3	0.15	0.4	0.49	100	46344184	12.954
F A03-4	A06-1	A05-1	1		Swale with	0.45	0.3	1	5.96	100	46344186	38.669
F A07-1x	A07-1	A04-1	1		7.5 m road	0.3	0.15	0.4	6.87	100	46344187	29.244
F A08-1	A08-1	A07-1	1		7.5 m road	0.3	0.15	0.4	5.62	100	46344188	32.204
F A09-1	A09-1	A01-19	1		7.5 m road	0.3	0.15	0.4	5.15	100	46344189	49.235
F A09-2	A09-2	A09-3	1		7.5 m road	0.3	0.15	0.4	7.09	100	46344190	14.298
F A09-3	A09-3	A01-19	1		7.5 m road	0.3	0.15	0.4	3.69	100	46344199	36.7
F A10-1	A10-1	A09-1	1		7.5 m road	0.3	0.15	0.4	7.18	100	46344192	43.041
F A010-2	A10-2	A09-2	1		7.5 m road	0.3	0.15	0.4	7.15	100	46344193	45.22
F A11-1	A011-1	A012-1	1		7.5 m road	0.3	0.15	0.4	3.18	100	46344202	17.5
F A012-1	A012-1	A03-1	1		7.5 m road	0.3	0.15	0.4	1.1	100	46344195	17.9
OF130487	N159188	A02-1	0.2		7.5 m road	0.3	0.15	0.4	1	100	46671226	25.8
F Bypass	Bypass	A01-18	0.2		Overflow a	0.05	0	0.6	2	0	76451743	10
OF_OSD	Basin8	A05-1	0.1	89.75	Very Wide	0.3	0.3	0.6	5	0	91457061	5.2
OF154692	A05-1	N185505	0.1		4 m wide p	0.3	0.15	0.4	1.39	100	53371041	12.7
OF39087	P_Shgrd_O	P_Shgrnd_I	0.1		10 m roadv	0.3	0.15	0.6	1.09	100	86026832	18.3
OF_Outlet_	P_Shgrnd_I	Outlet_1	0.1		10 m roadv	0.3	0.15	0.6	15.28	100	86026833	12.5

PIPE COVER DETAILS

Name	Type	Dia (mm)	Safe Cover	Cover (m)
P A01-1	Concrete, u	375	0.6	0.85
P A01-2	Concrete, u	375	0.6	0.96
P A01-3	Concrete, u	375	0.6	0.93
P A01-4	Concrete, u	375	0.6	0.93
P A01-5	Concrete, u	375	0.6	0.98
P A01-6	Concrete, u	375	0.6	1.11
P A01-7	Concrete, u	375	0.6	1.2
P A01-8	Concrete, u	375	0.6	1.12
P A01-9	Concrete, u	375	0.6	1.05
P A01-10	Concrete, u	600	0.6	0.78
P A01-11	Concrete, u	600	0.6	0.78
P A01-12	Concrete, u	600	0.6	0.87
P A01-13	Concrete, u	600	0.6	0.92
P A01-14	Concrete, u	750	0.6	0.84
P A01-15	Concrete, u	750	0.6	0.92
P A01-16	Concrete, u	750	0.6	0.95
P A01-17	Concrete, u	750	0.6	1
P A01-18	Concrete, u	750	0.6	1.03
P A01-19	Concrete, u	750	0.6	1.47
P A01-20	Concrete, u	750	0.6	1.47
P A01-21	Concrete, u	750	0.6	1.5
P A02-1	Concrete, u	375	0.6	1.06
P A02-2	Concrete, u	375	0.6	1.17
P A02-3	Concrete, u	375	0.6	1.17
P A02-4	Concrete, u	375	0.6	1.32
P A02-5	Concrete, u	375	0.6	1.18
P A02-6	Concrete, u	375	0.6	1.18
P A02-7	Concrete, u	600	0.6	1.14
P A02-8	Concrete, u	600	0.6	1.14
P A03-1	Concrete, u	375	0.6	1.03
P A03-2	Concrete, u	375	0.6	1.05
P A03-3	Concrete, u	375	0.6	1.29
P A03-4	Concrete, u	375	0.6	0.97
P A03-5	Concrete, u	375	0.6	0.97
P A04-1	Concrete, u	375	0.6	0.88
P A04-2	Concrete, u	375	0.6	0.88
P A04-3	Concrete, u	375	0.6	1.02
P A04-4	Concrete, u	375	0.6	1.06
P A04-5	Concrete, u	375	0.6	1.08
P A06-1	Concrete, u	375	0.6	0.67
P A07-1	Concrete, u	375	0.6	1.11
P A08-1	Concrete, u	375	0.6	0.98
P A09-1	Concrete, u	375	0.6	0.81
P A09-2	Concrete, u	375	0.6	0.92
P A09-3	Concrete, u	375	0.6	1.02
P A10-1	Concrete, u	375	0.6	0.85
P A10-2	Concrete, u	375	0.6	1.07
P A11-1	Concrete, u	375	0.6	0.92
P A12-1	Concrete, u	375	0.6	0.83

Pipe16451	Concrete, u	375	0.6	0.59	Unsafe
P A05-1	Concrete, u	375	0.6	0.63	
p-Shgrnd_c	Concrete, u	600	0.6	0.66	
p_Shgrnd_c	Concrete, u	600	0.6	-0.65	Unsafe

This model has no pipes with non-return valves

Appendix C AR&R 2019 Data Hub Report

Results - ARR Data Hub

[STARTTXT]

Input Data Information

[INPUTDATA]

Latitude,-33.727640

Longitude,150.987150

[END_INPUTDATA]

Storm Losses

[LOSSES]

ID,29664.0

Storm Initial Losses (mm),29.0

Storm Continuing Losses (mm/h),2.5

[LOSSES_META]

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[END_LOSSES]

Median Preburst Depths and Ratios

[PREBURST]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.5 (0.017),1.6 (0.043),2.4 (0.053),3.1 (0.060),1.9 (0.030),0.9 (0.014)

90 (1.5),0.4 (0.013),2.1 (0.048),3.2 (0.062),4.2 (0.072),2.4 (0.035),1.1 (0.014)

120 (2.0),4.2 (0.118),4.6 (0.097),4.9 (0.087),5.1 (0.079),3.9 (0.050),2.9 (0.034)

180 (3.0),3.0 (0.074),4.1 (0.076),4.9 (0.075),5.6 (0.074),6.3 (0.069),6.8 (0.066)

360 (6.0),4.0 (0.074),10.1 (0.138),14.2 (0.162),18.1 (0.177),13.5 (0.109),10.1 (0.071)

720 (12.0),5.7 (0.078),12.1 (0.118),16.2 (0.132),20.3 (0.139),26.2 (0.148),30.6 (0.152)

1080 (18.0),1.2 (0.014),7.6 (0.061),11.8 (0.077),15.8 (0.087),26.0 (0.119),33.6 (0.135)

1440 (24.0),2.8 (0.028),6.1 (0.043),8.3 (0.047),10.4 (0.049),21.1 (0.083),29.1 (0.101)

2160 (36.0),1.2 (0.010),3.7 (0.022),5.4 (0.025),7.0 (0.027),9.0 (0.029),10.5 (0.030)

2880 (48.0),0.0 (0.000),0.4 (0.002),0.6 (0.003),0.8 (0.003),3.5 (0.010),5.4 (0.014)

4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),2.0 (0.005),3.4 (0.008)

[PREBURST_META]

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Note,Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

[END_PREBURST]From preburst class

Probability Neutral Burst Initial Loss

[BURSTIL]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),18.8,11.5,11.1,11.4,10.2,8.4

90 (1.5),18.1,11.7,10.5,10.5,10.1,7.5

120 (2.0),13.9,10.0,10.4,10.3,10.2,6.6

180 (3.0),15.6,11.4,11.6,10.5,10.3,6.2

360 (6.0),16.2,11.2,10.4,9.4,10.3,4.0

720 (12.0),17.1,12.9,13.0,11.4,12.7,3.4

1080 (18.0),19.6,15.0,15.3,12.5,13.4,4.1

1440 (24.0),20.6,16.7,17.1,14.8,15.4,4.8

2160 (36.0),23.6,17.9,18.2,17.0,17.1,7.1

2880 (48.0),28.8,23.4,21.5,23.3,19.5,9.9

4320 (72.0),30.7,25.7,25.7,24.7,21.4,10.9

[BURSTIL_META]

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Version,2018_v1

Note,As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. Probability neutral burst initial loss values for NSW are to be used in place of the standard initial loss and pre-burst as per the losses hierarchy.

[END_BURSTIL]

Transformational Pre-burst Rainfall

[PREBURST_TRANS]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),10.2,17.5,17.9,17.6,18.8,20.6

90 (1.5),10.9,17.3,18.5,18.5,18.9,21.5

120 (2.0),15.1,19.0,18.6,18.7,18.8,22.4

180 (3.0),13.4,17.6,17.4,18.5,18.7,22.8

360 (6.0),12.8,17.8,18.6,19.6,18.7,25.0

720 (12.0),11.9,16.1,16.0,17.6,16.3,25.6

1080 (18.0),9.4,14.0,13.7,16.5,15.6,24.9

1440 (24.0),8.4,12.3,11.9,14.2,13.6,24.2

2160 (36.0),5.4,11.1,10.8,12.0,11.9,21.9

2880 (48.0),0.2,5.6,7.5,5.7,9.5,19.1

4320 (72.0),0.0,3.3,3.3,4.3,7.6,18.1

[PREBURST_TRANS_META]

The tranformational pre-burst is intended for software suppliers in the NSW area and is simply the Initial Loss - Burst Initial Loss. It is not appropriate to use these values if considering a calibrated initial loss.

[END_PREBURST_TRANS]

[ENDTXT]