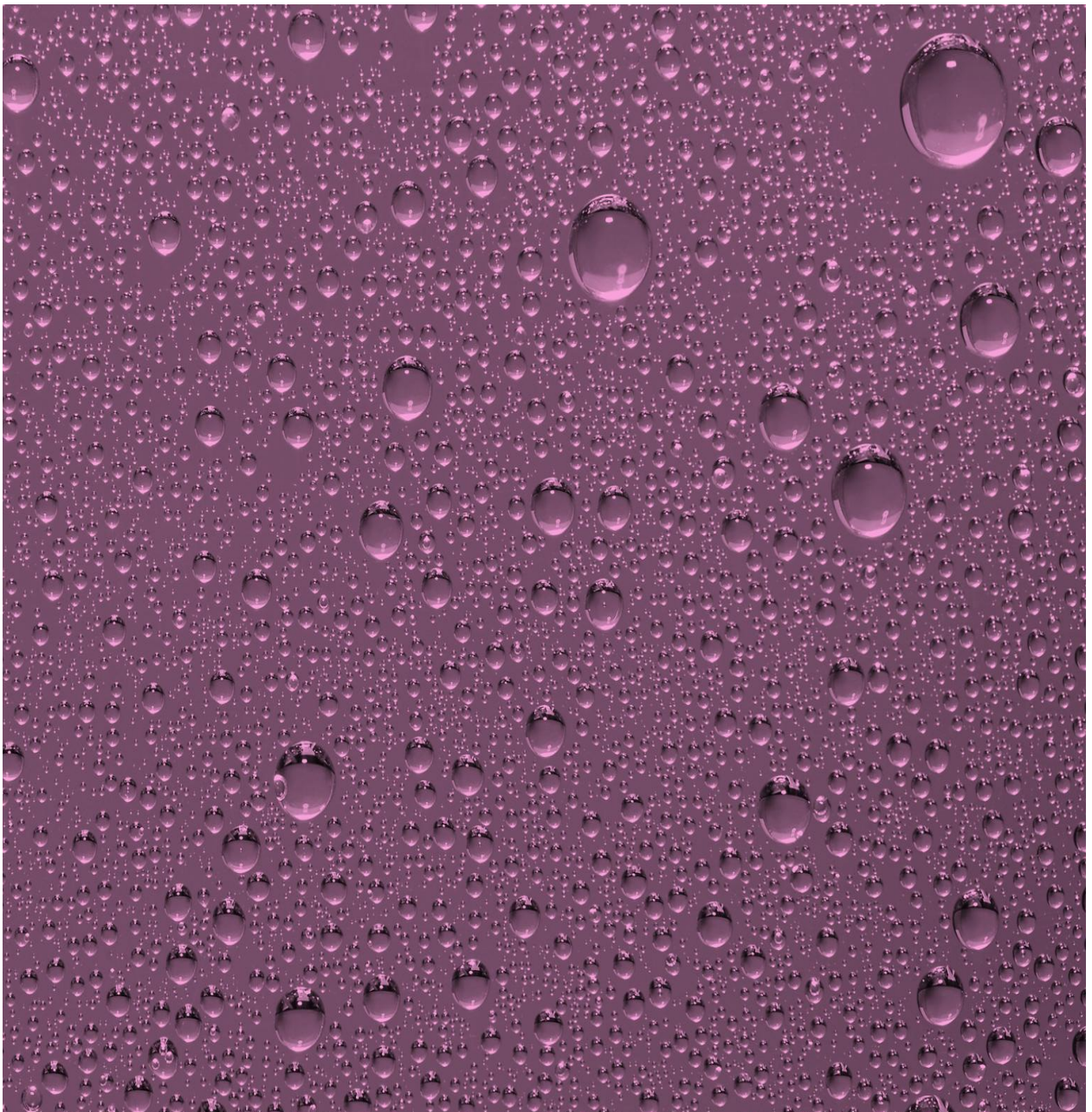


Flood Impact and Risk Assessment



Flood Impact and Risk Assessment

Proposed Mixed Use State Significant Development Application
93-107 Cecil Ave & 9-10 Roger Ave, Castle Hill

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1.0 Summary

This Flood Impact and Risk Assessment (FIRA) has been prepared to support State Significant Development Application SSD-78156221 for a proposed mixed use development at 93–107 Cecil Avenue and 9–10 Roger Avenue, Castle Hill. The FIRA has been prepared in response to advice issued by the Conservation Programs, Heritage and Regulation (CPHR) Group of the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) dated 2 April 2026 (reference DOC26/154809), which recommended provision of a FIRA consistent with the NSW Government's Flood Risk Management Guideline LU01. This assessment has been prepared as a Simple FIRA in accordance with Section 2.8 of LU01.

The site comprises approximately 17,610 m² of land currently occupied by 18 residential lots in The Hills Shire Council local government area. The site falls approximately 14 m from north-west to south-east and is situated on a local hill crest, with the lowest point on the site boundary at 116.5 mAHD. The proposed development involves the demolition of all existing structures and the construction of a mixed use, multi-storey development comprising four buildings across two construction stages.

A DRAINS hydrological model was established to assess overland flow behaviour from four identified upstream catchments. The analysis demonstrates that upstream catchments largely bypass the site due to its elevated position. The site stormwater system incorporates on-site detention (OSD) systems for each construction stage, sized to limit post-development discharge to the Permissible Site Discharge (PSD) for events up to the 1% Annual Exceedance Probability (AEP). Bioretention basins and stormfilter cartridges are proposed to meet the Water Sensitive Urban Design (WSUD) water quality targets of The Hills Shire Development Control Plan, and MUSIC modelling has confirmed these targets are exceeded.

Risks have been assessed for PMF flood conditions. The driveway crest has been designed to be above the PMF overland flow depth. The cross-sectional capacity, flood behaviour (depths, velocities, and flood hazard), and impacts on neighbouring properties from the easement realignment have been assessed using DRAINS. For the PMF storm, the proposed easement overland flowpath has a maximum depth of 118 mm and a maximum velocity of 3.1 m/s resulted in a DV product of 0.31 m²/s, which is considered safe for pedestrians and vehicles. The proposed drainage easement realignment can safely convey the PMF storm.

2.0 Introduction

This Flood Impact and Risk Assessment (FIRA) has been prepared to support State Significant Development Application SSD-78156221 for a proposed mixed use development at 93–107 Cecil Avenue and 9–10 Roger Avenue, Castle Hill, NSW.

The subject site is located in The Hills Shire Council local government area and comprises 18 residential lots covering a total area of approximately 17,610 m². The site has a primary frontage along Cecil Avenue and a secondary frontage along Roger Avenue, a cul-de-sac connecting to Francis Street. The site falls approximately 14 m from its north-western to its south-eastern boundary. The development proposal involves the demolition of all existing buildings and their replacement with a mixed use, multi-storey development comprising four buildings across two construction stages.

This FIRA has been prepared in accordance with the NSW Government's Flood Risk Management Guideline LU01: Flood impact and risk assessment (DPE, 2023) and addresses the flood-related requirements of the

Secretary's Environmental Assessment Requirements (SEARs) for this application, including the specific matters identified in the DCCEEW advice dated 2 April 2026.

3.0 Background

The topography of the study area is positioned near the crest of a local ridge, falling from approximately 130 mAHD at the north-western boundary to approximately 116.5 mAHD at the lowest south-eastern boundary point, representing a fall of approximately 14m. This elevated hilltop position is the defining characteristic of the site's flood exposure. The low point in Roger Avenue, which is the key downstream hydraulic control for the study area, sits at approximately 113.84 mAHD, some 2.66 metres below the lowest point on the subject site boundary.

Four upstream catchments have been delineated that are relevant to flood behaviour in the vicinity of the site. An existing drainage easement passes through the site, conveying stormwater from upstream properties along Old Northern Road and Cecil Avenue to the Council drainage network. The characteristics and flood behaviour of these catchments are described in this report, as well as in Stellen's Water Management Report.

No flood studies or flood maps by Council exist for this area. The area is not identified as flood affected in any existing floodplain risk management study.

4.0 Pre-Development Modelling and Analysis

4.1 3.1 Modelling Approach and Design Parameters

Existing flood behaviour has been assessed using the DRAINS hydrologic and hydraulic urban catchment modelling software. The Bureau of Meteorology 2016 Design Rainfall Data (IFD), specific to the site's latitude and longitude, was used as the rainfall input. Design events assessed include the 10% AEP (minor) and 1% AEP (major) events, 1% AEP including climate change adjustment, and PMF. Impervious percentage assumptions were derived from Table 4.6 of The Hills Shire Council Design Guidelines for Subdivision and Developments (2011).

The following key design parameters were adopted in the existing conditions DRAINS model:

Impervious area depression storage: 1 mm

Supplementary area depression storage: 1 mm

Pervious area depression storage: 5 mm

Soil Type: 3

Antecedent Moisture Content (AMC): 3

BOM IFD storm durations: 5 minutes to 2 hours

These parameters are appropriate for the fully urban catchment conditions at this location. Pit loss coefficients were adopted generally in accordance with the Queensland Urban Drainage Manual (2017).

4.2 Catchment Delineation

Four upstream catchments contributing overland flows to the study area have been delineated using a combination of 1m resolution DEM data obtained from ELVIS (Geoscience Australia), DBYD stormwater drainage information, Google Earth and SIX Maps aerial imagery, and site observations. The delineated catchment areas and predicted peak flows are summarised in Table 1.

Catchment ID	Area (ha)	Peak Flow 1% AEP (m ³ /s)	1% AEP + Climate Change (m ³ /s)	PMF (m ³ /s)
1	6.272	3.090	4.48	14.5
2	0.176	0.108	0.156	0.435
3	0.824	0.467	0.662	2.01
4	0.077	0.050	0.072	0.198

Table 1 — Delineated catchment areas and predicted peak flows

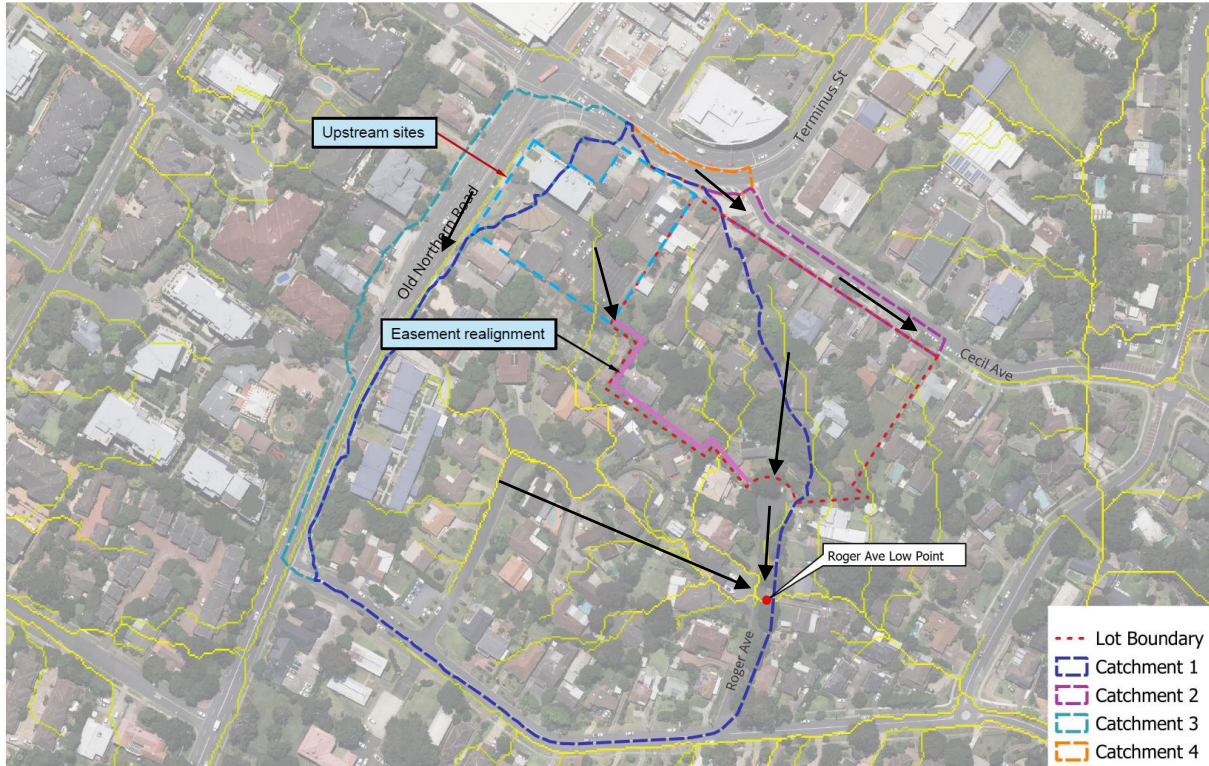
In the context of the subject site, catchments 1, 2, 3, and 4 contribute to overland flows that bypass the site and flow along established paths:

The easement serving 249 and 251 Old Northern Road and 89, 91, and 93–101 Cecil Avenue is proposed to be realigned. The proposed easement has been designed to accommodate the contributing flows. Refer to the stormwater management plan by Stellen Consulting, Revision 2.

Remaining flows from Catchment 1 and Catchment 3 are directed towards the overland flow path along the low point at Roger Avenue. As a result, Catchments 1 and 3 do not directly impact the site itself.

Catchments 2 and 4 flow south-eastward down Cecil Avenue towards the Orange Grove intersection, passing by the basement access.

The road capacity along Cecil Avenue was evaluated based on its characteristics, which include a road width of approximately 4.5 m and a fall of about 8%. Using the QUDM (2017) Road Flow Capacity Table, Chart No. A3-5, the capacity of the road was estimated to be approximately 0.487 m³/s. Since the peak flow from Catchment 2 is only 0.435 m³/s in the PMF scenario, the flow will be contained within the road. Catchment 2 does not contribute to overland flow that would impact the site during the 1% AEP flood event, other than possible interaction with the basement access (detailed in Section 6.3).



[Figure — Catchment delineation and flow path plan]

4.3 Tailwater Conditions at Roger Avenue

A separate DRAINS model was constructed to determine the tailwater level at the proposed stormwater connection point in Roger Avenue, accounting for overland flow behaviour at the Roger Avenue low point. The modelled tailwater levels at this point of connection are:

10% AEP event: 137 mm depth above road surface, corresponding to a water level of 114.03 mAHD

1% AEP event: 168 mm depth above road surface, corresponding to a water level of 114.06 mAHD

These tailwater levels have been incorporated into the design of the on-site OSD systems and stormwater extension. Under existing conditions, localised flooding in Roger Avenue during major storm events is expected.

5.0 Post-Development Modelling and Analysis

5.1 Post-Development Stormwater System

The key components of the post-development stormwater management system are as follows.

Two OSD systems — one per construction stage — provide a combined total storage volume of 789 m³. Each OSD system has been sized using the UPRCT On-Site Stormwater Detention Handbook (Version 4) methodology. The Permissible Site Discharge (PSD) and Site Storage Requirement (SSR) for each stage are:

Stage 1: SSR 407 m³, PSD 124 L/s

Stage 2: SSR 382 m³, PSD 146 L/s

remain below the underside of the building slab. No overflow from the OSD goes to Roger St in the climate change adjusted 1% AEP scenario.

Catchments 1 and 3, which flow to Roger Avenue, increase from 3.090 m³/s and 0.467 m³/s to 4.48 m³/s and 0.662 m³/s respectively. These flows bypass the site entirely along established overland flow paths.

Overflows from the easement are contained within the easement in the climate change adjusted 1% AEP scenario. Section 6.2 shows that overflows along the proposed easement are safe, even in the PMF scenario.

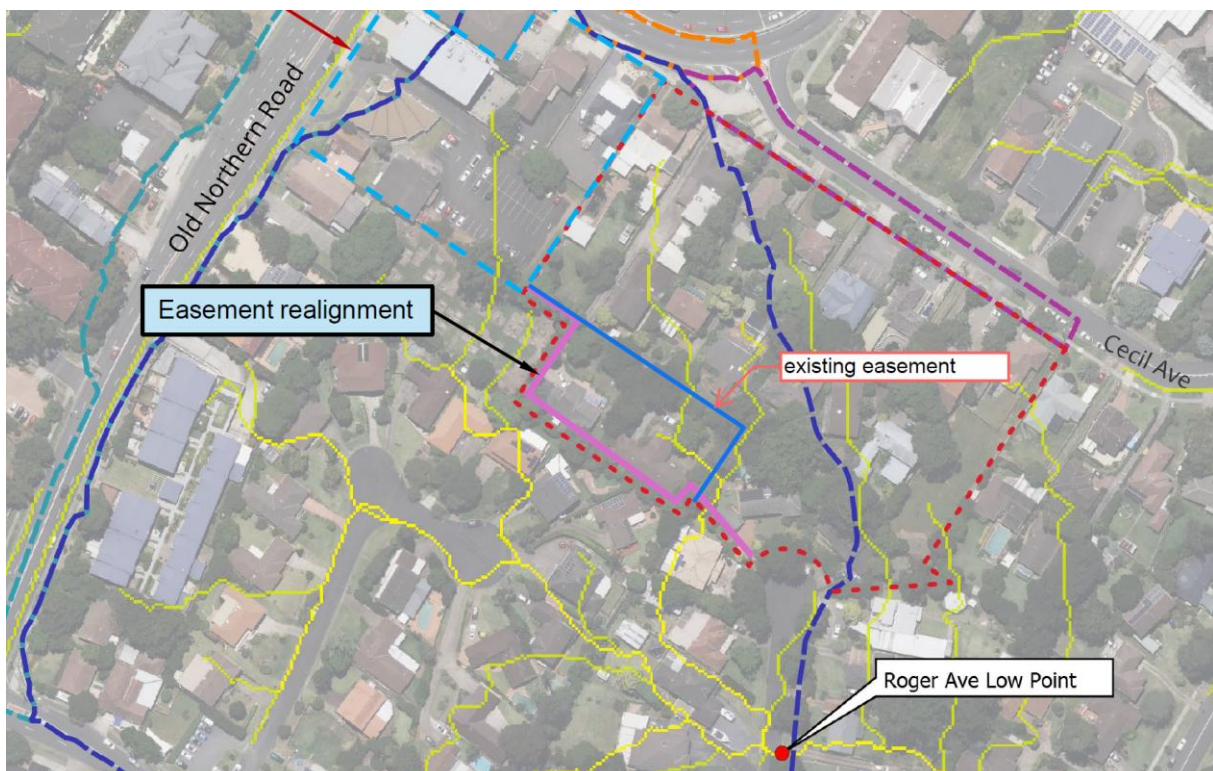
6.0 Flood Impacts of Proposed Development

6.1 Impacts on Downstream Properties and Infrastructure

The OSD systems have been designed to limit post-development discharge to the PSD, ensuring that the peak flows leaving the developed site do not exceed pre-development levels. This means the development will not increase downstream flood levels or flow rates at the Roger Avenue low point relative to the existing situation. DRAINS modelling has confirmed the adequacy of the existing trunk network to accommodate the development's flows once the proposed 525 mm pipe extension is constructed.

6.2 Proposed Drainage Easement Realignment

The existing drainage easement that currently traverses the subject site, serving properties at 249 and 251 Old Northern Road and 89, 91, and 93–101 Cecil Avenue, is proposed to be realigned to run along the south-western boundary of the site before connecting to the proposed 525 mm stormwater extension in Roger Avenue. The existing easement alignment and the proposed realigned alignment are shown below. There are multiple easements fully contained within the site which will be extinguished.

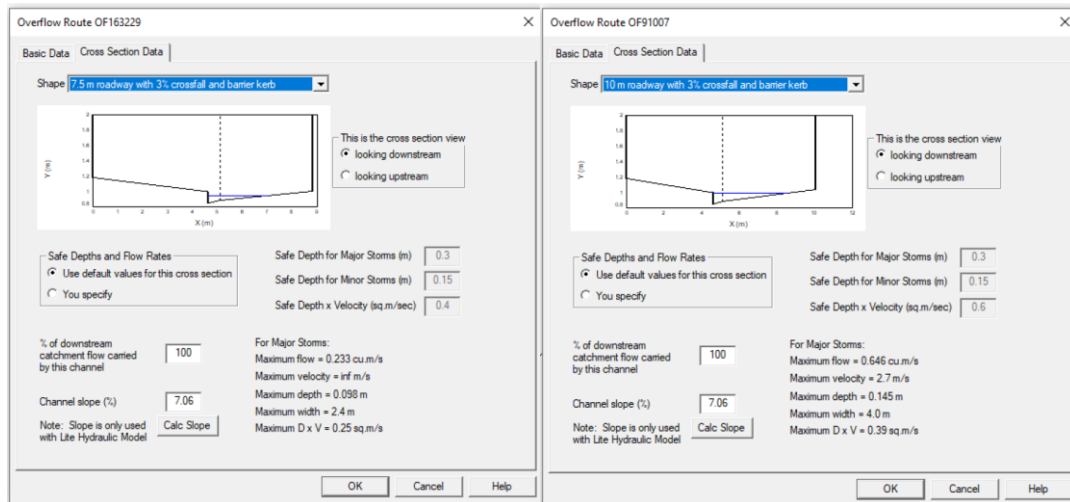


[Figure — Easement realignment plan (existing vs proposed)]

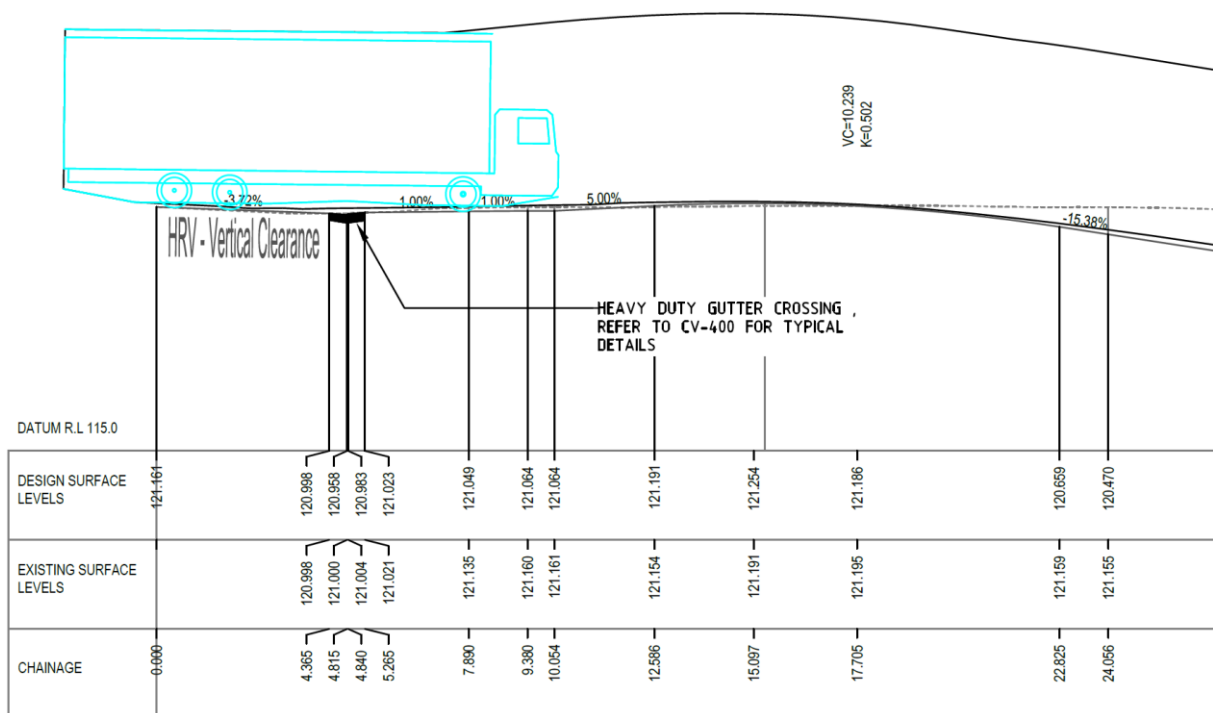
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delivering 150mm of freeboard above the PMF flow. This design is consistent with the requirements of LU01 for basement car park protection.



[Figure — DRAINS results of overland flows past driveway access in 1% AEP and PMF scenarios]



[Figure — Basement access cross-section and crest level]

7.0 Flood Emergency Response

7.1 Residue Risk Scenarios

A Flood Emergency Response has been considered to address residual risks associated with:

- Extreme rainfall events exceeding the 1% AEP (PMF event)
- Temporary localised ponding or overland flow from adjacent roadways
- Potential full blockage or surcharge of the realigned easement or OSD system

Two options are available to all developments for the safe refuge of occupants:

Option 1: Shelter-in-place: move to an area above any conceivable water level within the development.

Option 2: Evacuate: move to an area outside the potential flood extent.

7.2 Shelter-in-Place

The preferred strategy for this development is shelter-in-place, due to the following considerations:

- The site is elevated with no modelled overland flow paths crossing the site.
- Any local flows on the site are of short duration, rising and receding within an hour
- All levels above the ground floor are above the highest predicted overland flow level for the PMF event.
- Shelter-in-place reduces exposure to severe weather and avoids unnecessary evacuation.

Safe refuge: Any level above the ground floor (minimum 117.5 mAHD) is above the maximum predicted overland flow level. Level 1 and above are recommended for shelter.

In the event of an extreme localised rainfall event or drainage blockage, occupants shall move to Level 1 or higher, remain indoors until advised by emergency services or floodwaters subside, and contact emergency services if required, stating the property's location, situation, and number of occupants.

7.3 Evacuate

Given the site's elevated position, no significant inundation is predicted for the PMF event. However, in the event of localised overland flow affecting Roger Avenue an evacuation route is available via Cecil Avenue to Terminus Street and to higher ground to the south-east (lowest evacuation point approximately 118.5 mAHD).

Evacuation would only be required if directed by the Emergency Services.

8.0 Flood Risk Categorisation – Not Flood Prone Land

In accordance with LU01 Section 2.8, the flood risk category for this development is determined as follows.

The site is situated on a local hill crest. DRAINS modelling of all relevant upstream catchments under 1% AEP, 1% AEP + climate change (SSP2-4.5), and PMF conditions demonstrates that:

- Upstream catchments bypass the site via established overland flow paths (roadways and the drainage easement).

- The lowest point on the site boundary (116.5 mAHD) is 2.66 m above the nearest downstream low point at Roger Avenue (113.84 mAHD).
- No overland flow paths cross the site under any modelled scenario.
- The site is not subject to inundation under the PMF.

Based on the above, the site is not flood prone land as defined under the NSW Flood Risk Management Manual (2023), as it is not susceptible to PMF inundation. Accordingly, the flood risk category for this development is Low.

Reference Flood Level (RFL): Not applicable; the site is not flood prone land.

Design Flood Level (DFL): Not applicable; the site is not flood prone land.

Notwithstanding the above categorisation, flood-compatible design measures have been incorporated for the basement car park access (crest above PMF depth) and the realigned drainage easement (designed to convey PMF flows without adverse impact on neighbouring properties), consistent with LU01 requirements.

9.0 Conclusions and Recommendations

The subject site at 93–107 Cecil Avenue and 9–10 Roger Avenue, Castle Hill has a naturally favourable flood exposure. Its location on a local hill crest, with the lowest site boundary approximately 2.66 m above the nearest overland flow low point at Roger Avenue, provides substantial topographic protection from external overland flooding. DRAINS modelling for the 10% AEP, 1% AEP (including climate change), and PMF events confirms that **upstream catchment flows do not enter the site**. They either bypass the site entirely or are contained within the road network.

The site is not flood prone land as defined by NSW Flood Risk Management Manual (2023). The site is not susceptible to inundation under the PMF. **The flood risk category for this development is Low.**

Key outcomes of this assessment are as follows:

- The proposed development incorporates OSD systems for each construction stage, sized to limit post-development discharge to the PSD, preventing any increase in downstream peak flows.
- Bioretention and stormfilter treatment measures are proposed to meet and exceed the Council's WSUD targets.
- A new 525mm trunk stormwater extension in Roger Avenue will connect the development to the Council drainage system, and hydraulic modelling has confirmed its adequacy.
- Climate change impacts under the SSP2-4.5 scenario have been assessed for both the on-site stormwater system and external overland flows. The system performs satisfactorily under climate-affected conditions, and Cecil Avenue road capacity is sufficient to contain climate-adjusted flows from Catchment 2.
- Overland flow paths have been mapped for the 1% AEP, 1% AEP + climate change, and PMF events, showing depths, velocities, and hazard classifications consistent with LU01 Appendix A Table 6.

- The sub-catchment at the Cecil Avenue/Terminus Street intersection has been confirmed to direct flows south-eastward along Cecil Avenue, consistent with the site topography.
- The minimum required crest level at the basement car park access has been determined by hydraulic analysis of overland flow depths during the PMF event.
- A hydraulic assessment of the proposed drainage easement realignment has been completed, including depths, velocities, hazard classification, and hydraulic grade line analysis for the 1% AEP event. The realignment does not adversely affect upstream or neighbouring properties.