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10 February 2026

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Overland Flow Assessment for 93-107 Cecil Ave & 9-10 Roger Ave, Castle Hill

Dear Brittney

1. Introduction

Stellen Consulting was engaged to assess the proposed new development at 93-107 Cecil Ave & 9-10 Roger Avenue in reference to potential risks arising from overland flow.

The following documentation has been used in the preparation of this overland flow assessment report:

- Google Earth and SIX Maps aerial imagery
- Site specific survey information by SDG Land Development Solutions (REF: 6864, REV C)
- DEM with a resolution of 1m obtained from ELVIS by Geoscience Australia

Flood behaviour on-site has been assessed in accordance with the requirements of LU01 and the NSW Flood Risk Management Manual (2023), ensuring that both existing and future conditions—including climate change considerations—are appropriately addressed.

2. Site Description

The subject site, located at 93-107 Cecil Avenue and 9-10 Roger Avenue, Castle Hill, is irregular in shape and consists of 18 residential lots, covering a total area of approximately 17,610m². It has a primary frontage along Cecil Avenue, with a secondary frontage along Roger Avenue, which serves two lots and is a cul-de-sac connecting to Francis Street. The southwestern boundary of the site borders a church and St. Paul's Cemetery. Figure 1 displays the subject site (yellow boundary) and location plan.

The site falls from the north-west to the south-east by approximately 14 metres.

The development proposal involves the demolition of existing buildings, and replacing them with a mixed use, multi-storey development.

3. Overland Flow Assessment

3.1 Approach

The following steps were taken to quantify the potential overland flow:

- Calculate the total size of the catchments and determine their characteristics.
- Create a DRAINS model to determine the peak flows, design the site drainage systems
- Evaluate the risk of overland flooding by analysing model results, available data, and observations from a site visit.

- Assess the impact of the development on existing conditions.

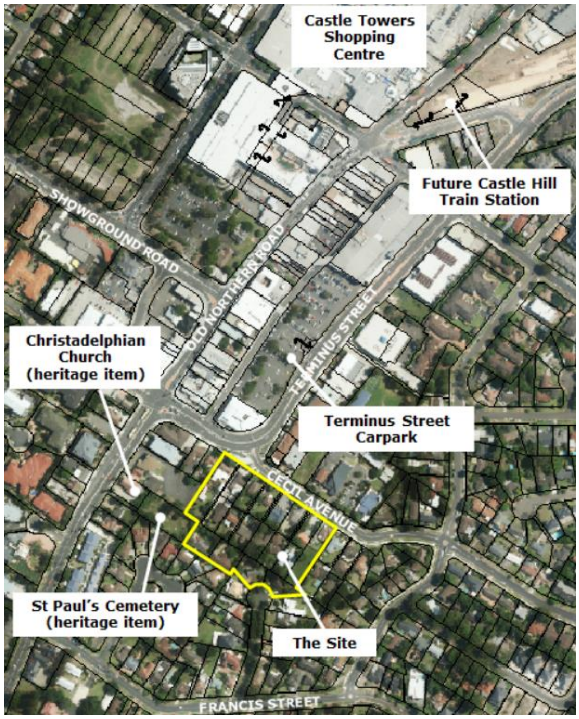


Figure 1 - Aerial view of the site and surrounding locality

3.2 Catchment Delineation

The catchments were delineated using a combination of DEM data, DBYD stormwater drainage information, Google Earth imagery, and site observations.

Refer to the Catchment Plans in Appendix A, which depicts the extent of the catchments and indicative potential flow paths.

3.2 Hydrologic and Hydraulic Modelling

A DRAINS hydrologic model was established for the catchment to estimate peak flows. The model used the Bureau of Meteorology (BOM) 2016 Design Rainfall Data as input. This rainfall data was based on the site's latitude and longitude. The impervious percentages used in the model are based on Table 4.6 of the Design Guidelines for Subdivision/Developments, 2011, The Hills Shire Council.

The following design parameters were adopted in the model:

- Impervious area depression storage = 1 mm
- Supplementary area depression storage = 1 mm
- Pervious area depression storage = 5 mm
- Soil Type = 3
- AMC = 3
- BOM IFD storm durations: 5min to 2hr

3.3 Model Results & Findings

Table 1 presents the details of the catchments and their predicted peak flows for the 1% Annual Exceedance Probability (AEP) flood event.

Table 1 - Catchment areas and peak flows

Catchment ID	Area (ha)	Peak Flow (m^3/s)
1	6.272	3.090
2	0.176	0.108
3	0.824	0.467
4	0.077	0.050

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 (refer to Appendix B for the potential flow paths). The stormwater system serving 249 and 251 Old Northern Road and 89, 91 and 93-101Cecil Avenue, connect to an existing easement that passes through the site. Accordingly:

- The easement that 249 and 251 Old Northern Road and 89 and 91 Cecil Avenue connect is proposed to be realigned, and the proposed easement has been designed to accommodate their flow. 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.
- Catchment 4 flows down Cecil Avenue towards Terminus Street, while Catchment 2 flows south-eastward along Cecil Avenue towards the Orange Grove intersection.

The road capacity along Cecil Avenue was evaluated based on its characteristics, which include a road width of approximately 4.5m 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 m^3/s. Since the peak flow from catchment 2 is only 0.108 m^3/s, the flow will be contained within the road and catchment 2 is not predicted to contribute to overland flow that would impact the site during the 1% AEP flood event.

Additionally, the site is situated atop a hill, with the lowest point at the boundary being 116.5mAHD, which is 2.66 meters higher than the downstream low point at Roger Avenue (113.84m AHD). This elevation difference ensures overland flooding from these catchments do not impact the site.

3.4 Flood Behaviour On-site

The above analysis in section 3.3 confirms that the site does not function as a flood storage area or conveyance corridor under current or design conditions.

The proposed development has been designed so it does not alter the existing flow patterns. The strategy is described in the stormwater management plan by Stellen Consulting. Two appropriately sized on-site detention

(OSD) systems form the core of the stormwater strategy. These two OSDs limit discharge from the site to the Permissible Site Discharge (PSD) up to and including the 1% AEP event, ensuring the development does not increase downstream flood levels or flow rates. The OSD outlets are set above the downstream weir level at Roger Avenue, which allows them to continue discharging effectively even during high-flow conditions and avoids any risk of backwater effects.

An existing drainage easement that conveys flows from neighbouring properties along Old Northern Road and Cecil Avenue is proposed to be realigned. The new easement layout has been designed to safely accommodate those upstream flows without changing how overland flow moves through or around the site. Importantly, no natural overland flow paths cross the developable area, and the proposed works do not block or redirect any of the existing off-site flow routes.

Overall, the development maintains the natural flood behaviour of the site. Overland flows remain external, the stormwater system ensures no increase in downstream flood risk, and the proposal is compatible with the local flood context and the requirements of LU01.

3.5 Climate Change

In line with SEARs and LU01 Section 2.4.2, the potential impacts of climate change have been assessed. Although the site is elevated, future climate conditions were tested to account for possible increases in overland flow, exceedance, and downstream impacts.

A climate change rainfall modifier by Watercom was applied. This approach follows the ARR v4.2 climate change framework, which uses Shared Socioeconomic Pathways (SSPs) to represent future emissions scenarios. The assessment adopted SSP2-4.5, a “middle-of-the-road” climate change scenario that reflects moderate increases in greenhouse gas emissions and is widely used for design sensitivity testing. This resulted in an approximate 44% increase in peak flows for the 1% AEP event. These increased flows were tested against the proposed stormwater system using DRAINS, including the OSDs and the extended downstream connection.

The results show that the system continues to operate effectively under SSP2-4.5 climate change condition:

- Emergency overflow pipes will be engaged and can convey the climate-adjusted peak flows, and
- Top water levels within the OSDs remain below the underside of the slab, maintaining the required protection.

Overall, the assessment demonstrates that the system continues to perform satisfactorily under climate-affected conditions.

3.6 Localised Flood Behaviour and Urban Drainage Interaction

Although the site is elevated, local road flows and potential surcharge were reviewed using the modelling results. Overland flows from surrounding catchments continue to bypass the site and follow established paths toward Roger Avenue and Cecil Avenue, and the proposed stormwater design maintains this existing behaviour.

The proposed OSD systems restrict discharge to the PSD, with outlet levels set above the downstream weir at the Roger Avenue low point to prevent backflow or surcharge into the site. Under the climate-adjusted SSP2-4.5 scenario, the stormwater system—including emergency overflow pipes—can safely convey increased peak flows while keeping OSD water levels below the underside of the slab.

The street drainage pits along the proposed extension system are sealed pits, reducing the risk of surcharge and debris ingress. With these measures in place, the development will not worsen minor flooding on-site or downstream, and overall urban drainage performance is preserved.

4. Conclusions

The overland flow analysis indicates that the site is well-positioned to avoid significant overland flooding during the 1% AEP flood event. Key conclusions drawn from the results include:

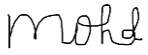
- The site is situated atop a hill and upstream catchments are predicted to bypass it.
- Flows from the existing easement are maintained with the realigned easement to run along the site boundary.
- The lowest point on the site (116.5mAHD), is sufficiently high above the downstream low point at Roger Avenue, ensuring that overland flows from catchments 1 and 3 do not affect the site.
- The road capacity along Cecil Avenue is sufficient to manage the peak flow from catchment 2 (0.108 m^3/s), as the road can handle up to 0.487 m^3/s, well above the expected flow from this catchment.

The proposed solution is considered robust as the proposed development is protected from overland flooding for all events up to the 1% AEP, including SSP2-4.5 Climate Change scenario and it will not worsen localised ponding, surcharge, or downstream flood risk.

In conclusion, the site's topography, positioned atop a hill, combined with established flow directions bypassing the site, indicates that it is unlikely to be affected by overland flooding from upstream catchments during the 1% AEP flood event. Therefore, the site is not predicted to be subject to overland flooding from upstream catchments.

Please contact me if you have any questions.

Kind regards,



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