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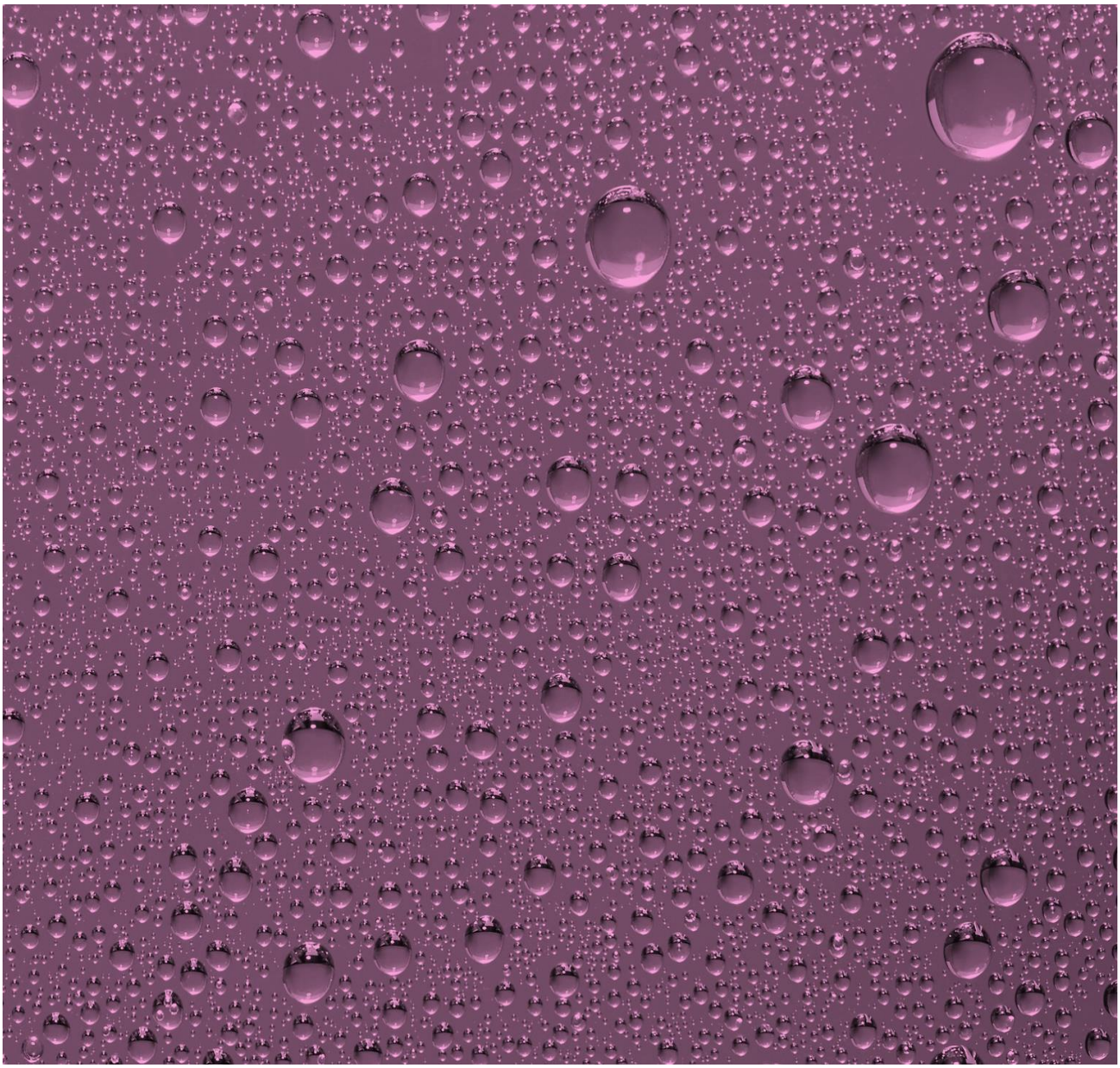
Flood Risk Assessment Report

Proposed Childcare Centre at 427 Burwood Road, Belmore



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Flood Risk Assessment

Proposed Childcare Centre at 427 Burwood Road, Belmore

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03 November 2022
P171015

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Executive Summary

Stellen Consulting was engaged to assess the proposed redevelopment at 427 Burwood Road in reference to potential risks and impacts connected with flooding.

A HECRAS 2D model was developed to assess the impact of the development on the flood characteristics in neighbouring properties.

Based on the evaluations of the proposed design, council-provided flood information and model results, the following can be concluded:

1. The subject site is affected by flooding during the 1% AEP event.
2. The proposed development is not predicted to have significant adverse impacts on the neighbouring properties and the hazards to people and vehicles are predicted to be largely unchanged.
3. Potential flood entry points shall need to be floodproofed up to the relevant Flood Planning Levels (FPL), as described in this report.
4. In the event of a flooding emergency, refuge can be taken within the first floor of the development. This approach is consistent with best practice for responding to the flood risk.

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Table of Contents

1.0 Introduction

Stellen Consulting was engaged to assess the proposed development at 427 Burwood Road in reference to potential risks and impacts connected with flooding.

Council flood modelling for the catchment notes the site as affected by overland flow during large storm events. Therefore, an assessment of the general flooding constraints and requirements is required for the site. This report provides detailed assessment of the flow information specific to the site and assesses the proposed development in accordance with the relevant requirements of Canterbury Development Control Plan 2012, Part B5.

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 listed in Appendix A
- DEM with a resolution of 1m obtained from ELVIS by Geoscience Australia
- Canterbury Council's Stormwater System Reports Issued 18/01/2019, and 13/05/2022 (REF: WP-SIA-921/2022)

2.0 Site Description

The subject site, 427 Burwood Road, has a total area of 2354m^2. Currently, there is an existing 2 storey rendered building.

The proposed development involves redevelopment of the existing RSL club to a childcare centre. Survey and architectural plans of the proposed development are provided in Appendix A.

3.0 Overland Flow

3.1 General

The subject site is affected by overland flooding generated by a large catchment (approx. 27 ha) upstream of the site, and Council has identified the site as being affected by the Cooks River overland flow path.

Council flood information (Appendix B) predicts that during the 1% AEP rain event and greater, the site will be subject to flooding, as a result of this an assessment of the relevant flood related development controls is required to support the DA.

3.2 Overview of Approach

The following steps were taken to complete the site-specific flood risk assessment:

1. Obtain and review flood information from Council including flows.

2. Develop a predevelopment 2D HEC RAS model and calibrate against Council flood model results.

3. Develop a 2D HECRAS model for post-development scenario.

4. Compare the post-development water surface levels, depths, velocities, and hazard classifications with the pre-developed base scenario, particularly for impacts on adjacent properties.

5. Assess the proposed development against the relevant requirements of Canterbury Council DCP, Part B5.

3.3 Hydraulic Model Setup

A HEC-RAS 2D model was established for pre and post-development conditions based on available survey data and architectural drawings to assess the impact of the development on the flow depths and hydraulic hazard during the 1% AEP event.

Two different 1-metre by 1-metre resolution raster grid DEM data (Data Capture Date: 2020-05-11 and Data Capture Date: 2013-04-24) compiled from Geoscience Australia's elevation foundation database were compared with site-specific survey data. The data captured in 2013 was found to be in good agreement with the site-specific survey and was imported into HECRAS to create the 2D domain.

The HECRAS 2D model was developed approximately 30m downstream of the subject site. The location of the 2D domain extent was selected to provide logical and (where possible) defined upstream catchment input location that would see runoff propagate through the 2D domain in a manner likely to be consistent with the overall hydrological regime. This was selected based on a detailed analysis of the topography, aerial photography and information gathered via a site visit.

Peak flow obtained from Council (Appendix B) was assigned to the upstream end of the 2D flow area in the HEC-RAS model. The outflow was set to a normal depth boundary condition, using bed slope as the estimated energy slope, as measured from the available terrain data.

A manning's 'n' roughness value of 0.05 was used for the general catchment surface, with impervious areas using roughness 0.02.

Architectural features of the proposed development were incorporated into the model by using RASMAPPER, and QGIS in order to satisfactorily model the impact of the proposed development on the predicted flood flows.

Breaklines and refinement areas were also used to ensure there was no leakage in the 2D flow area.

An adaptive computational time step was applied. The Full Momentum equation set was adopted to account for the varying flow directions.

3.4 Calibration of Hydraulic Model

The goal of this project is to create a hydraulic model to simulate flood processes with reasonable accuracy.

The following was performed to check and improve the performance of the developed hydraulic model:

- The time step is controlled by the model using the courant condition to ensure model stability
- Mass balance of the model has been checked for losses to ensure errors are less than 1% to 2% in accordance with s10.4.2 of Book 7, ARR 2019 (Ball, et al., 2019)
- Signs of instability, such as unrealistic jumps or discontinuities in flow behaviour, oscillations, and excessive reductions in time step or iterations required to achieve convergence have been checked.

The model predicts a maximum water surface level of 25.22m AHD (Figure 1) during the 1% AEP event, which is consistent with Council's model results (25.2m AHD) (Appendix B).

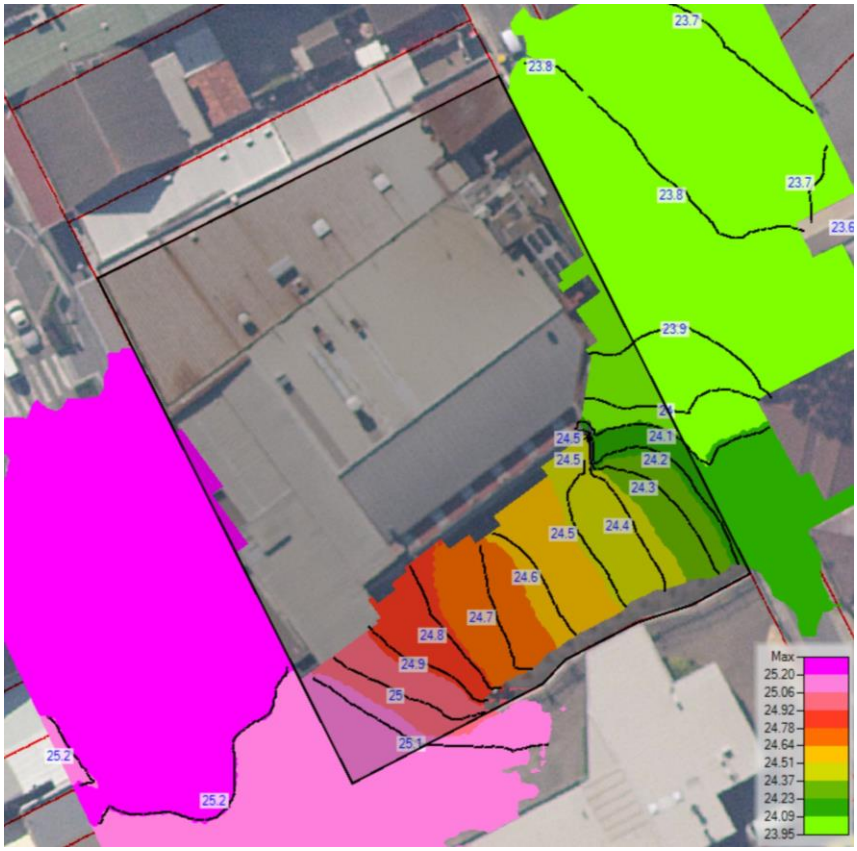

Figure 1: 1% AEP flood, Water Surface Elevation (WSE), predevelopment scenario (m AHD)

3.5 Results

3.5.1 General

The goal of this project is to create a hydraulic model to simulate flood processes with reasonable accuracy. The hydraulic model has been prepared with the data available and accessible with reasonable cost and time, given the nature and size of the project. Like any mathematical model, hydraulic modelling is sensitive to a range of inputs and assumptions, each adding some level of uncertainty to the result. Some of these inputs include rainfall intensities, temporal patterns, terrain models, new and existing buildings and the models themselves. The results have been interpreted in the context of the likely model uncertainties, its nature and risks of this project.

3.5.2 Summary of Results

Using the results of the model as described, the impact of the new development on flood behaviour immediately upstream and downstream of the new development has been examined. Figure 2 and Figure 3 show the water depths during the 1% AEP rain event.

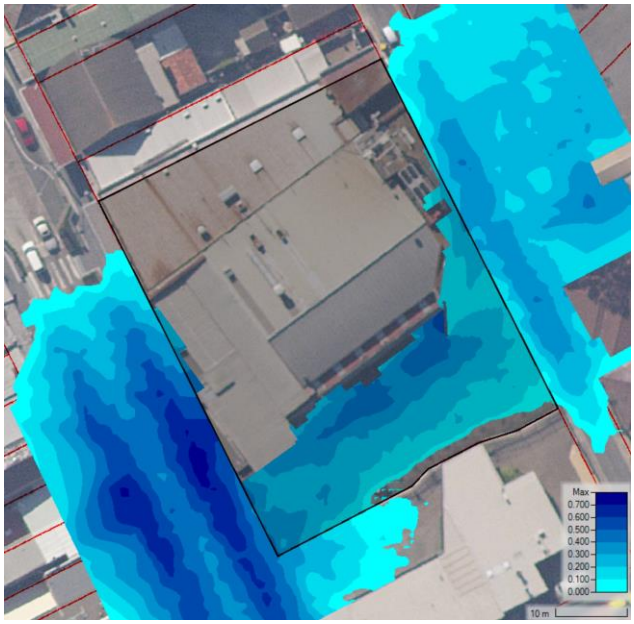

Figure 2: 1% AEP water depths (m) for pre-development base scenario

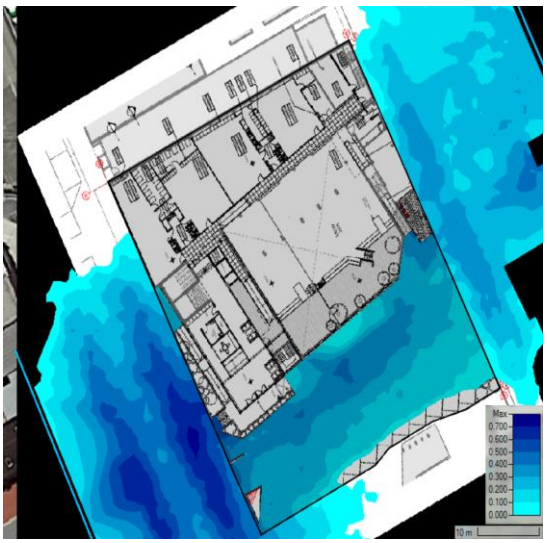

Figure 3: 1% AEP water depths (m) for post-development scenario

Overall, comparison between modelling results for the pre-development base scenario and post-development condition show that the flood levels during the 1% AEP event largely remain the same as there are no major changes proposed to the existing building footprint. Figure 4 shows the depth difference between the pre-development base case and post-development scenario.

The bulk of afflux values are shown to occur within the subject site due to the proposed development. The results also show that there would be some areas of afflux at locations A (48mm) and B (22mm). This can be attributed to the error tolerance of the DEM data and calculations within the flood model. Overall, the increase in depths is not expected to have a significant effect on the downstream properties for the following reason:

- the flood hazard classifications at these locations remain similar for pre and post development, refer to the following section 3.5.3 for discussion.

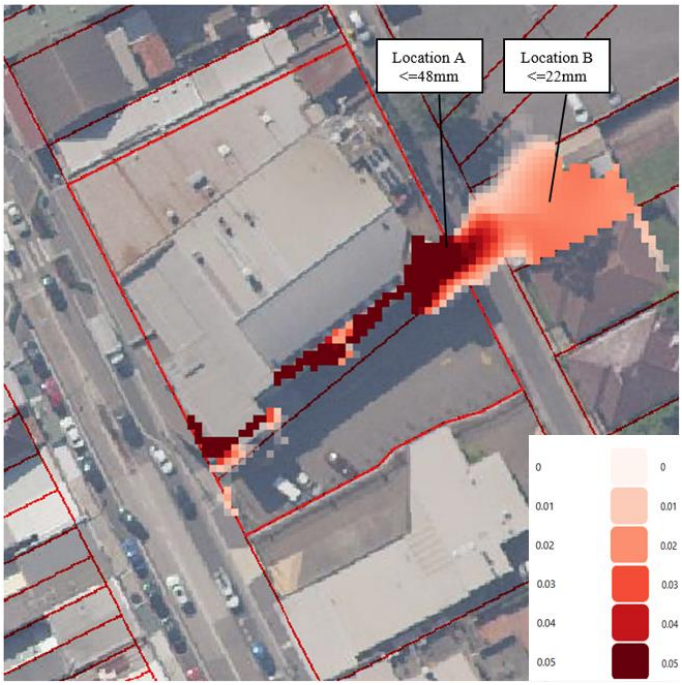

Figure 4: 1% AEP Flood Afflux (pre vs. post) – 0% blockage

3.5.3 Hydraulic Hazard

Hydraulic hazard classification maps were prepared with hydraulic hazards assigned in accordance with the recommendations outlined in ARR 2019 (Book 6, Chapter 7 – Table 6.7.3, 6.7.4 & Figure 6.7.9). Pre and post-development hydraulic hazard maps are shown side by side in Figure 5 below. Hydraulic hazard for pre vs. post development scenarios remains largely unchanged outside of the subject site.

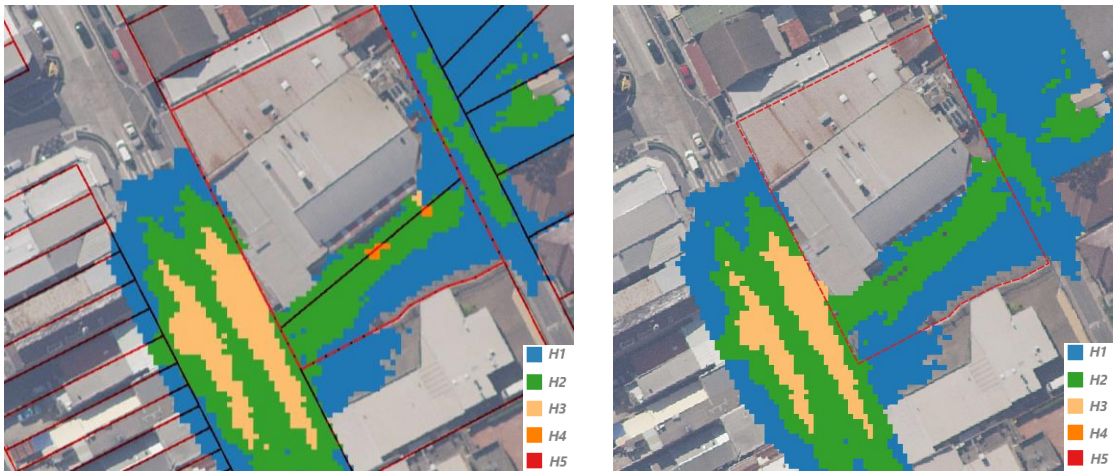

Figure 5: Hazard Classification – Predevelopment base scenario (left) and post-development scenario (0% Blockage) (right)

3.6 Flood Planning Level and Design Considerations

The flood model predicts that during the 1% AEP, the site will be subject to overland flow from upstream catchment. Because of this, the ground floor area of the development must be adequately protected against the inundation of floodwaters. Given the topography of the site and nature of overland flow, the flood planning level applicable to the development varies across the site.

The development must be flood proofed up to the 1% AEP flood level + 0.5 m freeboard. Figure 6 shows the 1% AEP flood extent for the post-development scenario which forms the basis of the flood planning levels for the development.

Within Figure 6, a number of 1% AEP water surface elevations (WSE) are shown which are critical in determining the following flood planning levels (FPLs) for potential flood entry points. Flood gates/doors and/or physical thresholds set at the FPL (e.g., stairs, etc.) shall be incorporated into the design to ensure flood risk is managed, generally in accordance with Council's development control plan.

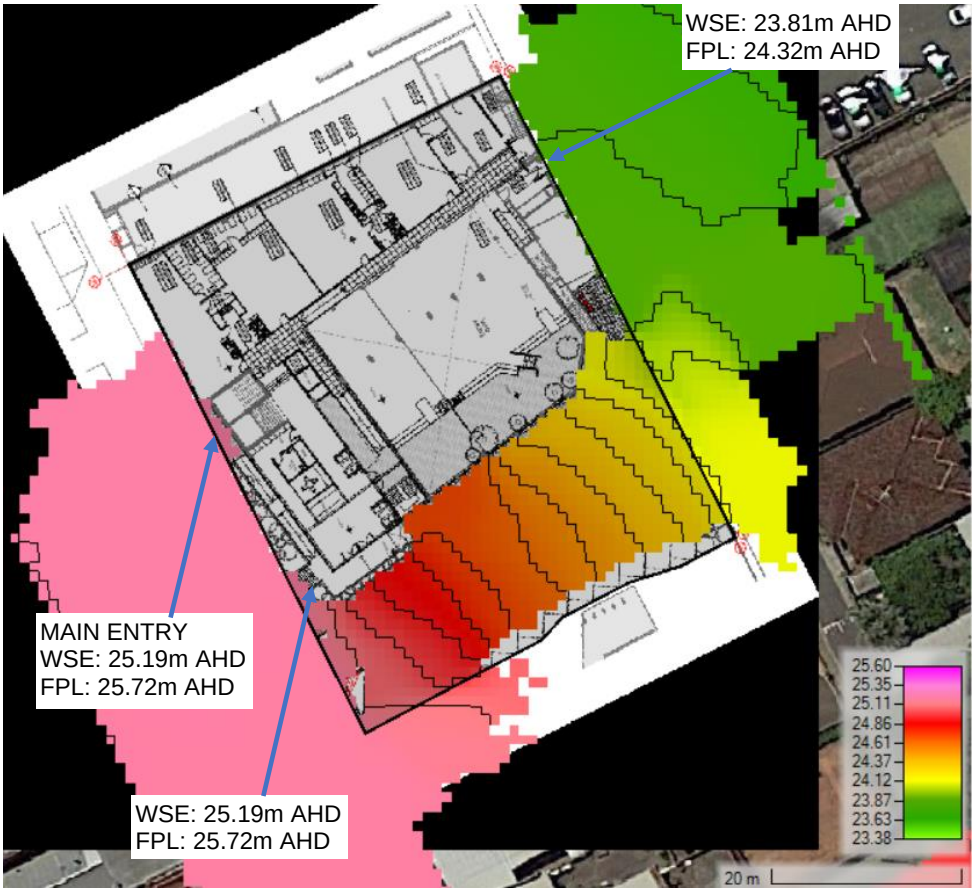

Figure 6 - Post Development 1% AEP Water Surface Elevations, WSE (m AHD)

4.0 Assessment of Council Flood Controls

A number of development related flood controls apply to the proposed development. The applicable flood controls in the DCP are listed and assessed below.

B5.13 Areas Subject to Possible Flooding

C2: Council may require a flood study be undertaken and submitted with the development application, where flood studies have not previously been undertaken for areas adjacent to water courses.

This report, based on information obtained from Council and a 2D hydraulic model, forms the basis of the required Flood Study.

C3: Habitable floor levels of all residential and institutional buildings are to be a minimum of 500mm above the 1 – 100-year flood level.

Given that all potential flood entry points will be at least 500mm above the adjacent flow paths, habitable areas will be adequately protected from floodwater.

C4: All garages or parking areas are to be at least 150mm above the 1 – 100-year flood level

The development proposes open parking areas below the 1% AEP flood level. There are currently similar parking spaces on the site within the flood affected area. Therefore, there is no significant change in the current flood behaviour and the risk profile as a result of the proposed works.

B5.14 Flood Management

C1: Submit a survey plan to Council showing the relative levels to AHD, prepared by a registered practicing surveyor.

Refer to Appendix A

C2: Flood levels of all habitable rooms should be 0.5m or more above the standard flood level. A certificate by a registered practicing surveyor certifying the level of the completed building will be required.

Refer to C2 of B5.13 above.
A surveyor to provide required certificate prior to issuing an occupation certificate (OC).

C3: Where Council considers flooding could damage a proposed development, no work should be commenced until a qualified structural/civil engineer has submitted a certificate of structural adequacy with regard to stability as a result of flooding.

All aspects of the proposed development at or below the 1% AEP flood levels will be designed and certified by a structural engineer as capable of withstanding forces subject to floodwater, debris, buoyancy forces anticipated by the 1% AEP flood event.

C4: Where the development relates to an existing building, a certificate is to be provided from a qualified practicing structural or civil engineer stating that the existing building is capable of withstanding the likely floodwaters and impact from debris in those waters without sustaining structural damage.

Refer to C3 of B5.14 above.

C5: Developments such as sporting grounds and open air car parks will be considered on flood liable land. Any consent for such development will require certificates from surveyors and engineers as referred to above.

Refer to C4 of B5.13 above.

5.0 Emergency Response Plan

During the predicted critical storm events, the area surrounding the development will become inundated with floodwaters. The recommended Flood Emergency Response Plan during critical storm events is to shelter-in-place until floodwaters subside or emergency services advise otherwise. The space, water and food available is adequate for this.

In the event that floodwaters begin to overtop the kerb along any of the street frontage of the site, the recommended actions are:

- The occupants of the property shall be directed to remain within the building to level 1.
- The occupants must not exit until advised by emergency services or floodwaters subside.
- Emergency services shall be contacted stating the property's location; the situation faced, number of people on the property and any additional measures to be carried out.

6.0 Conclusions and Recommendations

This Flood Risk Assessment Report has been undertaken by Stellen Consulting based on information obtained from Council flood data and development in the site-specific flood model.

The model predicts a reduction of flow depths downstream of the subject site during the post-development scenario). While the model also does predict an increase in flood depth for some areas within the immediate vicinity of the site, this level of increase is considered minimal and is within the accuracy of the hydraulic model itself. Therefore, it is concluded that these affluxes will not result in any adverse impacts to the surrounding properties.

Based on the evaluations of the proposed architectural drawings, flood information available from Council and the flood model, the following can be concluded:

- In the event of an emergency, safe refuge can be taken at the first-floor level.
- The proposed development is consistent with the flood hazard of the land and will not create any additional adverse impacts to upstream and downstream property owners.
- The proposed development can comply with the relevant flood-related development controls outlined in Canterbury Council DCP (2012).

To meet Canterbury Council's relevant flood requirements, it is recommended that the following be implemented in the design:

- Open style fencing shall be adopted within areas subject to the 1% AEP flow to ensure no blockage or obstruction of flows.
- All potential flood entry points shall be flood-proofed up to the relevant FPL.
- All new structures below the FPL must be constructed of flood compatible materials.
- Adequate Warning Systems, Signage and Exits shall be installed to allow safe refuge within the site during emergency.
- Filling within any flood-affected areas must be accompanied with equivalent compensatory works (cut) elsewhere to ensure no loss of flood storage.

Provided that the recommendations within this report are followed, no signifcant adverse flooding impacts are expected to occur to the neighbouring upstream and downstream properties as a result of the proposed development.

Appendix A

Architectural Drawings by Supercontext Studio

DRAWING No.	DESCRIPTION	REV	CHK	ISSUED	PUBLIS...	REMARK
002	FRONT PAGE	05		☒	☒	
050	EXISTING SITE PLAN	05		☒	☒	
100	GROUND FLOOR DEMO PLAN	06		☒	☒	
101	FIRST FLOOR DEMO PLAN	06		☒	☒	
102	GROUND FLOOR PLAN	06		☒	☒	
103	FIRST FLOOR PLAN	06		☒	☒	
104	ROOFTOP PLAN	06		☒	☒	
200	ELEVATIONS - DEMOLITION	05		☒	☒	
201	ELEVATIONS	06		☒	☒	
300	SECTIONS	05		☒	☒	
301	SECTIONS	04		☒	☒	

Survey by Veris Australia Pty Ltd dated 29/11/2018 (REF: 201044)

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Appendix B

Council Supplied Flood Information