

# Flood Risk Assessment

120c Old Canterbury Road, Summer Hill

59918139

Prepared for  
The Yard 120C Pty Ltd

23 August 2018



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## Executive Summary

As described by GSA Planning in 2017, a Planning Proposal has been prepared on behalf of The Yard 120C Pty Ltd by for the property known as No. 120C Old Canterbury Road, Summer Hill, legally described as Lot 1 in DP 817359 and Lot 100 in DP 875660 (hereafter referred to as the “subject site”).

Following the conditional Gateway approval granted by the Department of Planning in October 2017, Cardno was engaged by the owner to carry out a risk assessment in response to the Gateway determination. This included:

- An assessment of the flooding impact of the planned development;
- Flood emergency response; and
- Compliance with requirements of the Comprehensive Inner West DCP 2016 and the Section 117 Direction 4.3 – Flood Prone Land.

The proposed development site at 120C Old Canterbury Road, Summer Hill is subject to flooding by floodwaters spilling from Hawthorne Canal and overland flows. Detailed flood modelling of existing conditions has been undertaken by WMAwater in 2015.

Features of the subject site and planned development include:

- The site ground levels generally vary west to east across the middle and northern section of the site from around 10 m AHD to 9.5 m AHD except in the southern section of the site where the ground grades up to Old Canterbury Road at levels which vary from 17.1 m AHD – 18.5 m AHD;
- The proposed ground floor level of apartments is 18.25 m AHD will provide 6.45 m freeboard above the 100 year ARI flood level and 4.25 m freeboard above the PMF level;
- The proposed floor levels of apartments on Levels 01, 02, 03, 04, and 05 are likewise all higher than the PMF level;
- Adjusting the driveway access from McGill Street such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing;
- A crest level of 12.5 m AHD at the car park entry from the driveway from McGill Street to the two-storey car parking levels which provides 700 mm freeboard above the 100 year ARI level;
- Proposed floor level of 12.5 m AHD for car parking on Level LG02 would be inundated in the PMF;
- Level LG02 is suspended in order to create a void beneath the building to maintain flood storage and the pattern of flood flow through the property in a 100 yr ARI flood (refer **Figure 13**);
- The proposed floor level of 15.375 m AHD for car parking on Level LG01 provides 1.375 m freeboard above the PMF level.

The car park is accessed via a driveway from McGill Street. It is proposed that the driveway access from McGill Street be adjusted such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing of Hawthorne Canal.

It is estimated that it would become unsafe for small vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.3 m (which would occur in around a 340 yr ARI flood). It is estimated that it would become unsafe for large vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.5 m (which would occur in around a 700 yr ARI flood).

A crest level of 12.5 m AHD at the car park entry from the driveway from McGill Street to the two-storey car parking levels provides 700 mm freeboard above the 100 year ARI level. Overtopping of the car park Level LG02 is estimated to commence in around a 2,000 yr ARI flood.

It should be noted that while both Figures 1 and 2 in the 2016 WMAwater letter report (refer **Appendix A**) and in **Figures 5 – 10** show flooding across Old Canterbury Road along Hawthorne Canal and along the light rail corridor this is misleading. The flood contours in this area are for flood flows conveyed through the Hawthorne Canal crossing and the rail crossing. Old Canterbury Road is considerably higher than the PMF levels at these crossings and is in fact not inundated at these locations at any time.

It is noted in **Figure 9** that shallow flooding is mapped in the vicinity of the Old Canterbury Road / Edward St / Weston St intersection located west of 120C Old Canterbury Road, Summer Hill. The mapped flood depth is in the range 0.15 m – 0.3 m. In the case of the 100 yr ARI flood the depth of floodwaters is less than 0.15 m. It is concluded that if needed emergency services would be able to access 120C Old Canterbury Road from the west along Old Canterbury Road and/or residents could be evacuated if in need of medical attention via the ground floor connection to Old Canterbury Road.

Flood emergency planning in the South West Metropolitan District was reviewed to provide the context for flood emergency planning for the subject site. The 2017 South West Metropolitan Regional Emergency Management Plan details arrangements for, prevention of, preparation for, response to and recovery from emergencies within the South West Region. The Inner West Council website currently advises that the Inner Emergency Management Plan is to be published soon

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

It is expected that the building on-site manager or other designated person(s) will be responsible for implementing the actions defined in the Flood Emergency Response Plan and should not rely on the SES for any evacuation warnings.

In the case of the proposed development any visitors and/or residents who may need to shelter in place would shelter within the apartments and would not require additional flood refuge. The only Persons at Risk (PAR) directly during the PMF is any resident or visitor who happens to be in car parking level LG02 during extreme floods which overtop the car park floor level ie. flood events greater than a 2,000 yr ARI flood. The estimated PAR directly at risk in extreme floods on Level LG02 is 1.5 persons which is very low. Any persons who happen to be on Level LG02 during an extreme flood will need to evacuate to LG01 via stairs or the driveway ramp. Residents and visitors should not attempt to access Level LG02 during extreme floods.

A draft Flood Emergency Response Plan is outlined in Section 6.2. Signage will be installed to warn residents/visitor driving along the driveway from McGill Street and parking on LG01 of the potential for flooding in extreme floods and what to do in an extreme flood.

A Flood Emergency Response Plan would accompany any DA lodged with Council.

The objectives of Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land are:

- (a) to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and
- (b) to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.

A planning proposal may be inconsistent with the Section 117(2) Direction only if the relevant planning authority can satisfy the Director-General (or an officer of the Department nominated by the Director-General) that:

- (a) the planning proposal is in accordance with a floodplain risk management plan prepared in accordance with the principles and guidelines of the Floodplain Development Manual 2005, or
- (b) the provisions of the planning proposal that are inconsistent are of minor significance.

The future flood risk is addressed by the proposed form of development which achieves and/or exceeds the requirements of the Comprehensive Inner West DCP 2016. As discussed under Section 3.4, it is concluded that the configuration for the planned development on the site that:

- There is a local reduction in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

Consequently there will be no substantially increased requirement for government spending on flood mitigation measures or infrastructure arising from the proposed concept development.

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

A Flood Emergency Response Plan for the development is outlined in Section 6.2.

The implementation of a FERP for the development is not reliant on any requirement for government spending on services.

The proposed development has been assessed against each of the considerations set out in Direction and concludes that the proposed form of development is informed by the principles and guidelines of the Floodplain Development Manual 2005 and the complies with intent of Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land and any provisions of the planning proposal that are inconsistent are of minor significance.

It is further concluded that the site is therefore suitable for the proposed development.

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# 1 Introduction

## 1.1 Background

As described by GSA Planning in 2017, a Planning Proposal has been prepared on behalf of The Yard 120C Pty Ltd for the property known as No. 120C Old Canterbury Road, Summer Hill, legally described as Lot 1 in DP 817359 and Lot 100 in DP 875660 (hereafter referred to as the “subject site”).

It was requested that the Inner West Council amend the Ashfield LEP 2013 to rezone the western portion of the subject site (Lot 1 DP817359) from SP2 Infrastructure to B4 Mixed Use as well as alter the FSR and maximum building height across the entire site.

The Planning Proposal was lodged on 16 December 2016. The proposal initially sought a maximum height of RL46.50 and an FSR of 3:1 across the entire site.

In June 2017, in response to submissions and liaison with Council, the proposed building height was lowered by 2 floors to a maximum RL of 41.1 and the proposed FSR was reduced to 2.75:1

In July 2017, the Planning Proposal was considered by Council who resolved to proceed with the Planning Proposal subject to further amendments which have been incorporated into the Planning Proposal report amended by GSA Planning in August 2017.

This report was amended to reflect a six (6) storey building height to Old Canterbury Road and a reduced FSR. Additionally, changes have been made to address the LEP Making Guidelines outlined in Table 5 of the Council report.

The 2017 Planning Proposal also considered the Section 117 directions including Section 117 Direction 4.3 – Flood Prone Land as follows:

*Direction 4.3 – Flood Prone Land*

*The direction applies when a relevant planning authority prepares a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land.*

*The objectives of this direction are stated, inter alia:*

- (a) to ensure that development of flood prone land is consistent with the NSW Government’s Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and*
- (b) to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.*

*The proposal is inconsistent with the Direction as it does seek to rezone special uses land which is flood prone to a mixed-use zone. However, this inconsistency is considered to be of a minor significance and readily overcome through the design and siting of development. The proposal is accompanied by a flood level certificate and these levels have been considered in the concept design which is separately submitted. As noted in Council’s report, a detailed flood study will be prepared following Gateway determination.*

The Inner West Council provided the following notes in regard to closing out the inconsistency to the Section 117 Direction 4.3 Flood Prone Land:

*Condition 1(b) of the attached Gateway Determination issued by the Department of Planning and Environment (DPE) on 25 October 2017 a detailed flood study is required to be prepared which includes the following:*

- *Demonstrated consistency with NSW Flood Prone Land Policy and principles of the Floodplain Development Manual 2005 as indicated in the attached Section 117 Direction 4.3 – Flood Prone Land. .*

The matters to be considered are outlined in the Council Report (Item No C0717 Item 7) considered at 25 July 2017 Council meeting, namely:

- *A review of the existing topography maps, flood inundation maps, flood hazard maps etc.*
- *The implementation of Council controls and State Government policies to ensure adequate and design of any potential development the proposed planning controls can accommodate on the site during a flood event.*
- *Engineering assessment and reporting of the potential development the proposed planning controls can accommodate on the site and its impact on the existing surrounding developments/sites.*
- *A review of the impact of flooding on the potential development the proposed planning controls can accommodate on the site and surrounding properties and mitigation solutions to any future development that might be required to minimise any adverse impact.*
- *Identify the Flood Study flood risk management procedures necessary for the potential development the proposed planning controls can accommodate on the site.*
- *Quantify any post development flood water levels.*

## **1.2 Objective**

The objective of the study was to address the following considerations for planned development of the site:

- A qualitative assessment only of the impact of planned development on flooding;
- Flood emergency response; and
- Compliance with requirements of the Comprehensive Inner West DCP 2016 and the Section 117 Direction 4.3 – Flood Prone Land.

It is noted that The Yard 120C Pty Ltd advised that a quantitative assessment of flood impacts would be undertaken during the detailed design stage.

## 2 Previous Studies

The proposed development on 120c Old Canterbury Road, Summer Hill is subject to flooding by floodwaters spilling from Hawthorne Canal and overland flows. Consequently previous studies of flooding in Hawthorne Canal are relevant to the subject site.

### 2.1 2015 Hawthorne Canal Flood Study

As described by WMAwater, 2015:

*In order to implement the Policy within its local government area (LGA), Ashfield Council and Marrickville Council have embarked on a program of studies and actions as set out in the NSW Floodplain Development Manual with the assistance of Sydney Water Corporation and the Office of Environment and Heritage.*

*The Hawthorne Canal Flood Study constitutes the first stage of the management process for the Hawthorne Canal catchment within the Ashfield and Marrickville LGAs.*

*The primary objectives of the study are to:*

- *prepare suitable models of the catchment and floodplain for use in a subsequent Floodplain Risk Management Study;*
- *provide results for flood behaviour in terms of design flood levels, depths, velocities, flows and flood extents within the study area;*
- *prepare maps of provisional hydraulic categories and provisional hazard categories;*
- *determine provisional residential flood planning levels and flood planning area;*
- *prepare preliminary emergency response classifications for communities; and*
- *assess the sensitivity of flood behaviour to potential climate change effects such as increases in rainfall intensities and sea level rise.*

The 2015 report details the results and findings of the Study. The key elements included:

- a summary of available flood related data and a summary of previous events;
- details on the build and verification of the hydrologic and hydraulic models;
- sensitivity analysis of the model results to variation of input parameters;
- potential implications of climate change predictions; and
- the definition of design flood behaviour for existing catchment conditions.

The approach to hydrological and hydraulic modelling was summarised as follows:

*The hydrologic modelling was undertaken using DRAINS and the hydraulic model was established using TUFLOW.*

*Due to the limited available data for calibration and significant changes to the catchment in recent history, the calibration and verification of the models to historic data was tentative. Sensitivity analyses were undertaken to assess the influences of modelling assumptions on key outputs, and the potential impacts of future climate change. In the context of the Hawthorne Canal catchment, sea level rise is not likely to affect structures within the Marrickville LGA and impacts are restricted to the downstream areas of Ashfield Council.*

*The design rainfall events that were modelled were the 2 year, 5 year, 10 year, 20 year, 50 year and 100 year ARI design events and the Probable Maximum Precipitation (PMP). The temporal patterns for the design events were sourced from Australian Rainfall and Runoff (AR&R) (Pilgrim, 1987) and the Intensity-Frequency-Duration (IFD) data was obtained from the Bureau of Meteorology's (BoM) internet-based tool. The PMP estimates were derived according to the BoM guidelines, the Generalised Short Duration Method (BoM, 2003).*

The outcomes of the study were identified as follows:

*The design flood modelling indicates that significant flood depths may occur in a number of locations included in the Haberfield, Petersham, Lewisham, Ashfield / Dulwich Hill and Summer Hill suburbs. A detailed examination of existing flood behaviour at these "hot spots" has been undertaken. The study shows that while the railway line exacerbate the flooding problem, rail transport itself is unlikely to be severely disrupted during flood events. Major routes such as Parramatta Road and Old Canterbury Road are both reported and shown to experience significant flooding during most ARI design events, likely leading to severe traffic disruption.*

## **2.2 2016 Flood Certificate for 120c Old Canterbury Road, Lewisham**

On 21 June 2016, WMAwater prepared a flood certificate report for 120C Old Canterbury Road, Lewisham.

This letter report is attached in **Appendix A**.

As described by WMAwater, 2016:

*Figure 1 and Figure 2 (refer **Appendix A**) attached shows the existing flood behaviour in the vicinity of the property for the 1% AEP event and the PMF event. Based on modelling results from the Flood Study, it is evident that 120C Old Canterbury Road is impacted by mainstream and overland flow.*

*Mainstream flow in the vicinity of the site originates from the open channel of Hawthorne Canal, located to the south-east of the site, and which travels in a northerly direction along the eastern boundary of the site. Overland flow approaches the site from the west; with overland flow originating from streets and properties to the west as well as from the light-rail underpass to the south-west of the site. Flow through the light-rail underpass occurs when the mainstream flow to the south of the Old Canterbury Road embankment exceeds the capacity of the constricting culvert and backwaters; with the increasing flood level and extent allowing flow to diverge through the light-rail underpass.*

*The peak flood depth on the site was found to be 5.7 m in the 1% AEP event and 7.9 m in the PMF event. The peak flood level was found to be:*

- In the 1% AEP event: a minimum of 11.8 m AHD and a maximum of 12.3 m AHD; and*
- In the PMF event: a minimum of 14.0 m AHD and a maximum of 14.4 m AHD.*

In relation to the flood planning level, WMAwater, 2016 advised:

*Given the depth of flood affectation, the recommended freeboard is 0.5 m in addition to the 1% AEP peak flood level. Therefore the minimum level of 12.8 m AHD is applicable for:*

- *the entry levels to the underground car park facilities (this includes the driveway entry level, the ground floor entry level of stairs or lifts that will descend into the underground area and ventilation ducts);*
- *the floor level for residential dwellings; and*
- *the floor level or if not the floor level, the level below which the building should be flood-proofed with no sensitive equipment below this level for non-residential areas*

It should be noted that while both Figures 1 and 2 in the 2016 WMAwater letter report (refer **Appendix A**) show flooding across Old Canterbury Road along Hawthorne Canal and along the light rail corridor this is misleading. The flood contours in this area are for flood flows conveyed through the Hawthorne Canal crossing and the rail crossing. [Old Canterbury Road is considerably higher than the PMF levels at these crossings and is in fact not inundated at these locations at any time.](#)

The downstream headwall of the Hawthorne Canal crossing is located around 11m downstream of the southern boundary of the property. Consequently the maximum 1% AEP flood level on the property identified by WMAwater of 12.3 m AHD is in fact the water level inside the Hawthorne Canal crossing and is not the maximum 1% AEP water level within the open sections of the property.

## 3 Flooding Assessments

As overviewed in Section 2.1 the 2015 Hawthorne Canal Flood Study is the most recent study which provides flood information under existing conditions.

At a meeting held with the Inner West Council on 27 June 2018 it was requested that the impacts on flooding of the planning proposal be assessed using Council's Hawthorne Canal floodplain model. This assessment was undertaken on 4 August 2018 and is described as follows.

### 3.1 2015 Assessment

As overviewed in Section 2.1, the 2015 Hawthorne Canal Flood Study is the most recent study which provides flood information for the 2 yr ARI, 5 yr ARI, 10 yr ARI, 20 yr ARI, 50 yr ARI, 100 yr ARI floods and the PMF under existing conditions.

#### 3.1.1 Model Configuration

The floodplain model which was used for assessment purposes is described in WMAwater, 2015. The model schematisation is given in **Figure 2**.

#### 3.1.2 Terrain

As described by WMAwater, 2015:

*Airborne Light Detection and Ranging (LiDAR) survey of the catchment and its immediate surroundings was provided for the study by SWC. It was indicated that the data were collected in 2007 by AAMHatch. These data typically have accuracy in the order of:*

- +/- 0.15m (for 70% of points) in the vertical direction on clear, hard ground; and
- +/- 0.75m in the horizontal direction.

*The accuracy of the ALS data can be influenced by the presence of open water or vegetation (tree or shrub canopy) at the time of the survey.*

*From this data, a Triangular Irregular Network (TIN) was generated by WMAwater. This TIN was sampled at a regular spacing of 1 m by 1 m to create a Digital Elevation Model (DEM), which formed the basis of the two-dimensional hydraulic modelling for the study.*

#### 3.1.3 Cross Section Data

As described by WMAwater, 2015:

*Within the Hawthorne Canal catchment the main drainage network includes regular open channel sections. For these areas, the definition to the top of the concrete-lined channel was based on cross-sections provide by the SWC capacity assessment document (SWC, 1998).*

*Structures traversing the waterway such as bridges and culverts may have a significant influence on flood behaviour. Often such structures constrict and obstruct flow and their impact can vary with flood magnitude. Geometric details of these structures are required for the hydraulic model. These structures are typically not accurately captured by remote sensing technologies such as ALS and for this reason a traditional ground survey was commissioned and undertaken by Chase Burke & Harvey (CBH) Surveyors. From this, definition of the cross-sectional area was obtained, particularly where the underside of the bridge was not the same height as the top of the concrete-lined channel*

### 3.1.4 Roughness

The spatial variation in Manning’s “n” values is shown on **Figure 3** The Manning’s “n” values adopted for these areas, including flowpaths (overland, pipe and in-channel), are shown in **Table 1**.

**Table 1 Roughness “n” Values adopted in TUFLOW (after Table 13, WMAwater, 2015)**

Surface	Roughness “n” Value
Pipes	0.02
Roads and Footpaths	0.02
Light Vegetation (such as parks with predominantly grass surfaces)	0.04
General Overland Areas	0.04
Properties	0.05
Medium-Heavy Vegetation	0.08

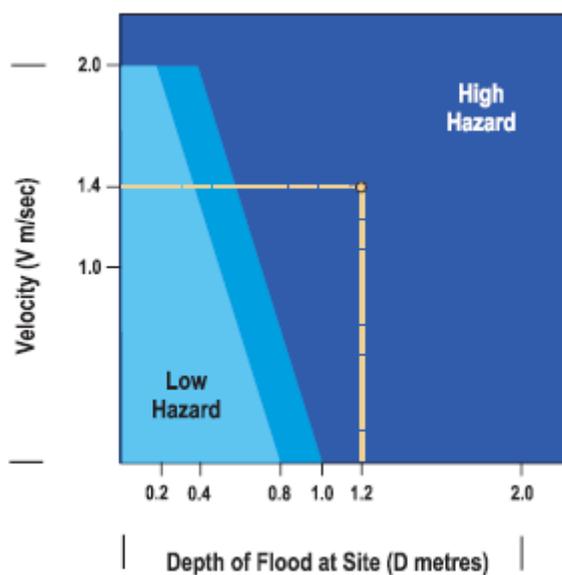
### 3.1.5 Results

The peak flood level profiles for the 2 yr ARI, 5 yr ARI, 10 yr ARI, 20 yr ARI, 50 yr ARI, 100 yr ARI floods and the PMF under Existing Conditions are plotted in **Figure 4**.

The estimated 100 yr ARI extent, flood levels and flood levels in the vicinity of the property under Existing Conditions are plotted in **Figure 5**.

The estimated 100 yr ARI flood velocities in the vicinity of the property under Existing Conditions are plotted in **Figure 6**.

Experience from studies of floods throughout NSW and elsewhere has allowed authorities to develop methods of assessing the hazard to life and property on floodplains. This experience has been used in developing the 2005 NSW Floodplain Development Manual to provide guidelines for managing this hazard. These guidelines are shown schematically below.



*Provisional Hazard Categories (after Figure L2, NSW Government, 2005)*

To use the diagram, it is necessary to know the average depth and velocity of floodwaters at a given location. If the product of depth and velocity exceeds a critical value (as shown below), the flood flow will create a **high hazard** to life and property. There will probably be danger to persons caught in the floodwaters, and possible structural damage. Evacuation of persons would be difficult. By contrast, in **low hazard** areas people and their possessions can be evacuated safely by trucks. Between the two categories a transition zone is defined in which the degree of hazard is dependent on site conditions and the nature of the proposed development.

This calculation leads to a provisional hazard rating. The provisional hazard rating may be modified by consideration of effective flood warning times, the rate of rise of floodwaters, duration of flooding and ease or otherwise of evacuation in times of flood. The estimated 100 yr ARI provisional flood hazard in the vicinity of the property under Existing Conditions are plotted in **Figure 7**.

As described by WMAwater, 2015:

*The hydraulic categories, namely floodway, flood storage and flood fringe, are described in the Floodplain Development Manual (Reference 1). However, there is no technical definition of hydraulic categorisation that would be suitable for all catchments, and different approaches are used by different consultants and authorities, based on the specific features of the study catchment in question.*

*For this study, hydraulic categories were defined by the following criteria, which has been adopted by consultants in a number of flood studies in NSW:*

- *Floodway is defined as areas where:*
  - *the peak value of velocity multiplied by depth ( $V \times D$ ) > 0.25 m<sup>2</sup>/s AND peak velocity > 0.25 m/s, OR*
  - *peak velocity > 1.0 m/s AND peak depth > 0.15 m.*

*The remainder of the floodplain is either Flood Storage or Flood Fringe,*

- *Flood Storage comprises areas outside the floodway where peak depth > 1 m; and*
- *Flood Fringe comprises areas outside the Floodway where peak depth < 1 m.*

The provisional 100 yr ARI hydraulic categorisation in the vicinity of the property under Existing Conditions are plotted in **Figure 8**.

The estimated PMF extent, flood levels and flood levels in the vicinity of the property under Existing Conditions are plotted in **Figure 9**.

The estimated PMF provisional flood hazard in the vicinity of the property under Existing Conditions are plotted in **Figure 10**.

### **3.2 2018 Assessment**

In August 2018 the Hawthorne Canal 1D/2D floodplain model supplied by Council was re-run and the calculated flood extents and levels under a 100 yr ARI flood and the PMF are plotted in **Figures 11** and **12** respectively.

The flood levels were extracted at four reference locations (refer **Figure 18**) as follows:

Point	100yr ARI (m AHD)	PMF (m AHD)
A	11.76	13.96
B	11.78	13.95
C	11.78	13.95
D	11.87	13.95

These flood levels are in agreement with the results presented in Council's 2015 Hawthorne Canal Flood Study report.

The supplied floodplain model was adopted as the benchmark against which impacts were assessed.

### 3.3 Future Conditions

The concept planning proposal layout of the car parking levels (LG01, LG02), ground floor layout, the typical layout of Levels 01-05 and typical sections are attached in the selected Architectural Drawings given in **Appendix B**.

The concept layout of the basement car parking level and associated works including the raised access road and bridge crossing is detailed in **Figure 13**.

**Figure 13** details the bridge concept which was based on ignoring the current bridge and only retaining the piers. The access road was re-graded to a new low point at 11.80 m AHD while the bridge was re-graded from this low point to the proposed basement car park level of 12.5 m AHD. The bridge span across the canal was assumed to incorporate 0.5 m high open railings which were assumed to be 50% porous.

**Figure 13** also details the assumptions regarding obstructions in the void beneath the basement car parking slab, the location of a perimeter grill between the ground and the basement car parking slab and between the basement car parking slab and the upper car park. It also features solid walls at the southern end of the basement where earthworks will be undertaken to create the parking level.

The concept 22 x 0.6 m x 0.4 m columns represent less than 1% of the basement footprint. The void between the current ground level and the underside of the basement car parking slab (which was assumed to be at 12.2 m AHD) was therefore assumed to be 99% porous. Under existing conditions the adopted roughness value for the site is 0.05. This roughness value was retained for future conditions on the basis that all current buildings and obstructions and vegetation will be removed within the basement footprint and that the lowering of roughness due to these actions would provide be balanced by local hydraulic losses in the vicinity of the proposed rectangular columns. The void would be also extended at the southern end of the basement level by excavating the tow of the existing embankment to a level around 10.0 m AHD.

The proposed level of the basement car parking slab is a uniform level of 12.5 m AHD. This provides around 700 mm of freeboard above the 100 yr ARI flood level. The underside of the basement car parking slab was assumed to be at 12.2 m AHD.

The concept includes provision of a perimeter grill between the ground and the underside of the basement car parking slab and between the basement car parking slab and the upper car park level. The intent of the perimeter grill between the ground and the underside of the basement car parking slab is to limit access to the void beneath the basement car parking slab while maintaining the provision for flow through the site in a 100 yr ARI flood. The intent of the between the basement car parking slab and the upper car park level is to provide secure parking while maintaining the provision for flow through the site in extreme floods greater than a 100 yr ARI flood.

The assumed porosity of this grill is 80% which offers the opportunity to install an aesthetic grill while maintaining the available flow area.

The calculated flood extents and levels in a 100 yr ARI flood and the PMF under Future Conditions are plotted in **Figures 14** and **16** respectively.

### 3.4 Flood Impact Assessment

The calculated flood level differences in a 100 yr ARI flood and the PMF are plotted in **Figures 15** and **17** respectively.

It is noted that:

- There is a local impact in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

The ability of the proposed western solid wall to provide 0.5 m freeboard in the 100 yr ARI flood was also assessed. The proposed extent of solid walls to ground level was added to **Figure 13**. Based on this overlay the 100 yr ARI flood level at the end of the western solid wall is < 12.0 m AHD and therefore the 0.5 m freeboard is achieved at this location.

It is concluded that under the configuration for the planned development on the site detailed in **Figure 13** that:

- There is a local reduction in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

## 4 Flood Risks

The flood risks at and in the vicinity of 120C Old Canterbury Road, Lewisham are discussed as follows.

### 4.1 Flood Levels, Velocities and Hazards

The estimated 100 yr ARI flood extent, levels and depths, velocities and provisional hazards under Existing Conditions are plotted in **Figures 5, 6 and 7** respectively.

The estimated PMF extent, levels and depths and provisional hazards under Existing Conditions are plotted in **Figures 9 and 10** respectively.

The calculated flood extents and levels in a 100 yr ARI flood and the PMF under Future Conditions are plotted in **Figures 14 and 16** respectively.

### 4.2 Flood Risk

The provisional 100 yr ARI hydraulic categorisation in the vicinity of the property under Existing Conditions are plotted in **Figure 8**. The inundated section of the property is mapped as floodway.

The car park is accessed via a driveway from McGill Street. It is proposed that the driveway access from McGill Street be adjusted such that the minimum road level is 11.80 m AHD which is above the 100 yr ARI flood level in the vicinity of the crossing of Hawthorne Canal. It is estimated that it would become unsafe for small vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.3 m (which would occur in around a 340 yr ARI flood). It is estimated that it would become unsafe for large vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.5 m (which would occur in around a 700 yr ARI flood).

A crest level of 12.5 m AHD on the car park entry from the driveway from McGill Street to the two-storey car parking levels provides 700 mm freeboard above the 100 year ARI level. Overtopping of the car park crest level is estimated to commence in around a 2,000 yr ARI flood.

It should be noted that while both Figures 1 and 2 in the 2016 WMAwater letter report (refer **Appendix A**) and in **Figures 5 – 10** show flooding across Old Canterbury Road along Hawthorne Canal and along the light rail corridor this is misleading. The flood contours in this area are for flood flows conveyed through the Hawthorne Canal crossing and the rail crossing. Old Canterbury Road is considerably higher than the PMF levels at these crossings and is in fact not inundated at these locations at any time.

It is noted in **Figure 9** that shallow flooding is mapped in the vicinity of the Old Canterbury Road / Edward St / Weston St intersection located west of 120C Old Canterbury Road, Summer Hill. The mapped flood depth is in the range 0.15 m – 0.3 m. In the case of the 100 yr ARI flood the depth of floodwaters is less than 0.15 m. It is concluded that if needed emergency services would be able to access 120C Old Canterbury Road from the west along Old Canterbury Road.

### 4.3 Rate of Rise of Floodwaters

To understand the likely warning times and associated response times during extreme flood events it is necessary to estimate the expected rate of rise of floodwaters. At the car park entry the estimated rate of rise of flooding in a 60 minute PMF event is around 5 m/hr (WMAwater, 2015).

PMF floodwaters would rise from the 100 yr ARI flood level to the car park entry level within around 12 minutes. The LG02 car park would be inundated subsequently to a depth of 0.3 m in around 4 minutes and to a depth of 0.9 m in around 11 minutes. It is noted that access to/from the car park LG02 via McGill St would be cut-off before the car park entry is overtopped.

#### 4.4 Duration of Inundation

Depending on the duration of the PMP storm the indicative duration of PMF levels exceeding the LG01 car park level is around 55 minutes.

#### 4.5 Persons at Risk (PAR)

The only Persons at Risk (PAR) directly during the PMF is any resident or visitor who happens to be in car parking level LG02 during extreme floods which overtop the car park level ie. flood events greater than a 2,000 yr ARI flood.

The number of residents and/or visitors that would be directly at risk during a PMF on LG02 was estimated based on the following assumed occupancies of apartments in the development (noting that all apartments are located well above the PMF level).

- Studio / 1 Bedroom      1.5 persons
- 2 Bedroom                2.5 persons
- 3 Bedroom                3.5 persons

In relation to estimating the PAR in the two car parking levels during a flood the following assumptions were made

- During day-time hours on weekdays:
  - the average occupancy per apartment over the whole building applies;
  - the average duration of occupancy of the car park would be 0.25 hours per day;
- During night-time on weekdays:
  - the average occupancy per apartment over the whole building applies;
  - the average duration of occupancy of the car park would be 0.25 hours per day;
- During weekends:
  - the average occupancy per apartment over the whole building applies;
  - the average duration of occupancy of the car park would be 0.5 hours;

The estimated PAR across the two car parking levels is 3 persons. The estimated PAR directly at risk in extreme floods on LG02 is 1.5 persons which is very low.

## 4.6 Pedestrian and Vehicular Stability in Floods

The latest edition of Australian Rainfall and Runoff released in 2016 provides guidance on both pedestrian and vehicle stability in floods.

### 4.6.1 Pedestrian Stability

As stated in ARR2016:

*Cox et al., 2010 concluded that self-evacuation of the most vulnerable people in the community (typically small children, and the elderly) is limited to relatively placid flow conditions. Furthermore, a D.V as low as 0.4 m2s-1 would prove problematic for people in this category, i.e. the more vulnerable in the community.*

*These hazard regimes for tolerable flow conditions (D.V) as related to the individual's physical characteristics (H.M) are presented in Figure 9.2.4 .....*

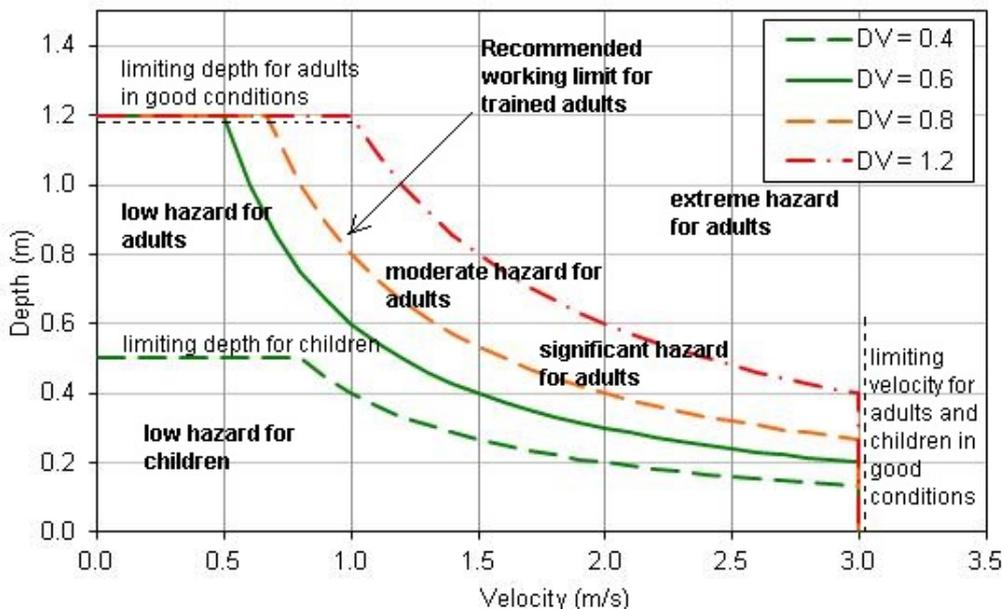


Figure 9.2.4. Safety Criteria for People in Variable Flow Conditions (After Cox et al, 2010)

### 4.6.2 Vehicle Stability

*Determining safety criteria for vehicles requires an understanding of the physical characteristics of the vehicle along with the nature of the flow.*

*The measure of physical attributes for vehicle stability analysis is the vehicle classification as based on length (L, m), kerb weight (W, kg) and ground clearance (GC, m). Three vehicle classifications are suggested:*

- *Small passenger: L < 4.3 m, W < 1250 kg, GC < 0.12 m*
- *Large passenger: L > 4.3 m, W > 1250 kg, GC > 0.12 m*
- *Large 4WD: L > 4.5 m, W > 2000 kg, GC > 0.22 m*

*The measure of flow attributes for vehicle stability analysis is D.V m2s-1, determined as the product of flow depth (D, m) and flow velocity (V, ms-1).*

Limiting conditions exist for each classification based on limited laboratory testing of characteristic vehicles. The upper tolerable velocity for moving water is defined based on the frictional limits, and is a constant  $3.0 \text{ ms}^{-1}$  for all vehicle classifications.

The upper tolerable depths within still water are defined by the floating limits:

- Small passenger vehicles: 0.3 m
- Large passenger vehicles: 0.4 m
- Large 4WD vehicles: 0.5 m

The upper tolerable depths within high velocity water (at  $3.0 \text{ ms}^{-1}$ ) are defined by the frictional limits:

- Small passenger vehicles: 0.1 m
- Large passenger vehicles: 0.15 m
- Large 4WD vehicles: 0.2 m

... Stability criteria based on the best available information for stationary small passenger cars, large passenger cars and large 4WD vehicles in various flow situations are presented in Figure 9.2.6 .....

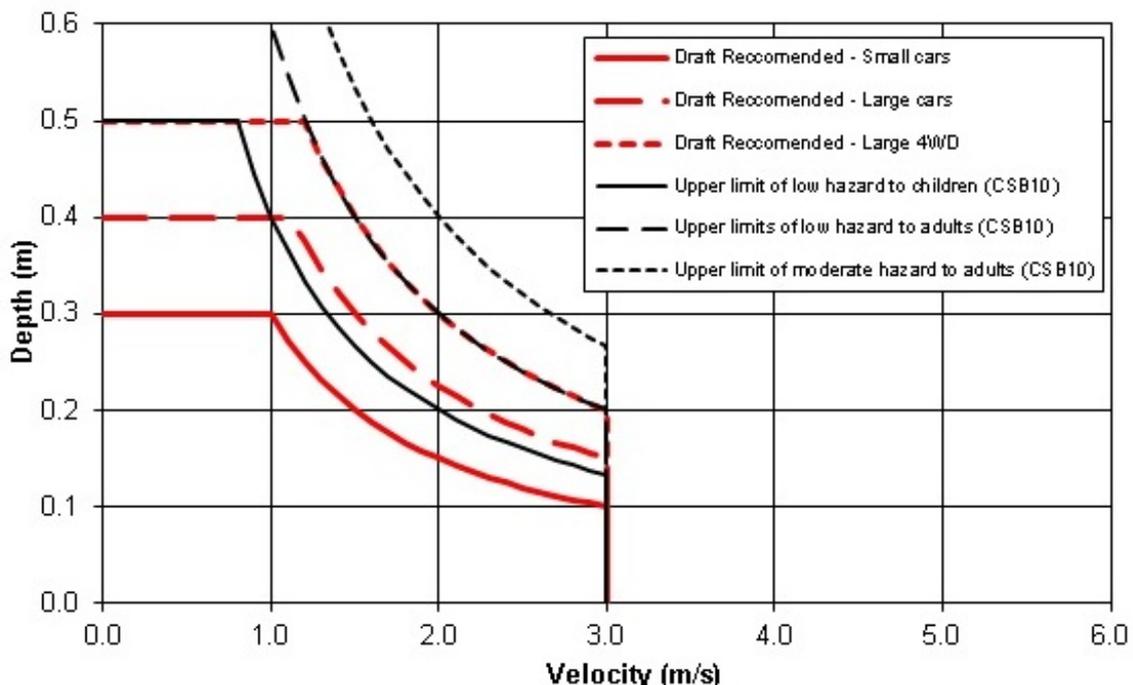


Figure 9.2.6. Interim Safety Criteria for Vehicles in Variable Flow Conditions  
(After Shand et al, 2011)

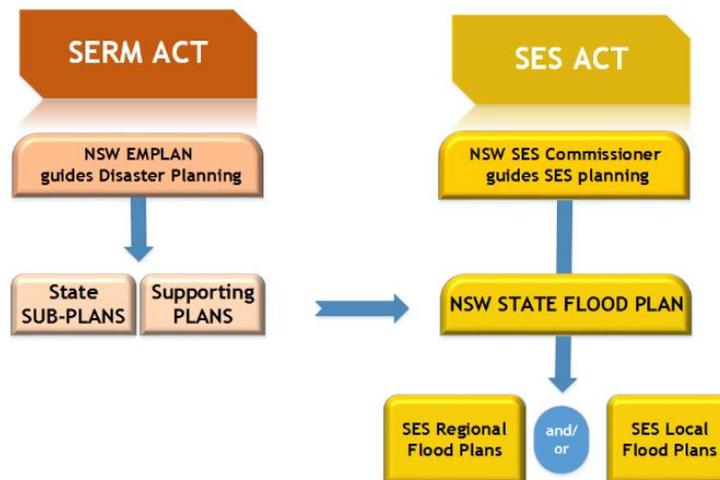
Shand et al (2011) concludes that the available datasets do not adequately account for the following factors and that more research is needed in these areas:

- Friction coefficients for contemporary vehicle tyres in flood flows;
- Buoyancy changes in modern cars;
- The effect of vehicle orientation to flow direction (including vehicle movement);
- Information for additional categories including small and large commercial vehicles and emergency service vehicles

## 5 Emergency Planning

The hierarchy of plans which guide the planning for floods in NSW is as follows:

### NSW Hierarchy of Plans - Floods



#### 5.1 2017 NSW State Flood Plan

The NSW State Flood Plan is a sub plan of the State Emergency Management Plan (EMPLAN) (NSW Government, 2017). It has been prepared in accordance with the provisions of the State Emergency Service Act 1989 (NSW) and is authorised by the State Emergency Management Committee in accordance with the provisions of the State Emergency and Rescue Management Act 1989 (NSW).

The latest plan was provisionally endorsed by the State Emergency Management Committee at Meeting 107 held on 5 December 2017.

The purpose of this plan is to set out the arrangements for the emergency management of flooding in New South Wales

As described by the Plan:

*The Plan sets out the emergency management aspects of prevention; preparation; response and initial recovery arrangements for flooding and the responsibilities of individuals, agencies and organisations with regards to these functions.*

*The Plan recognises the existence of the problem of coastal inundation and erosion caused by severe weather. The management system for dealing with episodes of coastal erosion is described in the New South Wales State Storm Plan.*

*The Plan recognises the existence of the threat posed by tsunami to NSW coastal communities. The arrangements for the emergency management of tsunami are contained within the State Tsunami Emergency Sub Plan.*

*This Plan is intended to be read in conjunction with:*

- (a) *The New South Wales State Emergency Management Plan (EMPLAN), of which the State Flood Sub Plan is a sub-plan;*
- (b) *The New South Wales State Storm Plan, which covers arrangements relating to severe storm events; and*
- (c) *NSW Floodplain Development Manual.*

## **5.2 2017 South West Metropolitan Regional Emergency Management Plan**

The 2017 South West Metropolitan Regional Emergency Management Plan details arrangements for, prevention of, preparation for, response to and recovery from emergencies within the South West Region (NSW Government, 2017). It encompasses arrangements for:

- emergencies controlled by combat agencies ;
- emergencies controlled by combat agencies and supported by the Regional Emergency Operations Controller (REOCON) ;
- emergency operations for which there is no combat agency;
- circumstances where a combat agency has passed control to the REOCON; and,
- demobilisation and transition of control from response to recovery.

As described by the Plan:

*The objectives of this plan are to:*

- *support Local Emergency Management Plans (EMPLANs) and augment them when required;*
- *identify trigger points for regional level activation, escalation and demobilisation;*
- *define participating organisation and Functional Area roles and responsibilities in preparation for , response to and recovery from emergencies;*
- *set out the control, co-ordination, support and liaison arrangements at the Regional level;*
- *detail activation and alerting arrangements for involved agencies at the Regional level;*
- *detail arrangements for the acquisition and co-ordination of resources at the Regional level;*
- *maintain a governance over the Local Emergency Management Committees within its area of responsibility; and*
- *provide/facilitate emergency management training at a local and regional level*

*The plan describes the arrangements at Regional level to prevent, prepare for, respond to and recover from emergencies and also provides policy direction for the preparation of Sub Plans and Supporting Plans. Further:*

- *This plan relies on effective implementation of the Governance framework for Emergency Management;*
- *Arrangements detailed in this plan are based on the assumption that the resources upon which the plan relies are available when required; and*

- *The effectiveness of arrangements detailed in this plan are dependent upon all involved agencies preparing, testing and maintaining appropriate internal instructions, and/or standing operating procedures.*

*This plan is to be read in conjunction with the arrangements stipulated in the NSW State-EMPLAN*

### **5.3 Inner West Emergency Management Plan**

The Inner West Council website currently advises that the Inner Emergency Management Plan is to be published soon (Visit: <https://www.innerwest.nsw.gov.au/council/meetings/committees/local-emergency-management-committee>)

As described on Council's website:

*To minimise the consequences of emergencies, it is necessary for a responsible authority to have in place an emergency management structure and set of arrangements designed to assist the community to prevent, respond to and recover from emergencies.*

*Inner West Council has established a Local Emergency Management Committee to carry out emergency management as the responsible authority for the Inner West local government area.*

*This committee is responsible for an all-agencies comprehensive approach to emergency planning to prepare the community for disasters. Committee members include Emergency Services and agencies with functional responsibilities.*

### **5.4 Temporary Flood Refuge**

In the case of the proposed development any visitors and/or residents who may need to shelter in place would shelter within the apartments and would not require additional flood refuge. Access would be via internal stairs and will link to Old Canterbury Road.

## 6 Flood Emergency Response

It is expected that Building Owners and Managers (in accordance with existing OH&S requirements, the Building Code of Australia and relevant City of Parramatta regulations) are to have a building Emergency Management Plan which complies with the provisions of AS 3745.

### 6.1 Flood Warning

The Bureau of Meteorology does not prepare flood predictions for Hawthorne Canal.

Other sources of information regarding approaching severe weather conditions which could cause potential flooding at the site including:

- The Bureau of Meteorology through their website ([www.bom.gov.au](http://www.bom.gov.au));
- Observation of local rainfall;
- The local SES (<http://parramatta-ses.com>);
- Inner West Council Emergency Management Officer;
- Local television stations; and/or
- Local radio stations.

An important indication of likely imminent flood activity would be intense local rainfall and residents, retail workers and visitors should take notice of extreme rainfall warnings issued by the Bureau of Meteorology and disseminated by local media.

### 6.2 Draft Flood Emergency Detailed Response Plan

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

The Flood Emergency Response Plan (FERP) for the proposed development would describe:

- Flood behaviour at the site for the 100 yr ARI and Probable Maximum Flood (PMF),
- Any flood protection measures including signage to warn residents/visitor parking on LG01 of the potential for flooding in extreme floods, and
- A Flood Emergency Response Plan for the site would include:
  - Evacuation strategy, measures, procedures and plan
  - A FloodSafe Plan

A Flood Emergency Response Plan would accompany any DA lodged with Council.

An outline of the FERP is given as follows.

## Flood Threat

- The site ground levels generally vary west to east across the middle and northern section of the site from around 10 m AHD to 9.5 m AHD except in the southern section of the site where the ground grades up to Old Canterbury Road at levels which vary from 17.1 m AHD – 18.5 m AHD;
- The proposed ground floor level of apartments is 18.25 m AHD will provide 6.45 m freeboard above the 100 year ARI flood level and 4.25 m freeboard above the PMF level;
- The proposed floor levels of apartments on Levels 01, 02, 03, 04, and 05 are likewise all higher than the PMF level;
- Adjusting the driveway access from McGill Street such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing;
- A crest level of 12.5 m AHD at the car park entry from the driveway from McGill Street to the two-storey car parking levels which provides 700 mm freeboard above the 100 year ARI level;
- Proposed floor level of 12.5 m AHD for car parking on Level LG02 would be inundated in the PMF;
- Level LG02 is suspended in order to create a void beneath the building to maintain flood storage and the pattern of flood flow through the property in a 100 yr ARI flood (refer **Figure 13**);
- The proposed floor level of 15.375 m AHD for car parking on Level LG01 provides 1.375 m freeboard above the PMF level.

The car park is accessed via a driveway from McGill Street. It is proposed that the driveway access from McGill Street be adjusted such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing of Hawthorne Canal. It is estimated that it would become unsafe for small vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.3 m (refer Section 4.6.2) (which would occur in around a 340 yr ARI flood). It is estimated that it would become unsafe for large vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.5 m (refer Section 4.6.2) (which would occur in around a 700 yr ARI flood).

A crest level of 12.5 m AHD at the car park entry from the driveway from McGill Street to the two-storey car parking levels provides 700 mm freeboard above the 100 year ARI level. Overtopping of the car park Level LG02 is estimated to commence in around a 2,000 yr ARI flood.

PMF floodwaters would rise from the 100 yr ARI flood level to the car park entry level within around 9 minutes. The LG02 car park would be inundated subsequently to a depth of 0.3 m in around 4 minutes and to a depth of 0.9 m in around 11 minutes. It is noted that access to/from the car park LG02 via McGill St would be cut-off before the car park entry is overtopped.

It should be noted that while both Figures 1 and 2 in the 2016 WMAwater letter report (refer **Appendix A**) and in **Figures 5 – 10** show flooding across Old Canterbury Road along Hawthorne Canal and along the light rail corridor this is misleading. The flood contours in this area are for flood flows conveyed through the Hawthorne Canal crossing and the rail crossing. Old Canterbury Road is considerably higher than the PMF levels at these crossings and is in fact not inundated at these locations at any time.

It is noted in **Figure 9** that shallow flooding is mapped in the vicinity of the Old Canterbury Road / Edward St / Weston St intersection located west of 120C Old Canterbury Road, Lewisham. The mapped flood depth is in the range 0.15 m – 0.3 m. In the case of the 100 yr ARI flood the depth of floodwaters is less than 0.15 m. It is concluded that if needed emergency services would be able to access 120C Old Canterbury Road from the west along Old Canterbury Road and/or residents could be evacuated if in need of medical attention via the ground floor connection to Old Canterbury Road.

## Responsibilities

While in a flood emergency the NSW State Emergency Service (SES) has responsibilities including to:

- Direct the evacuation of persons and/or communities at risk of flood inundation.
- Issue evacuation warnings for individual communities that describe possible local effects, suggested actions and evacuation arrangements.

It is expected that the building on-site manager or other designated person(s) will be responsible for implementing the actions defined in the Flood Emergency Response Plan and should not rely on the SES for any evacuation warnings. These actions would include liaising with the SES, monitoring any flood warnings, maintaining regular communication with residents and initiating actions as documented in the Plan.

## Preparedness

Visitors and residents shall be advised of the potential flood threat in their locality, and recommended management and procedures in case of a flood event. They will comply with all lawful directions.

## Warning

While in a flood event, the SES will prepare, authorise and distribute evacuation warnings it is expected that the short warning times mean that in the case of extreme floods that there would be insufficient time to evacuate any residents and/or visitors from the site and that instead residents and/or visitors would need to shelter in place.

The building on-site manager or other designated person(s) will be responsible for implementing the actions defined in the Flood Emergency Detailed Response Plan and should not rely on the SES for any warnings.

## Response

In the case of extreme weather events eg. a PMF event it is expected that there would be insufficient time to evacuate any residents and/or visitors from the site and that instead residents and/or visitors should to shelter in place particularly given that the floor levels of all apartments are more than 5.8 m above the 100 year ARI flood level and 3.6 m above the PMF level. Residents and visitors should not attempt to access car park Level LG01 during extreme floods greater than a 700 yr ARI flood.

If needed emergency services would be able to access 120C Old Canterbury Road from the west along Old Canterbury Road and/or residents could be evacuated if in need of medical attention via the ground floor connection to Old Canterbury Road in events up to the PMF.

## Recovery

The building on-site manager or other designated person(s) will issue an 'all clear' message when the immediate danger to life and property has passed.

## 7 Planning Considerations

### 7.1 Comprehensive Inner West DCP 2016

The compliance of the proposed development with the planning requirements identified by WMAwater, 2016 which are now included in Section A3 Flood Hazard of the Comprehensive Inner West DCP 2016 is assessed as follows.

*DS2.1 Floor levels of habitable rooms must be a minimum of 0.5m above the standard flood level at that location. For areas of minor overland flow (a flood depth of 300mm or less or overland flow of 2cum/sec or less) a lower freeboard of 300mm may be considered on its merits.*

The proposed ground floor level of apartments is 18.25 m AHD which provides 6.45 m freeboard above the 100 year ARI flood level and 4.25 m freeboard above the PMF level; and The proposed floor levels of apartments on Levels 01, 02, 03, 04, and 05 are likewise all higher than the PMF level.

The proposed development complies with this requirement.

*DS2.2 Any portion of buildings classified as being flood prone must be constructed from flood compatible materials.*

This requirement is noted and will be implemented during the detailed design and construction.

*DS2.3 Flood free access must be provided where practicable.*

The car park is accessed via a driveway from McGill Street. It is proposed that the driveway access from McGill Street be adjusted such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing of Hawthorne Canal. It is estimated that it would become unsafe for small vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.3 m (which would occur in around a 340 yr ARI flood). It is estimated that it would become unsafe for large vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.5 m (which would occur in around a 700 yr ARI flood).

In the PMF shallow flooding is mapped in the vicinity of the Old Canterbury Road / Edward St / Weston St intersection located west of 120C Old Canterbury Road, Summer Hill. The mapped flood depth is in the range 0.15 m – 0.3 m. In the case of the 100 yr ARI flood the depth of floodwaters is less than 0.15 m. It is concluded that access to 120C Old Canterbury Road is available from the west along Old Canterbury Road directly to the Ground Floor of the proposed development.

#### Controls for underground garages

The car park level of LG02 is 12.5 m AHD. Car parking Level LG02 is assessed against the following requirements.

*DS11.1 Freeboard protection of 500mm must be provided within the internal driveway prior to descending into the underground garage.*

The crest level of 12.5 m AHD on the car park entry from the driveway from McGill Street to the two-storey car parking levels provides 700 mm freeboard above the 100 year ARI level to the car parking on Level LG02.

The proposed floor level of 15.375 m AHD for car parking on Level LG02 provides 3575 mm freeboard above the 100 yr ARI flood level.

The proposed development complies with this requirement.

*DS11.2 Suitable pumps must be provided within the garage to allow for drainage of stormwater should the underground garage become inundated during flooding.*

This requirement is not applicable because car park level LG02 is self-draining.

*DS11.3 Adequate flood warning systems, signage and exits must be available to allow safe and orderly evacuation without increased reliance upon the SES or other authorised emergency services personnel.*

A draft Flood Emergency Response Plan is outlined in Section 6.2. Signage will be installed to warn residents/visitor driving along the driveway from McGill Street and parking on LG02 of the potential for flooding in extreme floods.

A Flood Emergency Response Plan would accompany any DA lodged with Council.

The proposed development will comply with this requirement.

*DS11.4 Reliable access for pedestrians or vehicles must be provided from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF*

The proposed ground floor level of apartments is 18.25 m AHD which provides 6.45 m freeboard above the 100 year ARI flood level and 4.25 m freeboard above the PMF level.

The proposed floor levels of apartments on Levels 01, 02, 03, 04, and 05 are likewise all higher than the PMF level.

In the case of the proposed development any visitors and/or residents who may need to shelter in place would shelter within the apartments and would not require additional flood refuge.

The proposed development complies with this requirement.

## 7.2 Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land

Drawing on the preceding assessments and considerations the following responses to considerations under Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land are provided:

### Objectives

- (1) *The objectives of this direction are:*
  - (a) *to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and*
  - (b) *to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.*

### What a relevant planning authority must do if this direction applies

- (4) *A planning proposal must include provisions that give effect to and are consistent with the NSW Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005 (including the Guideline on Development Controls on Low Flood Risk Areas).*

Flood risk can be defined as being existing, future or residual risk:

- **Existing flood risk** - the existing problem refers to existing buildings and developments on flood prone land. Such buildings and development by virtue of their presence and location are exposed to an 'existing' risk of flooding.
- **Future flood risk** - the future problem refers to buildings and developments that may be built on flood prone land in the future. Such buildings and developments may be exposed to a 'future' flood risk, i.e. a risk would not materialise until the developments occur.
- **Continuing risk of flooding** - the continuing problem refers to the 'residual' risk associated with floods that exceed management measures already in place, i.e. unless a floodplain management measure is designed to withstand the Probable Maximum Flood, it will be exceeded by a sufficiently large flood at some time in the future.

Measures available for the management of flood risk can be categorised according to the way in which the risk is managed. As a result, there are three types of measures for the management of flooding:

- Flood Modification Measures (for the existing risk)
- Property Modification Measures (for the future risk)
- Emergency Response Modification Measures (for the residual risk).

The flood risks on 120C Old Canterbury Road, Summer Hill are described in **Section 4** above.

### Existing Flood Risk

The existing flood risks on 120C Old Canterbury Road has been assessed using a 1D/2D floodplain model and are described in Section 3.1 above.

The estimated 100 yr ARI flood extent, levels and depths, velocities and provisional hazards under Existing Conditions are plotted in **Figures 5, 6 and 7** respectively.

The provisional 100 yr ARI hydraulic categorisation in the vicinity of the property under Existing Conditions are plotted in **Figure 8**. The inundated section of the property is mapped as floodway.

The estimated PMF extent, levels and depths and provisional hazards under Existing Conditions are plotted in **Figures 9 and 10** respectively.

### Future Flood Risk

The future flood risk is addressed by the proposed form of development which achieves and/or exceeds the requirements of the Comprehensive Inner West DCP 2016 as discussed in Section 7.1 and by providing measures for the passage of floodwaters through the site.

As discussed under Section 3.4, it is concluded that the configuration for the planned development on the site detailed in **Figure 13** that:

- There is a local reduction in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

### Continuing Flood Risk

The only Persons at Risk (PAR) directly during the PMF is any resident or visitor who happens to be in car parking level LG02 during extreme floods which overtop the car park level ie. events greater than a 2,000 yr ARI flood. The estimated PAR directly at risk in extreme floods on Level LG02 is 1.5 persons.

As indicated in Section 6.2, it is expected that Building Owners and Managers (in accordance with existing OH&S requirements, the Building Code of Australia) are to have a building Emergency Management Plan which complies with the provisions of AS 3745.

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

A Flood Emergency Response Plan for the development is outlined in **Section 6.2**.

A detailed Flood Emergency Response Plan would accompany any DA lodged with Council.

- (6) *A planning proposal must not contain provisions that apply to the flood planning areas which:*
- (a) *permit development in floodway areas,*

The 2005 NSW Floodplain Development Manual defines “floodway areas” as follows:

*“those areas of the floodplain where a significant discharge of water occurs during floods. They are often aligned with naturally defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.”*

Level LG02 is suspended in order to create a void beneath the building to maintain flood storage and the pattern of flood flow through the property in a 100 yr ARI flood (refer **Figure 13**).

As discussed under Section 3.4, it is concluded that the configuration for the planned development on the site detailed in **Figure 13** that:

- There is a local reduction in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

It is therefore concluded that the proposed concept development complies with the intent of this requirement, namely to not significantly redistribute flood flow or to significantly increase flood levels.

- (b) *permit development that will result in significant flood impacts to other properties,*

As concluded under Section 3.4 the concept planned development has no adverse impact on 100 yr ARI flood levels and no significant adverse impact on PMF levels due to the proposed form of development and the presence of local hydraulic controls downstream of the property which are controlling 100 yr ARI and PMF levels on the property.

- (c) *permit a significant increase in the development of that land*

The only Persons at Risk (PAR) directly during the PMF is any resident or visitor who happens to be in car parking level LG02 during extreme floods which overtop the car park level ie. events greater than a 2,000 yr ARI flood. The estimated PAR directly at risk in extreme floods on Level LG02 is 1.5 persons.

As indicated in Section 6.2, it is expected that Building Owners and Managers (in accordance with existing OH&S requirements, the Building Code of Australia) are to have a building Emergency Management Plan which complies with the provisions of AS 3745.

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

A Flood Emergency Response Plan for the development is outlined in **Section 6.2**.

A detailed Flood Emergency Response Plan would accompany any DA lodged with Council.

- (d) *are likely to result in a substantially increased requirement for government spending on flood mitigation measures, infrastructure or services*

As discussed under Section 3.4, it is concluded that the configuration for the planned development on the site detailed in **Figure 13** that:

- There is a local reduction in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

Consequently there will be no substantially increased requirement for government spending on flood mitigation measures or infrastructure arising from the proposed concept development.

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

A Flood Emergency Response Plan for the development is outlined in **Section 6.2**.

The implementation of a FERP for the development is not reliant on any requirement for government spending on services.

### **Consistency**

- (9) *A planning proposal may be inconsistent with this direction only if the relevant planning authority can satisfy the Director-General (or an officer of the Department nominated by the Director-General) that:*
- (a) *the planning proposal is in accordance with a floodplain risk management plan prepared in accordance with the principles and guidelines of the Floodplain Development Manual 2005, or*
- (b) *the provisions of the planning proposal that are inconsistent are of minor significance.*

The future flood risk is addressed by the proposed form of development which achieves and/or exceeds the requirements of the Comprehensive Inner West DCP 2016. As concluded under Section 3.4 the concept planned development is expected to have a no adverse impact on 100 yr ARI flood levels and no significant adverse impact on PMF levels due to the proposed form of development and the presence of local hydraulic controls downstream of the property which are controlling 100 yr ARI and PMF levels on the property. Consequently there will be no substantially increased requirement for government spending on flood mitigation measures or infrastructure arising from the proposed concept development.

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

A Flood Emergency Response Plan for the development is outlined in **Section 6.2**.

The implementation of a FERP for the development is not reliant on any requirement for government spending on services.

The proposed development has been assessed against each of the considerations set out in Direction and it is concluded that the proposed form of development is informed by the principles and guidelines of the Floodplain Development Manual 2005 and the complies with intent of Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land and any provisions of the planning proposal that are inconsistent are of minor significance.

## 8 Conclusions

As described by GSA Planning in 2017, a Planning Proposal has been prepared on behalf of The Yard 120C Pty Ltd by for the property known as No. 120C Old Canterbury Road, Summer Hill, legally described as Lot 1 in DP 817359 and Lot 100 in DP 875660 (hereafter referred to as the “subject site”).

Following the conditional Gateway approval granted by the Department of Planning in October 2017, Cardno was engaged by the owner to carry out a risk assessment in response to the Gateway determination. This included:

- An assessment of the flooding impact of the planned development;
- Flood emergency response; and
- Compliance with requirements of the Comprehensive Inner West DCP 2016 and the Section 117 Direction 4.3 – Flood Prone Land.

The proposed development site at 120C Old Canterbury Road, Summer Hill is subject to flooding by floodwaters spilling from Hawthorne Canal and overland flows. Detailed flood modelling of existing conditions has been undertaken by WMAwater in 2015.

Features of the subject site and planned development include:

- The site ground levels generally vary west to east across the middle and northern section of the site from around 10 m AHD to 9.5 m AHD except in the southern section of the site where the ground grades up to Old Canterbury Road at levels which vary from 17.1 m AHD – 18.5 m AHD;
- The proposed ground floor level of apartments is 18.25 m AHD will provide 6.45 m freeboard above the 100 year ARI flood level and 4.25 m freeboard above the PMF level;
- The proposed floor levels of apartments on Levels 01, 02, 03, 04, and 05 are likewise all higher than the PMF level;
- Adjusting the driveway access from McGill Street such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing;
- A crest level of 12.5 m AHD at the car park entry from the driveway from McGill Street to the two-storey car parking levels which provides 700 mm freeboard above the 100 year ARI level;
- Proposed floor level of 12.5 m AHD for car parking on Level LG02 would be inundated in the PMF;
- Level LG02 is suspended in order to create a void beneath the building to maintain flood storage and the pattern of flood flow through the property in a 100 yr ARI flood (refer **Figure 13**);
- The proposed floor level of 15.375 m AHD for car parking on Level LG01 provides 1.375 m freeboard above the PMF level.

The car park is accessed via a driveway from McGill Street. It is proposed that the driveway access from McGill Street be adjusted such that the minimum road level is 11.80 m AHD which is at the 100 yr ARI flood level in the vicinity of the crossing of Hawthorne Canal.

It is estimated that it would become unsafe for small vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.3 m (which would occur in around a 340 yr ARI flood). It is estimated that it would become unsafe for large vehicles to drive along the driveway when the depth of floodwaters across the driveway exceed 0.5 m (which would occur in around a 700 yr ARI flood).

A crest level of 12.5 m AHD at the car park entry from the driveway from McGill Street to the two-storey car parking levels provides 700 mm freeboard above the 100 year ARI level. Overtopping of the car park Level LG02 is estimated to commence in around a 2,000 yr ARI flood.

It should be noted that while both Figures 1 and 2 in the 2016 WMAwater letter report (refer **Appendix A**) and in **Figures 5 – 10** show flooding across Old Canterbury Road along Hawthorne Canal and along the light rail corridor this is misleading. The flood contours in this area are for flood flows conveyed through the Hawthorne Canal crossing and the rail crossing. Old Canterbury Road is considerably higher than the PMF levels at these crossings and is in fact not inundated at these locations at any time.

It is noted in **Figure 9** that shallow flooding is mapped in the vicinity of the Old Canterbury Road / Edward St / Weston St intersection located west of 120C Old Canterbury Road, Summer Hill. The mapped flood depth is in the range 0.15 m – 0.3 m. In the case of the 100 yr ARI flood the depth of floodwaters is less than 0.15 m. It is concluded that if needed emergency services would be able to access 120C Old Canterbury Road from the west along Old Canterbury Road and/or residents could be evacuated if in need of medical attention via the ground floor connection to Old Canterbury Road.

Flood emergency planning in the South West Metropolitan District was reviewed to provide the context for flood emergency planning for the subject site. The 2017 South West Metropolitan Regional Emergency Management Plan details arrangements for, prevention of, preparation for, response to and recovery from emergencies within the South West Region. The Inner West Council website currently advises that the Inner Emergency Management Plan is to be published soon

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

It is expected that the building on-site manager or other designated person(s) will be responsible for implementing the actions defined in the Flood Emergency Response Plan and should not rely on the SES for any evacuation warnings.

In the case of the proposed development any visitors and/or residents who may need to shelter in place would shelter within the apartments and would not require additional flood refuge. The only Persons at Risk (PAR) directly during the PMF is any resident or visitor who happens to be in car parking level LG02 during extreme floods which overtop the car park floor level ie. flood events greater than a 2,000 yr ARI flood. The estimated PAR directly at risk in extreme floods on Level LG02 is 1.5 persons which is very low. Any persons who happen to be on Level LG02 during an extreme flood will need to evacuate to LG01 via stairs or the driveway ramp. Residents and visitors should not attempt to access Level LG02 during extreme floods.

A draft Flood Emergency Response Plan is outlined in Section 6.2. Signage will be installed to warn residents/visitor driving along the driveway from McGill Street and parking on LG01 of the potential for flooding in extreme floods and what to do in an extreme flood.

A Flood Emergency Response Plan would accompany any DA lodged with Council.

The objectives of Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land are:

- (a) to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and
- (b) to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.

A planning proposal may be inconsistent with the Section 117(2) Direction only if the relevant planning authority can satisfy the Director-General (or an officer of the Department nominated by the Director-General) that:

- (c) the planning proposal is in accordance with a floodplain risk management plan prepared in accordance with the principles and guidelines of the Floodplain Development Manual 2005, or
- (d) the provisions of the planning proposal that are inconsistent are of minor significance.

The future flood risk is addressed by the proposed form of development which achieves and/or exceeds the requirements of the Comprehensive Inner West DCP 2016. As discussed under Section 3.4, it is concluded that the configuration for the planned development on the site that:

- There is a local reduction in the vicinity of the end of the western solid wall in the 100 yr ARI flood partially within and adjacent to the site;
- There are no adverse impacts on any adjoining development in the 100 yr ARI flood;
- There are no significant adverse impacts in the PMF.

Consequently there will be no substantially increased requirement for government spending on flood mitigation measures or infrastructure arising from the proposed concept development.

The building Emergency Management Plan will contain a Flood Emergency Response Plan. It is also expected that all wardens trained under the building emergency plan are to be aware of the actions to be implemented in an extreme flood, trafficable routes to the site during extreme floods and how to liaise with the any building occupants on the site.

A Flood Emergency Response Plan for the development is outlined in Section 6.2.

The implementation of a FERP for the development is not reliant on any requirement for government spending on services.

The proposed development has been assessed against each of the considerations set out in Direction and concludes that the proposed form of development is informed by the principles and guidelines of the Floodplain Development Manual 2005 and the complies with intent of Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land and any provisions of the planning proposal that are inconsistent are of minor significance.

It is further concluded that the site is therefore suitable for the proposed development.

## 9 References

Department of Planning ( ) *Section 117(2) of the EP&A Act 1979, Section 4.3 Flood Prone Land*

FEMA (2000) *Design and Construction Guidance for Community Shelters*, Federal Emergency Management Agency, Mitigation Directorate, FEMA361, 1<sup>st</sup> Ed., July 2000.

Inner West Council (2016). *Comprehensive Inner West DCP 2016*, Section A3 Flood Hazard.

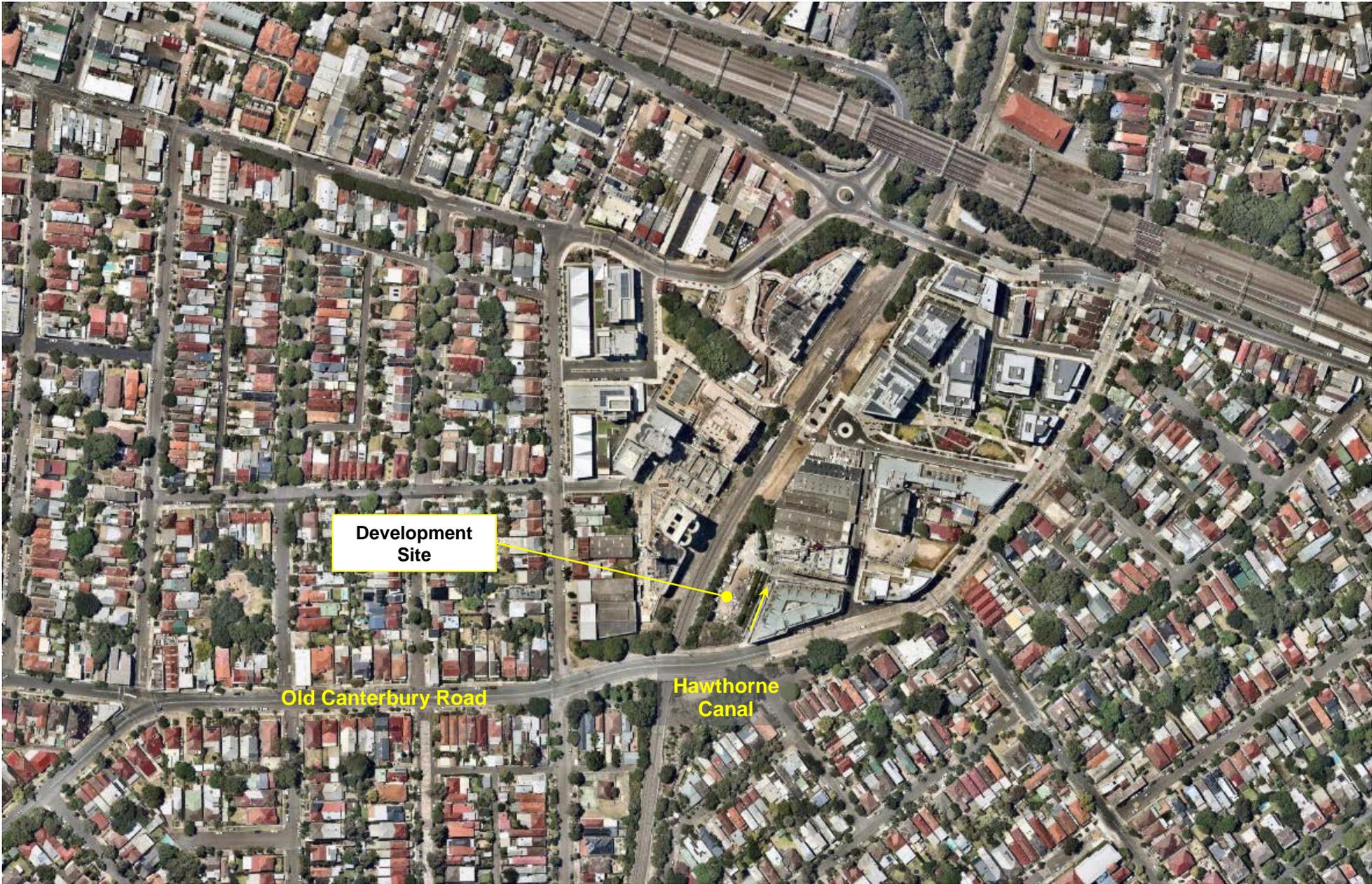
NSW Government (2005). *Floodplain Development Manual, The management of flood liable land*, April, 29 pp + Apps

NSW Government (2017) *New South Wales State Flood Plan*, December, 105 pp.

NSW Government (2017) *South West Metropolitan Regional Emergency Management Plan*, July, 27 pp.

WMAwater (2015) *Hawthorne Canal Flood Study*, prepared for Marrickville Council, Version 6, February, 80 pp + Apps.

WMAwater (2016) *Flood Certificate for 120C Old Canterbury Road, Lewisham*, prepared for Mr Timperi, 21 June 2016.



(Source: Nearmap accessed 3 March 2018)

**Figure 1** Location of 120C Old Canterbury Road

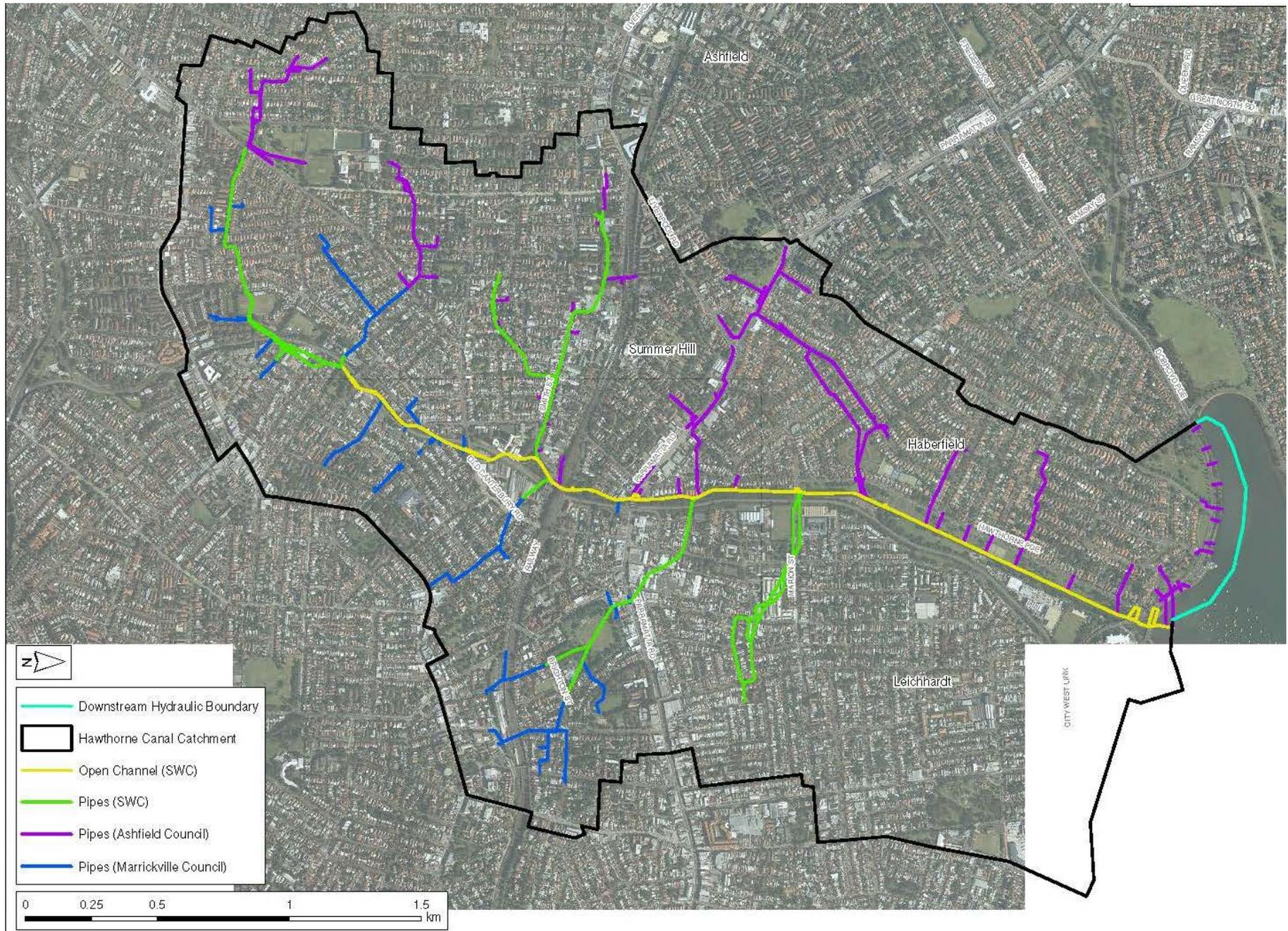


Figure 2 Hydraulic Model Schemitisation (after Figure 13, WMAwater, 2015)

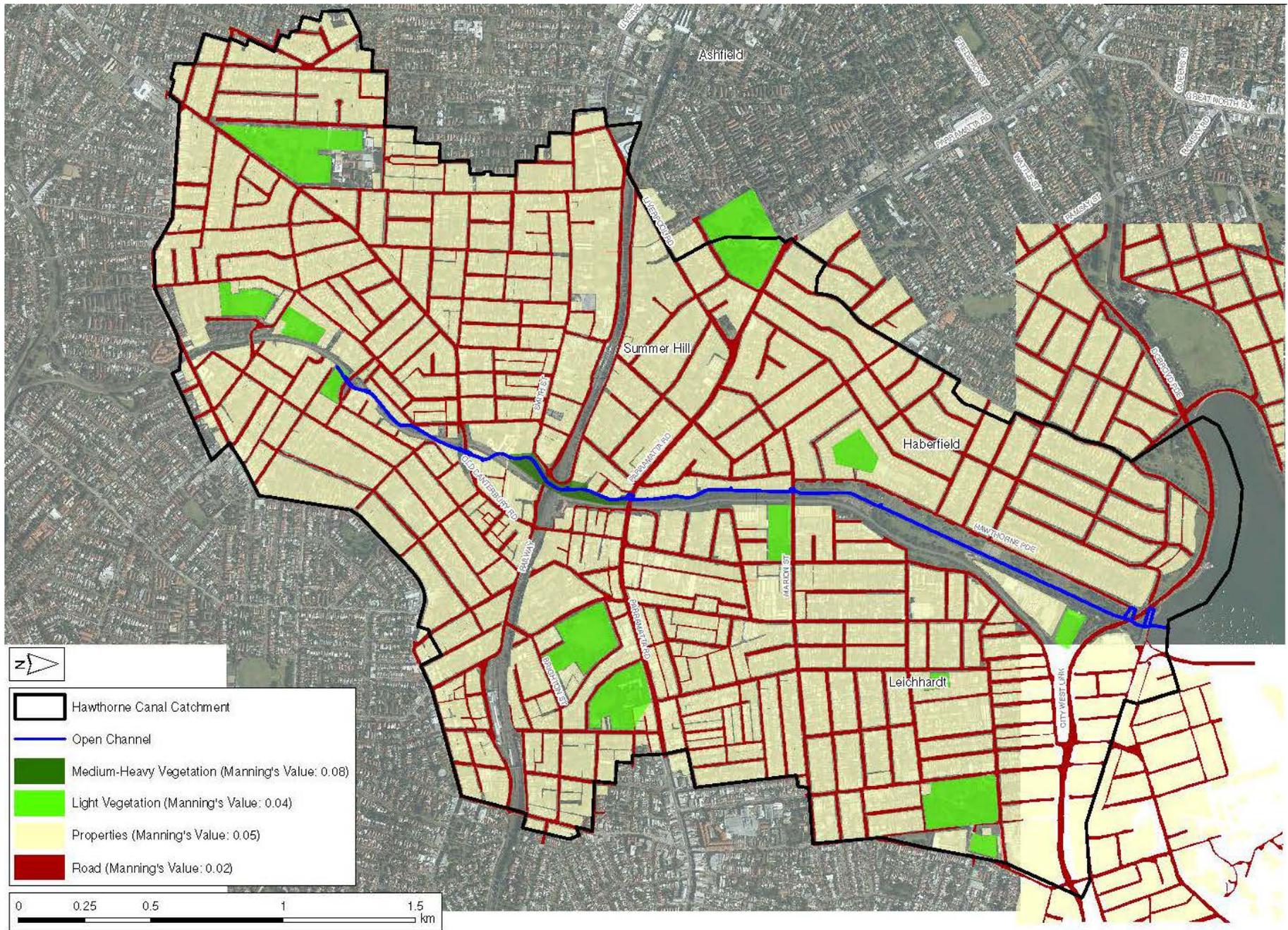


Figure 3 Floodplain Roughness (after Figure 14, WMAwater, 2015)

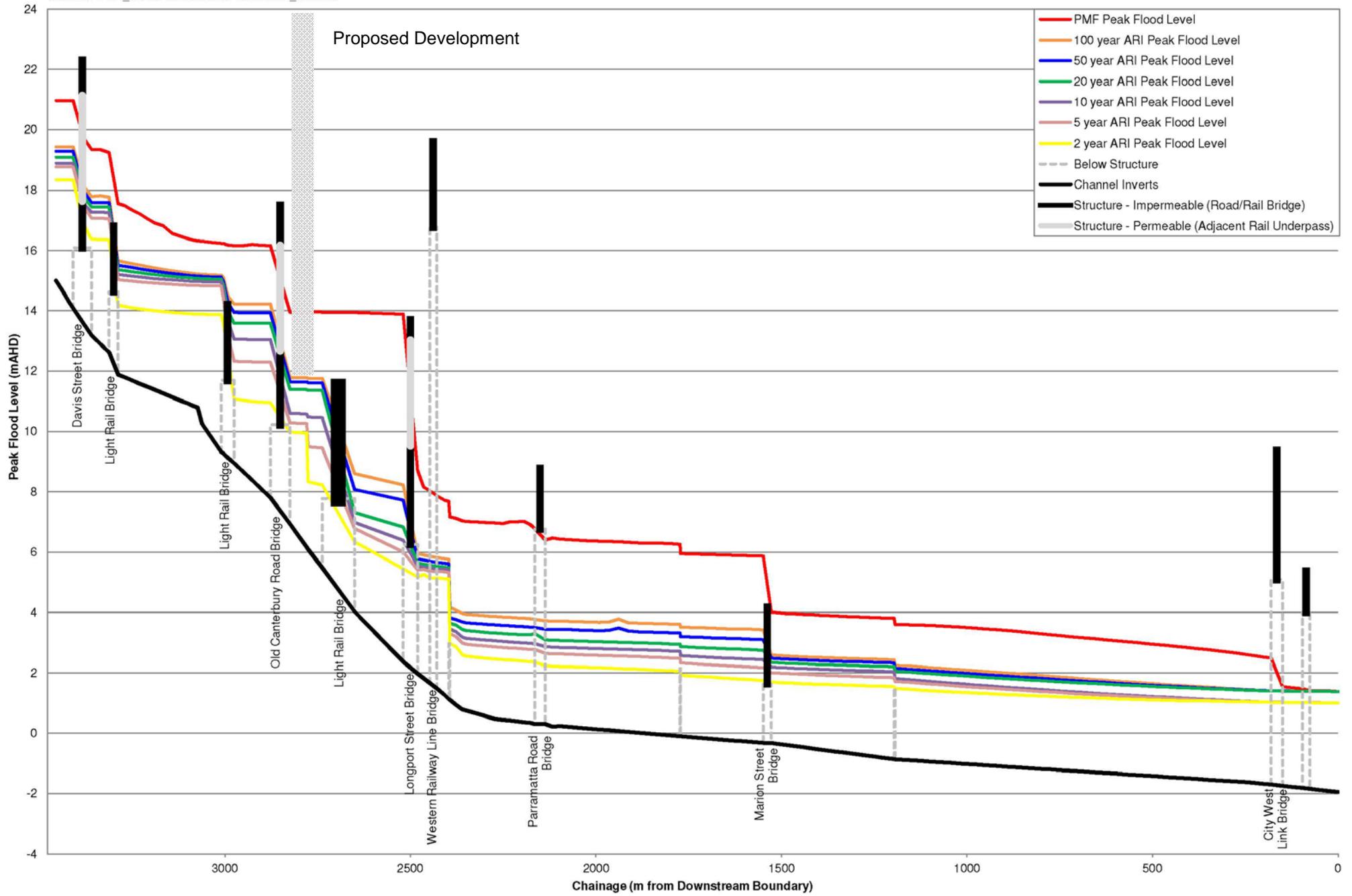


Figure 4 Peak Flood Level Profiles (after Figure 26A, WMAwater, 2015)

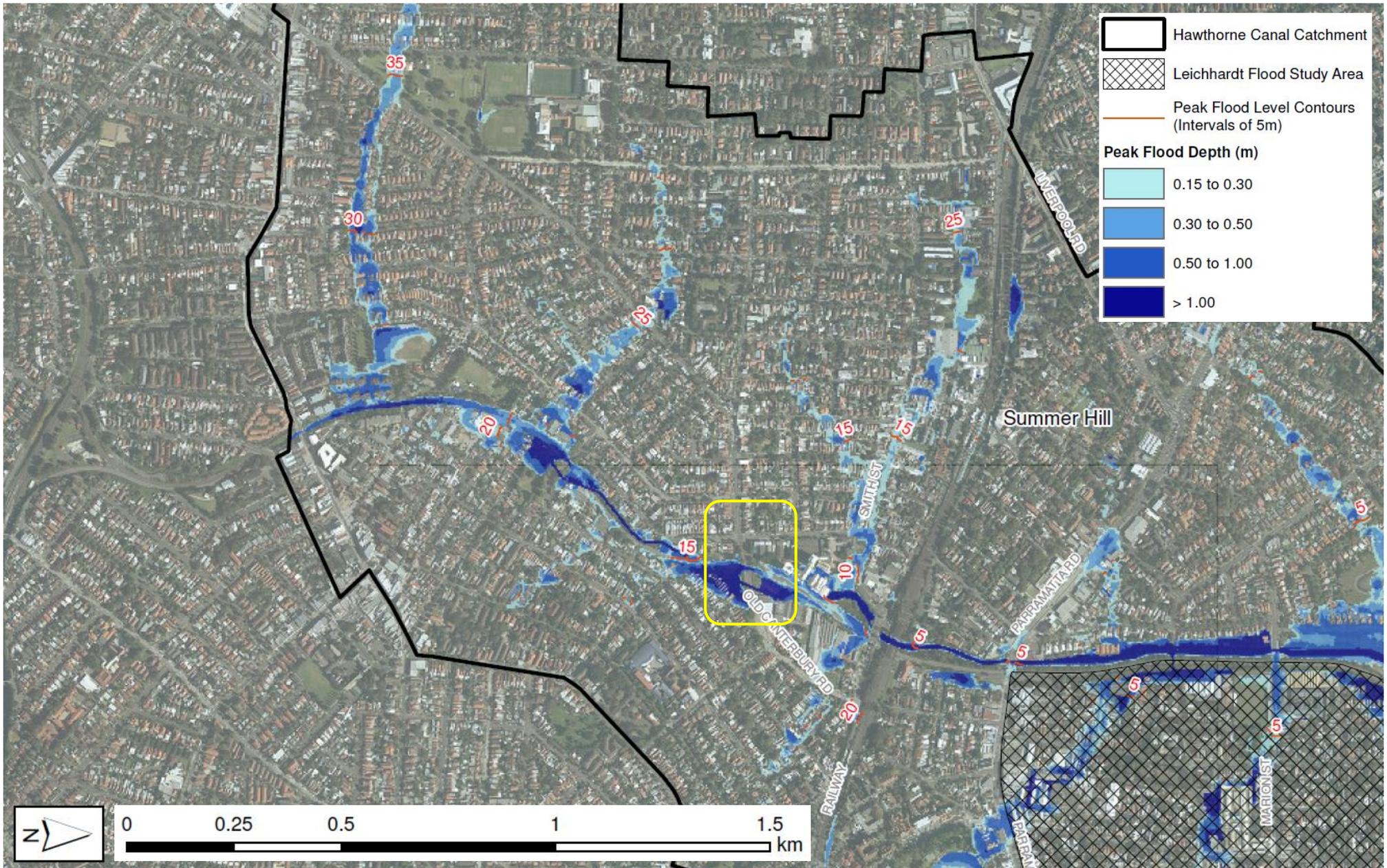


Figure 5 100 yr ARI Flood Extents and Flood Levels (after Figure 24, WMAwater, 2015)

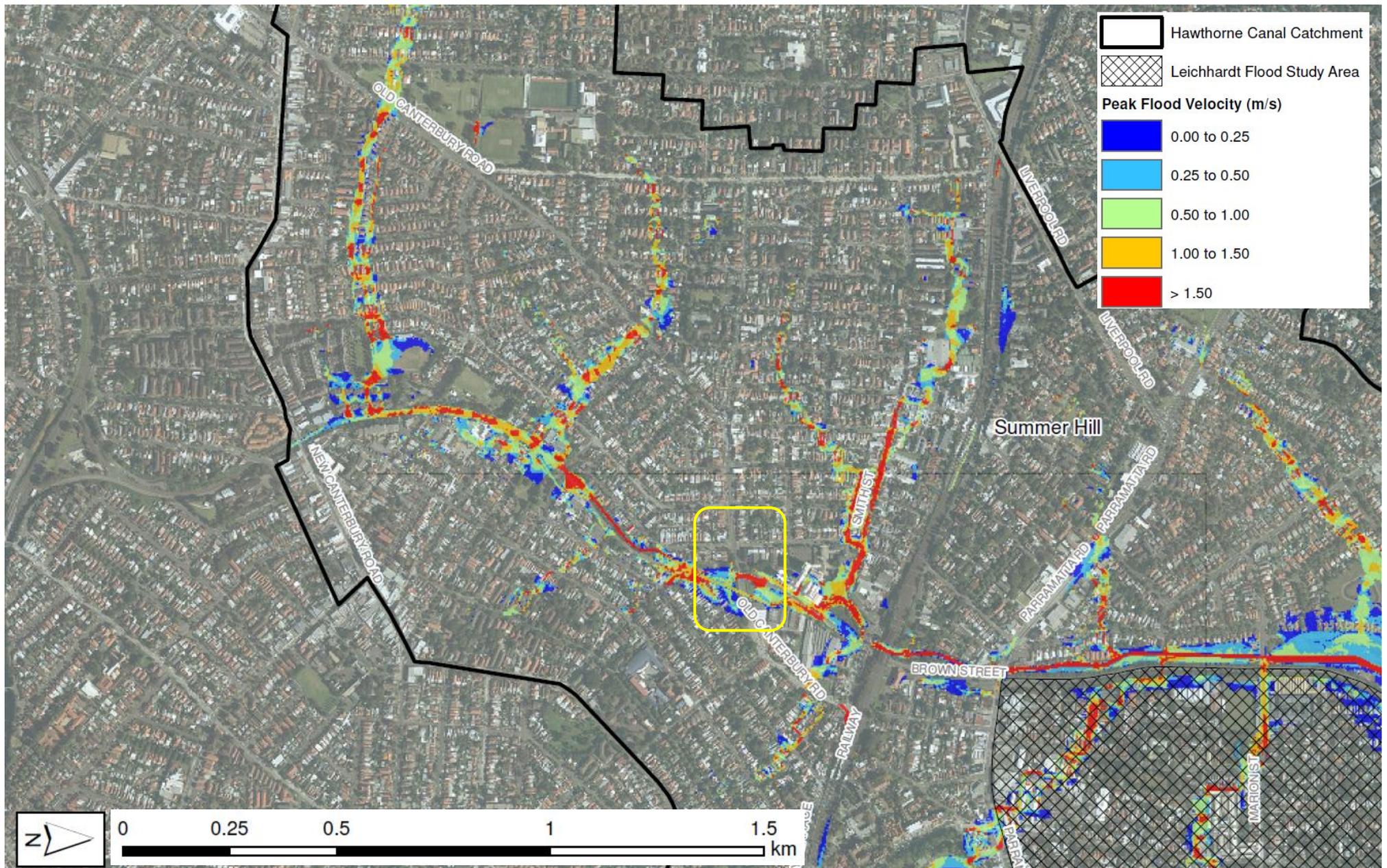


Figure 6 100 yr ARI Flood Velocities (after Figure 27, WMAwater, 2015)

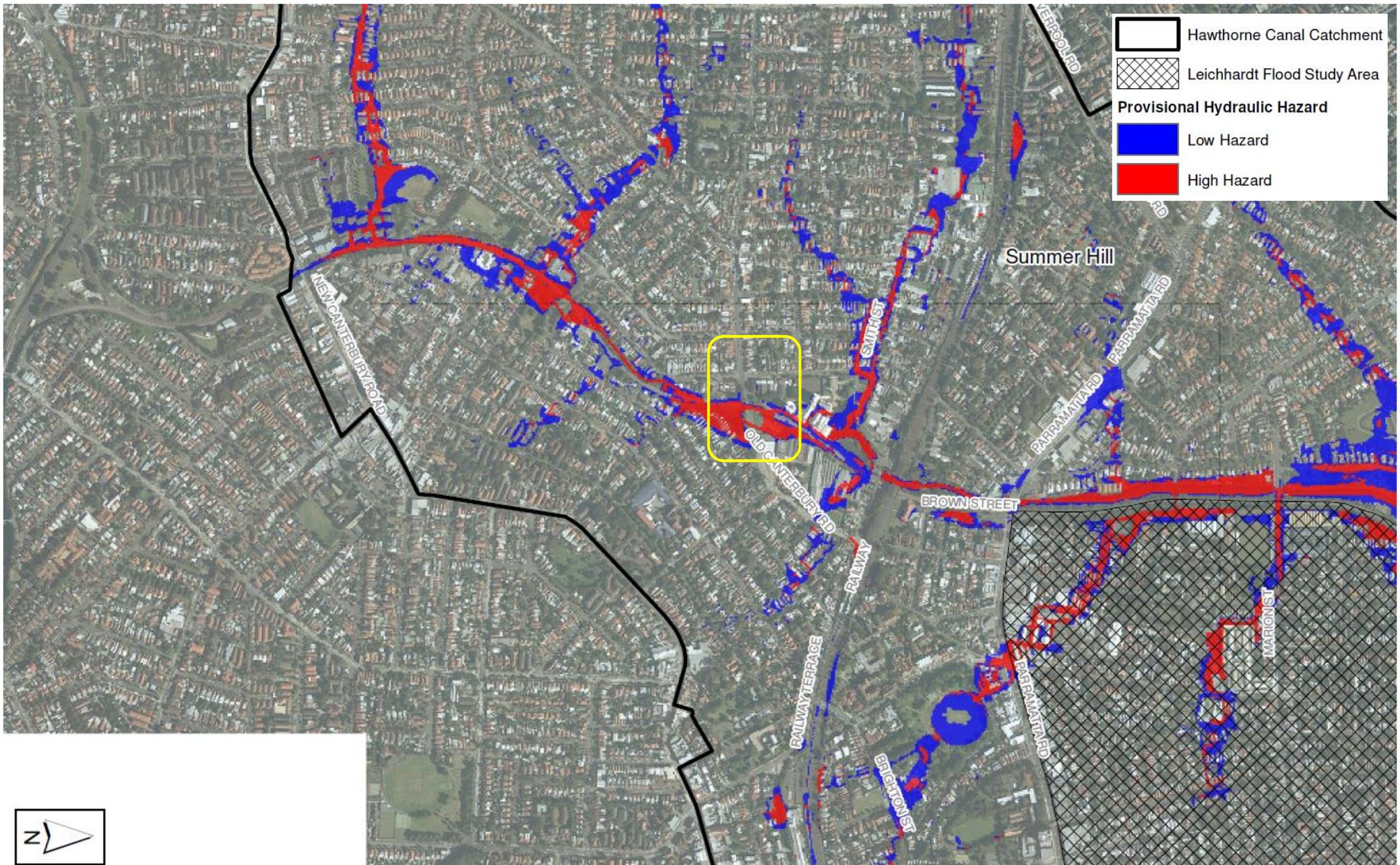


Figure 7 100 yr ARI Provisional Flood Hazards (after Figure 30, WMAwater, 2015)

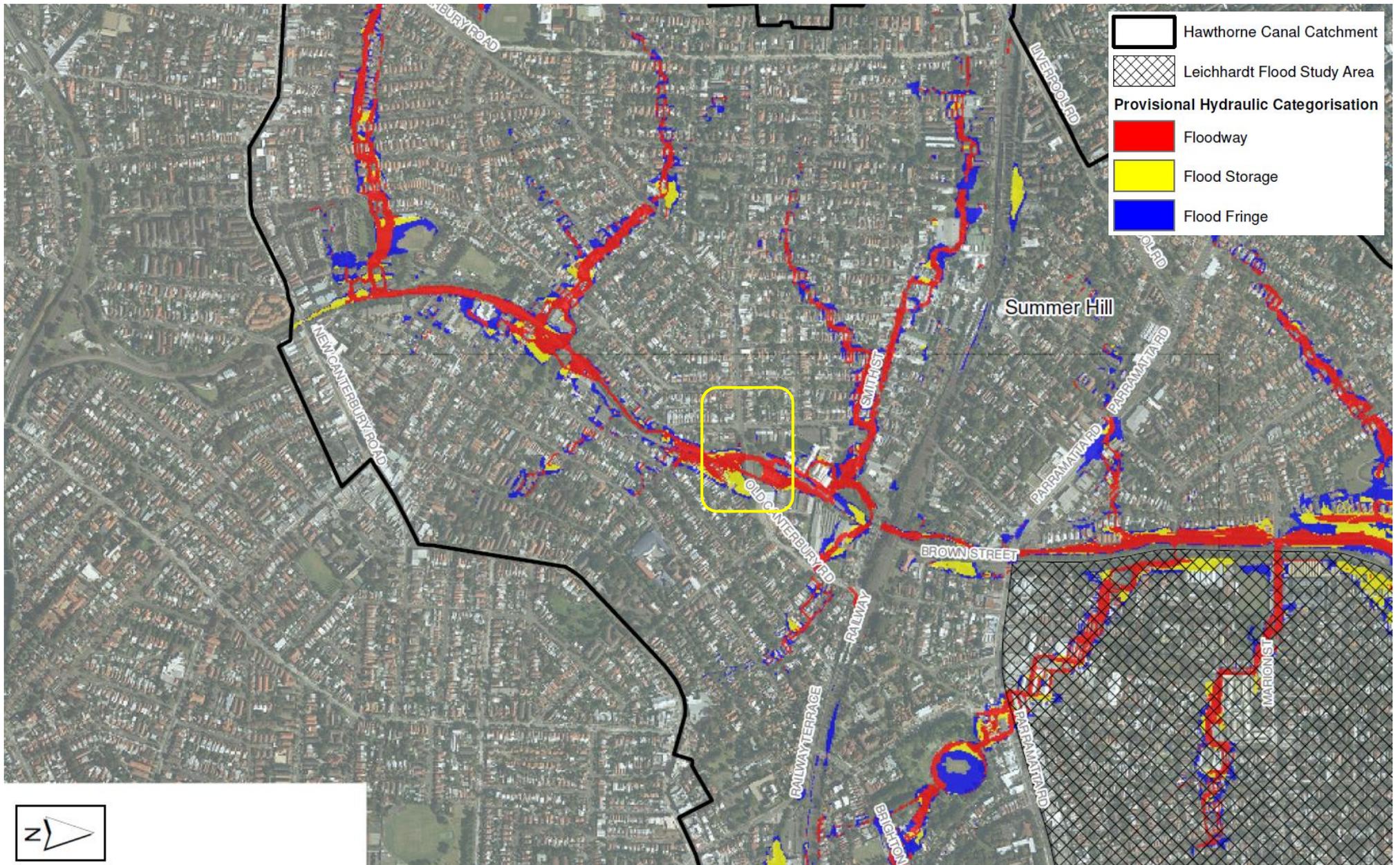


Figure 8 100 yr ARI Hydraulic Classification (after Figure 34, WMAwater, 2015)

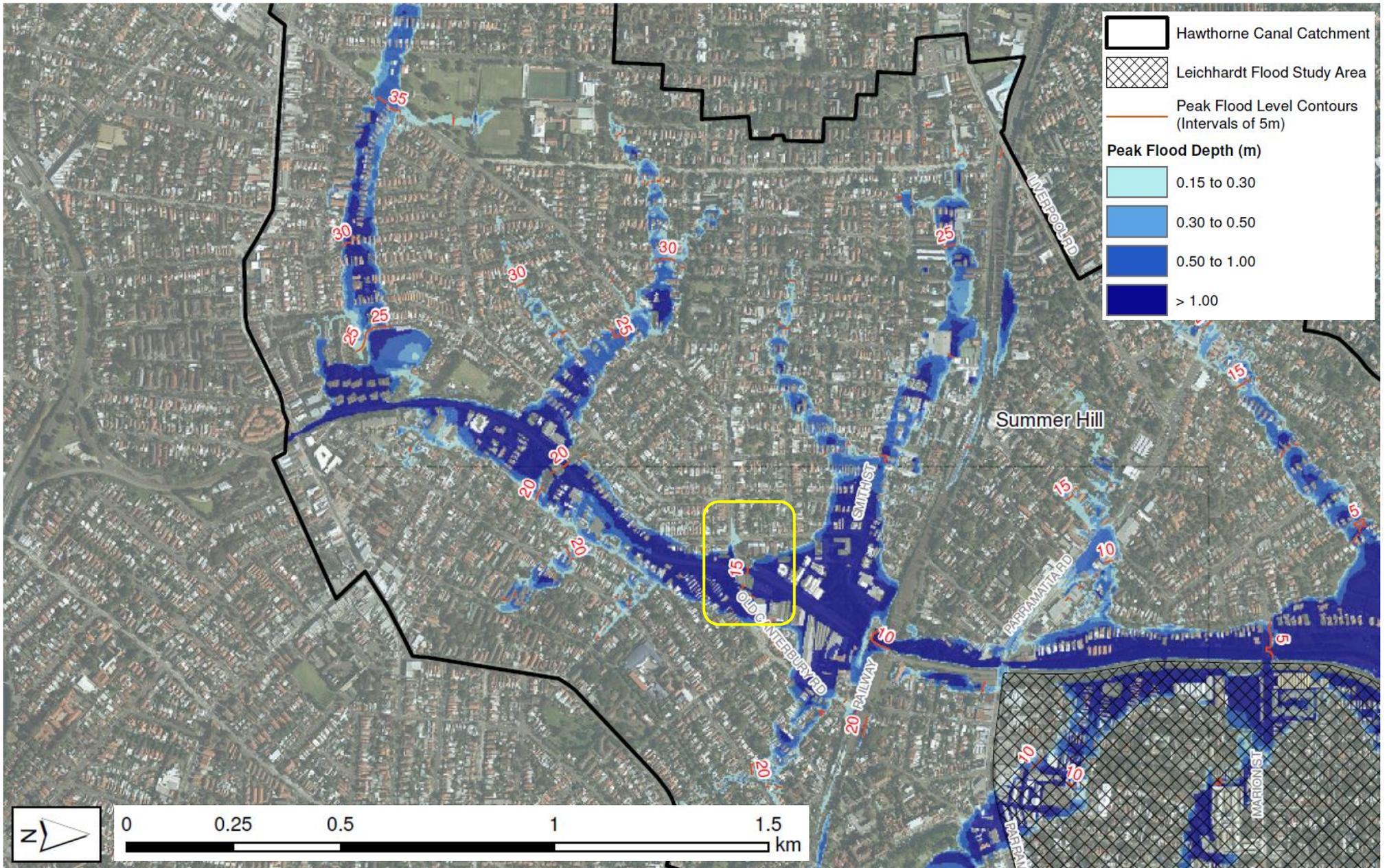


Figure 9 PMF Extents and Flood Levels (after Figure 25, WMAwater, 2015)

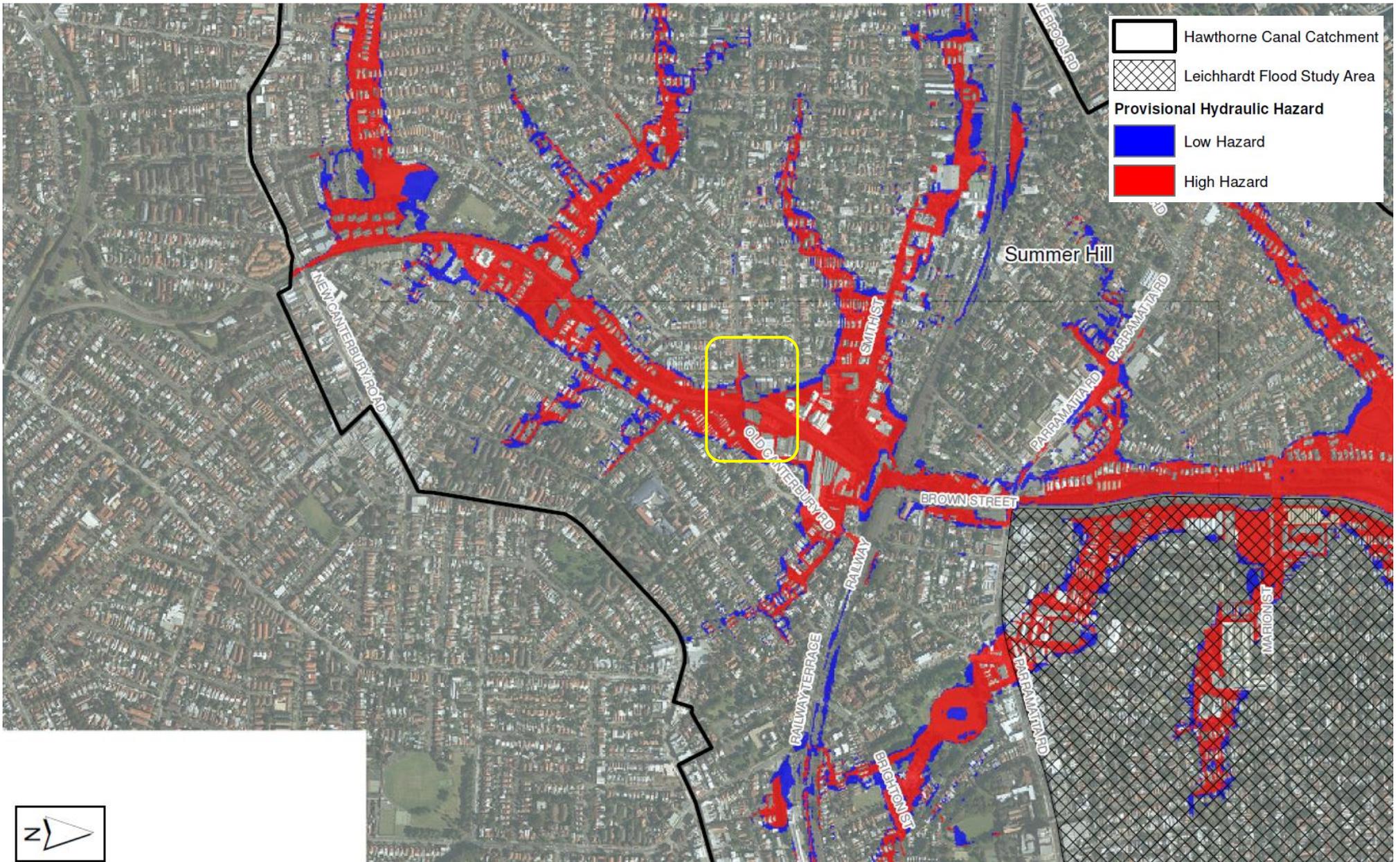


Figure 10 PMF Provisional Flood Hazards (after Figure 31, WMAwater, 2015)

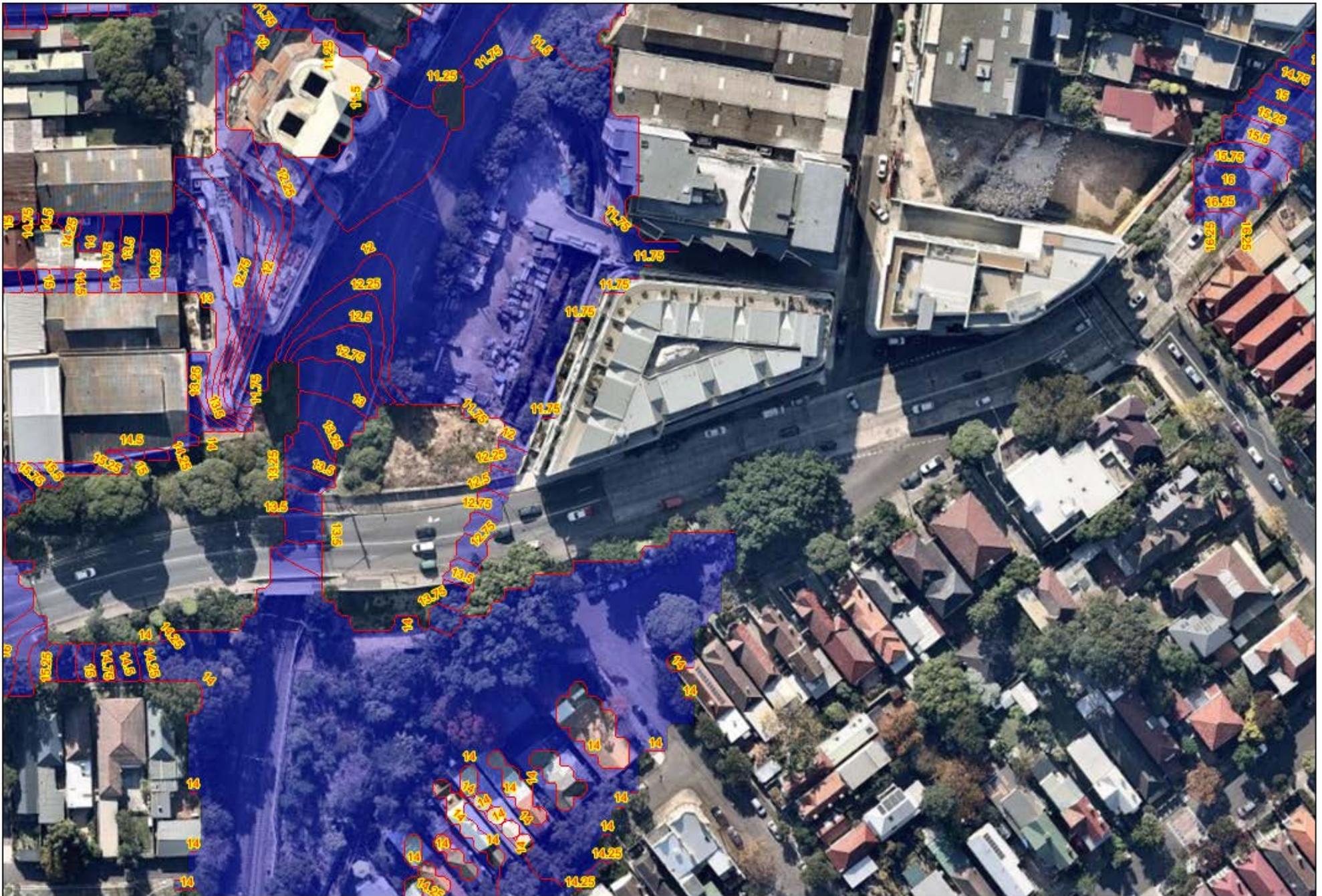


Figure 11 100 yr ARI Flood Extents and Flood Levels (m AHD) – Benchmark Conditions



Figure 12 PMF Extents and Flood Levels (m AHD) – Benchmark Conditions



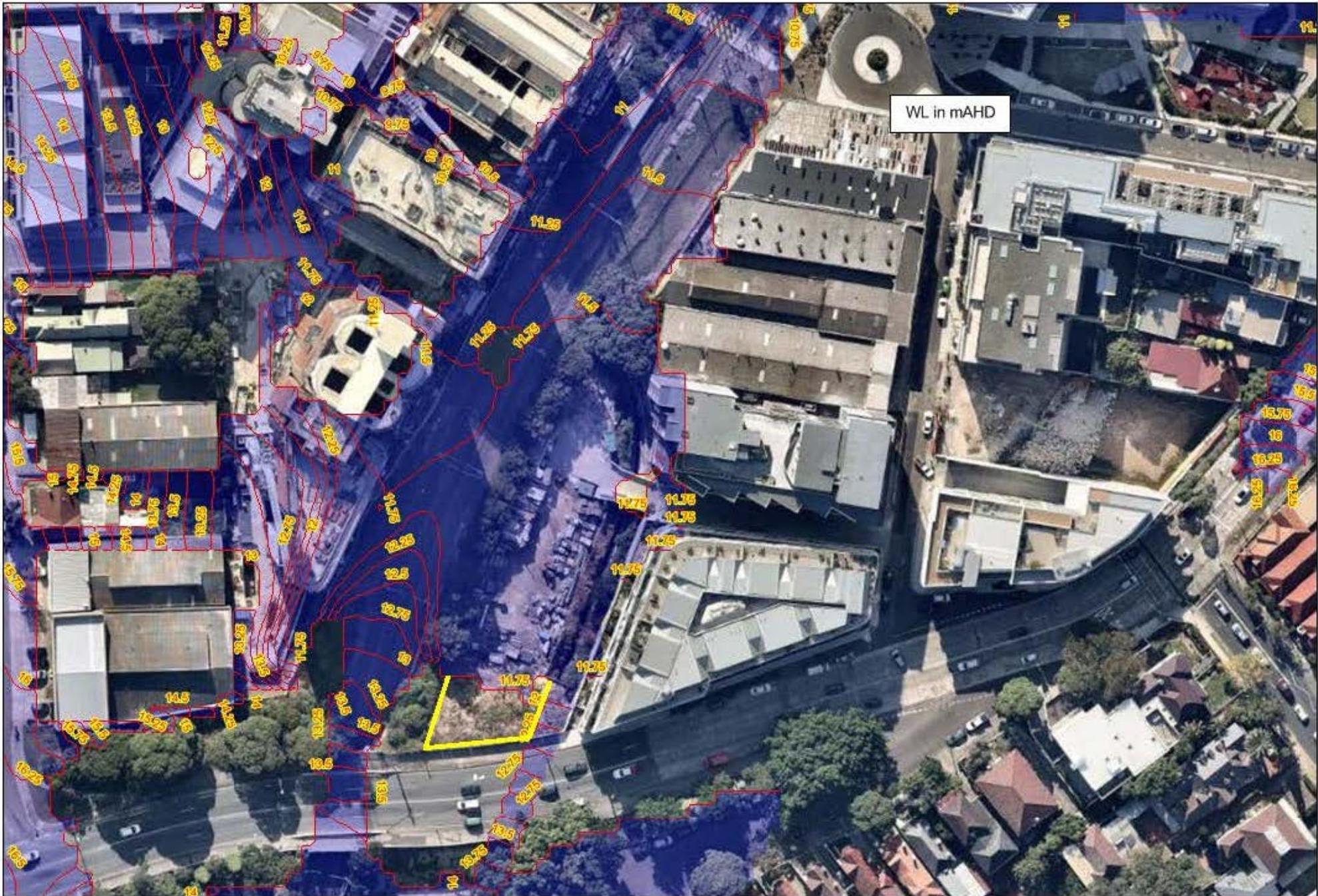


Figure 14 100 yr ARI Flood Extents and Flood Levels (m AHD) – Future Conditions

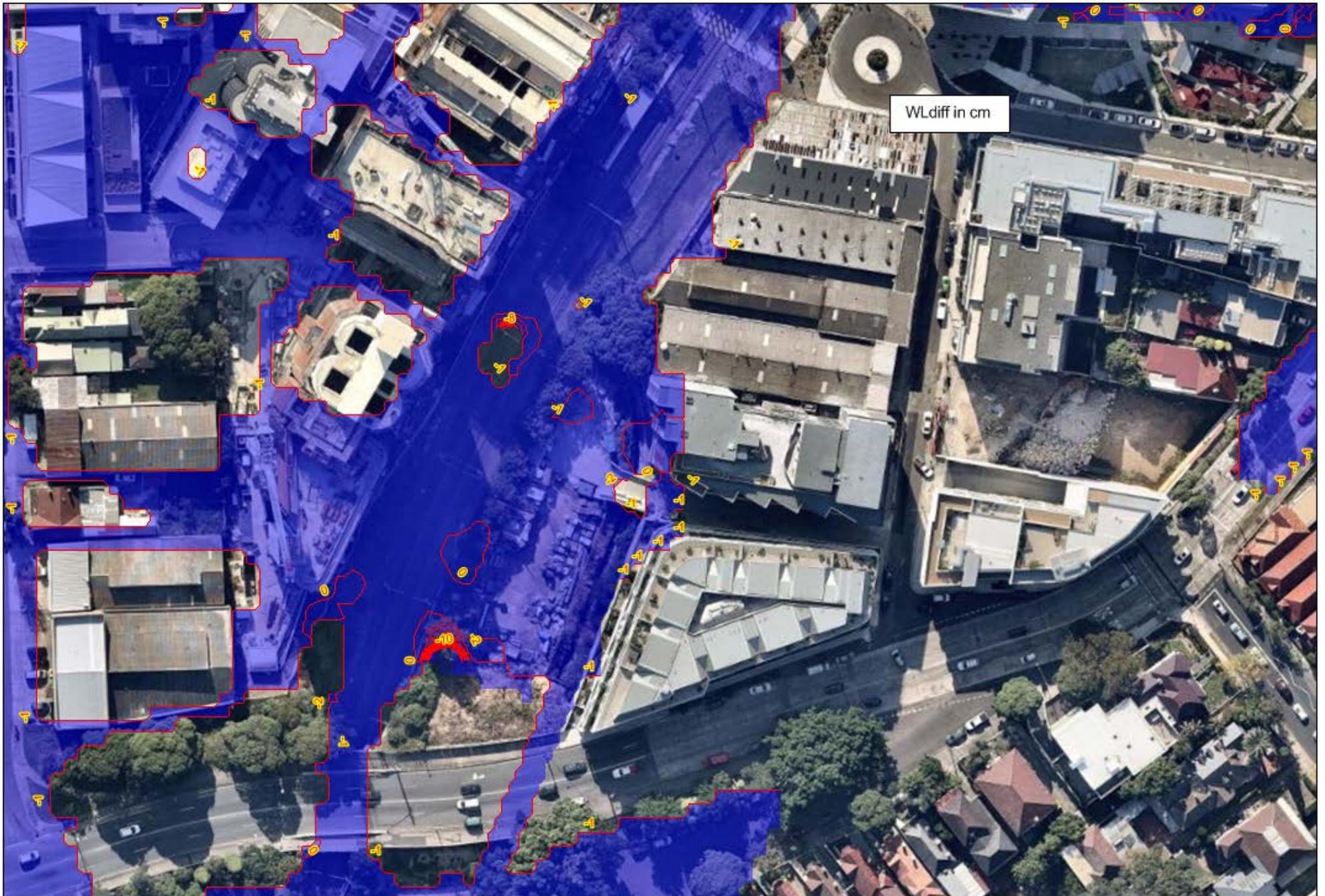


Figure 15 100 yr ARI Flood Level Differences (cm) – Future minus Benchmark Conditions

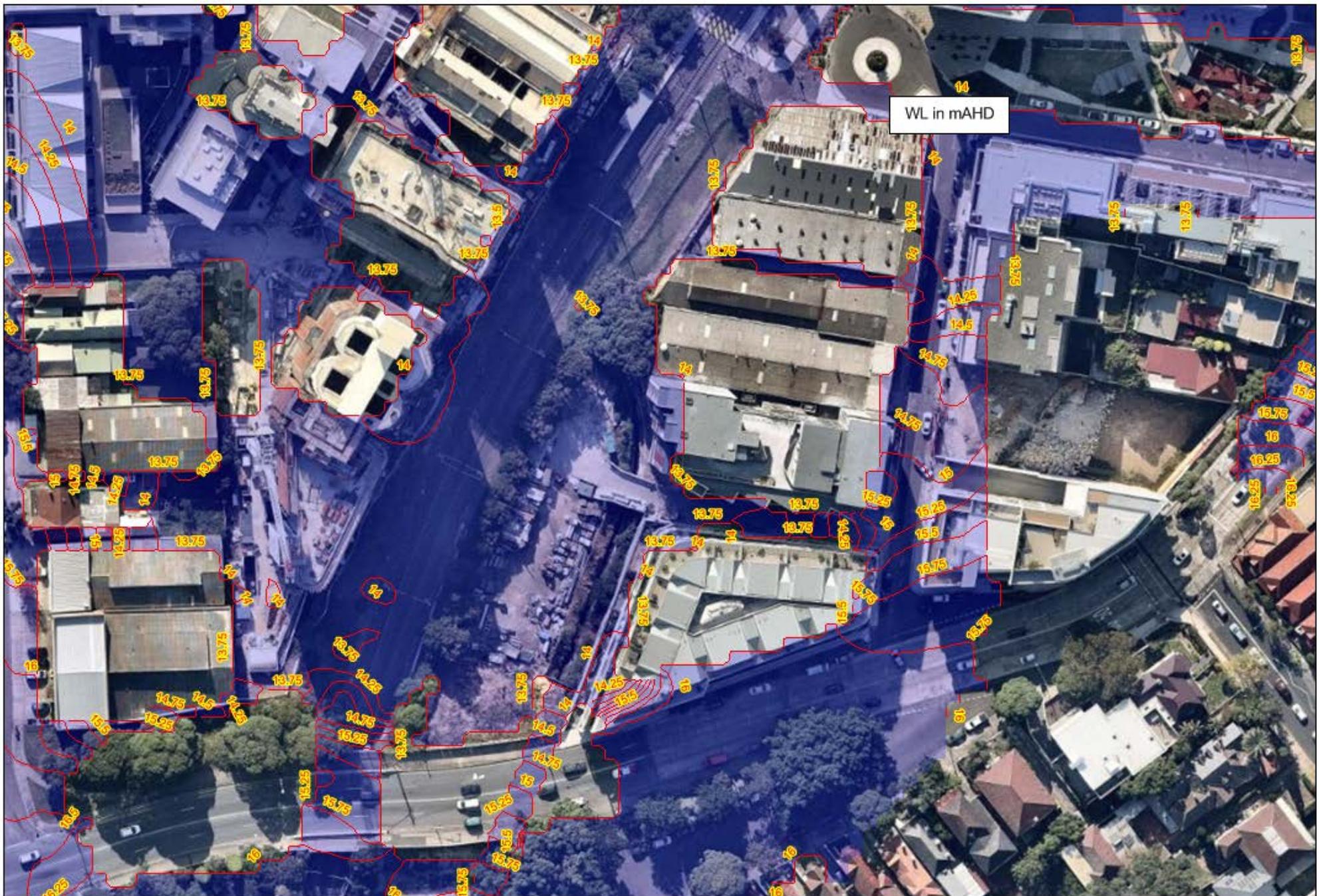


Figure 16 PMF Extents and Flood Levels (m AHD) – Future Conditions



Figure 17 PMF Level Differences (cm) – Future minus Benchmark Conditions



Figure 18 Reference Locations

120c Old Canterbury Road, Summer  
Hill

**APPENDIX A**  
FLOOD CERTIFICATE JUNE 2016



Mr Timperi  
2 Tebbutt Street  
Leichhardt, NSW 2040

L11105499\_120C\_OldCanterburyRd.docx

21 June 2016

**Attention: Mr Timperi**

Dear Rick,

**Re: Flood Certificate for 120C Old Canterbury Road, Lewisham**

Thank you for contacting WMAwater in regard to a flood certificate for the property located at the above referenced address. WMAwater completed the Hawthorne Canal Flood Study on behalf of Ashfield Council and Marrickville Council, within which area the property is located.

The site consists of Lot 1 in DP 817359 and Lot 100 in DP 875660; with the joint address of 120C Old Canterbury Road, Lewisham. It is bounded by Old Canterbury Road to the south, the light-rail line to the west, the open channel of Hawthorne Canal to the east, and the intersection of the light-rail line and the open channel at the north boundary of the site. Access to the site is via a privately owned and operated bridge across Hawthorne Canal with a right of carriageway through the adjacent property.

The current land use of the site is industrial and no impermeable buildings are currently located on the site. The Planning Proposal is for an increase in Floor Space Ratio (FSR), an increase in allowable building height and a rezoning of the site.

Figure 1 and Figure 2 attached shows the existing flood behaviour in the vicinity of the property for the 1% AEP event and the PMF event. Based on modelling results from the Flood Study, it is evident that 120C Old Canterbury Road is impacted by mainstream and overland flow.

Mainstream flow in the vicinity of the site originates from the open channel of Hawthorne Canal, located to the south-east of the site, and which travels in a northerly direction along the eastern boundary of the site. Overland flow approaches the site from the west; with overland flow originating from streets and properties to the west as well as from the light-rail underpass to the south-west of the site. Flow through the light-rail underpass occurs when the mainstream flow to the south of the Old Canterbury Road embankment exceeds the capacity of the constricting culvert and backwaters; with the increasing flood level and extent allowing flow to diverge through the light-rail underpass.

**WMAwater Pty Ltd (Formerly Webb McKeown and Associates)**

**DIRECTORS**

M K Babister  
R W Dewar  
E J Askew  
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BE(Hons), MEngSc GradDipMgt, FIEAust  
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**ABN 14 600 315 053**

Level 2, 160 Clarence St, SYDNEY NSW 2000  
Phone: 02 9299 2855 Fax: 02 9262 6208  
Email: enquiry@wmawater.com.au  
Website: wmawater.com.au

The peak flood depth on the site was found to be 5.7 m in the 1% AEP event and 7.9 m in the PMF event. The peak flood level was found to be:

- In the 1% AEP event: a minimum of 11.8 m AHD and a maximum of 12.3 m AHD; and
- In the PMF event: a minimum of 14.0 m AHD and a maximum of 14.4 m AHD.

## **COUNCIL POLICY**

The Ashfield Council *Interim Flood Development Control Policy* (DCP) was adopted by Council on the 25th March 2014 and is applicable to this development proposal. From this:

### Controls for new residential developments

- (2.1) *Floor levels of habitable rooms must be a minimum of 0.5m above the standard flood level at that location. For areas of minor overland flow (a flood depth of 300mm or less or overland flow of 2cum/sec or less) a lower freeboard of 300mm may be considered on its merits.*
- (2.2) *Any portion of buildings classified as being flood prone must be constructed from flood compatible materials.*
- (2.3) *Flood free access must be provided where practicable.*

### Controls for new non-residential development

- (5.1) *Floor levels (except for access-ways) must be at least 0.5m above the standard flood level or the buildings must be flood-proofed to at least 0.5m above the standard flood level. For areas of minor overland flow (a flood depth of 300mm or less or overland flow of 2cum/sec or less) a lower freeboard of 300mm may be considered on its merits.*
- (5.2) *Flood free access must be provided where practicable.*

### Controls for underground garages

- (11.1) *Freeboard protection of 500mm must be provided within the internal driveway prior to descending into the underground garage.*
- (11.2) *Suitable pumps must be provided within the garage to allow for drainage of stormwater should the underground garage become inundated during flooding.*
- (11.3) *Adequate flood warning systems, signage and exits must be available to allow safe and orderly evacuation without increased reliance upon the SES or other authorised emergency services personnel.*
- (11.4) *Reliable access for pedestrians or vehicles must be provided from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF.*

## **FLOOD PLANNING LEVEL**

Given the depth of flood affectation, the recommended freeboard is 0.5 m in addition to the 1% AEP peak flood level. Therefore the minimum level of 12.8 m AHD is applicable for:

- the entry levels to the underground car park facilities (this includes the driveway entry level, the ground floor entry level of stairs or lifts that will descend into the underground area and ventilation ducts);
- the floor level for residential dwellings; and
- the floor level or if not the floor level, the level below which the building should be flood-proofed with no sensitive equipment below this level for non-residential areas

Should you require any further clarification, please do not hesitate to contact the undersigned.

Yours Sincerely,

**WMAwater**

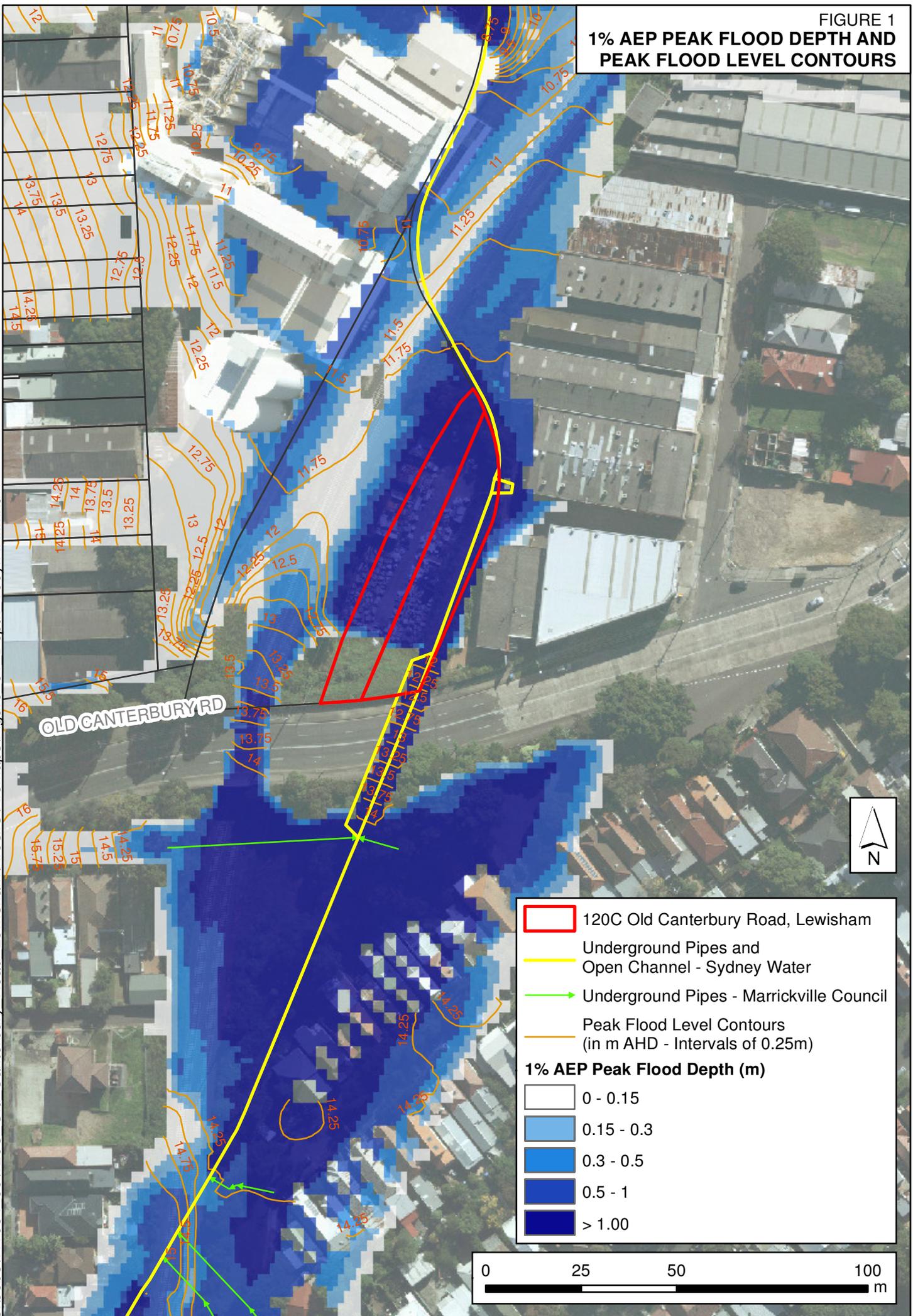


**Erika Taylor**

Project Engineer

FIGURE 1  
**1% AEP PEAK FLOOD DEPTH AND  
 PEAK FLOOD LEVEL CONTOURS**

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**OLD CANTERBURY RD**

-  120C Old Canterbury Road, Lewisham
-  Underground Pipes and Open Channel - Sydney Water
-  Underground Pipes - Marrickville Council
-  Peak Flood Level Contours (in m AHD - Intervals of 0.25m)

**1% AEP Peak Flood Depth (m)**

-  0 - 0.15
-  0.15 - 0.3
-  0.3 - 0.5
-  0.5 - 1
-  > 1.00

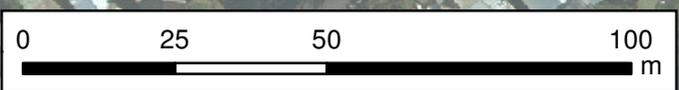
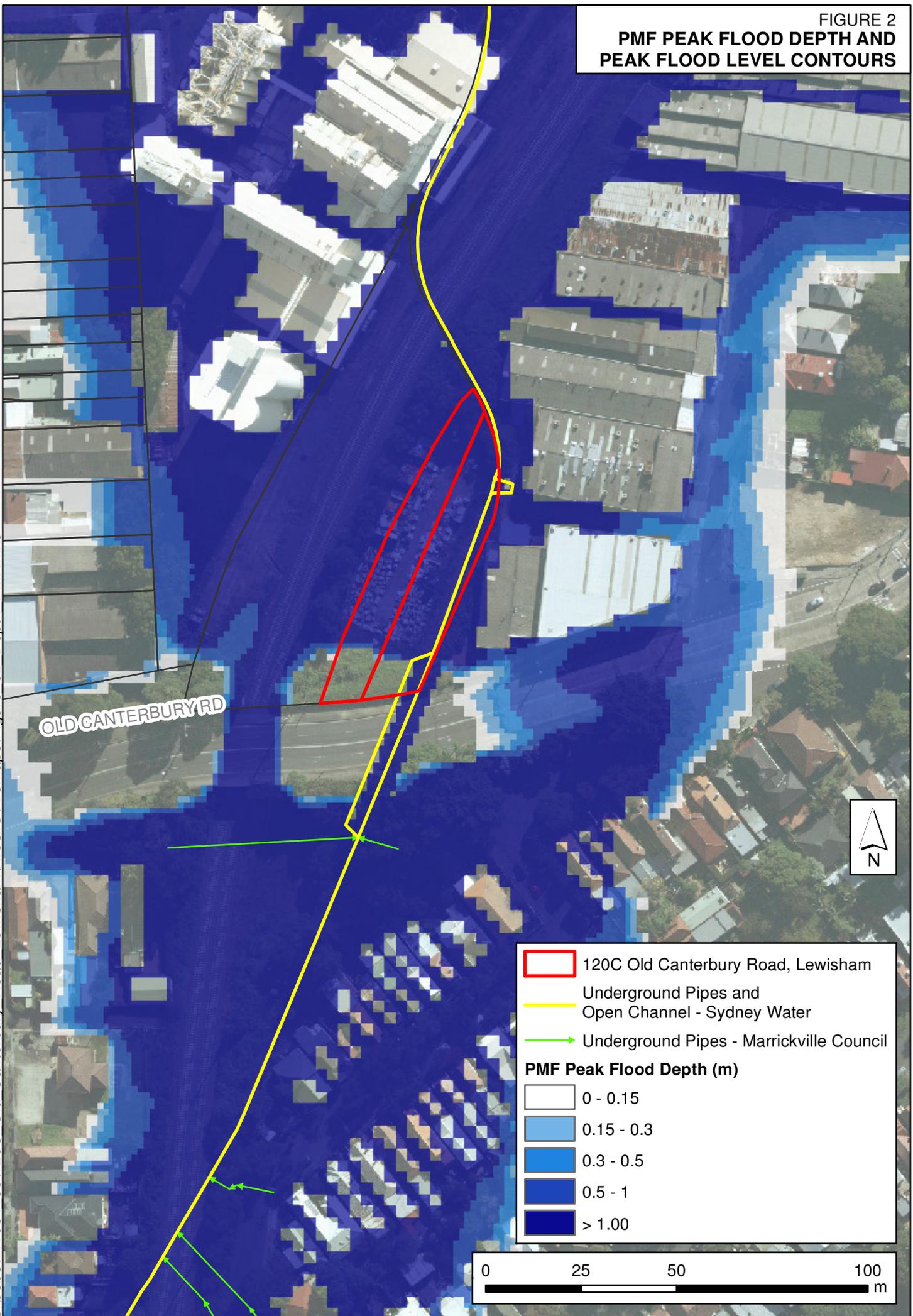


FIGURE 2  
PMF PEAK FLOOD DEPTH AND  
PEAK FLOOD LEVEL CONTOURS

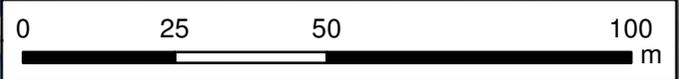
J:\Jobs\111054\_99\120C\_Old\_Canterbury\_Road\_Lewisham\ArcGIS\ArcMaps\Figure\_02\_Depth\_PMF.mxd



-  120C Old Canterbury Road, Lewisham
-  Underground Pipes and Open Channel - Sydney Water
-  Underground Pipes - Marrickville Council

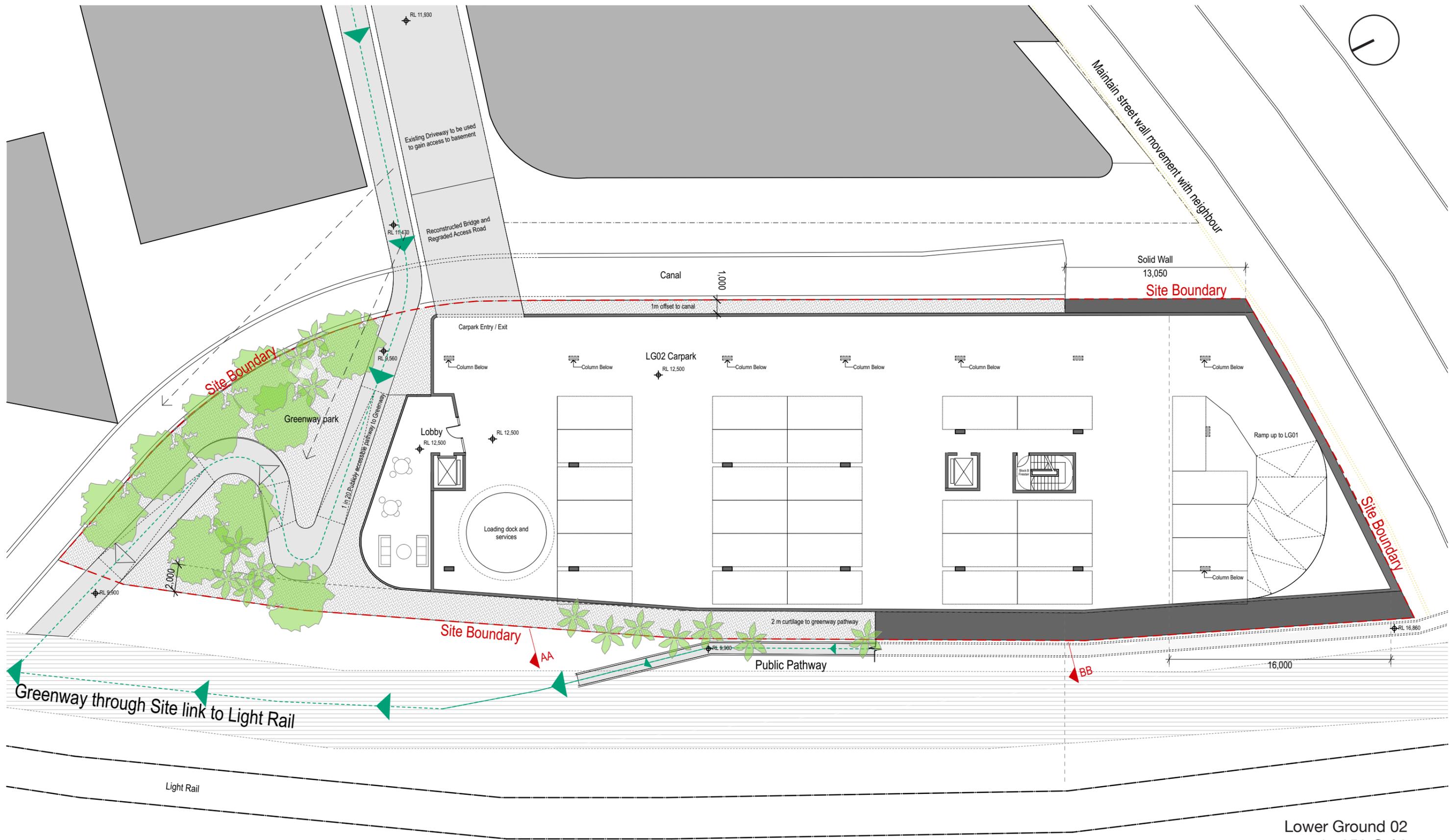
**PMF Peak Flood Depth (m)**

-  0 - 0.15
-  0.15 - 0.3
-  0.3 - 0.5
-  0.5 - 1
-  > 1.00



120c Old Canterbury Road, Summer  
Hill

**APPENDIX B**  
SELECTED ARCHITECTURAL  
DRAWINGS





CANTERBURY ROAD

Road below

Canal Below

\* Site Area = 1956.8 m2

Site Boundary

Site Boundary

Greenway park below

Pathway to Greenway below

VOID

VOID

Lobby

RL 15.375

bridge to lobby

LG01 Carpark

RL 15.375

Site Boundary

Site Boundary

Public Pathway

RL 16.860

Greenway through Site link to Light Rail

BB

LIGHT RAIL

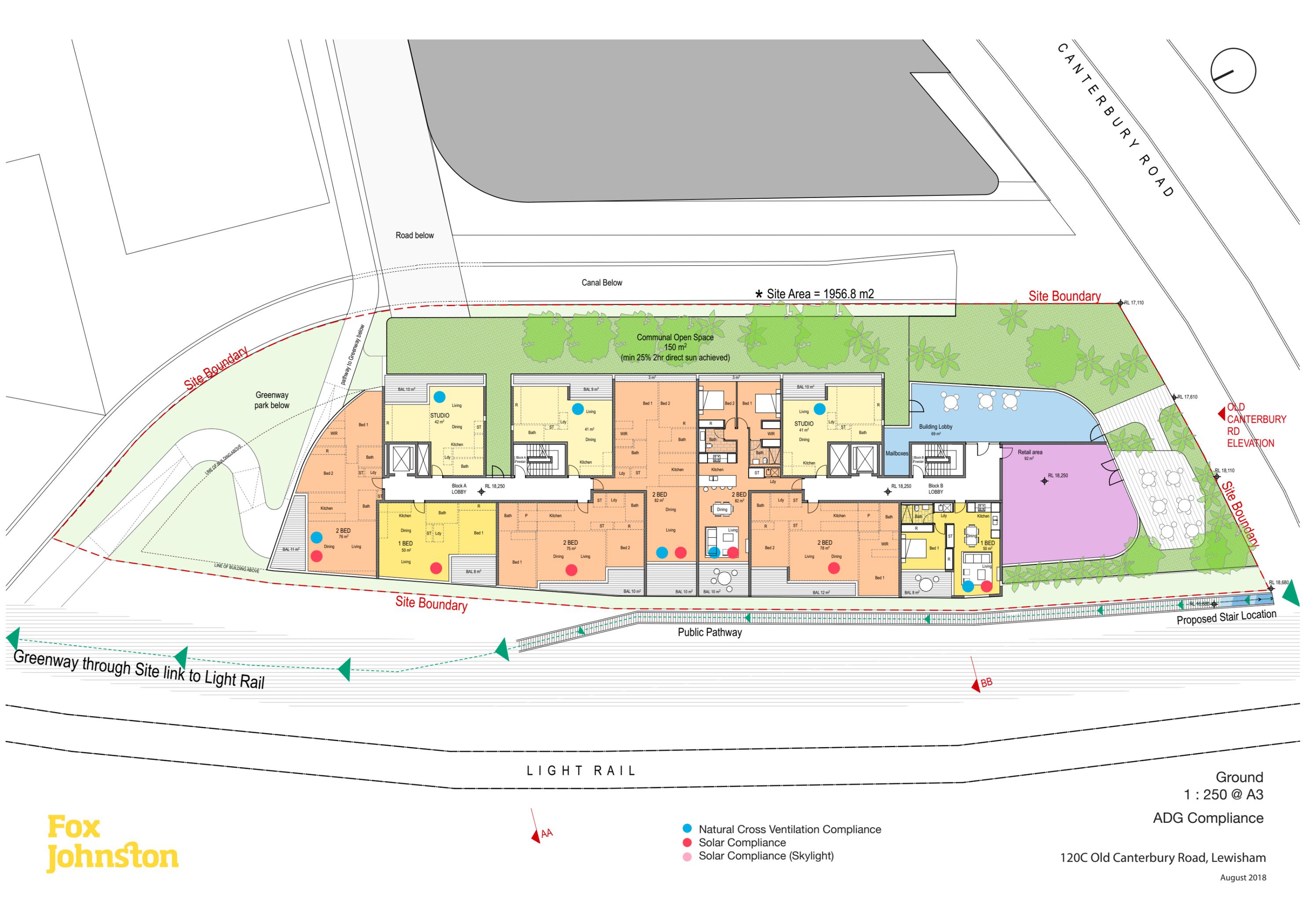
AA

Lower Ground 01  
1 : 250 @ A3  
ADG Compliance

**Fox  
Johnston**

120C Old Canterbury Road, Lewisham

August 2018



CANTERBURY ROAD



Road below

Canal Below

\* Site Area = 1956.8 m<sup>2</sup>

Site Boundary

Communal Open Space  
150 m<sup>2</sup>  
(min 25% 2hr direct sun achieved)

Site Boundary

Greenway park below

Pathway to Greenway below

OLD CANTERBURY RD ELEVATION

Site Boundary

LINE OF BUILDING ABOVE

LINE OF BUILDING ABOVE

Site Boundary

Public Pathway

Proposed Stair Location

Greenway through Site link to Light Rail

BB

LIGHT RAIL

**Fox Johnston**

AA

- Natural Cross Ventilation Compliance
- Solar Compliance
- Solar Compliance (Skylight)

Ground  
1 : 250 @ A3  
ADG Compliance

120C Old Canterbury Road, Lewisham

August 2018





CANTERBURY ROAD

Road below

Canal Below

\* Site Area = 1956.8 m<sup>2</sup>

Site Boundary

Site Boundary

Site Boundary

Site Boundary



BB

LIGHT RAIL

AA

- Natural Cross Ventilation Compliance
- Solar Compliance
- Solar Compliance (Skylight)

Level 04 - 05  
1 : 250 @ A3  
ADG Compliance

120C Old Canterbury Road, Lewisham

August 2018

